Managerial Culture and Company Survival: Technological Change and Output-mix Optimisation at Fiat, 1960-1987

Giuliano Maielli

PhD Dissertation

Economic History Department
The London School of Economics and Political Science

2003

Abstract

This dissertation contributes to the debate on the decline and transformation of mass production in the 1970s and 1980s by analysing the case of the Italian car manufacturer Fiat. In particular, the thesis addresses the question whether the company's restructuring led to a discontinuity in management. The established literature on Fiat depicts the company as one of the first movers in the development of flexible manufacturing systems, and traces the move towards flexible mass production back to the late 1970s. In doing so, the literature implies a discontinuity between the group of managers who had developed Fordist production at Fiat in the1950s and 1960s and the set of managers who gradually came to dominate the company after 1973.

Crucially, the established literature on Fiat is locked in a circular argument. Firstly, it explains the deployment of robotics as a move in the quest for production flexibility, and then uses the deployment of robotics as compelling evidence that the Fiat production setting during the 1980s was flexible. This dissertation breaks this circularity by testing the flexibility of Fiat production system during the 1980s against an independent variable, namely the rate of capacity utilisation of the production lines.

This dissertation demonstrates that during the 1980s, Fiat production remained inflexible. It also shows that Fiat did not maximise flexibility because the output-mix optimisation strategy pursued by the management did not require the maximisation of flexibility. The new contribution of the thesis to the international literature emerges from three key elements. Firstly, the thesis departs from common wisdom by showing that the managerial culture underpinning the restructuring of the company and its recovery from the crisis of the 1970s was essentially "Fordist". Secondly, the thesis investigates flexibility by analysing the behaviour of the utilisation rate of both robotised and traditional lines. The methodology has been implemented for the first time, thanks to a set of unpublished data discovered during extensive fieldwork in the Fiat Archives, and is based on the assumption that the main drive for investment in flexible manufacturing systems is the stabilisation of the utilization of production lines at about the optimal rate. Finally, the thesis underlines the complex relationship between technological change, product development and output-mix optimisation, which has been often overlooked by the post-Fordism debate.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF CHARTS

Acknowledgements

This dissertation has been written with the help and assistance of many people and institutions. In 1997, the European Commission awarded me a Marie Curie Fellowship. The European Historical Economic Society supported my attendance at their summer school in 2000, while the Economic History Society financed my attendance of their annual conference in 2001. This thesis could not have been completed without the co-operation of Fiat. In particular, I would like to thank Giusepe Berta, Giusi Cortese, and Massimo Castagnola from the Archivio Storico Fiat, Paola De Nard, Antonio Malandri and Francesco Scimone from Fiat Auto.

Selected parts of my thesis have been presented at various conferences, workshops and seminars at the LSE, The Manchester Federal School of Business and Management, the EHES Summer School, Economic History Conference, and the Hagley Center for the History of Technology, Business and Society. I would particularly like to thank Patrick O'Brien, Philip Scranton, Jonathan Zeitlin and Karel Williams for their useful comments.

I wish to express my gratitude to the members of staff of the Economic History Department of the LSE for their guidance and support; Max Schulze, Dudley Baines, Larry Epstein, Peter Howlett, Paul Johnson, Tim Leunig, Linda Sampson and Mary Morgan. The Business History Unit was a source of inspiration thanks to Michael Anson, Richard Coopey, Sonia Copeland, Dil Porter and Nick Tiratsoo. In particular I would like to thank Terence Gourvish, for sharing with me his vast and articulated knowledge. His integrity and his sense of intellectual freedom will remain as a life guideline. The errors that might be found in this dissertation will remain my own.

On a personal level, I wish to acknowledge my beloved parents Lorenzo and Anna, from whom I inherited an appetite for knowledge and passion for life, my brothers Vincenzo and Michele and my sister Maria Teresa, who supported me with the strength of their love. During my years at the LSE, I had the privilege to meet exceptional friends; Fiorella and Bill Day, Gabriella and Sam Fahmy, Anna Spadavecchia, Oscar Calvo Gonzales and Virgine Vial. Camilla Brautaset, Simon Niziol, Regina Grafe and Sarah Man shared with me the tension of the frantic final year. So did Liz and Richard, who also shared with me their own home and kindness. However, those years have the colour of her eyes and the sound of her voice; Anna Maria supported and inspired me. She taught me what no theory could really explain: what really matters in life.

Chapter 1
Introduction

Fiat is the largest Italian industrial group, and car manufacturing is its core business. Since the company was founded in 1899, it has played a key role in Italian industrialisation. In particular, during the "Golden Age" (1950-1973), Fiat was one of the most important "engines" of Italian economic growth. The company's expansion path in that period recalls closely Chandler's paradigm of big business growth, where an exceptionally stable managerial structure drove the company towards "Fordist" mass production and the maximisation of scale economies. As was the case with many car manufacturers in the 1970s, Fiat experienced a long period of crisis that ended only in the early 1980s after extensive restructuring. Therefore, Fiat offers a valuable case study in the debate about "post-Fordism" and the response of industrial economies to the crisis of the 1970s.

This thesis addresses the question whether the intangible capital accumulated by the firm from the post-war period to the late 1960s impeded the restructuring of physical capital during the 1970s and early 1980s, or whether it enabled the ownership and top management to address restructuring in an effective way. In general, the literature dealing with post-Fordism and the car industry suggests, either implicitly or explicitly, that the shift from Fordism to new organisational and technological settings implies the substitution of intangible capital, since the "Fordist culture of mass production" is seen as a constraint on the development of new managerial paradigms. The bulk of literature on Fiat echoes this view by assuming, rather than proving, a substantial discontinuity in the managerial culture that gradually came to dominate the company after 1973. On the other hand, Amatori has recently suggested that more research is needed in the case of Fiat to explore how much of the managerial culture accumulated by the firm during the "Golden Age" was left after the restructuring of the 1970s.[1] This thesis attempts to fulfil the research agenda set by Amatori and to explore the hypothesis that the restructuring

[1] F. Amatori, 'Gli uomini del Professore. Strategie, organizzazione, management alla Fiat fra anni Venti e anni Sessanta', in C. Annibaldi and G. Berta (eds), *Grande impresa e sviluppo italiano. Studi per i cento anni della Fiat* (Bologna, 1999), pp. 257-343.

of Fiat after the crisis of the 1970s was a process in which cumulative intangible knowledge affected strategic planning and ensured long-term success. This view is inspired by Chandler's paradigm of big business development and survival, and finds theoretical support from the Nelson and Winter evolutionary theory of economic change.[2]

The established literature on Fiat assumes that the managerial turnover at the top end of the hierarchy during the 1970s led to a shift from a process- to a market-oriented approach to the car business. This included a shift from inflexible to flexible mass production, and from a strategy based on dominating the bottom end of the market to a strategy based on the ability to compete in any segment of the market. This view implies a huge discontinuity in the way management intended to pursue both functional and strategic effectiveness, which, in turn, implies a huge discontinuity in the business culture underpinning the strategic and functional thought of Fiat management.[3] Finally, the shift from process- to market-oriented manufacturing should imply a shift in decision-making power, from production engineers, who typically dominate process-oriented structures, to marketing managers.

This thesis focuses on technological change and output-mix optimisation from 1960 to 1987, presenting empirical evidence that over that period, discontinuity did not occur to the extent underlined by the literature. The work shows that the firm's owners did not change the basic criteria used for strategic choice, and that production engineers remained influential in the process of decision-making in spite of the managerial turnover at the top end of the hierarchy. Even after 1973, production managers identified the main source of competitiveness as the containment of the cycle time and complexity costs, rather than the flexibility of the system. New production technologies, such as robotics, were developed in order to maximise production speed rather than product-mix flexibility. Moreover, by controlling product renewal, engineers enforced an output-mix

[2] See: R. S. Nelson, S. Winter, *An Evolutionary Theory of Economic Change* (Cambridge, Massachusetts, 1982).
[3] Functional effectiveness is defined as the way companies improve labour relations, process of productions, products and marketing structures. Strategic effectiveness is defined as the way companies shift from declining markets to growing ones. A. D. Chandler, *Scale and Scope. The Dynamics of Industrial Capitalism* (Cambridge Massachusetts, 1990), p. 8.

strategy that maximised the specialisation in the production of small cars rather than the ability to compete in a wider range of market segments.

Thanks to a new set of data and unpublished documents collected during extensive fieldwork in the company's archives, it has been possible to pursue an empirical analysis of flexibility in manufacturing, as well as an empirical approach to output-optimisation strategies at Fiat. As far as the issue of production flexibility is concerned, the new set of data has enabled empirical analysis of the way Fiat management used flexible production lines based on robotics. This data includes output per model, per month, per plant, per line (all unpublished), data on the optimal utilisation rates of each line (some of these have already been published while others are new findings), and data concerning the cycle time of both robotised and traditional welding stations (unpublished). As will be explained in the subsequent paragraphs of this chapter, the new information shows that Fiat used robotics to reduce the cycle time of the process, by removing the bottlenecks generated by the old technological set in the spot-welding shop, rather than by profiting from the deployment of robotics in order to maximise flexibility. As far as output-mix optimisation strategy is concerned, the new data set has enabled an analysis of output structure over time. Moreover, unpublished evidence of managerial thought has been utilised to identify the principles underpinning the output-mix optimisation strategy of Fiat. The analysis of both qualitative and quantitative evidence shows that: a) Fiat adjusted its production mix upmarket in the early 1970s, but shifted back downmarket in the early 1980s, whereas the traditional view suggests continuity in the output mix up to the late 1970s and discontinuity in the 1980s; b) the temporary shift upmarket during the 1970s was not a genuine attempt to break with the traditional specialisation of the firm in small cars, but an opportunistic and temporary move made possible by a temporary suspension of price competition.

The analysis of both technological change and output-mix optimisation strategy shows continuity in managerial thought among the production engineers, who remained the most influential group within the firm throughout the period analysed.

Technological change at Fiat 1960-1987

As far as technological change is concerned, the thesis looks at the introduction and development of robotics in the spot-welding shop at Fiat between 1970 and 1987, though the process of automation during the 1960s is also analysed. This thesis argues that: 1) internal factors (i.e. optimisation of the existing processes) drove the introduction and development of robotics during the 1970s; 2) the increased tool flexibility brought about by robotics did not change the way Fiat management responded to changes in the structure of demand for Fiat models during the 1980s. This view is opposed to the common interpretation of technological change, which maintains that, from 1972 onwards, flexible manufacturing systems (henceforth FMS) such as the Robogate were introduced by the new management in order to cope with the increasing need for output-mix flexibility caused by changes in the structure and dynamics of demand. In the literature, the flexibility paradigm has replaced the industrial relations approach, which was dominant in the late 1970s and early 1980s, and saw robotics as the managerial response to the strategy of the unions. On the contrary, from the mid-1980s the literature on Fiat started to focus on working conditions, quality, efficiency and flexibility, to justify the implementation and development of robotics. Crucially, flexibility could be improved only by implementing the specific technology based on robotics, whereas quality, efficiency, and working conditions could be improved also by developing traditional technology. Therefore, according to the established literature, flexibility drove the choice of that specific technology. Furthermore, the established literature maintains that output-mix flexibility was achieved.

The interpretation of technological change as a response to the increasing need for flexibility[4] implies that, within the new technological settings, the management of production developed in a way antithetical to "Fordism". Within a flexible-manufacturing framework, production is determined by the inputs coming from the marketing department, so that product differentiation is preferred to product standardisation. Actually, the introduction of robotics brought the possibility of rejecting the pattern of routines constructed around the Fordist principle of product

[4] The Robogate system was the most advanced example of a flexible manufacturing system for monocoque welding at the time.

standardisation and cycle-time minimisation, to favour the introduction of a set of routines aiming for flexibility maximisation and product differentiation. This thesis, nonetheless, shows that the introduction of robotics during the 1970s did not cause a change in the pattern of routines defining production management, because engineers kept their grip on the process of technological change, orienting the development of new technologies towards the achievement of their goals. Production engineers aimed to reduce and equalise the cycle time of each stage of production as had been postulated by Taylor and Bedaux, whose theories were the root of a set of routines developed by Fiat management from the post-war period onwards.

As far as methodology is concerned, the issue of product flexibility cannot be approached through the narrow comparison between single versus multi-model production functions, but has to be analysed in relation to the issue of production line utilisation rates. In fact, Fordism does not prevent multi-product manufacturing. The inflexibility of the system, on the other hand, can make multi-product manufacturing inefficient, because the adjustment of output mix to demand might well generate spare capacity. As already said, within the Fordist technological set, managers aimed to reduce the lead time of production (the time needed to produce a complete car) by cutting the cycle time of each stage in the process of manufacturing. The minimisation of the cycle time was obtained through the hyper-segmentation of the process and the specificity of tools. Thus, each manufacturing line was model-specific. Therefore, for a multi-model producer, the adjustment of the output mix to the structure of demand depended on the implementation of short time or overtime. Output-mix flexibility was obtained by changing the capacity utilisation rate of each line to offset changes in the stock levels of each model produced. This required a certain amount of spare capacity. On the other hand, FMS aims to achieve product-mix flexibility and to keep constant the utilisation level of each line. By reducing tool specificity, two or more models can be processed simultaneously on the same line in different proportions. Because the reduction in demand for one model can be offset by producing other models on the flexible line, and the availability of several flexible lines enables management to optimise output distribution over the whole production set, capacity utilisation can be stabilised at the optimum level. In theory, therefore, if a production setting is flexible, the capacity utilisation of each line will remain stable at around the optimum level.

By elaborating upon a new set of unpublished data concerning output per model, per plant, per production line, output capacity range per line, and the cycle time in the monocoque spot-welding process, this thesis shows that in spite of a massive deployment of robotics in the spot-welding shop, between 1978 and 1987 some Fiat plants were under-utilised while others were often over-utilised. This shows that in spite of robotics, production output could not be optimally allocated over the whole production setting.[5] On the other hand, evidence is provided that robotics allowed engineers to minimise the cycle time of some stages of monocoque welding. Furthermore, through interviews with technical management, and through qualitative and quantitative evidence, it has been shown that because engineers addressed technological change according to their "process-oriented needs", innovation was localised only where traditional automation was inefficient. As a result, between 1972 and 1987 the overall process remained inflexible, so that it proved difficult to spread output among different lines in an optimal way.

Output-mix optimisation and the regime of competition

The second variable analysed by this work is the output-mix optimisation strategy. In a multi-production function, output-mix optimisation consists of the choice of the product mix that best maximises total contribution margins This is because the larger the total contribution margin, the larger the total operating profits. In the absence of constraints, the total contribution margin tends to increase along with a shift of the output-mix towards the units with larger contribution margins. In the case of car manufacturing, each producer supplies different types of cars, competing in different segments of the market. The cost structure changes across segments, because of changes in quality benchmarks. Selling prices vary across segments too, so that shifts in output mix affect average costs and revenues. It is commonly thought that upmarket units provide larger per unit margins of contribution, because the demand for upmarket units

[5] The set of data used in this thesis is the most detailed available so far, and makes possible the analysis of the utilisation rate of production lines.

tends to be income rather than price elastic, whereas the demand for downmarket units is price elastic. For this reason, the difference between average costs and prices in the case of upmarket units is expected to be wider then the difference between prices and costs of downmarket units.[6]

In theory, therefore, the more the output mix shifts towards the upmarket units, the more the total contribution margin increases, and total operating profits are maximised. Actually, within competitive markets, manufactures specialised in the production of upmarket units set price/quality benchmarks, which represent the barrier to entry for less specialised manufacturers. In fact, if in order to shift upmarket the less efficient manufacturer is forced to set the price of its upmarket units at too low a level, the difference between average costs and prices will shrink. Because average costs of upmarket units are larger than those of downmarket units, the shift upmarket will have a detrimental effect on total contribution margins. In the real world, thus, management has to maximise the output mix in the face of many constraints, such as capacity, design and manufacturing expertise, the structure and quality of the component supply chain and so on. Ultimately, specialisation (the pattern of routines around which the manufacturing process is organised) represents a constraint to the shift upmarket, and manufacturers have to maximise sales in the segment of the market in which they are more specialised and competitive.

The literature on Fiat emphasises that one of the major elements of weakness of the company during the 1970s was a product mix skewed towards lower segment units.[7] On the contrary, during the 1980s Fiat acquired the ability to compete in the upper segments in spite of the traditional specialisation of the firm in the manufacturing of small cars.[8] Flexibility, therefore, was seen by the established literature not only as the ability to concentrate, on each flexible line, the production of a range of different models

---

[6] Pricing in car manufacturing is based on mark-up pricing (average costs plus margins) rather than marginal cost pricing. This is because economies of scale are substantial, which means that average costs are in excess of marginal costs. Therefore, by applying marginal cost pricing, prices will be lower than average costs.

[7] A. Enrietti, G. Fornenego, *Il Gruppo Fiat. Dall'inizio degli anni Ottanta alle prospettive del mercato unificato del 92* (Roma, 1989), p. 172; A. Mosconi, D. Valeo, *Crisi e ristrutturazine del settore automobilistico* (Bologna, 1982), p. 61; G. Volpato, *Il caso Fiat. Una strategia di riorganizzazione e di rilancio* (Torino, 1996), p. 141.

[8] Volpato, *Il Caso Fiat*, pp. 161-164.

competing in the same segment of the market, but also as the ability to compete in any segment of the market, with the possibility of implementing a much more flexible output-mix optimisation strategy. In the first case, the advantage of flexibility was the stabilisation of production lines, as described in the preceding section of this chapter. In the second case, the aim of flexibility was the optimisation of the output mix. This view assumes that during the 1980s, many of the constraints represented by the company's specialisation in small cars had been removed. Interestingly, though, the established literature failed to support the view of Fiat moving away from the specialisation in the manufacturing of small cars with the empirical evidence. On the other hand, by elaborating on the output database, this thesis shows that output-mix strategy was rather different from what the literature put forward. During the 1970s, Fiat actually changed its production mix from that of the 1960s, putting more emphasis on the middle and top ranges. In fact, from 1972 onwards, the share of Fiat's total output in the upper segments (C, D and E) fluctuated between 45% and 50% compared to 30% in the 1960s. By contrast, it was between 1980 and 1987 that the sum of the shares of segments C, D, and E dropped again to about 30%.[9] Therefore, if there was any discontinuity in the output-mix optimisation strategy of the company, it occurred in the 1970s, while the output mix of the 1980s resembles that of the 1960s.

This finding raises the question of why Fiat shifted upmarket during the 1970s, and shifted back downmarket during the 1980s. The issue is connected with the process of routine confirmation and rejection, and with the role of different actors operating within the managerial hierarchy, which might have influenced decision-making. The thesis provides evidence that engineers and marketing management had different views concerning the best output-mix optimisation strategy, and since the 1960s the two groups started to confront each other in this field. Engineers wanted to maximise the competitive advantage of the firm in small cars, whereas marketing management wanted to maximise revenues from the sales of the medium and top range units. The divide between engineers and marketing staff illustrates the problem of the confirmation or

[9] In general, the market is structured in segments indicated by different letters (A, B, C, etc.) according to the cubic capacity of the engine. The lower segments are A (500-900 cc.) and B (900-1100 cc.), while the upper segments are C (1100-1300 cc.), D (1300-1600 cc.) and E (1600-2200 cc.).

rejection of routines. The firm's specialisation emphasised by engineers, and the market opportunities for increasing revenues from sales stressed by marketing managers, can be seen as justifications for confirming or rejecting the pattern of routines developed around the specialisation of the firm in the manufacturing of small cars.

Engineers (the techno-structure) were the most influential group in the Fiat hierarchy. This thesis shows that the techno-structure remained fairly stable throughout the period, in the sense that internal appointees usually replaced retired engineers. Moreover, technical managers were very influential within the Administration Board, and advised the Board and the owners of the company to follow the strategic advice of the techno-structure. This work shows that in the first half of the 1960s technical management had developed a criterion regulating output-mix decision-making. This was that Fiat should focus on the lower end of the demand spectrum unless price competition was inhibited. Only if it were the case, engineers would have agreed with marketing managers to shift upmarket, advising the top management to pursue that strategy. Fiat, therefore, shifted upmarket during the 1970s because the market was characterised by collusive behaviours, where in each national market the largest manufacturer was the price setter and competitors were following upward. Vice versa, when price competition was in place, top management followed the advice of engineers to shift back downmarket in order to maximise the firm's specialisation in the lower segments of the market.

The rationale for such behaviour can be found in the fact that German and French manufacturers were much more specialised than Fiat in the manufacturing of medium and large cars, so that Fiat would have not met the quality benchmarks of competitors in the top range at competitive costs. For this reason, engineers were concerned by the possibility that the adjustment of the output mix upmarket would have put upward pressure on total production costs, which in conjunction with price competition from German and French manufacturers would have considerably squeezed profits. The argument was strong and top management and the owners tended to support the engineers' point of view unless price competition was inhibited. In fact, if in each national market competitors were adjusting their prices above the price level set by the national leader, specialisation was to some extent less important in driving the output-mix strategy.

In 1980, Silva et al. showed that during the 1970s, price competition was de facto inhibited in all the largest European markets.[10] Based on a wide set of unpublished data and primary sources, this thesis shows that during the 1970s Fiat management was aware of the suspension of price competition, and adjusted the output mix upmarket as wished by the marketing staff. Moreover, the thesis shows that given the price levels set by Fiat, upmarket units achieved higher contribution margins and operating profits than lower market units. On the other hand, by elaborating on price behaviour, the thesis shows that price competition was restored from the early 1980s. At that time, Fiat shifted back to an output mix skewed toward the lower segments of the market.

In general, the output mix is affected by the product renewal strategy, since the latter determines the expansion in sales for specific models and, therefore, for specific segments. During the 1970s, product renewal was concentrated mainly in the upper range of both the Fiat and Lancia brands, [11] whereas in the 1980s, it concentrated mainly on the bottom range of the two brands. This product-renewal strategy is quite surprising considering that Fiat forecasts of the early 1980s had predicted that the medium segments would experience the most remarkable growth during the decade.[12] As a consequence, more emphasis in the renewal of the medium, rather than the lower model range should have been expected. The priority given by Fiat to the lower, range, therefore, denotes the managerial will to compete mainly in the bottom end of the market, maximising specialisation.

The analysis of the Fiat output-mix optimisation strategy underlines two important points. Firstly, as already mentioned, the output mix of the 1980s was still skewed towards lower-range units and, therefore, reflected the traditional specialisation of Fiat. Secondly, the discontinuity in output-mix optimisation occurring during the 1970s was more apparent than real. Actually, the temporary adjustment of the output mix upmarket was an opportunistic move driven by the regime of competition, rather than a genuine attempt to shift away from the traditional specialisation of the firm. A genuine long-term strategy of shifting upmarket, in fact, would have required the restructuring of the whole

---

[10] F. Silva, M. Grillo, M. Prati, *Il mercato italiano del'auto nel contesto europeo* (Milano, 1982).
[11] Lancia had been taken over by Fiat in 1969.
[12] Introductory relations to the 1982 Fiat Auto Balance Sheet, p. 14.

process, including the redefinition of the design and manufacturing routines towards quality, along with the reorganisation of the components supply chain.

In this respect, it is important to highlight the relationship between the output-mix optimisation strategy and technological change. Since during the 1980s Fiat management intended to compete mainly in the lower end of the market, to which the larger part of financial resources for product renewal was allocated, extra flexibility was not actually needed. On the contrary, the minimisation of the cycle time was a central element of the strategy, considering the scale of production required in order to supply the lower end of the market, and a progressive reduction in the working time occurred during the 1970s. Both technological change and an output-mix optimisation strategy were coherently inspired by the knowledge accumulated by Fiat management during the 1950s and 1960s, and, therefore, by the pattern of routines defining the company's specialisation, in the manufacturing of small cars.

Thus, it is interesting to see whether the strategy of Fiat during the 1980s was the best profit-maximising one. As already observed, during the 1980s, Fiat fully recovered from the crisis of the 1970s. Nonetheless it could be argued that an output mix more skewed towards upmarket units might have brought even better profits. The exploration of the argument would require a counterfactual based upon the projection of expected contribution margins for each model at various levels of output. Such a set of data, obviously, does not exist. However, the available data suggest that the output-mix optimisation strategy of Fiat during the 1980s was the best profit-maximising strategy. Not only did Fiat realise substantial profits (as shown in balance sheets) during the 1980s, but also the containment of complexity costs enabled the company to maximise profits, whereas a higher level of flexibility and a shift of the output mix towards upmarket units would have caused an expansion of complexity costs, which, in turn, would have put downward pressures on profits. This is an important point, because within the evolutionary theory of economic change, management confirms or rejects routines according to expected profits.[13] Crucially, management has to estimate a trade-off between flexibility and complexity costs, and if the information is not entirely available or assessable, the decision is affected by knowledge and experience.

Ultimately, though, the market determines whether the confirmation or rejection of given routines was the best choice. According to the available information, it seems that at the end of the 1970s, Fiat management guessed right in focusing on the lower end of the market, and continuity paid off.

The structure of the thesis

This thesis consists of eight chapters including an introduction and conclusions. Chapter 2 highlights the dominant approaches in the historiography on the car industry, and provides a review of the relevant bibliography on Fiat. It explains that the Italian literature concerning the restructuring of Fiat after 1973 implies the same discontinuity in management and technology assumed by the international literature on post-Fordism regarding the restructuring of the world car industry after the two oil crises. In the case of Fiat, though, this discontinuity has not been demonstrated, so that there is scope for further analysis, by testing the alternative hypothesis that the Fiat restructuring was actually inspired by the knowledge accumulated over time by the techno-structure. This hypothesis has its theoretical foundation in the Nelson and Winter evolutionary approach to economic change, and is more compatible with the Chandler paradigm of big business growth, as compared with the view of discontinuity often implied by the established literature.

Chapter 3, drawing mainly on secondary sources, examines the crisis of the 1970s and the recovery of the 1980s. Moreover, the evolution of the company from the post-war period to the late 1980s is analysed, by focusing on changes in management, organisational structure, and production facilities. The chapter ends by suggesting that the established literature is not convincing when it assumes that the managerial turnover and organisational restructuring experienced by Fiat in the second half of the 1970s led to a drastic change in the pattern of routines regulating production management and competitive strategy. In fact, managerial turnover occurred at the top end of the structure, and did not affect the composition and role of the techno-structure within the company.

---

[13] Nelson and Winter , *An Evolutionary Theory*, p. 18.

The conclusion of chapter 3, therefore, suggests that the empirical analysis of specific variables is the most appropriate way to find and evaluate elements of continuity and discontinuity in the management of Fiat before and after the first oil crisis.

Chapter 4 is the first of the core chapters of the thesis and, therefore, is mainly based on unpublished data. The chapter focuses on the first of the two variables analysed in this work, namely technological change, by looking at how Fiat management developed production technology before and after the first oil crisis. By focusing on the process of car manufacturing and analysing technological change in the spot-welding shop, the chapter demonstrates that the introduction and development of robotics at Fiat aimed to resolve the bottlenecks generated by the previous technological setting, without radically changing it, and without changing the routines regulating production management. This hypothesis departs from the current literature, which maintains that technological change at Fiat from 1972 was the result of a marked change in the production management towards flexible mass production.

One of the distinguishing features of the chapter is the empirical assessment of the level of flexibility achieved by the production shops in which robotics had been deployed. As already mentioned, the analysis is based on the assumption that if product-mix flexibility is fully exploited, it enables the capacity utilisation rate of each flexible line to be stabilised at about the optimum level. This is the level of output within the output range,[14] which maximises the production function for each production line. The stabilisation of production at the optimum level has been indicated by the literature, and by several Fiat internal documents,[15] as one of the principal justifications for investing in robotics. The chapter, therefore, compares the utilisation rate of robotised and traditional lines between 1984 and 1987. The exercise shows that throughout the period considered all the Fiat production lines, be they based on robotics or on traditional technology, experienced marked fluctuations in the capacity utilisation rates. This

[14] By output range is meant the range of different output levels comprised between the minimum economically viable, and the maximum technically achievable amount of output, for each production plant or line. See: M. Moroni, *Production Process and Technical Change* (Cambridge, 1992), p. 147.

[15] See P. Bianchi, G. Volpato, 'Flexibility as the Response to Excess Capacity: The Case of the Automobile Industry', in C.W.F. Baden-Fuller (ed.), *Managing Excess Capacity* (Oxford, 1990), pp. 215-246. See also Fiat Department of Production Technology Development and Assessment, 'The Robogate', internal document, pp. 1-16.

indicates that the adjustment of output to demand for specific models was still obtained by over/under-utilising each single line, rather than shifting production from the over-utilised line to the under-utilised ones. This finding leads to the conclusion that the production management of the robotised lines was not different from that of the traditional lines organised around the "Fordist" principle of hyper-specificity of production tools.

Chapter 5 is descriptive and mainly based on secondary literature. It concerns industrial relations and is related to the issue of technological change. The aim of this chapter is to instruct the reader on the development of industrial relations at Fiat, explaining, at the same time, why it seems correct to interpret technological change at Fiat using technical arguments, such as those proposed in chapter 4, rather than industrial relations arguments. It is shown that the most recent literature on industrial relations at Fiat attributes the defeat of the unions in 1980 to political rather than technological factors. Moreover, it is shown that given the characteristic and limits of the deployment of robotics, and given the nature and the scope of the industrial conflict at Fiat during the 1970s, management had no theoretical or practical reasons to assume that the localised deployment of robotics in the spot-welding shop would have had a short or medium-term impact on industrial relations. This is an important point because given the state of industrial relations at Fiat during the 1970s, at first glance it could be thought that technological change was actually responsive to industrial conflict.

Chapter 6 opens the section of the thesis concerning output-mix optimisation strategy and is mainly based on unpublished documents and data. This section reconstructs the output-mix optimisation strategy of Fiat during the 1970s and 1980s, testing the hypothesis that the principle regulating output-mix decision-making did not change over time. The literature, on the other hand, assumes that in the late 1970s the company shifted from process to market-oriented approaches to car manufacturing. This caused a change in the principle regulating output-mix maximisation. Chapter 6 shows that since the mid-1960s, the marketing staff started to question the output-mix optimisation strategy of Fiat, which was characterised by an output structure skewed towards the bottom range of the market. This output structure reflected the production-oriented culture developed by technical management since the inter-war period and, therefore, the specialisation of the firm. The incentive for questioning that output-mix strategy had been provided by the progressive abolition of tariffs by EEC countries. The new scenario compelled management to decide whether to reinforce the Fiat position as a supplier of small cars, or compete with German and French manufacturers for market shares in the medium and upper segment of the market. Those segments were expected to develop in Italy as they had already done in the French and German markets. At first glance, the new approach seems to be a radical departure from the production-oriented approach of engineers, which tended to favour the manufacturing of small cars, where Fiat could exploit its competitive advantage. From the analysis of documents, though, it emerges that the Italian management contemplated the possibility of shifting upmarket under the assumption that Fiat "retained price leadership privilege", and that competitors adjusted their price upwards in a predictable way. This means that management did not conceive the shift in the output mix upmarket in the broader context of a radical re-thinking of the design expertise and manufacturing routines towards increasing cost efficient quality manufacturing. On the contrary, the move was seen as an opportunistic strategy to exploit higher margins from the sales of large cars, under the assumption that Fiat set price levels according to its own cost structure, and competitors adjusted their prices upward, without exploiting the competitive advantage deriving from their specialisation in the medium and upper segments of the market. The chapter describes the reasons why Fiat management expected that the abolition of tariffs would not trigger severe price competition among European manufacturers. Then, by supporting the conclusions reached by Silva in his analysis of the Italian car market during the 1970s with evidence from company internal documents, the chapter shows that during the 1970s, the Italian market was actually characterised by a regime of competition resembling implicit collusion, and that Fiat management was aware of this. The chapter also shows that during the 1970s, Fiat shifted upmarket and that given price levels, management expected the upper range units to perform better than lower range ones, in terms of contribution margins.

By contrast, chapter 7 shows that during the 1980s, price competition was restored, while Fiat shifted the output mix back downmarket. In the late 1970s, there were already signals that collusion was not going to hold for long, while in 1981 it became evident that competitors were no longer available to follow Fiat's pricing upward. The policy of product renewal reflected this expectation, with Fiat allocating resources to the renewal of models competing in segments A and B, where new models were developed, starting from the design of new model-specific platforms and engines. By contrast, in segments C and D new cars were developed from old platforms and engines, which were shared by relatively large numbers of models of both Fiat and Lancia ranges. This was a production rather than marketing-oriented policy, aiming to reduce costs, and it led to the limited commercial success of Fiat in those segments. Finally, the product renewal in segment E was postponed to 1984-1985, while the entire Lancia range was shifted downmarket.

The last part of chapter 7 shows that the available data suggest the output-mix optimisation strategy of Fiat was the best profit-maximising strategy. By applying average per segment production costs of the European car industry to the Fiat output structure, it emerges that the more the mix shifted downmarket the more costs were reduced. The methodology is not ideal but it seems to be indicative of the soundness of the Fiat strategy, because European average costs are expected to be higher than the actual Fiat costs in the lower segments and lower than the Fiat costs in the upper segments. Therefore, if the same exercise were repeated applying the real costs of Fiat, the cost saving deriving from the shift in the output mix downmarket should be even higher.

The last chapter of the thesis synthesises the conclusions reached by the empirical analysis of the two variables considered by this work. In the case of both technological change and output-mix optimisation, a substantial continuity emerges, due to the fact that, in spite of the managerial turnover at the top end of the hierarchy occurred during the 1970s, the techno-structure remained substantially stable. This enabled production engineers to keep their grip on technological change and output-mix decision-making and to maximise the technical specialisation of the company in the manufacturing of small cars. This, in turn, prevented the maximisation of both the flexibility of production lines and the flexibility in approaching output-mix optimisation. Therefore, this work departs from the existing literature, which maintains that after the first oil crisis Fiat shifted from process to market oriented car manufacturing, implying a marked discontinuity in management.

Archives and sources

This thesis is based on unpublished qualitative and quantitative sources collected during an extensive fieldwork in the Fiat Archive. Interviews with members of Fiat technical management have also been conducted in order to collect data and information concerning production technology and organisation between 1960 and 1987.

The Fiat Archive[16] is administered by the External Relations Department of the Fiat Group. Each department within the Group keeps its own records for five years. After this period, documents are sent to the Fiat Archive. The director of the department issuing each document decides upon the disclosure period, which usually ranges from five to fifteen years. In any case, access to documents after the disclosure period has to be authorised by the Director of External Relations.[17]

Qualitative sources consist mainly of two sets of documents: a) verbatim minutes of the Administration Board Meetings from 1960 to 1967; b) a series of studies, internal correspondence and memos produced by various Fiat departments. In particular, this thesis includes documents from Fondo Pedrana (Pedrana File), Fondo Crescimone (Crescimone File) and Fondo Fiat Società Capogruppo (Fiat Core Companies File), which includes the majority of managers' and top executives' memos.[18]

The principal strength of these sources is that the documents were produced exclusively for internal use. They are very detailed and provide information which is much more complete and explicit than any other document edited for external relations and public exposure purposes. These sources, therefore, enable the process of decision

[16] Along with the main archive located in the 'Centro Storico Fiat' (Fiat Historical Centre), there are two secondary locations namely 'Archivio di Corso Ferrucci', (Corso Ferucci Archive) located in the Fiat Avio Head Quarter, and 'Archivio di Mirafiori' (Mirafiori Archive), located in the Mirafiori plant, the main production premises of Fiat Auto. The latter contains only files concerning the activity of Fiat in the car sector. All the locations are in the urban area of Turin, the Italian city where the Fiat Headquarters is located.

[17] The authorisation to access documents depends upon two criteria: the protection of the company's best interests, and privacy protection of individuals either formerly or currently employed by Fiat, or involved with the company as clients, suppliers, partners etc.

[18] Pedrana is the name of the Director of the International Affairs Department between 1960 and 1973. Crescimone is the name of the Director of the Lingotto plant from 1960 to 1978.

making at Fiat to be thoroughly analysed. However, verbatim minutes of the Administration Board Meetings need to be analysed with care in order to fully exploit the information they contain. In particular, the reader has to take into account the managerial culture of the Fiat management during the 1960s to correctly interpret the text. Such a culture had been developed over half a century of managerial stability and was shaped by a strong sense of respect for the company and its leadership. This involved a number behavioural codes that managers had to understand and apply when they came to report to the Board. These codes have to be taken into account when the verbatim minutes of the Administration Board Meeting are analysed. Two elements are of particular interest: a) Valletta, (the president of Fiat and Chairman of the Board from 1946 to 1966), customarily presented his personal view as a matter of corporate fact; b) since failure could not be contemplated by the managerial culture at Fiat, junior managers had to choose the appropriate way to report on problems to the board. For example, if a car was not enjoying commercial success and needed major re-development, the manager in charge would have probably reported to the board that the decision to start major development was driven by the will of Fiat designers to push harder and pursue further commercial success. Usually, figures in the annex to the minutes help to interpret correctly what managers said during the meetings. Moreover, in order to appreciate and understand the communication codes of the minutes, it was necessary to read through the entire series of documents from 1899 to 1967. Finally, the book written by a former designer of Fiat, Dante Giacosa, *Progetti alla Fiat prima del computer* provides very useful insights on how the managerial culture of Fiat management affected communications among members of the Board and between owners and executives.[19] From both the minutes and the Giacosa book, it emerges that the way information was presented to the board was not designed to mislead the top management, which was clearly capable of decoding information to ascertain its exact meaning.

[19] D. Giacosa, *Progetti alla Fiat prima del computer* (Milano, 1978).

The main quantitative sources consist of the 'Libro dei numeri di matricola delle vetture prodotte' (Fiat Production File), and Fondo Sepim (Sepim file). The production file consists of the serial numbers of all vehicles produced by Fiat from the late 1950s to the present although for the purpose of this thesis only the data up to 1987 have been disclosed by Fiat. From January 1967 onwards the serial numbers are arranged by month, by plant and by production line. Since each serial number refers to the last vehicle of a given type produced each month, by subtracting each number from that of the subsequent month it is possible to work out the monthly production per model per line. Therefore, by using serial numbers it was possible to construct an unpublished data set, the relevance of which should not underestimated. The output data published so far, in fact, show only annual totals. The new figures for line output per month along with figures for the optimum, maximum and minimum capacity utilisation rates of each production line, and data on the number of working days and shifts actually performed by Fiat each month enabled us to test the flexibility of the Fiat production setting against an independent variable, namely the regime of utilisation of production lines. The methodology and the theoretical concepts utilised in this work are explained in chapter 4. At this stage it is important to emphasise that the data set utilised in this work allowed us to pursue the kind of empirical analysis of production flexibility that the literature on car industry has failed to pursue so far. Finally, the new output data permitted an analysis of changes in the structure of the Fiat output overtime, which along with qualitative evidence provided important insights on output-mix optimisation strategy.

As far as the Sepim file is concerned, it provides data of employment concerning enrolled workers per plant, numbers of working hours, number of workers effectively present each month and the number of hours effectively performed by the workers. These data allowed us to examine productivity in the manufacturing sector before 1978, whereas the data usually available from published sources do not allow us to single out workers in the manufacturing sector from the total number of workers in the Fiat Group before 1978.

Finally, important data and information were gathered by interviewing two Fiat technical managers who contributed to the deployment and development of 'Robotgate', the robotised system for spot-welding, at the Cassino and Rivalta plants from 1976 to 1987. Antonio Malandri is a mechanical engineer currently working in the Department of New Technology Development at Fiat Auto. Francesco Scimone is a skilled worker who started his career at Fiat working in the maintenance and repair of spot-welding tools at the Mirafiori plant and then was gradually promoted to different roles up to a middle management position in the Department of New Technology Development.

The two managers provided data concerning the optimal capacity utilisation of all Fiat production lines in the spot welding-shop, be they based on robotics, or on the Robogate technology or indeed on non robotised technology. These data were provided along with a detailed technical description of various technological settings and the time cycle of the various stage of spot-welding process according to the various technologies deployed. Finally, Malandri explained the various definitions of flexibility used by Fiat and various problems faced by the company while developing the spot-welding technology. All the information provided by Malandri and Scimone has been incorporated in chapter 4.

Chapter 2

Interpreting Fiat restructuring: Continuity versus discontinuity

Introduction

This thesis addresses the question whether the restructuring of Fiat during the 1970s and early 1980 caused the progressive displacement of the intangible and the physical capital accumulated during the age of Fordism or, on the contrary, whether the restructuring was inspired by the collective knowledge that Fiat management had been accumulating over time. The question relates to two different but interconnected debates, namely the "international" debate about post-Fordism and the third industrial revolution, and the debate within the Italian Business History and Business Economics literature about the crisis and restructuring of Fiat. This chapter clarifies in which way this work contributes to the debates mentioned above, and explains why the analysis focuses on changes in production technology and output-mix optimisation strategy.

When it comes to analysing the car industry in terms of production modalities, the whole body of literature on post-Fordism, including the neo-Fordist school of thought, assumes that after the two oil crises, the world car industry shifted to flexible mass production. The entire literature on Fiat accepts this assumption for the company. On the other hand, this chapter maintains that the shift to flexible mass production implies a discontinuity in management and, therefore, a discontinuity in managerial knowledge that has not yet been demonstrated. The thesis argues that for Fiat in the late 1970s and early 1980s, the shift to flexible mass production was more theoretical than practical, and that the managerial "culture" underpinning technological change and output mix optimisation strategy remained rather stable over time. In this sense, the Fiat case study requires the adoption of interpretative frameworks from outside the school of post-Fordism. These are provided by authors such as Chandler and Nelson and Winter.

This chapter is organised as follows. The first section sets the issue of discontinuity and specifies the characteristics of Fordism that have to be considered in order to make sense of the debate on post-Fordism. The second section summarises the debate on post-Fordism by describing the different schools of thought that have contributed to the debate and providing a taxonomy of Fordist and post-Fordist production modes. Then, by building on the arguments of Chandler and Nelson and Winter, the subsequent section of the chapter sets the theoretical foundation of the continuity paradigm. The fourth section summarises the Italian literature on Fiat, and underlines the scope for further research. The fifth section analyses the paradigm of market maturation and its limits in justifying the views of discontinuity in management at Fiat after 1973.

Section one
Fordism, post-Fordism and discontinuity

This section focuses on the problem of discontinuity in the transition from Fordism to post-Fordism, and looks at the various approaches to the analysis of these two forms of industrial organisation. In so doing, the section defines the scope of the debates to which this thesis intend to contribute.

The problem of discontinuity

There is a widespread, though not uncontroversial, consensus that the mid-1970s represent a transition from one distinct phase of capitalist development to another. The nature and direction of this epoch-making change is at the heart of the post-Fordism debate. This debate is, of course, intrinsically affected by the debate about Fordism. Although there is a general agreement on the nature of Fordism, both in terms of production organisation and institutional frameworks, its diffusion is more controversial. Jessop emphasises that Fordism, as it had been formulated in theory, was actually quite limited in diffusion and never fully realised even in Ford's own plants.[1] This view finds support from several studies in the field of Business History, showing that limits to the diffusion of Fordism reflect social, economic and cultural limits, which make it impractical or unacceptable in specific regional and national contexts, as well as in specific time spans for given contexts.[2]

---

[1] B. Jessop, 'Fordism and post-Fordism: a Critical Reformulation', in M. Storper, A. J. Scott (eds), *Pathways to Industrialization and Regional Development* (1992), pp. 46-69.

[2] A number of case studies on Fordism adaptation are provided by: J. Zeitlin, G. Herrigel (eds), *Americanisation and its Limits: Reworking US Technology and Management in Post-War Europe and Japan* (Oxford, 2000).

Indeed, the fact that the debate about the nature and diffusion of Fordism is still open questions the very notion of post-Fordism.[3] Nevertheless, over the last twenty or thirty years, the academic world has produced many different definitions and specifications of post-Fordism, with applications for the whole spectrum of academic disciplines from Economics to Production Management, from Industrial Relations to Urban Sociology. Economic and Business History were, of course, also affected by the debate. Business History, in particular, seems to be the discipline with the highest potential both to profit from and add to the debate about post-Fordism, in the same way it has both profited from, and added to the debate about Fordism. Because Business History is intrinsically based upon case studies, it represents the ideal field of research in which conceptualisations developed within the post-Fordism debate can be tested against the available evidence. Moreover, by focusing on case studies over a wide time span, the origin of production and industrial relations settings can be traced back, highlighting the backward linkages between current and preceding settings and, therefore, the specificity of each industrial organisation. Thus, to analyse a specific firm through a Business History approach is likely to yield interesting empirical results, which can, in turn, help to refine the models of Fordism and post-Fordism, by addressing the specificity of each industrial system. In contrast, conceptualisations developed within Business Management, Economic Geography and Business Economics often, though not always, fail to capture backward linkages between the systems they analyse and previous organisational and technological settings, missing the specificity of the units analysed.

Jessop emphasises that the chronological prefix "post" preceding the word Fordism implies major discontinuities that, nevertheless, should be demonstrated.[4] The discontinuity issue links the debate about post-Fordism to several core issues in the theory of economic and technological change. The hypothesis of post-Fordism as a discontinuous process of technological and organisational change resembles Solow's neo-classical growth model, where technological change is seen as a shift of the

[3] Lewchuk, for example, poses that the decline of the UK motor industry was due to the refusal of unions to adopt American technology of mass production. Such a view is clearly asymmetric with respect to the idea that the crisis of the motor car industry during the 1970s coincided with the crisis of Fordism. The reference is to W. Lewchuk, *American Technology and The British Vehicle Industry* (Cambridge, 1987).
[4] Jessop, 'Fordism', pp. 46-69.

production function leading to an increase of output per unit of input, and technology is considered as exogenous.

Accordingly, post-Fordism cannot be reconciled with the evolutionary theory of economic change developed by Nelson and Winter, which puts great emphasis on localised and path-dependent innovation. In this respect, it is important to stress that the literature on the evolutionary theory of economic change and the literature on path dependency are deeply connected to each other. Path-dependency refers to the situation in which an industry is locked into an inferior technology, due to a number of possible factors, including high sunk-costs, managerial inertia, and uncertainty over the development of the external environment. The classical example of lock-in is the QWERTY keyboard developed in the 1880s.[5] The initial condition driving the QWERTY design was the necessity to minimise key jam, which was a relevant problem associated to typewriter technology in the late 19th century. The QWERTY keyboard became the standard one, although it was sub optimal in terms of pure typing practicality and speed. When the typing jam problem was sorted out, the QWERTY layout remained unchanged. In fact, the replacement of that layout would have required the re-training of a large number of people already trained in touch-typing techniques based on QWERTY.[6] This, in turn would have increased switching costs. This took away any incentive for typewriter suppliers to try to change the original design. It is worth noting that the classical QWERTY example highlights the relationship between capital and knowledge accumulation, which also underpins the evolutionary theory of economic change and its core concept of routines.

[5] P. David, 'Clio and the Economics of QWERTY' in U. Witt (ed.), *Evolutionary Economics* (Aldershot, 1993). See also L. Magnusson and J. Ottoson (eds), *Evolutionary Economics and Path Dependence* (1997).

[6] The issue of learning costs is a critical one also in the literature on First Mover Advantages, which is clearly related to that on Path Dependency. On the relationship between learning curve and first mover advantages see: B. Lieberman and D.B. Montgomery, 'First Mover Advantages', *Strategic Management Journal*, V. 9, Special Issue (1988), pp. 41-58.

The divide between the evolutionary theory of economic change and path dependency on one side, and the literature on post-Fordism on the other concerns not only technological and organisational change but also the transfer of technological and organisational capabilities. Generally speaking, it is possible to say that the post-Fordist paradigm reckons that not only technology, but also organisational and managerial capabilities, can be imported from outside the firm. With the possible exception of the Flexible Specialisation paradigm,[7] post-Fordism implicitly considers organisational and managerial capabilities as driven by neutral techniques, where new techniques and technologies combined together produce a new production paradigm. On the other hand, Nelson and Winter have shown that technological change is often localised and path-dependent, and based on research and development conducted within the firm. Thus, innovation is embodied not just in new devices and tools but also in the organisational routines of companies. This concept leads to two important consequences. Firstly, internally generated and context-specific innovation is not easily importable or exportable. At least, the importability or exportability of systems cannot be taken for granted. Secondly, technological change is not separable from the accumulation of managerial capabilities and technical knowledge that, in Chandler's view, represent the prominent feature and the reason of success of managerial corporations.

The overall idea underpinning this work is to focus on two specific variables, representative of the way Fiat management intended to pursue long-term company survival, and to analyse them from 1960 to the late 1980s in order to trace elements of continuity and discontinuity in management and practices before and after the 1970s. The two variables are: technological change, and the strategy of output mix optimisation. The aim is to see whether the restructuring of Fiat during the 1970s and early 1980s involved a shift to a new paradigm of production organisation and marketing, or simply the adaptation of new technologies to the existing production and marketing framework, aiming to remove bottlenecks previously generated by the Fordist system of mass production. Therefore, this work tries to contribute to the debate about

[7] The asymmetry of Flexible Specialisation in respect to other schools of thought within post-Fordism will be discussed in the subsequent section of this chapter.

post-Fordism by addressing the specific issue of continuity and discontinuity posed by Jessop.

In this study, contributions from the Business History literature, such as the classic work of Alfred Chandler, and from the Business Economics literature, such as the work of Nelson and Winter, will provide the framework to focus on Fiat's tangible and intangible capital accumulation during the 1960s, when the company expanded its mass production capability by building upon technical and managerial structures developed from the immediate post-war period onwards. Nelson and Winter provide the conceptualisation needed in order to analyse the implications of tangible and intangible accumulation on firms' long-term strategies and, therefore, the theoretical framework to predict "non-discontinuous" developments in big business. Such predictions will be tested against the case of Fiat during the 1970s and early 1980s. The literature on post-Fordism, on the other hand, offers conceptualisations that help to define the alternative production setting that might have been expected to emerge, had Fiat departed from Fordist mass production and shifted towards flexible mass production during its restructuring from the second half of the 1970s onwards.

However, this thesis not only aims to address the international debate on post-Fordism in the motor car industry, but also to contribute to the specific debate on Fiat. Much of the literature on the Italian company, in fact, tends to interpret Fiat as a successful case of transition from Fordism to post-Fordism, where the recovery from the crisis of the 1970s was due to the deployment of new managerial and production paradigms underlining product flexibility rather than production specialisation. Yet, sufficient evidence to support this view has not been provided by empirical studies, so that no consensus has emerged. As Amatori has recently pointed out, "Forty years of [Valleta's][8] managerial leadership [from 1926 to 1966] contributed strongly to the building up of Fiat's organisational capability, [and] its *genetic patrimony.* How much has been left of such a patrimony after 1970 is an important question for historians still to be addressed".[9]

---

[8] Valletta was General Director of Fiat from 1926 to 1946, and President of the Company from 1946 to 1966.

[9] Amatori, 'Gli uomini del Professore', pp. 342-343.

By exploiting a new set of unpublished data and documents, as well as by using extensive published documentation, this thesis adds to the debates concerning Fiat and post-Fordism by showing that restructuring during the 1970s and early 1980s was driven by a pattern of technical and business knowledge substantially similar to that which had characterised the growth of the company during the 1960s. This knowledge represents the intangible capital accumulated by the company during the age of Fordism. Despite the implementation of new technology (i.e. robotics), intangible capital, rather than new technology, shaped both production organisation and output-mix decision-making in the 1980s, where process specialisation rather than product flexibility was still seen by Fiat senior management as the basis of the company's profit maximisation strategy.

In this sense, this work supports the view of Fiat restructuring as a continuous process of development and contributes to the fulfilment of the research agenda set by Amatori, providing a different view from that proposed by the major part of the Italian literature on Fiat. Furthermore, the research concludes that the managerial decision to contain complexity costs attached to flexibility turned out to be the best profit-maximising strategy for Fiat. This finding suggests that the emergence of consumerism during the 1980s, which according to the paradigm of post-Fordism drove the development of flexible production systems, did not necessarily displace the old pattern of specialisation, in which there were few dominant actors in each segment of the market.

Specifying Fordism

Henry Ford never made any secret of the production technology developed by his company. On the contrary, during the 1910s, technical delegations, mainly from European car manufacturers, were invited to visit Ford production facilities. During the 1910s and 1920s, Fordism was at the core of technical exercises of production management in many European firms. Ever since, not only did the term "Fordism" enter the official dictionary of almost every language, but it was also clear that, given the implications in terms of labour control, the debate about Fordism was going to be a debate about society, rather than a mere debate about the scientific principles of production management. This might generate confusion in the debate about Fordism and post-Fordism, unless specific and clearly defined areas of investigation are addressed. Jessop distinguishes four areas of investigation, corresponding to different specifications of Fordism as a mode of production, a mode of regulation, a regime of accumulation, and a mode of socialisation.[10] This work is mainly concerned with the first two. As far as the modes of regulation are concerned, it focuses on organisational structures and strategic management, rather than industrial relations.

As a production process, Fordism refers to a specific configuration of the technical division of labour, involved in mass production of standardised goods. Technical division of labour is typically organised along Taylorist lines, the speed of which depends upon the technology implemented (for example automation, process segmentation etc.). The system is based on the supply-based principle that the production process must be continuous in order to secure long-run economies of scale. The speed of the work process is, indeed, the main feature of Fordism around which the staging of the process and the transportation system are designed.[11] However, in discussing the speed of the production flow, it is important to distinguish two technical concepts, namely lead time and cycle time. The former is the duration of the process from the first to the final stage of the process (i.e. the time taken for an engine to be produced or a car to be assembled), while the latter is the duration of each stage of the production process.

The lead time is a function of the cycle time of each stage of the manufacturing multiplied by the number of stages of the process, and the time needed to move a component from an assembly station to the subsequent one. Therefore,

$$Lt = (Tc * \Sigma Sn) + (Tt * \Sigma Sn) = \Sigma Sn * (Tc + Tt)$$

where Lt is lead time, Tc is cycle time, Tt is the time required to move a component from station to station, and ΣSn is the sum of n stations. The longer the Lt, the larger the work in progress and the relative inventory costs. Moving technology *per se* is not

[10] See: Jessop, 'Fordism', pp. 46-69.
[11] See, for example, B. Coriat, 'Microeletronica, robotica e lavoro operaio nelle industrie di montaggio', in A. Dina (ed.), *Modello Robot* (Roma, 1984), pp. 154-167.

sufficient to speed up production because it would affect only Tt, whereas Lt is also a function of Tc and ΣSn.

In order to understand the technical principle of Fordism, the relationship between the cycle time, the complexity of each component and its design, and the segmentation of the process is of interest. Different components involve different levels of complexity. Taking the example of car manufacturing, to produce chassis sub-components (for example the floor) by stamping is a much easier and quicker operation than the welding of the floor to the chassis. To avoid bottlenecks in the flow, each stage of the process has to absorb the same amount of time. Such a standard time is called the basic cycle time, which, ideally, is equal to the cycle time of the fastest stage of the process. If, for instance, the shortest cycle time in the process of chassis making corresponds to that of floor stamping, the welding of the chassis must be hyper-segmented up to the point that the duration of each sub-stage of the chassis welding equals that of the floor stamping. Sometimes, however, the equalisation of cycle times is not technically achievable, so that parallel lines or intermediate buffers must be deployed in order to avoid bottlenecks in the process.

The basic cycle time must be set at the fastest speed possible in order to maximise output. In fact, daily output is equal to

$$P= Wt/tc,$$

where P is output, Wt is the daily time available to production and Tc is the basic cycle time. Mass production, therefore, minimises the cycle time in order to maximise output. However, an equilibrium must be found between the minimisation of the cycle time and the hyper-segmentation of the process. The minimisation of Tc requires the hyper-segmentation of the production process of the most complex components, which in turn causes the number of stations - ΣSn - to increase. Hyper-segmentation, therefore, will lead to an increase in the lead time with a relative increase in inventory costs, unless engineers control and reduce the complexity of each component, limiting the segmentation of each stage of the production process, and manage to keep Tc constant. The standardisation of operations, components, and complete products is the way engineers minimise complexity and, therefore, try to find the optimal equilibrium between Tc and Lt. The minimisation of complexity obtained through product/process standardisation helps a great deal to minimise the cycle time. This is the reason why the Fordist firm tends to be process-oriented rather than market-oriented.

Containment of complexity and the reduction of the cycle time are the principal sources of productivity growth and, therefore, the most important sources of cost savings in the Fordist system of mass production. Excessive process/product standardisation, though, has also negative side effects. If a shift in the demand curve occurs, or macro-economic shocks make demand erratic, investment in fixed assets usually associated with mass production can no longer provide the expected returns. Usually, mass producers set up multiple production for different types of products, for example different types of vehicles. This involves multiple lines. However, to run multiple Fordist lines producing different types of cars may generate inefficiency when some lines must be over-utilised and others under-utilised in response to shifts in demand from one product to another. Over/under-utilisation is determined by the fact that in a multi-product Fordist setting, the production of the most required model cannot to be shifted from the saturated line to the under-utilised one because each product requires its own tools and its own segmentation of the process.

Tool specificity and process hyper-segmentation induce specialisation in specific segments of the market. As already pointed out, the mass production of small cars requires the deployment of technology, product and process design skills, and labour skills very different from those needed to produce relatively small batches of medium and large cars. Although car producers usually have a relative wide product range, they tend to specialise in the sense of favouring process/product renewal in those segments in which they perform better, rather than dispersing energy in trying to catch up in all segments.

The Fordist organisation of labour requires a separation between workers and managers, with the latter responsible for decision-making. The techno-structure is responsible for the standardisation of procedures.[12] Because the standardisation of procedures and product is the most important source of productivity, the techno-

[12] For the definition of techno-structure see H. Mintzberg, *Mintzberg on Management* (1989), pp. 130-133.

structure effectively influences top management in decision-making.[13] Since the techno-structure has a critical role in the accumulation of tangible and intangible capital (with the latter referring to routines and knowledge, which within the Evolutionary Theory of the Firm are regarded as the "genetic stock" of the firm), it could be tempted to influence the process of decision-making in order to preserve its own accumulated knowledge, when changing market conditions suggest rejecting the established pattern of routines.

Regulatory framework

Discussing the relationship between principal and agents within the firm, the analysis of Fordism has to shift to modes of regulation, which involve all aspects of the Fordist organisation of production within and outside the firm including internal/external relations, financial relations and State regulation. Here the focus is mainly on internal relations, although the other aspects will be briefly mentioned.

Within the Fordist system of mass production, the wage scheme is designed around the role of semi-skilled and unskilled workers who represent the core of the labour force in large plants. Managers recognise unions for collective bargaining, while unions, in turn, recognise job organisation and corporate strategy as prerogatives of management. The foundation of the social pact consists of wages being indexed to productivity. In theory, because increases in productivity are driven by progress in technology, design and routines, the concentration of knowledge and organisational decision-making in the techno-structure should not be not questioned by unions or workers. In practice, there is plenty of historical evidence showing that the social pact described above holds as long as job organisation is rational, tasks are not excessively alienating and production plans are made according to available production resources. Otherwise, labour reacts by substituting engineering-led routines with routines inspired by shop-floor experience, or by rising levels of absenteeism, or by opting for open conflict, when excessive control prevents the first two strategies from being implemented.

---

[13] Ibid.

As far as the structure is concerned, the typical Fordist firm is a large company in which ownership and control are separated. Multi-divisional structures are dominant, with decentralised division overseen by a central board engaged in long-term planning. The achievement of commercial and financial targets is a concern of divisions. The development of multi-divisional organisations is usually considered as depending upon an increasing complexity in decision-making,[14] along with increasing development of market-oriented strategies.[15] Nonetheless, if we accept the argument that in the Fordist firm the techno-structure retains much of the decision-making power, it also has to be accepted that, regardless of the formal structure adopted, a Fordist organisation remains product- rather than market-oriented, unless marketing management displaces engineers from the decision-making leadership. The actual functioning of structures, in other words, is likely to depend upon the relative power of agents within the firm rather than depending upon the formal structure adopted. This is an important point to be considered when discussing continuity in production organisation, where the literature on post-Fordism tends to ignore the capacity of managerial structures to resist pressures for change.

As far as the regime of accumulation is concerned, the main source of profits for Fordist enterprises is the surplus value derived from continuous increases in productivity and economies of scale. Firms are engaged in mark-up pricing (costs plus margins), and market shares are also affected by non-price elements, such as product renewal, advertising, quality of the product and after-sales services.[16] Within growing markets, price competition drives pricing behaviour, whereas within mature markets non-price competition tends to prevail. Non-price competition refers primarily to the case in which manufacturers compete by renewing product and improving quality. This form of competition usually leads to an upward adjustment in prices. Crucially, non-price competition will disguise implicit collusion, if prices of all competitors increase more than quality. The regime of competition depends mainly on macro-economic conditions and waves of product renewal.

---

[14] See the introductory chapter in A. D. Chandler, *Strategy and Structure. Chapters in the History of the American Industrial Enterprise* (Cambridge Massachusetts, 1962).
[15] Se: Jessop, 'Fordism', pp. 46-69.
[16] Ibid.

The domestic market is extremely important for mass production because export-related costs are substantial, so that large market shares in the domestic market are critical in ensuring cost reductions driven by scale economies, as the basis for price competitiveness abroad. Typically, the early stage of mass production in a specific country is protected by tariffs, which are gradually removed as soon as the industry achieves the minimum efficient size in an international context. Specialisation is induced by the technical minimisation of the cycle time, along with consumer tastes and income in the domestic market. European mass producers tend to be more specialised in the manufacturing of small (compact) cars whereas American mass producers manufacture large cars. Since the internal market is so important for Fordist mass producers, the regulatory role of the State has a huge impact on the efficiency of the Fordist industry. Welfare state schemes might promote a virtuous economic circle by stabilising demand for consumption goods through income transfer, enabling capital intensive and product specific assets to be utilised at optimal levels of capacity utilisation, which, in turn, gives firms sufficient confidence to re-invest profits in applied R&D.[17]

The Fordist regulatory framework involves the banking system as the financial engine of the supply and demand mechanism. Both consumer and industrial credit are important to sustain the market and finance long-term investments and daily operations, particularly in the case of industries producing cars or white goods. For such industries, the link with banks and financial institutions specialising in financing hire purchasing is critical. Stable interest rates, therefore, are vital to ensure the Fordist virtuous circle, with central banks playing a pivotal role in masterminding stable demand.

---

[17] The Keynesian welfare state is a typical example of welfare policy supporting the development of mass production.

Section two

The paradigm of post-Fordism

The literature on post-Fordism should be seen as an ongoing debate rather than an achieved or universally accepted theory of transition.[18] Differences between various contributions to the debate on post-Fordism concern mainly the compatibility of new production settings and technological paradigms with the existing Fordist regulatory framework. The principal question addressed by the post-Fordism literature, in fact, is whether the new production settings emerging from specific technological progress are compatible with the Fordist regulatory framework, or are likely to change the framework, or are totally in contrast with it. On the other hand, when the analysis shifts to specific production settings or specific technology, a common implicit view emerges within the post-Fordism debate, which is that technological and managerial changes have been leading, from the mid-1970s onwards, to a completely different technical setting, supporting a completely new way of approaching production management. Post-Fordism considers flexibility as the benchmark for the new best practice, and predicts that those firms that fail to shift to flexibility are destined to become marginal.

The following paragraphs suggest that the shift to flexible mass production implies a discontinuity with Fordism because flexible manufacturing is not compatible with the knowledge accumulated by the Fordist techno-structure over time. New production settings might be considered either compatible with the old regulatory settings, as suggested by the neo-Fordist approach, or incompatible with Fordist labour relations and managerial structures, as suggested by other approaches within the debate on post-Fordism. However, once new production settings are analysed in relation to the production mode *per se*, they appear to be inevitably discontinuous with respect to the Fordist technical production mode they have replaced. As a consequence, the paradigm of post-Fordism suggests, either implicitly or explicitly, that new technology and flexible production displace the old set of tangible and intangible capital stock. The following paragraphs of this section address the various schools of thought in the debate

[18] A. Amin, 'Post-Fordism. Models, Fantasies, and Phantoms of Transition' in A. Amin (ed.), *Post-Fordism: A Reader* (Oxford, 1995), pp. 1- 40.

on post-Fordism, focusing in particular on the issue of discontinuity in the production mode.

Long wave theory (LWT)

The theory was developed in the mid-1970s in order to explain long-term waves in economic development. In particular, Christopher Freeman and Carlotta Perez have analysed the relationship between technology and social structures, conceptualising it in terms of a "techno-economic paradigm". The successful transition from one wave to another depends upon "quantum leaps" in industrial productivity, deriving from the diffusion of cutting-edge technologies. In their early stage of development, though, new technologies are unlikely to ensure increases in productivity because of limited diffusion and learning-curve-related costs. In the process of transition, therefore, a key role is played by institutions, which ideally should be organised to sustain the development and diffusion of new technologies. According to Freeman and Perez, the passing age of Fordism corresponds to the fourth Kondratiev wave. Fordism, during the 1970s, became a constraint on the diffusion and development of new technologies, new production tools, and a new organisational framework, because Fordist institutions tended to use advances in new technologies to optimise existing processes and products rather than to develop new ones. The prediction of the two authors, however, was that the development of micro-electronics and information technologies would have in any case triggered the growth of new typologies of firms developing new processes and products, which eventually would have displaced the old pattern of process and products, fostering an adaptive response of institutions.

Two criticisms of the Freedman/Perez theory soon emerged, namely the technological determinism pointed out by the Flexible Specialisation school, and the fact that the origin of technological change was not specified, where new technologies tend to appear on the scene as a *deus ex machina*.[19] Indeed, in the LWT, the reason why new technologies should be stronger than old institutions in shaping the new techno-economic paradigm is not theoretically justified. LWT, nevertheless, has had a long

[19] K. Hoffman, R Kaplinsky, *Driving Force. The Global Restructuring of Technology, Labour and Investment In the Automobile and Components Industry* (1988), pp. 34-35.

lasting impact on the post-Fordism debate, particularly in regards to the emphasis on systemic and "revolutionary" innovation in the shift from a declining period to a new stage of development. In this respect, the various schools of thought in the post-Fordism debate do not deviate significantly from the LWT formulation, where differences emerge in regard to the impact of technological change on institutions.

Flexible specialisation

The idea of flexible specialisation was formulated and elevated to a paradigm of socio-economic interpretation of industrial history by the work of Bergen, Piore and Sabel and Zeitlin and Hirst.[20] At the heart of the approach lies the claim that since the nineteenth century two industrial paradigms, namely craft and mass production, have existed and opposed each other, and neither has ultimately demonstrated its superiority over the other. A first industrial divide occurred at the beginning of the century when mass production started to become dominant, developing in the inter-war period and becoming the leading form of production organisation in the post-war period, as it was sustained by Keynesian policies of demand stabilisation. Nevertheless, craft production, though limited to some specific regions, did not disappear. On the contrary, networks of small industries organised in industrial districts showed a distinct capability to absorb employment and achieve high levels of output at the aggregate industry level. Furthermore, craft production was better suited to cope with those segments of demand in which product differentiation matters. Within the flexible specialisation paradigm, therefore, the concentration of production in big plants was seen as the outcome of a socio-political choice, reflecting the supremacy of specific social groups (not necessarily social classes), rather than an organisational development purely enforced by economic rationale. The weaknesses of mass production emerged during the 1970s.

The crisis of the 1970s featured a two-fold problem. Firms had been suffering from a slowdown in the rate of growth of output due to the instability of the world economy

[20] The seminal works for the definition of the Flexible Specialisation are S. Bergen and M. Piore (eds), *Dualism and Discontinuity in Industrial Society* (Cambridge, 1980); M. Piore and C.F. Sabel, *The Second Industrial Divide* (New York, 1984); C. Sabel, J. Zeitlin, 'Historical Alternative to Mass Production: Politics, Market and Technology in Nineteenth- Century Industrialization', *Past and Present*, 108 (1985),

caused by instability in the oil prices, instability in the exchange rate, world wide inflation, the large US public debt, and widespread social unrest. Moreover, firms had been suffering, and were going to suffer even more in the future, from changes in the pattern of consumption caused by the rise of consumerism and the differentiation of demand associated with it. Thus the long-term prospects for Fordism were bleak even if economic stability was to return. The 1970s, therefore, marked the threshold after which Keynesian intervention no longer would have guaranteed economic stabilisation within a system dominated by mass production. During the 1970s, on the other hand, those areas in which institutions had favoured the deployment of new technologies in small firms, had clearly outperformed areas in which mass production was the prevailing form of labour organisation. This superiority was not only evident in terms of per capita income, but also in terms of quality of life. Those regions became an example of the social and production framework defined as Flexible Specialisation, based on small firms deploying computerised and flexible production technologies.

Flexible specialisation has been widely discussed and criticised by a number of authors.[21] One of the most common criticisms of the flexible specialisation theory is that it fails to capture the diversity existing in both craft- and mass-production paradigms. Also, it is not entirely clear whether the shift from craft to mass production at the end of the nineteenth century occurred entirely for socio-political reasons, such as the will of the political and economic establishment to concentrate production factors in big plants to better control the labour force and revenue distribution, or because of an internal superiority of mass production in terms economic efficiency in a situation when demand expands rapidly. Moreover, it is not entirely clear whether the shift to flexible specialisation should occur for socio-political reasons (redistribution of production factors and revenues) or because of the crisis of mass production. Furthermore, Sabel and Piore have been accused of underestimating the capability of big corporations to persist and adapt to new circumstances, and to remain competitive in respect to small firms by exploiting their grip on finance, market outlets, distribution networks,

---

pp. 133-176; P. Hirst and J, Zeitlin, 'Flexible Specialisation Versus Post-Fordism: Theory, Evidence, and Policy Implication', *Economy and Society*, 20/1 (1991), pp. 70-115.

[21] A review of the various voices of criticism addressing Flexible Specialisation is provided by. Amin, 'Post Fordism', pp. 1- 41.

advertising and so on. Finally, in many cases the development of networks of small firms disguised the mere downsizing and decentralisation of production promoted by big corporations.[22]

As was the case with long wave theory, the flexible specialisation approach also implies technological discontinuity. Within flexible specialisation, in fact, new technologies are no longer developed to maximise the hyper-segmentation of the production process and the standardisation of the product, as was the case with mass production, but are developed in order to maximise flexible production within small firms. As a consequence, both intangible capital and tangible assets accumulated by mass producers over time are not going to be re-utilised in the new production framework resulting from the process of shift from mass production to flexible specialisation.

The Regulation approach

The regulation approach was initially pioneered in France in the early 1970s and then developed world wide, mainly within political economics and industrial relations debates. At the heart of the regulation approach, there is a recognition of the paradox inherent within the capitalist system. This is the tendency towards instability and cyclical change, combined with a relative stability of the institutional set of regulations supporting the production system. As is the case with the other school of thought engaged in the post-Fordism debate, the regulatory theory reckons that long-term renewal of the capitalist system requires a radical change in both institutions and production frameworks. Nevertheless, this approach is rather reticent in predicting the features of the system to follow Fordism as opposed to the certainty of the long wave and flexible specialisation theories, which clearly define the characteristics and the name of the new era. The regulation theory stresses that the system emerging from the crisis of Fordism will result from the dialectic and the uncertain confrontation among different systems of production. Therefore, it prefers to concentrate the conceptual effort on defining a pattern of hypotheses to be investigated, rather than defining the

[22] In this respect see B. Harrison, *Lean and Mean: The Changing Landscape of Corporate Power* (New York, 1994).

characteristics and name of the new era. The hypotheses are that of flexible mass production, and that of neo-Fordism. The difference between the two hypotheses regards the evolution of the regulatory framework. While flexible mass production is defined as a gradual but discontinuous and irreversible resolution of both the Fordist production system and the pattern of regulation underpinning Fordism, the emergence of neo-Fordism is regarded as the development of new flexibility-oriented production frameworks within a substantially stable regulatory framework. This would still involve hierarchical firms based on the separation of management and labour, industrial relations based on unions engaged with wage bargaining but not with production organisation, and political institutions ensuring appropriate welfare policies. Therefore, both hypotheses maintain that in the aftermath of the crisis of mass production occurring during the 1970s, the production mode gradually shifted toward flexibility. This means that both hypotheses assume a discontinuity in production management. This thesis refers mainly to the regulatory school of thought because this is the approach that focuses more closely on the production mode.

The flexible mass production approach has been developed by Benjamin Coriat, who argues in favour of a discontinuous approach to transition, by suggesting that from the early 1980s onwards, industrial societies have been witnessing a melding of traditional mass production, automated robotics technologies, and flexibility.[23] New technologies such as robotics and computer-aided design and manufacturing systems have been dramatically transforming production into a new manufacturing model. Flexibility of the production system allows management to effectively exploit opportunities in differentiated markets, where shares change continuously, calling for continuous adjustments of total output and output mixes. Discontinuity, therefore, emerges in the way management has to deal with competitive strategies and product development. In order to achieve flexibility, the supply-oriented Fordist system of mass production has to be overruled.

The impact of new technologies on the broad industrial organisation has been also analysed by Martin Kenny and Richard Florida, who argue that the main characteristic

---

[23] B. Coriat, *L'Atelier et le Robot: Essai sur le Fordism et la Produsion de Masse a l'Age de l' Eletronique* (Paris, 1990).

of Fordism was the separation between R&D and production. The development of cad-cam technologies and the emergence of R&D-oriented manufacturing, on the other hand, have caused a radical change in human capital, where labour re-skilling and the intellectual enrichment of labour are the main features of the emerging production paradigm that the two authors define as Innovation-Mediated Production.

Dohse, Jürgens and Malsh[24] have taken a less discontinuous approach, identifying in the Toyota system of mass production a development of the traditional mass production framework, which allows the recomposition of some stages of the process without reducing the speed of the production process. In this sense, there is no break with the principle of Fordism, although the new system allows for product-mix flexibility. Such a neo-Fordist approach, however, has been partially revised by the authors,[25] after the success of works edited within the MIT International Automotive Project,[26] fostering the view that the Toyota production setting should actually be seen as an example of a flexibility-oriented system totally discontinuous with Fordism.

Fordism and Toyotism

Not surprisingly, a substantial part of the literature on post-Fordism has focused on car manufacturing. In particular, the Toyota system of production has attracted the attention of a significant number of scholars, who were intrigued by the extraordinary catching up of the Japanese manufacturer, not only in terms of output, but also in terms of technology, quality and product differentiation. This has been explained by the diversity of the Toyota system in respect to Fordism. As a result, the term Toytotism has become synonymous with post-Fordism in the same way that Fordism had become synonymous with mass production.

According to common wisdom, the most important feature of the Toyota system was the decentralisation of the production system, including not only the supply of electrical and mechanical components, but also the decentralisation of the production of

[24] See: K. Dohse, U. Jurgens, T. Malsh, *From Fordism to Toyotism? The organisation of the Labour Process in the Japanese Automobile Industry, Politics and Society*, 14/2 (1986), pp. 45 - 66.

components such as chasses and complete engines, the process of which is capital intensive and, therefore, usually internalised and concentrated in large plants. The system was based on a network of suppliers producing a relatively small batch of components. The relatively small size of suppliers and their capital stock is thought to facilitate re-set time minimisation, which in turn leads to maximum flexibility. The supply chain in such a complex network required a careful planning of the production flow, which forced Toyota to find a way to optimise logistics. This was achieved through the *kanban*, the most important feature of which consists in the decentralisation of the component purchase at the level of each production line which, therefore, purchases only the quantity of components required by the daily production. The transaction related to order and delivery takes place between the shop-floor and the specific supplier attached to each specific plant or line. Provided the delivery occurs just in time, the system has also the advantage of eliminating buffers. Finally, in order to achieve the same level of quality among the different suppliers, quality control procedures are standardised by Toyota for all suppliers.

As already stated, Dohse, Jurgens and Malsh have interpreted the Toyota system as a refined form of Fordism, minimising the bottlenecks deriving from excessive hierarchy and process segmentation.[27] In fact, the institutional framework remains substantially Fordist, in the sense that Toyota management exercises significant control over the Toyota workforce, in order to maximise the speed of the production process and, therefore, labour productivity. Moreover, Toyota exercises total control over the suppliers, not only by enforcing quality and productivity standards, but also by setting component prices.

On the other hand, several authors associated with the MIT International Motor Vehicle Program reached a different conclusion. This is that the Toyota system represents a new paradigm of production organisation, *lean production,* which is totally

---

[25] See: U. Jürgens, T. Malsh, K. Dohse, *Breaking from Taylorism. Changing Forms of Work in the Automobile Industry* (Cambridge, 1993).
[26] A. Altshuler, (ed.), *The Future of the Automobile: The Report of MIT's International Automobile Program* (1984).
[27] See Dohse, Jurgens, Malsh, *From Fordism to Toyotism?*, pp. 45-66.

incompatible with mass production, and inherently superior.[28] The prophets of the new paradigm predicted that by shifting to lean production, the European and American car industries would recover from their structural crises and start a new virtuous circle. Womack, Johnes and Ross pick up the same technical aspect of the Toyota system already underlined by Dohse, Jurgens and Malsh, but draw the conclusion that the Toyota system is lean because stocks are kept to minimum levels, the production of each model is calibrated on demand, while spare capacity is close to zero thanks to a high degree of product-mix flexibility.

Womack, Johnes and Ross prefer to ignore the institutional and endogenous features of the Japanese system, which on the contrary were at the centre of the analysis of Dohse and his colleagues. This is because the prophets of lean production try to demonstrate that Toyotism is exportable and, in order to do so, they must overlook all the issues related to the Japanese industrial relations system, which, in the aftermath of the unions' defeat in the 1950s, features the displacement of independent unionism in favour of an ethic of the firm entirely constructed around the unquestionable power of managers.[29] Such a system of industrial relations is difficult to export to Western countries, but was indeed one of the sources of Toyota's competitive advantage. Most of the many criticisms of the International Motor Vehicle Program and the idea of Toyotism as a universal benchmark of a perfect production framework are based on the concept that the higher complexity costs faced by Toyota in running flexible production are actually compensated by a relatively low cost of labour. Interestingly, Williams shows that both Ford's Highland Park (1915-1916) and Toyota's Takaoka (1980-1990) kept the labour share of added value lower than 45%.[30]

Elaborating on these criticisms, it seems worth turning attention to the relationship between Toyota and its suppliers. These are usually divided into primary, secondary and tertiary suppliers. Toyota has permanent relationships with primary suppliers, which therefore plan their output over the long term. On the other hand, primary suppliers

[28] J. P. Womak, D. T. Jones, D. Ross, *The Machine That Changed the World* (New York, 1990).
[29] In this respect, see M. A Cusumano, *The Japanese Automobile Industry. Technology and Management at Nissan and Toyota* (Cambridge, Massachusetts, 1985), pp. 137-185.
[30] The respective labour shares of added value are 39% for Ford and 42% for Toyota. K. Williams, C. Haslam, S. Johal, *Cars. Analysis, History, Cases* (Oxford 1994), p. 18.

choose among secondary suppliers, which therefore compete against each other by setting lower prices for their output. The same relationship exists between secondary and tertiary suppliers. The more suppliers are peripheral, the more labour is flexible both in terms of entering into and exiting from the production process. Therefore, peripheral wages are more flexible as well.[31] Arguably, if Toyota's primary suppliers obtain lower prices from secondary and tertiary suppliers by shifting their purchases from one supplier to another, some spare capacity must exist somewhere in the system. Womack and his colleagues do not address this problem, although, in order to be convincing, they should have shown that production at Toyota is really lean, in the sense that there is no spare capacity, either at the Takaoka plant, or anywhere else within the network of suppliers.

From the mid-1980s to the early 1990s, the literature was inclined to identify Toyotism rather than Fordism as the best practice. The relevant question, therefore, was whether or not Toyotism could be exported to Europe and the US. In the late 1990s, the literature seemed more inclined to depart from the "best practice" approach, where the shift from Fordism to flexibility is seen as a selective adaptation of Toyotism in combination with a range of different possible options.[32] Lean production, in other words, was not seen as the outcome of a single model of production organisation. Moreover, it was recognised that the effort to identify "the model" for car production was, in a way, pointless. However, even the most recent literature on the car industry admits, either implicitly or explicitly, that flexibility is the most important factor distinguishing the old from the new production system. Therefore, it is important to establish when and to what extent a given firm became flexible. This is the reason why this thesis focuses on Fiat, testing the hypothesis that the company shifted to flexibility in the 1980s against an independent variable, namely the behaviour of the rate of utilisation of production lines.

---

[31] For a description of the Toyota supply chain organisation see: M. J. Smitka, *Competitive Ties. Subcontracting in the Japanese Automotive Industry* (New York, 1991).

[32] R. Boyer, E. Charron, U. Jürgens, S. Tolliday, 'Transplant, Hybridisation and Globalisation: What Lesson for the Future?' in R. Boyer, E. Charron, U. Jürgens, S. Tolliday (eds), *Between Imitation and Innovation*, (Oxford, 1998), pp. 374-379.

Flexibility and discontinuity

In general, the regulation school suggests that over the last twenty years, in each industrialised country new institutional and technical paradigms of production have been developed, with varying degrees of differentiation and autonomy.[33] Therefore, the tendency to identify the new production mode as the Japanese system, suggested for example, by Hoffman and Kaplinsky,[34] and, in other ways, by the group linked to the International Automotive Program, has found less support within the Regulation School. In spite of such a variety of views, when the focus shifts to the relationship between production technology, production management and marketing strategy, a common pattern of concepts emerges in the various schools of thought within post-Fordism. This pattern is organised around the idea that product-mix flexibility is the key factor in international competition. New technologies, including numeric control tools and robotics, are deployed to support flexible production, where high speed lines are capable of processing a range of products simultaneously, with product mixes randomly set and reset during the shift.[35]

Flexible technology is meant to minimise spare capacity and intermediate buffers. Since the product mix is determined by inputs received from the marketing department, the whole organisation of production is determined by a random variable (the demand for specific products) to which production has to adapt. By contrast, in the Fordist system production was a function of a pre-determined plan. Within flexible manufacturing, neither is the standardisation of the production process the focus of the techno-structure effort, nor is the techno-structure the centre of the decision-making, nor is the product developed in order to minimise complexity and, by that, lead times. On the contrary, products are developed continuously in order to follow, and when possible to change, the taste of consumers. The product mix shifts according to the shifts in opportunity from one segment of demand to another, regardless of the direction this opportunity might take (i. e. up- or downmarket).

---

[33] Amin, *Post-Fordism*, pp. 7-9.
[34]. Kaplinsky and Hoffman, *Driving Force*, pp. 34-35.
[35] 'Randomly set' means that output-mix setting and tolls resetting occur according to inputs provided by the marketing department. From the point of view of production management, therefore, the output mix is

The entire process, when set to maximise flexibility, leads to a total departure from the Fordist system of mass production, because the intangible capital stock accumulated around the principle of standardisation is displaced along with the physical capital stock developed around the principle of tool specificity and task fragmentation. When it comes to discussing the production framework, therefore, the whole body of literature on post-Fordism, including neo-Fordism, implies a marked discontinuity between Fordism and the production frameworks that gradually replaced it in the various industrialised countries. Such a discontinuity is constructed around a pattern of concepts underpinning flexible mass production, which have been summarised in table 2.1 and which indeed emerge constantly in the debate about post- Fordism.

Table 2.1: Fordism and post-Fordism production features

	Fordism	post-Fordism
Decision-making	Centralised and supply-oriented	Decentralised and demand-oriented
Technological change	Incremental - endogenous	Systemic - exogenous
Aims of technological change	To improve the existing process/product	Either to improve or change process/product
Use of technology for	Cycle time and lead-time minimisation	Flexibility maximisation
Job content	Minimal	Intellectually relevant
Labour features	Unskilled; unaware of the entire process; interchangeable without training	Skilled; aware of the whole process; adaptable to different complex tasks
Labour development	Towards progressive de-skilling	Featuring constant re-training
Product features	Standardised	Customised
Product development	Supply-driven	Demand-driven
Product quality	Benchmarked on competitors	Tied to theoretical possibilities offered by cutting edge technologies

Source: Elaboration of the author.

determined by a random variable (orders for specific products), rather than a constant (predetermined production plan).

The case study approach enables researchers to see whether and when specific firms shifted to flexibility, experiencing the discontinuity suggested either implicitly or explicitly by post-Fordism. Alternatively, the case study approach could show that such discontinuity is more apparent than real, in specific contexts or time spans, adding valuable insights to the debate. The next section of the chapter introduces the paradigm of continuity as a way of interpreting the restructuring of Fiat during the 1970s as a continuous process of development, not only in terms of regulation, as suggested by most of the literature on the company, but also in terms of production framework and marketing strategy, where new technologies were utilised to maximise a system still dominated by a pattern of routines developed in the age of Fordism.

Section three

The paradigm of continuity

This section highlights the set of conceptualisations underpinning the view of continuity. This considers the response of industrial firms to the crisis of the 1970s as a process of development, in which the technical and managerial knowledge accumulated by firms in their quest for optimising Fordist mass production played a central role. The view of continuity departs from the approaches developed within the post-Fordism debate, which imply the substitution of the intangible capital stock as a condition to shift from Fordism to new forms of industrial production.

Firms and the accumulation of intangible capital

The paradigm of continuity is constructed around the relationship between investments in managerial structures and the accumulation of knowledge in the form of developments of routines. The evolutionary theory of economic change refers to routines as established and repetitive practices within a given firm. Routines play the role that genes play in the biological evolutionary theory. They are hereditary features of the firm and are selectable in the sense that firms with certain routines may do better than others, and, if so, their relative importance in the population is augmented over time.[36] Routines especially affect the process of decision-making, in particular the search for new techniques. The development of routines can be defined as a process of intangible capital accumulation, which occurs concurrently with the accumulation of physical capital.

The relationship between the accumulation of tangible and intangible capital is at the heart of both the Evolutionary Theory of Economic Change and the Business History paradigm developed by Chandler. The last-mentioned author identifies the dynamic element of modern capitalism in the development of managerial hierarchies.[37] Managerial structures enable firms to co-ordinate the input/output flow, to co-ordinate R&D for product/process development, and to organise multi-product manufacturing and distribution. Those activities, in turn, enable the firm to maximise economies of scale and scope. Investments in managerial structures bring about intangible capital accumulation which, in turn, enables corporations to maximise both strategic and functional effectiveness. Strategic effectiveness means the ability of a firm to acquire a monopolistic position in its own market, or in leaving declining markets for expanding ones. Functional effectiveness means the ability to compete for market shares in a mature oligopolistic industry. Both strategic and functional efficiency develop within the firm, along with the expansion of assets and hierarchies. The significance of cumulative knowledge, be it technical or managerial expertise, explains why, in Chandler's view, the large corporations, which, in the late 19th and early 20th centuries exploited first-mover advantages by investing in production distribution and managerial structures, were still dominant in the second half of the 20th Century[38].

The expansion of managerial hierarchies leads to the increasing complexity of the information flow between departments, which in turn leads to the standardisation of practices and standardisation of knowledge. A theory of routines rejection or confirmation is necessary in order to explain long-term company survival in changing market conditions. In those conditions, the accumulated knowledge of a firm might or might not become a constraint on development. Nelson and Winter identify the routine-

---

[36] Nelson and Winter, *An Evolutionary Theory*, pp. 14 -18.

[37] A. D. Chandler, and H. Daems (eds), *Managerial Hierarchies: Comparative Perspectives on the Rise of the Modern Industrial Enterprise* (Cambridge Massachusetts, 1980).

[38] Chandler, *Scale and Scope*, pp. 3-13.

changing process of a given firm as the most important of all routines, determining the probability distribution of new routines. Those are found by a search process, which is determined by a number of variables (for example R&D expenditure) which might be a function of the size of the firm. Companies judge new routines by using a set of criteria, among which the most common is *expected profits.* Expected profits link the process of routine selection within the firm to the external environment (market). This is an important element in the Nelson and Winter theory, because routines are created within the firm, but are ultimately selected by the external environment.

This leads to the issue of defining the nature of strategic firms. William Lazonick and Mary O' Sullivan have focused on corporate governance, trying to recompose the dichotomy between the concept of cumulative knowledge and that of strategic firm. This dichotomy stems from the fact that if the company development is entirely dictated by cumulative knowledge, then strategic management and innovation are de facto inhibited. Lazonick and O'Sullivan insist that the process of technological change can be characterised as *cumulative, collective and uncertain.* Technological change is a cumulative process because the possibility to change technological and market conditions depends on the development of those conditions in the past. It is a collective process because the transformation of technological and market conditions involves the commitment of a large number of individuals. Finally, technological change is an uncertain process because the elements that can transform market and technological conditions in an optimal way are not fully known at the moment in which the commitment in new technologies is made.[39] Hence, according to the two authors, the innovative firm is strategic firstly, and overall, in the way it engages in cumulative and collective learning, and secondly in the way it moves in the market.

This thesis refers to the pattern of conceptualisations, rather than the pattern of formal models developed by Nelson and Winter. The process of routines rejection/confirmation is referred to the deployment of a specific technology (robotics), as well as the to the implementation of a specific strategy of output-mix optimisation.

[39] W. Lazonick, M. O'Sullivan, 'Organisation, Finance and International Competition' *Industrial and Corporate Change*, 5/1 (1996), pp. 1-49. M. O'Sullivan, 'The Innovative Enterprise and Corporate Governance', *Cambridge Journal of Economics*, 24/4 (2000), pp. 393-416.

Such use of the concept of routines exceeds the boundaries of technological change, which seems to be the main concern of the evolutionary theory of economic change. Nonetheless, the definition of a strategy as a routine and the identification of strategic decision-making as a process of routine rejection/confirmation seems to be justifiable on the ground that both strategic and technology-related decision-making are determined by expected profits. In both cases, expectations are affected by the accumulated knowledge of managers, which affects the way in which management weighs risks involved in strategy/technology rejection, vis-à-vis risks involved in strategy/technology confirmation.[40]

The confirmation/rejection of routines is a central issue in the discussion of the crisis of Fordism and the response of industrial economies to the crisis of the 1970s. The debate on post-Fordism, including the school of neo-Fordism, suggests that new technologies enabled firms to achieve flexibility in manufacturing. This view implies the rejection of a pattern of technical routines related to standardisation and costs reduction. The flexible manufacturing paradigm, in fact, assumes that the expansion in complexity costs is compensated by the possibility to run production lines at the optimum capacity level. Profits in this case are expected to derive from production stabilisation and from the possibility offered by flexible production to compete in a range of different market segments, shifting up/downmarket every time such a shift is needed. The shift to flexibility implies a discontinuity in production management with respect to Fordist manufacturing.

Within Chandlerian multi-divisional structures, the process of routines rejection/confirmation is extremely complex and is affected by several elements including, arguably, the power of different groups within the firm and the kind of information different actors can access, in order to support their business view. A shift towards flexibility might be desired by marketing mangers under the pressure of expected changes in the pattern of demand, whereas engineers, who had developed Fordist routines related to standardisation and cycle-time minimisation, might oppose the shift towards flexibility. Top managers might support marketing managers, if they

[40] Nelson and Winter, *An Evolutionary Theory*, pp. 14 -18.

think the pattern of consumption is going to change, or they might support engineers if they think otherwise.

This thesis suggests that after 1973, Fiat confirmed a pattern of routines which defined the aim of technological change and output-mix optimisation strategy. Technological change, and in particular the deployment of robotics, aimed to minimise the cycle time of critical stages of manufacturing, such as spot welding, rather than output-mix flexibility. Such a development was consistent with the output-mix strategy that aimed to maximise the company expertise in the manufacturing of small cars. This development was the result of the prevalence of the engineers over the marketing managers.

Section four:
The literature on Fiat

This section provides the reader with an overview of the Italian literature on Fiat. Moreover, the section shows that the Business Management literature on Fiat mirrors the view of a discontinuous development of industrial firms after the crisis of the 1970s, emerging from the debate on post-Fordism.

The Italian literature on Fiat: An overview

The literature on Fiat is vast. The bibliographical directory edited by Archivio Storico Fiat,[41] contains 1510 references to monographs and articles, covering a wide range of disciplines. Business History-oriented studies refer mainly to industrial relations,[42] whereas technological change and corporate strategy have been mainly the object of studies in the field of Business Management.[43] Even the latest work of Castronovo in Business History, which analyses Fiat from 1899 to 1999, has its principal focus on industrial relations and political history, while the analysis of the post-1973 strategic and technical developments of the firm builds upon the Business Management literature. Those authors suggest, either implicitly or explicitly, a marked discontinuity with

[41] C. Annibaldi, M. R. Moccia (eds), *Bibliografiat* (Torino, 1998).
[42] S. Musso, 'Le relazioni industriali alla Fiat', in Annibaldi and Berta (eds), *Grande impresa e sviluppo italiano*, pp. 165-231; V. Castronovo, *Fiat 1899 - 1999: cento anni di storia italiana* (Milano, 1999); G. Berta, *Conflitto industriale e struttura d'impresa alla Fiat 1919 – 1979* (Bologna, 1998).
[43] See: Enrietti and Fornengo, *Il gruppo Fiat*; Volpato, *Il caso Fiat.*

respect to the Fordist system of mass production developed by Fiat in the post-war period. In fact, these authors assume that, after 1973, Fiat shifted to flexible mass production, and deployed a new and discontinuous output-mix optimisation strategy. Therefore, by following a Business History approach, this thesis aims to criticise the view of discontinuity expressed by the Business Management literature on Fiat.

In contrast with the 1970s and 1980s, the pre-1973 history of Fiat has been analysed by various business historians, who have covered a variety of aspects of the company over time. Castronovo and Bairati have focused mainly on the political and social history of Fiat through the reconstruction of the role of leading personalities such as Giovanni Agnelli Senior and Valletta in Italian political history.[44] Sapelli has carried out extensive research on the role of Fiat management in the development of technical knowledge and corporate culture in Italy, as well as extensive analysis of unionism in the inter-war period.[45] Bigazzi has analysed Fiat in both the inter- and the post-war periods, with reference to management, technical organisation, multinational activities and overseas investments. His work on the development of large-scale production at the Lingotto and Mirafiori plants addresses the transfer of American technology into the Fiat production system, highlighting the complexity involved by the adaptation of that technology to the Fiat shop-floor.[46] Finally, Amatori has reconstructed the development of the Fiat structure from a Chandlerian perspective, from the inter-war period to the late 1960s, suggesting that further research is needed in Business History, to see whether or not the business culture developed by Fiat over a very long period of managerial stability survived the events of the 1970s.[47] From such a suggestion, it emerges that the conclusions reached by the Business Management literature do not appear completely convincing to Amatori, who, therefore, still considers the 1970s as an open field for further research, which is the starting point of this thesis.

[44] See V. Castronovo, *Giovanni Agnelli* (Torino, 1977); P. Bairati, *Vittorio Valletta* (Torino, 1983).

[45] G. Sapelli, 'Gli organizzatori della produczione tra struttura d'impresa e modelli culturali', in *Storia d'Italia. Annali. Vol IV: Intellettuali e potere* (Torino, 1981), pp. 591-696. See also G. Sapelli, *Organizzazione, lavoro e innovazione industriale nell'Italia tra le due guerre* (Torino, 1978).

[46] D. Bigazzi, 'Struture della produzione: il Lingotto, L'America, L'Europa', in C. Olmo (ed.), *Il Lingotto1915-1939. L'archittettura, l'immagine, il lavoro* (Torino, 1994), pp. 281-336; Bigazzi, 'Mirafiori', in Zetlein, Herrigel (eds), *Americanisation and Its Limits*, pp. 163-211.

[47] Amatori, 'Gli uomini del Professore', in Annibaldi and Berta (eds), *Grande impresa e svilluppo Italiano*, pp. 257-343.

This work explains the introduction and development of robotics as an incremental and evolutionary process aiming to remove the technical bottlenecks of the existing Fordist system of production, whereas the Business Management literature explains the introduction of robotics as a process of systemic innovation aiming to shift from Fordism to flexibility. Furthermore, the idea of discontinuity expressed by the Business Management literature will be also criticised in relation to output-mix optimisation strategy.

Although this work relates mainly to the Business Management literature, industrial relations are also considered. The most recent literature on industrial relations tends to deny that technological change in the late 1970s and early 1980s was the result of a managerial determination to weaken the unions by the implementation of technological means. This thesis accepts this view without adding to the debate, explaining how the hypothesis has emerged, why it seems convincing, and why it seems reasonable to look at arguments beyond industrial relations to analyse technological change at Fiat.

The Industrial Relations literature

During the 1970s, Fiat experienced a regime of quasi-permanent conflict between management and workers. This had started in 1969, with the wave of strikes of the so-called "Hot Autumn", and ended in the autumn of 1980, when after 32 days of strike, the unions had to accept the Fiat plan for major redundancies.[48] A good deal of the literature, therefore, refers to the long-lasting confrontation between workers and management. Although this thesis does not intend to deal directly with industrial relations, the events of the 1970s and early 1980s have been summarised in chapter 5, in order to make the reader aware of such an important aspect of both the history of Fiat, and the history of contemporary Italy. At the same time, that chapter shows that the engineering-led and evolutionary view of technological change argued in this thesis does not conflict with the literature on industrial relations developed over the last fifteen years, which refused any form of technological determinism in explaining the defeat of the unions in 1980, turning its attention instead to political and social explanatory variables.

This was an important development, because some of the Industrial Relations literature during the 1970s had portrayed restructuring and technological change as a "technocratic" response by management to the increasing power of the rank and file in its quest for greater control over production. This argument was initially put forward in 1974 by extreme-left unionists such as Guidi, Bronzino and Germanetto.[49] At that time, experiments with robotics had just begun in spot welding, and robotics was rather an unknown subject, as was its potential for accelerating the replacement of workers by capital. Those authors, therefore, expressed concerns that robotics would be used to weaken the unions, by pursuing a massive substitution of capital for labour. In the early 1980s, Collidà and Negrelli[50] reached the conclusion that organisational and technological changes were not to be seen as the only factors affecting a change in industrial relations. On the other hand, the two authors maintained that the determination of management to undermine union power was one of the factors explaining technological change.[51] The new technology, in their view, not only created the conditions for a reduction in labour input, but also for a change in the overall technological content of the process, so that the ability of unions to influence production planning and technological developments was going to be undermined by the knowledge gap brought about by the new equipment. Moreover, the deployment of new technologies accelerated the turnover of workers, because new specialisation and professional profiles among workers were needed to support the deployment of robotics. Because new workers were more skilled and knowledgeable than the old workers, the social and cultural distance between new workers and engineers was reduced, which in turn helped to reduce the gap between management and new labour and to create a divide between new and old workers.

Even in Collidà and Negrelli's refined formulation, however, the "technocratic response argument" contains the unavoidable shortcoming that the localised implementation of robotics in the spot-welding and painting shops at Fiat could not

---

[48] Details of this event will be provided in chapter 5.

[49] G. Guidi, A. Bronzino, L. Germanetto, *Fiat: struttura aziendale ed organizzazione dello sfruttamento* (Milano, 1974).

[50] A. B. Collidà, S Negrelli, *La transizione nell'industria e nelle relazioni industriali: l'auto ed il caso Fiat* (Milano, 1986).

prevent workers from creating artificial bottlenecks elsewhere in the process, particularly in the final assembly, which at least up to 1988 remained labour-intensive. The relationship between robotics and the decline of unions at Fiat, therefore, should have been demonstrated rather than assumed. In fact, it has always been assumed, but never demonstrated. This is not to deny that, in the long term, organisational and technological change, along with changes in the composition of the labour force, had a significant and positive impact on the broad context of industrial relations at Fiat. The question, though, is whether such a development of industrial relations was the predictable - and predicted - outcome of the specific process of technological and organisational change taking place at Fiat during the late 1970s. As will be shown in chapter 5, during the 1970s Fiat management had few reasons to believe *ex-ante* that technological change would have had a huge impact on the unions' ability to create artificial bottlenecks in production, in order to put pressure on management.

The technocratic response argument was developed to explain the reason why Fiat management developed robotics in the 1970s. Interestingly, the Industrial Relation literature dealing with the defeat of the unions in 1980 does not give much credit to the idea that the defeat was the outcome of technological change. On the contrary, during the 1980s, industrial relations experts within and outside the academic community became increasingly sceptical about the correlation between technological change and changes in the pattern of industrial relations, because the crisis of the unions appeared too widespread and deep to be explained solely by technological change. At that stage, the debate no longer asked whether robotics had been developed to weaken the unions. Therefore, the technocratic response argument was never openly criticised by using the counter-argument mentioned above that the Fiat management had neither theoretical nor practical reasons to expect that robotics would cause a decrease in the unions' ability to stop production. Chapter 5 will fill this gap.

As early as 1981, Enzo Mattina[52] emphasised the progressive detachment of workers from the unions. This detachment was caused by the inability of union leaders to depart from an ideological approach to unionism, and to adopt a more pragmatic and orthodox

---

[51] Ibid, pp. 165 and 210-228.
[52] E. Mattina, *Fiat e Sindacati negli anni 80* (Milano, 1981).

bargaining framework. Other authors on union matters, such as Mana and Valvo, have analysed the Fiat restructuring from a business management perspective,[53] giving an overall positive assessment of the restructuring including technological change. They imply that the decision to downsize the workforce, which had caused the 32-day strike in the Autumn of 1980, was an undesirable but necessary course of action to be taken, in order to regain competitiveness.[54]

Bonazzi has argued that in the long term robotics had a positive effect on the relationship between managers, foremen and workers, helping management to normalise industrial relations.[55] However, the author seems to reject the hypothesis of any pre-planned strategy of systematic use of technology in order to weaken the unions. Moreover, along with Business Management authors, Bonazzi tends not to consider working conditions as a sufficient explanation for the deployment of robotics, because in theory, it was possible to improve working conditions by improving traditional automation. In practice, though, traditional automation would have prevented the development of flexible manufacturing. Therefore, the author maintains that the most important drive for investing in robotics was flexibility.

The most recent Business History literature on industrial relations at Fiat, including the work of Berta, and the history of Fiat written by Castronovo,[56] tends to explain the defeat of the unions in 1980 in terms of their increasing internal weaknesses, as already suggested by Mana, combined with a change in the overall political climate, and a revived determination of management to exploit those factors in order to regain the power to manage. The internal weakening of the unions was due to the inability of the three largest Italian organisations, CGIL, CISL and UILL, to control the shop floor, where union representatives were often bypassed by dissident ultra-left extra-parliamentary groups, imposing their decisions over both management and the rank and file by using undemocratic or even violent methods. Such uncertainty and, in many cases anarchy, not only put the future of the company in jeopardy, but also led to a deterioration of overall working conditions, which in turn led to the progressive

[53] F. Mana, T. Valvo, *Fiat Auto anni 80. Organizzazione, professionalita' e salario* (Milano, 1985).
[54] Ibid, pp. 69-78.
[55] G. Bonazzi, *Il Tubo di Cristallo* (Bologna, 1994), p. 104.
[56] Berta, *Conflitto industriale*, pp. 40-70; Castronovo, *Fiat*, pp. 1199-1535.

detachment of workers from the unions. This phenomenon was concurrent with a progressive decrease in power of the Christian Democrat Party, and a change in the attitude of the Communist Party. During the late 1960s and 1970s, both parties had given strong backing to the unions in their struggle against Fiat management, though with different motivations and modalities of action. Following Berta and Castronovo, Stefano Musso shows that in the early 1980s, restructuring, and in particular technological change could be successfully completed because of the defeat of the unions.[57] In this way, the author turns the old "technocratic response argument" upside down, in the sense that the recovery of the managerial power was a pre-requisite for the implementation of new technology.

The Business Management literature

At the beginning of the 1980s, thus, the Industrial Relations literature started to gradually shift its focus from technological and organisational changes to the unions' internal dynamics within the broader political context, in order to explain the defeat of the unions in 1980. At the same time, a number of authors in the Business Management area, most notably Mosconi and Valeo, Volpato, Merli, Dina and later Enrietti and Fornenego,[58] shifted the main focus from industrial relations to other factors to explain technological change, and more generally, the restructuring of Fiat. No longer was Fiat analysed in the relatively "narrow" context of the Italian social and political environment. On the contrary, the process of restructuring was analysed in the broader context of changes in the international pattern of car demand and supply.

As far as the relationship between technology and labour relations is concerned, the Business Management literature mirrors the Industrial Relations literature of the mid-1980s, by taking the view that technological change contributed to the improvement of working conditions in the long term and, therefore, to the stabilisation of industrial relations after the unions were defeated in 1980. Of course, this literature acknowledges also the unquestionable view that improvements in industrial relations after 1980 proved

[57] Musso, 'Le relazioni industriali alla Fiat', p. 225.

[58] See: Mosconi, Valeo, *Crisi e ristrutturazione*; G. Volpato, *L'industria automobilistica internazionale*, (Padova, 1983); A. Dina, 'Introduction Notes' in Dina (ed.), *Modello Robot*, pp. 11-31; Enrietti and Fornengo, *Il gruppo Fiat.*

to be a critical factor in the recovery of Fiat from the crisis of the 1970s.[59] The Business Management literature, nonetheless, introduces the argument that the introduction of robotics in the mid-1970s would have occurred anyway, even in a context of collaborative industrial relations, because of market factors. The implementation of robotics in spot welding, and particularly the development of the system called "Robogate", was necessary in order to increase the degree of product-mix flexibility - the capacity to produce a pattern of cars wiith the same set of tools and to change the product mix according to shifts in demand for different models.[60] The need for such flexibility had been generated by expectations of a progressive maturation of the European market. Mature markets, in fact, are usually associated with rapid changes in consumers' preferences for specific models and instability in the relative size of market segments and market shares within specific segments.[61] The concept underpinning product-mix flexibility is that when a range of cars is processed on the same production line, with the possibility to change the output mix without stopping production, the likelihood that the capacity utilisation rate of that production line is stabilised at about the optimal utilisation rate increases considerably. In the Fordist organisational model, technological change achieved increases in productivity at the expense of flexibility. The Business Management literature underlines that robotics was able to realise increases in productivity by increasing the speed of the process, along with the flexibility of the process. Moreover, flexibility was as important as the increase in the speed of production precisely because productivity could be maximised only if the production lines operated at about the optimum rate of capacity utilisation. Moreover, given the instability in the demand for specific models typical of mature markets,

---

[59] Actually, in one of his various essays on Fiat, Volpato even maintains that among other factors industrial relations 'have been a strong stimulus in the automation of process at Fiat and Alfa Romeo', but offers neither evidence nor a theoretical argument to support the statement. See :G. Volpato, 'The Automobile Industry in Transition: Product, Market Changes and Firm Strategies in the 1970s and 1980s', in S. Tolliday and J. Zeitlin (eds), *Between Fordism and Flexibility* (Cambridge, 1987), p. 218. In other works, he seems to put less emphasis on the direct relationship between technological change and industrial relations. See: Bianchi, Volpato, 'Flexibility as the Response to Excess Capacity', in Baden-Fuller (ed.) *Managing Excess Capacity*, pp. 215-246.

[60] Dina, 'Introduction Notes' in Dina (ed.), *Modello Robot*, p. 15. See also F.Silva P. Bianchi, 'Robots, Employment and Industrial Relations in the Italian Automobile Industry', in S. Watanabe (ed.), *Microeletronics, Automation and Employment in the Automobile Industry* (Chichester, 1987), table 6, p. 139.

[61] See : Volpato, 'The Automobile Industry', pp. 217-218.

production stabilisation could be achieved only when production lines were so flexible as to be able to shift production from one model to another without stopping the process.

The interesting question for business historians is whether Fiat actually achieved such a production stabilisation. If not, the question is whether through process innovation, engineers were actually pursuing goals other than flexibility, such as the mere minimisation of the cycle time. The matter will be addressed in chapter 4 of this thesis. Here it is important to emphasise that the interpretation of technological change suggested by the Business Management literature clearly resembles the view emerging in the debate on post-Fordism, that the rise of consumerism from the late 1960s onwards compelled manufacturers to shift from inflexible to flexible mass production. Accordingly, the Business Management literature implies the same kind of discontinuity, which emerges in the post-Fordism debate, in regard to the shifts from Fordist manufacturing to new modalities of production. In fact, from the mid-1980s, authors such as Volpato have been increasingly mirroring the views fostered by the International Automotive Project, which incorporated many concepts developed within the post-Fordism debate, translating and simplifying those concepts into the "new ethos of flexibility" as opposed to the "old ethos of standardisation" embodied by the Fordist system of mass production.[62]

According to the Business Management literature, technological change at Fiat was part of the company's broader shift from a process- to market-oriented approach. The new managerial paradigm was introduced into the firm via managerial turnover, and in this sense, it was "exogenously generated". In contrast, the process-oriented culture of Fiat engineers, which had been dominant in the company up to the first oil crisis, had been "endogenously developed" in a context of extraordinary managerial stability. The pre-1973 managerial paradigm had been developed around the increasing need for increasing product/process standardisation, whereas the new technological framework reflected the need to expand flexibility. Accordingly, the new managerial paradigm contemplated the possibility of competing in any segment of the market, as opposed to

[62] This is implied by the concept of flexibility as the mean to reduce excess capacity, as expressed by Bianchi and Volpato, 'Flexibility as the Response to Excess Capacity', pp. 215-246.

the old managerial paradigm, which had been constructed around the principle of specialisation in the manufacturing of small cars.

The restructuring of Fiat, as described by the Business Management literature, implies the complete rejection of the routines developed within the Fordist system of mass production, where the hyper-segmentation of the process towards cycle-time minimisation, and the containment of complexity towards the reduction of lead times were the leading elements of decision-making in both technological trajectory choice and output-mix optimisation strategy. This view, therefore, implies that the old set of routines was not confirmed by new management, which, on the contrary, expected profits to by maximised by a new set of routines constructed around flexible production and the enhanced capability to design, manufacture and sell cars in almost any segments of the market. This last point highlights the complexity of the product-mix flexibility issue. Market segments are usually classified according to cubic capacity. So is the output range. In the case of mass manufacturers, the lower output range includes segments A (500-900 cc.) and B (900-1100 cc.), whereas the medium/upper range includes segments C (1100-1300 cc.), D (1300-1600 cc.), and E (1600-2200 cc.).[63] The structure of costs and revenues for each segment varies considerably across the market spectrum, so that variations in the output mix affect the profitability of the operation. Output-mix flexibility, understood as the technical ability to produce different models on the same line at the same time, is intimately connected with the company's ability to design and manufacture models in different segments of the market at competitive costs and quality levels. Although the company had been always producing a wide range of cars, from the 1920s to the 1960s, the bulk of production had invariably consisted of lower segment units, for which Fiat had traditionally enjoyed competitive advantage. Such a specialisation was reflected in the knowledge accumulated by the company. Therefore, according to the Business Management literature, the introduction of flexible manufacturing systems at Fiat also meant a shift from a regime of product specialisation to a regime based on the strategic ability to compete in any segment of the market, and

[63] Note that such a classification applies strictly to the European market in the 1970s and 1980s, since the correspondence between segments and cubic capacity can vary considerably across time and across countries.

to go upmarket, had such a move been considered profitable by management. Actually, a large part of the Business Management literature of the beginning of the 1980s expected Fiat to adjust its output mix upmarket, under the assumption that such a move would have increased the total margin of contribution. In the late 1980s, such expectations proved to be fallacious because the output mix was still skewed towards downmarket units. Yet, according to Enrietti and Fornengo, the output mix during the 1980s had been driven by demand,[64] since from the supply side Fiat had acquired not only the production capability to adjust the output mix to demand composition, but also the design ability to compete in any segment of the market.

Of course, not all authors are convinced that during the 1980s, Fiat had fully developed product-mix flexibility. According to Negrelli and Loke,[65] the pattern of demand during the 1980s not only forced Fiat to keep focusing on the lower end of the demand spectrum, as implied by Enrietti and Fornengo, but also affected investments in retooling. In their view, the flexible capability developed in the late 1970s by Fiat exceeded actual needs, so that in the 1980s Fiat management seemed to reintroduce some forms of inflexible automation, such as the automated engine production line at the Termoli plant. The view was partly criticised by Bonazzi, who pointed out that during the 1980s, Fiat was still in a stage of transition, where several different technological and organisational options had to be investigated. In this transitional phase, flexibility had been achieved, although the production setting was still relying on large intermediate stocks.[66] The Termoli plant seemed to be a diversion from the path towards flexibility, but in reality it was just a "mistake" in the process of learning how to maximise flexibility, by minimising intermediate stocks in the process. Management ended up creating a rather inflexible system for engine manufacturing, in the attempt to achieve such a reduction of intermediate stocks. Dina puts forward the same view, that car manufacturers during the 1980s were in the middle of an uncompleted and uncertain process. Flexibility enhancement was in many cases hampered by the fact that flexible tools were often deployed along with traditional tools, or within an outdated plant

---

[64] Enrietti and Fornenego, *Il Gruppo Fiat*, pp.70-75, and 79-83.
[65] R. Loke, S. Negelli, 'Il caso Fiat Auto', in M. Regini and C. Sable (eds), *Strategie di riaggiustamento industriale* (Bologna, 1989), pp. 61-94.
[66] Bonazzi, *Il tubo di cristallo*, pp. 78-80.

layout. It is worth noting, though, that Bonazzi and Dina do not reject the Volpato argument that technological change in the late 1970s was inspired by the quest for flexibility. Neither do Loke and Negrelli, though these authors are simply less optimistic than Volpato about the actual achievements of Fiat in terms of flexibility. Nonetheless, they explain under-achievements by an *ex post* set of circumstances, namely developments in the pattern of demand limiting the need for flexibility in the case of Locke and Negrelli, or managerial and technical constraints in the case of Bonazzi and Dina.

In general, the literature on Fiat is rarely based on quantitative empirical evidence. In that respect, the most interesting research is that carried out by Bonazzi, which, nonetheless, is almost exclusively based on interviews with Fiat managers and therefore does not seem free from "inherent company bias". So is the work of Volpato, Enrietti and Fornengo, who use data and information from the department of external relations. Those data unequivocally point in the direction of flexibility. This is not surprising, given that it is in the interest of car manufacturers to reassure the financial market about the industry's ability to cope with the erratic demand of mature markets. With regard to the international literature on the automotive industry, the same criticism may be suggested for the whole International Automotive Project, which was also inspired and financed by many manufacturers in the industry.

For this reason, this thesis pursues a more quantitative approach, as has been described in the methodological section. Rather than arguing on the *ex post* argument of whether or not Fiat used its flexible capacity during the 1980s, this work establishes that Fiat did not maximise flexibility, and poses the *ex ante* argument that management chose to maximise specialisation instead. In this work, it is suggested that production engineers kept their grip on process/product development, in spite of the managerial turnover in the upper level of the hierarchy, and managed to confirm the pattern of routines "endogenously" developed around the principle of Fordism. As a result, the Fiat product-mix optimisation strategy aimed to exploit the competitive advantage deriving from specialisation in the manufacture of small cars, rather than the potential flexibility in shifting the output mix upmarket. Finally, the work suggests that by maximising specialisation rather than flexibility, Fiat was able to contain complexity costs and, therefore, to maximise profits in the price competitive scenario of the 1980s. This view resembles the typical evolutionary pattern, in which the confirmation of routines enables a firm to survive over time, because routines happen to be compatible with the business environment, in the same way that the genetic patrimony of evolving organisms happens to be compatible with the natural environment at a given point in time.

Section five

Demand and discontinuity in management

According to the post-Fordism literature, the discontinuity in operations and strategic management occurring after the two oil crises was triggered by a discontinuity in the pattern of demand caused by the maturation of the European market. The Management literature on Fiat holds a similar view. This section explores the relationship between market maturation and the shifts towards flexible mass production. In doing so, it criticised the assumption underpinning the paradigm of discontinuity that within mature markets firms have to shift towards flexible mass production and flexible output-mix strategies if they want to survive.

The discontinuity paradigm, and market maturation

The business management literature relates to the vast debate on post-Fordism, sharing with it the underpinning concept that the crisis of Fordism as a production mode is a consequence of the rise of consumerism during the 1970s and 1980s. This is the shift in consumer preferences from cheap standardised to quality-customised products. Such a shift is typical of relatively high-income countries, where the bulk of demand for a given product tends to shift from first-time buyers to second-time buyers replacing an old good with a new one. Second-time buyers have higher disposable income than first-time buyers, so that they are in the position to pay a premium for the intrinsic qualities of the product they purchase, whereas first-time buyers tend to minimise costs generated by acquiring and using the goods they need. The shift in consumer preferences causes a shift in the structure of supply, towards quality and customised goods. Suppliers, on their part, tend to stimulate replacement by product renewal, otherwise second-time buyers would delay their second purchase up to the durability limit of the item they have to replace, which would in turn considerably slow down output growth. Because demand growth depends mainly on product renewal, high-income consumer markets are also defined as mature markets. Within a regime of oligopolistic competition, product renewal is a critical factor in competing for market share in a mature market.

The general concept of market maturation as described above applies to all markets characterised by oligopolistic competition. Yet, the market for cars is also characterised by the interconnection between the new vehicle market and that for second-hand cars. Given the relative long-term durability of automobiles, in the stage of maturity the car market is characterised by an abundant stock of second-hand vehicles, which are usually traded in by second-time buyers to finance part of their second purchase, so that first-time buyers' demand is, to a significant extent, satisfied by the supply of used cars. Therefore, the individual decision to replace a car does not necessarily imply the scrapping of the old vehicle, whereas in the market for white goods, for example, individual replacement usually implies individual scrapping. The textbook definition of maturity for the car market, therefore, refers to the whole stock of vehicles, rather than the decision of individuals to replace their old car. By definition, the market for cars reaches the maturity stage when replacement demand outweighs new demand.[67] New demand means the portion of demand that exceeds scrapping, whereas replacement means the portion of demand that equals scrapping.[68] New demand, therefore, makes the entire stock of cars increase. In theory, markets reach saturation when new registrations equal scrapping, although in practice saturation is never reached. Markets for cars reach maturity at a level of car density of between 400 and 600 cars per 1000 inhabitants. In the case of the US, this density was reached in the early 1960s, while in Europe it was reached between the early 1970s and the early 1980s, according to the GDP levels of the various countries.

[67] Note that in the car industry literature the term demand is widely used as synonymous with registrations, although the concept of actual registrations differ from that of demand. For example, registrations do not coincide with the actual demand for cars when there is a supply shortage that leaves some demand unsatisfied.

[68] For a detailed discussion of the topic see: K. Bhaskar, *The Future of the World Motor Industry* (1980), chapter 3.

In infant markets, the increase in GDP leads to a proportional increase in car density. In mature markets, where car density is already high, it tends to grow at a slightly slower pace than GDP.[69] Because car density increases slowly, the entire car stock grows slowly too. Replacement demand is a percentage of the whole stock of cars, so that a slow growth of the vehicle stock causes the slow growth of replacement, which is the main component of demand. The result of the process is the slowing down of the yearly rate of growth of total registrations. That is the reason why suppliers tend to accelerate replacement by speeding up product renewal and widening the product range. The other characteristic of mature markets, as opposed to infant markets, is that demand fluctuates, both in terms of total demand as well as demand for specific models within each segment. The fluctuations in the demand of specific models are the reason why the literature stresses that the maturation of markets compelled manufacturers to shift towards flexibility.[70]

One obvious reason for fluctuations in total demand is that replacement can be postponed if economic conditions are not ideal.[71] Also, given that hire purchasing is prevalent, car demand is affected by expansions and contractions in borrowing. Furthermore, even if economic conditions are stable, an expansion of replacement is usually followed by a period of stagnation, since car owners tend to own a car for a relatively long period before replacing it. The ageing of the car stock, thus, introduces a cyclical element into the fluctuations of replacement demand. Finally, Manufacturers usually introduce incentives in order to sustain demand during downswings, mostly in the form of interest-free consumer credit,[72] but in general they try to sustain demand by speeding up product renewal, and by widening the product range in the hope of encouraging replacement and multiple purchases. Of course, there are many limits to the acceleration of product renewal, not only from the supply side, where many different factors could prevent time-to-market minimisation, but also from the demand side,

[69] For a detailed discussion of the topic see: G. Bos, *The Demand for Private Cars* (Rotterdam, 1970).
[70] Volpato, *Il caso Fiat*, pp. 171-173; Volpato, 'The Automobile Industry In Transition. Product, Market Change and Firm Strategies in the 1970s and 1980s', in Tolliday and J. Zeitlin (eds), *Between Fordism and Flexibility*, pp. 193-223.
[71] In this regard see Bhaskar, *The Future*, chapter 3; for the effects of regulation polices on demnd see Foreman-Peck, Bowden, McKinlay, *The British Motor Industry* (Manchester, 1995), chapter 7.
[72] Public funds have often been made available by various EC Members, to finance accelerated scrapping.

where clients do not generally appreciate a model with a too-short life cycle, as this is usually associated with a rapid depreciation of the model and, therefore, has a negative effect on the overall cost of replacement. Nonetheless, manufacturers try to renew each model every 4 or 5 years.

Product renewal causes fluctuations in the demand for specific models because new models are likely to capture market shares at the expense of old ones. Critically, car manufacturers compete in a range of different segments of the market, supplying a range of models in each segment, and experiencing fluctuations in demand for their products both within each segment and across segments. Of course, manufacturers renew their models at different points in time, so that fluctuations in output occur with various frequencies. This is the reason why the literature on post-Fordism, and the Business Management literature on Fiat both emphasise that the maturation of the market compelled manufacturers to deploy flexible manufacturing systems. The underpinning assumption is that the flexibility of production tools enables manufacturers to minimise reset times and retooling costs. Because of the low level of tool specificity, the manufacture of the whole range of models is spread across the whole set of production lines. By doing so, all lines can operate at a utilisation rate close to the optimum level. In fact, the decrease in production of a given model can be offset by the high production levels of new models. Moreover, small batches of niche products can be produced along with large production models in a more efficient way. Also, shifts in the output mix up- or downmarket are more efficiently pursued.[73] In the capital-intensive stages of the process, product-mix flexibility depends upon the kind of tools utilised, whereas in the labour-intensive stages of production flexibility depends upon the capacity of labour to work on different cars, which implies a wide range of labour skills, and the flexibility of individual workers. It is not surprising, therefore, that robotics and labour organisation are two of the most developed topics within the debate on post-Fordism.

In theory, the paradigm of "market-maturation-driven" discontinuity seems to be convincing. In practice, it has to be tested against historical evidence, to establish whether and when the path toward flexibility started and the discontinuity in management implied by such a shift actually occurred. The conventional wisdom indicates the second half of the 1970s as the period in which the problem of flexibility was foreseen by management and investments in flexible capacity started to increase within the industry, because in that period managers started to realise the implications of market maturation and increasing competition from Japan.[74] If this were the case with Fiat, the company would have shifted towards flexible mass production a decade earlier than the rest of the Italian manufacturing sector, which, according to Bartezzaghi and Turco, started to shift towards the flexibility managerial paradigm in the late 1980s.[75] Moreover, as already said, Negrelli and Locke have shed doubt on the view that during the 1980s, the maximisation of flexibility was as urgent as much of the literature on the car industry assumes.

The view that the maturation of the markets triggers the shift towards flexible mass production is based on the assumption that there is a necessary trade-off in shifting toward flexibility. This is not necessarily true, since flexible manufacturing involves higher complexity costs that might well offset the economic advantage of running production lines at the optimum capacity level. Moreover, if flexibility is used to shift production from a given model to another competing in a different segment of the market, both cost and revenue curves shift upwards, but revenues might or might not shift more than costs. The decisions whether or not to shift to flexibility or whether to shift the output-mix upmarket, are taken on the basis of assumptions involving a certain degree of uncertainty. This uncertainty offers room for discussing strategies among the various actors, such as engineers, marketing mangers or owners, who are involved in the process of confirmation or rejection of routines. Long-term company performance will depend upon the decisions emerging from the dialectic between various actors in the firm in relation to uncertain scenarios, and upon how well those decisions fit with the actual development of the market.

The literature on Fiat fails to capture the complexity of the decision-making process, assuming the simplistic view that managerial turnover at the pinnacle of the structure

[73] This is the model suggested by both Altshuler and Volpato.
[74] See: Volpato, 'The Automobile Industry in Transition', in Tolliday and Zeitlin (eds), *Between Fordism and Flexibility*, pp. 191-192.
[75] E. Bartezzaghi, F. Turco, 'Flessibilità ed Efficienza nel Manufacturing', *L'Impresa* (July, 1989), pp. 60-67.

was sufficient to introduce a radically different business approach. This thesis, on the other hand, focuses on the role played by different actors within the firm (top management, ownership, production engineers and marketing staff) in the process of decision-making regarding the confirmation or rejection of routines. Engineers were the actors who had actually developed the production management culture based on cost reduction through process/product standardisation. However this work shows that by the mid-1960s, marketing management started to question this culture, by increasingly suggesting that the best output maximisation strategy was to gradually shift upmarket, in order to maximise revenues from sales. Production engineers, on the other hand, insisted that given the specialisation of Fiat in the lower segments of the market, the comparative costs of Fiat upmarket units were higher than those of its German and French counterparts. Therefore, higher revenues from sales were not necessarily going to turn into higher profits. This depended upon the price level set by the most efficient competitors, which means that the shift upmarket was a risky move. This work shows that the criterion for routine selection held by the top management was essentially based on the regime of competition. According to such a criterion, Fiat shifted upmarket during the 1970s, when, in each domestic market, the domestic champion set prices, and foreign competitors followed upward in a way that resembled collusive behaviours. The suspension of price competition represented the medium-term response of the industry to the upward instability in the price of inputs that characterised the 1970s. This situation enabled Fiat management to be sufficiently confident to actually adjust its output mix up-market, because the company could mark up prices according to its cost structure, knowing that competitors would follow upward, and that given price levels, upmarket units would provide better margins of contribution. The shift upmarket, therefore, was an opportunistic behaviour, rather than the outcome of a deeper rethinking of the whole production organisation towards upmarket production and flexibility.

This approach links this thesis to the macro-economic literature on the Italian car industry, and in particular the work of Silva on the competitive structure of the Italian and European markets during the 1970s. By implementing the input/output analysis based on quarterly data from inter-sectoral tables, Silva demonstrated that after 1975, the Italian car industry reversed the trend, started in 1969, towards decreasing contribution margins. This reflected the suspension of price competition, which enabled Fiat to sustain selling prices and offset the effect of increasing input prices. By building upon the Silva results, and complementing his findings with new qualitative evidence, this work will show not only that Fiat management was confident about the predictability of the their competitors' pricing behaviour, but also that given the price levels set by Fiat, the shift upmarket would maximise the contribution margin. When, in the late 1970s, Fiat managers perceived that in the 1980s price competition was going to be restored, they focused product renewal on small cars. This ultimately caused the output mix to shift back downmarket, where Fiat was confident of keeping its market shares and set the price, which would have maximised its contribution margin.

Conclusions

This thesis suggests that when robotics was introduced and developed by Fiat during the 1970s, engineers decided to use the new technology to minimise the cycle time rather than opt for flexibility, because production managers intended to optimise the whole process for the production of small cars. Engineers, in fact, perceived the shift upmarket pursued by the company during the 1970s as a temporary and opportunistic move, fostered by a temporary suspension of price competition. Accordingly, the restructuring of Fiat during the 1970s is seen as a case of maximisation of the intellectual capital accumulated by the firm in the age of Fordism. This view finds its theoretical foundation in an interpretative framework based upon the Chandlerian paradigm of big business development, and upon the evolutionary theory of economic change.

Thus, the interpretation of Fiat restructuring suggested by this thesis departs from the view emerging from the post-Fordism debate, that the business organisations developed in the aftermath of the crisis of the 1970s were inherently discontinuous in respect to the Fordist organisation of mass production. It is worth noting that even the school of thought usually referred to as neo-Fordism, which implies a continuity with the passing age of Fordism in terms of institutional frameworks, implies nonetheless a discontinuity in the knowledge underpinning the organisation of production, caused by the shift to flexibility. The majority of the Italian literature on Fiat mirrors the neo-Fordist discontinuity in production management. The contribution of this work to the current literature on Fiat consists of showing that such a discontinuity did not actually occur after 1973, particularly with regard to the use Fiat management intended to make of new production technologies, and in regards to output-mix optimisation strategies. If discontinuity occurred, it emerged in the 1990s, when the Italian company developed its own lean production scheme and expanded its product range into niche market. Given the significance of Fiat in the world car industry, such a finding is also a contribution to the international debate on post-Fordism, in relation to the dating of the development of new production frameworks that effectively departed from Fordism.

Chapter 3

From growth to crisis, and from crisis to recovery: Fiat, 1960-1987

Introduction

This chapter describes the development of the Fiat organisation from 1960 to 1987. After 1973, Fiat witnessed a remarkable acceleration in managerial turnover at the top end of the hierarchy. Moreover, some of the new appointees came from outside the Fiat Group, as opposed to the pre-1973 period, during which managerial turnover had traditionally occurred through internal mobility. Therefore, the question arises whether the new management rejected the old pattern of routines, or whether new managers integrated into the existing structure and maximised the stock of available knowledge. The latter hypothesis has been rather overlooked by the established literature, which has generally accepted the discontinuity view. By reviewing Fiat restructuring, this chapter suggests that there are no obvious reasons to believe that new managers replaced the old set of supply-driven routines (which had enabled Fiat to exploit a rapidly growing market during the Golden Age), with new market-oriented routines designed to deal more efficiently with market maturation. This leads to the analysis conducted later in this thesis, where the new contribution consists of showing that the principles underpinning technological change and output-mix optimisation strategy in the late 1970s and early 1980s were similar to those that had inspired strategic decision-making during the 1960s.

The chapter is organised in three main sections. The first summarises the growth of the Fiat Group from the 1950s to the 1990s, and addresses the issue of market maturation, questioning the paradigm of discontinuity, and the way the paradigm has been applied to Fiat. The second deals with the development of managerial capabilities at Fiat during the Golden Age, and analyses the company's restructuring during the 1970s. This section shows that there is no evidence to suggest that the restructuring of managerial hierarchies during the 1970s led to a replacement of managerial knowledge. The final section deals with the crisis of Fiat during the 1970s and addresses the impact of the oil shock on the Italian company. This section points out that the crisis of the 1970s might well have encouraged the Fiat management to reinforce rather than reject the old set of routines, in order to exercise a more effective control over costs. What emerges from the three sections is that the mere analysis of Fiat's transformations during the 1970s provides no clear indications as to the direction that the new management was going to take in order to compete during the 1980s. Therefore, it would be wrong to simply assume that the strategy was new because the management was new.

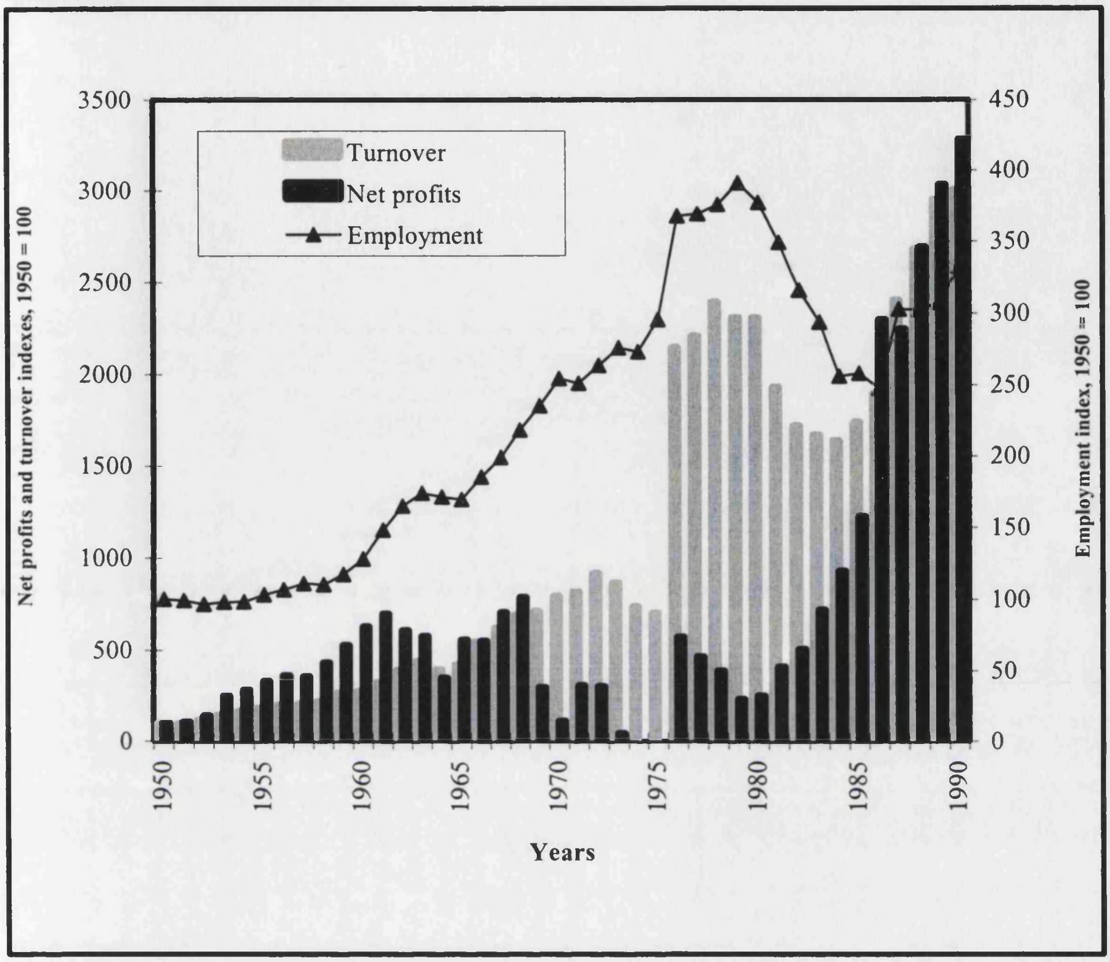
Section one
Fiat and the paradigm of discontinuity

This section analyses the development of Fiat between 1950 and 1990, providing the reader with general information on the Italian company. Furthermore, the following paragraphs criticise the view of discontinuity in Fiat development after 1973.

Fiat growth, 1950-1990. An overview

The evolution of Fiat from the post-war period to the 1980s resembles the textbook pattern of the Western economies from the expansion of the "Golden Age" to the crisis of the 1970s and the recovery of the 1980s. Figure 3.1 displays the turnover, net profits and employment of the Fiat group from 1950 to 1990. During the 1950s, profits expanded more rapidly than turnover and labour, indicating that the expansion of the group was led by gains in productivity, something that was to be expected in the Golden Age. On the other hand, profits decreased after the peak of 1961. After the trough of 1964, profits increased again, but exceeded the 1961 level only in 1968. In comparison with the previous decade, labour input increased much faster than turnover and profits, which indicates a reverse trend in productivity.

Figure 3.1: Gross turnover, net profits (in constant 1993 prices) and employment of Fiat Group, 1950-1990



Source: Archivio Storico Fiat, *Fiat: le fasi della crescita. Tempi e cifre dello sviluppo aziendale* (Torino, 1996), pp. 100-101. See: table A 3. 1 in the appendix.

In 1969, profits decreased remarkably although the turnover increased slightly. The first six years of the 1970s, unsurprisingly, show the signs of deep crisis. Turnover stagnated, while labour expanded at an unprecedented rate, in the aftermath of a marked shortening of the working week. Profits collapsed. From 1977, turnover expanded quite rapidly, but profits recovered to the 1969 level only in 1984. From 1981 to 1984, profits increased whereas the turnover decreased, indicating a steady expansion of productivity. Finally, from 1985 to 1990 profits and turnover increased with the former expanding more rapidly than the latter. Only in 1987 did turnover expand more than profits.

As will be shown in the third section of the chapter, the crisis of the 1970s was caused by many different factors, including the increase in the per unit cost of labour input, the expansion of the payroll, high levels of absenteeism and the high frequency of industrial conflicts.[1] The oil crisis and the upward trend in the price of raw materials helped make a bad situation worse. Fiat had to increase the price of output to offset increases in the price of inputs. This put downward pressure on demand, which was already stagnating because of the oil crisis. In contrast with the 1970s, the 1980s witnessed the normalisation of industrial relations, along with the stabilisation of the prices of inputs, and the recovery of demand. Those factors undoubtedly stimulated the recovery of Fiat.

It is commonly agreed that the crisis of the 1970s contributed to the speeding up of restructuring, by giving more urgency to the transformation of a structure that had already been proving increasingly inefficient in the late 1960s.[2] According to the established literature, managerial turnover was not simply the replacement of incapable managers by capable ones. Compared with those they had replaced, the new managers were different rather than better. The point stressed by the literature is that during the Golden Age management had been very effective in interpreting Fordist principles of mass production. Those principles were compatible with the social, political and economic conditions in which Fiat was operating, and enabled the company to cope with the rapid expansion of demand.[3] On the other hand, socio-economic conditions changed dramatically during the 1970s, so that the Fordist principle of mass production was no longer adequate to cope with the changing pattern of demand. Had Fiat replaced its management, without changing the managerial paradigm in the process, the company would have not been able to profit from the improvement of industrial relations and the macro-economic conditions that characterised the 1980s. In particular, Fiat would not have been able to cope with changes in the pattern of demand caused by the maturation of the European market. Based on this assumption, the established literature is inclined

[1] Industrial relations will be approached in chapter 4.
[2] See V. Comito, *La Fiat tra crisi e ristrutturazione* (Roma, 1982), pp. 57-58. See also A. Mosconi, 'Fiat 1968 -1977: gli anni del cambiamento', in A. Mosconi, E. Rulliani, *Il gruppo nello sviluppo dell'impresa industriale. Con un analisi del caso Fiat* (Milano, 1978), pp. 69-70.
[3] Volpato, *Il Caso Fiat*, pp. 67-89.

to believe that a discontinuity in the market brought about a discontinuity in management.

The next part of the section will address the question whether the conceptual framework on which the paradigm of discontinuity is based is sufficiently sound. It will define discontinuity in demand, and will criticise the idea that discontinuity in demand leads necessarily to discontinuity in supply management.

Market maturation and new registrations, 1950-1990

This section looks at vehicle registrations in the four largest European markets, namely Germany, France Italy and the UK,[4] and describes the process of market maturation, which characterised the end of the Golden Age. As already explained in chapter 2, the cause and effect relationship between market maturation and the emergence of flexible manufacturing systems is at the centre of the inter-related debates on post-Fordism and the restructuring of the world-wide motor vehicle industry. This paragraph discusses and criticises the widespread idea that demand discontinuity in the form of market maturation inevitably causes a shift from Fordist mass production to flexible mass production, which, in turn, implies discontinuity in production management.[5] On the contrary, it is suggested that the nature and direction of restructuring has to be analysed case by case, and that in the case of Fiat a discontinuity in management has not been yet sufficiently demonstrated.

Infant markets are characterised by the rapid growth of new registrations and, therefore, of the car stock. By contrast, in mature markets, the rate of growth of new registrations is much slower because car density is much higher. The rate of growth of vehicle registrations, therefore, can be used to describe the process of market maturation, identifying the period of time in which markets shift from infancy to maturity. Table 3.1 displays the rate of growth of vehicle registrations by decade, from 1950 to 1990, in Italy, Germany, France and the UK.

---

[4] The largest national markets in Europe in terms of vehicle registrations.

[5] See: Volpato, 'The Automobile Industry in Transition', in: Tolliday and Zeitlin (eds) *Between Fordism and Flexibility*, pp. 191-192.

Table 3.1: Rate of growth of vehicle registrations, 1950-1990, selected countries

	Italy	Germany	France	UK
1950-60	16.9%	20.0%	13.9%	19.8%
1960-70	13.5%	8.0%	7.3%	3.1%
1970-80	1.1%	1.4%	3.7%	2.9%
1980-90	4.0%	2.2%	2.0%	2.8%

Source: Calculations based on data from ANFIA (Italian Association of Car Manufacturers and Traders), *L'automobile in cifre* (Torino, 1996), pp. 232-238. For the data set, see table A 3.2 in the appendix.

In the 1950s, the rate of growth of new registrations ranged from 13.9% per year in the case of France to 20.0% per year in the case of Germany. In the 1960s, the rate of growth started to slow. At the centre of the distribution, there were Germany and France with growth rates of 8.0% and 7.3% per year respectively. At the upper end of the distribution there was Italy, still growing at a rate of 13.5% per year, while the UK was at the lowest end with a far slower pace of growth, namely 3.1%. The rate of growth of the Italian market during the 1960s was exceptional, since it matched that of France during the 1950s. In the 1960s, therefore, Italy was still in its phase of infancy, and Fiat profited from that. Between 1960 and 1970, domestic demand expanded by 3.6 times, and Fiat output expanded by 3 times.[6]

During the 1970s, however, the rate of growth of the Italian market decreased sharply. This time Italy was at the bottom end of the distribution, with a rate of growth of only 1.1% per year, while France was at the top end with 3.7%. The striking decrease is partly explained by the normal trend towards maturation, and partly by the severe effect of the oil crisis on demand. In fact, the Italian market exceeded the pre-oil crisis vehicle registrations only in 1980, whereas Germany recovered in 1975, France in 1976 and the UK in 1979.[7] Thus, the fact that the oil crisis occurred exactly when the process of transition of the Italian market from infancy to maturity started made the transition less gradual than in Germany and France. As will be shown in the following paragraphs, the established literature maintains that the relatively late and rapid maturation of the

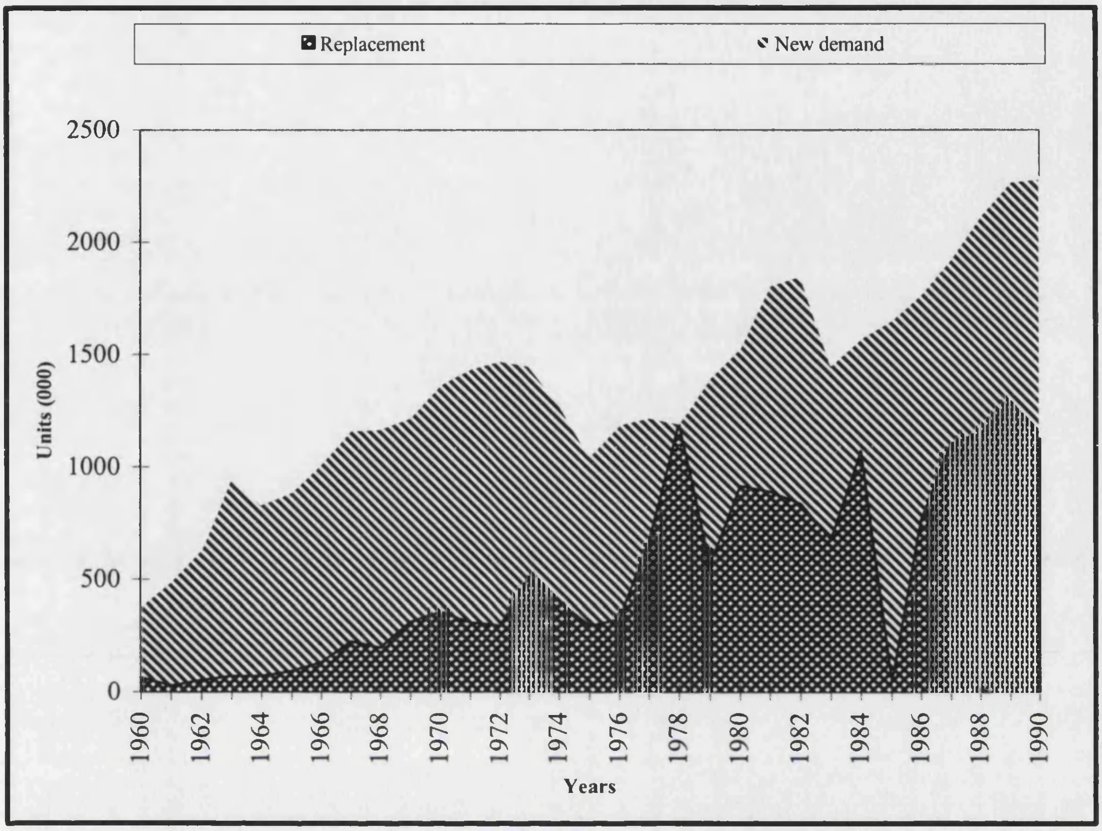
[6] See tables A 3.2 and A 3.3 in the appendix.
[7] See table A 3.2 in the appendix.

Italian market explains why after 1974 Fiat saw a marked acceleration of managerial turnover, which in turn brought about discontinuity in management.

During the 1980s, Germany and particularly Italy experienced an increase in the growth rate of new registrations as compared with that of the previous decade. Actually, the Italian market exceeded the French growth of the previous decade and, of course, this helped the recovery of Fiat during the 1980s. The recovery of vehicle registrations in the Italian market was partly a consequence of the prolonged downswing experienced by the Italian market between 1974 and 1980. In that period, second-time buyers tended to delay the replacement of their cars up to the point when their old vehicles had to be scrapped. This led to the ageing of the car stock, which in turn caused the acceleration of replacements in the 1980s. Moreover, because of the ageing of the car stock in the late 1970s, during the 1980s first-time buyers preferred to buy new rather than second-hand cars, which, in mature markets, usually provide a large proportion of first-time purchases. A further busting factor was that new vehicles were expected to substantially lower running costs.[8] The fact that first-time buyers preferred brand new vehicles explains why during the 1980s new demand - the portion of vehicles that makes the car stock grow as opposed to replacement, which is the portion of demand equal to scrapping - remained a substantial part of total registrations, as shown by figure 3.2.

[8] The Fiat Uno is a good example of a car designed to minimise running costs. It was fitted with the new 1000cc. F.I.R.E. engine, which was substantially more efficient than the previous 903 cc engine fitted in the Fiat 127. Thanks to improvements in its design, the new power unit consisted of a substantially reduced number of components, which contributed to lower maintenance costs.

Figure 3.2: The structure of demand in the Italian market, 1960-1990



Source: Calculations based on data from ANFIA, *L'automobile in Cifre*, pp. 334, 340. New demand is the portion of demand that makes the vehicle stock to grow. Replacement demand is the portion of demand that equals scrapping. For the calculation of new demand and replacement, see table A 3.4 in the appendix.

This is an important element to keep in mind when discussing output mix maximisation strategies. The relevance of new demand in the structure of the Italian market during the 1980s indicates that in that period the lower end of the demand spectrum had remained very important, in spite of the fact that the Italian market was advancing towards maturity.

Market maturation and managerial turnover at Fiat

In general, the literature on motor car manufacturing tends to see the restructuring of the European industry during the 1980s as a response to the maturation of the market. The argument is as follows. Because mature markets are characterised by slow growth, and by a large portion of demand absorbed by replacements, firms have to stimulate replacement through increasing product renewal and differentiation. This requires the maximisation of flexibility in production.[9] In the preceding chapter, this view has been criticised, in that it establishes a rigid cause and effect relationship between market maturation and the decision of managers to maximise flexibility. The criticism was based upon the consideration that flexible production might increase the level of complexity of both the production process and product development. This means that the potential advantage of flexibility, namely a stabilisation in the rate of plant utilisation, and an expansion of the product range, might be outweighed by an increase in complexity costs. Managers, therefore, may or may not decide to maximise flexibility according to their estimates of costs and benefits. This implies that the shift to flexible production during the 1980s cannot be taken for granted, but has to be empirically verified case by case. This consideration is even more important for Fiat, given that during the 1980s its domestic market was still characterised by very large demand for lower market units, for which price was the most relevant element of competition.

The established literature on Fiat, nonetheless, takes it for granted that the company fits into the paradigm of market discontinuity. The literature underlines three points. Firstly, although the restructuring process had already started in 1967, it was slow and ineffective until 1973, while it accelerated enormously after 1974. Secondly, while before 1973 the restructuring consisted mainly of the reshuffling of the hierarchy by internal appointments, after 1974 managers were appointed from outside the firm. Finally, new management accelerated the process of technological change, in order to increase output-mix flexibility and, in so doing, to acquire the ability to implement a more flexible output-mix optimisation strategy, and to cope with the shift upmarket of demand that is normally expected in mature markets. According to the established literature, therefore, the abrupt transition from infancy to maturity compelled the company to accelerate the process of restructuring, which therefore resulted in the abrupt replacement of old managerial paradigms with new ones. The first oil crisis functioned as a catalyst for the entire process of restructuring, primarily because of the

[9] See chapter 2, pp. 67-74.

psychological impact the crisis had on the Fiat owners, who felt that restructuring could not be postponed any longer. Another factor was that the crisis put downward pressure on new registrations, and this was expected to be long lasting. Therefore, managers expected competition for market share and niche markets to become even more severe than expected before the first oil crisis.[10]

As already mentioned, the literature based on the paradigm of discontinuity is not convincing because it assumes - without demonstrating it through cost/benefit analysis - that car manufacturers should respond to the maturation of the market by shifting towards flexible mass production. Moreover, that literature assumes - without empirically demonstrating it through the monthly analysis of production line operations - that the car industry, including Fiat, shifted, or attempted to shift towards flexibility. On top of that, the way the paradigm of discontinuity has been applied to the case of Fiat seems to contradict the very assumptions underpinning the paradigm. The argument that the Italian market matured later and more rapidly than the other main European markets has been used by the literature to explain why Fordist management remained fairly stable until 1973, and why it was replaced fairly quickly after the first oil crisis, when, according to the established literature, Fiat had to introduce new paradigms of production management in order to compete in a much more competitive environment. At the same time, the literature emphasises that the new management was successful in managing the shift towards flexibility, and that during the 1980s Fiat was in step with, if not more advanced than, other European competitors in the development of flexible mass production.[11] The contradiction lies in the fact that, precisely because the Italian market was the last one to reach maturity, the paradigm of discontinuity should predict that the Italian car industry would be the last one to accumulate the "intellectual capital" necessary to develop new paradigms of production management. As will be shown in the following paragraphs, the fact that new appointments in the upper end of the hierarchy had been made by recruiting managers from outside the firm does not resolve the contradiction, given the technical background of those managers. In addition, these had developed their careers in Italy, so it is not clear why they would have developed a

[10] Volpato, *Il Caso Fiat*, pp. 137-188.
[11] Ibid.

flexibility-oriented business culture, or a business culture in any way different from that of the old management. Given these considerations, it seems wise to test the hypothesis of discontinuity against the hypothesis that new managers integrated into the existing structure, and utilised new technology to optimise rather than change production management, in order to optimise rather than change the output mix optimisation strategy of the company. According to the hypothesis of continuity, the strategy of Fiat proved effective because, as shown by figure 3.2, during the 1980s in the Italian market - the main outlet of Fiat output - new demand was still a significant share of total demand. Therefore, the lower segments of the market, where competition was mainly based on price, and in which Fiat was traditionally more specialised, still represented an important share of demand for the company. In this sense, the hypothesis of continuity reflects the evolutionary theory of economic change, according to which firms select routines under the influence of accumulated knowledge, while the market determines the survival of the firm according to the compatibility of the selected routines with the structure and trend of demand.

The following chapters of the thesis will test the continuity hypothesis. Meanwhile, the next paragraphs of this chapter analyse the evolution of the Fiat structure from the post-war period to the 1980s. The aim is to provide the reader with all the information necessary to understand the arguments developed in this thesis. At the same time, the question is addressed whether, from the information used by the established literature, it is actually possible to infer that the new managers were really different in terms of business culture from the management they replaced, and whether there is evidence that the restructuring of the top management influenced the accumulated knowledge of the firm as a whole.

Section two

Fiat's managerial structure, 1946-1987

This section looks at the Fiat structure from 1946 to the late 1980s. Firstly, it analyses the development of the company, its organisation, and the managerial culture developed during the Golden Age. Secondly, it addresses the restructuring occurring during the 1970s.

1945-60: From the end of the War to the Growth of the 1960s

Between 1946 and 1966, Fiat enjoyed exceptional managerial stability. The bulk of the managerial structure was designed by Giovanni Agnelli, the founder of the company,[12] in the inter-war period, and was later developed by Vittorio Valletta, President and Chairman of the Board from 1946, who had been Agnelli's right hand man since 1922.[13] When Valletta retired in 1966, he was replaced by Giovanni Agnelli junior (the grandson of the company's founder). However, many key managers appointed by Valletta remained in charge, while others were replaced by internal appointments. Moreover, Gaudenzio Bono, Valletta's right hand man since 1946, retired in 1972. Therefore, it is reasonable to say that the managerial culture of Fiat in the early 1970s reflected the business knowledge accumulated by the firm during the 1950s and 1960s.

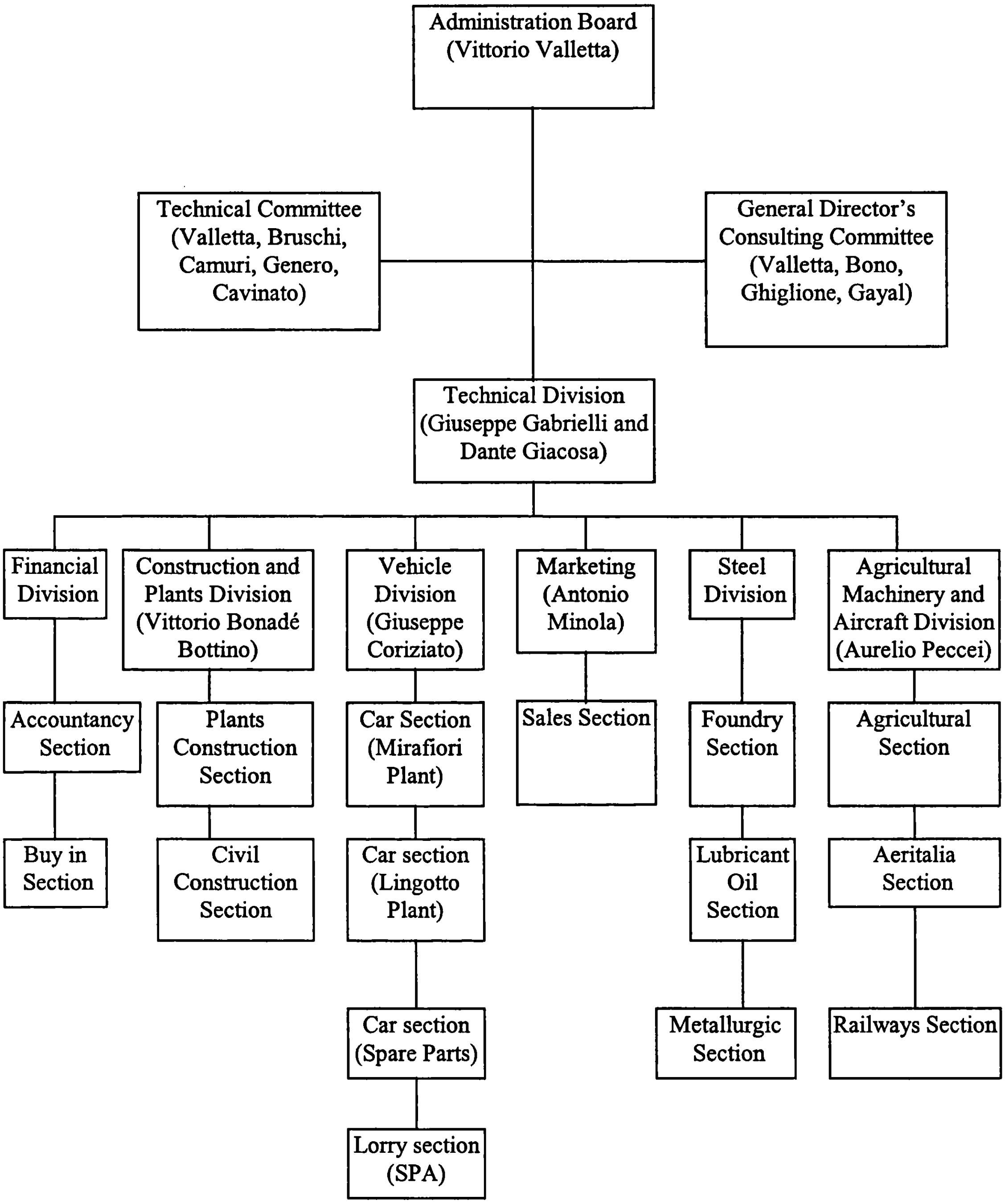
Immediately after his appointment as Fiat president, Valletta started a reorganisation of the company, in order to recover from the disruption brought about by the war, and to get ready to profit from the expected stabilisation of the economy and recovery of demand in the post-war period. In practical terms, Valletta rationalised the functional

[12] Fiat was established in 1898 in Turin by Ludovico Scarfiotti, Emanuele Cacherano di Bricherasio, Giovanni Agnelli and others. By 1908, though, Giovanni Agnelli acquired the complete control of the company. During the inter-war period, Fiat diversified its activities, becoming an industrial group. Around the core business, namely vehicle manufacturing, Fiat was engaged in aircraft production and shipbuilding as well as in non-manufacturing activities such as banking and consumer credit. Fiat also participated in the ownership and control of several companies in both the manufacturing and service sectors. In 1927, Agnelli established IFI (Istituto Finanziario Italiano), a financial company owning 70% of the shares of the Fiat Group. Since then, the Agnelli family controlled Fiat by controlling IFI. For the structure of the Fiat Group see G. Piluso, 'L'evoluzione dell'azionariato Fiat: assetti proprietari, struttura di gruppo e alleanze finanziarie', in Annibaldi and Berta (eds) *Grande impresa e sviluppo italiano*, p. 221. For the structure of the ownership see F. Barca et al., 'La trasformazione societaria di Fiat, Pirelli e Falck dal 1947 ad oggi', in F. Barca (ed.), *Storia del capitalismo italiano* (Roma, 1997), table 3, p. 164. For the establishment of IFI, see Castronovo, *Agnelli*, pp. 444-462.

[13] Valletta became president of Fiat following the death of Giovanni Agnelli senior, and because his grandson, Giovanni Agnelli junior, was too young to take over the leadership of the group.

structure already in place in the inter-war period. The structure set up in 1948 is represented by chart 3.1, although for simplicity not all the divisions are represented.

Chart 3.1: The Fiat managerial hierarchy in the car sector, 1948[14]



Source: Archivio Storico Fiat, file "Fiat Capogruppo, delibere e documentazioni varie", quoted in in Amatori 'Gli uomini del Professore', in Annibaldi and Berta (eds), *Grande impresa e sviluppo italiano*, pp. 323-324.

[14] As far as the Steel Division is concerned, in the archives there is no information concerning

The term 'division' was used to mark the hierarchical relationship between divisions and departments within divisions,[15] but in reality, Fiat was a long way from deploying a multi-divisional M-form organisational structure of the kind implemented by General Motors, where divisions were in charge of both the achievement of production targets and strategic decision- making. Actually, Fiat was a departmentalised structure (U-form structure) in which decision-making was centralised and operation managers executed plans drawn up by top management.[16] Decision-making was centralised in two structures: the Comitato Tecnico (Technical Committee) for the development of process and product; and the Direzione Generale (General Director's Consulting Committee) for strategic planning.

The "distribution of expertise" in the managerial structure is of interest. Apart from Valletta, who was an economist, both the Comitato and the Direzione were dominated by production engineers such as Bruschi, Bono and Genero. On the other hand, design engineers such as Giuseppe Gabrielli and Dante Giacosa, respectively the director and deputy director of the Divisione Tecnica, had no seats in the Comitato or the Direzione.[17] The Comitato Technico decided which products had to be produced and what resources had to be allocated, with the role of Divisione Tecnica being limited to product design according to the cost target set by the Comitato. Therefore, neither Gabrielli nor Giacosa were involved in the decision-making process in 1948.[18] Moreover, managers such as Genero and Bono had an almost hostile attitude towards designers.[19]

management in 1948.

[15] Here the word department translates as the Italian word sezione.

[16] Mintzberg's Machine Organisation is a particularly suitable definition for Fiat. Machine Organisation, in fact, features centralised bureaucracy, formal procedures, specialised work, sharp division of labour, functional groupings, extensive hierarchy, with a key role for the technostructure. See Mintzberg, *Mintzberg on Management*, pp. 130-133.

[17] Dante Giacosa is the 'father' of almost all Fiat cars from the late 1940s to the late 1960s, including the 500, which became synonymous with Fiat all over the world.

[18] A few years later, Gabrielli was included in the General Director's Consulting Committee, and appointed member of the Board. Giacosa, in contrast, was never appointed to the Board, and was appointed an 'added member' of the Technical Committee only in 1960.

[19] Amatori, 'Gli uomini del Professore' in Annibaldi and Berta (eds), *Grande impresa e sviluppo italiano*, p. 333.

The hierarchical structure reflected a precise managerial view that Valletta had been sharing with Giovanni Agnelli during the inter-war period. This was that the design team had to be controlled by the production team, in order to avoid over-engineering leading to excess complexity and extra production costs. As Giacosa pointed out,[20] since the 1910s, when Agnelli split the technical direction of the workshop away from the technical direction of the design department, power had always been in the hands of production engineers. Moreover, the actual power of managers was defined by an informal ranking rather than by their formal position in the hierarchy. A good example of this was the relationship between the Technical Division and the Automobile Division. In theory, Giuseppe Coriziato, the production manager responsible for the Automobile Division was subordinate to Giacosa, who was the vice-director of the Technical Division (see chart 3.1). In fact, the decision-making power of the Automobile Division was much greater than that of the Technical Division. Coriziato, in fact, was fully in charge of the Ufficio Tempi e Metodi (Time and Methods of Production Department), a sub-section of the Automobile Division. That office decided methods of production, and set the cycle time of each operation. If a particular design involved overlong cycle times, and therefore high costs, Coriziato asked for a modification of the design, knowing that Bono and Genero would have supported him on the grounds that cost control had priority over any other consideration. For this reason, Giacosa submitted a project to Bono only after the approval of Automobile Division.[21] The incentive for Coriziato to reject any project involving high complexity was quite strong, because the simpler the product, the easier the process and, therefore, the easier it was to reach production targets set by Bono and Genero. Therefore, Valletta, Bono and Genero could be reasonably sure that Coriziato's informal power over Giacosa was the best way to control costs.

The power exercised by production engineers over designers was the main element of continuity between the company run by Giovanni Agnelli Senior and that administrated by Valletta. In the inter-war period, the hierarchical relationship between production engineers and designers had been designed to make sure the latter delivered projects

[20] D. Giacosa, *Progetti alla Fiat prima del computer* (Milano, 1979), p. 67.
[21] Ibid.

involving the lowest possible level of process complexity and, therefore, requiring the least possible amount of raw materials, which were almost all imported and, therefore, extremely expensive.[22] When, in the post-war period, Fiat introduced and developed mass production technology, production engineers instructed the design team not only to address the minimisation of raw material input, but also the minimisation of the cycle time in the manufacturing of each component designed. The efficiency with which Fiat pursued the minimisation of costs and the maximisation of economies of scale enabled the company to supply the latent demand for cheap vehicles that characterised the Italian market in the stage of its infancy during the 1950s and 1960s. The structure set up by Valletta, therefore, enabled the company to pursue the strategy of expansion, launched in 1946, which, in turn, was compatible with the size of the Italian market and its potential for expansion. The adoption of "Fordist" techniques of mass production in the 1950s fitted well into the overall Fiat strategy, and was favoured by the important fact that a significant quantity of American production machinery came with Marshall Aid.[23]

The Fiat structure remained substantially unchanged throughout the 1950s and 1960s.[24] The long-term stability of the techno-structure set up by Valletta, of course, contributed to the consolidation of a corporate culture among young engineers, whose skills were measured according their capacity to conform to the production-oriented approach of the techno-structure.[25] This means that the business culture generated by

---

[22] In general, process complexity is proportional to the complexity of the component manufactured. The more complex the components, the more complex the process and the larger the quantity of material and labour input utilised. Moreover, the more complex the process, the larger the amount of material lost as process waste.

[23] However, as pointed out by Bigazzi, the adoption of American technology and techniques was selective for several reasons, including the composition of the workforce, the availability of skilled workers, and the fact that some engineers who had visited the GM and Ford plants during the 1950s had not found them particularly efficient in terms of stock management. Bigazzi, 'Mirafiori', in Zetlein and. Herrigel (eds), *Americanisation and Its Limits*, pp. 163-211.

[24] In 1954, the Divisione Technica was replaced by the Ufficio Tecnico Autoveicoli (Automotive Technical Office), and the Comitato Tecnico was transformed into the Comitato Studi e Ricerche (Research and Technical Analysis Committee). Dante Giacosa became the director of the Ufficio Tecnico but was excluded from the Comitato Ricerche e Studi and, therefore, had no decision-making powers. Amatori, 'Gli uomini del Professore.', in Annibladi and Berta (eds), *Grande impresa e sviluppo italiano*, pp. 327-334.

[25] Mintzberg defines technostructure as the group of analysts which, according to the type of firms, serves to effect certain forms of standardisation. The Fiat technostructure was formed by the kind of industrial engineers that Mintzberg defines as work-study analysts, in charge of the work process standardisation. See H. Mintzberg, *Structures in Five. Designing Effective Organisation* (1983), pp. 15-16.

such stability was likely to survive in the firm for many years, because of the training process young engineers had to pass through in the design and production departments.

Although Fiat was engaged in the production of a wide range of models, the efficiency in designing, engineering and producing small cars is one of the most important characteristics of the techno-structure set up and developed by Valletta. This feature of the Valletta management was obviously affected by the structure of demand of the Italian market, which, during the 1950s was massively skewed downmarket.[26] Nonetheless, there was also an internal reason why the Fiat technical team performed much better in the design and engineering of small cars. This was that both lower- and upper-range models were designed according to the strict cost targets set by production engineers. As a result, the Fiat upmarket range was inferior to that of Lancia, Alfa Romeo, and German manufacturers in terms of overall quality. Therefore, Fiat was able to acquire and defend market shares in the upper segments mainly because of the protection of the domestic market and the relatively small production capacity of domestic competitors. On the other hand, the quality of the Fiat bottom range was comparatively higher than that of competitors. As the design team found it easier to reach the Comitato's cost targets for small cars, and was indeed judged according to its ability to reach the targets, Giacosa was keen to persuade Bono to allocate most of the resources at his disposal to small rather than large car projects. Because the comparative advantage of Fiat derived from small car manufacturing, the Comitato was keen to allocate resources according to Giacosa's requests.

After Valletta: The search for a new structure

Under the guidance of the managerial structure set up by Valletta, Fiat grew at a remarkable rate. Production in the car sector expanded from 108,700 to 513,300 units between 1950 and 1960.[27] Moreover, the Valletta management masterminded and implemented the expansion plan that led to the establishment of the Rivalta plant in

---

[26] As pointed out by Volpato, with the introduction of the 600 and the 500 in the second half of the 1950s, Fiat captured the latent demand for cheap cars represented by scooter drivers wishing to upgrade their transportation means. Volpato, *Il caso Fiat*, p. 47.

[27] See table A 3.3 in the appendix.

1967. It was a giant facility, at least by Fiat standards, with an area of 2,000,000 m^2, including 300,000 m^2 of shop floor. It was as big as Mirafiori, and twice the size of Lingotto, the other two Fiat plants at that time. Consequently, production reached 1,506,847 units by 1970.[28] The strategy of expansion pursued by Valletta will be analysed in the following chapter of the thesis. At this stage, the focus is on the transformation of the managerial structure, which occurred before and after 1966, when Agnelli replaced Valletta as president of Fiat.

Table 3.2 shows the composition of the Fiat Administration Board from 1946 to 1970. The change from Valletta to Agnelli brought about little change in the Fiat managerial structure. The group of production engineers representing the bulk of the Valletta management, such as Bono, Ugo Camuri, Vittorio Bonade' Bottino, Alessandro Genenro and Domenico Taccone, stayed on until 1969, with Bono remaining until 1972. Giacosa did not become a member of the board. Nonetheless, the appointments to the board of Enrico Minola in 1963 and Niccolò Gioia in 1969 deserve attention.

[28] Ibid.

Table 3.2: Composition of the Administration Board, 1946-1970

Name	Degree	1946-50	1950-55	1955-60	1960-66	1966-70
V. Valletta	Economics	P/C	P/C	P/C	P/C/HP	
G. Agnelli	Law	VP	VP	VP	VP/C	P
R. Bruschi	Engineering	MB	MB	MB		
V.B. Bottino	Engineering	MB	MB	MB	MB	MB
G.Bono	Engineering	C	C	C/GD	C/GD	VP/C
A.G. Cavinato	Engineering	MB	MB	MB	MB	MB
A. Genro	Engineering	MB	MB	MB	MB	MB
C. Ghiglione	Engineering	MB	MB	MB	MB	
D. Taccone	Engineering	MB	MB	MB	MB	MB
G. Gabrielli	Engineering				MB	MB
E. Minola	Engineering				MB	
A. Fiorelli	Engineering				MB	MB
C. Ciuti	Engineering					MB
N. Gioia	Engineering					MB

Source: Archivio Storico Fiat, Reports of the Administration Board Committee, various years, in Amatori, 'Gli uonini del Professore' in Annubaldi and Berta (eds), *Grande impresa e sviluppo italiano*, pp. 322-342. P = President; C = Chairman; VP = Vice President; GD = General Director; HP= Honorary President; MB = Member of the Board.

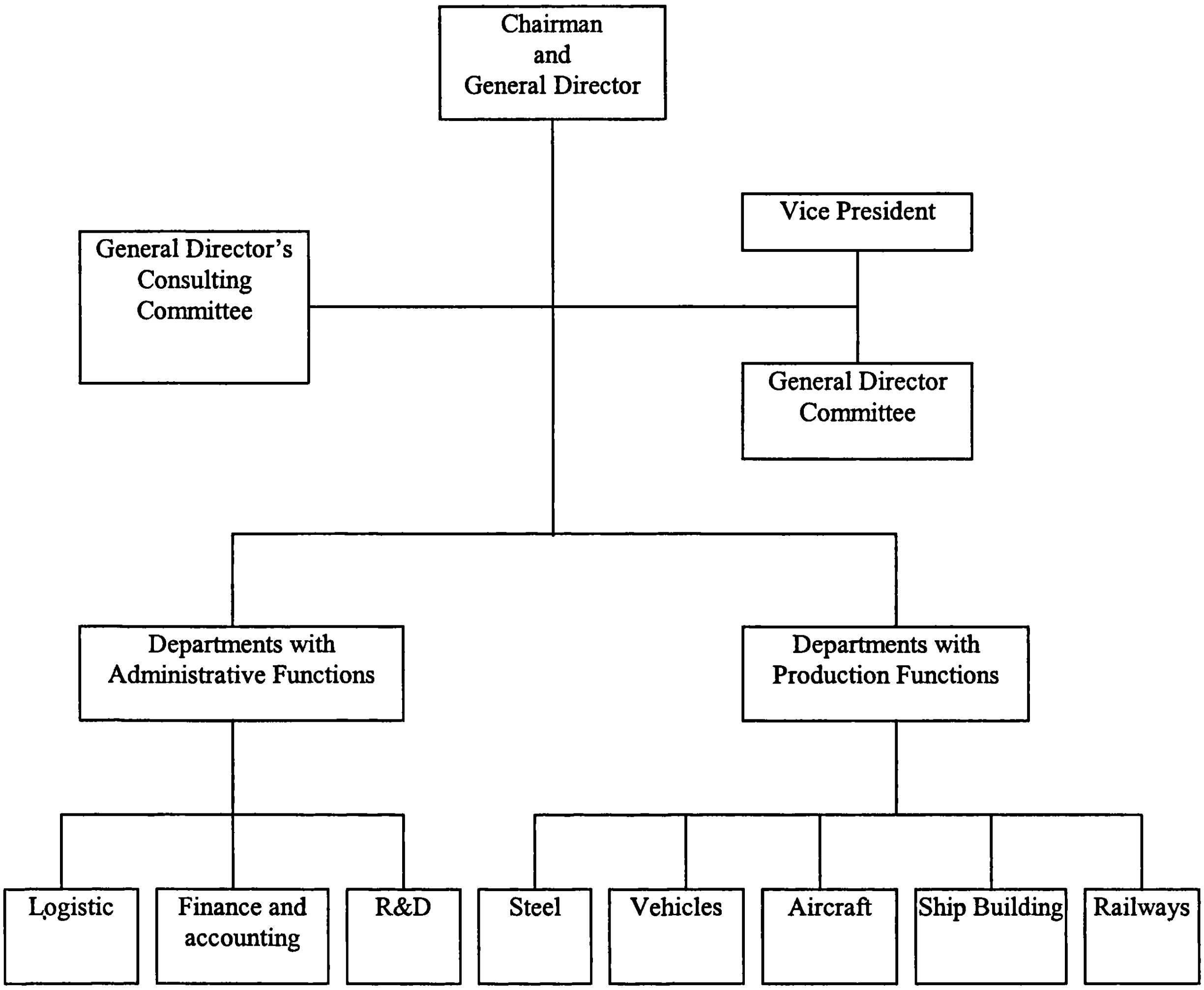
Minola started his career at Fiat in 1924. In 1927, he was appointed Director of Fiat Deutsche, in 1957 became Director of the Divisione Commerciale (Commercial Division). He retired in 1967.[29] Although Minola was an industrial engineer, during his career in the commercial sector he developed a market-oriented approach to car manufacturing. In 1957, with the help of Giammario Rossignolo, a newly-appointed young economist, Minola tried to transform the Commercial Division from a mere logistical division managing the distribution network, into a proper marketing division capable of analysing trends in demand and consumer behaviour and of providing the design and production teams with substantial feedback on demand. Minola's appointment to the board reflected Valletta's need for more precise feedback about

[29] Amatori, 'Gli uomini del professore', in: Annibaldi and Berta (eds), *Grande impresa e sviluppo italiano,* p. 334.

demand, in a context in which decreasing tariffs were expected to bring about more competition in the domestic market and to cause an increase in exports. Whether this feedback was used by Fiat management to shift towards a more market-oriented approach to car manufacturing, or whether Valletta intended to use market information to lobby the Italian Government to reintroduce forms of market protection had competition become too severe, is a question that will be approached in chapter 6. At this stage, it is important to point out that the appointment of Minola to a board dominated by production engineers was not likely to promote a shift from a product- to a market-oriented approach in the short term. Nonetheless, it gave the opportunity to managers like Rossignolo to make their way through the Fiat hierarchy and confront their business views with those of production engineers.

The appointment of Niccolò Gioia to the board in 1969 is also extremely important. Gioia was the manager chosen by Agnelli to develop a multi-divisional M-form structure, as opposed to the U-form departmental structure set up by Valletta. Given the continuous expansion of production and the integration of the process, by 1966 the structure set up in 1948 had become much more complex. Chart 3.2 shows the first four levels of the hierarchical structure. Below the fourth level, which was organised in divisions, there were more than a hundred sub-divisions with production, sales, and accounting and finance functions.

Chart 3.2: Fiat structure, 1966



Source: Archivio Storico Fiat, file 'Fiat Capogruppo, delibere e documentazioni varie', in Amatori, "Gli uomini del Professore', in Annibaldi and Berta (eds), *Grande impresa e sviluppo italiano*, p. 368.

Production divisions were responsible for the monitoring of actual costs, while sales divisions monitored revenues from sales. Cost and revenues were then analysed by the General Director's Consulting Committee. According to the results of the analysis, the Consulting Committee set the cost and sales targets, and decided how to reach the target. Moreover, the General Director made strategic decisions concerning new products and markets, and issues such as mergers and acquisitions. Therefore, there were more than a hundred divisions and only one centre of decision-making. Moreover, sub-divisions were organised by function rather than product. For example, within the vehicle division, the production function of cars and lorries and special vehicles was co-ordinated by the same sub-division. It was in this context that in 1966 Agnelli commissioned a study from Boston Consulting to redesign the entire structure and decentralise part of the decision-making. The aim was to set up a multi-divisional structure, organised by product lines rather than by function, in which decisions concerning product improvements and cost targets were taken at the divisional level, in accordance with the budget allocated to each division at the central level. Long-term strategic decisions and budget allocation remained under the control of the General Director's Consulting Committee.

In 1967, Gioia was appointed as supervisor of a group of five divisions, namely car, lorries and industrial vehicles, steel, marketing and railway equipment. Moreover, all the companies controlled by Fiat, such as OM and Autobianchi were co-ordinated by a section of Fiat called "Gruppo Società Controllate" (Controlled Companies Group).[30] Meanwhile, a group of managers who had served in Valleta's team, including Genero, Fiorelli, and Enrico Minola, all retired due to old age. Vincenzo Buffa replaced Fiorelli as director of the Car Division, while Giammario Rossignolo became director of the Marketing Division, and afterward, director of the Direzione Studi, Pianificazione e Controllo (Strategic Planning Office).

---

[30] As will be shown in the following paragraphs of the chapter, the separation of car and lorry manufacturing and the establishment of the GSC were the first steps towards the establishment of Fiat Holding and the formation of an independent floated company in each of the manufacturing sectors in which Fiat was involved. The transformation occurred during the 1970s.

At first glance, the restructuring started in 1967 brought about a large discontinuity, and there is little doubt that the new multi-divisional structure of Fiat aimed to change the functioning of the company and, therefore, the managerial style of the directors. However, the change was neither smooth, nor rapid or effective. Gaudenzio Bono remained the General Director of the company until 1972. Gioia and Buffa, the two men ultimately responsible for car manufacturing, were production planners who had developed their career within the Fiat Group. Rossignolo was one of the few managers who tried to introduce a different managerial style. He become one of the most influential managers when Agnelli become President of Fiat and, in fact, he inspired all the strategic moves undertaken by the new President, including the decentralisation of production in Southern Italy, the take-over of Citroën and the transformation of Fiat into an industrial holding.[31] Overall, during his entire career at Fiat, Rossignolo tried to establish a marketing-oriented approach to the business. However, as will be shown in the subsequent chapters of the thesis, during the 1970s Rossignolo faced the opposition of production engineers such as Gioia and Ghidella, in the same way that Minola had faced the opposition of Fiat engineers during the 1960s. Because of this opposition, and in spite of his personal relationship with both Giovanni and Umberto Agnelli, Rossignolo left Fiat in 1972. He returned to the Fiat Group as General Director of Lancia in 1976, but resigned again in 1978. The contrast between Rossignolo and the production engineers underlines to what extent production managers remained influential in the post-1973 Fiat as opposed to marketing managers. Moreover, the contrast suggests that the business culture of production engineers could not easily be reconciled with the market-oriented approach of innovative managers such as Rossignolo.

[31] See the profile of Giammario Rossignolo in P. Gennaro and G. Scifo, *Parabole di imprenditori ed imprese in cinquant'anni di sviluppo italian,* (Milano, 1997) pp. 79-88.

The strategy of growth

According to the established literature, the long-term strategy set by Agnelli featured elements of continuity as well as elements of discontinuity, in respect to the strategic thought of Valletta. The expansion of Fiat into Eastern Europe and South America is usually seen an element of continuity. On the other hand, the decentralisation of production to Southern Italy is considered an element of discontinuity, since Valletta and his staff had always ruled out any major investment outside the Turin hinterland. Moreover, Agnelli pursued horizontal growth, trying to take over upmarket brands, whereas Valletta had pursued vertical growth. The analysis of the international strategy of Fiat is beyond the scope of this work. On the other hand, it seems appropriate to refer briefly to investments in Southern Italy and the attempt to take over upmarket brands, because both moves were connected to production organisation and the strategy of output-mix optimisation, which form the main focus of this thesis.

In 1967, Fiat took the decision to establish a number of production plants in Southern Italy. The structure developed by Valletta before 1967 resembled the Fordist model of vertical growth, in which an integrated cycle of production profited from the concentration of all the operations of the cycle within the same plant, or within the same geographical area. A rather superficial interpretation of Fiat investments in Southern Italy suggests that by decentralising production in that area of the country, the company intended to move away from the Valletta organisational model of strong vertical integration and geographical concentration of manufacturing.[32] However, as will be shown in chapter 4, production plants in Southern Italy replicated exactly the same production model of the parent plants in Northern Italy, with an even lesser degree of flexibility. Moreover, there is enough evidence that the investment policy was driven by a number of clearly identifiable factors, not directly related to production organisation.[33] These include: a) the overcrowding of the Turin suburbs, with the lack of infrastructure, housing, and social services, all of which had been already highlighted by the last wave

[32] S. Mariotti, L. Treves, 'Grande impresa e Mezzogiorno: la presenza della Fiat', in Annibaldi and Berta (eds), *Grande impresa e sviluppo italiano*, pp. 299-239. On the topic see: A. Dal Monte, A. Gianola, *Il mezzogiorno nell' economia italiana* (Bologna), 1978; V. Zamagni, *Dalla periferia al centro* (Bologna, 1990).

[33] See Castronovo, *Fiat 1899-1999*, pp. 1087-1097, 1166-1169, 1238-1239.

of mass migration caused by the establishment of the Rivalta plant; b) increasing pressure from the Government to contribute to the regional development of the Italian South; c) the increasing availability of funds; and d) investments by the rival company Alfa Romeo in Southern Italy.[34]

Along with the domestic competition from Alfa Romeo, funding seems to be one of the most important factors behind the strategy of decentralisation. Without incentives, Fiat could have allocated investments elsewhere in the North or even in other areas of Piedmont. Until the early 1960s, incentives and subsidies had been provided to small and medium-sized industry, through a special incentive and subsidy scheme called the Intervento Straordinario per il Mezzogiorno (Extraordinary Intervention for the Italian South).[35] From 1965 onwards, however, incentives and subsidies were gradually extended to large firms. The extension of the Intervento Straordinario to big business was part of the wider industrial development policy of the centre-left Government, and was based on the involvement of the car industry in the development of the Italian South.[36] In 1967, Alfa Romeo planned to expand output. The state-owned industrial holding IRI, which controlled Alfa Romeo, approved the project with the support of the government. This support was determined by the fact that Alfa Romeo, as all the IRI-controlled enterprises, had to allocate at least 40% of investments in Southern Italy. Initially, Fiat argued against the IRI decision, stressing that the Alfa Romeo investment

---

[34] Alfa Romeo was the second Italian car manufacturer. At that time A. R. was controlled by Istituto per la Ricostruzione Industriale (I.R.I), which was an industrial holding owned by the State through the Ministry of Treasure and directed by management appointed by the Government. I.R.I was established in 1933 in order to finance the restructuring of firms in crisis.

[35] There were also significant direct investments of state-owned companies, in the heavy industry sector, as well as direct state investment in infrastructures.

[36] The first attempt of the Government to involve the car industry in the process of industrialisation in Southern Italy traces back to 1962. When the construction of Rivalta was announced, the Government, under the guidance of the Prime Minister Amintore Fanfani, tried in vain to persuade Fiat to invest in Southern Italy rather than in the Turin hinterland, where Rivalta was located. The attempt had the double aim of transferring some production capability to the South, and avoiding the congestion of the Turin area that the arrival of hundred of thousands of families from Southern Italy would have caused. In order to facilitate the relocation of Fiat to Southern Italy, funds were made available for investments in infrastructure. However, the Fiat management was adamant in rejecting the plan, because it was not compatible with the vertically integrated and geographical concentrated structure that allowed Valletta and his management to exercise strict control over the entire process. See Castronovo, *Fiat 1899-1999*, pp. 1166-1169.

would have led the Italian industry to run over capacity.[37] However, soon after Alfa Romeo started to implement its plan, Fiat decided to invest 250bn Lire in its own pattern of facilities. These included the Bari plant for the production of components, the Termoli plant for engines, and two plants for the manufacturing of cars, Termini Imerese in Sicily, and Cassino in Lazio: the former able to produce 500 cars per day and the latter 1400. Half of the whole investment was subsidised.

By investing in Southern Italy, Fiat tried to prevent the state from allowing further investment by Alfa Romeo. At same time, it profited from the funds made available by the Italian state to create the extra capacity Fiat needed, in order cope with the expected increase in demand during the 1970s. According to Fiat forecasts, between 1970 and 1980 demand was expected to grow by 2.2% per year in the EC area, while the aggregate demand of the EC and EFTA areas was expected to grow by 2.9% per year.[38] Due to investment in Southern Italy the theoretical capacity of Fiat increased from 7000 cars per day in 1970 to 8900 cars per day in 1980, thus by 2.4% per year, which was in line with forecasts.

Take-overs represented perhaps the most important element of the Agnelli strategy. In the late 1960s, the president of Fiat shared the view, quite common at the time, that within twenty years only six or seven car producers would be left.[39] A sound strategy of mergers and acquisitions was therefore essential, in order to ensure the long-term survival of Fiat. Because the company was already prominent in the bottom end of the market, the obvious move was to take over companies more specialised in the manufacturing of medium/high quality cars. The strategy would have provided Fiat with the ability to respond effectively to the increase in the relative size of upmarket segments, which is generally expected in mature markets. In this regard, the acquisition of Lancia and the attempt to take over Citroën made perfect sense. In 1969, Fiat took

[37] In 1967, Fiat tried to persuade the government not to allow Alfa Romeo to invest in new capacity, partly because the Alfa Romeo strategy was to expand output in segment C, which would have transformed it into a direct competitor of Fiat, whereas up till then it had produced mainly upmarket units for segments D and E.

[38] See table A 3.5 in the appendix.

[39] See: Servizio Commissioni Parlamentari della Camera dei Deputati, *Situazine e prospettive dell'industria automobilistica Italiana* (Roma, 1971).

over Lancia[40] with the blessing of the Italian Government and without any effective opposition from the Lancia management. By contrast, after having acquired a substantial share of Citroën stocks, Fiat faced the increasing reluctance of the Michelin family to give up the control of the company, so that Fiat withdrew its bid in 1973. In an interview with Volpato, Giovanni Agnelli explained that the failure of the operation depended largely on the fact that the Citroën management held a strategic view substantially different from that of the Fiat management.[41] At the core of Fiat strategy there was the maximisation of economies of scale, by sharing platforms, engines and other mechanical components between Citroën, Lancia, and the top range of Fiat, whereas Citroën managers wanted to preserve the technical identity of the French brand. Agnelli describes this as a "technical culture divide". Actually, it was a "business culture" divide. Fiat managers held a production-oriented approach, where the sharing of components enables manufacturers to maximise economies of scale and reduce process complexity. The French management, on the other hand, thought that technical differentiation through the implementation of complex technologies, such as the hydrolastic suspensions, was a key factor to effectively compete in the upper end of the market. Thus the loss of technical distinction between the Fiat and Citroën brands would have led to decreasing Citroën market shares, with detrimental effects on both the Fiat and Citroën performance. Ultimately, the market-oriented business culture of the Citroën management was not compatible with the production-oriented business culture of the Fiat management. Interestingly, within Fiat, Rossignolo held the view that Lancia should have kept its technical autonomy distinct from Fiat, but this was not what the technical management aimed for, and thus from 1970 onwards, all the new Lancia models were equipped with Fiat engines and gearboxes. This was one of the reasons for disagreement between Rossignolo and the Fiat technical management.

[40] Lancia was established in Turin in 1908 by Vincenzo Lancia, a former Fiat employee. The company developed as an innovation-driven manufacturer and specialised in the manufacturing of upmarket technically sophisticated cars.
[41] Interview with Gianni Agnelli in Volpato, *Il caso Fiat*, pp. 389-390.

Managerial turnover and Fiat restructuring, 1973-1983

The reshuffling of the managerial structure, started in 1967, did not bring the expected changes in the management style. Although innovative managers such as Rossignolo and Antonio Mosconi[42] were pushing for radical changes, decision-making was still influenced by production engineers such as Gioia, Buffa and, of course Bono. In 1972, though, Bono retired, while Nicola Tufarelli joined Fiat from Olivetti as Director of the Finance and Control Division. [43] Tufarelli replaced Gioia at the head of the Car Division in 1974. Considering that lifetime employment, internal mobility and internal training of top management had characterised the development of managerial hierarchies at Fiat during the previous forty years, the appointment of Tufarelli and his rapid advancement within the hierarchy represented a considerable change in the routines regulating human resources management at Fiat. As director of the Car Division, Tufarelli tried to reorganise the division according to a "management-by-objectives scheme".[44]

In 1974, Cesare Romiti, a financial manager from the state-owned industrial sector, was appointed as General Director of Fiat. The structure of control now included three chairmen, Umberto Agnelli, brother of Giovanni, Romiti and Carlo De Benedetti, the former chairman of Gilardini.[45] Gianni Agnelli remained the President of the Company. The appointment of De Benedetti and Romiti, thus, continued the trend towards the renovation of Fiat management through external appointments. However, the new structure proved rather unstable. After replacing Tufarelli as director of the Car Division, De Benedetti asked Rossignolo to resign due to divergent views concerning

[42] In 1970, Rossignolo became responsible for the Direzione Studi Pianificazione e controllo (Strategic Planning Office), and Mosconi was a member of his staff.
[43] Tufarelli had left Olivetti in 1972 to take the position of Director of the Strategic Planning Department at Fiat. Two years later, he became Director of the Car Division. See Volpato, *Il caso Fiat*, pp. 119-121.
[44] This is a matrix scheme involving two vectors in the decision flow. The vertical vector, from the top to the bottom of the hierarchy, describes the flow of decisions concerning output and costs targets. The horizontal vector, on the other hand, describes the process of decision-making by which the directors of divisions optimise the process. Managers of each division or sub-division decide how to optimise the functioning of the whole structure, by collaborating with their colleagues from other divisions, in order to reach the common objectives of the various departments. For example, in order to increase sales, the design, production and marketing divisions must co-operate in order to improve the quality and meet the need of clients more effectively.
[45] Gilardini is a company of the Fiat Group specialised in components for cars.

the restructuring of the component sector.[46] Moreover, De Benedetti and Romiti held different opinions about the strategy to follow to recover from the undergoing crisis. In particular, De Benedetti saw product renewal as the most urgent priority, whereas Romiti was concerned with reducing costs and consolidating the expanding debt.[47] Because of this divergence, De Benedetti resigned, and Tufarelli was temporarily restored to his former position, but he had no further input into the restructuring of the Car Division. Moreover, Rossignolo returned to Fiat as General Director of Lancia.

The restructuring of the top management was connected with the transformation of the Fiat Group into an industrial holding. This was the most important transformation at Fiat since 1946. The introduction of a multi-divisional structure that Agnelli had been pursuing since 1967 was meant to be the first step towards the division of Fiat into several independent companies, specialised in different products and processes, and responsible for their own competitive strategies. Those firms would be controlled by an industrial holding (Fiat Group) responsible only for long-term financial strategies. To achieve this target, it was necessary to separate the various production activities within Fiat, and to decentralise decision-making in the first place. The plan had been masterminded by Rossignolo and Mosconi in 1970 but proceeded slowly until 1972, when Fiat accelerated the reorganisation of the lorry and agricultural machinery division, leading to the establishment of IVECO in 1975.[48] The de-integration of the commercial vehicle sector into an independent stock company was a huge step towards the rationalisation of manufacturing operations at Fiat, and there is little doubt that the new General Director Romiti had substantial input into this process. Similar operations followed in the machine tools sector with the foundation of COMAU in 1977, in the steel and foundry sector with the establishment of Teksid in 1978, and in the components sector, where Magneti Marelli acquired the control of all companies producing components within the Fiat Group.[49] Finally, Fiat Auto was established in 1979. Chart 3.3 shows the new set-up in 1981. At the top, there were two industrial

---

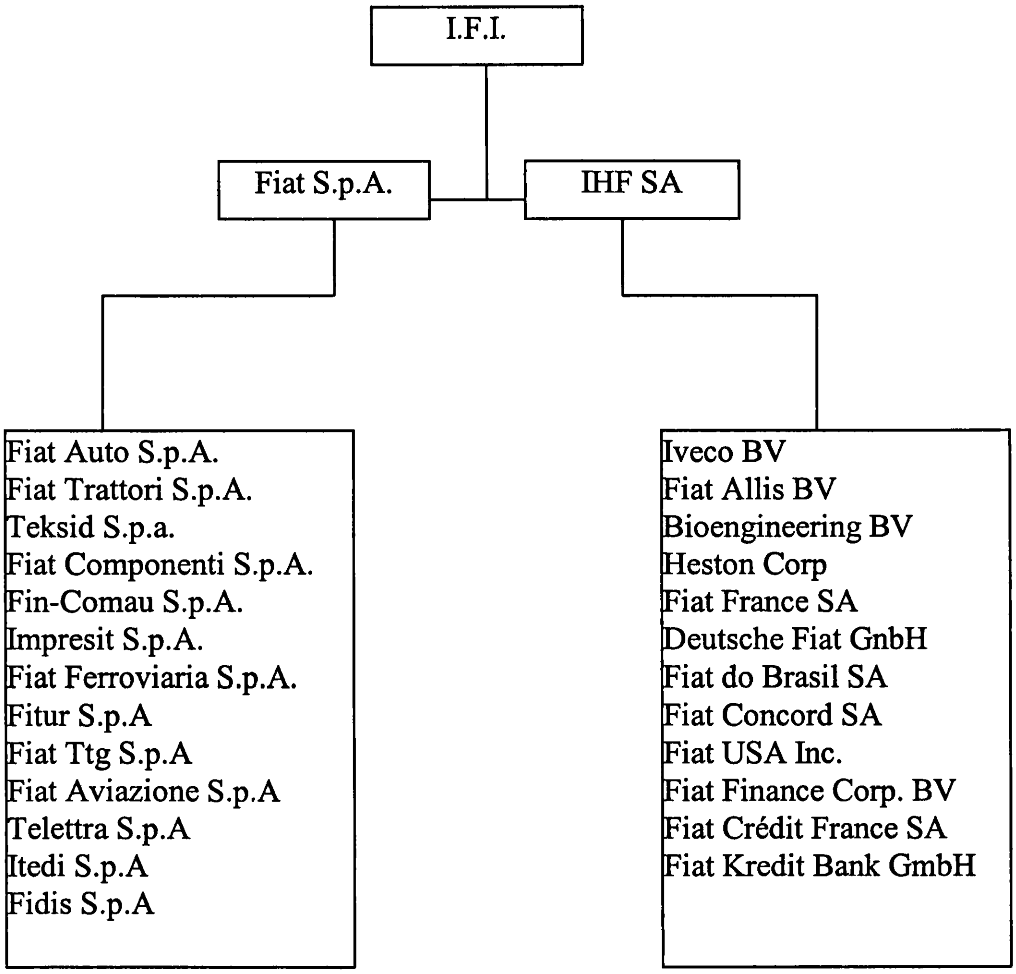
[46] Gennaro and Scifo, *Parabole di imprese*, p. 140.
[47] See Volpato, *Il caso Fiat*, pp. 122-123.
[48] IVECO (Industria Veicoli Commerciali) was the industrial group incorporating all the companies involved in lorries manufacturing within the Fiat group, including OM, Magirous and UNIC.

holdings, Fiat S.p.a., and IHF (International Holding Fiat). The former controlled the companies registered in Italy, while the latter controlled the companies registered abroad. IHF itself was registered in Switzerland. Both holdings were responsible for the financial co-ordination of their companies, including the procurement of funds, with particular regard to venture capital. Both were controlled by I.F.I.[50]

[49] Magneti Marelli is a company producing electrical and electronic components founded in 1919. In 1967, Fiat bought 100% of the Magneti Marelli shares.

[50] A detailed description of the Fiat Group at that time has been provided by Enrietti and Fornengo, *Il gruppo Fiat*, pp. 13-56.

Chart 3.3: The Fiat Group, 1979



Source: Enrietti and Fornengo, *Il Gruppo Fiat*, p. 28.

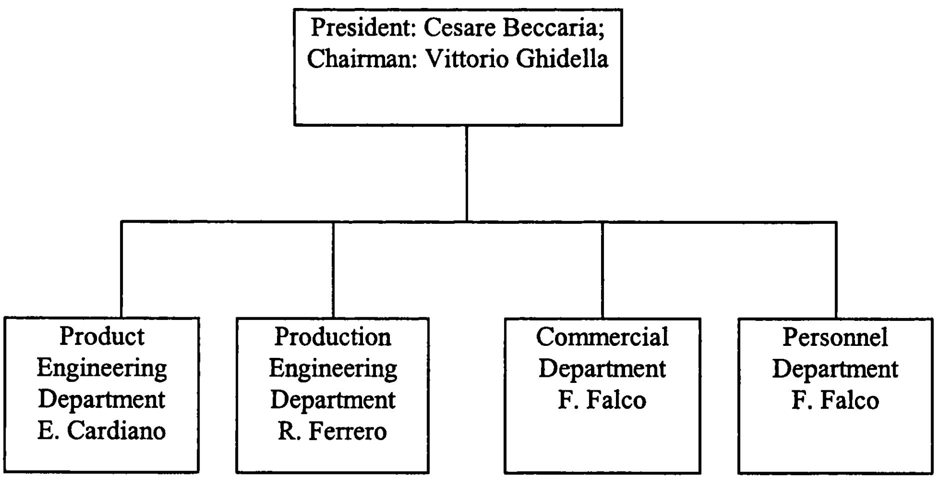
Fiat's transformation of internal operations into joint companies was responsive to the increasing need for venture capital, under the pressure of increasing competition. [51] Fiat S.p.A and I.H.F. retained the controlling share of each individual company, but allowed external investors to enter the ownership structure of each individual company. The main incentive for the external investors was the fact that the transformation of the Fiat Group into an industrial holding had increased the degree of separation between the

[51] Barca et al., 'La trasformazione societaria ' in Barca (ed.), *Storia del capitalismo italiano*, pp. 155-185.

Agnelli family, which remained the largest shareholders of I.F.I, and the professional managers, who were fully responsible for the strategic decision-making of individual companies. This was expected to increase the rapidity and effectiveness of decision-making, and the efficiency of resources allocation, with positive effect on profits and dividends. Moreover, the strategic independence allowed the companies producing components and production tools, such as Magneti Marelli, COMAU and Teksid, to sell their products not only to other companies controlled by the Fiat holding, but also to competitors, with clear advantages in terms of economies of scale. This made those companies even more attractive for investors.

The in-depth analysis of the transformation of the Fiat Group during the 1970s in terms of distribution of property assets goes beyond the scope of this research.[52] In the context of this thesis, the relevant question is whether it is reasonable to assume that managerial turnover and group restructuring experienced during the 1970s caused a different managerial style to emerge at Fiat Auto. Chart 3.4 shows the managerial structure of Fiat Auto S.p.A in 1979.

Chart 3.4: Fiat Auto Managerial Structure, 1979



Source: Volpato, *Il caso Fiat*, p. 125.

Beccaria came from IVECO, while Ghidella come from Riv SKF, a company with strong links with the Italian group, but had previously developed his career within Fiat and by education was a production engineer. As far as the techno-structure was concerned, it was based on three engineers: Caridiano Ferrero and Falco, who kept the same positions they previously held in the Fiat Car Division. In other words, the technostructure inherited by Ghidella in 1978 was the same that Tufarelli had inherited from Gioia in 1974.[53] Therefore, the instability of the top managerial structure between 1972 and 1979 was in striking contrast with the stability of the technostructure in the Car Division.

Among the top managers appointed between 1972 and 1979, Tufarelli, Romiti and De Benedetti were external appointments. However, Romiti was involved in the financial management of the group and in long-term planning, while De Benedetti was at the head of the Car Division for less than a hundred days. The leadership of Tufarelli was undermined by the fact the Umberto Agnelli replaced him with De Benedetti, and even when Tufarelli was reintegrated into his former role after the resignation of De Benedetti, he could have no real impact on the transformation of the Car Division. Ghidella was a production engineer who had developed his expertise within Fiat. Thus, the restructuring of the Fiat organisation and the turnover of top management during the 1970s do not seem to be sufficient to suggest a discontinuity between the management style of Fiat Car Division and that of Fiat Auto S.p.A after 1974.

The appointment of Ghidella as chairman of Fiat Auto caused Rossignolo to depart as General Director of Lancia. In fact, Ghidella decided to incorporate Lancia into Fiat Auto. The move aimed to maximise synergy deriving from the use of common platforms and mechanical components. Cost reduction and process maximisation, rather than product differentiation, were the two elements underpinning his strategy. This move was clearly inspired by the "production engineering background of Ghidella", and was not compatible with the marketing strategy of Rossignolo, which was based on technical and commercial diversification between Fiat and Lancia, with the latter

[52] See Enrietti and Fornengo, *Il Gruppo Fiat*, pp. 13-56.
[53] This results form a comparison of the technostructure of the Fiat Car Division in 1974 with that of Fiat Auto in 1979, as described by Volpato, *Il caso Fiat*, pp. 121, 125, figures 27 and 28.

competing upmarket.[54] Interestingly, the rift between Rossignolo and Ghidella was motivated by the same difference in business approach that a few years earlier had led to the rift between Fiat and Citroën management. This is a strong indication that the production-oriented business culture of the Fiat management had actually survived the changes occurring in the Fiat structure after the first oil crisis.

Section three
Crisis and recovery of Fiat, 1973-1983

This section describes the crisis of the 1970s and the recovery of the early 1980s. Once again, the analysis suggests that there is no obvious reason to assume that Fiat management regarded a shift towards flexible mass production as the way to recover from the crisis of the 1970s. On the contrary, it is reasonable to assume that the financial crisis experienced by the Italian company compelled management to minimise complexity and maximise its specialisation in the production of small cars.

The crisis of the 1970s and the problem of labour productivity

As has been already pointed out, those authors who apply the paradigm of discontinuity to Fiat see the oil crisis as the catalyst for the restructuring of the company's top management. Other authors such as Comito, though, hold the opposite view that the crisis of the 1970s actually had the effect of delaying managerial and technical restructuring. According to Comito, the oil crisis generated confusion among Fiat managers and owners about the long-term perspective of the car manufacturing business.[55] This led to a lack of strategic planning in the car-manufacturing sector, and to the postponement of investments in product renewal. This section of the chapter analyses the crisis of Fiat, and shows that after 1973 managers and owners of the company had no other option than to tackle the financial crisis of the company before setting any other strategy. In this respect, the appointment of a financial manager such as

[54] Interestingly, Rossignolo started the co-operation with Saab, which would lead to the design of the Lancia Thema and Fiat Croma, namely the two models competing in segment E from 1984 onwards.

Cesare Romiti to the role of general director was certainly a sensible move. At the same time, the financial crisis of Fiat, which was particularly acute between 1974 and 1978, explains the lack of decision-making in the car sector much more than the scepticism of prominent members of the board about the future perspective of the car industry.[56] Moreover, this section makes the point that the financial crisis of Fiat provides another reason to be sceptical about the literature emphasising discontinuity in management. Given the scarcity of financial resources, it seems to be perfectly reasonable to assume that Gianni Agnelli and Cesare Romiti instructed the technical management to be over rigorous in terms of cost control. Also, it seems reasonable to assume that the renewed attention of Fiat management to cost control was likely to result in the rationalisation of existing routines, as opposed to the development of new ones, which would have introduced uncertainty in terms of costs containment.

The crisis of the 1970s was indeed a complex phenomenon, embodying demand recession, financial constraints, and adversarial industrial relations. The crisis was characterised by exogenous factors, such as instability in the price of raw material and inflation, and by endogenous factors, such as decreasing productivity. The complexity of the Fiat crisis in the 1970s stems from the interrelations between endogenous and exogenous factors. In 1970, Fiat had already experienced a "wage shock", since real wages increased by 16.4% as compared to 1969. Between 1970 and 1973, wages kept growing faster than living costs, while in 1974 real wages decreased by 4.9% as compared with the previous year. This was caused by inflationary pressure in the aftermath of the first oil crisis, causing prices to grow faster than wages. However, already in 1975 real wages recovered almost entirely the loss of the previous year and kept growing in the subsequent two years (see table 3.3).

[55] Comito, *Fiat tra crisi e ristrutturazone*, p. 57.
[56] According to Comito, Umberto Agnelli was the manager most sceptical about the future of the car industry. Ibid.

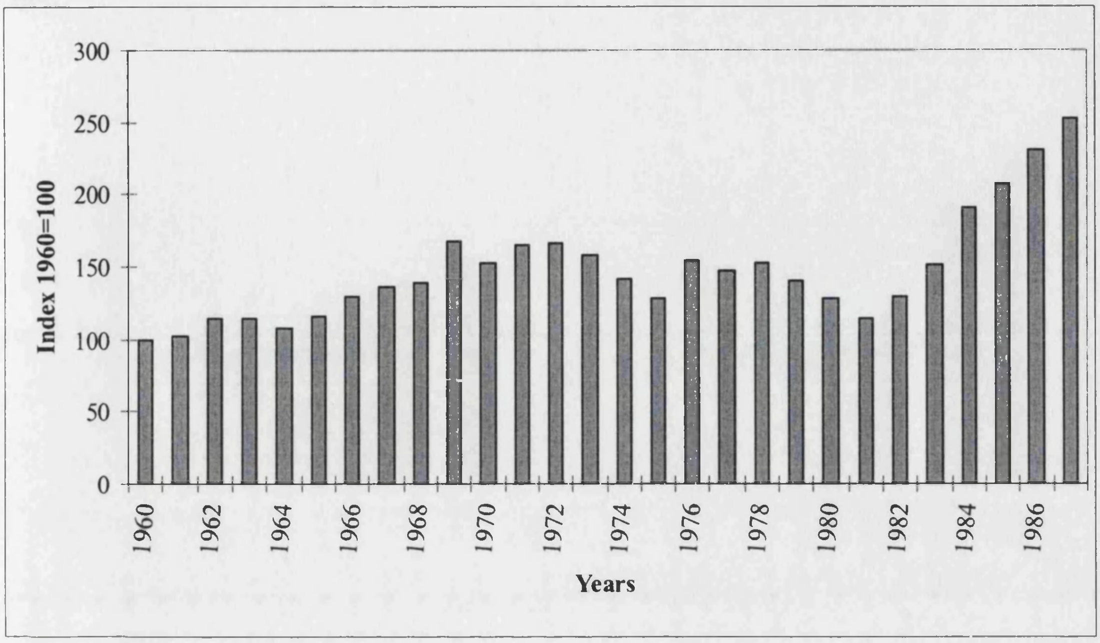
Table 3.3: Annual wage increase (blue collar) relative to inflation at Fiat, 1969-1977

Years	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77
Wages	+ 21.7%	+ 13.4%	+ 8.3%	+ 16.9%	+ 20.4%	+ 15.6%	+ 24.5	+ 20.5 %
Living Cost	+ 5.3%	+ 4.7%	+7.3 %	+ 12.2%	+ 25.3%	+ 11.1%	+ 21.8%	+ 14.9%

Source: Volpato, *Il caso Fiat*, p. 113.

Crucially, the increase in wages was not correlated with an increase in productivity, which, on the contrary, did not increase between 1969 and 1972, and, after 1973, started a negative trend that was reversed only from 1982 onwards (see figure 3.3).

Figure 3.3: Productivity index, direct labour, 1960-87 (car sector only, 1960 = 100)



Source: for data sources, see table A 3.6 in the appendix.

The various factors explaining the behaviour of the index will be analysed more in depth in the next two chapters of this work. [57] At this stage, it is sufficient to mention that the drives for productivity gains and losses changed from time to time over the period considered. From 1960 to 1969, productivity gains had been driven by both stable industrial relations and technological change towards automation. At beginning of the 1970s, on the other hand, labour-management relations became increasingly adversarial, while the Fiat technological setting seemed to have exhausted the scope for major productivity improvements.[58] From 1974 to 1977 both output and labour input decreased, so that the index remained fairly stable, with the exception of 1975, when output decreased faster than labour input.[59] After 1977, an inappropriate human resources policy led to an expansion of the labour force,[60] while industrial relations deteriorated even further despite the relative calm of the 1974-1976 period.[61] Finally,

[57] The technological development of Fiat from 1960 to 1987, and the effects on productivity will be analysed in chapter 4. Labour management and industrial relations will be analysed in chapter 5.
[58] This element will be analysed in chapter 5.
[59] See table A 3.6 in the appendix.
[60] Collida, Negrelli, *La transizione nell'industria*, pp. 185-203.
[61] See table A3.3 in the appendix.

after 1982, improved industrial relations, the rationalisation of the process, and the massive implementation of robotics enabled Fiat to resize the working force and improve productivity by a remarkable extent.

The index captures the productivity of the man-hour units performed during each year, and refers to workers in the car sector. Data have been disentangled from the rest of the direct and indirect labour force of the Fiat Group. Unfortunately, before 1979, the capital stock deployed in the car sector cannot be disentangled from the whole capital stock of the Fiat Group. Therefore, before the establishment of Fiat Auto, capital productivity of the car sector cannot be calculated. Volpato looks at annual losses in total output, in order to give a quantitative indication of the impact of strikes on capital productivity.[62]

Table 3.4: Hours lost per labour unit, and output lost (units), 1969-1977

1969	1970	1971	1972	1973	1974	1975	1976	1977
273,000	88,300	87,300	70,000	146,300	92,900	52,000	91,000	85,900

Note that from 1974 onwards, the number of hours lost includes those lost for the implementation of the temporary redundancy scheme (cassa integrazione). Source: Volpato, *Il caso Fiat*, pp. 111-112.

As shown by table 3.4, the impact of strikes on output between 1969 and 1977 was quite significant. However, after 1974 the data quoted by Volpato include the units not produced due to the implementation of short time and temporary redundancies, in response to the contraction in the demand for Fiat cars. The very fact that Fiat had to implement such measures indicates that after 1973 the company ran an oversized stock of unsold vehicles, in spite of the underutilisation of plants caused by strikes. This indicates that after 1973 the impact of the demand crisis on capacity utilisation overshadowed that of strikes.

[62] Volpato, *Il caso Fiat*, pp. 108-111.

The Fiat financial crisis

When the first oil crisis occurred, the profitability of Fiat had been already reduced by the wage shock, stagnating productivity and adversarial industrial relations. The oil crisis triggered a downward demand shock and an upward interest rate shock. Italy was almost totally dependent on raw material imports. The upward shock in the price of imported materials after 1973 generated a deficit in the balance of payments, which, combined with the already existent budget deficit, triggered the crowding out effect.[63] The simultaneous expansion of interest rates and material costs, combined with decreasing demand, decreasing productivity and increasing labour costs brought Fiat to the brink of collapse in 1975.

Another element that exacerbated the combined effects of increasing input prices and decreasing sales in the short term was the government's package of extraordinary measures to contain inflation, such as the price freeze on several goods, including cars. The freeze was lifted at the end of 1974, but it caused major concern to the management, since it deprived Fiat of the only possibility to reduce its losses. This was to raise selling prices and maximise earnings from the portion of demand that was income elastic, rather than price elastic, namely replacements that could be not postponed. In this sense, the price freeze was not at all good news for Fiat.[64]

Between 1973 and 1975, sales (domestic plus export) decreased by 41.2%.[65] Over the same period, output decreased by 27.6%. Therefore, the stock of unsold vehicles increased by 13.6%. In January 1974, in the immediate aftermath of the oil crisis, the stock rose up to 300,000 units, which was 21.5% of the 1973 output, worth 450 billion current lire.[66] Considering the financial exposure of Fiat due to the ongoing investments in Southern Italy and Brazil, the impact of the shock on Fiat's financial stability was huge. In October 1974, cash needed by Fiat to finance its cash flow exceeded the budget by 127%. Total debt increased from 168bn ITL in 1973 to 651bn in 1974 and 764bn in

---

[63] Mosconi, and Valeo, *Crisi e ristrutturazone del settore automobilistico*, pp. 51-54.
[64] As will be shown in chapter 5, the Fiat management was concerned about the price freeze, because Fiat would have lost its price leadership privilege, had the freeze lasted. As already mentioned, during the 1970s competition was characterised by collusive price leadership.
[65] See tables A 3.3 and A 3.7 in the appendix.

1976.[67] Short loans represented 60% of the whole debt. Short-term loans were those with the highest interest rates.[68] Moreover, at least in theory, there was the risk that banks would respond to uncertainty by asking Fiat for immediate repayment of the existing debit and refusing further credit.

Between 1974 and 1979, Cesare Romiti's priority was indeed to ensure the financial stability of the company, while carrying on with the restructuring of the group. The first move was the consolidation of the short-term debt by linking the loan repayments to the reduction of the stock. Banks, including the state-owned Banco di Roma agreed to the Romiti proposal, but the move had to be approved by Banca d' Italia, the Italian Central Bank. In fact, to link the short-term loans to the absorption of the stock technically meant to transform short-term debt into long-term debt. In this way, short-term debt decreased from 60% to 30% of the total. Meanwhile, Fiat accelerated the cashing in of the outstanding credit by asking dealers to pay for cars immediately, instead of within the customary three months. Moreover, the company placed 70,000 employees throughout the group in temporary redundancy. Direct labour in the car sector decreased by 11,200 units between 1973 and 1977.[69]

A more articulated and wider financial strategy, though, was needed in the medium term, in order to ensure the long-term rescue of Fiat. The long-term debt had to be refinanced in order to carry on with the investment programme. This required an even more complex exercise of financial engineering, given the company's crisis, and the wide uncertainty surrounding the car industry. In theory, Fiat could increase the level of financial commitment of the Agnelli family through a direct investment by I.F.I, and then issue shares in the hope that the commitment of I.F.I. would convince investors to channel financial resources into Fiat. Actually, neither the increase in capital nor the issuing of shares was an easy option.

To issue shares was not a viable solution for two interrelated reasons, namely the decreasing value of the existing Fiat shares, and the determination of the Agnelli family to retain control of the company. In 1972, the ratio equity value to capital was 1.6, but it

---

[66] Volpato, *Il caso Fiat*, pp. 118-119.
[67] Ibid, pp. 197-201.
[68] Ibid.
[69] See table A 3.6 in the appendix.

decreased to 0.6 in 1974 and to 0.2 in 1979. This automatically undermined the confidence of stock market operators, so that nobody would have subscribed to new shares, unless agents were interested in acquiring the control of the company. However, Agnelli had ruled out this option. As far as the commitment of I.F.I. is concerned, the Agnelli family proved insufficiently confident to risk its own money. This of course made it even more difficult to bring in venture capital.[70].

In this context Romiti, together with Enrico Cuccia and Mediobanca, masterminded the so-called "Operation Lafico", which involved the Libyan Arab Foreign Bank. Politically, the Libyan Bank was not an optimal partner.[71] The participation of Lafico in Fiat, in fact, met with little enthusiasm in US financial and political circles. Precisely for this reason, though, the Libyan Bank was an ideal partner, financially speaking. In order to gain a role in the Western financial establishment the Libyan Arab Foreign Bank was able to inject huge amounts of cash into Fiat, in order to finance the increase in social capital and investments, without claiming a role in strategic management or a controlling share. The overall conditions to which the operation was subjected, therefore, proved attractive for the Fiat management and for the Agnelli family.

The financial conditions of the loan were extremely attractive too. In the first stage of the operation, Fiat issued 20 million new ordinary shares and 10 million preference shares at a nominal value of 500 Lire each. Lafico, nevertheless, paid a premium of 5500 Lire per share, which was an outstanding premium, considering that the market value of ordinary Fiat shares in 1976 was about 2000 Lire for the ordinary shares and 1300 Lire for the preferences.[72] In the second stage, Fiat issued convertible bonds for 90bn Lire at an interest rate of 9.50% per year. Lafico actually converted bonds into shares, for which the bank paid the same premium of 5500 Lire. Finally, Fiat subscribed to a Lafico loan of $104m at an interest rate of 9.50%.[73] I.F.I. and the other majority shareholders did not lose control of the company. Lafico was indeed an important shareholder with two representatives on the Administration Board. Nevertheless, the

[70] See Comito, *La Fiat*, p. 216.
[71] Enrico Cuccia was the Chairman of Mediobanca, an investment bank established in 1946. For the role of Mediobanca in the Lafico operation, see S. Ori, *Storie di una dinastia. Gli Agnelli e la Fiat* (Roma, 1996), pp. 270-279. Se also Castronovo, *Fiat 1899-1999*, pp. 1399-1408, 1572-1576.
[72] Volpato, *Il caso Fiat*, pp. 197-201.

agreement included a form of "no strategic interference" clause, by which the Lafico representatives were prevented from interfering with strategic decision-making.

In terms of rescue strategy, there is little doubt that the Lafico operation was a success. As pointed out by Silvio Ori, nevertheless, the agreement became increasingly difficult to manage from a political point of view. The clashes between the American Administration and Libya forced Fiat to withdraw from the agreement in 1986, through a buy-back operation, which increased the level of Fiat debt. Moreover, Mediobanca put the shares Fiat had buy back from Lafico on the market. This led to a decrease of the share value, which resulted in a net loss for small shareholders. This is the reason why Ori is very critical about the final outcome of the whole operation.[74]

Out of the crisis

Investments in car manufacturing between 1974 and 1978 concerned mainly the process, whereas extensive product renewal was undertaken only after fresh capital was injected into the company. Between 1974 and 1978 only one new model was presented. This explains the lack of competitiveness of Fiat models in the late 1970s, which resulted in domestic market shares decreasing by 13% between 1970 and 1980. From 1979 onwards, Fiat Auto was able to carry out both investments on production technology and product development, and to present eight new models in six years. As shown by table 3.5, in 1983, Fiat Auto announced sizeable profits for the first time since its establishment in 1979.

---

[73] Ibid.
[74] Ori, *Storie di una dinastia*, pp. 329-336.

Table 3.5: Performance indicators of Fiat Auto, 1979-1986

	1979	1980	1981	1982	1983	1984	1985	1986
Employment (direct and indirect)	139,949	110,112	100,611	89,751	83,600	79.277	75,358	75,995
Output* (units)	1,309,777	1,297,667	1,119,891	1,162,453	1,216,921	1,388,276	1,316,228	1,580,637
Investments (Billions of current Liras)	342.5	336.1	326.4	810.4	758.4	885.8	667.9	762.4
Operating Profits/losses (Billions of current Liras)	- 97.2	- 130.1	- 154.5	- 79.7	+ 80.6	+ 234.9	+ 402.4	+ 457.1

Source: Archivio Storico Fiat, balance sheets, also in Enrietti, and Fornengo, *Il gruppo Fiat*, p. 81. *Output data have been amended by using figures data from Fiat Archives, 'Libro dei numeri di matricola dei veicoli prodotti' (Production File), which are slightly different from the figure shown by the original table of Enrietti and Fornengo.

The most interesting features shown by the table is the remarkable reduction in the break-even point. Profits were made in 1983 although output was 13.5% lower than in 1979, when Fiat made operating losses. This is consistent with the reduction in the number of employed over the period, and with the recovery in productivity already shown by figure 3.3.

The established literature assumes that the reduction of the break-even point was achieved by maximising flexibility. The assumption is that the deployment of robotics enabled Fiat to concentrate production of the entire range of different models on number of flexible lines, which therefore were always utilised at optimum capacity. This enabled Fiat to lower the break-even point of each single model, to produce more efficiently relatively small batches of upper-range units and niche products, and, ultimately to lower the break-even point of the whole Fiat operation.[75] Those advantages offset the increase in costs caused by the complexity of flexible manufacturing relative to traditional Fordist management of mass production. Moreover, because of flexibility, Fiat was in the position to adopt a more flexible output-mix optimisation strategy, with the possibility to adjust output mix upmarket, and meet the expected requirements of demand in mature markets. In other words, according to the relevant literature, flexible

[75] Bianchi and Volpato, 'Flexibility as the Response to Excess Capacity', in Baden-Fuller (ed.), *Managing Excess Capacity*, pp. 215-246.

mass production enabled Fiat to achieve the double goal of lowering the break-even point and shifting from process- to market-oriented manufacturing.

However, the adoption of flexible production and a flexible output-mix optimisation strategy would have required a complete change of production management at Fiat. This would have required a shift in strategic emphasis from production to marketing, where management should have set production targets according to the feedback from the marketing department. Above all, management should have ensured that all the resources of the firm, from investment in retooling to investments in car design and development were oriented towards the satisfaction of the requirements set by the marketing department. The pre-1973 techno-structure of Fiat was indeed process-oriented, and thus the transition towards market-oriented approaches could have been carried out only by a "traumatic" replacement of management, leading to the replacement of the stock of intangible capital accumulated by Fiat during a long period of managerial stability and smooth managerial turnover. However, when looking at managerial turnover at Fiat during the 1970s, it is far from clear that the new management brought in a market-oriented culture. On the contrary, marketing experts such as Rossignolo resigned after disagreeing with the Ghidella strategy, which he saw as more concerned with controlling the costs of the joint production of Lancia and Fiat models, than with the differentiation of the two brands, aiming to design different products for different markets. The search for synergy, aiming to control industrial costs, is perfectly consistent with the fact that during the 1970s, the company faced a serious financial crisis.

In this light, it is important to consider whether the containment of process and product complexity was the actual drive for the lowering of the break-even point shown by table 3.5. This interpretation implies that, rather than pursuing flexibility, Fiat management developed robotics to resolve the bottlenecks generated by the previous technology, achieving further reductions in the cycle time of automated operations. Also, management favoured product renewal and development of the lower segments of the market in which Fiat had comparative advantage over its competitors, minimising, at the same time, costs generated by product complexity. If it was the case, routines confirmation, rather than routines rejection and substitution, was the key strategic element of the Fiat rescue. The high rate of growth of the Italian market relative to the other main European markets during the 1980s, and the fact that expansion demand remained considerably large in the structure of the domestic market provided a positive environment for the Fiat strategy. The next chapters of the thesis will address the issue of continuity in production management at Fiat before and after the crisis of the 1970s, through the empirical analysis of technological change and output-mix optimisation strategies.

Conclusions

The established literature maintains that Fiat responded to the maturation of the Italian and European markets by shifting from process-oriented to market-oriented manufacturing. At the core of this change lay the deployment of flexible mass production technology, and the implementation of flexible output-mix optimisation strategy. The change required the replacement of management, which in turn led to the replacement of the stock of intangible capital that the company had been piling up in the age of Fordism. By describing the restructuring at Fiat during the 1970s, this chapter shows that in spite of critical changes in organisation and management, there are no obvious reasons to believe that new management brought in a corporate culture different from that of the previous set of managers. On the contrary, there are suggestions that new managers retained a production-oriented approach to manufacturing.

The established literature seems to have set a two-stage circular argument, in which the underpinning assumption (stage a) provides the evidence for the outcome (stage b). The argument is that a) Fiat changed its management and technology to shift to flexibility; and b) it is possible to say that Fiat shifted to flexibility because it had changed its management. In order to break the circularity of the argument, the following chapters will proceed to the empirical analysis of technological change and output-mix optimisation strategy.

Chapter 4

Robotics at Fiat, 1970-1987: A strategy for product-mix flexibility?

Introduction

The closing note of the previous chapter emphasised the need for further empirical analysis, to see whether the managerial turnover of the 1970s brought about discontinuity in production and strategic management at Fiat. Based on primary unpublished sources, this chapter analyses changes in production technology between 1960 and 1987, focusing, in particular, on the introduction and development of robotics in the spot-welding shop. At the core of the chapter lies the concept that within the Fordist production framework, the basic routine driving the search for new technologies and techniques prioritises cycle-time minimisation above any other drive for competitiveness. The analysis carried out in this chapter aims to see whether technological change after 1973 coincided with a rejection of the Fordist routine regulating the search and choice for new technological trajectories.

Like the majority of European car producers, Fiat used spot welding since the early 1950s to produce chassis-less vehicles. The platform was welded to the body to form a single rigid structure called the monocoque, on which mechanical components were assembled. From 1972 onwards, Fiat had been increasingly using robotics in spot welding, and although this was a common trend in the world car industry, the company was considered a pioneer in the development of systems with a low level of tool specificity and capable of processing two or more models on the same line at the same time.

As already pointed out in the second chapter of this thesis, since the mid-1980s the literature moved away from the industrial relations approach in order to interpret what seemed to be a remarkable process of technological change. For many observers, this was driven by increasing market segmentation, the instability of demand structure, and the instability of demand for specific models within each segment that shaped the EC market from 1973 onwards. Flexible manufacturing systems (FMS) allowed management to minimise the effects of changes in demand structure and size on capacity utilisation.[1] As will be explained in the following paragraphs, the implication of this view would be that the introduction of robotics not only led to a drastic change in the technological trajectory of the company, but also to a discontinuity in the paradigm of production management at Fiat. This chapter discusses this view and argues that: 1) internal factors (i.e. the optimisation of the existing processes) drove the introduction and development of robotics during the early 1970s; 2) the priority behind the implementation of robotics was cycle-time minimisation rather than flexibility maximisation. As a consequence, during the 1980s, robotics did not change the way Fiat management responded to changes in the structure of demand for Fiat models (i.e. by changing the rate of utilisation of various plants or lines rather than relocating the production of the most requested model to low output lines). On this basis, this chapter departs from those who maintain that the company fully achieved flexibility during the 1980s, seeing the development of FMS as one of the major factors explaining the recovery from the crisis of the 1970s.

At this stage of the thesis, industrial relations have been intentionally overlooked. The issue will be treated in the next chapter, which shows that technological change cannot be convincingly seen as a "technocratic response" to the power of the unions. As will be shown, the argument is complementary to, rather than conflicting with, the incremental development argument proposed by this chapter. In any case, the empirical analysis of the impact of robotics on production flexibility represents a new contribution to the literature, whereas the analysis of industrial relations will be based mainly on secondary literature, without representing the main focus of this work.

The chapter is organised as follows: the first section syntheses part of the debate about FMS, provides a set of definitions for flexibility, describes methods of measuring flexibility, underlines the methodology used in this thesis, and finally provides an overview of the quantitative development of robotics at Fiat between 1972 and 1990. The second part deals with the long-term developments in the spot-welding shop at Fiat in more depth, analysing the reasons why the company started to experiment with robotics. The last part analyses flexible manufacturing systems at Fiat and presents conclusions that depart from the established literature, as they provide evidence that the possibility of using the same production lines to process different models at the same time and in a random sequence (plant flexibility) did not totally enable Fiat to stabilise

[1] Volpato, *Il caso Fiat*, pp. 171-173. See also Bianchi and Volpato, 'Flexibility as the Response to Excess

the rate of capacity utilisation for each line in a context of changing output structure (product-mix flexibility).

Section one
The context of the debate

This section defines the context in which the issue of flexibility has been analysed and highlights the relationship between output-mix flexibility and the stabilisation of capacity utilisation.

Technological change and "managerial culture"

During the 1970s, the influential managerial theory developed by Skinner and in general by the Harvard School assumed that there was a trade-off between product and process quality, product and process flexibility, and economic efficiency, so that management had to choose its priority target and to define the firm's specialisation path. According to Bartezzaghi and Turco, Italian managers questioned the theory of trade-offs in the decade 1975-1985, when firms gradually realised that both process and product quality were necessary conditions to achieve economic efficiency.[2] In the subsequent decade, 1985-1995, firms would realise that there is no trade-off between product/process flexibility and economic efficiency, because the former is the pre-condition for achieving the latter. Therefore, according to Bartezzaghi and Turco, a second wave of structural and inter-structural innovation would shape this decade after the restructuring occurring between 1975 and 1985.

Structural innovation refers to tools and technology, while inter-structural innovation refers to layout, job organisation issues and incentive systems. However, Bartezzaghi and Turco pointed out that "managerial innovation" should occur *ex ante* structural and inter-structural innovation, in order to take on the "flexibility challenge". By managerial innovation the two authors refer to a drastic change in goals the management would have to pursue given the competitive environment. In the new managerial paradigm, reset-time minimisation replaces process speed maximisation, while production

Capacity', in Baden-Fuller (ed.), *Managing Excess Capacity*, pp. 218-219.

[2] Bartezzaghi, Turco, 'Flessibilità ed Efficienza', p. 64. The two authors refer to the Italian case, without implying that Italy was an exceptional case as compared with the rest of Europe.

stabilisation is more important than plant saturation.[3] Time-reset minimisation is the pre-condition for production stabilisation, because it enables firms to shift production according to demand. At the same time, plant saturation and process-speed maximisation are the interrelated dogmas of the Fordist system of mass production called into question by the new cultural paradigm, in order to pursue both quality and flexibility.

In the late 1970s and early 1980s, Fiat deployed the Robogate, a system for monocoque welding capable of processing two or more different models of monocoques simultaneously, the proportion of which could be changed on a daily basis. Volpato,[4] has interpreted the development of FMS as the response to the increasing segmentation of demand. In addition, Volpato, following Altshuler et al (1984),[5] assumes that the two oil crises speeded up the process of market maturation, which is responsible for the increasing segmentation and volatility of demand.[6] Therefore, the earlier change in the nature of competition after 1973 fostered managerial innovation at Fiat from the mid-1970s. Innovative management enabled Fiat to direct technological change towards flexibility. If this was the case, then Fiat would have experienced developments towards flexibility much earlier than Bartezzaghi and Turco have suggested for the manufacturing industry as a whole. This would imply that since the mid-1970s, Fiat experienced the "managerial innovation" of the kind suggested by the two authors, leading to investment in FMS.

Nonetheless, the previous chapter has shown that there is little or no evidence that during the 1970s conditions occurred for Fiat to change managerial trajectories. This part of the thesis suggests that the introduction of robotics should not be seen exclusively either as a strategy responsive to discontinuity in the structure of demand within the European market, or as the effect of drastic change in the Fiat managerial approach to mass production. On the contrary, it puts forward the point that technological changes in the spot-welding shop were led by the need to optimise existing processes. Management understood optimisation as the improvement of the process speed and reliability. Indeed, process optimisation reduced tool specificity to a

---

[3] Ibid, p. 65.
[4] Volpato, *Il caso Fiat*, pp. 171-173; Volpato, 'The Automobile Industry In Transition', in Toliday and Zeitlin (eds), *Between Fordism and Flexibility*, pp. 193-223.
[5] Altshuler et al., *The Future of Automobile*, p. 15.
[6] The car market becomes mature when replacement outweighs new demand (namely demand from first-time buyers) at high levels of car density. Replacement demand is associated with hyper-segmentation and the volatility of segments.

huge degree, but flexibility was neither the initial factor driving the deployment of robotics, nor the main drive for subsequent developments. In order to demonstrate the point, this chapter analyses the way in which management responded to changes in the demand for specific Fiat models during the 1980s. The analysis tries to understand whether or not robotics enabled management to maximise product-mix flexibility, namely the capacity to adjust output to demand for specific models without changing the level of capacity utilisation of each line. This is central to the problem of continuity in the managerial practice. In this regard, the concept of flexibility itself needs to be approached in relation to the capacity utilisation issue.

Defining flexibility

In general, flexibility is defined according to three features: "plant flexibility", "product mix flexibility" and "process flexibility".[7] "Plant flexibility" is achieved when an existing plant can be re-utilised to produce a new model range with limited or no retooling, and should therefore maximise investments in fixed assets. "Product-mix flexibility" is achieved when a range of cars is produced on the same line, and the product mix can be changed in real time. This kind of flexibility should minimise the effects of demand segmentation and segment share volatility on capacity utilisation by reducing tool specificity. Finally, process flexibility is reached when a delay in one stage of the process does not prevent the entire process from being carried out. This should minimise either the effects of partial strikes or the effects of a machinery failure at a given stage of the process, or the temporary shortage of skilled workers for a particular task.[8]

One possible way to measure flexibility is to apply a model for investment justification analysis measuring equipment flexibility in terms of idle cost, which is the opportunity cost of under-using the equipment, product flexibility in terms of set up cost

[7] R. Merli, 'Il Robogate nella produzione della Fiat Uno', in Dina, (ed.), *Modello Robot*, p. 139. Fiat management distinguished between strategic and operational flexibility, with the former referring to plant convertibility and the latter referring to both process and product mix flexibility.
[8] The pattern of definitions provided by Fiat management broadly reflects definitions developed by academics. Park and Son have divided flexibility into four categories: a) equipment flexibility; b) product flexibility; c) process flexibility; d) demand flexibility. The difference between the Park and Son and the Fiat management definitions is that the latter includes equipment flexibility and product flexibility in the category of plant flexibility. In addition, Park and Son refer to system flexibility as process flexibility. C.S. Park, Y.K. Son, 'An Economic Evaluation Model for Advanced Manufacturing Systems', *Engineering Economics*, 34 (1990), pp. 1-26.

reduction as a function of set-up time reduction, process flexibility as a reduction in work in progress, and demand flexibility as a reduction in inventory costs.[9]

The investment justification approach is essentially a cost accounting approach, where the lack of information drastically hampers the viability of the methodology for historical research proposes. However, the thesis does use a set of data made available for the first time. This includes monthly production for each model, each plant, and line, as well as optimum capacity utilisation for each line. Using those data, it is possible to see whether or not during the 1980s the Fiat management was able to stabilise production in any facility by shifting production from one model to another and from one plant to another, or whether the over/under utilisation of plants was still the fastest way to respond to changes in demand.

Within the Fordist technological set, in which each line was model specific, the capacity to adjust output to demand structure (product-mix flexibility) depended on the implementation of short/extra time, which caused the output of each production line to change according to demand for the model produced. Demand was monitored by controlling final stocks. Thus, flexibility was obtained by changing the capacity utilisation rate for each line, and therefore required a certain amount of spare capacity. On the other hand, flexible manufacturing systems aim to reach product-mix flexibility by reducing tool specificity. In theory, reduced tool specificity (plant-flexibility) allows the firm to shift production from one model to another according to demand, without stopping production or changing the utilisation rate of lines. In fact, two or more models can be simultaneously processed on the same line in different proportions. The stabilisation of production is one of the most important justifications for investments in flexible manufacturing systems. In the case of Fiat during the 1980s, production was organised on double shift 5 days per week. Therefore, the optimal utilisation range of lines was given by an utilisation rate going from 80% to 100% of capacity on double shift. The implementation of the third shift (extra time) was not consistent with an economically efficient use of production factors given extra costs involved with higher depreciation and labour costs.

This chapter provides evidence that between 1978 and 1987, Fiat failed to exploit the whole potential flexibility of robotics. It will show that, in spite of robotics, some plants were under-utilised while others were often, or even consistently, saturated by

[9] See M. J. Chandra, C. M. Armonosky, 'Analytical Techniques for Justification of Manufacturing

implementing extra time, which is exactly what flexible manufacturing systems are supposed to avoid or minimise.

Given those findings, the question arises why Fiat invested in robotics after 1972. By looking at a set of unpublished documents concerning production management and by analysing unpublished data concerning the cycle time of the monocoque welding process for various technological sets, this chapter shows that robotics was implemented to resolve the bottlenecks created by the process of automation during the 1960s without changing the overall functioning of the system.

Robotics at Fiat: an overview

In 1976, Fiat introduced a new robotised and computerised monocoque production system called Robogate, although the initial implementation of robotics dates back to 1972. Until the early 1970s, the production framework was based on "hard automation".[10] Some stages of the process, such as the platform welding and part of the body assembly, were highly automated, but production tools were dedicated to a single model. The implication was that in order to reset tools and change product, it was necessary to stop the process. On the other hand, according to the Fiat management, one of the most important gains generated by robotics was flexibility. In particular, through the Robogate system, Fiat achieved the ability to switch production from one model to another without stopping the process or adding new production facilities.[11] Overall, according to Fiat official publications, the system enabled the company to change the output structure from day to day and even from shift to shift. For this reason, the Fiat management defined the Robogate as one of the most advanced examples of "flexible manufacturing systems".[12] In general, the literature has echoed this official view, overlooking the real question of whether production management maximised the potential flexibility of robotics.

The continuous development of robotics during the 1980s led to the establishment of one of the most technologically advanced production lines in the world, which started to operate at the Cassino plant in 1988. However, the difficulty in setting up the robotised

Systems', in: H. R. Parsei, A. Mital (eds), *Economics of Advanced Manufacturing Systems* (1992), p. 114.
[10] Ernietti, Fornengo, *Il Gruppo Fiat*, p. 79.
[11] Archivio Storico Fiat, Dipartimento Personale ed Organizzazione, 'Il Robogate', working paper, (1984), p. 7. See also: Fiat Ufficio Stampa (ed.), *La curva di produzione ed il suo connubio con l' elettronoica* (Torino, 1977).
[12] Archivio Storico Fiat, 'Il Robogate', p. 11.

final assembly forced management to re-establish a more labour intensive assembly system at the Melfi plant (1992). This combined robotics in the welding shop and in the assembly of mechanical components with the employment of skilled workers for the final assembly, along with the optimisation of flow through the implementation of JIT (Just in Time) and TQM (Total Quality Management) techniques.[13] At any rate, Robogate remained the core of production technology at Fiat.

Table 4.1: Total number robots at Fiat Auto, 1972-1987

	1972-74	1975-77	1978-82	1981	1982	1983	1984	1985	1986	1987
Welding	20	60	180	180	452	532	526	549	662	830
Mechanical Assembling					112	129	133	158	163	158
Painting			20	20	74	74	100	100	108	138
Total	20	60	200	200	638	735	759	590	933	1,126
Welding robots/total robots	100%	100%	90%	90%	70%	72%	69%	56%	71%	74%

Source: Fiat, Dept. Personnel and Organisation. Source: Enrietti, Fornengo, *Il gruppo Fiat*, p. 83.

The quantitative development of robotics at Fiat between 1972 and 1990 is summarised by Table 4.1. Unfortunately, between 1975 and 1980 there are no available data on robots in the painting shop. However, it seems clear that spot welding is the technological area in which robotics has been implemented to the largest extent. Robotics obviously affected labour intensity although the quantification of automation on the employment trend is based on information made public by Fiat. According to Fiat estimates, between 1972 and 1979 around 1400 workers were replaced by automation in several stages of the process.[14] The two Robogate lines at Cassino and Rivalta replaced 110 workers each in the monocoque welding shop (15.7% of the total).[15] However, as has been already pointed out in the previous chapter, after 1977 the trend towards labour downsizing, which had started in 1973, was reversed as Fiat had misjudged its

[13] On the process of restructuring leading to the pilot plant of Melfi, see Bonazzi, *Il tubo di cristallo.*
[14] P. Buran and R. Lanzetti (eds), *Dossier auto. L'industria automobilistica italiana verso le nuove sfide* (Torino, 1989), p. 80.
[15] Volpato, 'The Automobile Industry in Transition' in Tolliday and Zeitlin (eds), *Between Fordism and Flexibility*, p. 219.

manpower planning and had recruited labour above its actual need. Technology-driven unemployment, therefore, did not occur. Between 1980 and 1982, 1600 workers were replaced by automation, or 7.6% of labour downsizing. Finally, according to Fiat estimates, between 1982 and 1987 each robot in the spot-welding shop replaced 1.5 workers per shift. Since production was organised on double shift, each robot replaced three workers. The number of robots increased from 452 to 830 units, thus, 1134 workers were replaced by technological innovation in the spot-welding shop.[16] This was 7.3% of the total labour downsizing in the period. If we accept the replacement rate of 1.5 workers per robot per shift, then the conclusion should be that technological innovation was not the main driving force behind labour downsizing between 1972 and 1987. Fiat estimates seem to be in line with those from other car manufacturers in the same period.[17] Nonetheless, Silva noted that the highest rates of labour reduction during the 1980s occurred in those plants with a higher deployment of robotics, casting doubts over the replacement rate suggested by Fiat, which might underestimate the effect of robotics on employment levels.[18]

Section two

Technological change at Fiat in monocoque welding, 1960s to the 1980s

This section deals with technological change at Fiat between 1960 and 1977 in the welding shop. It first provides a general description of the monocoque assembly process, and then moves on to look at why traditional technology had to be replaced after the early 1970s, and how and to what extent specific innovations have influenced further developments. The conclusion is that the introduction of robotics in 1972 was the logical consequence of the innovation process started by the company during the 1960s in the spot-welding shop. In this sense, the shift to robotics was a technical solution to a technical problem and should be considered as the consequence of the new competitive environment of the 1970s.

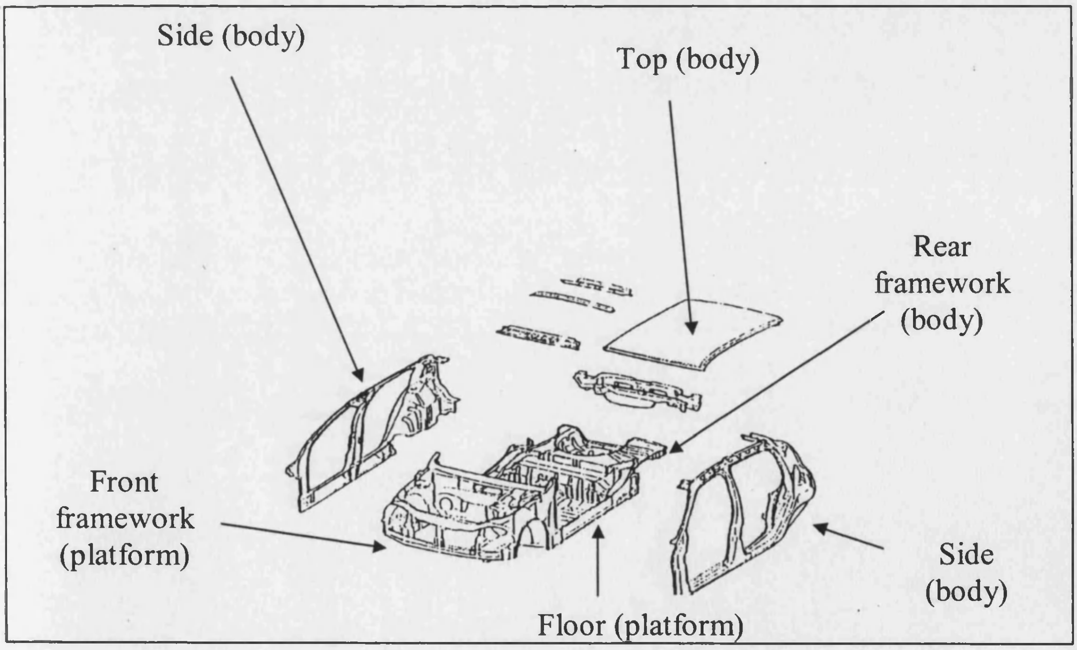
---

[16] Buran and Lanzetti (eds), *Dossier auto*, p. 81.
[17] For an international comparative outlook of the impact of robotics, see Watanabe, *Microelectronics*.

Monocoque assembly: The process segmentation

The main non-mechanical component in a modern car is a rigid structure called the monocoque. The monocoque consists of two sub-components (see Figure 4.1). The platform includes the floor to which are welded supports for the engine, suspension and transmission, while the body comprises the sides, the pillars supporting the doors and those supporting the top. When the platform and the body are welded together, the car assumes its shape, and those characteristics, such as size and wheelbase, which determine the market segment in which the car is going to compete. After painting, the monocoque is assembled with mechanical components. Therefore, semi-finished cars go through the final stage of the process (dressing), which consists of the assembly of electrical components, wheels, internal components (seats, dashboard etc.) side doors, rear and front bonnet tops.

Figure 4.1: The monocoque and its components

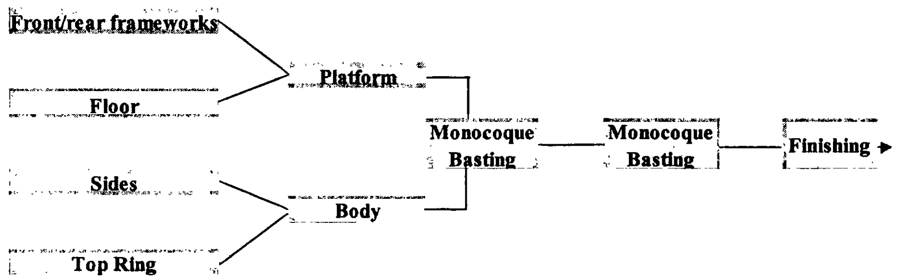


The monocoque welding is performed in two different stages: *basting* and *finishing*. Basting is the stage in which the platform and the body are linked together by welding

[18] F. Silva et al, 'Robots, Employment and Industrial Relations in the Italian Automobile Industry', in Watanabe (ed.), *Microelectronics*, p. 143.

the two sub-components at a number of points.[19] This stage does not confer much rigidity on the monocoque but gives it the shape (geometry) according to the design. Finishing is the spot welding of the body to the platform along the edges of each sub-component. This step of the process confers rigidity on the monocoque, in that the links between platform and body are engineered to sustain the stress caused by torsion forces and mechanical vibrations. The process is described by chart 4.1.

Chart 4.1: Spot-welding shop and the process of monocoque segmentation



Source: Based on information from Malandri and Scimone, Interview with the Author, 18-03-1999.

Basting and finishing must be performed in different stages for a simple but important reason: before the basting, detached platforms and bodies are rigidly linked to a three-dimensional metallic frame to prevent the monocoque assuming an imperfect shape during the basting. This frame impedes welding in any direction inside the monocoque, so that only a limited number of welding spots can be executed. However, after basting there is no need to keep the monocoque fixed to the frame. Thus, the monocoque is detached from the frame and fixed to a simpler fixture that enables welders to be operated freely inside, in order to perform the finishing. Because basting involves a relatively small number of welding spots compared with finishing, the latter must be more segmented than the former, in order to equalise the cycle time of each stage.

Monocoque technology was a totally new design approach compared to the traditional way in which cars were assembled until the late 1930s. This consisted of bolting or welding the body to the chassis, a rigid framework completed with the engine and power

[19] Technical literature often refers to basting as tack-welding.

train. Since the body did not contribute to the overall rigidity, it was possible to assemble several different bodies on the same chassis, provided links between body and chassis were standardised.[20] On the other hand, with the monocoque technology both platform and body impart the structural rigidity. Consequently, any change in the shape of the body must be carefully engineered in order not to change the overall rigidity of the monocoque. This was one of the reasons why manufacturers basing their process on monocoque technology became increasingly inflexible even where welding was performed using manual multi-purpose welders.

The monocoque technology was made possible by progress in spot welding. This technique allowed a better ratio between rigidity and weight to be achieved in car design. Since a lighter design led to the more efficient adoption of small engines, it affected the segmentation of the European market, by creating a new market for very small cheap cars.

Spot-welding technology at Fiat before automation (1950s)

Until the beginning of the 1960s, the sequence of operations involved in the assembly of the monocoque was performed manually. Steel sheets and panels were fixed on rigid supports and welded to form platforms and body sub-components such as the floor, the rear and the front frameworks for the platform, sides and roof for the body. Supports holding the steel panels were usually moving on a truck conveyor. Some workers had to fix steel panels on supports, while others had to weld them by using manual welders while the conveyor was moving. Manual welders were heavy and their handling precarious. When demand was exceeding the expected quota, it was usual practice to weld sub-components off track by fixing them to rigid supports tied up on the floor. In this case, the same worker had to fix the steel sheet on the fixture and weld it.

The subsequent step was the parallel assembly of platforms and body. The former was assembled by welding the front and rear framework to the floor, while the body was made by welding the sides to the top. These operations were performed while sub-components were attached to a moving truck conveyor.

The final stage of the spot welding process was the assembling of the monocoque. The platform and the body were fixed to a three-dimensional framework, called the

[20] This was the way GM differentiated production during the1920s.

mascherone, by four or five workers.[21] At this stage, basting was performed by a couple of workers. Afterwards, the monocoque was detached from the mascherone and fixed to a much simpler frame that allowed the finishing to be performed. The monocoque was transported from basting to the finishing stations by a truck conveyor. The finishing process was performed in different stages. Both basting and finishing were performed by workers operating heavy manual welders. In order to pass from basting to finishing, each monocoque was detached from its support (mascherone) and fixed to another framework.

In spite of the fact that welders were multi-purpose tools, the process was inflexible, in that each model of car required its own mascherone, so that in order to switch production, it was necessary to substitute this device, having first stopped the entire production process.

The "hard automation" of the 1960s.

At the beginning of the 1960s, the degree of automation of the Fiat production process was rather low. A step towards automation was made in 1961, when the retooling for the new model 1300/1500 (segment D, 1300-1600 cc.), led to the implementation of highly automated welding systems at the Lingotto and Mirafiori plants. This was to produce platforms, the components of which were automatically fixed to supports moving on a conveyor. Automatic multiple weldersexecuted the welding of the rear and front frameworks to the floor. The only manual operation was the charging of the sub-components on the head side of the conveyor and the discharging of the assembled chassis on the end side. In 1966, Fiat moved another step forward in terms of automation. Automatic multiple welders were installed to produce the body of the 124 model (segment C, 1100-1300 cc.) at the Lingotto and Mirafiori plants and, subsequently, the entire basting of the 124 and the 127-128 models (segment B 900-1100) at the Rivalta plant. Thus, in 1970, finishing remained the only manual operation. As far as the process is concerned, the introduction of automated multiple welders added another element of inflexibility to the system. In fact, while the manual welders could be used indiscriminately for any type of car, the automated multiple welders were dedicated to a single model since they were able to perform only a

[21] Mascherone literally means large framework.

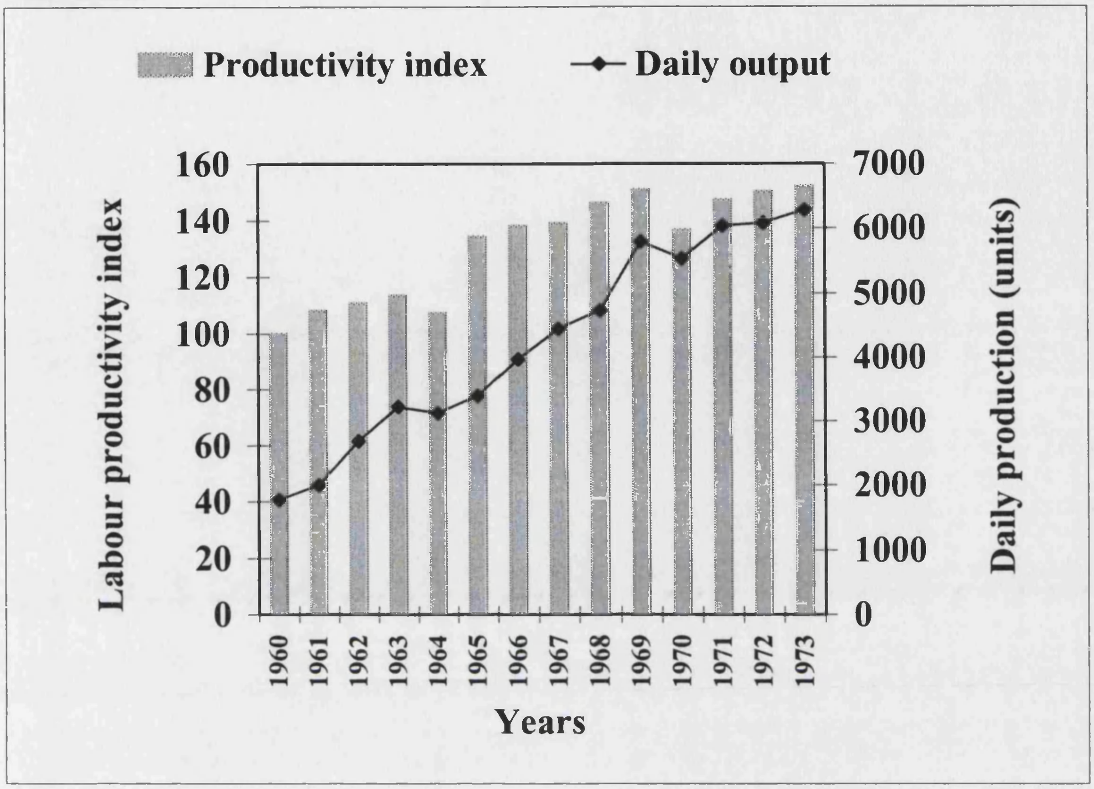
sequence of welding spots. Any change in the chassis requiring a different sequence needed the resetting, if not the replacement, of the welders.

The automation of the monocoque welding shop was decided in 1959. The first stage of restructuring aimed to expand production from 1600 to 3000 cars per day by 1962, while the second stage aimed to reach 4500 per day by 1965.[22] Top management and the owners were committed to achieving the production target. In 1960, a sum of 180 billion Lire was invested, mainly in the car sector.[23] Between 1960 and 1963, extraordinary investments plus depreciation reached 500 billion Lire with 310 billion devoted to the car sector alone.[24] The size of investment was remarkable considering that total sales, including lorries, trucks and other products, amounted to 457 billion Lire in 1960 and 794 billion in 1963.[25]

On the other hand, the effectiveness of the expansion strategy is contentious. The quota of 3000 cars per day was reached only in 1964, two years later than the expected schedule. At the end of 1964, production managers set the 1965 production target at between 3660 and 3750 cars per day, explaining to the top management and owners that the low level of capacity utilisation was justified by prudent expectations about demand for 1965. In any case, according to middle management, the technology developed by Fiat would enable the company to speed up production if the need arose.[26] At the beginning of 1966, managers proudly reported to the administration board that in 1965, the daily average production had been 3938 cars with peaks of 4250 cars. This was between 250 and 562 units below the target set in 1960 for 1964, but still superior to the target set at the beginning of 1965 for that year.[27] Yet, management was referring to the overall Fiat group production, which included the output of controlled companies such as Autobianchi and SEAT. In reality, the average daily production of Fiat was 3397 cars per day, which means 1100 cars below the 1964 target (see Figure 4.2).

[22] Archivio Storico Fiat, 'Verbali dei Consigli di Amministrazione', 30 Luglio, 1960, p. 160, Libro 28. From now onwards, this source will be quoted as follow: Unpublished Report of the Fiat Administration Board Meeting July the 30th , 1960, p. 160, Book 28.
[23] 130 million Lire out of 180 million were external funds. Ibid.
[24] This figure cumulates depreciation between 1960 and 1963 plus extraordinary investment. Ibid, February 4, 1964, p. 99, Book 34.
[25] Ibid. January 26, 1965, pp. 185-185, Book 35.
[26] Ibid. p. 145.
[27] Ibid.

Figure 4.2: Labour productivity index (direct labour) and daily output (unit), 1960-1973



Source: Index of ratio output to man-hours (1960 = 100). Calculations based on data from Archivio Storico Fiat, Fondo Sepin (employment file) 1960-77, 5/VIII/1/A. Labour input includes only direct workers involved in stamping, machining, welding and final assembling. From 1960 to 1967, the calculation of output is based on data from Fiat (ed.) *Fiat: Le fasi della crescita*, p. 121. From 1968 onwards, the calculation is based on data from Fiat Archives, 'Libro dei numeri di matricola dei veicoli prodotti' (Production File). Production refers to Italians plants. Daily production has been calculated by dividing output by the number of days in which production actually took place each year. Note that figure 3.3 refers to the productivity of all workers of the Fiat car sector employed in Italian plants, whereas figure 4.2 refers to selected shops.

The reason why management played around with numbers is explained by the cultural paradigm developed by the firm under Valletta's direction,[28] in which failure was not contemplated. Presumably, Valletta had been informally told about the problems relating to production, but during board meetings, operative managers always had to show their total commitment and an unconditional trust in the human and technical resources of the company, as a mark of respect for the company and its chairman.[29] In any case, the production target set in 1960 proved unrealistic. The downturn in demand in 1964 had hidden the fact that output was not expanding

[28] Valletta was the President and Chairman of Fiat from 1946 to 1966.
[29] This appears evident from the complete reading of the reports of the Board meetings.

according to plan. However, in 1965, and particularly in 1966, demand recovered and middle management could not hide the overwhelming accumulation of outstanding orders.[30] While cars were delivered at the average rate of 66,700 per month, the outstanding orders averaged 60,000 per month.[31]

Only in 1967 was Fiat able to exceed the target set for 1965 (4500 cars per day) by 317 units, but the company was clearly behind schedule. The daily production set for 1969 onwards was 7000 cars per day,[32] a target that was never reached. In 1973, daily production was still about 6788 units (see Figure 4.2). In the whole period in which the hard automation of spot welding was introduced and developed, 1960-1973, domestic demand grew by 10.8% per year, and daily production rose at the same pace (10.8%.) However, demand also expanded in the other European main markets, though to different degrees: by 8% in France, 5.8% in Germany, and 5.6% in the UK.[33] In this context, the fact that Fiat was behind schedule with its production programme was a problem.

Investments in automation were supposed to increase labour productivity. Nonetheless, between 1960 and 1973, labour productivity increased by 4.4% per year. It rose by 5.9% per year between 1960 and 1969 and only by 1% per year between 1969 and 1973.[34] In other words, after 1969, productivity growth slowed down, in spite of the fact that the automation of basting had been extended to the whole range of models. Moreover, labour productivity slowed its growth at a moment in which Fiat still needed to speed up the output growth.

After 1969 industrial relations deteriorated sharply, so that it would be reasonable to think that when the production process is not regular each man-hour unit is less productive than it would have been, had production been regular. Nonetheless, during the 1960s, the productivity peak was reached in 1969, precisely when man-hours lost during industrial action also peaked. In spite of the less man-hours performed, more cars were produced in 1969 than in 1968.[35] Strikes in 1969 were concentrated in the last two months of the year, while before the so-called "Hot Autumn" lines had been run at full capacity. Yet, daily production was far from the expected 7000 cars per day (see figure

[30] Outstanding orders refers to cars already sold but not delivered to clients.
[31] Unpublished report of the Administration Board, January 30, 1967, pp. 103-104.
[32] Giacosa, *Progetti alla Fiat prima del computer*, p. 299.
[33] Elaboration of Elaboration of data from ANFIA (Italian Association of Car Manufacturers and Traders), *L'automobile in cifre* (Torino, 1996), pp. 232-238.
[34] Calculation based on the productivity index, reported by table A 3.6, in the appendix.
[35] See table A3.6 in the appendix.

4.2). In 1973, also, productivity increased as compared to 1972, in spite of the fact that less hours were performed due to strikes and, after September, due to short-time implemented in the aftermath of the oil crisis. This is consistent with findings of Jones and Paris, suggesting that the direct effect on strikes on productivity is marginal.[36] Thus, the slowing of labour productivity growth after 1969, and the inability of Fiat to reach the production target of 7000 cars per day were in part a consequence of the technological saturation of the Fiat production setting. The strategy of Fiat management during the 1960s seems to consist of the introduction of automation wherever technology allowed it, regardless of the fact that, in an integrated process, production speed differentials between the initial and the final stages of the processes are likely to produce bottlenecks. Until 1966, basting and finishing were still performed manually, which means that the automation of platform and body welding could not improve production speed unless more labour units were put into the cycle to increase the segmentation of the monocoque welding. In addition, intermediate stocks were gradually introduced before basting to avoid production jams.[37] The automation of basting after 1966 did not improve the situation because finishing - the last step of spot welding - remained manual. Again buffers were introduced between basting and finishing, and again finishing had to be hyper-segmented. Labour saved in basting was re-deployed in finishing instead of final assembly, so that new labour was needed for the final stages of the manufacturing process. This explains why the daily production of 4500 cars per day was exceeded only in 1968, three years later than the expected schedule. Moreover, the transfer of workers from basting to finishing contributed to the slowing of productivity growth after exceeding the threshold of 5800 cars per day in 1969.

Asked on this specific point, two managers, who started their career at Fiat in the late 1960s, have confirmed that the "hard automation" of the platform and body welding, as well as the automation of basting during the 1960s led to a vicious circle in labour productivity.[38] To minimise the bottleneck, finishing was hyper-segmented and more

---

[36] D. T Jones, S. J. Paris, 'Plant Size and Productivity in the Motor Industry: Some International Comparisons', *Oxford Bulletin of Economics and Statistics*, 40, No 2 (Oxford, 1977) pp. 123 - 146.
[37] Guidi et al, *FIAT*, p. 47.
[38] Interview with the author, March 18, 1999. Mr Malandri is an engineer enrolled in the Department of New Production Technologies Development of Fiat Auto. During the 1970s, he was directly involved in the process of shifting from hard to flexible automation, and during the 1980s, he was responsible for the Robogate at Rivalta. Mr Scimone is a member of staff at the Department of New Production Technology

workers were added to each finishing station so that more welding spots were performed in each finishing station. Moreover, the two managers explained that hard automation could not be extended to finishing in a profitable way, because automated multiple welders could perform only a limited number of welding spots. Because of the differential in the number of welding spots needed in basting and finishing, the automation of the whole process would have required the hyper-segmentation of finishing. Labour productivity would have increased, but the enormous increment in the number of multiple automated welders would have created tool reliability problems resulting in less efficiency.

The *ex post* explanation of the two managers is perfectly consistent with what Fiat actually experienced with the production line of the 126 model at the Cassino plant in 1973. There, Fiat experimented with the implementation of the automatic multiple welders in monocoque finishing, but the system proved to be unreliable and inefficient, even though production was organised on four lines to contain the segmentation of the finishing and reduce the speed of the process.[39] This confirmed that there was no further room for increasing productivity within the traditional automated multi-welder technology. Thus, the technological stall of the 1960s was that, by the end of the decade, the automation of finishing was needed to increase labour productivity as well as total output. On the other hand, the current technology did not allow the achieving of the target. As will be shown, this fact had a large influence on developments in welding technology during the 1970s.

Development, but he started his career at the beginning of the 1970s as a skilled worker in the tool repairs and maintenance section of the Mirafiori plant.

[39] R. Merli, 'Il Robogate nella produzione della Fiat Uno, in Dina (ed.) *Modello Robot*, p. 135.

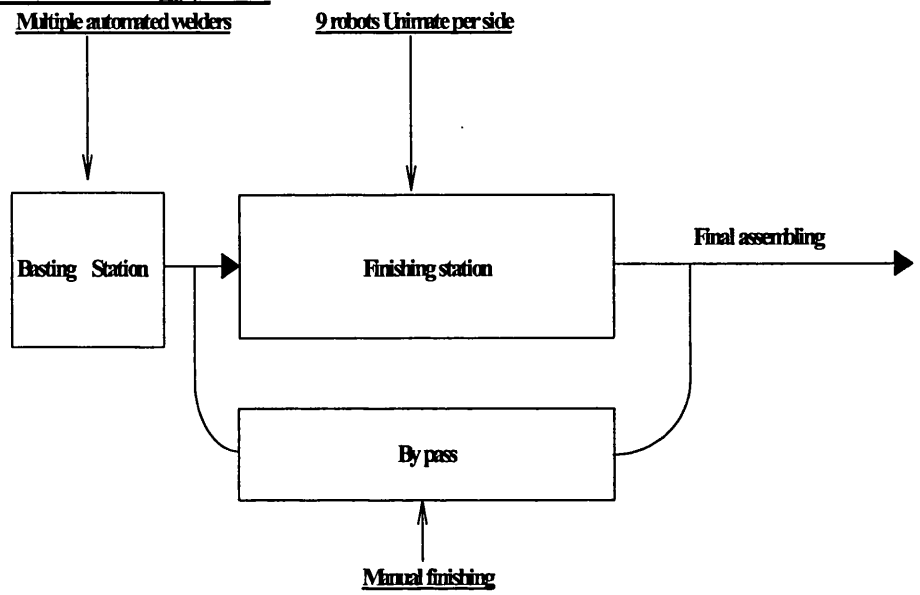
The 1970s and the early stages of robotics[41]

The difficulty encountered by Fiat engineers in the setting up of automated finishing explains why they experimented with robotics. The use of robotics was pioneered for the first time at the Mirafiori plant in 1972. A first batch of 18 robots was set up for the welding of the model 132 monocoque (segment D, 1600-2200 cc.). They were Unimate machines of the same typology of those "unsuccessfully" introduced since 1970 by General Motors at the Lordstown plant.[42] However, Fiat did not employ Unimates to perform the whole welding process, limiting the use of robots to the finishing stage. Chart 4.2 shows the layout of the Unimate station.

According to the Fiat engineer Bessusso,[43] the new technology yielded promising results in terms of improving the working environment and product quality. He explained that initially the company experimented with Unimates in order to improve working conditions by liberating workers from some of the more distressing operations during the monocoque welding (namely finishing). Only later did engineers start to see advantages in terms of flexibility and began to think about a completely new assembly system.

[41] The following sections of this chapter are based on a variety of sources and data the majority of which are unpublished. The description of various technological settings deployed in the spot-welding shop, including the Robogate had been provided by Malandri and Scimone during the interview with the author given the 18th of March 1999. The layouts displayed in this section have been drawn according their information. Malandri and Scimone also provided information concerning the time-cycle performed by different technologies in the spot-welding shop, and data concerning the optimum capacity utilisation of each welding line form 1978 to 1987. Monthly output data have been calculated on the bases of data from 'Libro dei numeri di matricola' (The Fiat Production File), while the number of working days performed per month have been calculated on the bases 'Fondo Sepim' (Sepim File). Both Production and Sepim files are stored in the Fiat Archive.
[42] Dina, introductory notes to *Modello Robot*, p. 19.
[43] Ibid, p. 19.

Chart 4.2: Layout of the spot-welding shop for the 132 model, Mirafiori plant, Unimate technology, 1972



Source: Based on information from Malandri and Scimone, Interview with the Author, 18-03-1999.

On the other hand, Unimate technology was heavily criticised as it caused many problems.[44] First of all, when finishing was performed manually, workers had the possibility of intervening on monocoques that had been imperfectly welded during the previous stage (basting) and, to a certain extent, to re-perform the imperfect basting during the finishing. With the Unimate technology, this was no longer possible with the result that monocoques had to be controlled before starting the finishing process. Imperfect monocoques were completed by a traditional line parallel to the Unimate station (the support finishing line), which was constantly kept on standby. Secondly, with the manual welders, workers could check the state of deterioration of the electrode, the component of the welder that performed the actual welding, and replace it just in time. With the Unimate technology, the deterioration of electrodes could be checked only after the finishing by analysing the welding quality of monocoque already processed. This involved the scrapping of imperfect monocoques. Finally, in case of robot failure, the Unimate station was by-passed and the finishing was performed manually through the support line.

The problems associated with the Unimate technology are extremely important to understand the further development of robotics and in particular the reasons why Fiat set up the Robogate system. However, before describing the Robogate technology, two other innovations need to be described: the *pallet* and the *robocarrier.* The pallet was introduced with the retooling for the 131 model (segment D, 1300-1600 cc.) in 1974. This was a wooden frame on which the platform and body were tied up simultaneously. The pallet was moved by a traditional truck conveyor. With the introduction of this new device, the monocoque was no longer fixed directly to the three-dimensional framework, or mascherone to be processed. It was the pallet that was fixed on the base of the framework, while the top of the monocoque was fixed to upper end of the jig through automatic pliers. Each specification of the 131 monocoque, such as the two-, the four- and five-door versions, had its own specific pallet. On the other hand, the framework holding the monocoque during the basting was no longer model-specific. By replacing the pallet and pliers, it was possible to fix different specifications of the 131 model in the same installation. However, basting was still performed by multiple automatic welders, which were still model-specific, while only finishing was performed by Unimate robots. For this reason, flexibility was limited to the finishing of the two- and four-door version of the same model. It is worth noting that the pallet technology consisted of a relatively simple modification of the mascherone of the 1960s. It is also worth noting that given the introduction of the pallet, imperfectly welded monocoques could be taken out from the process much easily than before and reintroduced into the process.

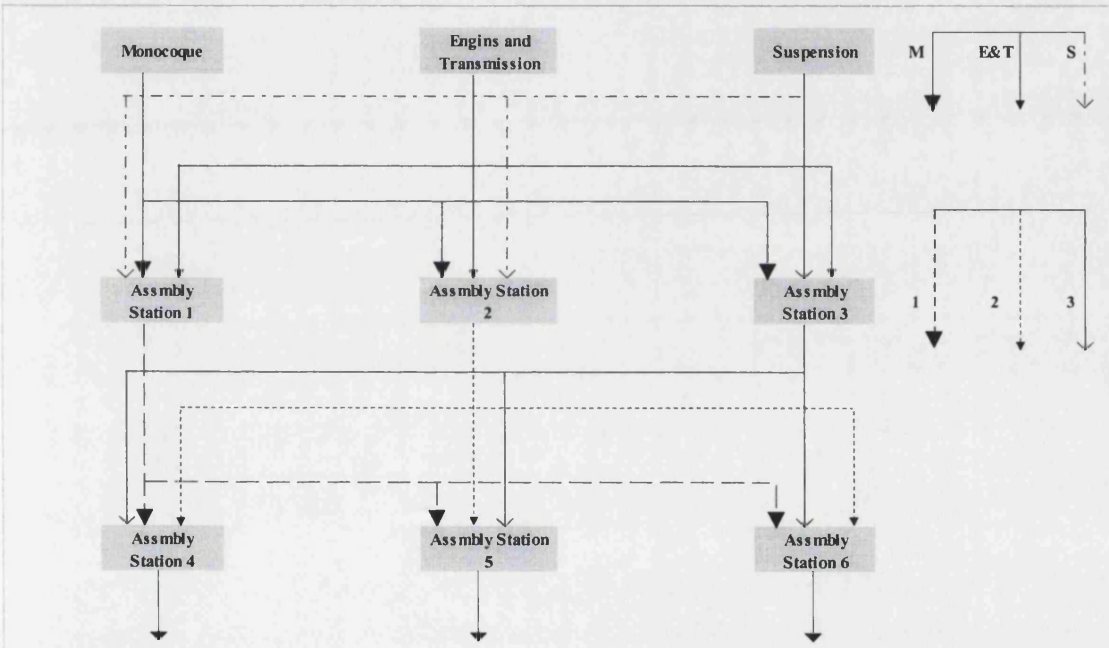
Robocarriers were first introduced with the Digitron system at the mechanical assembly shop at the Mirafiori plant in 1974. Subsequently, the technology was extended to Rivalta and Cassino. Although Digitron is not directly related to the welding technology, there was a relevant spill-over between Digitron and Robogate. In fact, with Digitron, Fiat experimented with the use of robotics paralleled by the introduction of a reticular layout.[45] Trolleys, called *robocarrier*s, were used to transport pre-assembled

[44] Guidi, et.al, *FIAT,* p. 40.

[45] Reticular layout means the disposition of the working stations according to their function so that they form a network. Within the network, different stages of the process can be performed without following a given and unchangeable schedule, as is the case with the linear layout.

mechanical components (engine, transmission and suspension) from depots to assembly stations. Robocarriers moved over the floor guided by a series of invisible magnetic tracks. The schedule was set up according to the software controlling the system. Robocarriers were able to go to different depots and pick up different components (e.g. either engines or suspension) of a given model or, alternatively, the same component (e.g. engine) for different models. Assembly stations were suitable for different types of cars because assembly was performed almost entirely manually by using multi-purpose tools (see chart 4.3).

Chart 4.3: Digitron mechanical assembly shop, Mirafori plant, 1974



Source: ibid.

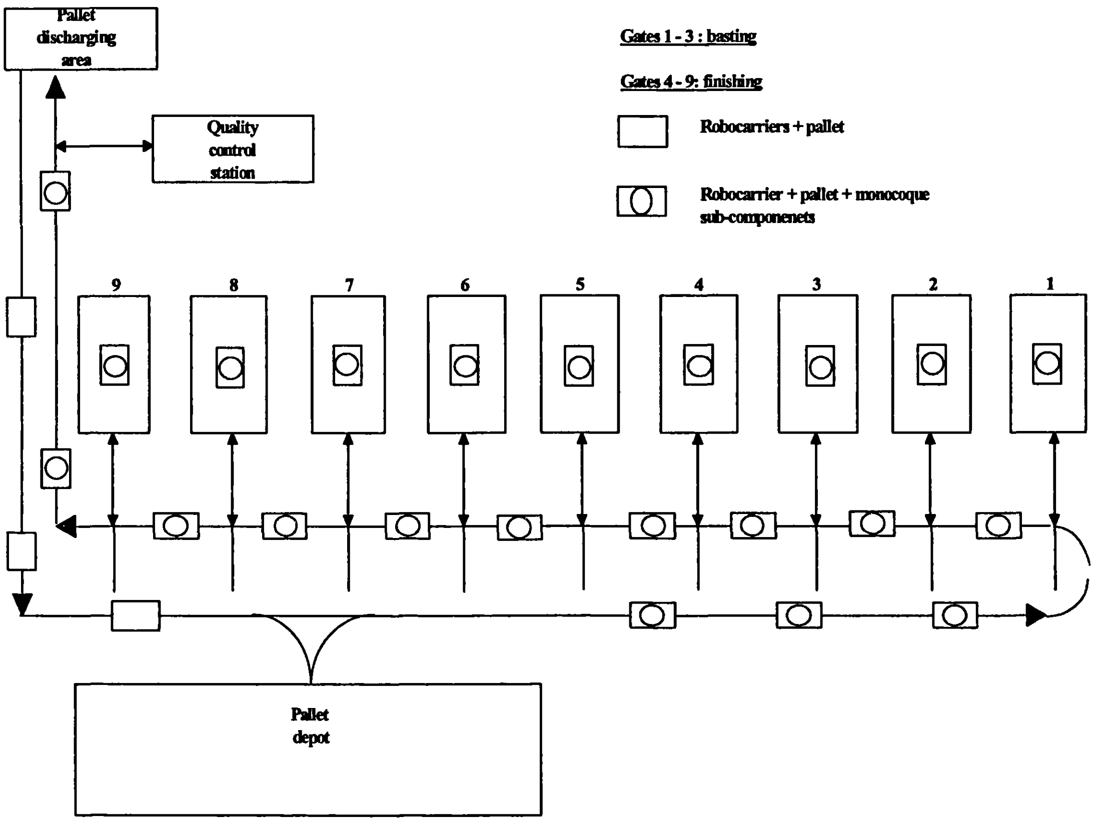
The Fiat experiment with flexible transport systems and the reticular layout was largely inspired by the failure of Unimate technology. This led to the necessity of setting a parallel traditional line beside the Unimate station. It will be shown that with the Robogate system, the reintroduction of imperfect monocoques into the cycle and the ability to bypass inefficient welding stations were both maximised through the introduction of robocarriers moving on a reticular layout along with the implementation of parallel welding and basting stations. A similar kind of process flexibility had been already obtained with the Unimate technology, but only at the cost of setting a parallel manual line, and facing extra labour and machine under-utilisation costs.

The Robogate system, 1976-1987 [46]

The Robogate was set up in 1976 to produce the Ritmo model (segment C), at the Rivalta and Cassino plants. Capacity was 800 units per day on double shift. At Rivalta after 1982, the Robogate was reset to produce the Uno model (segment B) simultaneously with the Ritmo and capacity was expanded to 1400 units on double shift. In addition, at Cassino the system was reset to produce the Regata simultaneously with the Ritmo. Daily capacity rose up to 1400 units on double shift. The Robogate combined the transport system already developed in the Digitron set with the extensive use of welding robots. The name of the system derived from the fact that it was based on nine welding stations called *gates*, three for the basting and six for the finishing, in which the entire welding process was executed by robots (chart 4.4).

[46] Source: Archivio Storico Fiat, 'Il Robogate', Fiat internal paper. Malandri and Scimone, interview with the author, 18-02-1999, see footnote 38.

Chart 4.4: Layout of the Robogate shop, Cassino and Rivalta plants, 1976-1987



Source: ibid.

The transport system was based on 40 trolleys moving along a magnetic track - robocarriers - which were similar to these already experimented with in the Digitron system. However, in this case, each robocarrier was completed by an interchangeable pallet, a wooden frame conceptually similar to that already introduced in 1974 in the production line of the 131 model, on which monocoque sub-components, platforms and bodies were fixed before the welding process. While welding gates and trolleys were multi-purpose tools, pallets were model-specific. The flexibility of the system derived from the possibility of replacing the pallets without stopping production. Each welding gate was equipped with two sets of automatic pliers. Thus, bodies and platform that had been tied together with very few welding spots before basting were held by the pallet from the bottom and by automatic pliers from the top during basting. As usual, during the finishing automatic pliers were not needed.

In 1982, Fiat introduced a different version of the Robogate system at the Mirafiori plant.[47] Welding gates, similar to those of Robogate, were arranged according to a more traditional linear layout (chart 4.5). In this case, pallets were moving on a traditional conveyor truck, which was charged with different pallets, each holding simultaneously the body and chassis of a different model according to the desired production mix. Therefore, after 1984, the Fiat Uno and Croma, and the Lancia Thema and Y10 shared the same three welding lines. Again, flexibility derived from the possibility of replacing the pallet, and by the fact that each welding station was equipped with two or more sets of automatic pliers. The optimum capacity was 850 units per day per line on double shift.

A similar system based on robotised welding gates had already been introduced at the Termini Imerese plant since 1979 for the production of the Panda, but this system was much more simple and much less flexible, because both the transport system and the fixtures by which the monocoque was held during the basting were model-specific.

Chart 4.5: Layout of the Robogate shop, Mirafiori plant, 1982-1987

Source: ibid.

47 The robotised jig.

The production sequence

The monocoque assembly process (see chart flow 4.4) started from the sub-components depots, where platforms and bodies of each model (for example the Ritmo and Regata) had been fitted into each other and then fixed to the appropriate pallet. This stage was not yet a welding stage. Platform and bodies were embedded together by fitting fins, set in the bottom edge of the body, into small holes arranged in the platform. After this stage, pallets were stored in the pallet depots. A group of three robocarriers arrived to the pallet depot and each picked up a pallet. The production of a given model, between the two possible choices, depended on the type of pallet picked up. The robocarriers then moved on to the welding area, where each stopped first at one of the three basting gates, and then at two of the six finishing stations in sequence. In fact, finishing was performed in two different stages. Robocarriers entered and exited from the front of the stations since the gates were parallel. After having discharged the monocoques at the head of the final assembly line, they went back to the pallet depot to start another cycle.

In the case, of the Mirafiori Robogate, pallets were carried by a normal truck conveyor. Pallets entered the basting gate from the front and exited from the back to enter the first finishing station from the front. As already stated, from 1982 onwards, the Robogate was set up to produce 1400 cars per day at Rivalta and Cassino. In the first case the production mix could range from 800 Uno and 600 Ritmo to 600 Uno and 800 Ritmo, while at Cassino it was possible to produce up to 1000 Regata and 400 Ritmo or vice versa. If, for instance, the Robogate was to process 750 Uno and 650 Ritmo, the shift from one model to the other occurred every 30 minutes. In fact, if all the Uno were produced first, and then all the Ritmo, the respective sub-component production lines would have been slowed down unless huge stocks were arranged.

Each robocarrier was equipped with a system to lift and set the pallet in the proper position within each welding gate. All the welding stations, be they basting or finishing gates, were equipped with six robots for welding (10 robots after 1982), and two sets of automatic pliers, one for each model, which held together the body and chassis during the welding. Automatic pliers were dedicated to a single model. Since each gate was equipped with two sets of pliers, it was possible to weld two different models without resetting the system.

The whole system, from the procession of trolleys to the welding sequence performed by each robot, was scheduled and monitored by a computerised system, which was able to detect imperfect or missed welding sequences and reintroduce any monocoque into the welding process when needed. Moreover, the software was able to change the path of trolleys in case one of the gates was temporarily out of order. Every single event of the process was recorded so that in case of a temporary crash of the electronic system, it was possible to reset robots and restart the process exactly from the point at which the cycle had been interrupted. The main difference between the Rivalta and Cassino Robogates, and the Robogate introduced at Mirafiori consists of the fact that in the latter system it was much more difficult to reintroduce monocoques imperfectly welded into the system. This suggests that by 1982, when the Mirafiori welding shop was set up, management felt totally confident about the quality of welding performed by robots and the reliability of the tools, so there was no longer a need for reticular layouts allowing defective stations to be bypassed.

From a technical point of view, it was possible to equip each basting gate with three sets of pliers so that, in theory, it was possible to weld up to nine different models at the same time, three for each basting gate. Actually, in the period considered in this chapter, no more than two models were processed at the same time by each Robogate at Rivalta and Cassino. This depended on the minimum scale of production required by the models processed in these plants. In fact, an expansion in the number of the models processed would lead to a decrease in the output for *each* model. The scale of production of each type of cars depended on the segment of the market in which models were going to compete. Accordingly, only the second Robogate line of the Mirafiori plant processed three models, two of which were competing in segment E (1600-2200 cc.), and therefore were produced in smaller numbers. This is an important point that will be explored in more detail in the following section of the chapter.

It should be mentioned that finishing was performed in two different stages by twenty robots, compared with the ten robots used for basting. As with traditional systems, this reflected the fact that during basting, the number of welding spots performed was smaller than that of finishing. In theory, the robots of the basting gates could have performed a larger number of welding spots in order to start the finishing of the monocoque. Actually, the automatic pliers prevented the robots from moving freely within the monocoques. Consequently, because basting was much quicker than finishing, the latter had to be segmented into two stages. Therefore, the differential in speed between basting and finishing was overcome by the over-segmentation of the finishing stage as it was during the 1960s and early 1970s. Thus, the flexibility of robots in performing many different welding functions did not lead to a re-composition of tasks through the re-composition of basting and finishing.

Some considerations on the Robogate system

In many respects, Robogate cannot be considered a "revolutionary" system. It did not lead to a substantial change of the segmentation of the process, nor to a re-organisation of its supply flow through the complete abolition of intermediate stocks, even though the queuing time of each batch of monocoque sub-components for each model in normal conditions was limited to just half an hour. The technical solutions implemented with the Robogate were almost entirely inspired by technical problems experienced by the firm during the early stage of robotics, which was initially introduced in order to find a technical solution to the bottleneck caused by the impossibility of applying hard automation to the finishing stage of spot welding. The change in layout, the most evident modification of traditional technology, reflected the need to improve the reliability of robotised systems once they were deployed. In fact, the second generation of the Robogate, which was implemented at the Mirafiori plant, was deployed according to a linear layout.

The established literature, on the other hand, has seen the Robogate as the most important outcome of a marked change in managerial knowledge. In the new managerial paradigm, flexibility was more important, or at least as important, than increasing total output per model per shift. This view implies that the routine underpinning the search for new technology consisted in choosing the technology which maximised flexibility and minimised the cycle time, as opposed to the traditional Fordist routine underpinning the search for new technology, which consisted of choosing the technology that minimised the cycle time, through the standardisation of process and product. Based on unpublished data and interviews with technical management, the next section shows that while the Robogate technology contributed to a massive cut in the basic cycle time in spot welding, constraints to flexibility remained substantial. This was the result of search for new technology and organisation influenced by the necessity of removing the bottleneck between basting and finishing, in the existing process.

Section three

The Robogate and product-mix flexibility

By using data concerning the cycle time of basting and finishing in the spot-welding shop, this section shows that robotics allowed for a quantum leap in the acceleration of the finishing process. Then, by using company production data arranged by model and by plant, along with data concerning the optimum capacity of each line, this section shows that in spite of the enhanced plant flexibility, some lines were still under-used, while in some others extra time was implemented.

The Robogate and cycle-time minimisation

Table 4.2 shows the cycle time of the monocoque spot-welding process of the Fiat 126 (1972), the Fiat Panda (1980) the Ritmo and Regata (1984), the Fiat Uno and Ritmo (1984), and the Lancia Delta and Prisma (1984).

Table 4.2: Efficiency expressed as duration of the cycle time in welding (seconds), various years, various plants

Year	Plant	Number of lines	Model	Efficiency Factor	Technology		Time cycle
					Basting	Finishing	Minutes and seconds
1975	Cassino*	4	126	0.80	Automated	Automated	6.10
1975	Mirafiori*	1	126	0.93	Automated	Manual	2.04
1980	Termini-Imerese	1	Panda	0.85	Robotics	Robotics	1.32
1980	Desio	1	Panda	0.93	Automated	Manual	2.51
1984	Chivasso	1	Lancia Delta	0.90	Automated	Manual	2.01
1984	Chivasso	1	Lancia Prisma	0.90	Automated	Manual	2.01
1984	Mirafiori	3	Uno	0.85	Robogate	Robogate	0.54
1984	Casino	1	Ritmo + Regata	0.83	Robogate	Robogate	0.32
1984	Rivalta	1	Ritmo + Uno	0.83	Robogate	Robogate	0.32

Source: Malandri and Scimone, interview with the author, 18-03-1999. * Volpato *Il caso Fiat*, p.170. The cycle time must not be confused with the lead time of each monocoque (time taken by each unit to pass through the entire process). The cycle time is the interval time between any monocoque entering or exiting each individual stage of the process. In the case of Rivalta (1984), for example, one monocoque enters into the basting station (head-stream), and one monocoque exits out the last finishing station (end-stream) any 32 seconds in each line. Cycle time tells us how many cars per day can be processed by a given segment of the manufacturing process. Cycle time has been calculated according to a simple formula suggested by Fiat management: $TC = \Sigma t^* \varepsilon / P$, where TC= time cycle, P = established daily output ; t = duration of each shift in the ordinary working time; ε = efficiency factor = 0.8. The efficiency factor is established by engineers according to the expected tool life cycle. An efficiency factor of 0.8 implies that only 80% of each shift was actually utilised for production. Thus, if P= 900 minutes, $P^* \varepsilon = 720$ minutes. Note that when minutes are divided by output, TC is expressed in minutes and hundredths of minutes for TC > 1, and in hundredths of minutes for TC < 1. For simplicity, in this table the results have been converted in minutes and seconds for TC> 1, and in seconds for TC< 1.

The table analyses the whole range of Fiat technological settings. The welding line for the 126 at the Cassino plant featured hard automation in basting and finishing, while the 126 line at the Mirafiori plant featured manual finishing. The Panda was produced by robots at the Termini Imerese plant and by using traditional welding at the Desio plant. It is also interesting to compare the welding technology used to produce the Lancia Delta and Prisma at the Chivasso plant with the Robogate of Cassino producing the Ritmo and Regata, which were models competing in the same segments of those produced at Chivasso. As already said, the Robogate was also deployed at the Rivalta plant and, though with a different layout, at the Mirafiori plant. As shown by the table, the superiority of the Robogate - be it the version used at Cassino and Rivalta or that deployed at Mirafiori - over the other technologies, including robotics deployed at Termini Imerese, was overwhelming. It is also interesting to note that Fiat was producing the Lancia brand at the Chivasso rather than at any of the robotised plants. Lancia was supposed to be the top quality brand of the Fiat Group. In fact, the optimum daily production of the Delta and the Prisma was 400 cars per day. The fact that the top brand production was allocated to a traditional rather than robotised plant clearly indicated that daily output, and therefore cycle time, rather than quality, was the criterion adopted by management to prioritise the deployment of robotics. On the whole, the table shows that, through the Robogate technology, the basting and finishing cycle time were substantially reduced. In the next section it will be investigated whether or not the Robogate allowed the Fiat management to optimise product-mix flexibility. [48]

---

[48] The view of discontinuity is implicit in many documents and pamphlets produced by Fiat stressing the innovative characteristic of the system. An example is provided by a Fiat document entitled 'Il Robogate'. On the other hand, a leaflet printed by COMAU, entitled 'Robogate' makes it clear that the system was the outcome of a long-term evolution profiting from the Fiat experience in automation. Moreover, the leaflet stresses that the system has been thought to be compatible with any kind of traditional technology. The striking difference between the two documents depends on the authors as well as on the target audience of the two documents. The first document was written by Fiat engineers, who wanted to stress the firm's commitment to innovation, and was aimed mainly at the academic world. The second was produced by COMAU, and was targeted at COMAU's potential or actual clients, namely car manufacturers external to the Fiat group, who were interested in the reliability and compatibility of the system with traditional technologies. Both documents have been provided to the author by the Department of Technology Assessment of Fiat Auto.

Plant flexibility and production allocation

Table 4.3 shows the average daily production of each model produced by flexible lines from 1978 to 1987. Both the Rivalta and Cassino Robogate had been used on a double model production line only after 1982 and 1983 respectively, which means four and five years after the deployment of the system. Moreover, from February 1986 the Rivalta Robogate shifted back to a single model production programme. In addition, the Mirafiori Robogate has been used on a multi-model production programme only after 1984, two years after the deployment of the system. In any case, multi-model production was performed only by two of the three lines deployed. Until 1982, flexible capacity was entirely devoted to the production of a single model, the Ritmo, while after 1983 the flexible capacity was increasingly and massively allocated to the Uno, although five different models were processed at Cassino, Rivalta and Mirafiori.

Table 4.3 Robogate line output per day (units), 1978 - 1987

Plant	Cassino		Rivalta		Mirafiori			
	Ritmo	**Regata**	**Ritmo**	**Uno**	**Uno**	**Croma**	**Thema**	**Y 10**
	Robogate		Robogate		Robogate (all lines)	Robogate (second line)	Robogate (second line)	Robogate (third line)
Year								
1978	63	0	320	0	0	0	0	0
1979	586	0	782	0	0	0	0	0
1980	643	0	778	0	0	0	0	0
1981	660	0	689	0	0	0	0	0
1982	706	0	672	117	3	0	0	0
1983	677	263	449	140	507	0	0	0
1984	133	884	536	635	1,918	0	11	0
1985	155	691	397	904	1,511	19	132	275
1986	377	628	19	1,309	1,551	311	191	349
1987	182	594	0	1,446	1,609	278	480	231

Source: Calculated from Fiat Auto 'Libro dei numeri di marticola dei veicoli prodotti' (Production File).

This is shown more clearly by table 4.4. In 1985, five production lines produced more than 80% of total output, of which the Uno represents the major share. In particular, the Uno represented 60% of the output of flexible lines in 1985, 59% in 1986 and 63% in 1987. Since 1983, there was a massive concentration of production on flexible lines. It is of extreme interest that beside a few lines producing the larger share of total output, there were a number of lines producing a relatively small share of output in a less efficient way, which allowed Fiat to keep a relatively large model range. This means that product differentiation was still depending on the existence of a number of traditional single product lines, in which robotics was deployed to a lesser degree or not deployed at all. Some of them produced a relatively low level of output. The Panda was produced in two different plants. This, along with the multi-location of the Robogate system, explains why the ratio of lines to models never goes below one in spite of the fact that multi-model production was performed by flexible lines.

Table 4.4: Flexible lines within the Fiat production system, 1978-1987

Year	Total number of lines - Italian plants	Number of flexible lines	Number of models produced	Ratio lines to models	Share of units produced by flexible lines out of total Fiat production - Italian plants	Share of Uno out of flexible lines output
1978	18	2	11	1.27	6.7%	
1979	17	2	11	1.18	27.5%	
1980	13	2	10	1.3	25.4%	
1981	13	2	10	1.3	29%	
1982	16	2	13	1.23	31.9%	
1983	16	5	12	1.33	52.5%	31.7%
1984	15	5	12	1.25	71.8%	62%
1985	11	5	11	1	82.1%	59%
1986	11	5	11	1	74%	60.4%
1987	12	5	10	1.2	58.2%	63.2%

Source: ibid.

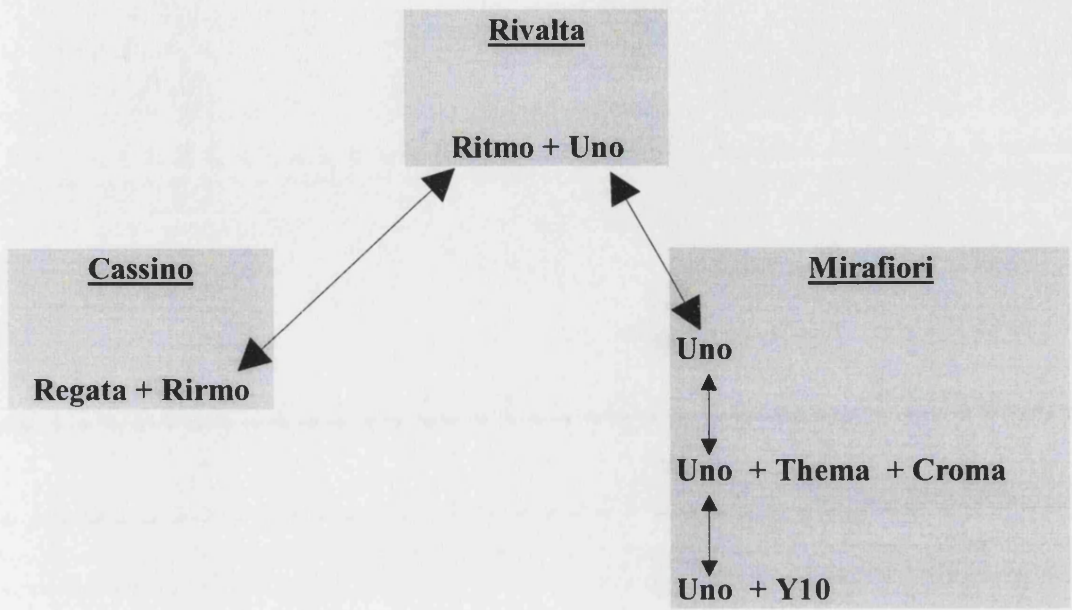
From tables 4.3 and 4.4, it is clear that apart from the second line at the Mirafiori plant, the Fiat management did not use flexibility to increase the efficiency of batch production of a large number of different luxury and niche models. On the contrary, they exploited the remarkable technical efficiency of the Robogate mostly to mass-produce the Uno. The full exploitation of flexibility, therefore, was constrained by the output structure of Fiat, which, as will be shown in chapters 6 and 7 of the thesis, was the result of the strategic choices concerning the core segment in which the company aimed to compete during the 1980s. The output structure determined the scale of production of each model. The scale of production of each model affected the use of the Robogate system, as will be explained in the following section.

Model scale of production and capacity utilisation

According to the Fiat management, in comparison with traditional technology the Robogate led to the reduction of spare capacity for the same level of flexibility. The argument was that, in order to have the same mix flexibility of the Robogate (in the case of Cassino 1000 Regata and 400 Ritmo per day or vice versa) by using traditional technology, two traditional model-specific lines were needed, each with a production range[49] from 400 to 1,000 cars per day. The installed total capacity would have been 2,000 instead of 1,400 cars per day. If daily production was 1,000 cars per day between the two models, the under-utilisation of the traditional lines would have been 1,000 cars per day, while that of the Robogate only 400 cars per day. Thus, product mix flexibility being equal, the Robogate reduced substantially the risk of running spare capacity.[50] On the other hand, a single Robogate line could not cope with a situation in which demand for both the models produced was rising simultaneously, exceeding 1,400 cars per day. This problem led to one of the most interesting features of the system, namely the production location of some models in more than one plant or line (see chart 4.6).

[49] The line production range is the difference between the minimum output needed to start production and the saturation level of output on double shift.
[50] This is one of the most quoted arguments among those used by management to demonstrate the intrinsic quality of the Robogate system.

Chart 4.6: Robogate plants and production allocation



Source: Based on information from Malandri and Scimone, interview with the author, 18-03-1999.

The multi-location of production is a key feature of the system, and must be taken into account for the purpose of the analysis. In theory, it gave the management the possibility of adjusting the output structure, keeping each line at 100% of the optimum capacity utilisation. Actually, as already said, the minimum efficient scale of each model limited the number of car types each Robogate line could produce in an economically efficient way. Also, once the number of models to be processed on each line was set, the minimum efficient scale of each type of car limited the maximum output for the others unless the plant shifted to a single type production programme.

By looking at table 4.3, it is clear that the Ritmo was constantly under-produced at Cassino (with the exception of 1986), in spite of the fact that the overwhelming production of the Uno pushed the Ritmo out of the Rivalta plant, which, after February 1986 had to shift to a single production programme. Thus, even with flexible welding tools it was difficult for the Fiat management to optimise the production of different models on the same lines. In this context, it is important to establish whether or not the management was able to stabilise production avoiding the under-utilisation of production facilities or the implementation of extra time.

Figures 4.3 (a, b, c, d and e) show the plot of the monthly capacity utilisation rate for the Rivalta, Cassino and Mirafiori Robogates, and for the Termini Imerese and Desio plants. For Mirafiori, the plot shows the capacity utilisation rate for each of the three lines, which have been called Mir I, Mir II, and Mir III. The monthly utilisation capacity rate of the Desio and Termini Imerese plants have been plotted in order to compare the utilisation pattern of two model-specific plants with plants using flexible lines. At the Termini Imerese plant, robots performed the welding, while at the Desio and Chivasso plants robotics was not implemented at all.

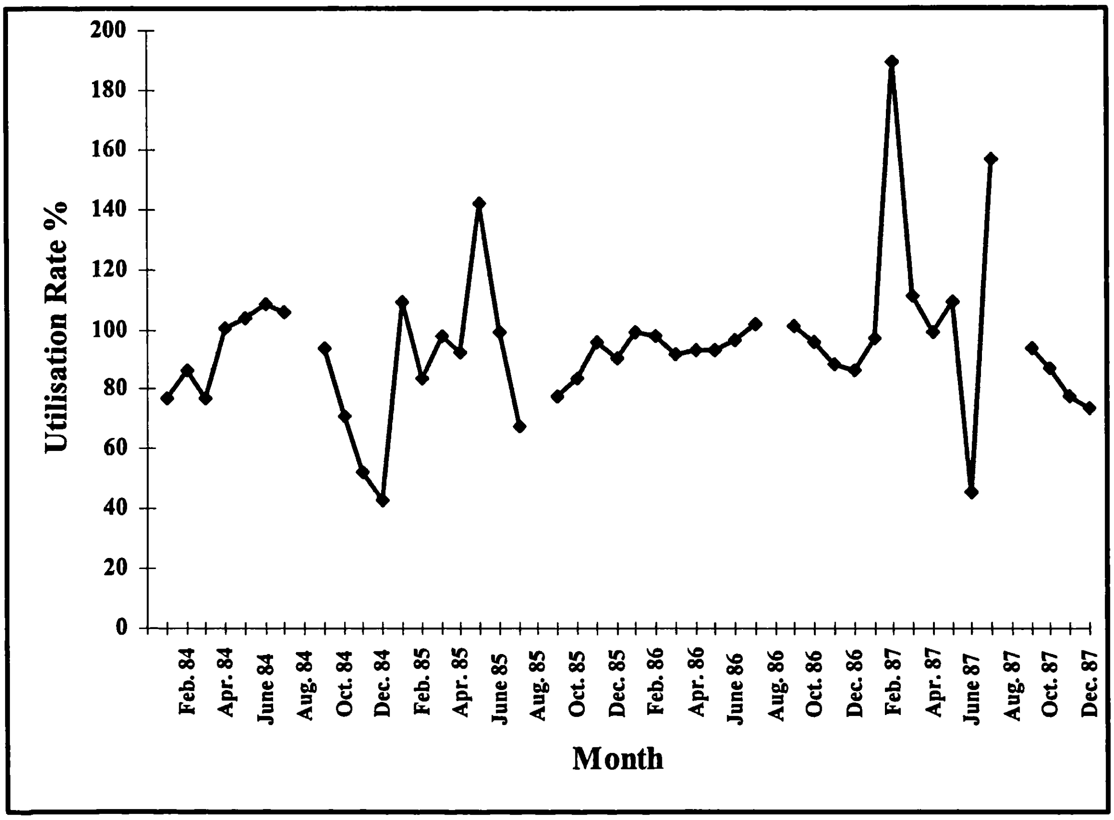
Desio and Chivasso were plants inherited by Fiat when the company took over Autobianchi in 1967 and Lancia in 1969. During the 1980s, the Desio plant produced the Panda. Technology was extremely backward since basting was performed by multiple automated welders and finishing was performed manually as it had been during the 1960s. However, output levels were relatively low and the optimum capacity was set at 300 cars per day. Obsolete technology was also utilised for the production of the Lancia Delta and Prisma at the Chivasso plant. In this case, there were two inflexible lines producing a model each. The optimum capacity of each model was 400 cars per day. It is interesting to note that the Delta and Prisma shared the same platform with the Ritmo and Regata and that as far as the Robogate was concerned there was no reason why the Delta and Prisma could not have been processed at Cassino.

The utilisation rate is an index of the actual monthly production of each line, as a percentage of the monthly optimum capacity on double shift. The monthly optimum capacity has been calculated by multiplying the daily optimum capacity on double shift by the number of working days of each month, from January 1984 to December 1987. Data on daily optimum capacity have been obtained from interviews with the Fiat engineers Malandri and Scimone.[51]

The actual monthly production has been calculated by using the Fiat Production File ('Libro dei numeri di matricola dei veicoli prodotti'). This consists of the serial numbers of Fiat cars and is arranged by models, by plants and by lines. For example, in order to work out the production of a given model in February, the serial number of January should be subtracted from that of February. Working days vary from month by month ranging from 19 to 23. During the period considered, there were 232 ordinary working days per year and five per week. In August, there were only six working days. However, in many cases the Fiat production files do not provide data for the production in August so that the plots show gaps in some cases. Because capacity refers to double shift, any value in the utilisation rate above 100% denotes that extra time was added to normal time by the introduction of an extra shift. By including the third shift from Monday to Friday, and six shifts each weekend, up to 11 shifts could have been added to normal time each week. Finally, it should be noted that during the period considered, the production schedule was set on a monthly basis.[52] The 1984-87 period has been chosen because a double production program was executed by all the flexible lines except Mir I and, in 1987, Rivalta.

[51] Data concerning Cassino and Rivalta have also been published by The Department of External Relations of Fiat. However, according to Malandri and Scimone, the optimum capacity utilisation of Cassino was 1400 rather than the 1300 cars per day quoted by the External Relations Department. Given that both Rivalta and Cassino shared the identical Robogate technology and that both sources quote 1400 cars per day for Rivalta, the figure quoted by Scimone for the Cassino plant is more credible.
[52] Interview with Malandri and Scimone; see note 38.

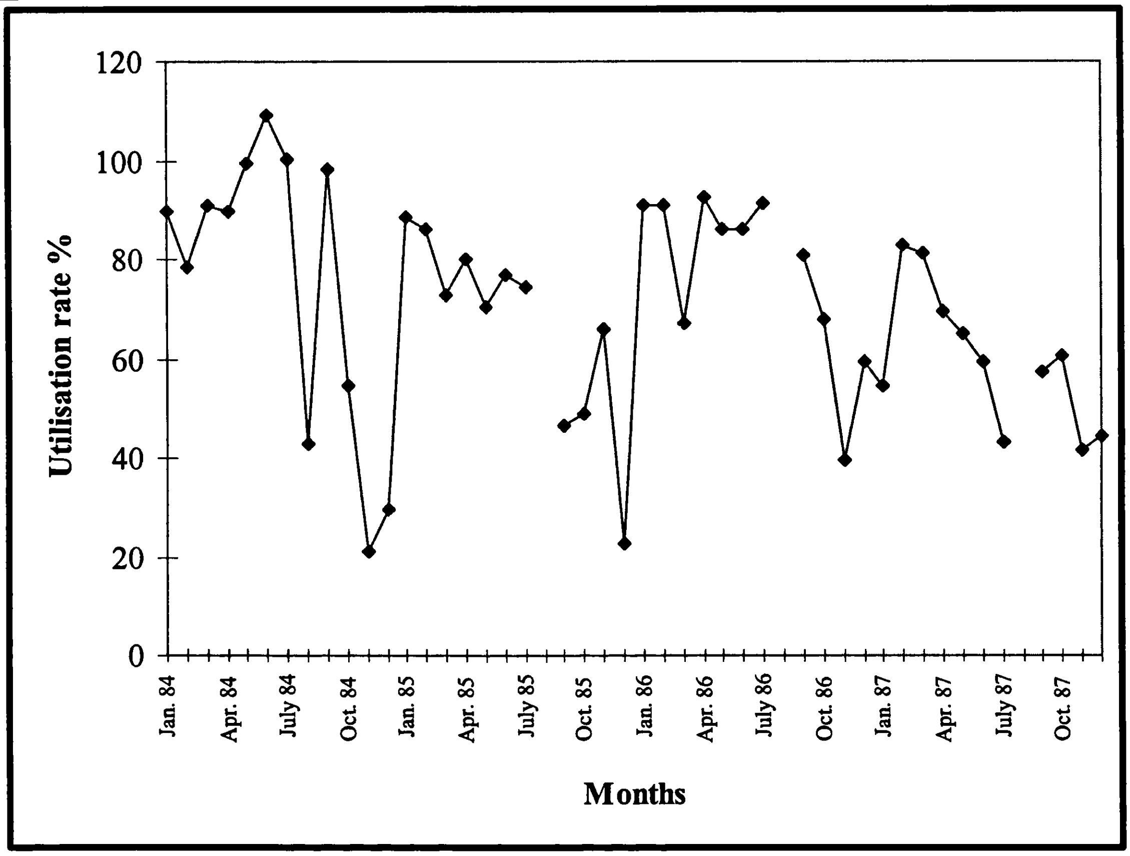
Figure 4.3 (a): Monthly capacity utilisation rate, Rivalta plant, Uno and Ritmo, January 1984 - December 1987



Source: Elaboration of data from Fiat Archives, 'Libro dei numeri di matricola dei veicoli prodotti' (Production File).

As far as the Rivalta plant is concerned, the plot can be divided into three sub-periods. The first, January 1984 - July 1985 was characterised by a serial peak and trough, denoting marked variations in the rate of capacity utilisation, which, in some cases, was well above 100%, in some others well below 100%, or even 75%. Notably, plant utilisation reached the lowest point in December 1984 and June 1987, in which the rate was around 40%. The second-sub period, from September 1985 to January 1987, shows a remarkably high and stable level of plant utilisation, with a moderate implementation of extra time. Utilisation never fell below 80%. However, in 1987 there was massive over-utilisation until May, then a remarkable slump in June to below 60%, and finally another peak in July, well above 100%. From September to December, capacity utilisation decreased from 90% to 75%. As already stated, from February 1986 to December 1987, the plant was used to produce a single model. Between January 1984 and December 1987, the capacity utilisation rate was on average 94%.

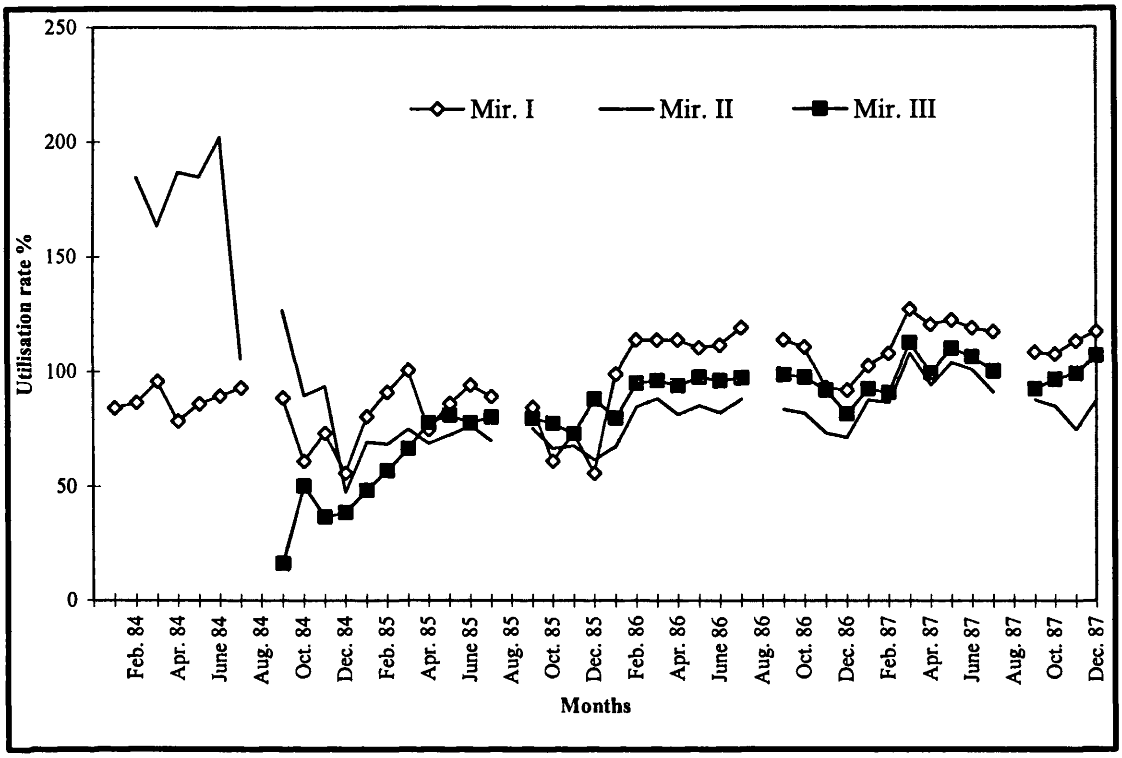
Figure 4.3 (b): Monthly capacity utilisation rate, Cassino plant, Rimo and Regata, January 1984 - December 1987



Source: Ibid.

The Cassino plant shows a slightly different path. Firstly, the utilisation rate between January 1984 and December 1987 was on average 64%, much lower than that at Rivalta. It is extremely important to note that the plant break-even point was reached at 70% of capacity utilisation. Apart from two short periods of relative stability, March-July 1985 and April-July 1986, the utilisation rate was unstable, and in some months very low. It seems therefore that in terms of capacity utilisation, the performance of Rivalta was much better than that of Cassino, which on the other hand, suffered from the low production level of the Ritmo, which was not compensated by the production of the Regata.

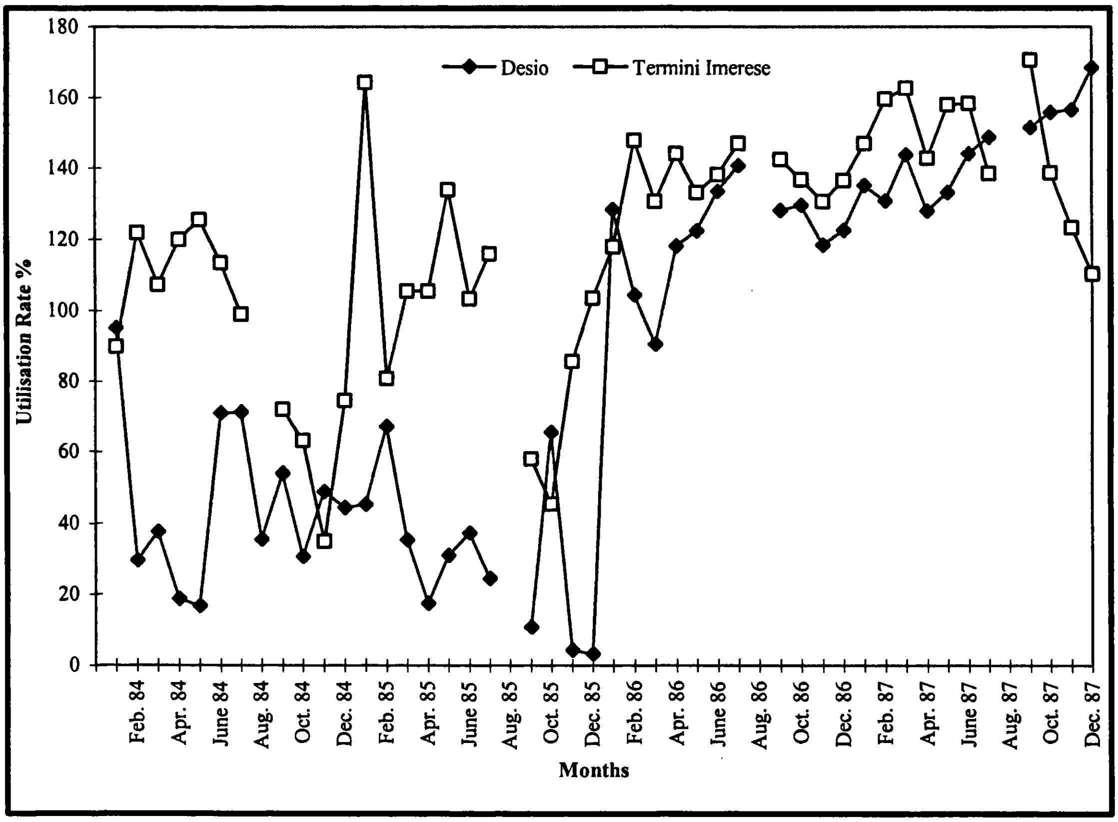
Figure 4.3 (c): Monthly capacity utilisation rate, Mirafiori plant, January 1984 - December 1987



Source: Ibid.

The Mirafiori plant exhibits a different regime for each line. The rate of capacity utilisation of Mir I was rather stable. In the first two years, 1984 and 1985, there was a drop below 75% in October and December, which reflects the seasonality of demand, but in general the utilisation was between 75% and 100%. However, from January 1986 and December 1987 the rate is almost constantly over 100%, implying a considerable amount of extra time. The average rate in the whole period is 96%. Flexibility was not exploited at all since a single model was produced. Mir II was massively over-utilised from February to September 1984. On the other hand, during 1985, the rate was over 75% only in March, June and September, in spite of the fact that both the Uno and Thema were produced. However, in 1986 and 1987 the rate was much better, always between 75% and 100%, with some extra time performed in March and July 1987. The rate improved in the last two years because the Croma was also processed on the second line. Flexibility was exploited extremely well in 1986 and 1987. Over the whole period the rate of capacity utilisation was 94%. Finally, Mir III was the most stable line from April 1984 to December 1987. Its capacity utilisation rate falls almost always between 75% and 100%. However, in 1987 extra time was performed during five months. On average, the rate was 83%.

Figure 4.3 (d): Monthly capacity utilisation rate, Desio and Termini Imerese plants, January 1984 - December 1987

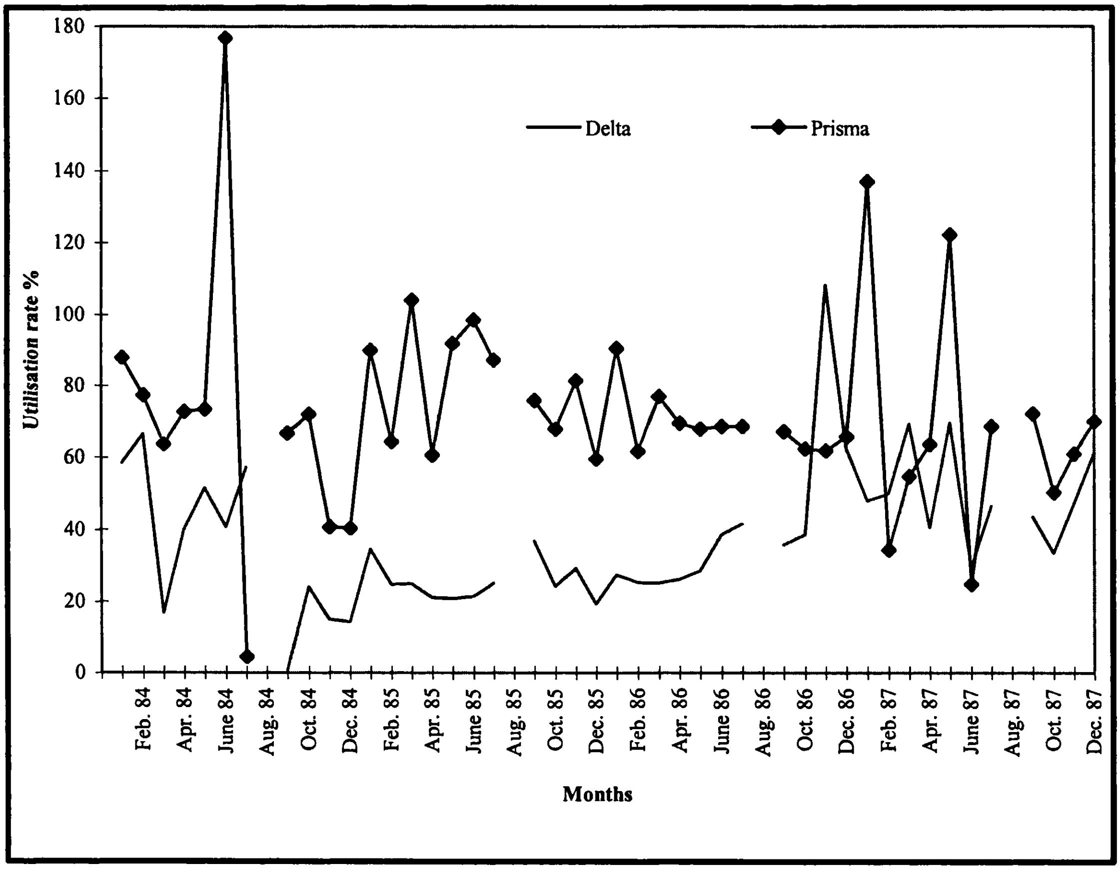


Source: Ibid.

As far as the traditional lines of the Desio and Termini Imerese plants are concerned, the plot shows two different patterns: Desio was consistently under-utilised in 1984 and 1985 and over-utilised in 1986 and 1987. In the case of Termini Imerese, utilisation in the first two years shows normal levels in the first six months - between 75% and 100% - and under-utilisation between September and December. In January 1985, extra shifts were implemented. In 1986 and 1987 there was a massive implementation of extra time. The rate of capacity utilisation was 87% for Termini Imerese and 83% for Desio.

Finally, the Chivasso plant shows marked fluctuations of the capacity utilisation rate, as we would expect from two lines based on hard automation. During the period considered the average capacity utilisation was 37.8% for the Delta line and 72.2% for the Prisma.

Figure 4.3 (e): Monthly capacity utilisation rate, Chivasso plant, January 1984 - December 1987



Source: Ibid.

All the plants, be they based on flexible or traditional technology, exhibit periods in which lines were over-utilised and periods in which they were under-utilised, although the proportion of over- and under-utilisation varies between lines and between periods. Thus, the practice of changing the rate of capacity utilisation characterised the production setting of the Uno, the Ritmo and the Regata, which shows the persistence of a traditional approach to managing product-mix flexibility.

This finding departs from the conclusions reached by Volpato (1990), who claimed that the introduction of flexible manufacturing systems led to the minimisation of spare capacity. Quoting company figures, Volpato shows that on the whole, Fiat exploited 95% of its capacity in 1986, which is perfectly in line with our analysis for that year.[53] The problem is that looking the utilisation rate of each line from January 1984 to December 1987, it is evident that the high rate of utilisation was obtained by implementing extra shifts in some lines, while some others were under-utilised. This means that the overall high rate of capacity utilisation was due to the positive sales cycle for some models rather than to the flexibility of the system. This determined the existence of some structural spare capacity. Structural spare capacity would include the spare capacity resulting from the under-utilisation of the Desio and Termini Imerese plants in 1984 and 1985, and the Chivasso plant.[54] This was typical of the traditional lines in which the decrease in demand for the model produced could not be compensated by the production of another model. Moreover, structural over-capacity also includes 36% of the Cassino plant capacity, which was not utilised in the whole period and particularly in 1987, when the Rivalta plant was consistently performing extra time.

[53] Volpato, Bianchi, 'Flexibility as the Response to Excess Capacity: The Case of the Automobile Industry', in Baden-Fuller (ed.), *Managing Excess Capacity*, p. 241.

[54] In the case of Desio and Termini Imerese, capacity utilisation recovered and even exceeded the optimum level after 1985, because Fiat had sold Seat to Volkswagen and the production of the Panda in Pamplona and Barcelona was transferred to the Italian factories.

Even more interesting is the amount of extra time implemented by Fiat. This was caused by the overwhelming impact of the Uno on the Fiat output structure. It created a paradoxical situation, in that levels of capacity utilisation of the flexible line were still massively affected by a single model. In the case of Mir I during the whole period, and Rivalta after February 1986, flexibility was sacrificed for plant saturation.

The fact that plants had to be saturated when demand for some models was at its highest suggests that robotics was developed in parallel with a project of re-sizing the overall business and that the high level of capacity utilisation emphasised by Volpato was the result of this re-sizing rather than the result of flexibility maximisation. This fact supports the well known Harrison argument that the 1980s have to be regarded as the era in which Fordism has been revitalised through the re-sizing, if not down-sizing, of operations, rather than the era in which the path toward "Flexible Specialisation" started to take place.

On the basis of the findings on the capacity utilisation rate, the Fiat technical management[55] was asked why the company did not shift the surplus production of the Uno to Cassino or alternatively close the Delta line at Chivasso, moving the production to the plant in Southern Italy. The answer was that the platform and body welding lines upstream of the Robogate were still model-specific, where the technology implemented was similar to that used by Fiat during the late 1960s and 1970s.[56] This limited the resetting of plants, so that it was not possible to shift the production of the Uno from Rivalta to Cassino, or the production of Regata to Rivalta in spite of the fact that the Robogate was the same. In addition, it was not possible to move the Delta to Cassino because of the fact that body sub-component welding lines were still model-specific. According to both Malandri and Simone the reason why the lines upstream of the Robogate had not been developed since the 1970s was that those lines were extremely efficient in terms of the cycle time, so that management focused on the innovation and

[55] Telephone interview with Mr Malandri and Scimone; see note 38.

[56] It is important to note that the production of the Fiat Uno was not moved to Cassino and that this information is based on the Fiat Production File, which specifies where and when cars were welded and assembled, and whether cars had been welded in one plant and assembled in another. The information has been also confirmed by Malandri and Scimone. This contradicts information given by Bonazzi, who says that some units of the Uno model where shipped to Cassino for final assembly. In any case, Bonazzi refers only to assembly and not to monocoque welding. The reference is to Bonazzi, *Il tubo di cristallo*, p. 81.

development of the basting and finishing stages of the spot welding. This would not have been a problem if production was to be shifted among the Mirafiori, Rivalta and Chivasso plants. These were all located in the same area, namely in the periphery or in the hinterland of Turin, so that to perform platform and body welding in one plant while basting and finishing in another was economically viable. On the contrary, to ship sub-components to Cassino would have been much less economically efficient.

Conclusions

After 1972, a major process of technological change started at Fiat. In particular, the implementation of robotics in the spot-welding shop has attracted the attention of experts in the academic and business world. Since the mid-1980s, the industrial relations argument has been replaced by the flexibility argument. This has been used to explain not only why the technological change occurred but also why it occurred after 1973, providing the justification for managerial and technical discontinuity. The flexibility approach had a much longer life, since it has dominated both the management literature and the business history literature of the 1980s and 1990s. Based on unpublished data and interviews with technical management, this chapter departs from the established literature by setting a double stage argument. In the first place, a "classical argument" is posed to explain technical change, that is the maturation of existing technology, leading to a downward shift in the production curve. After 1968, no significant gains in labour productivity had been achieved by Fiat. The spot-welding technology deployed at the time was not helping in that matter. On the contrary, workers saved by the automation of basting had to be re-deployed in the finishing stage of the spot-welding process, in order to avoid the bottleneck between the two stages of the process, given that hard automation could not be extended to finishing in an efficient way. Once robotics was introduced, it drove a development towards reliability, which ended in the deployment of the Robogate system. Reliability was achieved by maximising system flexibility. In addition, attention was paid to the convertibility of the system. System flexibility and convertibility reduced tool specificity to the extent that

Fiat could start to process monocoques of two different models on the same line, though this happened only in 1982, four years after the Robogate was set.

Once the reason for technological change and the development path has been set, the use management made of flexible lines is examined in relation to the capacity utilisation rate of each line. According to Bartezzaghi and Turco, the switch from inflexible to flexible mass production calls for management pursuing targets different from those to be pursued within a traditional Fordist framework, namely reset-time minimisation rather than flow-speed maximisation, and the utilisation of flexible capability rather than plant saturation. According to Volpato, this was the case with the Robogate, since lower tool specificity provided Fiat with the possibility of stabilising production at an optimal level of 90%. On the other hand, this chapter establishes that between 1984 and 1987, over-utilisation and, in some case under-utilisation of lines represented the main way in which Fiat adjusted output to the demand structure. Therefore, Fiat's utilisation of 90% of its total capacity on double shift reflected the particularly favourable business cycle for some models, rather than the flexibility of each production line.

The flexibility of the Robogate was limited by two factors: 1) the technology utilised before the stage of monocoque welding was still model-specific, which prevented management from moving the production of the Uno from Rivalta to Cassino despite the fact that the two plants shared the same Robogate technology in basting and finishing. The fact that Fiat kept the traditional technology in the segments of the process preceding the Robogate is explained by the fact that during the 1970s, in a context of financial constraints, the routine underpinning the search for new technologies consisted of addressing innovation in those segments of the process where substantial gains in cycle time minimisation had to be achieved. 2) For each flexible line, the minimum economically efficient output of each model limited the maximum output of the other model produced on the same line. This point leads directly to the market strategy of Fiat. The fact that during the 1980s the strategic competitive segment of the market was segment B (900-1100 cc.) and that a single model, the Uno, had a huge impact on the product structure, limited the possibility for Fiat to make the best use of the flexible lines. In fact, the increasing output of the Uno compelled management to produce that model on four of the five flexible lines, while extra time was often implemented to cope with demand. Thus, shifts in product mix were still based on variations in the rate of line utilisation with the implementation of extra time, which, on some occasions, was concurrent with the under-utilisation of lines elsewhere in the network of Fiat production plants. The use of the whole set of flexible capacity (5 lines) to assemble only 6 models compelled Fiat to keep a number of traditional lines that were indeed less efficient, but allowed the company to complete the production range. Traditional lines were sometimes under-utilised, at other times over-utilised. In general, it is possible to say that during the 1980s Fiat was not yet totally committed to the elimination of inflexible capacity while production management could not pursue the stabilisation of production given the technology available. Instead, line saturation or under-utilisation was still driven by the demand pattern, as was the usual case with the Fordist system of mass production.

In this respect, the case of Fiat fits with the view of Bartezzaghi and Turco, suggesting that the 1975-85 decade is the period in which the strategic target in manufacturing was the improvement in the quality of the process and product, while the 1985-95 decade was that in which flexibility became the main issue in the managerial theory and practice.[57] The efficiency of the Robogate system was remarkable in terms of potential output per day and the reliability of the system, and its global quality in terms of working conditions and its impact on the product quality are beyond question. On the other hand, the ability of the system to stabilise production by assembling different models on the same line remained in many respects theoretical.

The fact that investments in spot-welding robotics were led by cycle-time minimisation denotes that the routines underpinning the search for new technology during the late 1970s and the 1980s were Fordist in nature. The Robogate technology allowed for the de-bottlenecking of finishing, which had been the main unsolved technical problem brought about by the process of automation during the 1960s. On this basis, it seems safe to say that the process of technological change after 1973 denotes continuity rather than discontinuity in managerial knowledge.

[57] Bartezzaghi, Turco, 'Flessibilità ed Efficienza'.

Chapter 5
Industrial Relations at Fiat, 1960-1987

Introduction

This chapter deals with industrial relations (IR) at Fiat between 1960 and 1987, and builds on the most recent claims of the IR literature on the Italian company. This maintains that during the 1980s, technological change was maximised in the aftermath of a dramatic shift in bargaining power from the unions to management, rather than used as an instrument to exercise higher levels of managerial control over workers and unions. This shift was due to political and industrial relations factors. The political factors include a change in the overall political strategy of the Communist Party (PCI) after 1975, with more open attitudes towards industrialists; a reduction of the political power of the Christian Democrat Party (DC) and a softening of its anti-industrialist attitudes; and the emergence of the Socialist Party, in the late 1970s and early 1980s, as an effective mediator between the interests of the Catholic, communist and liberal areas of civil society. The industrial relations factor refers to the crisis of the unions due to the disaffection of both the moderate and extremist wings of the so-called workers' movement. After the oil crisis, unions failed to make a clear choice between the strategy suggested by moderate delegates, seeking for constructive bargaining with management, and that pursued by extremist delegates pushing for a radical challenge to managerial power. As a result, moderate workers felt increasingly uncomfortable with the inability of union leaders to control the extremists. On the other hand, the extremists felt very dissatisfied by any union attempt to pursue constructive bargaining with management, and became increasingly sympathetic with left-wing extra-parliamentary groups and increasingly tolerant towards acts of intimidation and terrorism. The combination of a more favourable political climate with the increasing divide between workers and unions enabled Fiat to reintroduce shop-floor discipline first, and then to re-establish the power of management, with a positive impact on the acceleration of technological change.

As has been shown in the preceding chapter, this thesis explains technological change in the spot welding shop as the managerial response to the technological inefficiency brought about by the process of automation of the 1960s, within an organisational framework that remained essentially "Fordist". This argument does not conflict with the most recent mainstream literature on industrial relations, which no longer sees technological change at Fiat as a "technocratic" response of management to the power of unions and adversarial industrial relations.

The chapter is organised as follows: the first section provides an overview of the relationship between Fiat and the political establishment from the late 1950s to the late 1980s. The second section provides an overview of IR over the same period. Both sections show how well the interaction between management, politics and unions explains why management lost control of the shop floor in the late 1960s, and regained it in the early 1980s. Finally, after posing the *ex-post* argument that technological change was not the main drive for improving industrial relations, the last section rejects the *ex-ante* counterfactual that technological change was actually driven by the expectation of Fiat management that robotics would diminish the power of the unions. The justification for the *ex-ante* argument stems from the logical argument that outcomes might well be independent from expectations, although the latter determine the technological trajectory undertaken by firms. In order to reject the *ex-ante* argument, it will been shown that given the structure of the unions and the tactics deployed during industrial actions, management had neither theoretical nor practical grounds to predict that localised deployment of robotics would have prevented unions from stopping production, had they so wanted.

Section one

The political sphere: The relationship between management, Government, and political parties 1950-1987

Based on secondary literature, this section analyses the relationship between Fiat management, political and institutional actors. The analysis aims to provide the reader with a broad knowledge of the political context in which industrial relations developed during the 1970s. This area of investigation has attracted considerable attention, with Comito's *Fiat tra crisi e ristrutturazione*, and Castronovo's *Fiat 1899-1999: cento anni* *di storia italiana* among the most influential books analysing the political sphere.[1] Both are based on primary company sources,[2] as well as upon a precise reconstruction of Italian political and economic history. Here, the relationship between Fiat and the political authorities is described by focusing on three periods: 1953-1962, 1962-1973, 1973-1983. Of course, the choice of these periods implies some simplification of events. Nevertheless, it helps the non-specialist reader to relate political events to industrial relations developments. A mention will be made also of the 1983-1987 period, although it was a time of stabilisation in which the pattern emerging in the late 1970s did not change.

1953-1963: The years of the "pax politica"

The 1953-1963 period was a decade in which the relationship between the Fiat management and the Government was extremely co-operative and constructive for both sides. It was in these years that the company built up the reputation of being a "highly politically integrated company". There are various reasons why Fiat achieved such a strong political position with enormous lobbying power. Some are common to many other car companies in Europe and US. Others were more time-specific and determined by historical circumstances.

In the post-war period, steel and car manufacturing were obviously the industrial sectors promising extraordinary growth, with the latter being much more labour intensive. Thus, it was in the interest of governments to create favourable conditions for the growth of the car industry. These included favourable international policies (including export incentives, national market protection, and incentives to attract external capital), investments in infrastructures (mainly roads), and an industrial policy mainly focused on the energy, steel and rubber industries.

In terms of international politics between 1953 and 1963, there was a substantial similarity of views between the Fiat management and the government regarding the

[1] Castronovo, *Fiat 1899 – 1999*; Comito, *La Fiat.* Those readers who need to further their knowledge in the area of relationships between Fiat and politics should refer to this literature.
[2] The Castronovo book is based mainly on the Reports of the Meetings of the Administration Board, which are fully accessible up to 1966. For reports after 1966, selective access may be granted by the Fiat

Common Market. Fiat, like many other European car manufacturers, was definitely pushing for a gradual abolition of tariffs, under the assumption that a creation of a market of continental size would have guaranteed large profits along with the expansion of economies of scale. Expansion plans had been already made during the 1940s,[3] and the outcome of the war did not change the picture, as long as the common market replaced the pan-fascist European market mentioned, for example, in the 1943 Reports of the Administration Board. On the contrary, the Allied victory accelerated technology transfer from the US to Europe, making the expansion plans achievable, at least supply-wise. The Christian Democrats were also pro-European Market, since they saw in the economic unification of Europe a way towards lasting peace, and an effective way of preventing the expansion of Communism.

As far as infrastructure and industrial policy were concerned, there was also a convergence of interest in promoting full employment and economic growth. However, there is little doubt that the lobbying activity of Fiat management proved decisive in the implementation of a developmental model based mainly on the car industry, where state investments in infrastructure favoured the road network rather than the railways.

The convergence of interests between Fiat and political power per se does not explain the level of influence Valletta exercised over the Government. The size and nature of the Industrial Public Sector represented the principal element of a potential contrast of interest between the Government and Italian private industrial groups. Therefore, the sharing of common views in terms of development was a necessary, yet insufficient condition to neutralise a potential source of friction between Fiat and the DC.[4] Moreover, Valletta's general fondness for a social model based on mass production and consumption did not find great support among the Christian Democrats. Thus, the constructive relationship between Fiat and the DC between the end of the war and the early 1960s is explained largely by the role Valletta played in the political integration of Italy into the international community after the war.

Department of External Relations, depending on the content of the reports. This is to protect the privacy of individuals.

[3] Archivio Storico Fiat, Reports of the Administration Board Committee, March 1943.

[4] The political party running the Cabinet.

At the end of the war, in the phase of transition from monarchy to republic, the DC was considered a privileged partner by the US administration. However, this was a contingent necessity rather than political convergence and mutual trust. Americans were sceptical about the Christian Democrats and the whole Catholic Church, as much as the DC was reluctant to adopt the intrinsically materialistic American social model. On the other hand, because of the Fiat links with the Chase Manhattan Bank, dating back to the late 1920s, the American financial and political establishments trusted Valletta. He, therefore, became an important referee for Italian international politics.[5] Thus, the strong relationship between Valletta and the US administration enabled Fiat to play a crucial role in the post-war political integration of Italy, and contributed to the reinforcement of the company's lobbying power, where a convergence of interests in terms of international politics was combined with a bargaining power that was skewed towards Valletta.

On the whole, it would be correct to think that it was the combination of converging interests of Fiat and the Government, and the strong bargaining position of Valletta resulting from his international role, which enabled the company to impose a model of development centred around the car industry, and around Fiat. In this context, state investment in steel production capacity also enabled the growth of the car industry, without forcing Fiat to massive financial exposure in the risky steel industry, which typically experiences marked fluctuations in prices and output over time.[6]

1963-1973: The end of the co-operation between the political establishment and Fiat

The 1963-1973 period saw the rise and fall of the Centre Left Governments, as well as a marked change in the overall political backdrop to the relationship between Fiat and the political authorities. The change in direction did not occur overnight, but the latent conflict of interest between the public and private sectors of the economy, and its political significance became increasingly evident during the 1960s. The 1967 decision

[5] Crucially, he persuaded the US Congress to grant the Italians Marshall Aid, of which 23%, unsurprisingly, was allocated to Fiat.
[6] See D. Valeo, *La strategia Fiat nel settore siderurgico* (Torino, 1983), pp. 39-51.

by the state-owned car manufacturer Alfa Romeo to invest in new capacity, the appointment of Cefis as Chairman of Montedison in 1969,[7] and the government mediation following the wave of strikes in the autumn of the same year, all represented the turning point in the relationship between Fiat and the Christian Democrat component of the government.

As already mentioned, Valletta had always felt ideologically and culturally distant from the DC, whereas he was more sympathetic to the Republican, Liberal, and Social Democratic parties. It was in the specific field of direct government intervention in the economy that the ideological distance between Valletta and the Christian Democrats was destined to evolve into open conflict. The rise of the centre-left government in 1962 was thus more than welcome to Fiat. In fact, the company hoped that Republicans and Liberals could counterbalance the Christian Democrats in the government, in order to make the Cabinet more sensitive to the needs (or the will) of industrialists, in terms of both the modernisation of the industrial system towards mass production, and the modernisation of society towards mass consumption. Moreover, Valletta hoped that the Social Democrat Party could effectively mediate between workers and corporations.

Nevertheless, the centre-left government did not bring good news at first, as the entire electricity industry was nationalised. Valletta was quick to spot the meaning of the move. The fact was that the DC started, under the guidance of Fanfani, to pursue greater independence from the industrialists - and from Fiat - by expanding political control over state-owned enterprises. This would have allowed the Government to promote a development policy not based on Fiat investment, and the DC to seek political consent by controlling recruitment in the state-owned companies.[8] Moreover, the nationalisation of the electricity industry indicated that the DC was seriously considering the expansion of direct economic control over productive activities by promoting the shift of private companies into the public sector. However, Valletta still hoped to be able to negotiate with the government, even in the face of disagreement, as had always happened before.[9]

---

[7] Cefis was the Chairman of ENI, the state-owned oil company. He was a Christian Democrat, and a Fanafani protégé.
[8] The control over recruitment as political instrument for building consent was called 'clientelismo'.
[9] In the Reports of the Board Meeting of March 4, 1962, Valletta showed his clear disappointment over the nationalisation of the Electricity Industry, expressing at the same time the hope that the government

The shift in power back to the political parties was due to a combination of factors. The position of Italy as an established member of both NATO and the European Community helped the Christian Democrats to manage international relations more independently from the traditional channels, such as Fiat and its management. This meant that in the late 1960s Fiat had basically lost one of the most important assets for bargaining with the Government and, more in general, with the political power. The internal and international stabilisation of Italian politics helped give the political leaders the confidence to design and implement economic policies that hardly could have met with the favour of industrialists. The various Governments that administered Italy from 1962 onwards implemented a strategy of public debt expansion, allowing for the growth of the public sector and state-owned industrial enterprises. Such an expansion would allow for political stabilisation via expanding clienteles and rent-seeking behaviours and, more in general, by expanding the political control over the labour market.

As far as the public sector was concerned, its expansion was based on a "low salary - safe job policy" in order to prevent the public debt from exceeding the already fat budget set by the Government. Therefore, the public sector expanded rapidly in Southern Italy, where levels of consumption had been kept lower in the North by slower and less effective structural change. The low salary - safe job policy was also seen with favour by those fringes of the DC and the Catholic Church adverse to the American model of work organisation based on wage growth indexed on productivity growth, and on mass production. Such a model was clearly divergent from the Catholic idea of social development because it fostered a materialistic attitude towards mass consumption in order to sustain the system of mass production.

As far as the industrial public sector is concerned, its expansion helped expand political control over access to the labour market, with clear advantages in terms of building political consent. Moreover, investments of state-owned companies contributed to the expansion of rent-seeking behaviours, which in turn provided political parties with an extra source of finance. Nonetheless, it would be to simplistic to consider the political project based on the expansion of public debt as a project exclusively driven by

---

would implement provisions in favour of the construction industry and agriculture, in order to boost sales in the lorry and agricultural machinery sector.

political deterioration and corruption. As already said, behind the Christian Democrat project lay an "anti-modernisation" ideology. This ideology had been the reason for mutual mistrust between Valletta and the Americans on one side, and the Christian Democrat and the Catholic Church on the other. But during the 1960s, with the financial and political support of state-owned companies, and within a new international political context, the DC could increasingly detach its politics from both the American Ambassador in Rome and from the man many Christian Democrat leaders saw as his assistant in Turin - Valletta. At the same time, the DC was freer to pursue a policy more in line with social project of the Vatican.

Of course, such a negative portrait of the DC represents a simplification of a more complex scenario. Within the DC and the centre-left government there were many different actors, many of whom genuinely believed that investments in the public sector would trigger the development of the Southern Italian economy, particularly because of a certain reluctance of private companies to invest anywhere south of Rome. Moreover, it would be misleading to say that the whole DC was shaped by an "anti-modernisation" ideology. Although it was the dominant one, it was not the only ideology within the DC. The party was divided into different groups, most notably the so-called left wing, postulating the independence of the party from the Catholic Church, and the right wing, which was closer to the Vatican. From the Fiat management's viewpoint, the problem was that in the late 1960s, the pendulum of power within the DC had shifted toward the right.

In terms of social history, the anti-modernisation attitude of the Christian Democrats created friction between the party and the Catholic Church and society. This friction would culminate in the defeat of the Christian Democrats following the referendum for the abolition of the Divorce Regulating Laws in 1974.[10] In terms of industrial history, the DC's anti-modernisation attitude had a negative impact on industrial relations. In particular, the pro-worker (or more precisely the anti-management) attitude of the Christian Democrat Minister of Industry Carlo Donat'Cattin turned out to be a significant bonus for the worker movement in 1969, when government mediation actually left Fiat with no other choice than to accept the unions' pay demands. This ended the regime of relative low salaries that had boosted the Italian economic miracle of the 1950s and 1960s.

Agnelli and the search for a new political equilibrium

In 1969, Gianni Agnelli had already been the President of Fiat for three years. Gianni and his brother Umberto showed much a more open attitude towards the left-wing parties, including the Socialists and, to certain extent, the PCI, than that shown by Valletta at the beginning of the 1960s. On the other hand, Valletta had proved to be a much more effective mediator with Fanfani and the Christian Democrats. This might have been quite an easy task for the man who, during the war, allegedly had persuaded the Allies not to be over-precise in bombing Mirafiori, and had persuaded the German Commander in Turin to speed up the settling of an outstanding bill for military equipment. However, the two Agnellis belonged to a different generation and perhaps to a different world. Their Anglo-Saxon education probably made a personality clash with Donat'Cattain unavoidable, but it was the broader social and economic views that were to separate the Agnellis from the Christian Democrats. Unusually for Fiat, the introduction to the 1972 balance sheet contained a political and economic analysis of the reasons why Italy, as a social and economic system, was running the definite risk of falling behind the rest of Europe once again, after continuously making up ground for two decades.[11] The analysis referred to the modernisation of the Public Administration, and to the need to prevent the diffusion of rent-seeking behaviours and to invest in infrastructure. It warned that the most urgent problem of the Italian economic system was the dangerous influence of political actors on economic activities, which, in turn caused the lack of an industrial policy based on clearly defined economic targets and rigorous development theory. In the view of Fiat management, the DC was responsible for the degeneration of the Italian economic perspective. Nevertheless, the lack of viable political alternatives to the DC created a "political strategy stalemate". The only party

[10] In 1981, the DC also lost the referendum on the abolition of the anti-abortion law.

[11] As pointed out by Comito, such considerations were usually made in the Reports of the Administration Board Meeting, whereas during the 1970s, the introduction to the balance sheets and the shareholders' newsletter were often used to communicate the management's thoughts to the external world. See Comito, *La Fiat*, p. 139.

big enough to be a political alternative to the DC was the Communist Party, which for obvious reasons could not be a political partner of Fiat. This political stalemate explains of the lack of political coherence that shaped the relationship between the Agnellis and the DC during the 1970s. Moreover, Fiat was to a large extent compromised with the political management of the Italian economy. The relationship with the DC had never been interrupted, and although Fiat saw its lobbying power reduced from 1962 onwards, Fiat was not always the losing partner. On the contrary, the relationship between Fiat and the DC took the form of an uncertain duel, in which, nonetheless, Fiat could still count upon solid contacts within the party.

On the one hand, Fiat was unable to prevent Alfa Romeo from building a new production plant in Southern Italy in 1967, but on the other it received subsidies to build its own plants in the area. Fiat took over Lancia in 1969 with the blessing of the government, but was unable to prevent the appointment of Cefis (already chairman of the state-owned ENI) as chairman of the chemical giant Montedison in the same year. Fiat had to accept the restrictive measures for circulation delivered by the government in the aftermath of the first oil crisis,[12] but in 1974 the Christian Democrats lost the battle to get Cefis elected as chairman of Confindustria[13] (the Italian Confederation of Industrialists). After a compromise with Cefis, Gianni Agnelli was elected, and tried to break the isolation of industrialists like Leopoldo Pirelli and himself.[14]

On the whole, Fiat was far too embodied within the Italian political system to become the centre of a credible political alternative to the DC, where the contradictions shaping the political role of the firm affected in particular the relationship between the Fiat Group and the PCI. Although, in theory, Agnelli shared the Communist party's opposition to the collusion between politics and management in state-owned enterprises, Fiat always attempted to take advantage from such collusion when it came to

[12] The ban on using cars on Saturday in late 1973, as a measure to preserve the national fuel stock, can be seen as a typical example of anti-Fiat Government attitude, given its dubious effectiveness in economic terms. The ban lasted four weekends.

[13] The Confederation of Industrialists.

[14] For a detailed reconstruction of the struggle for the control of the Confindustria, see Castronovo, *Fiat 1899 –1999*, pp. 1302-1311.

establishing joint ventures or doing business with firms run by IRI.[15] Not surprisingly, Niccolo' Gioia, one of the top managers close to the DC, was convinced that Fiat had to come up more effectively with the DC and "act like Cefis", which meant to try to exploit political linkages for business purposes.[16]

The dialogue with the Communist Party (PCI)

At least in principle, though, Gianni Agnelli and the PCI could find an area of agrrement when it came to opposition to rent-seeking behaviour in politics and the economy. It was in this climate of possible convergence and moderate attempts to start a dialogue that Fiat and the unions signed the agreement of 1972, with the mediation of the Communist leader Amendola and the blessing of Umberto Agnelli.

The meaning of the Amendola agreement in terms of industrial relations will be explained in the next section of the chapter. Here it is important to stress that the new Fiat attitude towards the PCI resulted in a pattern of incoherent behaviours of many managers and, in some cases, union leaders. In fact, management remained rather unimpressed by Umberto Agnelli's attitude towards the PCI. Therefore, the mutual diffidence between management and unions made the implementation of the Amendola agreement extremely difficult. This fact jeopardised any attempt to find a stable compromise between Fiat and the PCI, at least up the first oil crisis.

Fiat's attitude towards the PCI was ambiguous also because the company was under increasing pressure from the US administration not to give the PCI credibility as a government party. Therefore, Agnelli's attitude was to differentiate between the local level, where the agreement with the PCI had to be pursued, and the national level. On the other hand, the PCI was not ready for such credibility. Though determined to show internal unity as opposed to the thousand strands within the DC, the PCI actually had two souls. The first was embodied by Enrico Berlinguer[17] and Luciano Lama,[18] who shared Togliatti's loyalty to the Yalta framework and thus accepted Italy's role within

---

[15] IRI is the acronym for the Institute of Industrial Reconstruction, the largest industrial holding owned by the state, with an Administration Board appointed by the government. On the relationship between IRI see Comito, *La Fiat*, pp. 144-154.

[16] Gioia was General Director of Fiat from 1974 to 1977.

[17] General Secretary of the Italian Communist Party.

NATO. Moreover, this component of the Communist Party saw worker participation in the running of firms as a way to maximise competitiveness within a free competitive market, rather than an instrument to undermine managerial control over the production function. The second soul was represented by middle-ranking unionists and activists set on much more extreme and anti-capitalist positions. The strength of these two wings of the PCI depended very much on political circumstances, where one of the political problems of the party was to not lose consent in favour of extreme-left parliamentary and extra-parliamentary groups. To use a popular expression of that time, the party had to avoid being overtaken from the left.

The communist union CGIL had exactly the same problem. Every time far-left groups fostered a localised industrial action, the CGIL had to jump in, not to lose control over the workers. In the long term, this would have created friction among workers and the progressive alienation of orthodox communists from the unions. In the short term, this situation prevented Fiat and unions from establishing a constructive dialogue.

The PCI's attitude towards Fiat became more balanced in the immediate aftermath of the first oil crisis. Between 1969 and 1971, the communist union CGIL had emphasised wages, labour organisation and production control issues. Now the position of the PCI shifted towards the survival of the company in the face of a demand crisis accelerated by the oil shock, though actually dependent on a loss in competitiveness of the Italian product. The immediate reaction to the first oil shock was to reduce employment by implementing redundancy schemes and blocking labour turnover. The PCI did not oppose those measures and, in doing so, helped management to cope with the crisis. On the other hand, the response of government to the first oil crisis consisted of the already mentioned provisions to restrict circulation and to prevent prices from increasing. Moreover, the overall fiscal policy was inconsistent with the ongoing demand crisis.[19]

---

[18] General Secretary of the Communist Union CGIL.

[19] The special circulating tax on diesel cars imposed in 1974 penalised substantially the internal market for diesel cars and therefore Fiat. As a result the company fell behind German and French manufacturers in that important and rapidly growing segment of European demand.

1973-1983: The crisis of the Christian Democrat Party (DC)

In the aftermath of the first oil crisis, thus, the DC seemed to be indifferent to, if not distant from the Fiat management. Nevertheless, the economic recession put pressure on the DC strategy of public debt expansion, which formed the basis of the party's attempt to contain the quest for modernisation, emerging not only from the financial and industrial world, but also from civil society as a whole.[20] As already mentioned, in 1974 the DC faced the worst moral defeat in its history by losing the referendum for the abolition of the Divorce Law. However, it was in the field of pure politics that the widespread dissatisfaction with the DC became evident. In 1976, the PCI almost became the largest party in Parliament and soon it became clear that the DC was unable to offer political stability.

In contrast, the PCI was on the brink of a fundamental change in its political strategy, in its attempt to move from being a pure Marxist opposition party to a Western European democratic party capable of taking up governmental responsibilities. The political line of the PCI leader Enrico Berlinguer, which claimed political and ideological independence from the USSR, was formulated more explicitly as the European road to communism (Eurocomunismo). Such a political line gave more credibility to the PCI political agenda, which included, as already mentioned, the permanence of Italy within NATO as a precondition for the so-called "Historical Compromise". This was a strategic alliance between Communists and those Catholics more open to the modernisation of society.

Thus, in 1976 Gianni Agnelli could play the double card of dialogue with the PCI, albeit monitored by the US administration, and of political collaboration with the DC. In fact, Fanafani had to ask Umberto Agnelli to run for the Senate, as the DC was concerned about the results of the election and it seemed to be of mutual interest to reduce the friction between Fiat and the party. Although the collaboration of Umberto with the DC lasted only for a brief period, due to considerable hostility towards Fiat

[20] In this respect, the 1969 Hot Autumn was not just an industrial action but represented the trigger for a mass protest movement in which the overall social organisation from school to university to the labour division were questioned, in the same fashion as had happened in Paris in 1968.

within much of the DC, the Fanafani strategy was a sign that the balance of power was shifting slightly back to the company.

The PCI failed to win the elections, but from 1976 to 1978, the Christian Democrats could only govern with its external support. In theory, that support was consistent with the Berlinguer strategy of finding agreement with the left wing of the DC, and of preparing the transition towards a Communist government. Actually, in one of the most obscure periods in the history of the Republic, the PCI strategy provided political stability, particularly when the party participated in the Government of National Solidarity in 1978. This had been formed in the aftermath of the death of the Christian Democrat leader Aldo Moro, killed by the Marxist terrorist group Brigate Rosse (Red Brigades).

The PCI's attitudes to social and political stability, together with the moderate views of the CGIL leader Luciano Lama, certainly helped the Fiat management in the case of industrial relations, particularly in 1979, when the company shifted to a "zero tolerance" policy towards violent behaviour on the shop floor. But it was the decreasing power of the DC and the emergence of the Socialist Party, along with the intrinsic weakness of the unions that created the political conditions for Fiat to change strategy and "invest in strikes" in 1979 and 1980.[21] Those events will be described in more detail in the next section of the chapter. Here it is important to outline that the 1969-1977 period, when the workers took the most important steps towards the control of the organisation of work, were the years in which Fiat received little political support, if not open hostility, from the Minister of Labour, when it came to bargaining with unions for both wages and control of the workplace.

The political crisis of the DC was partly a reflection of the economic crisis. The oil crisis and the salary expansion fostered by the unions had hit state-owned companies as much as private ones. Therefore, the project of controlling political consent by controlling state-owned enterprises and, by this, the distribution of jobs, had been severely curtailed by the economic recession. The economic crisis had also minimised the capacity of state-owned companies to direct funds towards the illegal financing of

[21] The expression refers to the strategy of rejecting the unions' demands under the assumption that on the long-term gain deriving from the defeat of the unions will outweigh losses.

political party. Finally, the economic recession combined with large public debt had undermined the whole political project based on clienteles and widespread rent-seeking behaviours.

Since 1983, the solution to the political instability caused by the crisis of the DC was a coalition of five parties; the DC, the Republicans, the Liberals, the Socialists and the Social Democrats. The Socialists (PSI) increased their share of the vote from 9% to 16%, becoming the third largest party. The PSI leader Bettino Craxi became the premier. Moreover, he imposed a new political style, which proved to be more effective in terms of the relationship between politics and business, even if arguably immoral.

The conflict of interest between politics and business, generated by the politicians' direct control over the management of state-owned companies, was replaced by systematic corruption, which in pure economic terms proved to be more rational because it was more predictable.[22] Even when the Christian Democrat Ciriaco De Mita became premier in 1986, supported by the same political coalition, the overall style of managing the business - politics relationship did not change.

However, it should be stressed that apart from some companies controlled by the Fiat Group in the construction sector, where it was virtually impossible to operate without compromising with the authorities, the company was never directly involved in the wave of scandals that brought down "Craxism" and the five-party coalition in the early 1990s. Nevertheless, Fiat certainly profited from the end of what could be called "Fanfanism", namely the open conflict between the Government - pursuing the expansion of state-owned enterprises - and private business.

Section two

Industrial relations 1960-1987

This section deals with the developments of industrial relations from 1960 onwards, although the events of the late 1940s and 1950s will be also mentioned in order to provide a more comprehensive perspective of the shift in bargaining power from managers to workers occurring in the late 1960s. This section also builds on the

[22] In many cases discussed in court, evidence was provided the typical brown envelope ('tangente' in Italian) was worth 5% of the investment.

established literature on industrial relations, in particular the work of Musso, Contini, Berta and Castronovo.[23] The aim is to underline the relationship between the broad political events described in the previous section and changes in industrial relations.[24] The periods used are therefore consistent with those used in the previous section.

1953-1963: From union defeat to resurgence

For the entire 1950s, industrial relations had been shaped by the fundamental weakness of the unions, where CISL and Sida[25] guaranteed stability on the shop-floor and substantial collaboration with management. This had been the result of the unions' defeat between 1950 and 1955. Since the end of the war, Valletta was adamant that the influence of the Internal Commissions[26] had to be minimised. This was not only because they were dominated by militants of the CGIL, but also because they were perceived as an obstacle to the implementation of American mass production technology.[27] In fact, the internal commissions comprised highly experienced and specialised workers, who were not happy to see their craft skills undermined by the deployment of mass production technology, and the routines of the job to which they had contributed dismantled in the name of a American-style job control. Valletta thus preferred to confront CGIL directly, rather than to pursue agreement with the Catholic union CISL, because he knew that in terms of technological change the position of CISL was similar to that of CGIL. In this respect, the events of 1950-1955 reconfirm the point stressed by Stefano Musso, that "the major waves of change in the history of Fiat (World War I, the 1930s, the mid-1950s and the early 1980s) all occurred when the workers' movement

---

[23] Musso, 'Le relazioni industriali alla Fiat', in Annibaldi and Berta (eds), *Grande impresa e sviluppo italiano*, 1999, pp. 165-167; Castronovo, *Fiat 1899-1999*; Berta, *Conflitto industriale e struttura d'impresa*; G. Contini, 'The Rise and Fall of Shop-floor Bargaining at Fiat 1945-1980', in Tolliday and Zeitlin (eds), *Between Fordism and Flexibility*, pp. 144-167.

[24] The specialist reader might wish to explore the topic in more detail by analysing further the literature that has been summarised in this section.

[25] UIL (Unione italiana del lavoro) was the moderate right-wing union. Sida (sindacato autonomo dell'automobile) was an independent union of car industry workers, the formation of which had been inspired by Valletta himself.

[26] Commissions of representatives of unions and management. These were the basic shop-floor bargaining institutions.

[27] See Castronovo, *Fiat 1899 - 1999*, pp. 850-901.

has undergone a period of defeat, and with the legal or *de facto* suspension of workers' rights."[28]

Moreover, the business opportunity represented by the offshore contracts for the production of the F86 fighter aircraft helped convince Valletta to take a tough line. The contract was strategically important because it would have enabled Fiat to enter the business of NATO military contracts. However, in order to secure the first offshore contract, Fiat had to accept all the conditions set by the American Ambassador in Rome, Clare Boothe Luce. These included the careful selection of all personnel working in plants producing military equipment, CIA and Italian Intelligence Service supervision of plant security, and the elimination of communist workers from the factory. On the top of that, Valletta offered to create an internal union, which was to become the Sida, and a school for union leaders, which, in contrast, was never realised.[29]

The systematic sacking of communist workers begun in 1951, and was usually anticipated by the transfer of workers to secondary shops. Nevertheless, Valletta could launch an open confrontation with the CGIL because of two favourable circumstances. The first was the stagnation of demand, which clearly provided the economic reason for labour reduction. The second was the crisis of CGIL itself, caused by the fact that many strikes between 1950 and 1952 had been started for political reasons and were detached from any issues directly related to workers or to the firm. The increasing politicisation of the CGIL was the outcome of the union's support for the political strategy of the Communist Party, which was mainly centred on international pacifism in relation to the Korean War. Consequently, from 1950 CGIL started to lose members to the CISL, which was unwilling to support political strikes.

Thus, as in the case of the Japanese car industry, the 1950s saw the total defeat of the unions. Nevertheless, while in Japan this led to an industrial relations scheme totally skewed towards the interests of the firm,[30] lasting for the next fifty years, in the case of Fiat, the unions' defeat of the 1950s led to a temporary stabilisation of industrial

[28] L. Musso, 'Production Methods and Industrial Relations at Fiat (1930-1990)', in H. Shiomi and K. Wada (eds), *Fordism Transformed* (Oxford, 1995), p. 263.
[29] See Castronovo, *Fiat 1899 - 1999*, pp. 850- 963.
[30] To put it in a more moderate way, industrial relations begun to be based on the concept that what is good for the firm was good for the worker.

relations. The first challenge to the firm and its management did not occur until 1962, though it subsequently developed into permanent conflict in 1969. The Valetta-inspired independent union Sida did not survive the 1960s.

By the beginning the 1960s, many things were changing within and without the factory. In the first place, the CISL was not happy about the creation of an "independent" union such as Sida and, therefore, was increasingly critical of Valletta. Moreover, the CISL was trying to implement new forms of contracts involving higher levels of worker participation in production organisation, which were inspired by contract schemes successfully implemented by the American car industry. However, in this field the Fiat management, especially Valletta's lieutenants such as Gaudenzio Bono, was unwilling to accept any union proposals. The sense of oppression and frustration, therefore, was affecting even a potentially co-operative union like the CISL.[31]

A widespread sense of dissatisfaction was mounting in the firm because of working conditions. Productivity had been increasing much faster than wages, along with turnover and net profits.[32] Even the Confindustria could not deny that it could not have been possible to refuse a substantial pay rise. Finally, the flow of migrants from Southern Italy created serious problems of integration, aggravated by the lack of infrastructure and housing in big towns like Turin.

Although in 1961 the CGIL had not yet developed strategies to exploit the mounting worker dissatisfaction with the overall standard of living, it was clear that the opportunity was there to reinforce the role of the unions. By 1962, the strategy was already clear and it was that of open confrontation. Of course, the fact that two out of the three main confederations (CGIL and CISL) agreed a common action was not a good sign for Fiat. This also meant that the Christian Democrats were no longer unanimously backing Fiat and the Confindustria, as had appeared clear since 1960 when the Christian Democrat Minister of Labour Zaccagnini had backed the decision of Intersind to allow for firm-level bargaining to integrate national contracts.[33] But the Fiat management had

[31] See Castronovo, *Fiat 1899 – 1999*, pp. 1071-1082.
[32] Ibid., p. 1040.
[33] Confederation of State-Owned Companies.

failed to detect the increasing worker disaffection with the job and with the overall standard of living in the factory town, aggravated by the widespread practice of mobbing on the shop floor.

Fiat was unwilling to recognise the success of the first wave of strikes, until the local police issued official statistics on strike participation. Management then reacted by temporarily shutting down plants, triggering two further waves of strikes. Eventually, Fiat and the Confindustria had to accept the unions' wage demands and the reduction of the working week from 48 to 44 hours.

The outcome of the 1962 industrial conflict, though undesirable, was not considered a defeat by the Fiat management. In principle, Valletta had always favoured linking pay rises to increases in productivity, provided productivity gains were due more to labour effort, rather than new technology. He was convinced that in the face of higher labour costs, he could obtain more effort from workers. Perhaps Valletta failed to understand the full implications of the new alliance between the CGIL and CISL, namely the fact that Catholics were fighting alongside Communists and Socialists. This did not imply an alliance between the DC and the PCI, or even a convergence between the two within the centre-left government, which was actually rather divided particularly in respect to economic policy. However, the convergence between the CGIL and CISL certainly enabled the DC to pursue its own policies, which was not always consistent with the interests of Fiat.

The wage rises in 1963 were expected to trigger inflation. Moreover, given the superior quality of many imported consumer goods as compared to similar goods made in Italy, the expansion of wages was expected to boost imports with detrimental effects on the balance of payments. The government reacted by implementing anti-crisis measures. Fiat hoped for export incentives and property taxation, whereas the DC opted for consumption taxation and credit restriction, without even consulting Valletta. Fiat would experience this kind of isolation, not only in the field of economic policy but also in that of industrial relations, where the latter was instrumental in weakening Fiat's position with the authorities.

In terms of the relationship with the unions, Valletta did not realise one of the driving forces behind the CGIL-CISL alliance: that given a strong tendency towards local and spontaneous industrial conflicts, only a common strategy could maintain union control of the workforce. This tendency was due to almost unsustainable working conditions, in spite of the mass recruitment of labour. Paradoxically, the reduction of the working week made a bad situation worse, particularly after 1964, when demand started to expand again. As has been shown in the previous chapter, technological change simply created more bottlenecks downstream from the process, where automation could not be implemented. Thus, the conditions were there for industrial relations to degenerate into permanent industrial conflict, which actually happened in 1969. In that year the workers started to fight the same system, for the same reasons, but with greater consciousness, better organisation, broader targets, particularly in terms of worker control of the production system, and more violence. This was to continue for 11 years.

The "Hot Autumn" and the "permanent industrial conflict"

In September 1969, as the factory gates reopened after the summer break, the big surprise was that, for the first time since the end of the war, the three main unions had agreed a unified bargaining platform. The UIL had joined forces with the CGIL and CISL. Even more surprisingly, the unions had incorporated into the bargaining framework all the points made at the plant level by the Workers' Committees. This framework thus included equal pay rises regardless of the employment category of workers, the same health care regulations and bonuses for blue and white collars, a reduction of the working week to 40 hours, and limits to the implementation of extra time. This final demand was perhaps the most important of all, because it actually was the first to concern production management, and involved strategic implications beyond mere labour costs.

At first, management underestimated the determination of the unions, believing that strikes could not last for long, so that in rejecting part of the demands, there would have been a trade-off between lost production in the short term, and financial and efficiency gains in the long term. This would have minimised the predictable disappointment of the shareholders. However, not only did the unions prove to be sufficiently determined to go on for much longer than expected, but they also launched local strikes in order to create temporary bottlenecks, and although these strikes were not significant when taken individually, they had significant cumulative effects. On the top of that, the more the bargaining continued, the more unions could address the various demands continuously coming from the shop-floor representatives within a coherent framework. It became increasingly clear to the unions that the central issue was the control of the production process from the bottom, where production targets set by management were not consistent with the actual capability of the system.

This fact had led to increasing pressure from the management on the shop stewards, which ultimately created a rift between stewards pushing for increasing productivity and workers. If unrealistic production targets had created an unsustainable situation on the shop floor, then only a more democratic participation of workers in the job and process capability analysis could have restored a normal relationship between the actors on the shop floor, once management had reckoned that production targets had to be set according to job analysis rather than according to demand forecasts.

Thus, the problem was two-fold. First, management had to accept the setting of production targets according to realistic cycle times for each task, and according to the number of registered workers actually present in each shop. Second, management had to accept the involvement of workers in the job analysis, which is the process by which the cycle time of each task is determined. The setting of production targets was a strategic issue and the exclusive prerogative of top management, while job analysis was the exclusive prerogative of the Time and Methods office. Therefore, to accept these latest union demands would have meant not only destabilising a system of production essentially based on the Bedoux framework, on which the definition of time and methods was based, but also, and above all, destabilising a system of decision-making power, which, from top management to engineering middle management, was the real structure behind the Bedoux label. Therefore, after the first wave of strikes, Gianni Agnelli was now running the risk of signing an agreement that would have disappointed his own management, along with the shareholders.

The shareholders' disappointment came first, when the agreement concerning wages and working hours was signed in January 1970. The management's disappointment was still to come, and inevitably, it came in 1971,[34] when Fiat had to sign a new agreement concerning plant saturation levels and piece-work rates.[35] The agreement established three commissions, the Job Analysis Committee, the "Piece-work Committee" and the "the Job Safety Committee", all composed of representatives of workers and managers. Contini has underlined the modernity of the agreement, which had real potential to transform shop-floor bargaining into an instrument of positive co-operation between workers and management. On the other hand, even the bargaining on specific points was often very protracted, making the implementation of the agreement very difficult in practical terms.

Initially, middle managers thought they could dominate the bargaining because of their superior technical knowledge. However, they soon discovered how well-prepared the workers' representatives were, and how much the top management was detached from the shop-floor reality, as the insufficient practical knowledge of top management was one of the causes preventing the smooth implementation of the job analysis system. Still, as Berta has pointed out,[36] it is also true that between 1975 and 1977, 170 plant agreements were signed at the Mirafiori, Rivalta, and Lingotto works. Such a massive number could only result in enormous rigidity in the employment of the workforce. Moreover, as Musso has pointed out,[37] very often, particularly after 1975, these agreements were ignored and replaced by unwritten agreements made on a day-by-day basis on the shop floor. Initially, the procedure to set production on a daily basis was established for exceptional cases, in which the workforce actually present on the line was too low to meet the production target. This was an opportunity to bypass management by re-scheduling production, and the bargaining was made directly by workers' representatives and the shop steward.

The "beside-the–line" bargaining is one of the most important outcomes of the managerial defeat of the late 1960s and early 1970s. It had an enormous impact not only

[34] The agreement is known as Amendola agreement since it was signed with the mediation of Giovanni Amendola, one of the charismatic leaders of the Communist party.
[35] Note that the daily quota of production related to the normal wage was fixed. That amount was called by Fiat management cottimo, which in English translates as 'piece-work '. However, the system was not based on piece-work in the strict sense, since management was using the world cottimo improperly.
[36] Berta, *Conflitto industriale e struttura d'impresa*, p. 180.

on the management but also on the trade unions. An agreement considered by management as a defeat was also very difficult for the unions to manage. After a while, the unions started to lose control over this "beside-the-line" bargaining. This was one of the most important reasons why the whole industrial relations system started to implode, and why the unions lost cohesion in the second half of the 1970s.

The political meaning of the Amendola agreement was also extremely complex, and reflected the transition of the PCI towards being a fully-fledged European party with a right to govern. As already pointed out, the "European choice" was coherent with the strategy of the Historical Compromise. However, the European choice required a difficult transition towards the acceptance of an "European economic model" and, therefore, the acceptance of private industrial and financial enterprise. It was in this context that the PCI chose industrial relations as the field to prove that it was the party not only of the workers but also of the efficient use of inputs, which, in the Amendola view, was to be pursued by collaborating with management from a strong bargaining position.

The PCI agenda was made clear by Amendola in a seminar organised by *Il Mulino*[38] in 1973, when he stressed that the unions needed strong guidelines to avoid the opportunistic behaviours[39] of some workers, causing a waste of resources to the detriment of the working class. In addition, he agreed with Umberto Agnelli that the expansion of the public sector was going to create rent seeking, and openly accused the DC of fostering corruption through the intervention of the public hand in the economy. But it was the reference to the necessity of bringing industrial relations back into a normal framework that indicated the will of the PCI to consider the business enterprise as an actor in social life in its own right, and with specific efficiency needs to be respected.

---

[37] Musso, 'Le relazioni industriali alla Fiat', in Annibaldi and Berta (eds), *Grande impresa e sviluppo italiano*, pp. 212-213.
[38] A review engaged in political and cultural debates.
[39] Here opportunistic behaviour translates as 'corporativismo'. The fascist unions had been called corporazioni (guilds). The guilds were criticised by the Communists for protecting the interests of specific groups of labour against the interests of others, generating rifts within the working class. In his speech, however, Amendola was referring to those workers who were conducting 'beside-the-line bargaining', without union permission. Such behaviour was opportunistic, rather than anything else, but Amendola

Nevertheless, the PCI was not sufficiently unified to pursue its political strategy in a coherent way. As unions were struggling to keep the control over workers, the PCI was facing increasing pressures from radical left groups. In December 1973, the three unions started to bargain over the integration of the wage profile, but the CGIL line was to keep a low profile in terms of wage bargaining, in exchange for a Fiat commitment to invest in Southern Italy, and to improve working conditions. However, the situation went out of control as the most radical sectors of the CGIL along with extra-parliamentary groups took over the strike strategy. Moreover, radical unionists along with the Lotta Continua (LC) group pushed up wage demands by theorising that wages were an independent variable. The overall political context was also exacerbated by the action of the Red Brigades, which started to target Fiat management, as demonstrated by the kidnapping of Ettore Amerio, the Head of Personnel Department. Again, Fiat was ignored by the Government, which took part to the bargaining only to persuade Agnelli to sign the new contract in March 1974, although, in the aftermath of the first oil crisis, Fiat was on the brink of a cashflow crisis.

1973-1983: From the oil crisis to the end of the permanent conflict

The oil crisis did allow Fiat to reduce the workforce, as already pointed out in the previous sections. This time, in spite of several strikes against the implementation of temporary redundancy schemes, short time and blocks on labour turnover, unions had to accept the Fiat proposals. On the other hand, in 1975 Agnelli signed an agreement establishing a new index to be used to link wages to inflation, in the attempt to improve the dialogue with unions. He wanted to give a signal to the unions that for him the most important target was to re-establish a reasonable level of discipline on the shop floor.

Actually, the unions had already lost the control over labour, where those opportunistic behaviours already stigmatised by Amendola in 1973 had spread throughout the production shops. Workers were negotiating production levels 'beside-the-lines' without the permission of the unions, often using abusive and intimidating means to convince shop stewards. Many stewards had also been victims of direct

used the term 'corporativismo' to imply that any opportunistic behaviour was an intrinsically fascist behaviour.

violence and intimidation outside the firm, and in such an environment, terrorist groups found fertile ground not only to recruit new people but also to target their victims in the firm among managers and moderate unionists.

The incentive for the unions and the PCI to normalise industrial relations were enormous as compared to the costs of not doing so. Unions understood that their sole power and legitimacy was under threat since 1973, when the co-operative bargaining ended in confrontation, due to the ability of radical unionists and extra-parliamentary groups to operate in a climate of non-existent discipline. Moreover, the credibility of the PCI in terms of ability to reach the political targets of the Historical Compromise depended on the ability to re-address industrial relations within a normal framework.

The EUR conference of January 1978 was the official occasion in which the CGIL leader Luciano Lama re-addressed the overall framework of industrial relations. He stressed that wage bargaining had to be firmly reconnected to a business economics framework, and denied that the CGIL had ever formally or informally supported the view of wages as an independent variable. The PCI was on the point of joining the "National Solidarity Government" and the new line of the party was consistent with political developments. Nevertheless, the Lama speech was a restatement of the same line expressed by Amendola five years earlier. Sadly, yet unsurprisingly, the new line announced by the PCI and CGIL was followed by increasing escalation of terrorism at Fiat.

The phenomenon of terrorism was not new, but in those years, it was accompanied by the rise of the influence of the extra-parliamentary group Autonomia Operaia in the firm. This group's political agenda was hostile to both the firm and the unions. The radicalism of the Autonomia Operaia provided an even more supportive environment for terrorist groups. Nonetheless, in such an uncertain climate of political change and violence, came an historical change in industrial relations, at Fiat. In the summer of the 1978, Fiat deployed a new set of painting cabins at Mirafiori, following a request from unions to improve safety and reduce effort. The break time was reduced, in accordance with an agreement of 1977, stating that if new technologies allowed a reduction of effort, the break time could be reduced accordingly. Nevertheless, some workers at the painting shop started a spontaneous strike. Although the local branch of the CGIL ordered to stop this action as unjustified, workers ignored them, also committing several acts of violence and damaging tools and installations. Fiat fired them.

Although the unions formally supported the firm's position on the break issue, in practice they had to respond to the sacking with a strike, claiming that to fire the workers was too tough a measure. However, many workers had been victims of violence and abuse from members of Autonomia Operaia, and in particular from the workers Fiat had fired, and now was the time for the silent majority to speak up by not supporting the strike, which soon failed. Management picked up the feeling of this silent majority and decided that it was time to get rid of all workers who had committed violence or were suspected of supporting or belonging to terrorist groups.

Union leaders were unofficially informed by Cesare Romiti about Fiat's new course. Luciano Lama stressed that Fiat had to provide solid evidence supporting the allegations of violence, and so did the leaders of the CISL, Pier Carniti, and the UIL, Giorgio Benvenuto. However, soon after Fiat started scrutinising workers, Carlo Ghiglieno was killed, and a middle manager allegedly involved in the scrutiny process was shot in the leg a week after.[40] This last episode reinforced the management view that terrorists had an organised "fifth column" within the unions and the workforce. When Fiat eventually fired 61 workers who had committed acts of violence or were suspected of supporting terrorist groups, unions declared a strike and sued Fiat for infringement of contract. The dilemma of the CGIL and the PCI, particularly at local levels, consisted of the necessity of supporting Fiat and the new course of Lama, without losing the support of workers in favour of extreme-left groups.

On the other hand, to use the words of the head of Personnel, Maurizio Magnabosco, Fiat had decided to 'invest in strikes', and did not cancel the mass firing.[41] In any case, the strike failed again, and on the top of that many senior members of the PCI condemned the use of violence by workers. In particular, Amendola publicly admitted

[40] Carlo Ghiglieno was killed in March 1979 by the Marxist terrorist group Prima Linea (Front Line) As was typical of the strategy of terror, Ghiglieno was one of the most open-minded and moderate of the Fiat managers. Interestingly, he was one of the managers appointed from outside Fiat (from Olivetti) after 1974. He was in charge of strategic planning. The Fiat manager was killed on his own threshold, in front of his wife and children.

[41] M. Magnabosco, interview with Giuseppe Berta, quoted in Berta, *Conflitto industriale e struttura d'impresa*, p. 197.

that one of the worst mistakes of the Communist party had been to underestimate the phenomenon of terrorism on the shop floor, and not to have condemned violence of workers - against managers, unionists and other workers - as a vile and "intrinsically fascist" act against democratic institutions.

Apart from the role of the PCI and the new strategy of Fiat management, the development of industrial relations in 1979, and most crucially in 1980, was also affected by the crisis of the DC, and by the internal weakness of the three major unions, which, after 11 years of permanent industrial conflict had lost their identity along with the ability to manage industrial relations. The Christian Democrats had also lost their battle. As already stated, the intrinsic weakness of the DC social project derived from the fact that it was based upon the expansion of public debt. As soon as the expansion of the Public Sector was constrained by economic crisis, the DC discovered the dark side of political intervention in the economy. In fact, while it is extremely easy to plan the growth of state-owned enterprises, it is extremely difficult to downsize them without paying enormous political costs, particularly when the Public Sector is also the means of expanding political clienteles.

Moreover, once the DC lost its ability to buy social consent by directly orienting investments, it also lost the capacity to impose a social project intrinsically divergent from the Anglo-Saxon and European social model. The political meaning of the divorce law referendum defeat is thus the inability of the DC to propose a modern social project within an economic context, in which the possibility of buying consent for its own social project had been severely curtailed by the effect of the economic crisis, along with that of the political management, on the books of state-owned enterprises.

The Catholic union CISL was largely functional to the economic and social project of the DC. As Castronovo has pointed out, "During the 1970s, [the CISL] eventually denied one of the most important principles underpinning its industrial relations line of conduct, which was the autonomy in bargaining in respect to the DC. [...] Moreover, the progressive shifting of the largest sector of the CISL towards ideologically-biased bargaining lines (not different from those of radical left wing extra-parliamentary groups), was consistent with the political line of vast sectors of the DC [...]. For the CISL, economic democracy meant the shift of larger and larger sectors of private economic activity economy into the Public Sector. This would have been the long-term outcome [...] under the pressure of destabilising industrial actions".[42]

The question of whether the DC and the CISL had the hidden agenda of forcing an IRI take-over of Fiat is beyond the scope of this thesis. However, there is little doubt that in 1974, the effect of the first oil crisis, combined with the impact of the theory of salary as an independent variable on the outcome of wage bargaining, pushed Fiat to the brink of bankruptcy. As already described in chapter 3, the shift of Fiat into the control of IRI was avoided only because banks accepted the extension of short-term credit with the permission of Banca D'Italia,[43] while long-term capital was supplied by the Libyan Arabian Foreign Bank. Moreover, as will be described in chapter 6, the end of price blocks in 1975 and the following pricing policy allowed the increase of the price of output more than that of input. Whatever the DC agenda was, after 1975 the party started to lose strength, while Fiat managed to survive. This unavoidably meant that the pressure from the unions was destined to decrease as managerial power increased.

The intrinsic weakness of the unions and the heroic defeat of 1980

However, the pressure of the unions on Fiat diminished not only because of exogenous factors such as the political line of the PCI and the crisis of the DC. Unions imploded also because of the difficulty in controlling the workforce, a result of the diffusion of opportunistic behaviours, and the anarchist attitude of extra-parliamentary groups, along with the devastating effect of terrorism upon the general level of life on the shop floor. In general terms, the crisis of the unions derived from the fact that after 11 years of permanent industrial conflict, workers were sick and tired of the uncertainty and lack of direction that such an abnormal situation had created. Workers felt increasingly distant from the politics behind the unions' strategy, as well as from political strikes. If the rhythm of production is the rhythm of workers' life, the stabilisation of production means the stabilisation of life. The rhythm of production cannot accelerate beyond a given limit, as happened in the late 1960s under the pressure

[42] Castronovo, *Fiat 1899 – 1999*, p. 1427.
[43] The Italian Central Bank, which by law had to approve the operation. At this time, its Governor was Guido Carli, who replaced Agnelli at the head of the Confindustria in 1976. In 1980, Carli also became a member of the Administration Board of Fiat.

of the managerial quest for higher productivity, but it also can not slow below a given limit, as happened in the 1970s because of union strategy. If production is the life-rhythm of individuals, be they workers, shop stewards or managers, to stretch an industrial conflict over 11 years is strategically wrong and intrinsically immoral. It is strategically wrong because no unions can survive the immorality of the political exploitation of workers and their rights. No unions, in other words, can afford to substitute political for economic exploitation. The unions were to pay for this mistake.

After having invested in strikes in 1979, Fiat made another huge investment in 1980, and this time the return was very high. Between 1977 and 1980 the workforce at Fiat had again reached the levels of before the oil crisis. The decision of Fiat to undertake mass recruitment, particularly after 1978, has been explained in various ways. The explanations given by management referred to demand forecasting combined with high levels of absenteeism and restrictive regulations of the implementation of extra time. Unions and workers generally believed that Fiat had miscalculated the need for labour, or, particularly after 1980, that Fiat had mass recruited new labour in order to be able to fire unionised workers en masse.[44] As has been shown by Collidà and Negrelli, the hypothesis of manpower mismanagement was the most credible.[45]

In any case, it was in September 1980 that Fiat informed the three main unions that 14,490 units of labour were to be axed, due to structural labour over-capacity. Moreover, the effect of the second oil crisis, along with the fact that the government had practically ignored Fiat's call for an organic industrial policy had made a bad situation worse. Although some unionists recognised that labour had to be rationalised at some point, the union reaction, particularly in Turin, was to point out that Fiat had recruited new labour as late as the beginning of January, so that by claiming structural over-capacity, management simply wanted to hit the unions.

The point was that after the axing of 61 workers in 1979, it seems that the average health of the workers suddenly improved, with absenteeism dropping from 14.9% to 7%. Fiat did not want to sustain the burden of extra labour, now that the level of

---

[44] For the various explanations of the mass recruitment at Fiat between 1977 and 1980, see Castronovo, *Fiat 1899 – 1999*, pp. 1510-1528. See also Contini, 'The Rise and Fall of Shop-floor Bargaining at Fiat 1945 – 1980', in Tolliday and Zeitlin (eds), *Between Fordism and Flexibility*, p. 163.

[45] Collidà and Negrelli, *La transizione nell'industria e nelle relazioni industrial*, pp. 185-196.

absenteeism could be reduced by restoring discipline on the shop floor.[46] In any case, production was stopped on the initiative of the shop-floor assemblies. Unions at the national level were obliged to enter the process and support the workers. At the local level, the prevailing strategy was to block access to production plants. Although neither Castronovo, Berta or Musso underline this aspect, it seems to the author of the thesis that this strategy reflected the local delegates' awareness that a strike might fail, so that picketing was a much safer, and perhaps the only viable strategy.[47] In any case, at the national level, the unions decided to support the worker movement in Turin.

The PCI had just withdrawn from the National Solidarity Government, and now, holding a much more critical position towards Fiat and Confindustria, tried to mediate. But the visit of Berlinguer in Turin was interpreted by the local unions and shop-floor assemblies as PCI approval for the picketing, rather than an attempt to support the bargaining process. The tough confrontation started almost immediately, with workers blocking access to the plants.

However, the main question was: who were these workers? Many of the pickets were manned by members of Lotta Continua or Autonomia Operaia, and many of these were not even workers. This was not a secondary element of the mounting anger of workers and blue collars against the unions. It simply meant that a significant number of workers was prevented from earning their salary and cut off from any decisions concerning the future of Fiat by students, retired workers, and other individuals external to the firm who had nothing to lose. Fiat managers certainly knew this, and the company provided logistical support to a group of workers who had organised a meeting to protest against the picketing, to be held on October 14.

Meanwhile, the Minister of Labour, the Socialist Foschi, had proposed a compromise. This included short time for 24,000 workers, and the placing of all Fiat Auto workers on the state-financed temporary unemployment fund (Cassa Integrazione) from October 6, 1980 to January 6, 1981. The Cassa Integrazione, though, had to be

[46] As was pointed out by a white-collar worker during the assembly held by middle-ranking workers against the unions on October 10, 1980. See Castronovo, *Fiat 1899 – 1999*, p. 1523.
[47] The unions knew from an internal survey that the majority of workers were unimpressed by the policy of the unions in the early 1980s. The conclusion of the CGIL survey has been reported by Mattina, *Fiat e Sindacati negli anni 80*, Appendix.

implemented according a rotation scheme by which each worker could not be unemployed for more than 6 weeks. This became the main bargaining issue. In fact, Fiat did not accept the principle of rotation because it would have required additional training each time workers had to change tasks. Unions, on the other hand, suspected that without rotation the temporary unemployment would have been eventually transformed into permanent redundancy. Other measures included incentives for early retirement and a freeze of labour turnover. Soon after the reassignment of the premier Cossiga at the end of September, Fiat proposed the Cassa Integrazione for 22,000 workers without rotation, and the unions rejected the offer.

The stalemate was broken on October 14, when a huge number of blue collars and workers gathered at the assembly of the newly formed middle-rank committee (Coordinamento dei Capi). The meeting proceeded as a silent protest through the streets of Turin, and although the exact number of protesters was never established, the event became known as the "Protest of the 40,000". Even here, not all the protesters were Fiat employees, but this reinforced the impression that the unions were losing contact with civil society. This time, the protesters were silent, and were not preventing anybody from doing their job. Nevertheless, they were visible. That night, the unions signed an agreement, where 24,000 workers entered the Cassa Integrazione scheme, for three years rather than one, without rotation. The unions could participate in the selection of workers. Moreover, the Minister of Labour's proposals for incentives for early retirement and the block on labour turnover were also accepted by management. The agreement in itself, therefore was not a dramatic defeat, but it was perceived as a defeat of the unions by workers and public opinion. As the CGIL leader Luciano Lama pointed out in an interview for *L'Unita'*, "35 days of strike and occupation are very tough for workers, too tough to be compensated by just signing an agreement."[48]

The "Heroic Defeat"

It is interesting to notice that the unions knew that they could not count on the mass participation of workers in ordinary strikes, since a survey undertaken in January 1980 had provided them with plenty of information about the increasing divide among workers.[49] Thus, it did not come as a surprise that after a few days, it was clear that the number of currently employed workers engaged in the picketing was marginal. Moreover, the unions knew about the ongoing market crisis, which caused the stock of finished goods to increase considerably. The question thus arises of why the unions engaged in a direct confrontation with management from a weak bargaining position.

Castronovo suggests that in the initial phase of the conflict, the local union branches pushed the confrontation further than the National Secretaries of the CGIL, CISL, and UIL would have liked. Thus, both unions and the PCI were trapped in a situation they could not control.[50] However, Miriam Golden has suggested convincingly that the 1980 strike was a case of *Heroic Defeat*.[51] Golden's analysis fits into the political and industrial relations context that has been described so far. In addition, it provides a rational explanation for the fact that the unions went for confrontational bargaining, knowing that they would have lost. Heroic defeats, in fact, occur exactly when union leaders undertake strikes, while foreseeing their defeat, in a context in which management pursues mass job reductions and there is non-formalised seniority scheme regulating the labour downsizing process.

In the case of Fiat, the unions already knew the extent of their weakness before management announced the 14,000 redundancies. Nevertheless, precisely because the unions could not prevail in the field of mass labour reduction, they had to preserve their own existence, by institutionalising their role in the process of mass labour reduction, and formalising their residual power in respect to the workers, rather than the management. This meant that the unions had to become involved in the process of selection of those workers who had to be axed, provided that there was still no formalised seniority scheme agreed by both unions and managers to regulate the firing process. This was the reason why the Ministry of Labour proposed the rotating temporary unemployment scheme (Cassa Integrazione). The rotation would have prevented Fiat from transforming the temporary unemployment into a permanent

---

[48] Interview with Luciano Lama, *L'Unita*, 19 October 1980
[49] See note 47.
[50] Castronovo, *Fiat 1899 – 1999*, p. 1516.

expulsion of workers. Therefore, the rotation would have minimised the problem of who had to choose the redundant workers, while the unions would have been granted the formal privilege of organising the rotation.

Fiat, on the other hand, was ready to replace workforce reduction with temporary unemployment schemes only if management could choose not to take back workers after the end of the scheme. This requirement excluded rotation and reintroduced the problem of who was going to choose the redundant workers to be put in temporary unemployment. Eventually, the actors signed an agreement in which local public institutions committed themselves to relocate workers involved in the temporary unemployment scheme in other firms or positions. Management, on the other hand, committed itself to take back those workers who had not found another job during the period of temporary unemployment. Finally, the unions were involved in the selection of redundancies. As far as the re-deployment of workers is concerned, the commitment of both management and the institutions was not credible from the beginning. Thus, Fiat won its point, but the unions ensured their survival in the factory by being part of the redundancy scrutiny process.

After the events of 1980, the role of the unions gradually developed into a more normal institutionalised bargaining. Wage bargaining and extra time implementation were reconnected to an orthodox industrial relations logic, so that by comparing Fiat with any other car manufacturer in Europe, the unions could hardly be defined as particularly subject to managerial power. On the other hand, only 4,000 of the 24,000 workers put into temporary unemployment schemes returned to Fiat in 1984, and many of them quit after a while because they had been re-deployed in marginal shops, and not retrained to use up-to-date machinery. The less moderate unionists were forced to quit or transfer to marginal shops. Technological change was no longer discussed with unions and returned to being a pure managerial prerogative. Nevertheless, in the field of job safety and working conditions management and unions achieved remarkable co-operative results.

---

[51] See: M. A. Golden, *A Rational Choice Analysis of Union Militancy With Application to the Cases of British Coal and Fiat*, Western Societies Program, Occasional Paper no 26, Centre of International Studies, Cornell University (Ithaca, 1990).

Section three
Technological change and industrial relations

The previous section explains the unions' defeat of 1980 as the result of the intrinsic weakness of the unions combined with more favourable socio-political conditions helping management to re-establish managerial control over the production process. This section criticised the idea that the deterioration of industrial relations after 1969 forced Fiat management to invest in robotics in order to reduce the strength of unions. Such an argument has been defined as "the technocratic" response of management to deteriorating industrial relations.

The unconvincing relationship between technological change and agents' bargaining power

By reconstructing the political and industrial relations history of Italy in the 1970s, this chapter highlights the reason why, from the mid-1980s, industrial relations experts started to acknowledge that the internal evolution of the three main unions along with developments in Italian politics had affected industrial relations much more than any other factor. Experts started to credit technological change for having helped to stabilise industrial relations after the defeat of the unions in the 1980s, mainly through the positive effect of robotics on working conditions, but they dismissed technology as the main drive behind the unions' collapse at the beginning of the 1980s. This was a radical departure from the "technocratic response" argument that had been developed in the 1970s and early 1980s, according to which technological innovation was driven by the attempt of management to reduce the bargaining power of the unions. On the other hand, the technological response argument was not criticised from a theoretical point of view, nor was it tested on the empirical ground. In the absence of a theoretically structured criticism, it could be argued that the *ex post* recognition of the structural and political weakness of the unions as an explanatory factor of the their defeat does not automatically exclude the *ex ante* argument that when the deployment of robotics started in 1972, management might have expected a significant impact on industrial relations, and that such expectations were the real drive behind technological change, regardless of the actual outcomes.

It has to be pointed out that the technological response argument, which sees technological change as driven by the *ex ante* expectation of management that robotics would impact industrial relations, implies a technological discontinuity, which would appear as inconsistent with the engineering-led and evolutionary interpretation of technological change that has been posed in chapter 4. For these reasons, it seems important to criticise the idea that technological change was inspired by expectations of improvements in industrial relations, although this thesis does not aim to add to the industrial relations debate.

In order to address the question, it is important to establish whether the agents who actually masterminded the deployment of robotics at Fiat had theoretical or practical reasons to believe that the technology would decrease the bargaining power of the unions. This leads to the question whether the engineers who planned the investment in new production tools had information about industrial relations within Fiat, and whether that information could have suggested that robotics would improve industrial relations.

From a theoretical point of view, the impact of capital substitution for labour on industrial relations depends on whether it concerns the entire process or whether it is localised within specific stages of production, so that investments in fixed capital do not affect labour intensity to the extent that workers lose control over the process.[52] Furthermore, if the substitution of capital for labour is localised, the question should be addressed whether industrial relations are shaped by cohesive or non-cohesive unionism. Cohesive unionism is when workers are organised in a single union or in a set of unions that co-ordinate their bargaining platform and, if necessary, their plans for industrial action. By contrast, non-cohesive unionism refers to a situation in which workers are organised in different and not necessarily allied organisations, according to their specialisation.[53] In a context of cohesive unionism and adversarial industrial relations, a firm investing in retooling is exposed to the action of unions because of the low level of

[52] See: G, Bamberg, 'Technological Change and Unions', in R. Hyman and W. Streek, *New Technology and Industrial Relations* (Oxford, 1988), 204-219.
[53] A typical example of non-cohesive (or multiple) unionism is represented by the British car industry. See: Foreman – Peck, Bowden, McKinlay, *The British Motor Industry*, pp. 177-181.

capital amortisation, unless the substitution of capital for labour is rapid and extensive. By contrast, with non-cohesive unionism, localised substitution of capital for labour should be expected to play in favour of management when it allows mangers to eliminate jobs in those shops in which workers are represented by unions that are more radical.

As has been shown in chapter 4, in the late 1970s and early 1980s, the deployment of robotics at Fiat was localised mainly in the spot-welding and painting shops, whereas the final assembly remained relatively labour intensive, although rationalisation led to a reduction of the total labour input in the whole process. The new robotised shops were jointly designed by Fiat engineers and experts from the robotics supplier COMAU.[54] Thus, the Fiat production engineers knew to what extent the new technology was going to affect the labour intensity of the company, and the extent to which unions were going to retain the ability to create artificial bottlenecks along the production chain. As far as unions were concerned, it has been shown that during the 1970s industrial relations in Italy, and indeed at Fiat, were shaped by cohesive unionism, where the majority of workers was represented by the three main national unions regardless of their job or specialisation. Furthermore, the CGIL, CISL and UIL were confederated and planned their action together.

Given that the implementation of robotics at Fiat was localised, that industrial relations were characterised by cohesive unionism, and that production engineers who masterminded the implementation of robotics had information on both the development of the process and the regime of unionisation, it is reasonable to suggest that Fiat engineers had no sound theoretical reason to expect that the deployment of robotics was going to have a necessarily positive effect on industrial relations. On the contrary, they should have expected a deterioration of the bargaining position of management, because of the low level of amortisation of the fixed capital in which the company had invested. This is the reason why Musso's argument that the defeat of unions was a pre-condition for the full deployment and maximisation of new technologies is the most theoretically sound, although the author does not model his argument in the theoretical terms used in the paragraph above.

From theory to practice: Macro- and micro-conflicts

By suggesting that production management had no reason to expect investments in robotics to have a major impact on the ability of unions to stop production, this does not mean that Fiat engineers were not involved in a number of initiatives, including organisational and technical change to try to minimise that ability. It simply means that they could not expect robotics to have an intrinsic ability to minimise the action of the unions.

The measures taken by management to counteract unions should be analysed in relation to two different situations, the micro- and the macro-industrial conflict. Here micro-conflict means the action of a limited number of workers for a limited amount of time, aiming to create an artificial bottleneck in the production flow. Micro-conflicts were quite diffused at Fiat during the 1970s, although they took place in a context of cohesive unionism. The unions were involved both logistically and politically in micro-conflicts, although, after 1975, they progressively lost the control over this form of action, as localised strikes started to be increasingly fostered by extremist and extra-parliamentary groups. Official unions tended, at least up to 1979, to provide ex-post political support to those strikes, in the fear of appearing too sympathetic to management and of losing the support of unionised workers. As already pointed out, this was a major mistake for the unions, and one of the reasons for their internal decline.

Localised strikes rarely stopped production. More often, the effect was to slow production down. Whether or not production was stopped or just slowed depended on the number of workers participating in the action. Both union and management sources confirm that engineers made an effort to adapt the production system in order to cope with partial strikes.[55] However, this effort was reflected in changes in the layout of the production flow, rather than in the technology of the production tools. Fiat developed an inter-operational conveyer in order to connect together parallel lines, featuring homologous sets of tools. The theory underpinning the use of such a layout was that if

---

[54] Source: author's interview with Malandri and Scimone, 18-03-1999.

[55] See Germanetto, Bronzini, Guido, *Fiat.* See also Bonazzi, *Il tubo di cristall*; interview with Vincenzo Verri, (Executive Manager), p. 151.

multiple lines were connected together by a network of conveyors, and only some lines had been stopped in a given stage of production, components coming from the upstream stages of the process could be diverted to the operating lines, while non-operative lines could be bypassed. The deployment of an inter-operational conveyor aimed also to minimise the effect of localised absenteeism, which created bottlenecks in the same way micro-strikes did.

It is interesting to notice that between stamping and welding, the inter-operational conveyor consisted of a traditional conveyor following a non-linear layout.[56] As described in the previous chapter, after 1976, though, in some welding and mechanical assembly shops, trolleys moving along a magnetic path and controlled by computers were used instead of inter-operational conveyors. Multiple lines were operated in different plants regardless of the set of tools deployed. It is reasonable to say, therefore, that the reaction of managers to localised strikes had more to do with process layout than technological change.

However, the interesting question is whether the development of non-linear layouts was an effective technical strategy to normalise both production and industrial relations. In order to address this, it is necessary to understand the context in which localised strikes were organised. One of the features of industrial relations at Fiat during the 1970s was the practice of the so-called "beside-the-line" bargaining imposed by unions. In each line the output was decided at the beginning of each shift by unionists and foremen, according to the availability of labour, the technical capability of the tools deployed to cope with production targets, and to the consistency of production targets with safety requirements. In the early 1970s, the unions had introduced this practice initially to avoid the situation of the late 1960s, when production targets were set according to demand and with little consideration for the inputs actually available for production, which in turn exacerbated a rift between workers and managers. Later, though, unions increasingly utilised the "beside-the-line" bargaining as a generalised means of putting pressure on management. The mechanism had been designed to prevent management from asking those workers actually present on the line to increase their effort, in order to compensate for the absence of their colleagues. Because "beside-the-line" bargaining concerned the output of each specific line in which bargaining took place, daily production levels tended to change for every line. Clearly, this form of bargaining was the most serious challenge by the unions to the Fordist system of mass production at Fiat, in which the most complex operation had been typically hyper-segmented, in order to keep the cycle time as close as possible to that of the most simple operations. Through the practice of "beside-the-line" bargaining, the speed of production of each line was calibrated to that of the slowest segment in the line. The Fordist principle of cycle-time equalisation was also denied because the speed of production was even along a line, but was uneven across lines. Critically, localised strikes or a high rate of absenteeism in a given line represented a good reason to slow the pace of that line as well as the pace of subsequent lines. If the non-linear layout of the components flow had been efficient, the speed of production of a given line or segment of a line would no longer depend on the functioning of the preceding or subsequent line or segment, so that each stage of the process could operated at its own pace. As a consequence, the progressive disappearance of the "beside-the-line" bargaining should have been expected. Obviously, the total output would have been still lower than the normal because not all the capital available was actually utilised and because the efficiency of the system was likely to be lower than that of a system based on a linear layout. However, the justification for setting the pace of each line at the beginning of each shift would have been removed, and a fixed or semi-fixed measure of production pace would have been reintroduced. Nevertheless, "beside-the line" bargaining remained widespread up to the defeat of the unions in 1980,[57] which indicates that non-linear layouts did not bring any sizeable advantage in terms of production flow within a context of turbulent industrial relations, and that management could not normalise industrial relations by exploiting technological advantage. Both arguments reinforce Musso's view that a normalisation of industrial relations was a pre-requisite for technology maximisation and vice-versa. Moreover, this consideration seems even more pertinent when applied to sizeable investments in robotics, which

---

[56] Ibid.

[57] Musso, 'Le relazioni industriali alla Fiat', in Annibaldi and Berta, *Grande impresa e sviluppo italiano*, p. 225.

could not be profitable if the downstream labour-intensive lines were subjected to off-line output bargaining.

The literature concerning industrial relations during the 1970s is also full of information about the tactics adopted by unions during major strikes, and the counter-manoeuvres implemented by management.[58] In providing this information, the literature provides the implicit empirical confirmation that in a regime of cohesive unionism, the localised implementation of robotics should not have been expected to have a significant impact. During major strikes at Fiat, a number of well-known tactics were put in place, such as the blocking of the plant inlet and outlet gates, in order to prevent workers from getting in, and finished goods from leaving the factory. On the other hand, managers tried to deploy those workers who had been able to enter the factory on a small number of lines, in order to carry on with a limited production programme. At other times, when the strike was supposed to last for only one of the two ordinary shifts, or for one hour per shift, managers decided to stop production altogether, in the hope it could create friction among workers.[59] This was the case when the company was running oversized stocks of final goods. As already shown by chapter 3, after 1973 Fiat often ran such stocks, and therefore, management was often interested in avoiding artificial bottlenecks in distribution rather than production. When managers feared a long strike, they moved the stock of completed cars from the factory yards to the dealership network within and outside the Turin hinterland. This was a critical factor in the managerial strategy during the strike in the autumn of 1980, when the oversized stock of cars enabled Fiat to sustain 32 days of strike. During mass strikes at giant plants the size of an urban suburb, such as Mirafiori, both unions and managers were usually engaged in a range of military-style tactics and logistical exercises. In such a scenario, if it was asked whether the implementation of robotics in some stage of the process would really matter, the logic answer would have been no.

As already said, the political sphere of industrial relations was overwhelmingly important, so that the confrontation between management and workers exceeded the boundaries of "normal" industrial relations. The duration and frequency of strikes was

[58] Castronovo, Fiat *1899-1999*, pp. 1510-1528.
[59] See Guidi, Bronzino, Germanetto, *Fiat*, pp. 36-50.

highly affected by a political legacy shaped by a strong anti-management attitude. There was little scope for managers to expect technology to have an immediate effect on the ability of unions to slow or stop production. However, Bonazzi has argued that robotics, and more generally technological change had a long-term positive effect on the relationship between managers, foremen and workers, helping management to normalise industrial relations.[60] The author describes the process as a long-term one. During the 1970s, management focused on those sectors in which working conditions were particularly contentious, with the specific aim of minimising absenteeism and micro-conflicts. If anything, by replacing workers with robots in welding and painting, where levels of noise and pollution and the amount of physical effort required by the operation were exceptionally high, management actually removed one of the sources of friction with unions.[61]

However, as far as the short-term perspective is concerned, it should be asked whether, on the grounds of safety and general working conditions, managers should have expected collective and individual support from workers for the replacement of labour with capital in some stages of the process. In fact, management chose to deploy new labour-saving tools rather than to improve working conditions *ceteris paribus*. In this respect, the distinction between the elimination of direct labour from the most distressing, dangerous and unhealthy tasks, and the improvement of working conditions without the actual elimination of jobs is crucial. Under normal circumstances, if output levels are expected to increase, unions tend to accept the replacement of labour by capital in the more distressing and unhealthy operations, under the assumption that labour saved in those operations can be re-deployed elsewhere in the process, to cope with the expected increase in output. If production is not expected to increase, unions tend not to favour the substitution of capital for labour, in order not to lose jobs. On the contrary, unions push for a reduction in the cycle time, as a measure to improve working conditions.

Crucially, conditions at Fiat were not normal. The widespread practice of "beside-the-line" bargaining made the unions' response to investments in improving working

[60] Bonazzi, *Il tubo di cristallo*, pp. 104-105.
[61] Ibid.

conditions less predictable. The whole system of shop-floor output bargaining during the 1970s was justified by the assumption that safety and stress containment can be achieved only by expanding labour control over the cycle time. In this respect, technological innovation was seen by the unions as an attempt to take the control of the cycle time setting away from them. This was particularly true between 1969 and 1973, but after the first oil crisis, unions started to agree on the principle that technological innovation had to be used to improve safety, and that effort needed to be increased in the face of improved working conditions. Nonetheless, it was one thing to agree in principle, and another thing to translate a principle in practice. As has been previously shown, unions faced the opposition of the most radical wings of the workers' movement to agreements that recognised the right of management to ask for higher effort in the aftermath of technological innovation.[62]

As was the case with the example of non-linear layout, if technology-driven improvement of working conditions had a short-term positive impact on industrial relations, a progressive disappearance of the "beside-the-line" bargaining should be expected, but this was not the case. Moreover, in the context of the 1970s, management could not expect unconditional consent for the substitution of capital for labour aiming to improve working conditions, precisely because it would have undermined the justification underpinning the system of "beside-the-line" bargaining. In other words, management could not expect unions to give up their main instrument of control over production so easily. Therefore, in the short term, investment in capital would have caused more micro-conflict and splits between unions and managers.

Contini has pointed out that in those shops where "beside-the-line" bargaining was not taken too far and the plant agreements were applied correctly and within a logic of mutual respect of rights and duty, innovation, be it in terms of layout, organisation or technology, brought positive results.[63] This is another indication that management could expect a long-term positive effect of a technology-led improvement of working

[62] The reference is to the case of 'Luddism', described in the previous paragraph, occurring at the Mirafiori plant in September 1977, when some workers rejected the principle that the total rest time per shift in a specific segment of the painting shop could be reduced as a consequence of the deployment of new tools improving working conditions.

conditions, once industrial relations were normalised. In the same way, management could have expected that technological change would contribute to the maximisation of overall efficiency after normalisation.

Therefore, it does not seem correct to consider industrial relations as the main drive behind technological change. In the short term, management could neither reasonably expect technological innovation to minimise the unions' ability to create artificial bottlenecks nor that the removal of direct labour from distressing jobs would have necessarily increased the workers' consent of management. However, in the long term, it does appear fair to say that technological change contributed to sustained improved industrial relations, after the political defeat of unions had occurred.

Conclusions

Building on the most recent literature on industrial relations at Fiat, this chapter has shown that political factors and industrial relations developments explain the defeat of management during the 1970s as well as the defeat of the unions in 1980. This was the outcome the decision to invest in strikes taken by the Fiat management in 1979. Ten years earlier, political conditions and a higher degree of worker cohesion would not have allowed the company to go that way. Developing the argument, the chapter highlights the complexity of industrial conflict at Fiat, and the reasons why, from the mid-1980s onwards, the industrial relations literature no longer explained the defeat of the unions in technological terms alone, suggesting instead that the recovery of managerial power was the precondition for maximising technological change. Following this line, it has been shown that given the complexity and the precariousness of industrial relations during the 1970s, there was neither theoretical nor practical ground for management to believe technological change was the way towards the stabilisation of industrial relations. Thus, it would be difficult to believe that technological change was initially inspired by management's expectation that new technology would have an impact on industrial relations. This view is consistent with the conclusion of the preceding chapters, showing that technological change in the 1970s and 1980s aimed to

---

[63] Contini, 'The Rise and Fall of Shop-floor Bargaining at Fiat 1945 – 1980', in Tolliday and Zeitlin (eds), *Between Fordism and Flexibility*, p. 163.

resolve the bottlenecks generated by the process of automation carried out by Fiat during the 1960s, rather than to pursue a radical shift in production management towards flexibility. Nevertheless, the recovery of managerial power was a necessary precondition for an effective implementation of new technology.

Chapter 6

Output-Mix Optimisation Strategies at Fiat, 1960-1987

Introduction

This section of the thesis consists of two chapters both referring to output-mix decision-making. This is the second variable analysed by this work in order to approach the issue of continuity and discontinuity in management at Fiat before and after 1973. The section shows that output-mix optimisation strategy at Fiat was based on a routine, which links output-mix decision-making to the regime of competition. The regime of competition means price competition as opposed to collusive price leadership. This chapter deals with output-mix decision-making from the late 1960s to the late 1970s, while the next one analyses the output-mix issue in the 1980s.

Since the post-war period, Fiat had specialised in the manufacturing of small cars. Units above 1100 cc were produced mainly as "flagship models", in order to enhance brand reputation. Yet, those models were expected simply to break even or provide modest shares of total profits, while the bulk of profits came from vehicles below 1100 cc. This chapter shows that during the 1970s, Fiat adjusted its output mix upmarket despite its specialisation, and that the move was connected with the regime of competition. Under the protective umbrella of collusive behaviours,[1] Fiat could set prices in the domestic market according to its own cost structure and desired margin of contribution. This means that French and German competitors, on the other hand, were adjusting their price upward the Fiat ones, so that their comparative advantage over Fiat in the manufacturing of upmarket units was minimised.

Collusion was a substitute for prerequisites to the efficient manufacturing of upper-range units. Here prerequisites mean efficiency-maximising factors that were characteristic of the German and, in part, of the French car industry. These factors included specialisation in the design and engineering of high quality units, specialisation in the supply of quality components, a reputation for quality manufacturing, and scales

[1] The regime of competition in Italy during the 1970s has been analysed at industry level by Silva, who proved that the European industry during the 1970s suspended price competition, in that in each national market prices were set by the national champion while external competitors followed upward. See Silva , Prati, Grillo. *Il mercato Italiano dell'auto.*

of production sufficiently large to enable the maximisation of operating profits. Crucially, the chapter provides evidence that given price levels in any segment of the domestic market, per unit contribution margins of the medium and upper segments of the Fiat production range were higher than those yielded by Fiat's bottom range. As long as the collusion held, Fiat could profit from the relative expansion of the middle and upper segments of demand brought about by the maturation of the Italian market.

Nonetheless, Fiat management did not exploit the opportunity offered by the suspension of price competition to restructure design and manufacturing processes and to enhance competitiveness in the upper end of the production range. On the contrary, Fiat management shifted back downmarket at the end of the 1970s. The final chapter of the thesis will show that this shift was a response to the expectation that price competition would be restored in the 1980s. Given that Fiat had missed the opportunity to enhance its competitiveness in the upper range, there was no other choice than to shift the output mix back downmarket where management thought Fiat still had the comparative advantage.

From the analysis carried out in those two chapters of the thesis, thus, it appears that in the late 1960s Fiat management looked at the shift upmarket as an opportunistic move to exploit medium-term favourable circumstances, while the basic routines underpinning technological and design development efforts did not change. Fiat remained specialised in the bottom range of the market, despite the fact that the progressive maturation of the Italian market and the abolition of tariffs implied that the medium and top range of the demand spectrum would become extremely important and lucrative segments of global demand. If Fiat management thought to shift upmarket only if collusion was in place, which means without changing the specialisation pattern of the company, it is possible to say that from the late 1960s to the late 1970s, the basic routines underpinning output-mix decision-making did not change over time.

By saying that management decided to shift the output mix up- or downmarket, it is meant that managers decided to focus on a given segment of the market by prioritising product renewal. Because market shares are influenced by product renewal, the amount of resources allocated to the renewal of specific segments determined the commercial success of specific models and, ultimately, the output mix.[2] The shift upmarket of the late 1960s and early 1970s was due to product renewal focusing mainly on Fiat's top range and on the Lancia range. On the other hand, the shift downmarket of the late 1970s and early 1980s was the result of a product renewal strategy, allocating the larger share of resources on the bottom range.

Moreover, the new Fiat and Lancia models launched in the early 1970s shared existing Fiat mechanical components. This indicates that in the 1970s, Fiat wanted to contain costs of research and development, rather than to increase its chance of being competitive in the top end of the market. Assembling new chasses with old components was clearly not the best strategy to establish Fiat as a long-term competitor in a market segment in which the company lacked the reputation of the German manufacturers. By contrast, in the early 1970s the product renewal of the bottom range included new chassis and engine designs, by which Fiat was able to regain the technological and commercial edge and to retain it in the long term.

The analysis of output-mix decision-making developed in this section of the thesis is mainly based on unpublished sources and brings interesting results in the context of Fiat's business history. Moreover, the implications of those results are also relevant for the issue of discontinuity within the context of the debate on post-Fordism. It is critical to note that since upmarket adjustments of the output mix were made only when collusive behaviours were in place, the incentive to enhance efficiency in designing and manufacturing upper-segment units was minimal. Consequently, during the 1970s and 1980s, the pattern of design and production skills remained rather stable and Fiat kept its specialisation in the manufacturing of small cars. The Fiat management's preference for the bottom range of demand reflected the stock of technical and managerial knowledge accumulated by the company over time, as well as the Fordist approach to mass production, based on the containment of process and product complexity. In this sense, the routine underpinning output-mix decision-making at Fiat was coherent with the process-oriented technical culture of the Fiat technical management, which saw in the containment of product and process complexity the principal profit-maximising factor.

---

[2] See W. J. Abernathy (ed.), *The Productivity Dilemma: Roadblock to Innovation in the Automobile Industry* (Baltimore, 1978); W. J. Abernathy, K. B. Clark, A.M. Kantrow, *Industrial Renaissance:*

In this sense, output-mix decision-making was consistent with the process of technological change described in chapter 4. As already shown, the search for new technologies during the 1970s was inherently driven by the search for cycle-time minimisation, rather than flexibility. This was consistent with a marketing strategy based on an output mix skewed downmarket, because downmarket units are produced at a faster pace than upmarket ones. Thus, continuity in the routines underpinning technological change reflected continuity in the routines underpinning output-mix decision-making.

This chapter consists of three sections. The first exposes the theoretical rationale behind the routine of choosing an output mix according to the regime of competition. The second deals with output-mix decision-making during the 1960s, while the third concerns shifts in the output mix during the 1970s. Based on primary sources, the chapter shows that the routine of linking the output mix to the regime of competition had been established by Valletta, and that, contrary to common knowledge, during the 1970s Fiat actually shifted upmarket in response to implicit collusion. By quoting internal unpublished documents, it will be shown that in 1975, Fiat management regarded the pricing behaviour of competitors as predictable, and that, given the role of price leader enjoyed by Fiat in Italy, the shift upmarket was profitable. The following chapter of the thesis will show that during the 1980s, price competition was restored, and Fiat shifted back downmarket. Moreover, the available evidence indicates that the output mix skewed downmarket was the best profit-maximising choice.

Producing a Competitive Future for America (New York, 1983).

Section one

The economic rationale for linking output-mix decision-making to the regime of competition

This section highlights the relationship between the regime of competition and output-mix decision-making. First, the problem of output-mix optimisation strategy will be defined in relation to the established literature. Then, the section moves on to analysing changes in the Fiat output mix from 1968 to 1987. Finally, starting from the price competition theory, the section will investigate why shifts from price competition to collusive price leadership and vice versa might affect output-mix decision-making. Based on primary sources, the following sections of the chapter will show that Fiat fits into the case in which the regime of competition determined the output-mix optimisation strategy. Moreover, it will be shown that such a decision-making routine remained constant over the period considered by this thesis.

Output-mix optimisation and the established literature

Since the end of the Second World War, Fiat has established a solid reputation as a mass producer specialising in the lowest segment of demand. This reputation derives from the commercial success of models such as the 500, the 600 and the 850,[3] whose low selling price helped fuel the enormous expansion of internal demand during the years of the so-called "economic miracle" (1955-1969). The more recent success of the Uno, which, during the 1980s allowed the company to recover from the crisis of the 1970s, has confirmed and even reinforced the traditional image of Fiat.

At beginning of the 1980s, part of the analytical contribution to the debate about the state and the future of the car industry consisted of isolating the effect of the two oil shocks, from both the weaknesses inherent to the industry and those specific to individual firms. The distinction between exogenous and endogenous crisis factors was, in fact, crucial in order to foresee medium- and long-term strategic developments. As far as Fiat is concerned, many observers and analysts suggested that one of the weaknesses of the company consisted precisely of an output mix skewed towards lower segments of the market. In fact, during the 1970s, medium and large segments had been growing faster than the lower segments of demand, as an effect of market maturation. That trend

[3] All these models belong to segment A.

was expected to continue in the 1980s. Moreover, cars competing in the medium and upper segments were expected to yield higher per unit margins of contribution to fixed costs and, therefore, larger per unit operating profits.[4] The adjustment of the output structure upmarket was, thus, advisable and expected.

This expectation was captured by the literature of the late 1970s and early 1980s.[5] At the end of the 1980s, nonetheless, observers were surprised by the fact that Fiat's core market was still the bottom end of the demand spectrum. Again, this surprise was reflected by the literature of the late 1980s, and although Fiat had been consistently profitable from 1983 onwards, there was room to suggest that Fiat could have done better had the company shifted upmarket.[6] However, most authors maintained that the Fiat output mix of the 1980s had been driven by demand.[7] The fact that the Fiat core market was still the bottom range of demand was taken as evidence of flexibility, in the sense that Fiat was ready to compete in any segment but had to respond to increasing demand for its low range.[8] This interpretation was consistent with the view that Fiat had developed a range of products to compete in different segments of the market as well as the flexibility to shift the allocation of production capacity from one range of model to another.

As far as flexibility is concerned, the existing literature has been already criticised in chapter 4 of this thesis, where it has been shown that during the 1980s, flexible manufacturing systems had been deployed mainly in the spot-welding shops, whereas the machinery stock deployed upstream of the spot-welding stage was still model-specific. This severely curtailed output-mix flexibility. Crucially, the very fact that large shares of capital stock were still committed to the manufacturing of small cars indicates that Fiat management was not seeking a flexible output-mix optimisation strategy, as suggested by the established literature. On this basis, it is worth analysing output-mix strategy to see whether Fiat's lower-segment success during the 1980s reflected a precise

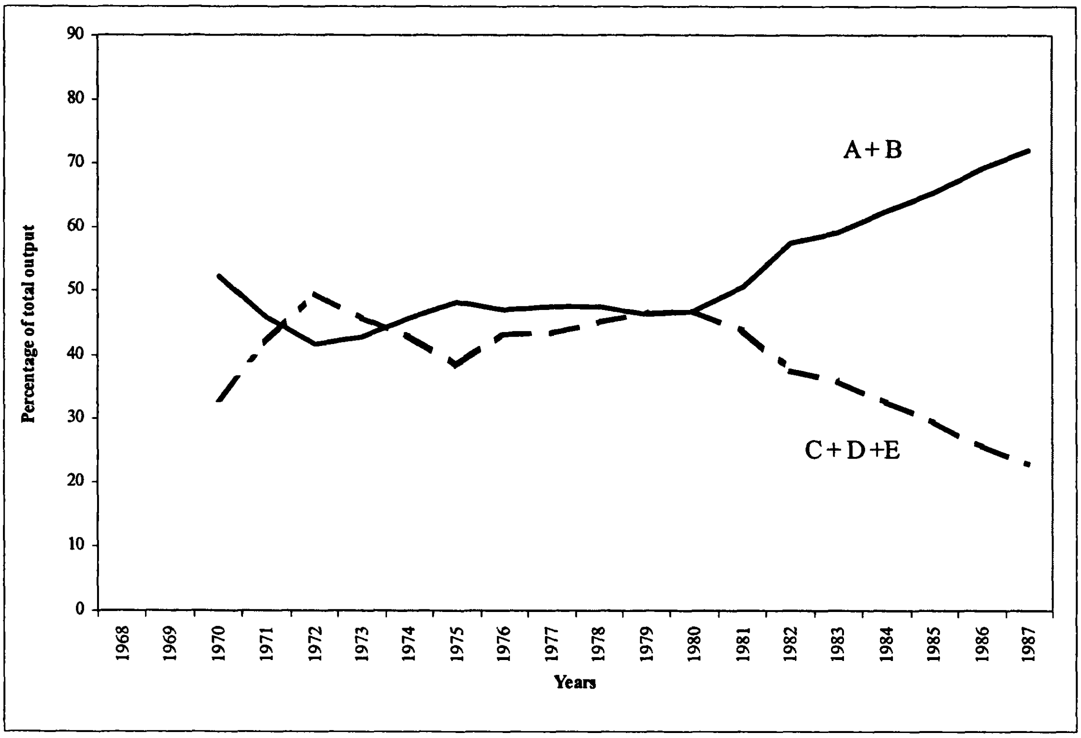
---

[4] The expectation for upmarket units to bring larger contribution margins depends on the fact that in the middle and upper segments of the market, demand tends to be income elastic rather than price elastic. This is a relevant point in relation to output-mix strategy, and it will be discussed in more depth in the following sections of the chapter.
[5] See Comito, *La Fiat*, p. 69.
[6] Enrietti and Fornenego, *Il Gruppo Fiat*, p. 172.
[7] Loke and Negelli, 'Il caso Fiat Auto', in Regini and Sable (eds), *Strategie di riaggiustamento industriale*, pp. 61-94.
[8] This is basically the argument posed by Volpato, *Il caso Fiat*; Enrietti and Fornengo, *Il Gruppo Fiat*; and, with different facets, by Loke and Negrelli, 'Il caso Fiat Auto'.

strategy aiming to maximise its specialisation in manufacturing small cars, as opposed to a strategy aiming to compete in all the segments relevant for Fiat. If this was the case, the hypothesis of continuity will be confirmed.

The first step in the scrutiny of output-mix strategies concerns the analysis of changes in the output mix over time. It is interesting to note that such an analysis has not been carried out by the literature before. However, the database already used in chapter 4, namely monthly output per plant for each model from 1968 to 1987, allows the empirical investigation of changes in the output mix.

Figure 6.1: Segment share of total output (percentage), by grouped segments (A+B; C-H), 1968-87 (3-year moving average)



Source: See table A 6.1 in the appendix.

Figure 6.1 represents changes in the output structure of Fiat. Vehicles have been grouped in lower-segment units (A and B) and upper-segment units (above C). This reflects the same criterion used by Fiat management to distinguish between lower and upper segments. The 3-year moving average has been chosen to smooth the line from contingent peaks and troughs. Unsurprisingly, the figure shows that Fiat output was skewed towards the bottom range in the 1960s and in the 1980s. This is consistent with the picture of Fiat reported by the literature. However, the surprising feature of figure 6.1 is that contrary to the common wisdom, during the 1970s Fiat had indeed adjusted its output mix upmarket. As already said, the literature of the early 1980s proposed that Fiat should shift upmarket to increase profitability, while the literature of the late 1980s acknowledged that the company had actually missed the opportunity to do so. Nevertheless, figure 6.1 shows that during the 1970s Fiat had already moved upmarket, whereas the company *shifted back* downmarket during the 1980s. This feature in the development of the Fiat output mix was not captured by the literature of the early 1980s.

The shift upmarket was consistent with the take-over of Lancia in 1969. It was also consistent with the product renewal strategy of the firm. This included the launch of the 124 and 125 Special (segment D) in 1970, the 130 Coupe (segment I) in 1971, the 132 (segment E) in 1972, and the 131 (segment D) in 1974, and the Lancia Beta range (segment E) from 1970 onwards. Meanwhile, in the bottom segment two models were launched in 1971, namely the 126 (segment A) and the 127 (segment B).[9] Given the Fiat merger and product renewal strategies in the late 1960s and early 1970s, it should be asked why in the late 1970s and early 1980s Fiat management shifted back downmarket when it was expected to go in the opposite direction.

The point made in this chapter is that the answer lies in the routine used by Fiat management in order to choose the output mix. This consisted of a framework linking output-mix decision-making with the regime of competition. The following paragraphs of this section address first the theoretical relationship between output-mix decision-making and the regime of competition, then move on to reviewing the competition regime during the 1970s in the European car market.

Competition and output-mix modelling

As already said, at the beginning of the 1980s, observers expected Fiat to adjust the output structure upmarket. This expectation, though, was based on the misconception of the Fiat output mix during the 1970s. In fact, the output mix had been already adjusted towards the medium and upper segments of the market, so that Fiat had the option either to stick with the output mix of the 1970s or to shift back downmarket. The firm could

[9] Source: Archivio Storico Fiat (ed.), *Fiat. Le fasi della crescita* (Torino, 1996), pp. 50-55.

hardly shift further upmarket, given that units above 1100 cc. already comprised almost 50% of its output. In any case, the idea that it would be profitable for Fiat to increase the production of upmarket units was based on the view that the increase in sales of upper-range units improves the bottom line. This section, on the other hand, suggests this view was an oversimplification of the output-mix optimisation issue.

In order to address this point, it is useful to the review the textbook principles underpinning output-mix decision-making.[10] Usually, the starting point of the output optimisation exercise consists of the standard analysis of costs versus revenues (C v R). The basic C v R analysis is based on a simple equation:

$$(USP * q) - (UVC * q) - FC = OP$$

Where USP stands for the per unit selling price, UVC refers to unit variable cost, q is the quantity produced, FC stands for fixed costs, and OP indicates total operating profits. From the equation shown above, a simple manipulation produces:

$$(USP - UVC)q = FC + OP$$

The term (USP - UVC) is the contribution margin (CM). The equation, therefore, can be also rewritten as follows:

$$CMq = FC + OP$$

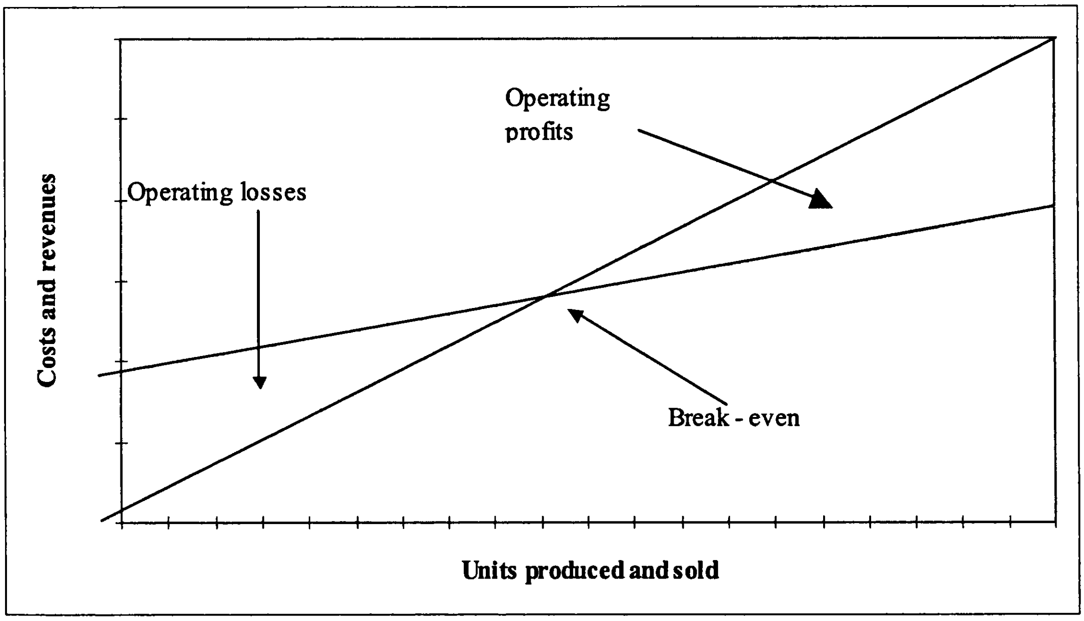
Consistently, by setting OP = 0 the equation enables managers to work out the minimum amount of output required to cover fixed costs, namely the break-even number of units:

$$q = FC/UCM$$

The simplest way to run a C v R analysis is by a graphic representation (figure 6.2), where profits are zero at the point in which revenues cross costs (the break-even point).

[10] See: C. Horngren, A. Bhimani, G. Foster, S. Datar, *Management and Cost Accounting*, (1999), pp. 234-414.

Figure 6.2: Break-even point: The graphic representation



The larger the MC the more the break-even point shifts to the left. Beyond the break-even point, the firms make profits, and the larger the sales, the higher the profits.[11] This analysis gives managers the opportunity to work out the quantity to be produced in order to reach the desired OP according to market prices, and, if demand is price elastic, the selling price that optimises q and maximises OP. This is equal to setting the target operating profits TOP. Once TOP has been set, the corresponding target number of units to be sold (TQ) is worked out as follows:

$$TQ = (FC + TOP)/UCM$$

When TQ refers to a mix of different products and UCM is averaged for the different products, the above equation implies that holding (FC + TOP) constant, the more the output mix shifts towards the unit with higher UCM, the more the break-even point shifts towards the left end of the graph and, therefore, the smaller the number of units that has to be sold in order to reach the target operating profit. The more the output mix shifts towards the units with larger contribution margins, the larger the operating profits. This rule is not universal. In fact, manufacturers could face constraints such as capacity, preventing them from shifting towards the units with higher contribution margins. In this, the output-mix optimisation exercise would consist of maximising the contribution margin in the face of constraints.

The assumption underpinning the expectation that Fiat would shift upmarket is that in general, upmarket units generate larger contribution margins as compared with lower-market units. This assumption is based on the fact that in the upmarket segments total demand tends to be income elastic rather than price elastic, which, in theory, leaves manufacturers with more room for setting prices to the desired contribution margin. Here, total demand means the demand for cars in a specific segment of the upper range, as opposed to the demand for a specific model in that segment. Critically, though, income elasticity of demand does not mean that in the upper segments of the market price competition does not take place between specific models competing in that segment. In fact, the most efficient manufacturer is still able to set price/quality standards that maximise TQ according to its own production function. If competitors are unable to follow, they will lose market shares without being able to maximise TQ.

This points lead directly to the discussion of barriers to segment entry and output-mix decision-making. The two most obvious barriers for a manufacturer specialised in a given segment of the demand spectrum, wishing to shift up- or downmarket, are the demand and supply structure, and specialisation and path dependency. The demand and supply structure is probably the most important constraint to shifting upmarket within mature oligopolies. For a given manufacturer specialised in downmarket products, it might be extremely risky to shift upmarket and compete for market shares with segment leaders. In order to erode the shares of the incumbent competitors, the newcomer in the upmarket segment should implement an aggressive policy of product renewal. However, if incumbents react by renewing their own products, market shares are likely to shift back to the initial position, because of the brand reputation effect. The shifting back of market shares to the initial levels would minimise the return of the huge investments in research and development made by the newcomer.

This is where specialisation and path dependency play a crucial role. Critically, research and development are likely to prove comparatively less expensive for the incumbent than for the newcomer, as the latter will be on the steep end of the learning curve. Furthermore, complexity costs are likely to penalise the newcomer more than the

---

[11] Figure 6.2 simplifies the issue by assuming a linear costs function.

incumbent player. Complexity costs are generated by the complexity in design and manufacturing involved in the quality-oriented production process or by quality-oriented component purchasing. Considering that in car manufacturing components represent about 60% of the value of the finished product, complexity costs associated with designing, manufacturing and purchasing upmarket components substantially affect variable costs and, ultimately output prices. The comparative advantage of the incumbent over the newcomer lies in the ability to control complexity costs more efficiently. This ability refers not only to the final assembler, but also to the chain of its suppliers. Ultimately, the specialisation of manufacturers and their component suppliers represents a constraint to output-mix shifts down- or upmarket.

A manufacturer specialised in downmarket segments, which tries to adjust the mix upmarket, might not maximise UCM if, in order to expand market shares, USP has to be set at too low a level as compared with UVC. Consequently, the shift upmarket would have a detrimental effect on TOP, particularly if the increase in the upmarket units absorbs capacity that could be allocated to the expansion of output in the lower segments. If an increase in production of upmarket units leads to decreasing production of downmarket ones, the improvement of CM in the former might be negatively offset by the deterioration of CM in the latter, with no benefit for total operating profits. This is particularly true for those processes in which economies of scale matter, so that the per unit cost of components decreases along with increases in output. In this case, as already mentioned, managers will maximise the contribution margin in the face of capacity constraints.

Those observers who expected Fiat to shift upmarket at the beginning of the 1980s did not consider the various constraints Fiat might have faced, had the company implemented such a shift. However, it is interesting to note that the expectation reflected not only the opinion of observers in the academic world, but also the business view of some managers within Fiat. As already mentioned in chapter 3, during the 1970s, managers like Rossignolo and Mosconi had tried to promote a shift in the managerial culture of the company from a process- to a market-oriented business approach. One of the strategies reflecting such a cultural change was the shift upmarket. Nonetheless, when Fiat Auto was established in 1979, Ghidella was appointed chairman of the new company. He was a production engineer and pursued technical synergy between Fiat and

Lancia, as opposed to the brand differentiation proposed by Rossignolo. Furthermore, Gidella favoured the product renewal of the bottom range over that of the upper range. Behind the difference in strategic thought between Rossignolo and Ghidella, there was a different consideration of constraints to shifting upmarket and their expected impact on TOP. This point will be analysed in more depth in other paragraphs of this chapter. At this stage, the question to be addressed is why during the 1970s did Fiat shift upmarket, as suggested by Rossignolo. After all, in the view of many Fiat managers, the comparative advantage of German and French producers in the upper-market segments might have already been seen as a constraint to shifting upmarket in the 1970s.

The answer to this question lies in the relationship between the contribution margin and the regime of competition. Recalling that UCM=USP-UVC, the manufacturer specialised in upmarket units will have lower UVC. This means that either it will set a lower USP as compared to the manufacturer specialised in lower segments of demand, or will offer better quality for the same price, or even much better quality for a reasonably higher price. However, if for whatever reason price competition is inhibited, the price level might be so high as to maximise the CM of the non-specialised manufacturer, in the face of a higher level of UVC relative to the specialised manufacturer. In other words, collusion is likely to remove, at least in the short term, the path dependency constraint to shifting upmarket. The next paragraphs address the regime of competition during the 1970s and investigate the relationship between the competition regime and output-mix decision-making. Then, based on primary qualitative sources, the chapter will move on to analyse the strategic thought underpinning output-mix decision-making at Fiat during the 1960s and 1970s.

The historical background: Infra-EC tariff abolition and collusive behaviours in the 1970s

By 1968, tariffs among EC countries had already been abolished for a wide range of products including cars. This resulted in an adjustment in the market shares of each producer in each of the EC countries. However, price competition played a marginal role in the adjustment, as non-price competition was much more effective and implicit collusion was in place.[12] Implicit collusion of car manufacturers during the 1970s was investigated by Silva Grillo and Prati in early 1982.[13] The authors showed that between 1970 and 1980 the price of output in Italy increased much faster than the price of inputs.[14] The results of this analysis have been reported in table 6.1.

Table 6.1: Output and inputs price indexes and relative price coefficient, Italian market, 1965-1979

Years	Output price index	Inputs price index	Relative price coefficient
	(a)	(b)	(C = b/a)
1965	94.4	87	0.92
1966	94.6	87.3	0.92
1967	94.6	88.4	0.93
1968	94.5	90.9	0.96
1969	94.5	93.7	0.99
1970	100	100	1.00
1971	108.3	102.9	0.95
1972	116.6	105.9	0.91
1973	130.6	124.8	0.96
1974	166.5	166.5	1.00
1975	216.5	181.3	0.84
1976	274.1	216.3	0.79
1977	323.9	250.8	0.77
1978	376.1	279.8	0.74
1979	430.7	323.6	0.75

Source: Silva, Prati, Grillo, *Il mecato Italiano dell'Auto*, p. 79.

The first column displays the index of the price of output (a), while the second column shows the index of the price of inputs (b). The third column reports the coefficient of the output relative price (C= b/a), which is the index of price of inputs divided by that of output. The base year is 1970. The relative price coefficient increases from 1965 to 1970 and then decreases for the entire decade with the exception of 1973

[12] Non-price competition usually means product renewal and quality competition. However, it is better to distinguish between competition based on product renewal and quality competition, the former not necessarily being related to price since a new model could have the same quality and price as a preceding one and simply have a different style. However, the latter is related to price since quality is not an absolute concept but is relative to price. This implies that the most efficient manufacturer will increase quality faster than prices.

[13] Silva, Prati, Grillo, *Il mercato Italiano dell'auto.*

[14] Ibid, p. 79.

and 1974, when the Government introduced restrictive rules to contain price increases. Since a decrease in the coefficient of relative price indicates that the prices of output increase faster than those of inputs, the table shows that the total margin contribution of the Italian car industry increased from the 1970s onwards with the exception of 1973 and 1974.[15]

Silva also showed that increases in the official prices of various manufacturers in Italy tended to move upward almost simultaneously, and that the same trend could be traced in the other EC countries.[16] He estimated the output price function for Italian car industry, concluding that demand was not statistically significant as an explanatory variable of the price of output.[17] Finally, he showed that the relative prices of cars increased faster in Italy than in the other countries,[18] as shown by table 6.2.

[15] Ibid., pp. 78-86.
[16] Ibid., pp. 124-125.
[17] Ibid., pp. 126-133.
[18] Ibid., pp. 164-168.

Table 6.2: Nominal price indexes and relative price coefficients, 1960-1978, 1970 =100

	France		Germany		Italy		UK	
Years	Vp. I	Rp	Vp. I	Rp	Vp. I	Rp	Vp. I	Rp
1960			89	1.14	91.2	1.33		
1961			89	1.11	84.4	1.20		
1962	83	1.14	89	1.09	84.4	1.14	86	1.19
1963	84	1.09	90	1.07	88.3	1.11	84	1.14
1964	85	1.08	90	1.05	95.6	1.13	83	1.09
1965	86	1.06	92	1.03	91.8	1.04	84	1.05
1966	86	1.04	94	1.02	91.8	1.02	88	1.06
1967	86	1.01	95	1.01	91.8	1.01	89	1.05
1968	87	0.98	95	1.00	91.8	0.99	91	1.02
1969	94	0.99	98	1.01	93	1.97	98	1.04
1970	100	1.00	100	1.00	100	1.00	100	1.00
1971	108	1.03	107	1.02	107.5	1.02	110	1.01
1972	116	1.04	113	1.02	116.6	1.05	117	1.00
1973	122	1.02	118	1.00	128	1.05	123	0.96
1974	136	0.99	125	0.99	159.6	1.09	141	0.95
1975	168	1.10	136	1.01	192.2	1.12	189	1.02
1976	190	1.14	148	1.06	254	1.27	218	1.02
1977	204	1.11	151	1.04	306.6	1.30	263	1.07
1978	225	1.13	156	1.05	349.5	1.32		

Source: Silva, Prati, Grillo, *Il mercato Italiano dell'auto*, p. 165. Vp. I = vehicle price index. Rp = relative price coefficient = Vp. I/cost-of-living index

Here, relative price means the price of cars relative to the cost of living. It is represented by the coefficient C, which is obtained by dividing the output price index (a) by the cost-of-living index (b). The bigger the value of C, the higher the price of cars relative to the cost of living.

The scenario described by Silva indicates collusive behaviours. The author assumes that in each country pricing was regulated by the national champion playing the role of price setter. Although the author does not prove it, the assumption seems more than reasonable.

Silva does not imply that collusion was based on formal agreement among car manufacturers. On the contrary, he maintains that car manufacturers had no incentive to restore price competition, because collusion enabled them to defend and in some cases expand total contribution margins in the face of increasing production costs.[19] Moreover, there was no incentive to restore price competition, due to the instability of exchange rates, which, in a context of transparent oligopolistic competition, would have penalised manufacturers in those countries where the exchange rates favoured imports rather than exports.[20] Finally, the foreign distribution network for each car manufacturer was not sufficiently developed to sustain a strategy of price-driven expansion of market share outside the domestic market. In any case, according to Silva, manufacturers were keen to restore price competition as soon as input prices and exchange rates stabilised, so that in 1980 there was already evidence of a tendency towards price competition, as indicated by the behaviour of prices in that year.[21]

The point made in this chapter is that output-mix decision-making at Fiat was influenced by the regime of competition, because collusion minimises the comparative cost advantage of manufacturers specialised in the upmarket segments, allowing non-specialised manufacturers such as Fiat to enter the upmarket sector. In this respect, the question whether or not collusion was based on an opportunistic and implicit response to a widely recognised economic contingency, as opposed to formal agreement between manufacturers is irrelevant. Much more relevant, instead, is the question whether or not Fiat was the price setter, and whether or not management was confident that competitors would follow upwards each time Fiat adjusted prices. In fact, to suggest convincingly that the regime of competition influenced Fiat's shift upmarket in the 1970s it is not sufficient to rely, as Silva did, on the assumption that Fiat was the price setter. On the contrary, it is necessary to show that managers were confident they could set prices and predict pricing behaviour. Both points will be proved in the second section of the chapter through the analysis of internal Fiat documents. At this stage, it is important to investigate further the relationship between the regime of competition and the output mix. The following paragraphs investigate this relationship in a context of profound market change. This was the shift from a situation in which individual European markets were protected to a situation in which tariffs had been abolished, and a new competitive framework took place. Under the umbrella of tariff protection, each individual market had developed its own market structure. The output-mix decision-

[19] Ibid., p. 172.
[20] Ibid., p. 176.

making dilemma for Fiat was determined by the fact that demand in Italy started to develop upmarket at the same time when tariffs started to be reduced. This created a difference in opinions between those managers that thought a shift upmarket was the way forward, and those who thought that the long-term survival of Fiat would depend on the company's ability to outperform competitors in the segment in which Fiat was more specialised.

Price leadership in price competition versus price leadership in non-price competition

The model of oligopolistic competition proposed by Sylos-Labini assumes that competitors try to maximise market shares.[22] In this case, the competitive element is the selling price, while the contribution margin is maximised by cutting costs. The target market share represents the independent variable, per unit price is the dependent variable, while technology and specialisation are the endogenous elements enabling the firm to control costs and maximise the unit contribution margins. In accordance with this model, the most cost efficient manufacturer is the price leader. By definition, price competition for market shares takes place within transparent oligopolistic competition.

Price competition, as described by Sylos-Labini, inspired the Fiat strategy of growth before and after the Second World War, where growth depended on the ability to capture market shares in the protected domestic market at the expense of other domestic competitors. Certainly, price competition inspired a generation of technical managers and engineers at Fiat who, as mentioned in chapter 2, during the post-war period had developed a Fordist production ethos based on cost containment through process/product complexity containment.

Sylos-Labini's model of competition is consistent with the Linder[23] model of specialisation that postulates that any car manufacturer specialises in the strategic segments of the domestic market, and then exports the same product abroad, exploiting cost advantages from specialisation and product diversity. "Imports-driven product diversity" introduces elements of non-price competition, where buyers would be keen to

---

[21] Ibid., p. 176.
[22] Modigliani refers to this assumption as the postulate of Sylos-Labini, see, F. Modigliani, 'New Developments on Oligopoly Front', *Journal of Political Economy*, N. 3, June, (1958), pp. 215-232.
[23] See S. Linder, *An essay on Trade and Transformation* (New York, 1961).

spend more money to buy a product different from that of the domestic supplier. Therefore, as demand diversifies, so does supply. This is known as the Barker effect,[24] where costs driven by excessive specialisation exceed those caused by diversification. Costs of specialisation result from the mismatch between supply and demand, while those caused by diversification are driven by process complexity. Once all suppliers have diversified their output mix, price competition within each segment of demand regains its significance while manufacturers compete for price leadership in each segment of demand. This is known as the Linder-Barker effect, due to which the most competitive factor is the ability of manufacturers to control costs driven by process complexity. This ability is commonly known as flexibility. The "Linder phase" of industry growth is process-oriented, whereas the "Linder-Barker" phase is market-oriented.

The transition from the Barker to the Linder-Barker competition framework might be postponed if manufacturers collude on prices, so that the incentive to search for cost efficiency in any segment of the market is reduced. As already pointed out, when collusive behaviours take place, price leadership no longer reflects cost efficiency so closely, because in any national market the largest manufacturer can increase prices to a given extent, knowing that all the others would follow. This allows the price leader to "endogenise" prices. If this is the case, the target unit contribution margin becomes the independent variable, and market shares and prices the dependent ones. Under collusion, the ability of a manufacturer to control costs is still an important factor because the larger the cost efficiency, the larger the possibility of maximising contribution margins. Yet, the price leader can be slightly less efficient than its nearest competitors in some segments of the product range and still optimise the contribution margin. If market shares are stable, the advantage for the more cost-efficient competitor is relatively small and collusion holds. On the other hand, if market shares are destabilised by the pressure of quality or product differentiation and the price leader loses market shares, the advantage for the most cost-efficient manufacturer is enormous since it enjoys lower costs and the highest prices. Moreover, market shares of the price leader can be eroded by informal price competition through discounts or the over-evaluation of replaced

[24] See: T. Barker, 'International Trade and Economic Growth: An Alternative to the Neoclassical Approach', *Cambridge Journal of Economics*, N. 1 (1977), pp. 153-172.

vehicles. If the loss of market shares is so marked that contribution margins of the price leader are eroded while prices cannot be increased further, collusion cannot hold for long. In order to survive, the price leader must regain cost efficiency and product competitiveness.

As already pointed out, if management believes that competitors will collude, this might also have an implication on product-mix decision-making. Product-mix decision-making is essentially the problem of maximising the contribution margin in the face of many constraints, such as cost and availability of labour skills, cost and availability of components, technical specialisation etc. In the upper segments of the market, demand tends to be income rather than price elastic, so that contribution margins tend to be larger than that the contribution in the lower segments of the market. Nonetheless, the non-specialised producer might not be able to maximise CM at the price levels set by the manufacturer specialised in upmarket units. If this is the case, the shift upmarket is not advisable for the non-specialised manufacturers. In fact, the more the shift from the bottom end to the top end of the market the more UVC increases along with USP. Therefore, for the manufacturer having the comparative advantage in the lower segment of the market, the shift upmarket would only lead to total costs increasing faster than total revenues.

However, if collusion allows the non-specialised manufacturer to endogenise selling prices, price leadership will no longer reflect cost efficiency. The incentive for the price leader to shift towards segments in which demand is income elastic rather than price elastic, therefore, remains substantial because price levels would maximise CM.

Section two

Output-mix decision-making in the 1960s

From the inter-war period to the mid-1960s, tariffs had been protecting domestic demand from foreign competitors, but among Italian players, Fiat was aggressively price competitive. The company had been able to exploit cost advantages to dominate the lower segments of the domestic market and become the foremost Italian producer. This section of the chapter addresses the origin of the routine linking output-mix decision-making to the regime of competition. In the late 1960s, with the upper end of the market starting to grow, and with the capacity of Italian upmarket producers still relatively small,[25] the Fiat management saw the opportunity to expand output upmarket. It will be shown that assumption underpinning the shift upmarket, though, was that Fiat could mark up prices according to its cost structure. Such an assumption implies tariff protection or collusive price leadership. Moreover, it will be shown that during the 1970s, the adjustment of the Fiat output structure upmarket was sustained by a regime of implicit collusion. The next chapter of the thesis will show that when in the early 1980s, Fiat shifted back downmarket, price competition had been restored.

Giacosa versus Minola: Product-mix decision-making at Fiat in the 1960s

As already stated, Fiat has an established reputation as a small car producer, even though the firm has always produced a wide range of cars from the smallest utilitarian models such as the Topolino (1936-55), the 500 (1957-75), the 126 (1972-90) and the Uno (1982-93) to luxury and sports cars such as the 2300 S (1963-67) and the 130 (1969-77), or saloons such as the 125 (1967-72) and the Croma (1985-95). The reputation of Fiat as a manufacturer of small cars depends mainly on the fact that in the inter-war period, domestic demand was almost satisfied by models under 1100 cc., such as the 508, the 509, the 1100 and, after 1936, the Topolino. In the immediate post-war period, utilitarian cars were still the most popular but the size of the market for cars was small in absolute terms, while demand for personal transport was mainly satisfied by scooters.[26] After 1955, Fiat strategy aimed to expand domestic demand, by supplying households with small and cheap cars as a substitute for scooters. The 600 was launched

[25] Lancia and Alfa Romeo.

in 1955 and the New 500 in 1957. The overwhelming popularity of those models made them the symbol of Fiat production as well as the symbol of the Italian "economic miracle". Fiat deployed the same strategy in Spain, where it started the production of the 600 through its subsidiary SEAT, in 1962.

The ratification of the Treaty of Rome in 1958, which would lead to the abolition of tariffs for cars by 1970, introduced an element of uncertainty for car manufacturers specialised in the bottom end of the market. Increasing imports had to be compensated by exports. However, cars such as the 500 and 600 were not suitable for countries such as Germany or France, in which consumers were already used to higher standards of quality and different technical specifications, such as size and cubic capacity. Moreover, while Fiat could reasonably expect to keep its dominant position in the domestic lower end of the market, the management had the problem of defending the upper end of the domestic demand. Fiat, in fact, was producing upper-segment units, but given the scale of production, it was not price competitive as compared with German manufacturers and, therefore, more sensitive to the removal of tariffs.

In 1967, the output structure of the firm was still dominated by cars below 1000 cc. However, as already shown by figure 6.1, since the second half of the 1960s, Fiat management, and in particularly the director of the car division Antonio Minola, had been pushing for a shift of the output structure in favour of higher segments. Moreover, Gaudenzio Bono, the General Director of Fiat, had started to pay more attention to the renewal of top-range models. On the other hand, Dante Giacosa, the influential director of the technical department who had designed all Fiat cars since 1930, did not welcome the new strategic tendency. Giacosa's dislike for upper-segment cars was well known to the top management. For this reason, in 1966, Bono did not consult Giacosa about the decision to commission a viability study for a car to compete with Mercedes in segment F (over 2300 cc.).[27] Giacosa was put in charge of the project only once Bono had already decided the size of the car and the quantity to be produced. On the other hand, Giacosa tried to persuade top management to postpone the project once he was in

[26] Volpato, *Il caso Fiat*, p. 77.

[27] It was not the first time that Giacosa was excluded from the basic decision-making of a luxury car project. It had already happened in 1958, when Valletta and Bono decided to start the viability study for a luxury car over 4000 cc. The programme was aborted after a few years. See Giacosa, *Progetti alla Fiat*, p. 279.

charge. Indeed, he wanted to focus on the development of new models competing in segments A, B, and C.[28] Eventually, though, the new Fiat competing in segment E, the 130, was presented in 1969 along with the Fiat 128 and Autobianchi 111 (segment C). The only model launched in segment B was the Autobianchi 112 (segment B). Giacosa retired in 1970. As already mentioned, the number of upmarket models presented between 1970 and 1974 outweighed those in the bottom range.

Giacosa's opposition to the views of Bono and Minola was based on a pattern of interrelated arguments describing the typical lock-in imposed by path dependency. The first argument referred to learning costs. According to Giacosa, Fiat did not possess labour skills to reach a sufficient standard of quality, particularly in the final assembly, to be able to compete in the higher segments of the market.[29] An extensive labour training program was necessary. There was a technical management problem too. According to Giacosa, the technical level of production engineers and the quality standard of the welding and painting shops had plenty of room for improvement. The second argument was related to the component supply chain, which had to be totally restructured if Fiat wanted to improve the quality of components up to the level of competitors such as Citroën, Peugeot, Opel and Ford, not to mention Mercedes and BMW. Finally, Giacosa claimed that cars above 1500 cc. involved higher costs per unit since each unit required the processing of a larger amount of raw material, especially steel, the cost of which was comparatively higher than that of other inputs.[30]

The latter argument reflected the technical culture of Fiat engineers at the time, according to which the most effective way to control costs consisted of limiting the use of steel. This resulted in a tendency to contain the weight of cars, and therefore their size. This routine explains why production was usually measured in both weight and units. This was a typical routine of manufacturing industry across Europe and in the US during the inter-war period, and reflected the high cost of non-labour input such as steel. In the post-war period, steel remained the most expensive input relative to labour, particularly in Europe, so that many Fiat designers kept considering the manufacturing of lighter units as the best way to ensure cost control. Indeed, Giacosa was convinced

[28] Ibid., pp. 279-282.
[29] Ibid.
[30] Ibid.

that the increase in production of upmarket, and heavier, units would have expanded total costs. This, combined with the lower quality of the Fiat upmarket units relative to German competitors, would have prevented Fiat from profiting from moving upmarket because the adjustment could be achieved only by setting prices at too low a level given Fiat's cost structure in the upper segment. He was convinced that after the abolition of tariffs, only those manufacturers able to transfer the savings deriving from more efficient production process and supply chain to better product quality would survive. Given the specialisation of Fiat, it would be able to realise this transfer only by producing small and medium cars. Throughout his career, Giacosa remained convinced that as far as output structure was concerned, the best move for Fiat was to stay where it was.

As already mentioned in chapter 3, Valletta and his managerial team had set up a process-oriented structure, in which cost control was exercised by production engineers These were able to superimpose process-oriented criteria on designers and marketing staff. It is not surprising that Giacosa remained loyal to the process-oriented culture. He had been developing his career in a managerial context in which the skills of designers were evaluated on the basis of the ability to control complexity.[31] Now, Giacosa was not prepared for a shift in the criteria by which his own designing skills were evaluated. Moreover, by containing complexity, Fiat had been able to be price competitive in respect to domestic competitors and to become the foremost Italian car producer. Giacosa was obviously proud of the results achieved at the time and sceptical about any strategic change.

Given the production-oriented culture of the Fiat management, it seems surprising that in 1963 Minola had been appointed Director of the Vehicle Division from the Marketing Division. Moreover, the U-turn of Bono, who shifted attention from mass-production models to the 130 model, seems even more surprising. At first glance, the appointment of Minola and the new attitude of Bono seem to indicate a marked change of direction toward a more market-oriented approach to the business. Yet, as will be shown in the next paragraphs of the chapter, Bono's U-turn and Minola's marketing-oriented approach were more apparent than real. It will be shown that the way Minola

[31] Ibid.

approached output-mix optimisation was far from a genuine marketing-oriented competitive approach. It was still based on the old routines traditionally used by Fiat management for pricing decision-making and profitability calculations and, overall, reflected the old pattern of Fiat managerial culture. This was the reason why Bono supported the views of Minola. The critical point outlined in the next section is that those routines were all based on the assumption that Fiat could endogenise price setting.

New ideas and old routines: The false shift towards market-oriented competition

The fact that Minola's output-mix strategy was based on the assumption that Fiat could set prices according to its endogenous cost structure emerges clearly from the analysis of primary sources such as the report of the board meeting report of January 30, 1967. Gianni Agnelli had been Chairman for a year and management had been encouraged to put even more emphasis on marketing issues. In the first meeting of 1967, Minola held the view that to move upmarket was not only necessary in order to boost exports, but was also beneficial for the overall performance of the firm. In particular, Minola constructed a double argument. Firstly, he pointed out that cars competing in the middle and upper segments of the market involved higher per unit revenues from sales, so that it was possible to increase total revenues from sales by changing output structure rather than by increasing output size. Secondly, he stressed that to change output structure rather than output size was the more profitable way to optimise output. While the first part of the argument is self-evident, the second part requires further investigation and explanations. To this end, it is useful to follow Minola's reasoning from the report of that meeting:

> "The number of units produced is a good indicator of the business trend. However, tonnage is a much better indicator. Well, with 834,546 tons, production in 1966 exceeded that of 1965, which reached 691,353 tons, by about 21%. In terms of units, as already said [in the previous paragraph], the increment was about 16%. The larger increment of production in terms of tonnage, compared with that in units, has been brought about by the production of vehicles of larger size, such as the 124 and commercial vehicles.
>
> Concurrently [as a result], average per unit revenues from sales have increased as well: in 1966 in Italy, [they have increased] from ITL 691,185 in 1965 to ITL 702,800 in 1966, and abroad [they have increased] from ITL 691,983 in 1965, to ITL 705,729 in 1966.

Also, revenues per kilo have not changed in Italy [remaining] at the level of ITL 950 per kilo, in spite of the great development [the commercial success] of the 500, which negatively affects the average, and have slight increased abroad, from ITL 837 per kilo in 1965 to ITL 859 per kilo in 1966.

The task for the Fiat commercial network is clear. We do not have to feel satisfied (sic) only by the increase in the quantity of sales but we have to increase the tone [quality] of them, and [we have to increase] the per unit revenues from sales and, therefore, the profitability of sales. So far, our balance sheets [revenues from sales] have been too much affected by the sales of the 500."[32]

As already said, Minola developed a double argument. In his first paragraph, he explains that production in terms of weight had grown by a larger proportion than production in units, which indicated that sales of larger-sized cars had increased. In the second paragraph, he says that per unit revenues from sales had increased, following the increase in the production of larger vehicles. Here, the key word is *parallelamente*, which literally means "in a parallel way" and has to be translated as "concurrently" or "at the same time". However, the Italian word not only implies a correlation between two phenomena, such as the parallel increase of two elements, but it implies also a cause/effect relationship, which Minola wanted to stress. Otherwise, he would have used the Italian word *incidentalmente*, which implies that two phenomena with the same features occasionally take place at the same time, though they are independent of each other.

In the third paragraph, Minola goes further by showing that in the European market, to which upper segment cars were mainly exported, not only had per unit average revenues increased, but also revenues per kilo. On the contrary, in the domestic market, which was still dominated by the 500, revenues per kilo did not increase. They did not decrease either, in spite of the dominance of the 500. For Minola, this was evidence that the global increase in the sales of larger vehicle still had a positive effect in the Italian market, but not to the extent to increase revenues per kilo as was the case with sales abroad.

Linguistically, this is the most ambiguous part of the Minola speech. Ambiguity derives from the fact that even negative news was never presented to the Board of

[32] Archivio Storico Fiat, Administration Board Meeting Report, January 1967, Book 37, p. 155.

Directors in a negative form.[33] The true meaning of the passage is that in Italy revenue per kilo was stagnating due to the dominance of the 500, which was bad news. On the other hand, revenues per kilo had increased abroad, to which mainly medium and upper-segment cars were exported. This was good news, which also indicated the output strategy to be pursued, namely to increase production of middle- and upper-segment cars. However, although results achieved so far were indicating the path to be followed, they were not enough, since only a "slight increase" in revenues per kilo had been experienced by sales abroad.

This introduced the second Minolta argument: in order to increase revenues from sales, it was more profitable to keep total output constant, repositioning output structure in favour of larger cars, rather than to expand output without changing its structure. In the Minola view, Fiat had to push harder in that direction. This is the sense of the last paragraph. It contains the suggestion to be followed in the future: to reduce the impact of segment A (the 500) on total sales. The aim of this move was to establish in the domestic market the same positive trend of revenue per kilo already experienced in the EC market and, possibly, to improve it. More precisely, in the last paragraph, Minola says that

> "we have to increase the per unit revenues from sales and, therefore, the profitability of sales".

The consecutive conjunction "therefore" (e dunque in the Italian text) is the key word of the paragraph, because it tells us that for Minola, higher per unit revenues from the sale of larger vehicles cause profits to rise. It is critical to note that he stated the concept after having analysed revenues per kilo and having said that they increase with the share of large vehicles in total sales (as in the case of sales abroad). In addition, it is important to underline the emphasis Minola put on the necessity to reduce sales of the 500, which prevented revenues per kilo from expanding in the Italian market.

The general sense of the whole speech is that it is more profitable to sell large rather than small cars, because they provide not only larger revenues but also larger profits, and they do it because they provide larger revenues per kilo. In other words, in Minolta's view, when revenues per unit increase with revenues per kilo, per unit profits

[33] This was a well-established routine of Fiat management and it is extremely important to be aware of it in order to interpret the reports correctly.

rise as well. Thus, Minola uses revenues per kilo as an indicator of per unit profit. The next sections explain why the methodology used by Minola was deeply inaccurate. Moreover, they explain why none of the other members of the Board argued with Minola's conclusions, on the grounds that the methodology was inaccurate.

Weight, pricing and competition

As is clear from the reports of the Board of Directors, as well as from other sources,[34] until the late 1960s, revenues from sales of many different products including spare parts and even raw steel were compared on the base of revenues per kilo within a well-established routine. For example, agricultural machinery was compared to road vehicles, including both cars and lorries. Minola applied the same methodology within the road vehicle sector. Actually, his findings that an increment of the weight of cars led to an increment of revenues per kilo was consistent with the result of many previous comparative analyses of revenues per kilo from sales of road vehicles and agricultural machinery. Those analyses showed that higher revenues per kilo derived from agricultural machinery, the average per unit weight of which was higher than that of road vehicles, be they cars or commercial. However, the fact that revenues per kilo increased with the weight of vehicles reflected the pricing routine. When the decision to produce a new vehicle was taken, the Chairman and the General Director decided the selling price, usually set at a slightly higher level than the price of the vehicle to be replaced. Then, designers had to choose a design of an appropriate weight in order to meet the target revenue per kilo. Therefore, revenues per kilo reflected the weight of the car and the pricing mark up.

As already said, Minola claimed that to raise revenues per kilo was important in order to achieve a rise in profitability. In so doing, Minola assumed a constant relationship between costs and weight. This implied that, for Minola, weight could be used as a proxy for costs. However, since weight captures only those costs driven by the quantity of raw material input, but does not capture the cost driven by the complexity of design and manufacturing, nor labour costs, the routine of using revenues per kilo as a

[34].In particular see: Archivio Storico Fiat, Administration Board Meeting Report, March 1958, Book 26, p. 105.

proxy for per unit profits is deeply incorrect. It is important to emphasise that both Giacosa and Minola shared the same idea that weight was a proxy for cost. However, there was a big difference between the two managers. Giacosa thought that weight could be used as a proxy for costs if the same manufacturer had to choose between two different design options for the same product. Other things equal, the design leading to savings in raw material would have led to savings in material costs. For example, in the case of the Fiat 500 and the Fiat 600, Giacosa opted for a design involving rear engine and rear wheel drive, instead of front engine and rear wheel drive, because the former was simpler and led to a substantial reduction in the weight of mechanical components.[35] On the other hand, without a *ceteris paribus* situation, weight could not be used for decision-making on cost-cutting, let alone on marketing strategy involving cost comparisons with competitors. This is precisely because weight does not capture entirely complexity costs.

Minola, on the other hand, used weight as a proxy for costs to justify the shift upmarket. As already said, he posed the argument that larger cars had larger revenues per kilo, which, in his view, indicated a better per unit revenue to costs ratio. However, given that weight as a proxy for costs could not be used to compare costs between different types of car and, overall, to compare costs between different manufacturers, Minola was amazingly using a methodology that could only be meaningful in the absence of competition.

In this light it is worth asking whether the use of that measure reflected the difficulty Fiat management had in monitoring costs, or the simple fact that Minola did not share Giacosa's concern with controlling costs. If so, it is worth asking whether Minola was less concerned with controlling costs than Giacosa simply because he was confident that after 1968, when tariffs were expected to be abolished, Fiat would have retained price leadership anyway, even in those segments in which the company had no comparative advantage. Obviously, this second option would occur either if tariff protection and quotas were kept, or collusive behaviours were put in place. In fact, within a domestic market protected either by tariffs or collusive agreement, it is possible to some extent to mark up the price according to the desired margin of contribution, which makes it

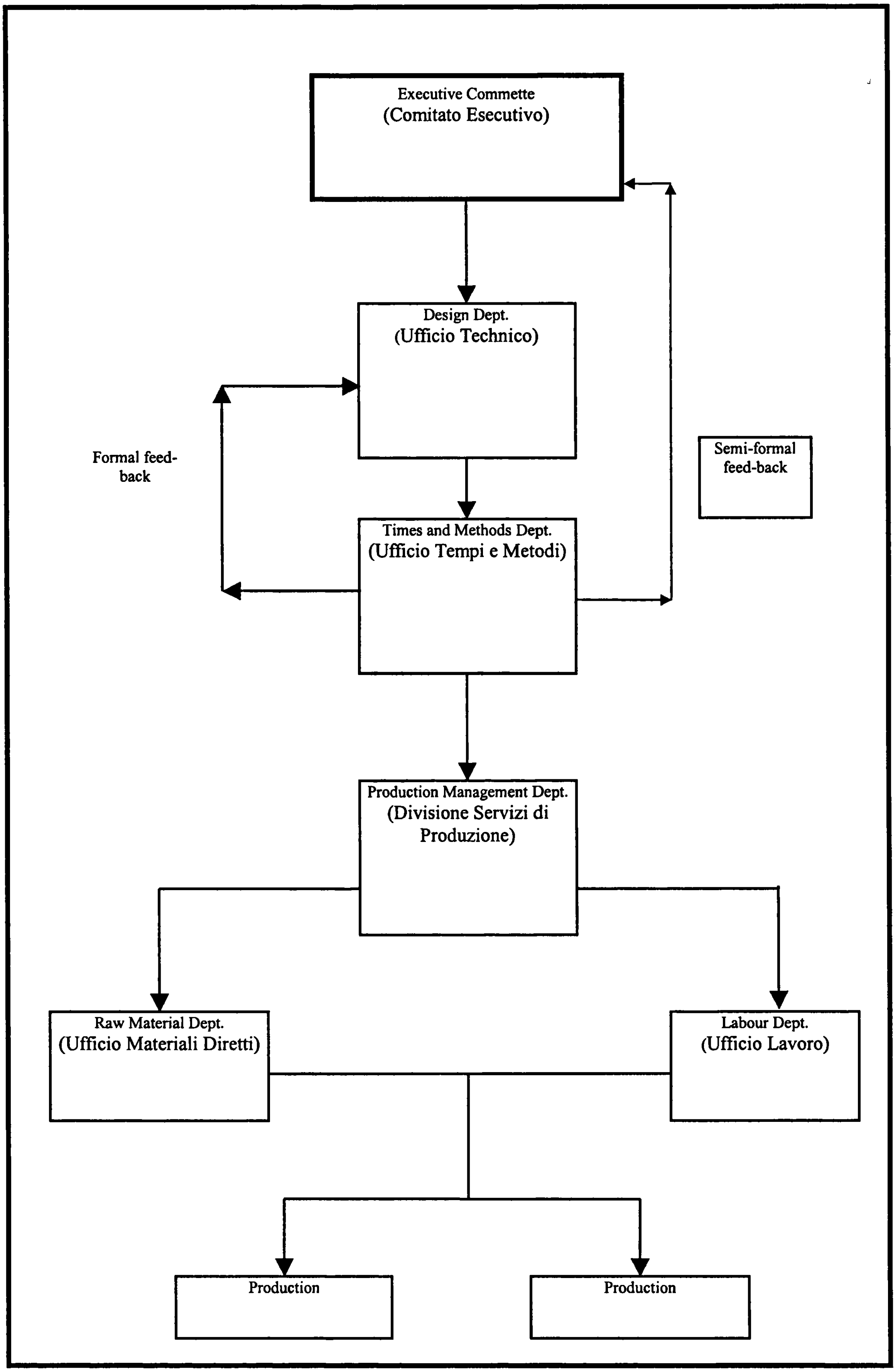
[35] Giacosa, *Progetti alla Fiat*, p. 223.

relatively less urgent to control costs. Therefore, the methodology used by Minola and accepted by Valletta might well reflect the fact that the manager was confident that Fiat would have been able to "endogenise" selling prices even after the removal of tariffs in 1968. In order to investigate this point, the next paragraphs address first the question whether Minola had the cost information to approach output-mix decision-making in a more methodologically correct way, and then will analyse the views of Valletta and his staff on the removal of tariffs.

Cost monitoring at Fiat during the 1960s

This section answers the question whether Minola used revenues per kilo as indicator of profitability simply because it was not possible to monitor costs. After a careful exploration of the Fiat Archives, and all the available secondary sources, it has been possible to trace the process of decision-making related to design, production and costs feedback for a new model. This is represented by chart 6.1. The Executive Committee consisted of the General Director of Fiat, Gaudenzio Bono, and the President and Chairman Valletta (Gianni Agnelli after 1966). They took all the relevant decisions concerning new models to be produced, their size, quantity and overall selling prices. At that point, the Technical Director Dante Giacosa and his staff designed the vehicle, including all non-electrical components of the engine, and the body and interior (seats, dashboard etc.), after having decided the shape of the body. For every component, a number of drawings - the so-called "technical specification sheets" (hereafter TSS) were made - each specifying dimension, material and weight. The drawings were then sent to the Time and Methods Department. At this level, timing and methods of production were established for each component, as well as the timing process for the entire car assembly, the typology of tools to be used at each stage of the process for each component, the precise timing and the number of workers to be employed in each sequence. The Time and Methods Department was the only department entitled to make changes in methods, tools, material, the number of workers, sequences, etc. It was also responsible for the monitoring of any stage of the process in order to certify that each operation was consistent with the efficiency standards set according to the Bodeaux System.

Chart 6.1: Product renewal and development. The process of decision-making



Source: Based on information from various sources. Archivio Storico Fiat, Crescimone File (Fondo Crescimone) files 55/7; Giacosa, *Progetti alla Fiat*, pp. 228, 264.

The cost analysis was performed by Antonio Crescimone, the head of the Production Management Department, and his staff, according to the industrial engineering method. This was a method of estimating the cost function by analysing the relationship between input and output in physical terms and then transforming physical inputs and output into costs. The result is an estimated cost function relating total manufacturing costs to the cost-driven *unit of output*. TSS contained the relevant information on physical input/output, namely material and time/labour units needed for the production of each single component and to assemble them into a vehicle. Therefore, it was possible to forecast the precise cost of each type of vehicle and to confront forecasts with the actual data from the Raw Material and Labour departments.[36] Because cost analysis included time and methods analysis, complexity was captured.

The feedback was given directly to Valletta and Bono, though it is not clear whether Minola had access to this information.[37] Giacosa had a fairly precise idea of the material costs as his staff engineered every single component apart from electrical devices. Moreover, the design staff worked in conjunction with the Time and Methods office. That was because designers had to take into account not only the mechanical characteristics and performance of each component but also the segmentation and timing of the production process in order to minimise complexity and optimise cycle times. Therefore, Giacosa should have known at least the expected cost of each vehicle.

The Crescimone collection - the set of documents and studies produced by the Production Department - includes a number of files concerning the cost analysis of the production of a wide range of components as well as the cost analysis of some models produced by Fiat and by competitors.[38] The collection includes files from 1950 to 1970. As far as Fiat models are concerned, the cost analyses of the 850 (segment A) and the

---

[36] In theory, by using relevant information from the TSS it was possible to work out standard costs. However, this technique was introduced only in 1970. See Rossignolo in. P. Gennaro, G. Scifo, *Parabole di imprese ed impreditori*, Franco Angeli, Milano, pp. 79-87.

[37] Secondo agnelli solo valletta sapeva quanto costasse una 500.

[38] It was an established practice to disassemble models made by competitors, redesign the TSS and project the manufacturing of that model assuming the deployment of Fiat technology. The process is known as reverse engineering. R.E. was implemented for a number of reasons, as to check whether or not it was more convenient to produce models of other manufacturers under licence rather than Fiat models. Overall, by using this system it was possible to compare the efficiency of Fiat technology with that of other competitors.

124 (segment C) for 1968 are available.[39] These provide valuable information, although the Minola strategy of shifting upmarket had been formalised in the Board meeting of January 1967. In fact, both models were already in production in 1966. Moreover, the information provides an immediate test for the validity of Minola's point of view. According to the Crescimone analysis, the total production costs of the 124 (segment C) were 27.2% higher than that of the 850 (segment A).[40] However, the selling price of the 124 was 35.5% higher than that of the 850, so that the company enjoyed an extra 8.3% profit for each 124 sold in comparison with the 850.[41] This proves that Giacosa's concern about the higher costs of manufacturing larger cars was consistent with the actual dynamic of Fiat costs, but also proves that, given current prices, larger cars were providing better margins, as Minola thought.

However, another Crescimone study, concerning the production costs of the Peugeot 204, the closest competitor of the Fiat 124, shows that the manufacturing costs of the French car were lower by 6.3%, and that the cost saving was mainly due to better design, enabling Peugeot to cut lead time.[42] This means that in the context of straight price-based competition, the per unit margin of profit of the 124 compared with that of the 850 would have been just 2.3% (the difference between 8.3% and 6.3%), which, considering the different scale of production and sales between the two models, would have reduced considerably the profitability of the 124. In addition, the study demonstrates that in perspective, Fiat should have caught up with the technology of foreign competitors more specialised in the manufacturing of medium and large cars. Thus, Giacosa's concern with the higher costs of producing larger cars was more than justified, unless tariffs were kept or collusive agreements were put in place.

It is not clear if Giacosa discussed the output-maximisation strategy directly with Minola. In his book, Giacosa quotes Minola only twice.[43] In any case, information on

[39] Reasonably, the same cost analysis was systematically made for all models. However, only the reports of some models have been stored in the archive.
[40] Archivio Storico Fiat, Fondo Crescimone (Crscimone File), Production Services Department corda 55/7.
[41] Ibid.
[42] The information on the Peugeot 204 costs, as well as the information of costs of many other models, was obtained via reverse engineering, the process of analysing the technology of competitors by analysing their product.
[43] In Giacosa's book there are several indications that the relationship between designers and marketing staff was not based on mutual respect. For example, during the 1960s engineers at Fiat used to refer to

costs was available to the Executive Committee, as well to the board. Why, therefore, at the January 1967 meeting, when Minola based his proposal for a shift upmarket argument on the analysis of revenues per kilo, did nobody point out the inconsistency of the methodology, or support Giacosa's well-known opinion that Fiat would not acquire upmarket competitiveness in the short or medium term? Why did Bono, the most "process-oriented" manager in the Fiat structure, support Minola's view, instead of advising Agnelli[44] that the methodology was not sufficiently robust to support the analysis of output-mix decision-making in price-competitive markets?

It seems that those questions can be addressed only by formulating two hypotheses. Firstly, the members of the Board were unaware of the effects that the removal of tariffs would have on price competition. Secondly, they thought the removal of tariffs would not lead straight to price competition so they accepted the implicit assumption underpinning the Minola methodology, which is that Fiat would retain its position in any segment of the market after 1968.

The former hypothesis can be rejected on the grounds that the reports of the Administration Board meetings contain plenty of evidence that management was perfectly aware of the risks involved with the abolition of tariffs. In fact, the removal of tariffs and price competition had been the object of relentless discussion during the Board meetings between 1963 and 1965.[45] From the analysis of documents, Valletta's views seem fairly straightforward. According to him, the Italian industry was less developed and it would take at least ten years for Italy to catch up with the scale of production already reached in the other European countries. Meanwhile, the production capacity of the European industry was already growing faster than demand, and, according to Valletta, there was the risk that Ford and General Motors could expand their capacity at a level not attainable by European competitors. If this were the case, Fiat could not sustain price competition once tariffs were removed. On this basis,

---

marketing management as the 'commerciali'. This word was supposed to be a sort of slang translation for the Anglo-Saxon term 'marketing staff'. Actually, in Italian the word 'commerciale' is an adjective rather than a noun. When the adjective 'commerciale' refers to a product, it is synonymous with cheap. Indeed, by referring to marketing staff as 'commerciali', engineers did not mean to flatter them. See Giacosa, *Progetti alla Fiat*, p. 280.

[44] Gianni Agnelli became President of Fiat in 1966, while Valletta became Honorary President.

[45] See: Archivio Storico Fiat, Administration Board Meeting, 30th of January 1963, book 33, pp 22-25; ABM, 29th of July 1963, book 34, pp. 1-7; ABM 4th of February 1964, book 34, pp. 96-99; ABM 24th of January 1965, book 35, pp. 179-187 and book 36, pp. 1-23 (continued). For the translation of the most interesting passage from the Administration Board Meetings Minutes, see the appendix to chapter 6.

Valletta expressed the view that the European Commission should introduce quotas, to prevent price competition from spiralling and cutting some producers out of the industry. The alternative was that each individual country would reintroduce tariffs on the grounds of the clause of the Treaty of Rome concerning the defence of national interests against external competitors acquiring dominant positions. In addition, Valletta underlined the substantial agreement between Fiat and French manufacturers, most notably Renault, concerning the possible ways of avoiding the creation of a dominant position within the European Industry.

Given the comparative advantage of Fiat in the bottom end of the market, the concern of management about price competition focused particularly on the middle and top ranges of the demand spectrum, which, as already said, were expected to expand along with the maturation of Italian demand. Moreover, given the Fiat managers' concern about price competition up to 1965, it seems amazing that in 1967, Minola was discussing output-mix strategy using a methodology that assumed Fiat price leadership and, at the same time, overlooked completely the costs structure both within Fiat and across the industry. This paradox can be explained only by assuming that in 1967, one year before the actual removal of tariffs,[46] management was no longer concerned about price competition after 1968. Moreover, the fact that Giacosa, who was not member of the Board, was still concerned about price competition suggests the legitimate suspicion that management and Board members did not share the same information about the regime of competition.

If this was the case, it seems reasonable to think that Minola could not explicitly report to the Board that his strategy was going to work only if tariffs or collusion were in place. Therefore, Minola approached output-mix optimisation through a methodology that implied collusive price leadership, while the Board accepted the methodology without addressing questions concerning costs and competition because the members implicitly agreed with the assumption collusive behaviours. In other words, Minola and the rest of the Board were sharing implicit knowledge that was not at the disposal of the whole managerial structure.

Whether such knowledge derived from formal agreements between manufacturers is impossible to say. In the light of the Administration Board reports, though, it is possible

[46] Tariffs should have been removed before 1970, but had been already removed in 1968.

to say three things. Firstly, the 1967 report shows the lack of concern of Fiat top management over price competition. Secondly, this lack of concern was a remarkable U-turn in comparison with the 1963-1965 period, when Valleta's fears over price competition forced him to utter many threats about joining with French manufacturers to lobby for the reintroduction of tariffs if price competition became unbearable.[47] Finally, the lack of concern over price competition in 1967 was not shared by those managers, such as Giacosa, who were not members of the Board, suggesting different information and/or perceptions of the competitive regime.

It is also conceivable that the Fiat top management believed the threat to reintroduce tariffs would be a credible way to discourage German manufacturers from pursuing a price war, as long as the agreement with French manufacturers held. Moreover, managers expected non-tariff barriers to trade to play a substantial role in cooling down price competition. As has been demonstrated by Silva,[48] during the 1970s, the regime of competition was shaped by collusive price leadership. Overall, the available evidence from the reports of the Administration Board suggests that such an outcome was not unexpected.

Section three

Competition and output-mix decision-making during the 1970s

Silva's analysis showed that during the 1970s, prices among competitors moved in the same direction at the same time. The author assumed that Fiat was the leader and the others were followers. According to him, implicit collusion was led by the fact that, given trends in the factor costs and instability in the exchange rate, there was no incentive for any competitor to restore price competition within and outside the national markets. It was logical, in that context, that in each national market, the national champion was the price leader, so that Silva's assumption of Fiat price leadership is more than reasonable. Silva's conclusions are based on an ex post analysis of prices. In the previous sections of the chapter, evidence has been shown suggesting that already in 1967 Fiat management did not expect price competition to play a role in the medium

[47] In particular, Valletta refers to the President of Renault Dreyfus as a possible allied. See, Administration Board Meeting Report, 30th of January 1963, book , p. 24.
[48] Silva, Prati, Grillo, *Il mercato Italian dell'auto.*

term. This section analyses the question whether Fiat management was confident about the predictability of competitors' pricing behaviours.

Within the implicit collusive framework set by Silva, the competitors' response to the price leader was, in theoretical terms, forecastable rather than predictable. In particular, the time span after which competitors would follow was not predictable, nor could the possibility be excluded that some competitors would not collude. On the other hand, the point made in this chapter is that output-mix decision-making was influenced by the fact that collusion was in place, where the predictability of competitors' pricing behaviour was the necessary precondition to make output-mix adjustments towards segments in which Fiat was less efficient. Therefore, in order to support the argument put forward in the chapter, it is necessary to show that the Fiat management was confident that competitors would follow upwards each time Fiat adjusted prices according to its own output mix and target contribution margins. Based on unpublished internal Fiat documents, the following paragraphs of the chapter show that the Fiat management considered the competitors' response to price rises predictable rather than forecastable and that given the price levels, contribution margins were higher in the middle and top segments of the Fiat production range.

The predictability of competitors' pricing and output-mix decision-making

Obviously, in any business archive in the world it would be extremely difficult to find documents referring to pricing behaviours, particularly in respect to collusion-related issues. However, an interesting document dated September 8, 1975 has been found in the Fiat Archives. This sheds light on the dynamics of price changes during the 1970s. The document consists of a memo written by the head of the car sector Niccolò Gioia, for the Direzione Generale del Gruppo (Group General Direction), which was run by Cesare Romiti at that time. Attached to the memo are the results of a sensitivity analysis assuming a price rise of 7%. The price rise had been also recommended by the Divisione Commerciale (sales department).

Gioia explained that to raise prices by 7% was the best move for the company because it would increase the average margin of contribution by 20%, in spite of the expected contraction in sales. To get the same result by boosting sales, Fiat would have had to increase them by 20%, which was unrealistic. It is important to note that when Gioia mentioned the contraction in sales, he referred to a contraction in short-term Fiat sales as well as a slowing of total demand in the medium term, while in the long term, he thought the expected growth of total demand would be restored, given that the increase in prices in October 1975 partly anticipated the rise in prices planned for the second part of 1976.[49] For Gioia, short term meant one month, medium term six months, and long term one year. In order to explain why Gioia was not concerned with losing market shares in the medium term, let us follow the document in its most significant parts:

> "The variation of our price list is possible because after the last change [of our price list] in June, other Houses [car manufacturers] have adjusted their own prices according to our prices, even though, as always happens, they [other competitors] have delayed that adjustment for one or two months in order to exploit the temporary position of advantage.
>
> Obviously, our position of leader, which obliges us to take the initiative in changing the price list, makes us less competitive after the price rise. However, competitors could exploit their position of advantage only in the last quarter of the year, which is the least favourable for sales [due to the typical seasonality of car sales between September and December]. In any case, as has been already pointed out, it is thought that [competitors] should follow in the generality of cases. The commercial direction thinks that in the case where competitors were late in following us, and therefore the sales of our models decreased, we would sustain the market [our market shares] by fully implementing our plan of incentives [discounts as trade in overpricing]."[50]

The passage is fairly clear. The only concern Gioia expresses in the document is about the fact that other competitors usually delayed the adjustment of their prices by about two months. On the other hand, there was no doubt that competitors would follow Fiat.

When referring to the competitors' behaviour after the June 1975 price increase, Gioia's remark "as always happens" denotes the repetitiveness of the mechanism by which followers adjust their price list, but also sounds like a complaint that the

[49] Archivio Storico Fiat , Fondo Fiat Capogruppo, Segreteria General Dottor Gioia, Corso Ferrucci , fila XXIII/ 98/6, (Fiat Core Companies File, General Director File, Corso Ferrucci, row XXIII, location 98/6).
[50] Ibid.

competitors were trying to exploit a short-term advantage by delaying the adjustment of their own prices.

In the second paragraph, Gioia explicitly refers to the Fiat role of price leader, which "obliged" the company to be the first to change prices. This term (obbliga in the Italian text) emphasises the duty of playing according to the rules regulating the mechanism of price leadership, and also denotes that the rules were rigid. Interestingly, in this paragraph Gioia refers to price changes rather price rises, which means that Fiat was the only player that could take the initiative to make any change in the price list, be it a rise or a cut.

On the other hand, Gioia's explicit reference to a well-established and predictable mechanism is counterbalanced by the central sentence of the second paragraph: "it is thought the competitors should follow", which sounds much more cautious. However, if on the one hand, it is perfectly understandable that Gioia did not want to lay too much stress on the predictability of the dynamics of prices, on the other hand, it refers to the time lag between price setting and price following as the only area of uncertainty, though this was limited to a maximum of two months.

It has to be emphasised that the document does not explicitly refer to agreements. What the document does say is that Fiat had the role of price setter and that management was confident the majority of competitors would follow each Fiat price rise. In addition, the document says that management expected competitors to follow in two months, which might suggest collusion was explicit. On the other hand, it could be argued that the two-month expectation might well be based on historical records. Moreover, it might be argued that it was in the interest of foreign competitors to follow upwards in order to exploit higher price levels, particularly if they were unable to exploit the price advantage because of demand and supply constraints, such as decreasing demand in the aftermath of the oil crisis or an insufficient distribution network. Therefore, it seems fair to say that although the document might provide a strong indication that collusion was organised, it is not definitive evidence. However, as has already been said, the thesis is not about collusion, but about output-mix decision-making. In this light, the document is interesting because it shows that Fiat management was aware of its role as the price leader, and confident about its competitors' response to increases in Fiat prices.

The predictability of the competitors' response to Fiat's price changes made it perfectly rational for Fiat to shift upmarket for two reasons. Firstly, given the predictable price leadership, Fiat could adjust prices up to desired margins, which, to some extent, would minimise the disadvantage of facing higher production costs than its competitors in the top market segments. Secondly, given price levels, medium and higher segments were more profitable then the bottom end of the market. In fact, in the lowest segments of the market room for increasing margins by upgrading prices was tight anyway given the quality of those models and given that demand tended to be price elastic rather than income elastic.

In this regard, the document quoted above is illuminating because it contains the result of a sensitivity analysis, showing the margin of contribution of all Fiat models once the price was increased by 7%. Table 6.3 shows the data, and they prove the point that given price levels, the margins of contribution were higher in the upper range.

Table 6.3: Per unit contribution margin, various models, 1975

Model	Market segment	Cubic capacity	Output per year	Prices*	Contribution margin**	Variable costs**	Operating profits**
126	A	600	149,178	1,300,000	337,326	962,674	-44534
127	B	900-1100	302,837	1,875,000	623,067	1,251,933	140,924
128	C	1100-1300	167,347	2,100,000	677,452	1,422,548	172,161
131	D	1300-1600	161,351	2,870,833	927688	1,943,145	196,336
132	E	1600-2000	54,160	3,378,333	1,158,985	2,219,348	305,153
130	F	2300	401	8,700,000	2,550,898	6,149,102	328,254

Source: Archivio Storico Fiat, Segreteria Generale Dottor Gioia (Fiat Core Companies File, General Director File), XXIII, 98/6. * Current prices (ITL). Average prices calculated on the basis of prices of different versions of each model. ** Average costs and profits of the various versions of the same model, in current ITL.

As appears from the table, segment A was a source of losses. This reflected the relatively low level of output for the segment, which, on the other hand, reflected demand at the bottom end of the segment range shifting from segment A to B. In any case, segment C was performing definitely better than segment B, with the 128 scoring better per unit profits at a much lower level of output in spite of higher per unit variable costs. Segments D and E also perform better than segment C, with the 132 showing comparatively high per unit profits. Finally, segment F performed fairly well, even though the contribution margin increases only by a marginal extent compared to that of the 132. However, the table also shows that costs were increasing according to the competitive segment. Therefore, the reason why contribution margins were increasing from the bottom to the top of the production range was clearly due to pricing. The reason why prices were rising from the bottom to the top of the range is explained by two interrelated factors. The first element, obviously, is the price setting of the basic version of each model in each segment, according to the equilibrium price of each segment, and the second element was the cost and price setting of accessories, the so called "optional sets". Table 6.4 shows this data from the same documentation used so far, which underlines the pricing behaviour and the availability of optional settings according to the various Fiat models.

Table 6.4: Mark up over production costs of accessories (optional settings), 1975

Model	Number of accessories available in the optional set	Average production cost of accessories (current Italian lire)	Average mark up over production cost prices
	Delete this row		
126	4	3,007	700%
127	8	10,587	449%
128	9	18,857	712%
131	16	52,444	251%
132	14	54,595	414%
130	10	98,306	196%

Source: Ibid.

Unsurprisingly, but impressively, the mark up of accessories was well over 200% for all models except the 130. Indeed, the 128 (segment C) was more profitable than both the 126 (segment A) and the 127 (segment B) and even though the mark up over production costs was almost the same for the 128 and the 126, the latter had a much smaller accessory set. The 132 (segment E) was also more profitable than the 131 (segment D) while in the case of the 130 (segment F) the decrease in both the number of accessories and the mark up reflects the fact that a wide range of accessories was already included in the basic selling price. In any case, it is clear that for Fiat it was convenient to push sales in the middle and upper segments as much as they could, trying also to sell the largest possible number of accessories.

So far, it has been shown that in the late 1960s the Fiat management decided to adjust the output mix upmarket, under the assumption that during the 1970s price competition would not be severe. Due to the expected expansion of the middle and upper segments of demand caused by the maturation of the Italian market, and given that in those segments demand tended to be income elastic rather than price elastic, the Fiat management saw a good opportunity to maximise total contribution margins by adjusting output upmarket. Such an adjustment was going to put upward pressure on total costs, so that the move could be expected to be profitable only if Fiat set the price that maximises per unit contribution margin. However, because the comparative advantage of German producers in the manufacturing of large cars, Fiat might have been a price setter only in a regime of collusive price leadership. In this respect, it has been shown during the 1970s Fiat management was confident that competitors would follow Fiat each time the company increased prices. Finally, it has been shown that given price levels, the upper-segment units were those with better contribution margins.

The next paragraph of the chapter deals with the contrast between marketing managers and engineers after 1967. As already said, when Fiat decided to concentrate more resources on the development of upmarket models in the late 1960s, key engineers such as Giacosa were unimpressed. Other engineers, such as Bono, supported the move because it was based on the assumption that Fiat would not face price competition in the short and medium terms. The disagreement between engineers and marketing mangers, though, was going to re-emerge in relation to long-term strategies.

Giammario Rossignolo and market-oriented management at Fiat

When in 1967 Fiat decided to shift upmarket under the assumption that after 1968 price competition would not be severe, the company had the possibility to choose between two different strategies. The first was to use the umbrella of collusive behaviours to protect market shares in the short and medium terms. Meanwhile, the company would restructure production, design and engineering capabilities, in order to increase the efficiency in the production of upmarket models and become an upmarket player in its own right. The second possibility was to increase the production of upmarket units for as long as collusion held. Meanwhile, engineers would develop the production process in order to maximise specialisation, to become even stronger in the segment in which the company was competitive in terms of price and quality and, eventually, to get ready for the restoration of price competition.

The first option was consistent with the ideas of a group of relatively young managers, such as Giammario Rossignolo, who wanted Fiat to shift from a process- to a market-oriented approach to manufacturing. The latter was consistent with the ideas of production engineers headed by Bono, who saw the shift upmarket as an opportunistic medium-term move rather than a change in the specialisation pattern of the company. As already said, Bono supported the ideas of Minola rather than the view of Giacosa, only because the shift upmarket was a function of the regime of competition rather than a function of a change in the specialisation pattern of the company.

Rossignolo was an economist by training who had started his career in the Divisione Commerciale, where he tried to introduce a "modern" marketing-oriented culture. Minola's promotion to the Board opened the way for him to move in that direction. In 1968, Agnelli let Rossignolo transform the Ufficio Studi (Department of Economic and Marketing Studies) into the Direzione Pianificazione e Strategia Aziendale (Directorate for Strategic Planning). From that position, Rossignolo advised Agnelli to take over Lancia and Citroën. The move was indeed inspired by a genuine market-oriented approach. Given the removal of tariffs and the significance of the middle and upper segments in the European market, the acquisition of Lancia and Citroên would have provided the Fiat Group with the right technology and branding to compete upmarket in its own right. As already stated in chapter 3, the outcome of the strategy was largely affected by the way engineers implemented it. The merger with Citroên was not completed because the French management did not agree with the Fiat engineers who wanted to use the same engines for both Fiat and Citroën ranges. The idea was driven by the engineers' desire to maximise economies of scale rather than brand value and differentiation. However, technical synergy was implemented between Lancia and Fiat, with the former using the engine of the latter. Indeed, between 1969 and 1973 product renewal was concentrated on Lancia and the Fiat top range, but the technical sharing of engines reflected more the engineers' desire to maximise economies of scale and minimise R&D expenditure, rather than the Rossignolo idea to develop a brand capable of competing in the upper band of the market in terms of competitive prices relative to high quality standards.[51]

Meanwhile, as shown in chapter 3, the production process was developed in order to maximise the mass production of small cars or, in other words, to minimise the cycle time. Clearly, production engineers and Rossignolo were approaching the business strategy according to different strategic thinking, so that the strategy of Fiat during the 1970s was a hybrid. Output mix was adjusted upmarket, but the production process was developed to maximise production pace rather than flexibility. As shown in chapter 4, the Robogate was eventually used to produce large batches of small cars, rather than small batches of a wide and differentiated upmarket production range.

In 1974, Rossignolo resigned in the aftermath of a conflict with De Benedetti over the restructuring of the component supply chain. He started up his own company specialising in the laser-cutting treatment of sheet metal. His company never became a Fiat supplier, although it enjoyed international success. This indicates how tense was the relationship between Rossignolo and the rest of the Fiat management.[52] Nonetheless, a few months after De Benedetti's resignation, Umberto Agnelli offered Rossignolo the chairmanship of Lancia, which at that time was owned by Fiat and controlled by the Fiat management, although formally still a separate company. As soon as Rossignolo became Chairman of Lancia, he established a partnership with Saab,[53] for the development of a common platform for cars competing in the E segment. Before 1969, when the company was taken over by Fiat, Lancia cars were characterised by a very sophisticated engine design and expensive steel and aluminium construction for the chassis. However, with the launch of the Beta range in 1970, Fiat engineers abandoned the Lancia technology for both engines and chassis. The problem of Rossignolo, therefore, was to regain the levels of chassis quality Lancia had achieved before being

[51] In this respect it is useful to underline that collusion meant to keep the price of competitors sufficiently high to minimise the advantage competitors had in terms of quality. In fact, in absolute terms the Fiat upper range was less expensive than the upper range of German competitors. However, the quality differential would have shifted demand towards competitors, if prices were set according to the cost structure of each player. In other words, German competitors had comparative advantage in the manufacturing of the upper range.

[52] Gennaro, Scifo, *Parabole*, pp. 82-83.

[53] Saab is a Swedish manufacturer specialising in segment E.

taken over. The partnership with Saab, for the development of common parts, such as the platform, was supposed to reach this target at a relatively low cost.

As already pointed out in chapter 3, in 1978 Fiat Auto was established. The new company incorporated all the activities related to the manufacturing of cars and light commercial vehicles, formerly run by the Fiat Group. Vittorio Ghidella, the production engineer appointed chairman of Fiat Auto, decided to maximise technical synergy among brands and different product lines. Rossignolo did not agree with the incorporation of Lancia into Fiat Auto. His argument was that although there was scope for sharing components, design, development and marketing had to remain separate. In fact, the Lancia clients were different from those of Fiat, so that the development of the brand depended on its being distinct from the Fiat range. As soon as Ghidella rejected Rossignolo's argument, the latter resigned immediately, and never returned to the Group.[54]

Thus, the appointment of Ghidella as Chairman of Fiat Auto had huge strategic implications with the fusion between Lancia and Fiat. Moreover, the whole product-renewal strategy changed. Apart from the Ritmo, launched in 1978 but designed before the oil crisis, product renewal focused on the bottom range, with the Panda (segment A) launched in 1980, and the Uno (segment B) launched in 1982. In 1980, the Lancia Delta (segment C) was launched, followed by the Lancia Prisma (segment D) in 1983 and the Regata in early 1984. However, the Delta, Prisma and Regata were all based on the platform and mechanics of the Ritmo, so they could not be considered as entirely new models, as opposed as the Panda and the Uno. Moreover, the model based on the Saab platform, which had been at the centre of the Rossignolo strategy, was launched only in 1984, eight years after the agreement with Saab was signed. The Lancia Thema (segment E) was followed by the Croma - a model based on the same platform - in 1985. The priority given to the renewal of the bottom range, along with the paucity of resources allocated to the renewal of segments C and D, for which neither new platforms nor new engines were developed, explains well why after 1980 the output mix shifted back upmarket.

---

[54] Gennaro, Scifo, *Parabole.*

The point made in this chapter is that the expectation of collusive pricing behaviour held by Fiat management in the late 1960s was the main factor underpinning the adjustment of the output mix during the 1970s. The next chapter will make the point that the shift back downmarket during the 1980s was the result of the Ghidella expectation that price competition would be restored. During the 1970s, in fact, Fiat had missed the opportunity window, offered by implicit collusion, to restructure design and production processes, in order to become an upmarket competitor in its own right. Once price competition was restored, there was no other chance than to allocate resources to the renewal of cars competing in those segments in which Fiat had comparative advantage, as this was the only way to defend market shares.

Conclusions

This chapter has examined the output-mix optimisation strategy of Fiat in the late 1960s and 1970s. It has been shown that in the late 1960s, management was conscious that Fiat had its comparative advantage in the manufacturing of small rather than large cars. On the other hand, the Fiat management was confident that the abolition of tariffs would not lead straight to price competition. Management therefore expected collusive price leadership to give them the possibility to set prices according to their cost structure and their target per unit contribution margin. Because demand in the upper segments was expected to grow faster than demand in the bottom segments, to move upmarket seemed a good idea.

Already in the early 1980s, the seminal study of Silva proved that during the 1970s collusion was actually in place during the whole decade. Moreover, through internal Fiat documents and data, it has been shown that Fiat management was conscious that prices were behaving in a way suggesting implicit collusion and that managers were setting prices accordingly. Moreover, it has been shown that given the price levels, the upmarket units provided much better contribution margins so that the adjustment of the output mix upmarket was advisable. Finally, it has been shown that once Ghidella became Chairman of Fiat Auto, he focused effort on renewing the bottom end of the Fiat range. At the same time, management delayed the development of the segment E range, and allocated relatively small resources to the renewal of segments C and D. This decision affected output mix, which, as has been shown, shifted back downmarket during the 1980s. The next chapter will address the question why Ghidella decided to shift back downmarket. It will be shown that in the late 1970s there was already enough evidence that collusion was not holding and that implicit price competition was effective, since the real price of cars tended to be much lower than the official one. Moreover, it will be shown that during the 1980s explicit price competition was actually restored, as had been expected in the late 1970s. Once price competition was restored, Fiat had no other choice than to go back downmarket to exploit the comparative advantage deriving from its specialisation in the manufacturing of small cars. Finally, an indication was given that the Fiat output mix during the 1980s was the best profit-maximising one.

In term of managerial continuity, it is therefore possible to say that the Valletta technical management and the Ghidella management shared the view that Fiat had to maximise its comparative advantage in the bottom range of the market. Departure from this framework could have been only contemplated if collusion or tariffs were in place. Overall, Ghidella and his predecessors shared the same set of routines underpinning product-mix decision-making. The decision to make Minola responsible for the car sector and to support his strategy of shifting upmarket in the late 1960s had the side effect of enabling innovative marketing managers to acquire remarkable weight in the Fiat hierarchy. Nonetheless, those managers were overtaken by production engineers in the late 1970s without having been able to establish a different and more market-oriented pattern on the Fiat design and manufacturing framework.

Chapter 7

Output-mix decision-making at Fiat in the 1980s

Introduction

The previous chapter has shown that during the 1970s, collusion enabled Fiat to set prices according to its target contribution margin. This affected output-mix decision-making. In theory, Fiat should have maximised its comparative advantage in the manufacturing of small cars. In practice, collusion led to price levels sufficiently high to maximise the contribution margin of upmarket units, which, in turn, drove Fiat's output mix upmarket. The previous chapter has also shown that during the 1980s, Fiat shifted the output mix back downmarket, because of the change in strategy pursued by Ghidella. In particular, the new Chairman focused on product renewal in Fiat's bottom range, despite the opposition of Giammario Rossignolo, who wanted to allocate more resources to the development of the Lancia brand in order to compete upmarket.

This chapter explains the change of strategy pursued by Ghidella, as a response to changes in the regime of competition in the 1980s, suggesting that the end of collusion during the 1980s caused the shifting of the production mix towards the lower-model range, in the same way as collusion during the 1970s had caused the shifting of the product mix towards the upper-model ranges. During the 1970s, Fiat had been exercising collusive price leadership throughout the demand spectrum. This meant that Fiat set prices and competitors followed regardless of the comparative advantage each manufacturer had in specific segments of the demand. Once price competition was restored, though, Fiat would no longer be in the position to set prices in any segment of the demand spectrum. More likely, the company would be able to be the competitive price leader in the bottom segments of demand, where Fiat had a comparative advantage, and a price follower in the upper segments of demand, in which German and French competitors were much more specialised and produced much larger outputs. Looking at the Ghidella strategy ex post, it seems that Fiat had no other rational choice but to maximise its specialisation. After all, how could Fiat compete with Mercedes and BMW in the E range when it produced only one-third as many cars as each of the German competitors in that segment? Nonetheless, an alternative did exist. This was the Rossignolo strategy, based on the acquisition of upmarket brands such as Citroën, and on the development of the Lancia brand at the upper end of the market. However, such an alternative should have been pursued coherently since the late 1960s. Clearly, it was not.

The chapter is organised as follows: the first section shows that already by the second half of the 1970s, the Fiat management had all the information needed to predict that collusion was not going to hold. The second section shows that during the 1980s, price competition was actually restored, and that Fiat and Ford were the two most price-competitive players in the Italian market. Finally, using available data on production costs, the last section suggests that the Fiat output mix in the 1980s was the most cost efficient.

Section one
A time for colluding and a time for competing: The late 1970s and the end of the "price truce"

This section shows that in the second half of the 1970s, collusion did not prove a sufficiently strong factor to keep market shares stable. On the contrary, competition based on product diversity played much a greater role in reshaping the structure of Italian demand. Within the new market structure emerging after the first oil shock, none of the players, Fiat included, had any incentive left to stick with collusion.

Management expectations and the dynamic factors underpinning collusion in the late 1970s

By definition, collusion would only hold if each of the players involved in collusive behaviour could pose a credible threat, in order to prevent other players from cheating. The credible threat usually consists of the ability to punish the cheaters by increasing output to a level not attainable by other players.[1] This leads to a form of "collusion paradox". If one of the collusive price leaders is so efficient as to put in place a credible threat, the temptation for him to shift back to price competition and compete for market shares might be significant. Given that the credible threat consists of a powerful incentive to shift back to price competition, collusion only holds if the various players have "exogenous incentives" for colluding, or when different players are experiencing different endogenous problems. The first case might occur when all players within a given industry experience a rise in input prices. The latter might occur when, for

[1] This, of course, implies that demand is price elastic.

example, one player is experiencing low labour productivity, while the closest competitor is experiencing inefficiency in distribution, due to the underdevelopment of the sales network.

In the previous chapter, it was shown that during the 1970s the Italian management was confident that competitors would follow any adjustment of Fiat prices. Critically, this confidence did not reflect Fiat's ability to mount a credible threat, because, as already shown in chapter 3, in 1974 the company was on the edge of financial collapse. Foreign competitors were compelled to follow Fiat's price leadership because of a set of externalities, over which the company had no control. Initially, competitors were colluding because the distribution network was not developed enough to sustain price competition. Then, after 1973, the increase in the price of raw materials and the instability of exchange rates forced the European industry to suspend price competition. In particular, the instability of exchange rates reduced the comparative advantage of German competitors, in the upper end of demand.[2]

Critically, all these factors were dynamic rather than static. The distribution network of foreign competitors had been developing over time as well as Fiat's distribution network abroad. The instability of raw material prices and exchange rates were temporary phenomena linked to the international business cycle in the aftermath of the oil crisis. Nonetheless, the international economic and political scenario was expected to stabilise following the end of the Vietnam war, and those European countries such as Italy, which had shifted to a regime of floating exchange rates, were expected to return to fixed exchange rates as soon as macro-economic conditions would allow.

Italy returned to fixed exchange rates in 1979. According to Silva, this was the main reason why the gradual restoration of price competition in the 1980s was expected.[3] Nonetheless, during the 1970s, Fiat was in no position to pose any credible threat. To explain this point, it is important to return to a number of issues analysed in the previous chapters. In late 1967, Minola and the rest of the Fiat Board seemed convinced that the output mix had to shift upmarket, and did not seem worried about price competition after the abolition of tariffs. From the minutes of the Administration Board, it appears that Valletta was convinced that he could pose a credible threat to competitors, by lobbying for the reintroduction of tariffs if price competition proved too severe, once

[2] Silva, Parati, Grillo, *Il mercato Italian dell'auto*, pp. 174-177.

tariffs had been removed. This would have discouraged foreign competitors from investing in production and distribution at a pace not attainable by Fiat. As already shown in chapter 6, it made sense for Fiat to shift upmarket within a collusive framework. Therefore, in 1967 Fiat decided to allocate resources to the renewal of the upper range, in accordance with what could be defined as the "Valletta theorem". This theorem was based on the "political ability" of Fiat to lobby the Italian Government for the reintroduction of tariffs, but, after 1973, Fiat could hardly pose such a "political threat". In fact, as shown in chapter 5, after 1962 the relationship between Fiat and the Italian Government had been gradually deteriorating, and reached its lowest point after 1973.

In the previous chapter, it was also shown that Silva's analysis demonstrates that at least up to 1979 the behaviour of prices indicates that collusion was in place. This finding has been supported by unpublished qualitative evidence, showing that Fiat management was aware of the pricing behaviour of competitors and was setting Fiat prices accordingly. Therefore, the expectations held by Fiat management during the late 1960s turned out to be correct. What had indeed changed by 1973 was the fact that Fiat managers knew they had no credible threat at their disposal. In the second half of the 1970s, the management's confidence that competitors would collude was based on the already-mentioned external factors (instability of input prices, instability of exchange rates and under-development of the sales network) that were compelling foreign competitors to collude. Nonetheless, this scenario was bound to change sooner or later. Therefore, Fiat had to increase its competitiveness in the upper band of the production range or get ready to return downmarket, as soon as it was clear that collusion would not hold. The contrast between Rossignolo and the Fiat management reflects this strategic dilemma.

The "Barker effect" and Fiat market shares, 1965-1987[4]

In the case of the Italian market during the late 1960s and early 1970s, the likelihood that collusion would hold depended upon incentives to collude, rather than upon the ability of the price setter to pose a credible threat. However, it should be pointed out that

---

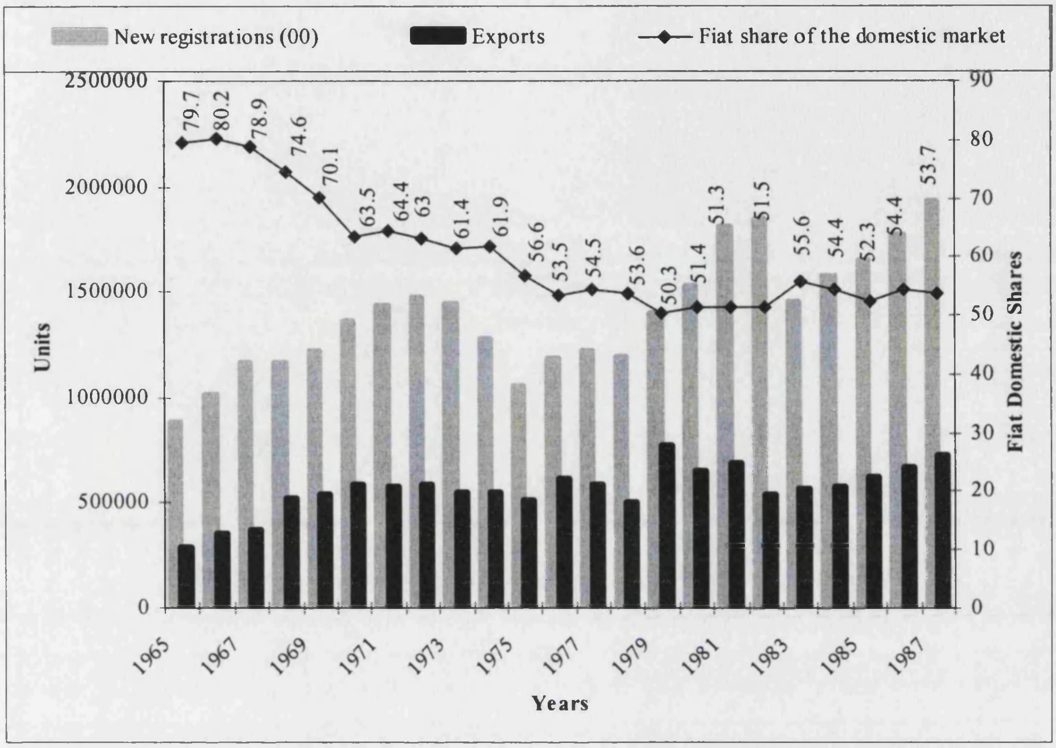
[3] Ibid. Note that the Silva book was published in 1982, but the analysis covered the period up to 1980. Therefore, the author expressed judgements about what was expected for the 1980s, without providing further investigation.

[4] See: T. Barker, 'International Trade and Economic Growth: An Alternative to the Neoclassical Approach', *Cambridge Journal of Economics*, 1977/1 (1977), pp. 153-172.

even when all the players have an incentive to collude, consumers might shift their purchases from one supplier to another because of the intrinsic quality of the product (design, exotic appeal, reputation, status symbol appeal etc.). This, in turn, would destabilise market shares, dividing suppliers into winners and losers. If such a scenario occurs, collusion will soon be over. Losers will cut prices in an attempt to defend market shares, and winners will cut prices to prevent other winners from capturing the market shares lost by the less competitive players. Under the assumption that none of the players would sell below costs, the most efficient manufacturer will get the largest market share.

What the Fiat management might have underestimated, both before and after 1973, was the impact of the Barker effect on market shares. This was the destabilisation of market shares under the pressure of product-differentiation-led competition. Even if the various players were colluding with Fiat, the question that should be addressed is whether and to what extent collusion was an effective means of locking in Fiat's clients. Figure 7.1 shows changes in Fiat's share of the domestic market from 1965 to 1987, along with domestic new registrations, exports and the Fiat shares of the EC market form 1976 to 1987.

Figure 7.1: Fiat shares of domestic market, domestic registrations and export, 1965-1987



Source: Fiat (ed.), *Fiat: le fasi della crescita*, 1996, pp. 131-135. Enrietti and Fornenego, *Il gruppo Fiat*, 1989, pp. 70-73, tables 5/1 and 5/2. ANFIA, (ed.), *L'automobile in cifre*, 1996, p. 334.

When Minola presented his plan to shift the output-mix upmarket to the board in 1967, the Fiat share of domestic demand was 75.8%. Indeed, the removal of tariffs in 1968 brought about structural adjustment of market shares. This was driven by the already-mentioned Barker effect. Between 1968 and 1970, Fiat domestic shares decreased by 11 percentage points. However, during the same period both domestic new registrations and Fiat exports increased. Plants were running at full capacity, and therefore the adjustment in the structure of the Italian market should not be seen as a negative fact. Between 1970 and 1973, domestic new registrations, Fiat shares of the domestic market, and exports all stabilised. Fiat managed to keep a prominent position in the domestic market while maintaining its level of exports. As shown in chapter 3, the company did not manage to reach its production target of 7,000 cars per day, even when plants were running at full capacity. In addition, industrial disputes led to losses in total output, which might suggest that market shares could have been slightly higher.[5] In this light, therefore, it seems fair to say the new structure of Fiat sales represented a profitable equilibrium for the company. This is consistent with the collusive framework described in the previous chapter.

Between 1974 and 1978, though, another dramatic shift took place. Fiat lost 8.3 percentage points of its share of the domestic market. This time, the domestic demand was experiencing a marked recession and Fiat exports were stagnating. On top of this, the company was running oversized stocks of finished goods. No longer would collusion work in Fiat's favour.

The decrease in Fiat's market share after the first oil crisis indicates that collusion was not sufficient to offset the Barker effect. In that situation, the incentives of the various players for sticking with collusion were becoming weaker and weaker. On the contrary, the incentive for each foreign player to capture Fiat's share was becoming stronger and stronger. German manufacturers were disadvantaged by the exchange rates, which did not favour German exports to Italy. As already mentioned, though, exchange rates were expected to stabilise, as soon as macro-economic conditions would allow. The last incentive to stick with collusion would disappear and the Barker-Linder effect, namely competition based on both product diversity and price competition in each segment of demand, would have severely penalised the Italian industry. Clearly, Fiat had to regain price competitiveness, if it was to have any chance of defending its position in the internal market.

Within the new market structure, Fiat had few chances to regain its pre-oil-crisis market share. Rather, it had to aim for the defence and improvement of its new position. Therefore, to lower the break-even point was mandatory. Moreover, because Fiat could not regain its pre-crisis market shares, it was in the interests of the company to stimulate total demand. This means that within the post-oil-crisis structure of the Italian market, it was in Fiat's interest to return to price competition and regain competitive price leadership as opposed to collusive price leadership. Thus, when Ghidella became Chairman of Fiat Auto in 1978, his task was to reduce the break-even point and to regain competitive price leadership, which meant to regain cost efficiency. In this situation, the incentive for the management to maximise specialisation and the comparative advantage in the manufacturing of small cars was enormous. Thus, Ghidella's decision to give the priority to the renewal of the bottom range seems to be the most rational one.

---

[5] See chapter 3, Table 3.4.

In 1979, Fiat's market share reached 50.3% - the lowest point for two decades - though demand was recovering along with exports. For three years demand increased, with Fiat keeping its share at about 51%, with slightly decreasing exports. Demand decreased again in 1983, but Fiat's share of the domestic market rose to 56.6%. Then, shares remained above 52% while demand recovered from the crisis of 1983.

As already pointed out in chapter 3, the stagnation of the Italian market after the first oil crisis lasted longer than in the other main European markets.[6] Silva maintains that the prolonged stagnation was caused by the fact that after 1973 the prices of vehicles in Italy increased by more than in the other major EC markets.[7] Given the regime of collusion the price spiral was determined by the Fiat price strategy. The recovery of demand between 1979 and 1982 can be explained by two phenomena. The first was the ageing of the car stock during the prolonged stagnation of demand between 1974 and 1978, which in turn determined a massive replacement wave between 1979 and 1982. The second element was the gradual return to implicit price competition. As will be shown in the next section, Silva's analysis of "official" prices between 1973 and 1980 shows that prices of various manufacturers were all moving in the same direction and at the same time, which is consistent with collusive behaviour. However, the author underlines that in 1980 there were already signs that manufacturers were practising informal price competition by offering discounts on the official selling price.

In theory, implicit price competition is not as effective as explicit price competition, because the collusive price leader can react to the discount policy of competitors by increasing official prices. If competitors follow, the real price of cars will rise anyway. On the other hand, if competitors do not follow, discounts lead to a reduction of real prices. As will be shown in the next section, after 1980 competitors stopped following Fiat price rises, while after 1983 Fiat and Ford started to increase their prices at about or even below inflation.

[6] See chapter 3, pp. 79-82.
[7] Silva, Grillo, Prati, *Il mercato Italian dell'auto*, pp. 174-177.

Section two

Competition during the 1980s

The preceding section argued that in the second half of the 1970s, Fiat's management had every reason to predict that the 1980s were going to see the restoration of price competition. This compelled Fiat to reconsider output-mix optimisation. The aim of this section is to see whether price competition was actually restored after 1980.

Price analysis: A comparison between the 1970s and the 1980s

As already seen, Silva has shown that the index of real prices in the Italian market increased by 134% between 1970 and 1980,[8] within a context of implicit collusion. Moreover, the author produced a matrix showing the frequency with which Fiat and its nine closest competitors changed their prices between January 1973 and October 1980. In that period there were 45 price increases. Based on monthly data,[9] Fiat raised prices 31 times. Silva constructed a variable showing the frequency with which any number of competitors in a range of 1 to 9 followed Fiat. Then, he calculated the cumulative variable (FX) that shows the cumulative frequency with which any given number of manufacturers, among the 9 competitors, followed Fiat. If all 9 competitors increased prices in 22.6% of the cases in which Fiat increased prices, while 8 competitors followed in 12.9% of those cases, the cumulative percentage of cases in which 8 competitors increased their prices was FX = 22.6% + 12.9% = 35.5% (see table 7.1)

Through his calculations, Silva showed that in 64.6% of the cases, two-thirds of competitors increased their prices in the same or the subsequent month as Fiat did, while in 22.6% of the cases all competitors increased their prices.[10] Under the assumption that Fiat was the first to change price in every month in which it and its competitors changed price, the result suggests a strong collusive price leadership of Fiat.

Of course, this methodology has many weaknesses, as the author himself points out. In particular, Silva could not produce any evidence to support the assumption that Fiat was the first mover in changing prices. Moreover, the shift in prices of a single manufacturer could have been decided several months before it actually took place and, therefore, could be not responsive to any change in competitors' prices.

[8] Silva, Grillo, Prati, *Il mercato Italiano dell'auto*, p. 79.
[9] This is to be done because data are available only on a monthly basis.
[10] Silva, Grillo, Prati, *Il mercato Italiano dell'auto*, p. 126.

However, as already stated Silva uses this exercise to support an argument based mainly on the analysis of the gross total contribution margins of the industry.[11] Moreover, from qualitative evidence presented in the preceding chapter we know that during the 1970s the Fiat management regarded its competitors' response to its price changes as predictable and that the response could be expected within one or two months. In addition, the same qualitative evidence shows that Fiat was the first mover in changing prices. Thus, on the one hand, the way Silva set the exercises in 1980 implied a circularity in its results, namely that Fiat was a collusive price leader, once it is assumed that the company was the first mover in changing prices within the relevant time span. On the other hand, because now we know that Fiat was the collusive price leader, the result of the exercise holds.

Having established that Silva's results are credible, the exercise has been replicated for the period between January 1981 and December 1987. Again, the assumption has been made that Fiat was the first mover in every month when the company and its competitors changed prices. The aim is to compare 1973-1980, when we know Fiat was the collusive price leader, with 1981-1987. Substantial similarities in the two frequency matrices would suggest that collusive price leadership could have been still in place during the 1980s. However, to confirm this requires qualitative evidence that Fiat was the first mover when a multiple price change occurred in the same month. On the contrary, substantial differences in the frequency matrix would suggest that collusion ended during the 1980s.

The price matrix for the January 1981 - December 1987 period has been constructed by calculating differences in the price list for each month for nine manufacturers competing in the Italian market during that period.[12] For each manufacturer, only those models that are broadly comparable with Fiat models have been considered.

For each month (Mn), the average price of the various versions of each model has been calculated.[13] Then, the price difference for each month (Mn – Mn-1) was

[11] This is an econometric estimate of the gross contribution margin of the Italian car industry according to the following function: log p = a + log M + log CLUP + log ImM/IMM, where: p = quarterly index of the output price of the Italian car industry; M = average index of input prices (non-labour input); CLUP = index of labour cost per unit of output; ImM/IMM = demand tension. See Silva, Grillo, Prati, *Il mercato italiano dell'auto*, p. 129.

[12] The competitors are Ford, Opel, Renault, Peugeot, Volkswagen, Audi, Citroen, Alfa Romeo and Volvo. See table A7.2. in the appendix.

[13] In some cases, special versions such as the Uno Turbo, the price of which differed substantially from that of the standard model, have been excluded from the calculation. To keep quality constant, prices in Mn and Mn-1 were compared only for the same model. This means that when a new model appears in the price list its price is not compared with the price of the model it has replaced.

calculated. Next, the average increase in the price list was worked out.[14] This calculation was used to construct a data-base showing the increase in prices for each manufacturer as a percentage of the previous month's prices. The data matrix is shown by table A7.2 in the appendix.

In the period considered, prices changed 28 times. In 15 cases, Fiat increased prices, while in eight cases prices were increased by competitors. In the remaining five cases, prices were actually reduced and in three cases out of five, Fiat made price cuts. The fact that there were price cuts already suggests a tendency towards the reintroduction of explicit price competition in the period considered.

Table 7.1 compares the results of the Silva analysis (1973-1980) with the frequency distribution of cases in which Xn competitors increased their prices in the same or in the subsequent month when Fiat increased its own prices in the 1981-1987 period.

Table 7.1: Frequency distribution of the number of price followers in the same month or within two months when Fiat increased its prices

1973 - 1980			1981 - 1987		
Xi	fXi	FX	Xi	fXi	FX
9	22.6%	22.6%	9	13.3%	13.3%
8	12.9%	35.5%	8	13.3%	26.7%
7	16.2%	51.7%	7	20%	46.7%
6	12.9%	64.6%	6	0%	46.7%
5	25.8%	90.4%	5	20%	66.7%
4	3.2%	93.6%	4	13.3%	80%
3	3.2%	96.8%	3	0%	80%
2	3.2%	100%	2	6.7%	86.7%
1	0%	100%	1	13.3%	100%

Source: 1973 - 1980, Silva, Grillo, Prati, *Il mercato Italiano dell'auto,* p. 124. 1981-1987, elaboration of official prices, *Quattroruote*, monthly. See tables A 7.2 and A 7.3 in the appendix. Xi is the number (i = 1, 2, ...9) of competitors who increased their prices in the same or in the subsequent month Fiat increased its own prices; f (Xi) is the frequency by which a number Xi of competitors increased prices when Fiat did. FX is the cumulative frequency If 9 competitors increase prices in the 22.6% of cases in which Fiat increase prices, while 8 competitors follows in 12.9% of cases, FX will be = 35.5% = (22.9% + 12.9%).

As already stated, the cumulative function FX shows that between 1973 and 1980, in 64.6% of the cases two-thirds of competitors (6) increased prices when Fiat did, while all competitors followed Fiat in 22.6% of the cases. In comparison, between 1981 and

[14] The increase in price of each model has been weighted by the number of its versions in the price list.

1987, two-thirds of competitors (6) increased prices concurrently with Fiat only in 46.7% of the cases, and only in 13% of the cases did all the competitors follow Fiat. Looking at the whole distribution the difference is significant.

As already stated, the Silva exercise was based on the assumption that Fiat was the first mover each month in which both Fiat and competitors increased prices, but qualitative evidence shows that as far as the 1970s are concerned, this assumption is acceptable. As far as the period 1981-1987 is concerned, there are two possibilities: a) Fiat was not the first mover in those months in which prices were raised by competitors, or at least by many of them. In this case, collusive price leadership did not take place by definition; b) Fiat was the first mover each time it increased prices in the same month with a number of competitors. Even in this case, there seems to be far less homogeneity in the price changes among manufacturers between 1981 and 1987 in comparison with the previous period. This suggests that during the 1980s collusion was replaced by a more transparent regime of price competition.

Monthly price data suggest that the transition to price competition started as early as 1981. In July 1981, Fiat increased the price list by 12% compared with its prices in March,[15] while in the same period the price index of consumer goods increased by only 4.7%.[16] Opel and Volvo increased their prices by 7.4 and 6% within the next two months, but the other competitors did not follow. In August, Fiat reduced its prices by 4% but this time all the closest competitors followed. Arguably, at that point, the Fiat management was no longer confident that its competitors would follow increases in Fiat prices.

Table 7.2 shows changes in the price list of Fiat and its closest competitors, and compares them with the changes in the ISTAT price index of consumer goods from 1981 to 1987. Each observation shows the percentage by which prices increased form January to December each year. As already shown elsewhere in the thesis, during the 1970s, Fiat prices rose by far more than the price index of consumer goods. On the other hand, during the 1980s this was not the case.

[15] See tables A7.2 and A7.4 in the appendix.
[16] Calculated using the ISTAT price index of consumer goods.

Table 7.2: Changes in prices, various manufacturers, 1981 – 1987

	Fiat	Alfa Romeo	Audi	Citroën	Ford	Opel	Peugeot	Renault	Volkswagen	Volvo	ISTAT price index of consumer good
	%	%	%	%	%	%	%	%	%	%	%
1981	21	9.5	13.1	5.88	15.5	21.2	20.5	13.4	19.7	1.2	18.7%
1982	18	20.9	21.3	20	15.6	15.1	13.6	17.7	16.1	24.9	16.3%
1983	6.2	9.4	24.5	11.2	6	11.9	13.6	14.4	17.5	10.2	15%
1984	13	15.2	11.4	13.2	14.2	15.1	10.6	5.8	6.1	9.5	10.6%
1985	4.4	6.7	4.2	5.56	3.51	7.9	8.1	7.7	12.3	6.1	8.6%
1986	5.2	6.1	12.9	6.2	0.3	11.2	4.4	4.91	15.4	4.4	6.1%
1987	4.2	5.64	10.5	5.98	7.36	4.58	5.7	13.3	7.4	3.4	4.6%

Sources: Elaboration of official prices, *Quattroruote*, monthly. ISTAT price index of consumer goods; See table A7.4 in the appendix.

As shown by the table above, Fiat increased prices below the ISTAT index in 1983, and from 1985 to 1987.[17] In the same period, Ford was the most effective competitor in containing the annual increase in prices. As shown in chapter 3, after 1982 Fiat returned to profitability, improving the bottom line throughout the period considered in this thesis. In addition, the last chapter has shown that during the 1980s the output mix shifted downmarket, because of the strategy of product renewal focused on the bottom product range. This strategy aimed to contain production costs and increase price competitiveness. The fact that during the 1980s Fiat was able to contain the increase in prices to levels well below inflation, responding efficiently to aggressive price competition by Ford, suggests that the adjustment of the output mix downmarket, and therefore the Ghidella strategy, worked according to expectations. The next section is an attempt to support this view with the available data concerning costs per segment.

Section three

Economies of scale: Fiat's output structure and typical European volumes

The preceding chapters argued that the Fiat's output mix during the 1980s was driven by the company's comparative advantage in the manufacturing of small cars, as opposed to the comparative advantage of French and German manufacturers in the production of upper-range units. Using the available data, this section investigates the relationship between the shift of the output mix downmarket and the behaviour of total costs.

[17] ISTAT (National Institute of Statistic).

Output-mix optimisation and the problem of data

The choice of the optimal output mix is usually taken according to a sensitivity analysis, which highlights the behaviour of the total margin of contribution (TCM) according to variations in the output of each model. The simulation of the behaviour of TCM, therefore, requires knowledge of the unit contribution margin (UCM) of each model at various levels of output. Because the contribution margin is such an important determinant of the performance of any company, information regarding CM tends to be circulated among only a restricted number of managers, and often is not recorded according to the normal archival procedures. Consequently, data on contribution margins such as those presented in the preceding chapter 5, table 5.3 are extremely rare. Business historians, thus, should always assume that the likelihood of finding an even more detailed and wider data set enabling the dynamic analysis of TCM is close to zero. An extensive exploration of the Fiat Archive has confirmed this assumption. This is the reason why this section of the chapter is mainly based on secondary sources, namely data from a study made by Ludvigsen and Associates Limited (LAL) in 1988, using information received by motor car producers.[18]

By using the LAL data, it will be shown how costs behave at different output levels and with different output mixes. It has to be made clear that the exercises run using LAL data will provide only an indication of how Fiat costs would have behaved assuming that Fiat's cost structure reflected the average cost structure of a typical European car manufacturer. In the LAL study, the 'typical' car manufacturer is one for which the cost incurred in the production of each model are equal to the typical costs of the European car industry, in each segment of the market. Typical costs were defined as the weighted average of production costs in each segment. This has been worked out by weighting the production costs of each model competing in a specific segment according to its share of the European market.[19] As will be explained in the following paragraphs, given the way LAL has weighted each single observation in the computation of the typical per unit costs in each segment, it seems reasonable to assume that these costs would be higher than Fiat's actual costs for the lower-segment units, and lower than Fiat's costs in the upper-segment units. Therefore, if the exercise shows that applying the European costs

[18] Ludvigsen Associated Limited, *The Cost of non Europe: The Benefit of the EC 92 in the Car Sector* (Bruxelles, 1988).
[19] Ibid., pp. 45-91.

to Fiat, the more the output mix shifts downmarket the more total costs are minimised, then we can assume that the same thing happened with the actual Fiat cost structure. Based on the same assumption, an exercise analysing the behaviour of total operating profits will be run. Both exercises will be presented as an indication that the available data suggest that the more the mix shifted downmarket, the more Fiat optimised output. The results of the exercises will be supported by some Fiat data on lead times in the final assembly.

The LAL study forecasts the effect of the 1992 integration of the European market on the car industry.[20] In particular, the study analyses the effect of the abolition of "fiscal and non-fiscal barriers to trade" on production costs. Non-fiscal barriers are differences in national regulation leading to different specifications for components and complete cars, which affect economies of scale negatively and diminish the profitability of certain markets.[21] Firstly, the study estimates the behaviour of costs for almost every vehicle component as well as for complete vehicles in the 1985 price condition. The analysis is run for each segment and costs are estimates for the typical model in each segment. Per unit costs of a typical model (typical costs) in each segment are estimated by using data from all the European manufacturers of cars and components. Finally, the study estimates the cost saving in the 1992 conditions, under the assumption that a more even fiscal policy would induce a demand-driven output expansion, while a more even regulation would induce a cost-saving-driven output expansion. In fact, uniform regulations would induce higher standardisation, which in turn would reduce both variable and fixed costs. The study, therefore, provides a valuable source of data about the cost structure of the European industry in 1985 conditions.

The relevant output-mix range

In order to establish whether Fiat's output mix during the 1980s was the optimal one for the company, it is necessary to establish viable alternative output mixes. In other words, we need to set a range of mixes within which the Fiat output could reasonably shift up- or downmarket. The following paragraphs compare the actual Fiat output structure during the 1980s with the European average output in 1985, with the European "normal output" (henceforth European Norm) in 1985, and with the Fiat budget output.

[20] Ibid.

[21] The extreme case of such non-tariff barriers to trade is driving on the left side in the UK.

The European average (Ea) and the European norm (En) are the two output structures used in the LAL study to analyse economies of scale in the European industry. The European average (Ea) has been calculated by dividing the European production in each segment by the number of platforms in each segment.[22] The European norm (En) refers to the average output of the typical model in each segment.[23] This has been worked out by weighting the output of each model in each segment by its share of the European market. Fiat's budget output is the output structure, as it would have been had the company produced each model at the optimum output level (for instance, 1000 Regata per day produced at the Cassino plant, 1000 Ritmo per day produced between the Cassino and the Rivalta plants, and 2000 Uno per day produced between the Rivalta and Mirafiori plants). This has been calculated on the basis of Fiat data.

The budget output, the European average and the European norm represent the alternative output structures we have to compare with the actual output structure of Fiat from 1984 to 1987 in order to assess the company's output-mix strategy. The whole set of outputs represents the relevant output range of this investigation. The reason why Fiat's actual output structure was different from that resulting from producing each model at its optimum level (budget output mix) will also be analysed. Once the various alternatives for Fiat to change the output mix have been set, the LAL data on segment per unit costs will be used as the basis for estimating the impact of changes in the output mix on Fiat's total costs. Finally, the impact of changes in the output structure on total operating profits will be estimated by confronting total costs with total revenues generated by the various hypothetical and real output mixes.

Before comparing the Fiat output mix with the European output structure, it is important to make a note of the criteria utilised by LAL to classify market segments as compared with the criteria adopted in this thesis so far, namely the standard criteria used by ANFIA.[24] According to those criteria, cars are grouped as follows: segment A (500-900 c.c.), B (900-1100 c.c.), C (1100-1300 c.c.), D (1300-1600 c.c.) and E (1600-2200 c.c.). In the LAL study, segments are divided into utility (U), small (S), lower medium (LM), upper medium (UM) and large (L). The study provides examples of models fitting into each category.

---

[22] Ludvigsen and Associates *The Cost of non Europe*, pp. 45-91.

[23] Ibid.

[24] The Italian National Association of Vehicle Manufacturers and Dealers.

In general terms, the two classifications are consistent with each other. However, the Lancia Prisma and Fiat Regata have been considered lower-medium units by the LAL study, whereas they have been considered as segment D units throughout this thesis. For this reason, some of the exercises presented in the subsequent sections of this chapter have been replicated in the appendix by assigning to the Regata and Prisma costs for segment C rather than segment D. As will been shown later, the results do not differ.

The reason why LAL considers the Regata and Prisma lower-medium units is that those cars used the same platform as the Ritmo. However, the Regata and Prisma engines ranged from 1300 cc to 1600 cc, as opposed to the Ritmo engines, which ranged from 1100 cc to 1300 cc. This means that in the case of Prisma/Regata the engine, namely one of the most expensive components of a car, fits into the segment D range of component costs (upper medium). This also means that for those two models, the level of finishing and body components had to be raised to the segment D level. Finally, the stretching of the platform involves some engineering costs, which means the cost of the Ritmo platform differs from the cost of the Regata platform.

For all those reasons, in this study the Prisma and Regata have been considered as upper-medium units. Nevertheless, as will be shown later, the use of the same platform damaged the image of the Fiat D segment, which was perceived by consumers and part of the specialised press as a sort of compromise between segments C and D.

The Fiat production mix compared with the European output structure

Table 7.3 shows how Fiat output per segment compares to the European average, and European norm.

Table 7.3: Relevant range of output mixes

Segments	Fiat output mix according to the budget allocation of capacity among segments	Fiat actual output (units)				European average volumes (1985 benchmark)	European norm: typical volumes (1985 benchmark)
	1984	1984	1985	1986	1987	1985	1985
A (U)	394,400	148,121	146,353	355,183	418,422	119,000	110,000
B (S)	498.800	675,614	595,922	663,618	708,834	350,000	440,000
C (LM)	348,000	185,773	151,704	130,705	100,312	505,000	525,000
D (UM)	348,000	272,304	233,713	209,873	200,827	243,000	315,000
E (L)	83,520	24,141	36,008	116,436	118,046	100,000	140,000

Sources: Elaboration of data from the Fiat Archives, ' Libro dei numeri di matricola dei veicoli prodotti' (Fiat Production File), and from Ludvigsen and Associates, *The Cost of non Europe*, p. 33.

First of all, it should be noted that had Fiat set production according to budgets, segments A and B would have been substantially above both average and norm, segment C would have been substantially below the average and the norm, segment D would have been substantially above the average and slightly above the norm, while segment E would have been below the average and substantially below the norm. If segment D is added to segment C according to the LAL criteria, the Fiat budget lower-medium output would have been far above the European average and norm, but still below the sum of lower and upper-medium in both the European average and norm (see table A 7.5 in the appendix).

In theory, the production plan reflects the visible hand of mangers in terms of output choice. The budget production output was divided into 53% for lower-segment units and 47% for upper-segment units. Therefore, if Fiat managers had stuck with the production budget, the output structure of the 1980s would have been less skewed downmarket compared with the output structure of the 1970s, than it actually was.

Once the attention shifts to the actual output, table 7.3 shows that Fiat is far below the En in the upper segments, while it is well above the En in the lower segments. This applies also to the average, where only segment E is slightly above the average after 1985, when the new Croma and Thema were introduced. This suggests Fiat's comparative advantage in the lower segments over the European industry. Nevertheless, the question to be addressed is whether the actual Fiat output mix was the outcome of consumers' preferences or the outcome of a deliberate strategy of output-mix optimisation.

Chapter 6 has addressed the relationship between output-mix strategy and product renewal. Here it is useful to elaborate a bit further on that relationship. The fact that product renewal is one of the most important factors pushing sales is the foundation of the product life-cycle theory.[25] Assuming that resources are limited, it is the priority given to each segment in terms of product renewal that ultimately dictates the output mix, and the way in which the available capacity is allocated to each model. Product renewal means the launch of an entirely new product as opposed to the re-styling of the body of an existing car. In segment A, the Panda was introduced in 1980, while the Y10, which was based on the same platform, was launched in 1984. In segment B, the Uno was launched in 1982. In segment C, the Lancia Delta was launched in 1980, but it was based on the platform of the Ritmo, which had been designed before the first oil crisis in 1973, and launched in 1978.[26] In segment D, the Prisma was launched in 1983 and the Regata in 1984. However, these new models were based on the platform of the Ritmo, which had already been used for the Delta. This had two implications. Firstly, neither model was suited to compete properly in its own segment.[27] Secondly, the Prisma was produced on the same line formerly producing the Beta range, which, in terms of segments was to be considered an E range. This actually shifted the Lancia output downmarket. In any case, the fact that the Prisma and Regata were based on the same platform as the Ritmo gave the public the impression that Fiat had devoted fewer resources to those models.

As far as the segment E is concerned, the Croma and Thema were based on the same platform, but in this case, the component had been newly designed, according to quality specifications of segment E. Therefore, the two models were more successful than Fiat's

[25] See Abernathy, *Industrial Renaissance*, p. 22.
[26] Source: *Fiat: Le fasi dell crescita*, Archivio Storico Fiat (ed.) (Torino, 1996).
[27] The Prisma, for example, could carry just four people.

models competing in the C and D segments. Nonetheless, it is important to point out that the so-called Project Four, which was based on a platform developed by Saab and included the Fiat Croma, the Lancia Thema, the Saab 9000 and the Alfa Romeo 164, was postponed by Fiat management. Therefore, the Thema and Croma were launched in 1984, eight years after the joint venture with Saab had been established.

Platform sharing is an engineering-led cost-saving strategy. The aim is to maximise economies of scale in the manufacturing of platforms. Although the strategy is effective in terms of cost saving, it has some downsides in terms of marketing. The fact that in the case of the Prisma and Regata, not only did management decide to share the platform, but also to use an existing one, means that the resources allocated to compete in that segment were relatively low. The whole project was based on a cost-saving strategy aiming to sustain low levels of output by lowering the break-even point rather than to expand market shares. The same concept applies to segment C. Segment E was, in a way, a surprise. The demand for the Croma and the Thema exceeded the budgeted output so that the segment output was well above average although it remained below the typical output (norm).

Given the renewal strategy and the technical synergy pursued by Fiat management, it looks obvious that the output mix shifted downmarket during the 1980s. In this sense, the budgeted output mix was rather meaningless. Along with the product renewal strategy, the inherent characteristic of the Robogate technology had also an impact on the output mix. As we have seen in other parts of the thesis,[28] according to the budget production plan, the Cassino plant should have been producing 1000 Regata and 400 Ritmo per day, with another 600 Ritmo produced at Rivalta along with and 800 Uno per day, although, after 1986 the Rivalta plant produced only the Uno. In any case, all the units were welded by the same set of welding tools, the Robogate system, which were also used at the Mirafiori plant. Such flexibility did not allow the stabilisation of production at the optimum capacity rate over the whole set of flexible lines, since the production of the Uno could not be moved to the Cassino plant. Nevertheless, the Robogate system had the effect of lowering the commitment of management to stick with the initial production budget set for the Rivalta and Mirafiori plants. Since the Uno could be welded at Mirafiori along with the Y10, the Thema and the Croma, and at Rivalta along with the Ritmo, all these models were competing with each other for

[28] See chapter 4, pp. 158-170.

production capacity allocation, and there is little doubt that the older models would have received the smallest share of capacity

Some considerations on using the Ludvigsen data set as a proxy of Fiat costs

The LAL study estimates the *typical* per unit production costs per segment of the European car industry at different levels of output in 1985. In order to work out per unit costs per segment, LAL has used the following sources:

1. Manufacturers' breakdowns of fixed and variable costs of particular models.
2. Variable cost differentials between models in different segments produced by the same manufacturer.[29]
3. Research findings on manufacturers' levels of purchasing and in-house sourcing.
4. A part-by-part costing of the principal components of a particular models.
5. Comparative data on engine costs for a wide range of European passenger car models.[30]

Using the above sources, LAL has established the existing cost structure of the "typical" car in each segment, and how its constituent costs change at different levels of output. Typical costs have been calculated by averaging the per unit costs of all cars produced in each segment in 1985. In the computation of the average, the costs of each model have been weighted for its market shares.[31] Typical costs at various levels of output are shown by table A7.5 in the appendix. From the LAL data set, typical costs have been derived for the Fiat relevant output range shown in table 7.2. The new data set allows analysing the impact of changes in output mix on Fiat's total costs, assuming typical costs.[32] Therefore, the relevant question is whether any useful inference on Fiat's actual costs behaviour might be derived from a simulation based on the LAL typical costs.

Table 7.4 shows the output per segment and per manufacturer of the European car industry in 1985. Fiat and Peugeot had a dominant position in the lower segments, Volkswagen, Opel and Ford were dominant in the middle sectors, whereas BMW, Mercedes and Volvo were dominant in the upper segments of the market. The data shown by table 7.4 were used to weight individual observations and compute typical

[29] Note that LAL published only the aggregate data of typical costs, since data on the costs of individual models are protected by a confidentiality clause.
[30] Ludvigsen and Associates, *The Cost of non Europe*, p. 42.
[31] Ibid.
[32] The data set is shown by table A7.6 in the appendix.

costs in each segment of the European market. Therefore, it is reasonable to assume that in the segments A and B the actual costs of Fiat and PSA should be closer to typical costs than the actual costs of other competitors. In addition, in segments C and D actual costs of Volkswagen Ford and Opel should be closer to typical costs than those of Fiat and PSA. Finally, typical costs in segment E should reflect the actual costs of BMW and Mercedes.

Table 7.4: Output (units) per segment, per manufacturer, 1985

Segment	A	B	C	D	E	F
C.C.	500-800	800-1100	1100-1300	1300-1600	1600-2200	Over 2200
Manufacturer						
Ford		380,795	500,550	326,467	85,000	
General Motors		277,101	576,351	340,504	97,912	
Fiat and Lancia	205,124	555,572	140,151	223,589	34,853	
Renault	87,835	454,089	537,167	91,647	137,012	
Volkswagen and Audi		260,857	878,991	108,261	339,830	
Austin Rover	34,974	166,536	167,618	65,844	15,920	
Peugeot and Citroën	208,164	595,339	360,716		166,840	
Volvo					239,180	157,838
BMW					287,158	143,927
Mercedes					211,804	290,785
Saab					98,092	13,721

Source: Ludvigsen and Associates, *The Cost of non Europe*, pp. 86-90.

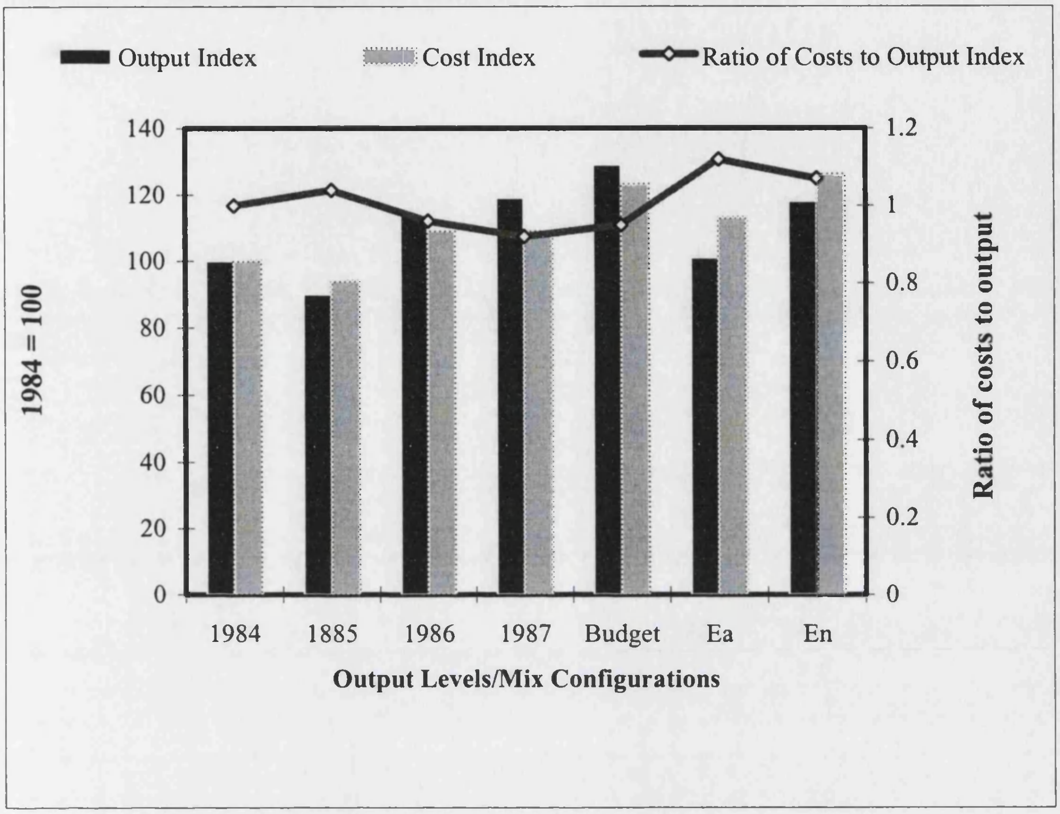
Since in car manufacturing economies of scale have a significant impact on per unit costs, it is reasonable to assume that in the lower segments of the market Fiat and PSA had the lowest production costs of all manufacturers, while Volkswagen Opel and Ford were the most cost-competitive manufacturers in segments C and D, and BMW and Mercedes had the lowest costs in segment E. By contrast, the actual Fiat per unit costs had to be among the highest in segments C, D and E. If we accept this assumption, we accept that typical costs could only be equal to, or higher than, the actual costs of Fiat in segments A and B. By contrast, typical costs in the upper segments could only be equal to, or lower than, Fiat's actual costs. Therefore, even if typical costs were different from Fiat's actual costs, we can assume that to use the LAL per segment unit typical costs as a proxy for Fiat's actual costs means essentially to overestimate Fiat costs in the lower segments at any level of output, and to underestimate costs in the higher segments at any level of output, as compared with the real Fiat costs. This implies that if the LAL data are used to work out the effect of changes in the output mix on Fiat's total costs, and the results of the exercises show that the actual output structure of Fiat during the 1980s minimised total costs, a similar behaviour of total costs and operating profits should be expected if the actual Fiat costs were used, with even lower total costs.

Cost variation in the relevant range of output-mix.

Starting from the LAL database (table A 7.5), by using linear regression technique, typical per unit costs have been estimated in each segment according to the Fiat output mix from 1984 to 1987. The same exercise was repeated for the Fiat budget production plan. The results are shown in tables A7.6 in the appendix. The results, thus, are a proxy for the unit cost per segment that would have occurred by setting production according to any of the output mixes within the relevant range shown in table 7.3. As already stated, the relevant range refers to different output mixes that should be compared in order to assess alternative output-mix strategies. Segment costs have been calculated by multiplying per unit costs in table A 7.6 by the number of units in each segment, for each alternative output structure. Total costs have been worked out, therefore, by summing up all the various segment costs (see table A7.7 in the appendix). The result shows the effect of changes in the output level and output mix on total costs assuming typical European costs in static 1985 conditions.

Figure 7.2 shows that the best output mix of Fiat was that of 1987, which was also that most skewed towards the lower segments, with 70% of the total output consisting of segment A and B units. The figure is based on the data shown by table A7.7 in the appendix. As already stated, the table shows how changes in output mix affects total costs.

Figure 7.2: Ratio of costs to output at various levels of outputs and output mixes, assuming typical costs - 1985 prices



Source: See table A7.7 in the appendix.

From data in table A7.7, an index of total output (in units) and total costs has been calculated, for each alternative output mix in the relevant range (base year 1984=100). The ratio of the costs index to the output index shows how rapidly costs increase compared with different output levels encompassing different output mixes (costs are expressed in 1985 ITL). Any value below 1 in the ratio scale denotes that costs increase more slowly than output.

As shown by figure 7.2, given the lowest ratio of costs to output, the output mix for 1987 is the most cost efficient, among those mixes with a value lower than 1. The budget output mix is the second best option, and the 1986 mix the third best, the ratios of both falling below 1. On the other hand, with the output set at the European simple average and norm, costs increase much more quickly than output.[33] Figure 7.2 suggests that by looking at the output-mix optimisation issue costs-wise, engineers were right in

[33] Figure A7.1 in the appendix replicates the same exercise, adding the output of the Regata and Prisma and relative costs to segment C rather than D. Nonetheless, the result does not change.

emphasising product renewal of the lower range, pushing the de facto output mix downmarket. This is an important piece of information, since engineers had access to cost-related information, which clearly affected not only their process of decision-making, but also their own perceptions of what had to be done to maximise profits and run the business properly. In other words, cost accounting was the determinant of the engineers' business culture.

The view of the engineers was opposite to that of some marketing managers, such as Rossignolo, who argued that by shifting output upmarket, revenues from sales would have been larger, and therefore, there was a trade-off between higher costs and larger revenues. In this respect, though, the effect of price competition becomes crucial. The relevant question, thus, is whether the output mixes most skewed downmarket were not only the most cost efficient, but also those ensuring the largest operating profits (total revenues minus total costs).

In order to address this question, the exercise previously run in figure 7.2 has been replicated by expressing segment and total output in terms of value rather than units. The value of total outputs has been calculated by multiplying the weighted average of per unit revenues from domestic sales in each segment by the output share of each segment in each of the various output mixes in the relevant range. Then, by summing up all the segment revenues, the total revenues of each output mix in the relevant range have been calculated. Table A7.8 in the appendix shows the data set so obtained.

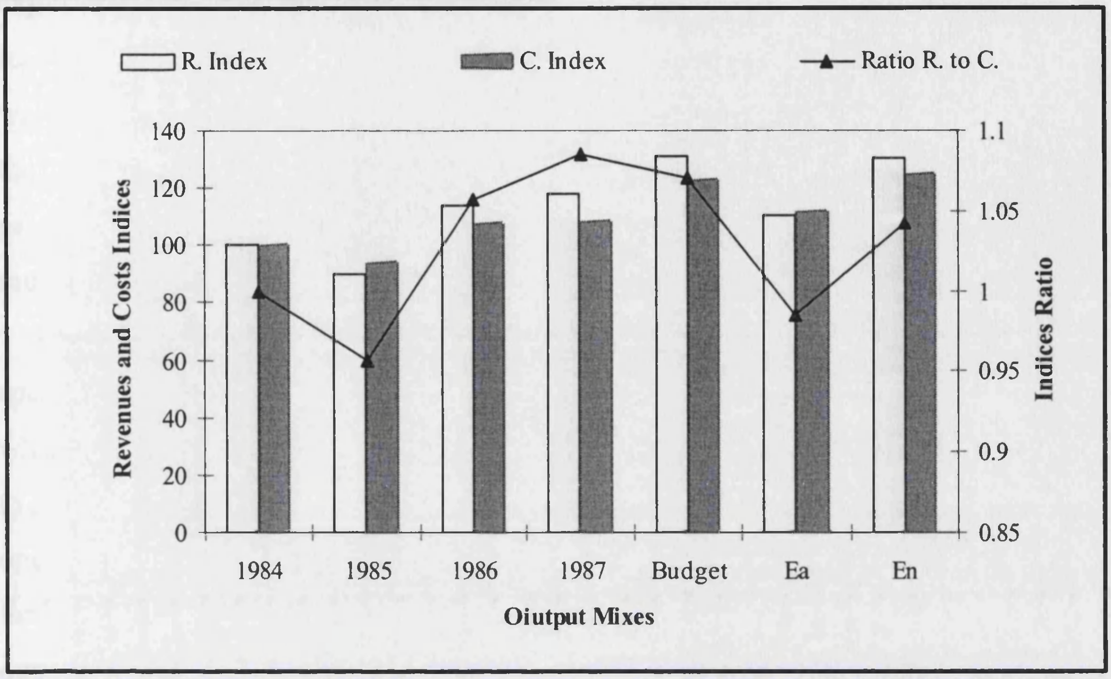
The weighted average of per unit revenues for each segment has been obtained by calculating the average price of each model in each segment net of VAT and dealer profits. The average segment price has been weighted for the share of each model out of the segment output. This provides per segment revenues assuming that the whole output is sold in the domestic market. Revenues have been calculated using domestic prices and domestic dealers' profits for simplicity, but also because per unit revenues from domestic sales are, by definition, higher than those from external sales. In fact, in order to push sales abroad, relative prices are set at a lower level than domestic prices. Moreover, in order to encourage dealers abroad to trade foreign rather than national brands, they have to be offered higher margins than those offered to domestic ones. Finally, it is reasonable to assume that in some markets such as Germany, the competitive pressure for a manufacturer like Fiat is much higher in the top end of the market. Thus, since the exercises assume domestic revenues that are higher than external ones in the face of equal costs for all units of each model, whether sold in external or domestic markets, if the exercises show that the best operating profit maximising outputs are those skewed towards the lower segments, the result has to stand had total revenues been adjusted for external sales.

VAT accounted for 20%, while the margin retained by the domestic dealers was 15% for the Fiat Croma, Regata and Ritmo and Lancia models, and 12% for the Panda Y10 and Uno.[34] The exercise assumes a static condition, in that it has been run by keeping prices constant in 1985 terms. The result shows how total revenues and total costs behave by shifting from the 1984 output to the 1985-86-87 output mixes, and to the budget output, the European average and the European norm outputs.

Figure 7.3 shows the effect of shifts in output mixes on costs, revenues and operating profits. As already said, total revenues encompass the effect of changing output mix. As for the previous exercise, an index of revenues has been calculated and confronted with the index of costs (output mix 1984 = 100). A ratio of revenues to costs has then been calculated. The output mix which best maximises revenues *vis-à-vis* costs is again the 1987 one, where the ratio is the highest among those above 1. Thus revenues grow more quickly than costs, where the difference between revenues and costs (operating profits) is the largest among those in the relevant range of alternative output mixes. The exercises presented above show the effect of changes in output mixes on total costs and operating profits, assuming that Fiat costs were consistent with European typical costs and that the entire output was sold in the domestic market, where selling prices are usually higher. Given those assumptions, the profitability of upper- rather than lower-segment units has been overestimated in the simulation. Yet, the results show that most profitable output mix was also the most skewed towards the bottom rather than the upper end of the product range. The results, therefore, can be taken as indicative of the actual effect of changes in the output mix on the behaviour of Fiat's total operating profits. In the final part of the chapter, the technical capacity constraints are analysed to approach output-mix optimisation from an organisational point of view and show how quality affects both production costs and production organisation. The aim is to support the results of our simulation with Fiat data.

[34] Source: ANFIA.

Figure 7.3 Ratio of revenues to costs at various levels of outputs and output mixes, assuming typical costs - 1985 prices



Source: See Table A. 7.8 in the appendix.

The cycle time in final assembly (Uno, Croma, and Thema)

This paragraph analyses lead-time differentials in final assembly among some Fiat models produced between 1984 and 1987. The investigation will shed light on some of the reasons why the more the output mix was skewed towards lower-segment units the more it was cost efficient. At the state of the art in the 1980s, car assembly was labour intensive, where costs were a function of the time absorbed by the operation, which was a function of the complexity of the vehicle processed.

The total time absorbed by an assembled unit is called the lead time. Let us take the example of the Fiat Uno. The lead-time was 7h = 420 minutes, while the basic cycle time of each operation was 2 minutes. The number of assembly stations was, therefore, 210 = (420/2 minutes). On average, there were two workers in each assembly station so that the total number of workers employed in the production line was about 420 units on double shift, for a total of 900 minutes of production per day. Each assembly line, thus, was processing 450 cars per day (900/2 minutes). Regardless of the number of stations through which each unit had to pass, the per unit assembly cost was:

$$C = 2 * 420 * W$$

where 2 is the number of workers per station, 420 is the duration of the lead-time expressed in minutes and W is the cost of labour per time unit. In other words, given a lead-time of 420 minutes and 2 workers per assembly station, the per unit assembly cost was equal to the cost of 2 workers working for 420 minutes on a single unit, even though each pair of workers actually worked 2 minutes on each unit. The per unit assembly cost, therefore, is a function of the number of workers per assembly station multiplied by the lead time.

By basic cycle time, we mean the minimum amount of time that each unit has to spend in each assembly station. The basic cycle time is a parameter set by engineers when a car is engineered. It depends on total output, the number of lines engineers want to set, the quality level established for the product and the complexity of each assembly operation.[35] In particular, quality is determined by the length of the basic cycle time. The longer the cycle time, the higher the quality. Once the cycle time is set according to the output and the number of lines, the complexity of the vehicle determines the lead time, as well as the number of stations and therefore the segmentation of the process. In fact, the number of stations is given by the lead-time divided by the cycle time.

Table 7.5: Lead-times in final assembly for the Uno, Croma and Thema

Model	Basic Cycle time	Output per assembly line on double shift	Lead-time	Number of Stations (lead time/cycle time)	Average Number of Labour Units per station
	Minutes		Minutes		
Uno	2	450	420	210	2
Croma	5	180	720	144	2
Thema	5	180	720	144	2

Source: Fiat technical management. Interview with the author, 8 January 2001.

From the table above, we infer that the cost of labour in the assembly of the Croma/Thema was 71.4% higher than the cost of labour in the assembly of the Uno. Let us assume, now, that the management wants to expand output in the upper end of the production range. In this case, it would hardly be possible to cut the cycle time and, therefore, the lead-time. Management would prefer to add another line or implement extra time. In fact, to cut the basic cycle time is not a viable solution, because to force workers to speed up the assembly operation by increasing effort would inevitably affect

[35] In this section, we are focusing on final assembly. However, the same concept stands for any segment of the process of car manufacturing.

quality, which is a crucial determinant of competitiveness, particularly for the upper-segment units. In this respect, the labour-intensive final assembly differs from spot welding and other highly automated stages, where the operating speed of robots and tools can be increased without compromising quality, given advances in the technology deployed. Once another assembly line is added, there are two possibilities. Either managers can double output or make the new line work at lower speeds, by setting a longer basic cycle time. This second option is less cost efficient. The implementation of an extra shift is not cost efficient either, because labour costs per hour would be much higher than the cost of labour utilised during the normal shift. If management manages to set an extra assembly line and to run it at full capacity thus doubling production, per unit assembly costs do not decrease, but rather remain constant, since the lead-time of the second line is equal to that of the first lines. In other words, because in final assembly quality constrains the cycle time, economies of scale are rather exhausted.

In any case, here the emphasis is on the fact that when output increases, the final assembly will be optimised if the increment in output justifies the implementation of each extra line at full capacity. Given that the capacity of the Croma assembly line was 180 units per day, the optimal increment of production would have been 360 cars per day (180 x 2).

If, on the other hand, output increases only by 50%, the following scenario would have taken place: the first 180 would have been produced by the first line with a cycle time of 5 minutes (900 minutes of double shift duration divided by 180 units of output), with a lead-time of 720 minutes and a process segmentation of 144 stations (720/5 minutes), while the other 90 units will be processed at a cycle time of 10 minutes (900/90 minutes), which multiplied by 144 assembly stations would give a lead-time of 1440 minutes, which implies double labour costs in final assembly. In other words, because in final assembly economies of scale are negligible, management can either double production having constant returns to scale or increase production by less than 100% and have decreasing returns to scale on the extra units produced by the second line. The same concept applies to the cost of capital allocated to an extra line in final assembly. This dramatically poses the problem of demand constraint. In 1986 and 1987, Fiat was producing both the Croma and the Thema above the planned quota of 180 units per day, but never managed to double output of both Croma and Thema, where the extra units produced were generating decreasing returns to scale in the final assembly.

In this respect, it is interesting to compare the Uno with the Croma and the Thema. Between 1982 and 1985, the number of assembly lines of the Uno increased from 4 to 6. One line was added to the first two lines at the Mirafiori plant in 1984, and one line was added at the Rivalta plant in 1986. Assembly rate of the new lines was 450 units per day which was the optimal rate for that model.[36] In 1986, the Thema was produced at Mirafiori at a rate of 231 units per day, while the Croma was processed at a rate of 277 units per day. For each model, the units exceeding 180 cars per day were processed by a second assembly line whose functioning was sub-optimal. Therefore, additional units had a per unit assembly cost higher than the first 180 units. In this regard, it is useful to remember that although the final assembly stage of manufacturing was labour intensive, the Croma and the Thema could not share the assembly line with the Uno precisely because the basic cycle time of the former was much longer than that of the Uno, which in turn would generate bottlenecks.

Of course, costs in final assembly do not necessarily represent the whole cost structure of Fiat. However, the examples reported above shows how production constraints interact with production organisation, where for Fiat it was easier to optimise an extra line for the assembly of the Uno than to organise the assembly of extra units of the Croma and the Thema in an optimal way. In the first case, to expand production by about 50% in each plant fully justified the deployment of another assembly line at both Mirafiori and at Rivalta, whereas for the Croma and Thema an expansion of production by 100% would have been necessary to optimise an extra assembly line for each model.

Conclusions

This chapter has highlighted three points. Firstly, it has shown that in the second part of the 1970s, Fiat management had various reasons to believe that collusion could not hold in the long term. Secondly, it has shown that during the 1980s, price competition was actually restored, and that Fiat was able to be price competitive. The final part of the chapter provides an indication that the shift downmarket led to the minimisation of total costs, which explains why the company could be price competitive throughout the decade. The exercises on costs are based on figures that are assumed to be representative of Fiat per segment costs. However, the analysis of lead-times in the final assembly of

[36] This paragraph refers to assembly lines which have not to be confused with the welding lines. Welding lines were three at the Mirafiori plant and one at the Rivalta plant.

some Fiat models confirms that for Fiat, during the 1980s, it was more profitable to increase output in the lower rather than in the upper segments of demand.

In the previous chapter, it was shown that in the late 1960s Fiat management shifted upmarket under the assumption that price competition was not going to play a role after the abolition of tariffs. This would have minimised the comparative advantage held by German manufacturers in the upper segments of the market, as acknowledged by the Fiat design team. In this chapter, it has been shown that as soon as price competition was restored, Fiat shifted back downmarket. The routine underpinning output-mix decision-making was essentially the same in both cases, which undoubtedly meant a kind of path dependency in the form of managerial lock-in was in place.[37] The output mix was decided according to the regime of competition while the pattern of specialisation, and, therefore, the comparative advantage had to remain stable over time.

[37] As far as the concept of path dependency is concerned see David, 'Clio' in Witt (ed.), *Evolutionary Economics* (1993), and Magnusson and Ottoson (eds), *Evolutionary Economics* (1997).

Chapter eight
Conclusions

In order to contribute to academic research, scholars can either explore new topics or re-address issues that still require satisfactory answers. This thesis looks at the restructuring of Fiat during the 1970s and 1980s, when the company experienced a managerial turnover at the pinnacle of the organisational hierarchy and the restructuring of the production process. In particular the thesis addresses the question whether there was a discontinuity between the generation of managers who had masterminded the growth of the company during the 1950s and 1960s, and the generation of managers who gradually came to dominate the company between 1973 and 1979. Much of the established literature on Fiat maintains that the restructuring of the 1970s brought about a discontinuity in management, which has been formalised as a shift from inflexible to flexible mass production. Such a shift implies a drastic change in the routines underpinning operations and strategic management. As already stated several times in this thesis, Amatori maintains that the issue of discontinuity in the Fiat management has not been satisfactorily answered so far. This thesis fulfils the agenda set by Amatori by looking at two variables, namely technological change and output-mix optimisation. In doing so, this work departs from the view of discontinuity and shows that the set of routines underpinning the selection of new technologies as well as the selection of the output-mix optimisation strategy remained stable throughout the period considered. Continuity in management and stability in decision making are the two important elements linking the case of Fiat to the literature on path dependency and managerial lock-in.[1]

[1] See David, 'Clio' in Witt (ed.), *Evolutionary Economics* (1993), and Magnusson and Ottoson (eds), *Evolutionary Economics* (1997).

The question addressed by this thesis is relevant in the debate on post-Fordism. In the 1980s and early 1990s, the response of the industrial economies to crisis of the 1970s attracted the interest of researchers in many disciplines, from Business History and Industrial Relations to Business Management and Business Economics. The crisis of the 1970s was interpreted as the crisis of the Fordist system of mass production. The shift from Fordism to new production paradigms was seen not only as the outcome of the rise of new industries exploiting new technologies and products, but also as a consequence of the application of new technologies to mature industries.

As far as mature industries were concerned, car manufacturing was unsurprisingly at the centre of the post-Fordism debate. Flexibility was the main category used to explain the crisis of the 1970s, and assesses the effectiveness of the response of the car industry to that crisis. In the late 1990s though, the debate on post-Fordism appeared to progress slowly. The shift from Fordism to post-Fordism implied a discontinuity in strategic and operations management. Nonetheless, such a discontinuity was assumed rather than proved. The main variable used to distinguish between Fordism and post-Fordism, namely the flexibility of the production system, was not empirically analysed in a satisfactory way.

In the context of the debate on the crisis of Fordism, the case of Fiat stands out as one of the most interesting. The established literature on the company supports the discontinuity view, and maintains that between the late 1970s and early 1980s Fiat departed from Fordist mass production by deploying flexible manufacturing systems based on robotics. Of particular interest was the deployment of robotics in the spot-welding shop. In fact, Fiat became one of the most studied cases of a firm shifting from inflexible to flexible mass production precisely because of its massive investments in robotics. Furthermore, Fiat developed robotics in house.

Crucially, the established literature on Fiat is locked in a circular argument. Firstly, it explains the deployment of robotics as a move in the quest for production flexibility, and then uses the deployment of robotics as compelling evidence that the Fiat production setting during the 1980s was flexible. This thesis breaks this circularity by testing flexibility against an independent variable, namely the rate of capacity utilisation of the production lines.

Such a methodology has been implemented for the first time, thanks to a set of unpublished data discovered during extensive fieldwork in the Fiat Archives. The theory underpinning the methodology is that the utilisation rate of flexible lines is less sensitive than that of inflexible lines to fluctuations in demand for specific models and to changes in the relative size of specific market segments. Therefore, if production lines are flexible, the rate of capacity utilisation of each line should stabilise at about the optimum level. As shown in chapter 4, the first finding of this thesis is that during the 1980s both robotised and traditional production lines experienced marked fluctuations in the rate of capacity utilisation, with some lines implementing considerable amounts of extra time, while others were under-utilised. The implication of this finding is that the flexibility in production assumed by the established literature was simply not there. This is an important contribution to the debate on post-Fordism because it shows that in the case of Fiat, it is not appropriate to trace the shift towards flexible mass production back to the late 1970s, or early 1980s. Furthermore, the findings show that the implementation of robotics *per se* does not imply flexible manufacturing.

The persistence of market fluctuations in the rate of capacity utilisation during the 1980s, when Fiat was using fully robotised plants, raises the question whether those fluctuations depended on the lack of technological development or on managerial factors. This question is important in the debate of continuity and discontinuity in management and leads directly to the issue of routines underpinning the selection and deployment of new technologies. Chapter 4 shows that the fluctuations in the rate of capacity utilisation of robotised lines depended upon the way Fiat production managers deployed robotics, rather than upon technological constraints. Robotics was deployed only in those stages of the process in which traditional technologies did not allow for the minimisation of the cycle time. The rest of the process was left unchanged.

The important point here is that the minimisation of the cycle time was the aim of the Fordist managerial exercise. Cycle time was reduced by increasing the segmentation of the process, by decreasing the complexity of the process and product, and by deploying task-specific tools. Tool specificity and process segmentation led to the inflexibility of the system. In this sense, Fordism was consistent with the managerial paradigm developed by Skinner during the 1960s. This was based on the concept of trade-offs between quality flexibility and efficiency (expressed as duration of the basic cycle time). By looking at the way Fiat management selected new technologies during the 1970s and 1980s, and by looking at the way Fiat management selected the stages of the process in which the new technology was to be deployed, it is evident that the main concern of Fiat management was to minimise the cycle time rather than maximise flexibility. Management made a trade-off between cycle-time minimisation and flexibility maximisation in spite of the fact that the technology could allow them to achieve both. . Therefore, it was the selective deployment of robotics, rather than the characteristic of the new technology, that prevented the whole production system from becoming flexible. The way management selected and deployed new technologies during the 1980s mirrors Skinner's theory of trade-offs that had inspired the development of inflexible automation during the 1960s.

The other important contribution of this work to the debate on post-Fordism consists of capturing the complex relationship between the development of production technology, flexibility and output-mix optimisation. The literature on post-Fordism and the literature on Fiat have addressed the issue of flexibility by looking at technology and management. Actually, flexible mass production entails complex output-mix optimisation issues. Output-mix optimisation consists of choosing the output mix that maximises total contribution margins in the face of many constraints.

Constraints usually refer to total capacity, the specialisation of a given manufacturer in designing and manufacturing specific type of cars, and the specialisation of the supply network in the manufacturing of components with specific quality standards. Those constraints affect the volume of production each manufacturer achieves in each of the segments of the market. Arguably, managerial and technical innovation towards flexible mass production might help to minimise capacity constraint but might have no effect on other constraints. Even if the production framework is flexible, and allows for shifts in output from one model to another and for shifts in output mixes from lower-segment units to upper-segment units, the output mix will be determined by the efficiency with which each manufacturer produces different vehicles and competes in each segment of the market. Therefore, a manufacturer aiming to develop the ability to adjust supply to fluctuations in demand for specific models, and to changes in the relative size of market segments should in theory develop the ability to produce both lower- and upper-segment units with the same efficiency. Otherwise, any reduction in the output of the most efficiently produced model will be detrimental to the margin of contribution.

This thesis argues that the reason why the Fiat management did not develop the entire production process towards flexibility, opting instead for selective deployment of robotics, was simply that managers were not interested in flexibility. In fact, the strategy of output-mix optimisation implemented by the company aimed to maximise the margin of contribution by acquiring a dominant position in the bottom end of the market, where the company was more specialised. In particular, Ghidella, the Chairman of Fiat Auto from 1979 onwards, was convinced that the best output-mix strategy was to maximise the comparative advantage of the company in the lower segments of demand. For this reason, he allocated the largest part of financial resources to the renewal of the models competing in segments A and B. As a result, the Fiat's output mix during the 1980s was remarkably skewed downmarket.

Interestingly, this was also the case with Fiat during the 1960s, when the Company produced a range of different models, but 70% of the output consisted of cars competing in the bottom range of the market. During the 1960s, therefore, the need for flexibility was limited. The capital deployed for the production process was model-specific, while the technical team developed its skills specialising in the design and manufacturing of models competing in the bottom range of the market, in which the company intended to maximise profits. As long as the bottom range was successful, the lines producing small cars were utilised at the optimum level or even over-utilised. At the same time, the models competing in the segments in which Fiat was not specialised were produced at the break-even point or even below it.

The fact that the Fiat's output mix in the 1980s was as skewed towards the bottom range of the market as it was during the 1960s indicates that the managerial culture inspiring output-mix decision-making during the 1980s was similar to the culture that had inspired output-mix decision-making twenty years before. In both decades the basic criterion dictating output-mix optimisation strategy was specialisation and not flexibility. However, the analysis of Fiat's output structure form 1968 to 1987 conducted in chapter 6, and the analysis of a number of unpublished documents concerning output-mix optimisation have revealed another unexpected result. Although specialisation was the principal factor affecting output-mix decision-making, the regime of competition was also important. It has been shown that during the 1960s the Fiat President Valletta held the view that a shift upmarket of the output mix could be considered as an option only if certain conditions hampering price competition took place. If collusive price leadership were in place, Fiat would have been able to set prices according to its own cost structure. This would have minimised the comparative advantage of German and French car manufacturers in the upper segments of the market, creating the conditions for Fiat to adjust its output mix upmarket and supply the expanding demand for upper-segment units. Nonetheless, the strategy of shifting upmarket under collusive price leadership, as theorised by Valleta and his staff, was conceived simply as a temporary and opportunistic move. It was not paralleled by a restructuring of the production process towards the enhancement of the efficiency in the manufacturing of upper-range units. The rationale underpinning the shifting upmarket under a regime of collusive price leadership depended upon the fact that demand in the medium and upper segment of the market tends to be income rather than price elastic. Assuming collusion, income elasticity of demand enables the price leader to set prices that maximise its per unit margin of contribution. On the other hand, if price competition is in place, the most efficient manufacturer in each segment will set prices. The analysis of changes in the Fiat output mix between 1967 and 1987 shows that from 1970 to 1979 Fiat adjusted its output mix upmarket. In that period, collusive price leadership was in place. Implicit collusion had been the response of the European car industry to the abolition of tariffs in 1970 and, after the first oil crisis, to the instability of input prices and exchange rates. However, because of the gradual abolition of non-tariff barriers to trade (such as the lack of a commercial network abroad) and because of the gradual stabilisation of the international economy, a return to price competition was expected by the late 1970s or early 1980s. The managers' response to that expectation was to allocate the largest part of the financial resources to the renewal of the bottom-range models, which, as already stated, led to a shift of the output mix back downmarket. This move was perfectly consistent with the views of Valetta, who thought Fiat could efficiently shift upmarket only under a regime of collusive leadership. The fact that during the 1980s Fiat recovered strongly from the crisis of the previous decade shows that the strategy set up by Ghidella was effective.

All in all, it appears that the turnover of top management during the 1970s did not bring about a change of direction towards a market-oriented approach to car manufacturing. This was because production engineers were still dominant in the structure. They had a process-oriented culture and kept their grip on process/product renewal decision-making throughout the period, influencing top management in strategic decision-making. This does not mean that the entire Fiat management shared a product-oriented approach to manufacturing. However, marketing managers such as Rossignolo were marginal, particularly in the second half of the 1970s, when the economic crisis suggested that top management should rationalise, rather than change their production system and marketing strategies.

As already said, from a methodological point of view, the contribution of this thesis to the debate on post-Fordism consists of testing flexibility against an independent variable, namely the rate of capacity utilisation of production lines. Moreover, this work underlines the relationship between production management, technological change and output-mix optimisation strategy, whereas the existing literature focused mainly on technological and managerial changes. In terms of findings, the thesis shows that the restructuring of Fiat during the 1970s did not bring about discontinuity in management. On the contrary, the process of technological selection and deployment and the process of output-mix decision-making were underpinned by the same criteria that had inspired technological change and output-mix decision making during the 1960s. In that period, operations and strategic management at Fiat were dominated by a production-oriented managerial culture, which had been shaped by the pattern of routines that were common in the Fordist approach of mass production.

Once the view of continuity is accepted, the implication follows that in the case of Fiat the crisis of the 1970s did not coincide with the crisis of Fordism. On the contrary the rescue of the company and its long-term survival were ensured by the effective use of the intangible capital accumulated by the company over time. This leads to the issue of the restructuring of the car industry after the crisis of the 1970s. The case of Fiat, in fact, suggests that the restructuring of the car industry after the two oil crises fits an interpretive model emphasising the relevance of intangible capital accumulation and routines, rather than an interpretive model implying the replacement of intangible capital along with the substitution of fixed capital via technological change. The accumulation of intangible capital is central to both Chandler's approach to Business History and the Nelson and Winter theory of economic change, whereas the dispersion of intangible capital is implied by all the schools of thought within the debate on post-Fordism. The findings of this work, invariably suggest that Chandler and Nelson and Winter provide a powerful framework to explain the third industrial revolution and the centrality of the process of intangible capital accumulation in explaining the restructuring of Fiat. Such a framework is intrinsically connected to the literature on path dependency, be it focused on pure technological change dilemmas or broader concept of managerial lock-in.

The analysis of this work stops at 1987, partly because of the data set, partly because the acquisition of Alfa Romeo that year changed substantially many parameters, including the comparability of data. However, on the basis of the findings of this work, it is possible to underline the strengths and weaknesses of the Italian company in the late 1980s. At the end of the decade, Fiat was very strong at the bottom end of the demand spectrum, particularly in the domestic market. Labour productivity had improved remarkably along with industrial relations, and the company had restored its reputation for managerial excellence, which had been badly damaged during the turmoil of the 1970s. Fiat management had also acquired a reputation for technological excellence thanks to the commitment of the company to develop robotics. Nonetheless, this work has shown that Fiat was much less flexible than previously thought by the established literature. Moreover, Fiat management concentrated much of its effort on cost reduction. As a consequence, labour was organised and trained in order to contain cycle time rather than improve quality and flexibility. Finally, Fiat was extremely weak in the C and D segments.

Crucially, the evolution of demand and supply in Europe during the 1990s was to change the competitive scenario in terms of external threats and opportunities. On the hand, Fiat was to become more exposed to competition in the lower segments of the market from both the traditional European competitors and those Japanese manufacturers which had established new production capacity within the EC, and represented an entirely new threat. On the other and, given the structure of the European demand, opportunities were expected to emerge exactly in those segments in which the Italian company was weak. In such a scenario, the production-oriented culture of the Fiat management, and the company's specialisation in small car manufacturing should be seen as a weakness.

During the 1990s, the performance of the company was not particularly brilliant, whereas the first few years of the new millennium have been particularly difficult. Nonetheless, in 1999 the Italian company celebrated a hundred years in the business. This work has captured important and undisclosed features of Fiat's strategy and restructuring from 1960 to 1987. There is still plenty for business historians to investigate, especially with regard to the 1990s. The future perspective and the survival expectancy of the Italian company is a matter for business economists and business strategists to evaluate and forecast. The author of this work is convinced that a better understanding of the restructuring of Fiat during the 1970s and 1980s might help both business historians and business analysts in achieving their respective goals.

APPENDIX
CHAPTER 3

Table A 3.1: Turnover, Net Profits and Employment, Fiat Group, 1948-1990. Millions of 1993 constant lire

Years	Turnover	Net profits	Employment	Years	Turnover	Net profits	Employment
1948	1,076,101	10,141	66,365	1970	16,931,680	53,331	184,814
1949	1,407,354	24,369	71,207	1971	17,417,400	148,452	182,501
1950	2,132,934	48,370	72,669	1972	19,547,130	145,623	191,510
1951	2,039,361	51,112	72,035	1973	18,486,000	20,040	200,574
1952	2,540,362	67,763	70,000	1974	15,711,440	2,03	198,374
1953	3,086,625	121,024	71,110	1975	14,983,800	0	214,700
1954	3,526,685	136,240	71,300	1976	45,776,200	275,792	267,179
1955	3,920,903	159,973	74,885	1977	47,091,680	224,387	268,279
1956	4,234,367	174,705	77,316	1978	51,030,240	187,439	273,053
1957	4,332,296	171,098	80,423	1979	49,228,560	111,760	284,148
1958	4,674,154	208,389	79,930	1980	49,262,820	120,827	274,060
1959	5,655,110	254,533	85,117	1981	41,233,360	197,531	253,715
1960	5,849,600	302,609	92,891	1982	36,701,820	244,394	229,571
1961	6,883,030	337,174	107,671	1983	35,615,700	347,445	213,402
1962	8,320,400	293,313	119,838	1984	35,005,110	449,874	186,162
1963	9,353,320	278,204	126,324	1985	37,128,370	591,887	187,539
1964	8,436,000	168,020	124,336	1986	40,485,060	1,111,172	179,851
1965	8,976,000	268,275	123,109	1987	51,287,250	1,087,016	220,000
1966	11,591,450	265,589	134,592	1988	57,157,320	1,300,492	219,677
1967	13,217,580	339,930	144,499	1989	62,942,990	1,465,875	223,444
1968	14,725,050	380,268	158,445	1990	64,074,080	1,587,301	241,688
1969	15,133,500	143,007	170,883				

Source: Archivio Storico Fiat, *Fiat: le fasi della crescita*, pp. 100-101.

Table A 3.2: Vehicle registrations 1950-1990 in selected countries (00')

Years	UK	Italy	Germany	France	Years	UK	Italy	Germany	France
1950	134,4	79,8	149,5	173,1	1971	1,334,7	1,435,5	2,115,6	1,468,9
1951	138,4	88,8	178,3	235,9	1972	1,702,2	1,470,4	2,143,0	1,637,6
1952	191,0	89,1	204,1	284,7	1973	1,688,3	1,449,9	2,031,0	1,745,8
1953	301,4	112,1	254,3	283,4	1974	1,273,8	1,280,7	1,693,0	1,524,8
1954	394,4	127,3	321,3	327,4	1975	1,194,1	1,050,9	2,106,0	1,482,7
1955	511,4	161,9	423,9	411,3	1976	1,285,6	1,187,6	2,112,1	1,858,3
1956	407,3	202,4	506,2	475,8	1977	1,325,5	1,219,2	2,561,3	1,907,0
1957	433,2	195,5	564,6	500,0	1978	1,591,9	1,194,4	2,663,8	1,945,0
1958	566,3	209,2	691,0	588,7	1979	1,716,3	1,397,0	2,623,4	1,976,4
1959	657,3	253,3	827,7	564,4	1980	1,513,8	1,530,5	2,426,2	1,873,2
1960	820,1	381,4	969,7	638,1	1981	1,484,7	1,808,5	2,330,3	1,,834,8
1961	756,1	491,8	1,095,1	717,1	1982	1,555,0	1,851,2	2,155,5	2,056,5
1962	800,2	634,7	1,217,4	912,4	1983	1,791,7	1,451,5	2,426,8	2,017,6
1963	1,030,7	951,7	1,271,0	1,047,6	1984	1,749,6	1,572,4	2,393,9	1,757,7
1964	1,215,9	832,0	1,243,0	1,053,1	1985	1,832,5	1,653,2	2,379,3	1,766,3
1965	1,148,7	889,3	1,517,6	1,057,4	1986	1,882,5	1,769,2	1,829,4	1,911,5
1966	1,091,2	1,015,0	1,506,1	1,210,1	1987	2,013,7	1,929,6	2,915,6	2,105,2
1967	1,143,0	1,162,2	1,356,7	1,230,9	1988	2,215,6	2,119,2	2,807,9	2,217,1
1968	1,144,8	1,167,6	1,425,1	1,239,8	1989	2,300,9	2,269,8	2,831,7	2,274,3
1969	1,012,8	1,217,9	1,841,0	1,365,7	1990	2,008,9	2,283,4	3,040,8	2,309,1
1970	1,126,8	1,363,6	2,107,1	1,296,9					

Source: Elaboration of data from ANFIA (Italian Association of Car Manufacturers and Traders), *L'automobile in cifre*, pp. 232-238.

Table A 3.3: Fiat output (Italian operations) 1951-1990

Years	Fiat output	Years	Fiat output	Years	Fiat output	Years	Fiat output
1951	108,889	1961	566,284	1971	1,560,362	1981	1,119,891
1952	101,659	1962	748,608	1972	1,591,478	1982	1,163,453
1953	132,061	1963	909,887	1973	1,568,390	1983	1,216,921
1954	163,561	1964	881,702	1974	1,382,310	1984	1,388,276
1955	218,082	1965	957941	1975	1,148,824	1985	1,316,228
1956	262,143	1966	1,110,701	1976	1,274,100	1986	1,580,637
1957	290,672	1967	1,358,438	1977	1,392,618	1987	1,668,129
1958	327,049	1968	1,315,103	1978	1,370,824	1988	1,635,791
1959	412,612	1969	1,352,232	1979	1,309,777	1989	1,721,925
1960	500,527	1970	1,506,847	1980	1,297,667	1990	1,638,580

Source: 1951-1966, Archivio Storico Fiat, *Fiat: le fasi della crescita*, pp. 120-121. 1967-1990 Archivio Storico Fiat, 'Libro dei numeri di matricola delle vetture prodotte' (Production File). Note that, data in table A4. 2-21 refers to the whole Fiat production in Italy and abroad. Therefore, after 1979 they are different from the data in table A 3.3.

Table A 3.4: Structure of demand in the Italian market 1960-1990 (00')

Years	Stock	Vehicle registrations	Replacement	New demand	Years	Stock	Vehicle registrations	Replacement	New demand
1950	1658,8	253,3			1975	15059,7	1050,9	295	755,9
1960	1976,2	381,4	64	317,4	1976	15925,1	1187,6	322,2	865,4
1961	2449,1	491,8	28,9	462,9	1977	16476,2	1219,2	668,1	551,1
1962	3030,1	634,7	53,7	581	1978	16240,9	1194,4	1194,4	0
1963	3912,6	951,7	69,2	882,5	1979	17073,2	1397	564,7	832,3
1964	4674,6	832	70	762	1980	17686,2	1530,5	917,5	613
1965	5472,6	889,3	91,3	798	1981	18603,4	1808,5	891,3	917,2
1966	6356,6	1015	131	884	1982	19616,1	1851,2	838,5	1012,7
1967	7294,6	1162,2	224,2	938	1983	20388,6	1451,5	679	772,5
1968	8266,4	1167,6	195,8	971,8	1984	20888,2	1572,4	1072,8	499,6
1969	9173,7	1217,9	310,6	907,3	1985	22494,6	1653,2	46,8	1606,4
1970	10181,2	1363,6	356,1	1007,5	1986	23495,4	1769,2	768,4	1000,8
1971	11307,1	1435,5	309,6	1125,9	1987	24320,2	1929,6	1104,8	824,8
1972	12484,3	1470,4	293,2	1177,2	1988	25290,2	2119,2	1149,2	970
1973	13424,7	1449,9	509,5	940,4	1989	26267,4	2269,8	1292,6	977,2
1974	14303,8	1280,7	401,6	879,1	1990	27415,8	2283,4	1135	1148,4

Source: Elaboration on data, in *L'automobile in Cifre*, p. 334, and p. 340. Since new demand is the portion of demand which makes the stock o vehicle to grow, it is calculated according to the formula ND= ST_{t1} - ST_{t0}, where ST is the stock of vehicles. Replacement demand is calculated as RD = VR-ND, where VR is vehicle registrations.

Table A 3.5: Forecast of stock and new registrations 1970-1980 (00')

	Stock		New Registrations		N.R. Rate ofrowth
	1960	1970	1960	1970	1960-1970
Occ. Europe	2,047,8	64,604,0	3,510,0	7,001,0	7.1%
USA	6,127,0	89,896,1	6,757,0	8,388,0	2.2%
Japan	345,0	8,779,0	129,0	2,430,0	34.1%
Other Countries	1,886,5	22,500,0	2,119,2	3,403,0	4.8%
Total	10,416,3	185,779,1	12,515,0	21,222,0	5.4%
	Stock Forecast		N.R. Forecast		Growth Forecast
	1970	1980	1970	1980	1970-1980
CEE	42,180,0	69,000,0	5,433,0	6,800,0	2.2%
EFTA	19,397,0	30,000,0	1,868,0	2,700,0	3.7%
EEC+EFTA	61,577,0	99,000,0	7,301,0	9,500,9	2.6%
Spain and Yugoslavia	3,027,0	11,000,0	600,0	1,200,0	7.1%
Total	64,604,0	110,000,0	7,901,0	10,700,0	4.3%

Source: Fiat, Archivio Storico, Direzione Studi Economici, Fondo Pedrana, 1/VIII/5/E.

Table A 3.6: Productivity index - blue collars- 1960-1987 (car manufacturing sector, year base 1960=100)

Year	Output (unit)	Labour input	Actual working hours per worker per year	Man-hours	Ratio output to man-hours	Productivity Index
1960	500,527	33,540	2,256	75,666,240	0.006615	100
1961	566,284	37,196	2,256	83,914,176	0.006748	102.0
1962	748,608	44,387	2,226	98,805,462	0.007577	114.5
1963	909,887	52,967	2,256	119,493,552	0.007615	115.1
1964	881,702	55,041	2,256	124,172,496	0.007101	107.3
1965	957,941	57,774	2,161	124,849,614	0.007673	115.9
1966	1,110701	60,642	2,146	130,137,732	0.008535	129
1967	1,253207	64,212	2,162	138,826,344	0.009027	136.4
1968	1,323707	66,818	2,144	143,257,792	0.00924	139.6
1969	1,352232	72,939	1,673	122,026,947	0.011081	167.5
1970	1,421054	77,782	1,814	141,126,883	0.010069	152.2
1971	1,490302	79,245	1,729	137,059,775	0.010873	164.3
1972	1,475791	82,442	1,623	133,834,694	0.011027	166.6
1973	1,453554	91,600	1,520	139,297,036	0.010435	157.7
1974	1,294501	94,500	1,466	138,623,940	0.009338	141.1
1975	1,075726	90,300	1,405	126,941,031	0.008474	128.1
1976	1,274100	88,800	1,405	124,832,376	0.010206	154.2
1977	1,318747	89,400	1,518	135,709,200	0.009717	146.9
1978	1,318747	86,600	1,505	130,333,000	0.010118	152.9
1979	1,254957	93,900	1,435	134,746,500	0.009313	140.7
1980	1,297667	111,200	1,381	153,567,200	0.00845	127.7
1981	1,119891	108,200	1,374	148,666,800	0.007533	113.8
1982	1,163453	95,415	1,420	135,489,300	0.008587	129.8
1983	1,246711	86,828	1,432	124,337,696	0.010027	151.5
1984	1,388276	77,666	1,415	109,897,390	0.012632	190.9
1985	1,393654	70,146	1,451	101,781,846	0.013693	206.9
1986	1,580637	63,046	1,641	103,458,486	0.015278	230.9
1987	1,668129	59,172	1,685	99,704,820	0.016731	252.9

Source: Index of ratio output to man-hours (1960 = 100). Calculation based on data from various Fiat sources. Data on the number of hours worked are from Fiat Archives: Fondo Sepin, 1960-77, 5/VIII/1/A; Personnel Department, "Relazione sullo stato del personale" in Anfia (ed.), *L'Automobile in cifre*, , Turin, Codex, 1988. Data on employment levels are also from various sources: Sepin file, 1960-77, 5/VIII/1/A; Fiat Auto, Human Resources Department; CGIL (ed.) *Lavoro, condizioni di lavoro, qualità di vita e di lavoro in una grande fabbrica capitalista.* Rapporto conclusivo della conferenza su Fiat Auto', (Turin, 1985). As far as output is concerned, from 1960 to 1969 the calculation is based on data from Fiat (ed.), *Fiat: Le fasi della crescita*, p.121. From 1969 onwards, the calculation is based on data from the Fiat Production File. Note that output and labour refer to Italian plants.

Table A 3.7: Fiat sales and domestic market shares 1960-1990

Years	Export	Domestic	Domestic shares	Years	Export	Domestic	Domestic shares	Years	Export	Domestic	Domestic shares
	Units	Units	%		Units	Units	%		Units	Units	%
1960	191,844	291,168	76.3	1971	577,886	821662	57.3	1982	541,400	927,000	51.5
1961	227,787	341,357	69.4	1972	591,170	804,809	54.7	1983	564,600	930,300	55.5
1962	301,004	412,526	65	1973	547,245	781,205	53.9	1984	574,000	928,200	54.4
1963	285,282	595,317	62.6	1974	554,856	690,068	53.9	1985		1,046,335	52.3
1964	304,603	583,326	70.3	1975	510,880	510,944	48.6	1986		1,117,579	54.4
1965	289,028	655,035	73.9	1976	613,100	696,256	53.5	1987		1,191,499	53.7
1966	349,909	752,561	74.1	1977	584,886	696,107	54.5	1988	853,300	1,345,500	60.7
1967	376,219	850,929	73.2	1978	503,351	691,350	53.6	1989	865,000	1,419,200	57.8
1968	521,534	591,574	72.1	1979	773,143	820,000	50.3	1990	900,100	1,231,400	46.8
1969	545,448	764,630	62.8	1980	651,400	942,000	51.3				
1970	586,496	760,417	55.8	1981	693,700	943,200	51.3				

Source: Fiat (ed.), *Fiat: le fasi della crescita*, 1996, 130-134.

APPENDIX
CHAPTER 4

Table A 4.1: Labour productivity index and daily production, 1960-1973

Year	Labour input	Output (unit)	Total per year man - hours	Actual working hours per worker per year	Contractual working hours per worker per years	Actual working days	Contractual working days	Daily output (unit)	Ratio output to man-hours	Productivity index
1960	25,906	500,527	58,443,936	2,256	2,256	282	282	1,775	0.0086	100
1961	27,101	566,284	61,139,856	2,256	2,256	282	282	2,008	0.0093	108.2
1962	35,442	748,608	78,893,892	2,226	2,256	278	282	2,690	0.0095	110.8
1963	41,460	909,887	93,533,760	2,,256	2,256	282	282	3,227	0.0097	113.6
1964	42,530	881,702	95,947,680	2,256	2,256	282	282	3,127	0.0092	107.3
1965	38,543	957,941	83,291,423	2,161	2,162	282	282	3,399	0.0115	134.3
1966	43,734	1,110,701	93,853,164	2,146	2,162	280	282	3,968	0.0118	138.2
1967	48,732	1,253,207	105,358,584	2,162	2,162	282	282	4,444	0.0119	138.9
1968	49,353	1,323,707	105,812,832	2,144	2,162	280	282	4,733	0.0125	146.1
1969	62,593	1,352,232	104,718,089	1,673	2,022	233	282	5,795	0.0129	150.8
1970	67,000	1,421,054	121,538,000	1,814	1,991	257	282	5,530	0.0117	136.5
1971	68,300	1,490,302	118,159,000	1,730	1,976	247	282	6,038	0.0126	147.3
1972	70,700	1,475,791	114,746,100	1,623	1,886	243	282	6,080	0.0129	150.1
1973	73,300	1,453,554	111,489,300	1,521	1,856	231	282	6,291	0.013	152.3

Source: Index of ratio output to man-hours (1960 = 100). Calculations based on data from Archivio Storico Fiat, Fondo Sepin (Employmnet File) 1960-77, 5/VIII/1/A. Labour input includes only direct workers involved in stamping, machining, welding and final assembling. From 1960 to 1967, the calculation of output is based on data from Fiat (ed.) *Fiat: Le fasi della crescita*, p. 121. From 1968 onwards, the calculation is based on data from the Fiat Auto Production File (Italian output). Daily production has been calculated by dividing output by the number of days in which production actually took place each year. Note that Table A 3.6 refers to the productivity of all workers of the Fiat car sector employed in Italian plants, whereas figure A 4.1 refers to selected shops.

Table A 4.2: Output per month, per line, per plant, 1968

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
500, Mirafiori	16,864	29,992	32,118	31,329	27,235	30,574	28,146	31,923	10,206	31,253	32,696	26,499	328,835
600, Lingotto	4,364	7,104	6,348	4,916	4,604	5,201	6,446	6,836	2,460	6,750	6,410	5,512	66,951
850 Special, Mirafiori	10,745	18,039	21,773	23,318	24,841	30,511	28,305	31,927	10,095	32,669	33,079	27,541	292,843
850 Coupé, Mirafiori	1,944	3,385	5,524	5,153	6,336	7,338	6,759	7,720	2,466	7,791	8,063	6,686	69,165
850 Spider, Mirafiori	756	941	1,593	1,888	1,749	2,078	1,960	2,271	633	2,285	2,609	2,256	21,019
1100, Lingotto	5,786	8,491	8,024	8,611	7,132	9,278	9,529	9,350	3,122	10,462	10,362	7,414	97,561
124 Special, Mirafiori	8,484	13,675	16,622	15,243	14,351	16,386	16,001	17,878	5,245	17,573	18,370	17,380	177,208
124 Coupé, Mirafiori	1,967	3,608	4,337	5,009	4,635	5,540	4,121	4,319	1,280	3,463	3,515	3,139	44,933
124 Spider, Mirafiori	267	110	734	406	738	811	737	963	375	717	767	850	7,475
125 Special, Mirafiori	5,442	9,725	13,154	13,555	11,445	13,444	12,503	12,495	2,603	7,356	6,755	5,149	113,626
Dino Coupé, Mirafiori	155	162	167	187	174	138	172	176	71	59	134	41	1,636
Dino Spider, Mirafiori	38	44	68	67	31	8	63	52	5	57	22	M	455
600 T, Lingotto	2,546	1,646	3,901	5,038	1,724	2,122	5,024	2,090	654	1,855	1,885	4,983	33,468
1100 T, Lingotto	632	719	643	898	667	503	483	472	158	482	473	298	6,428
238, Mirafiori	349	1,075	867	1,084	880	1,162	1,526	1,546	631	1,906	2,314	2,031	15,371
241, Mirafiori	380	440	402	287	397	618	419	545	204	711	798	6,76	5,877
Campagnola Benzina, Lingotto	95	126	108	119	129	146	129	131	70	3	58	36	1,150
Campagnola Disel, Lingotto	43	31	52	36	30	42	52	53	27	64	34	0	464
850 Familiare, Mirafiori	B	5,015	3,302	1,149	894	5,968	500	536	207	979	11,171	917	30,638
Total													1,315,103

Source: Archivio Storico Fiat, 'Libro dei numeri di matricola dei veicoli prodotti' (Production File). The File reports the serial numbers of the last unit of each model produced each month in each plant and in each line, starting from December 1967. Abbreviations: B = Beginning of production; E = end of production; M = missing datum; H = holydays. The months are given in the order of the calendar year. Note that the Fiat Production File includes the output of Autobianchi from 1970 onwards and the output of Lancia from 1979 onwards. Fiat plants involved in the of car manufacturing were Mirafiori, Lingotto, Rivalta, Chivasso (Lancia), Desio (Autobianchi), Cassino and Termini Imerese. From 1977 onwards, the Production File reports the output of Spanish., Brazilian and Polish production plants.
Note also that tables show welding lines. The final assembly was performed by more line since the cycle time was longer than that of the spot welding stage.

Table A 4.3: Output per month, per line, per plant, 1969

Months Models and Plants	J	F	M	A	M	J	J	A	S	O	N	D	Total
500, Mirafiori	25,941	30,049	32,023	38,327	37,865	36,316	26,726	43,653	11,964	29,040	28,643	18,588	359,135
600, Mirafiori	5,551	5,268	5,281	4,873	29,458	5,076	4,167	5,967	1,568	3,684	2,997	1,601	75,491
850 Special, Mirafiori	26,459	30,756	32,831	28,803	27,124	19,541	14,869	27,663	6,403	13,653	12,820	10,123	251,045
850 Coupé, Mirafiori	5,529	7,381	7,354	9,063	9,243	9,560	7,937	8,530	2,416	3,683	3,497	2,916	77,109
850 Spider, Mirafiori	1,912	2,873	2,466	2,664	2,554	2,751	2,504	2,930	836	1,643	2,331	1,656	27,120
1100, Lingotto			B	3,070	6,579	10,887	12,114	18,121	5,107	14,297	15,135	12,842	98,152
124, Mirafiori	16,315	20,279	20,644	22,802	20,760	18,073	9,509	22,565	6,045	13,737	13,240	9,403	193,372
124 Coupé, Mirafiori	3,538	4,779	4,936	4,510	4,129	2,924	3,124	2,693	625	1,644	2,256	1,279	36,437
124 Spider, Mirafiori	653	996	1,013	1,169	1,087	1,234	1,160	1,377	268	190	1,450	378	10,975
125 Special, Mirafiori	7,956	10,135	11,363	20,569	11,963	11,331	6,225	13,143	3,241	8,215	7,928	6,488	118,557
Dino Coupé, Mirafiori									B	16	36	57	109
Dino Spider, Mirafiori										B	5	5	39
130, Rivalta					B	75	241	276	61	230	84	217	1,184
600T, Lingotto	1,490	1,876	4,525	2,208	1,602	2,034	5,579	5,894	775	1,046	944	3,324	31,297
1100T, Lingotto	356	1,299	299	460	457	306	259	161	93	220	247	129	4,286
238, Mirafiori	2,099	2,654	2,649	3,065	2,705	2,663	2,318	2,124	738	2,082	2,142	1,777	27,016
241, Mirafiori	615	622	614	528	494	622	612	746	229	559	451	350	6,442
Campagnola Benzina, Lingotto	131	218	192	231	259	227	196	224	40	139	101	69	2,027
Campagnola Disel, Lingotto	110	99	89	105	66	55	109	53	35	63	28	15	827
850 Familiare, Mirafiori	982	5,085	1,211	8,245	1,118	943	4,238	1,581	453	418	6,752	586	31,612
Total													1,352,232

Source: Ibid.

Table A 4.4: Output per month, per line, per plant, 1970

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
500, Mirafiori	17,838	33,961	33,895	36,061	37,264	26,534	30,507	33,491	8,755	37,820	36,456	33,690	366,272
600, Miraifori	2,603	4,620	4,285	2,089	5	E							13,602
850 Special, Mirafiori	8,612	17,908	16,785	17,209	22,447	8,254	15,320	17,033	5,335	29,855	9,827	19,736	188,321
850 Coupé, Mirafiori	3,270	4,422	4,443	4,422	4,988	4,569	5,065	6,246	1,725	5,799	5,065	3,869	53,883
850 Spider, Mirafiori	1,603	2,502	2,446	2,613	2,031	1,727	2,307	2,609	640	2,478	2,498	2,116	25,570
128, Rivalta	12,144	24,339	22,180	25,026	26,940	23,359	26,195	31,719	8,353	36,923	38,735	37,421	313,334
124 Special, Mirafiori	7,529	16,062	17,341	15,584	17,355	13,963	14,098	14,546	5,098	19,858	20,145	19,813	181,392
124 Coupé, Mirafiori	1,659	2,247	2,611	2,633	2,865	2,519	2,860	3,741	1,049	4,379	4,637	4,479	35,679
124, Spider, Mirafiori	1,408	871	111	1,374	1,398	1,243	1,192	1,732	339	1,385	1,253	1,393	13,699
125 Special, Mirafiori	4,876	10,664	28,605	11,022	11,491	9,165	8,683	10,592	3,411	12,815	12,406	16,104	139,834
Dino Coupé, Mirafioiri	8	56	24	5	9	38	49	73	21	165	111	97	656
Dino Spider, Mirafiori		B	5	11	12	5	27	19	9	19	32	3	142
130, Rivalta	191	286	292	253	400	329	348	400	124	388	486	577	4,074
850 Familiare, Mirafiori	2,829	2,572	1,585	4,104	3,047	3,817	17,954	M	M	M	4,377	1,983	24,314
1100T, Mirafiori	112	108	122	101	65	168	291	186	21	45	43	112	1,374
238, Mirafiori	9,931	2,771	2,866	2,836	3,052	2,383	2,732	2,881	797	2,750	2,703	2,297	37,999
241, Mirafiori	615	622	614	528	494	622	612	746	229	559	451	350	6,442
Campagnola Benzina, Mirafiori	131	218	192	231	259	227	196	224	40	139	101	69	2,027
Campagnola Diesel, Mirafiori	110	99	89	105	66	55	109	53	35	63	28	15	827
A 111, Desio		B	5,081	1,538	1,264	1,884	1,974	2,331	626	2,399	2,468	1,484	21,049
A 112, Desio		B	7,175	2,137	4,550	3,747	5,215	5,786	1,707	6,200	5,155	4,401	46,073
500, Termini Imerese				B	555	112	837	2,227	102	2,157	738	4,885	11,613
500, Desio								B	1,733	6,780	5,725	4,433	18,671
Total													1,506,847

Source: Ibid.

Table A 4.5: Output per month, per line, per plant, 1971

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
500 L, Mirafiori	31,739	29,033	21,980	27,712	21,746	18,141	16,349	21,809	5,719	22,352	23,223	21,366	261,169
500 L, Termini Imerese	4,351	3,025	3,530	4,507	3,646	3,822	3,850	4,756	1,381	4,804	4,581	3,753	46,006
500 L, Desio	4,801	4,631	4,599	4,006	5,118	5,402	4,929	4,014	1,765	5,530	5,206	5,146	55,147
850 Special, Mirafiori	18,132	13,158	9,713	9,549	8,829	3,538	E						62,919
850 Coupé, Mirafiori	3,480	2,555	2,268	2,400	2,423	2,623	2,785	3,435	1,028	3,028	1,584	327	27,936
850 Spider, Mirafiori	1,892	1,603	1,690	1,666	1,109	775	1,090	1,624	425	1,263	1,063	907	15,107
127, Mirafiori			B	6,272	8,374	9,639	11,625	19,576	5,410	23,281	27,079	26,304	137,560
128, Rivalta	30,820	30,028	54,631	31,182	36,075	30,497	29,852	30,477	9,298	38,974	41,570	45,872	409,276
124 Special, Mirafiori	16,604	16,294	13,985	19,059	18,059	13,531	13,721	20,426	5,349	19,531	20,356	17,583	194,498
124 Coupé, Mirafiori	4,352	4,241	3,689	4,857	4,376	4,122	3,733	3,545	901	3,354	3,142	2,794	43,106
124 Spider, Mirafiori	1,106	761	1,163	1,510	1,114	1,225	875	1,480	273	1,479	1,205	1,162	13,353
125 Special, Mirafiori	8,325	7,836	6,929	27,348	7,789	6,965	6,007	9,004	2,793	10,192	9,870	11,555	114,613
Dino Coupé, Mirafiori	97	69	168	81	100	99	85	158	16	170	169	75	1,287
Dino Spider, Mirafiori	37	14	40	21	10	10	27	11	1	24	18	7	220
130, Rivalta	145	249	431	M	208	35	373	190	50	85	208	337	2,311
850 Familiare, Mirafiori	4,086	1,966	3,019	3,503	3,362	2,583	3,968	2,246	618	2,329	4,619	31,950	64,249
1100T, Mirafiori	12	M	M	M	M	M	M	M	M	M	M	2,370	2,382
238, Mirafiori	2,226	2,012	2,072	2,112	1,790	1,862	1,663	2,098	495	1,969	1,457	1,368	21,124
241, Mirafiori	7,453	675	463	575	582	474	520	616	232	670	619	629	13,508
Campagnola Disel, Mirafiori	1,451	194	206	182	179	174	145	198	49	150	159	153	3,240
Campagnola Disel, Mirafiori	548	21	34	25	18	16	26	48	17	50	68	42	913
A 111, Desio	1,152	1,004	787	839	670	1,159	925	686	153	1,469	1,340	1,227	11,411
A112, Desio	4,445	3,724	5,337	4,706	4,986	5,041	4,689	3,707	2,023	6,730	6,594	6,667	58,649
130 Coupé, rivalta				B	1	19		68	54	131	19	86	378
Total													1,560,362

Source: Ibid.

Table A 4.6: Output per month, per line, per plant, 1972

Months Models and Plants	J	F	M	A	M	J	J	A	S	O	N	D	Total
500 L, Mirafiori	21,921	16,128	17,800	19,847	15,681	15,930	6,849	3,724	2,383	3,836	E		124,099
500, Termini Imerese	2,579	2,288	4,366	5,232	4,159	5,031	4,309	4,569	1,581	4,751	4,963	2,439	46,267
500, Desio	5,275	4,810	4,404	4,880	3,457	2,374	5,264	3,805	1,334	3,670	12,025	3,651	54,949
126 ,Mirafori											B	5,587	5,587
850 Spider, Mirafiori	1,330	1,158	1,405	1,701	1,369	1,455	1,226	1,234	M	1,388	869	652	13,787
127, Mirafiori	24,264	27,683	29,627	36,770	30,886	33,208	29,429	34,709	10,897	33,046	35,550	27,973	354,042
128, Mirafiori	55,838	35,507	35,043	39,334	35,856	37,390	33,968	34,540	13,815	34,496	38,193	32,427	426,407
128 Coupé, Rivalta	B	3,966	5,365	6,156	7,264	8,800	7,614	9,119	3,273	7,888	8,897	7,402	75,744
124 Special, Mirafiori	14,430	15,299	15,702	15,953	14,826	15,255	15,363	15,768	5,923	24,228	12,541	10,519	175,807
124 Coupé, Mirafiori	2,055	1,088	1,588	1,811	1,722	1,961	1,776	2,891	936	2,282	3,070	2,892	24,072
124 Spider, Mirafiori	1,171	1,095	1,080	1,208	996	1,222	985	1,187	434	1,098	1,333	584	12,393
125 Special, Mirafiori	29,845	8,950	6,812	5,727	E								51,334
132, Mirafiori					B	4,468	4,092	6,004	2,901	6,852	8,659	6,564	39,540
130, Rivalta	251	323	192	303	278	304	210	322	161	246	451	231	3,272
130 Coupé, Rivalta	29	89	80	95	152	250	148	334	96	194	121	367	1,955
Dino Coupé, Rivalta	106	61		50	129	45	2	M	M	M	3	1	397
Dino Spider, Rivalta	7	18	1	M	M	M	M	2	M	M	1	E	29
850 Familiare, Mirafiori	4,486	2,140	2,785	3,609	4,097	2,429	2,269	3,456	299	3,899	2,611	3,666	35,746
238, Mirafiori	1,470	1,457	1,430	1,805	1,759	1,965	1,850	2,096	931	2,214	2,442	1,996	21,415
241, Mirafiori	689	582	605	725	370	573	578	542	239	567	633	606	6,709
Campagnola Benzina, Mirafiori	98	149	156	94	44	36	33	20	22	18	24	13	707
Campagnola Diesel, Mirafiori	28	41	40	41	72	91	66	91	26	68	56	69	689
A 111, Desio	1,221	1,332	1,996	1,813	1,338	1,768	1,479	1,093	E				12,040
A112, Desio	6,789	6,825	7,034	8,807	6,254	8,090	7,281	7,332	3,833	9,991	10,181	8,516	90,933
A 120 F, Desio	1,622	1,609	2,622	1,291	1,129	1,326	408	1,254	696	757	E		12,714
126 Cassino											B	844	844
Total													1,591,478

Source: Ibid.

Table A 4.7: Output per month, per line, per plant, 1973

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
500, Desio	2,546	2,797	1,050	2,510	1,258	3,799	953	3,199	E				18,112
500, Termini Imerese	5,236	4,321	3,850	4,201	3,999	4,859	4,402	3,956	2,088	4,290	5,547	5,005	51,754
126, Mirafiori	5,240	7,676	4,251	5,525	7,772	11,835	10,522	12,832	4,578	6,243	7,253	6,853	90,580
126, Cassino	5,240	7,676	4,251	5,525	7,772	11,835	10,522	12,832	4,578	6,243	7,253	6,853	90,580
127, Mirafiori	73,181	24,774	20,130	18,934	27,416	36,273	39,951	24,646	17,203	33,019	39,057	39,258	393,842
850 Spider, Mirafiori	611	653	515	652	755	851	14	E					4,051
128, Rivalta	23,180	25,501	25,688	33,926	15,876	44,638	37,108	17,663	26,913	23,956	77,256	7,964	359,669
128 Coupé, Rivalta	6,198	7,077	6,385	5,482	6,555	7,807	6,544	6,600	3,083	6,177	6,937	6,467	75,312
x1/9, Lingotto	B	158	185	325	352	336	1,149	1,043	586	1,199	1,629	1,401	8,363
124 Special, Mirafiori	10,884	7,856	9,788	7,416	13,005	17,087	14,853	15,378	7,795	16,345	19,168	17,504	157,079
124 Coupé, Mirafiori	2,440	3,073	2,594	2,515	3,068	3,939	3,506	3,354	1,689	3,843	4,252	3,896	38,169
124 Spider, Mirafiori	1,248	818	879	823	1,018	1,197	1,150	1,259	6	1,217	1,978	1,365	12,958
132, Mirafiori	5,232	5,063	4,632	2,974	4,633	6,676	5,540	6,010	2,626	6,397	7,560	7,444	64,787
130, Rivalta	90	315	423	1	M	265	822	M	M	M	236	298	2,450
130 Coupé, Rivalta	30	28	8	361	3	30	49	278	40	162	6	202	1,197
850 T, Mirafiori	1,880	1,795	4,948	455	1,793	2,021	3,954	2,072	1,133	5,651	863	2,536	29,101
238, Mirafiori	1,815	2,036	1,825	2,007	2,705	3,146	2,859	3,069	1,500	3,118	3,674	3,463	31,217
241, Mirafiori	556	593	1,091	1,067	1,124	1,266	1,333	1,324	1,030	1,051	1,546	1,529	13,510
Campagnola Benzina, Mirafiori	20	32	28	24	33	241	214	145	25	6	M	M	768
Campagnola Diesesl, Mirafiori	44	46	32	63	42	50	50	47	30	3	E		407
A120F, Desio	533	550	579	630	682	955	1,038	873	M	836	1,056	832	8,564
A112, Desio	6,867	5,886	8,427	7,957	8,349	11,109	9,482	10,018	5,659	9,700	12,015	10,803	106,272
126, Desio									B	2,517	1,258	5,873	9,648
Total													1,568,390

Source: Ibid.

Table A 4.8: Output per month, per line, per plant, 1974

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
500, Termini Imerese	3,414	5,028	4,211	4,672	4,666	4,542	3,735	3,946	1,860	4,780	3,809	2,711	47,374
126 Desio.	2,289	3,414	2,196	2,425	1,643	1,270	934	891	984	3,978	3,460	2,501	25,985
126, Cassino	13,215	20,477	15,990	18,676	17,110	21,397	17,260	16,450	6,676	16,834	20,695	642	185,422
126, Mirafiori	6,234	7,628	197	4,126	E								18,185
127, Mirafiori	23,657	38,171	27,690	30,543	31,635	45,788	27,940	38,047	20,240	44,241	26,252	20,067	374,271
128, Rivalta	31,840	26,549	30,515	15,886	25,812	26,165	23,639	25,576	13,586	23,950	17,743	12,040	273,301
128 Coupé, Rivalta	4,542	5,988	4,063	3,999	3,570	2,895	3,770	2,435	1,510	3,311	2,523	1,749	40,355
x1/9, Lingotto	1,141	1,878	1,177	1,844	1,961	1,961	1,742	1,855	M	12,074	1,143	2,514	20,278
124, Mirafiori	13,154	16,181	10,526	13,665	15,748	14,957	13,110	15,459	1,809	2,819	E		117,428
124 Coupé, Mirafiori	2,550	3,355	2,017	1,832	677	2,596	1,070	1,064	463	855	716	457	17,652
124 Spider, Mirafiori	1,024	1,251	1,075	1,212	1,670	1,610	1,506	1,368	638	1,225	3	3,088	15,670
131, Mirafiori										B	4,570	5,163	9,733
131, Cassino										B	873	1,339	2,212
132, Mirafiori	5,586	5,472	2,884	4,731	6,852	8,635	7,566	10,723	3,363	9,396	6,530	5,525	77,263
130, Rivalta	144	288	33	96	50	266	50	37	93	54	28	39	1,178
130 Coupé, Rivalta	11	147	43	155	26	24	13	58	10	21	36	14	558
Campagnola Benzina, Mirafiori	M	M	M	M	M	M	198	46	87	291	221	330	1,173
850 T, Mirafiori	3,835	2,285	1,938	3,452	3,173	2,586	4,098	M	2,514	3,062	2,049	4,339	33,331
238, Mirafiori	2,306	3,442	4,740	1,516	978	1,884	1,357	1,152	573	1,500	748	1,406	21,602
241, Mirafiori	442	728	547	613	603	839	664	661	319	796	552	730	7,494
242 Fiat, Mirafiori				B	144	259	378	508	245	733	880	889	4,036
A120F, Desio	512	698	896	1,149	1,039	M	M	1,595	477	972	313	176	7,827
A112, Desio	6,989	11,276	8,297	9,822	8,778	M	M	8,144	5,549	8,711	6,594	5,822	79,982
Total													1,382,310

Source: Ibid.

Table A 4.9: Output per month, per line, per plant, 1975

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
500, Termini Imerese	2,780	3,101	2,749	2,360	4,369	4,238	4,298	4,444	E				28,339
126 Desio	3,240	3,240	4,559	3,690	6,510	6,095	6,234	8,070	730	6,728	6,282	5,304	60,682
126, Cassino	4,912	4,529	5,972	6,739	7,441	9,320	9,006	11,515	2,782	8,977	9,617	7,686	88,496
127, Mirafiori	23,228	20,501	24,067	14,326	29,816	29,024	28,831	32,066	19,729	25,791	29,995	25,463	302,837
128, Rivalta	17,481	10,878	11,486	16,982	4,271	12,196	20,569	8,294	4,343	22,106	21,266	17,475	167,347
128 Coupé, Rivalta	2,068	2,107	1,314	1,060	2,539	3,167	2,740	3,872	1,074	4,336	4,473	3,751	32,501
x1/9, Lingotto	1,136	1,381	1,598	1,144	1,579	1,431	1,582	1,650	127	2,317	1,829	1,409	17,183
124 Coupé, Mirafiori	585	578	944	666	1,240	1,298	1,480	1,475	1	E			8,267
124 Spider, Mirafiori	919	1,200	1,366	971	1,735	1,243	1,343	1,068	63	2,140	1,110	1,363	14,521
131, Mirafiori	5,692	6,207	13,062	10,345	18,581	3,256	13,154	12,155	3,457	14,483	14,877	11,687	126,956
131, Cassino	2,138	1,974	2,756	2,712	3,363	2,770	2,711	3,707	3,600	1,193	4,295	3,176	34,395
132, Mirafiori	5,095	3,486	3,560	3,244	6,640	5,439	4,715	5,432	1,303	5,712	5,190	4,344	54,160
130, Rivalta	33	9	41	39	67	55	44	36	5	33	12	27	401
130 Coupé, Rivalaa	68	M	40	M	20	28	2	27	M	30	1	1	217
Campagnola Benzina, Mirafiori	271	349	294	308	414	53	100	206	68	262	142	156	2,623
850 T, Mirafiori	511	480	2,422	668	940	1,700	3,489	1,728	M	1,799	3,128	820	17,685
238, Mirafiori	1,165	979	1,379	1,078	2,214	1,803	1,512	1,812	527	1,950	2,041	1,638	18,098
241, Mirafiori	387	399	460	273	M	51,372	325	662	290	553	575	507	55,803
242 Fiat, Mirafiori	790	332	831	421	506	653	1,033	1,150	257	1,143	1,084	665	8,865
A120F, Desio	M	695	M	M	537	M	809	M	M	1,182	919	750	4,892
A112, Desio	M	10,043	4,287	3,534	6,793	M	12,760	M	M	16,564	8,229	5,996	68,206
131, Rivalta					B	3,297	3,993	4,544	1,386	5,465	5,392	4,325	28,402
126, Termini Imerese									B	2,368	2,997	2,583	7,948
Total													1,148,824

Source: Ibid.

Table A 4.10: Output per month, per line, per plant, 1976

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
126 Desio	5,046	4,740	3,949	3,135	3,100	2,498	2,503	3,047	3,926	1,326	2,976	2,912	39,158
126, Cassino	6,892	7,670	6,585	9,428	9,797	9,008	8,370	8,998	2,976	10,603	7,917	7,289	95,533
126, Termini Imerese	3,136	3,121	3,876	4,386	4,838	4,537	4,372	5,422	1,637	7,448	4,389	3,761	50,923
127, Mirafiori	26,393	24,662	23,999	25,807	21,930	28,064	26,703	29,830	10,804	29,566	29,153	29,647	306,558
128, Rivalta	19,109	14,526	16,102	16,964	13,857	6,302	680	76	E				87,616
128, Rivalta			B	26	48	33,496	17,328	22,882	7,286	23,044	19,643	20,934	144,687
128 Coupé, Rivalta	3,872	4,054	4,133	4,909	4,420	5,617	4,911	6,063	1,854	5,536	4,046	3,108	52,523
x1/9, Lingotto	1,398	1,202	1,175	1,371	1,160	353	2,355	1,652	603	1,442	1,530	1,500	15,741
124 Spider, Mirafiori	761	921	951	967	724	1,211	950	1,229	272	1,142	1,141	982	11,251
131, Mirafiorio	11,740	11,442	10,797	11,517	10,682	13,561	12,232	15,026	4,521	14,909	12,100	11,860	140,387
131, Cassino	3,271	2,846	4,064	4,449	5,609	6,448	6,417	7,706	2,669	8,246	7,924	7,370	67,019
131, Rivalta	4,505	3,581	3,529	3,566	2,845	3,912	3,642	4,118	1,376	4,154	3,540	3,286	42,054
132, Mirafiori	4,480	5,254	5,978	4,254	4,704	5,964	5,418	6,354	1,913	6,581	5,757	6,375	63,032
130, Rivalta	14	45	32	83	23	43	41	34	M	23	3	M	341
130 Coupé, Rivalta	8	21	104	60	8	1	3	42	M	6	E		253
Campagnola Benzina, Mirafiori	249	157	88	230	267	199	130	227	92	158	226	261	2,284
850 T, Mirafiori	2,324	1,454	1,714	2,612	3,373	1,323	2,745	2,510	2,299	1,640	E		21,994
238, Mirafiori	1,450	1,478	1,363	1,509	1,279	1,679	1,622	2,055	498	2,080	2,407	2,924	20,344
241, Mirafiori	410	407	462	514	497	518	483	501	151	425	410	425	5,203
242 Fiat, Mirafiori	187	366	481	641	544	929	838	1,035	349	1,015	989	984	8,358
A120F, Desio	724	1,202	238	747	1,009	1,063	206	900	386	806	704	536	8,521
A112, Desio	4,809	5,591	6,725	8,290	6,043	8,077	8,172	9,558	2,771	9,420	7,943	7,826	85,225
900 T, Mirafiori										B	1,508	3,587	5,095
Total													1,274,100

Source: Ibid.

Table A 4.11: Output per month, per line, per plant, 1977

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
126, Desio	2,362	4,447	3,300	4,881	3,061	6,170	5,634	12,292	1,739	6,790	4,567	4,425	59,668
126, Cassino	7,061	8,741	10,053	12,189	9,858	15,734	12,551	15,640	1,258	4,665	4,107	4,599	106,456
126, Termini Imerese	4,428	5,168	4,789	5,541	3,529	5,686	5,135	6,540	1,286	5,180	5,882	5,843	59,007
127, Mirafiori	27,484	29,982	28,624	27,183	110,888	28,583	23,684	27,705	9,727	36,808	43,988	25,777	420,433
128, Rivalta	19,211	21,937	20,465	24,788	25,712	23,024	13,628	15,986	5,478	19,180	16,540	17,913	223,862
128 Coupé, Rivalta	2,283	2,713	2,555	3,351	1,752	2,606	2,043	1,694	612	2,617	2,090	1,672	25,988
x1/9, Lingotto	1,475	2,012	1,797	1,458	1,590	1,316	3,767	1,675	326	1,776	1,691	1,666	20,549
124 Spider, Mirafiori	1,225	1,356	1,320	1,357	1,152	1,078	2,110	1,159	308	1,333	1,293	1,192	14,883
131, Mirafiori	10,847	9,706	9,567	8,238	4,940	7,192	5,108	4,967	1,404	5,563	5,949	4,878	78,359
131, Cassino	7,654	7,680	6,020	4,884	3,898	5,326	4,520	6,361	2,524	9,160	9,569	9,243	76,839
131, Rivalta	2,773	2,763	2,623	1,711	1,055	1,607	1,388	1,470	500	2,988	2,916	204	21,998
132, Mirafiori	5,795	6,763	7,120	3,262	24,313	6,626	5,281	6,128	2,123	7,960	7,217	7,559	90,147
Campagnola Benzina, Mirafiori	54	271	280	228	284	211	233	308	25	402	279	271	2,846
238, Mirafiori	2,830	2,765	2,759	2,648	1,224	1,494	903	907	193	974	845	882	18,424
241, Mirafiori	437	581	537	631	441	721	672	635	180	734	781	734	7,084
242 Fiat, Mirafiori	481	1,221	963	1,141	311	1,245	625	1,011	277	1,546	1,172	1,191	11,184
A120 F, Desio	602	420	506	654	369	604	344	828					4,327
A112, Desio	6,858	7,113	7,217	7,843	3,979	5,875	5,200	5,462	1,438	6,667	5,047		62,699
112, Desio												1,692	1,692
112 Elegant, Desio												5,529	5,529
112 Abarth, desio												1,571	1,571
900 T, Mirafiori	1,595	3,423	1,462	2,676	1,377	2,174	3,483	3,788	171	3,404	4,792	2,226	30,571
127 Seat, (Spain)		5,392	6,256	5,981	5,043	5,030	4,940	4,272	362	2,767	4,281	4,178	48,502
Total													1,392,618

Source: Ibid.

Table A 4.12: Output per month, per line, per plant, 1978

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
126, Desio	3,436	5,101	5,106	5,342	4,045	4,842	4,687	4,400	871	6,262	6,780	6,114	56,986
126, Termini Imerese	4,808	8,565	6,892	10,082	9,070	9,716	11,120	9,155	2,539	10,725	10,510	10,982	104,164
127, Mirafiori	27,300	38,139	31,042	35,209	29,605	33,213	34,038	30,851	5,999	33,537	34,692	31,489	365,114
128, Rivalta	18,497	21,049	29,905	18,948	12,650	14,901	8,391	3,609	1,809	2,986	5,603	5,803	144,151
128 Coupé, Rivalta	1,615	2,053	1,877	2,137	2,079	4,277	4,171	2,956	255	6	E		21,426
x1/9, Lingotto	1,261	2,127	1,629	1,724	1,572	1,723	1,802	1,729	282	3,245	2,175	1,509	20,778
124 Spider, Mirafiori	992	1,686	1,207	1,357	1,273	1,381	1,560	1,747	317	1,494	1,496	1,830	16,340
131, Mirafiori	15,992	5,989	5,276	7,449	7,828	11,151	11,010	11,654	2,000	11,479	12,455	12,551	114,834
131, Cassino	13,944	10,510	8,851	8,354	8,354	7,899	9,600	8,223	1,585	8,858	7,456	7,502	101,136
132, Mirafiori	46,014	8,543	6,954	8,377	8,121	9,550	9,405	8,597	1,577	7,584	8,828	8,703	132,253
Campagnola Benzina, Mirafiori	254	268	362	347	294	403	393	383	83	368	402	311	3,868
238, Mirafiori	427	326	1,328	977	761	1,111	1,236	1,255	141	2,161	3,008	1,896	14,627
241, Mirafiori	540	732	625	674	629	571	678	645	131	652	663	597	7,137
242 Fiat, Mirafiori	1,026	1,197	1,195	1,245	928	998	925	710	140	975	1,235	1,050	11,624
Ritmo, Rivalta				B	2,292	5,709	9,499	11,172	2,103	12,973	15,595	14,925	74,268
Ritmo, Cassino					B	59	828	1,242	325	2,273	4,038	5,863	14,628
112, Desio	1,240	983	642	541	520	581	800	950	194	870	1,008	998	9,327
112 Elegant, Desio	3,591	5,762	5,565	6,284	6,406	7,054	6,733	6,202	1,183	4,662	5,340	4,906	63,688
112 Abarth, Desiso	848	1,332	1,241	1,287	1,270	1,450	1,475	1,475	330	1,465	1,421	1,469	15,063
900 T, Mirafiori	1,534	6,434	629	3,658	2,220	2,133	2,429	1,289	948	2,061	2,061	1,939	27,335
127 Seat, (Spain)	3,520	4,224	3,151	3,318	2,637	4,090	4,879	5,686	2,451	6,841	5,802	5,478	52,077
Total													1,370,824

Source: Ibid.

Table A 4.13: Output per month, per line, per plant, 1979

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
Panda, Desio							B	48	238	353	1,573	2,608	4,820
126, Desio	4,964	5,926	3,888	3,941	3,543	3,915	3,429	3,031	E				32,637
Panda, Terminin Imerese									B	232	611	1,576	2,419
126, Terminin Imerese	9,200	11,204	10,763	10,227	8,871	10,612	10,442	7,057	2,602	8,417	4,951	6,093	100,439
127, Mirafiori	27,646	32,309	28,138	29,460	22,039	24,266	21,238	18,060	4,244	22,905	14,400	28,418	273,123
128, Rivalta	2,799	6,985	2,484	2,030	6,501	2,001	3,699	3,777	922	6,222	4,372	6,627	48,419
x1/9, Lingotto	1,468	1,742	1,837	1,691	1,609	1,802	1,501	1,772	483	1,939	3,711	2,174	21,729
124 Spider, Mirafiori	1,504	1,701	1,530	1,510	1,212	1,824	1,503	1,608	419	1,576	3,450	1,857	19,694
131, Mirafiori	10,941	13,409	11,897	12,438	10,435	10,826	9,184	8,029	727	10,294	5,418	12,390	115,988
131, Cassino	5,580	4,441	3,493	4,495	3,852	4,690	4,646	3,288	851	5,804	6,796	6,270	54,206
132, Mirafiori	7,836	8,903	7,781	8,211	6,734	6,789	5,021	5,009	634	6,178	38,339	7,780	109,215
Campagnola Benzina, Mirafiori	346	344	21	138	0	0	48	947	40	467	407	1,516	4,274
238, Mirafiori	282	1,713	1,909	1,741	1,483	1,668	1,622	1,598	382	1,938	2,208	2,014	18,558
241, Mirafiori	414	468	387	298	228	196	E						1,991
242 Fiat, Mirafiori	1,130	743	637	815	555	690	547	463	125	479	406	424	7,014
Ritmo, Rivalta	14,092	17,916	16,334	17,671	15,263	17,319	14,866	13,789	4,431	18,848	10,116	20,964	181,609
Ritmo, Cassino	5,873	9,313	10,123	13,028	11,945	14,511	13,289	8,846	2,360	15,047	16,727	14,916	135,978
112, Desio	955	983	989	1,002	1,251	1,445	2,306	197	122	1,012	E	E	10,262
112 Elegant, Desio	4,039	5,383	6,051	6,309	5,077	5,698	8,176	6,191	1,565	6,093	E	E	54,582
112 Abarth, Desio	1,163	1,413	1,278	1,311	1,248	1,402	1,501	1,389	333	1,493	E	E	12,531
112, Desio*											B	8,155	8,155
900 T, Mirafiori	1,651	2,872	2,465	2,255	2,545	2,572	1,485	2,279	591	3,063	2,095	13,441	37,314
127 Seat, (Spain)	3,030	3,851	4,076	4,383	4,341	4,031	4,053	6,344	8,877	3,215	8,619	M	54,820
Total													1,309,777

Source: Ibid.*From November 1979, the serial number of all the version of the A 112 were unified and produced on the same line.

Table A 4.14: Output per month, per line, per plant, 1980

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
Panda, Desio	6,903	4,625	5,185	4,999	6,066	5,951	6,356	287	4,755	4,247	5,919	5,939	61,232
Panda, Sicilia	5,259	3,994	6,014	8,648	9,908	11,639	12,783	1,007	9,629	11,451	11,591	12,659	104,582
126, Terminin Imererse	11,113	5,748	1,844	7,560	E								26,265
127, Mirafiori	49,414	28,371	28,565	26,404	28,039	23,730	25,723	72	8,687	13,825	29,045	22,583	284,458
x1/9, Lingotto	3,544	2,106	1,628	1,478	1,787	2,236	903	109	376	477	845	1	15,490
124 Spider, Mirafiori	3,599	1,563	830	964	1,185	1,864	1,283	107	661	1,064	1,124	1,238	15,482
131, Mirafiori	22,043	12,182	13,138	12,701	12,761	9,981	11,356	M	1,848	4,740	9,517	6,846	117,113
131, Cassino	11,652	6,907	6,539	6,620	6,310	6,424	6,463	M	2,044	1,829	2,424	2,246	59,458
132, Mirafiori	14,976	7,636	8,009	7,287	7,476	6,462	6,912	M	1,295	3,738	3,654	3,460	70,905
Campagnola Benzina, Mirafiori	777	412	451	433	518	456	510	15	197	727	371	363	5,230
238, Mirafiori	3,439	1,818	705	6,607	4,628	2,297	2,545	232	857	1,682	2,518	1,510	28,838
242 Fiat, Mirafiori	1,011	745	678	822	877	852	1,301	M	915	755	740	1,257	9,753
Ritmo, Rivalta	36,361	20,134	22,073	19,114	18,894	13,729	15,928	M	2,701	7,196	13,747	10,566	180,443
Ritmo, Cassino	28,011	15,445	15,404	14,893	15,151	12,447	12,408	M	3,055	6,501	13,971	11,919	149,205
112, Desio	12,711	6,959	6,349	6,197	6,654	7,393	8,247	445	6,536	5,103	7,701	7,734	82,029
Delta, Chivasso	B	3,412	4,429	5,013	5,870	13,162	1,363	411	3,933	4,058	7,863	6,287	55,801
900 T, Mirafiori	4,224	3,347	2,312	3,506	2,838	2,340	3,295	M	1,890	1,129	3,467	3,035	31,383
127 Seat, (Spain)	M	11,121	12,617	10,803	5,689	18,994	17,377	M	9,813	10,230	11,136	7,631	115,411
124 Seat, (Spain)	M	2,406	2,372	1,746	828	930	1,232	664	676	M	M	M	10,854
131 Seat, (Spain)	M	7,036	8,791	6,928	3,228	10,752	8,709	M	4,225	5,321	5,317	2,414	62,721
126, (Poland)	B	18,868	21,990	19,213	17,632	14,787	23,122	16,969	20,510	20,549	M	M	173,640
147, (Brazil)	M	10,186	10,130	13,460	14,110	11,320	10,274	16,010	15,884	14,336	17,884	12,405	145,999
Total													1,806,292

Source : Ibid. Where missing, the output of August has been incorporated in that of September.

Table A 4.15: Output per month, per line, per plant, 1981

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
Panda, Desio	6,231	5,241	6,200	5,602	5,799	6,447	6,428	274	6,466	4,532	3,070	2,082	58,372
Panda, Terminin Imerese	10,443	12,499	13,859	14,123	12,887	14,614	15,040	450	15,037	11,092	7,311	6,031	133,386
127, Mirafiori	28,502	27,716	22,347	17,516	22,518	17,867	23,686	M	18,812	17,339	16,773	9,395	222,471
x1/9, Lingotto	829	503	432	M	151	602	15	M	M	931	716	471	4,650
124 Spider, Mirafiori	1,386	1,266	120	M	802	689	112	M	M	457	668	787	6,287
131, Mirafiori	9,046	8,902	11,826	8,568	10,816	7,898	8,186	M	9,608	5,545	5,759	4,759	90,913
131, Cassino	2,217	2,144	3,150	2,687	2,296	2,385	2,513	132	2,813	1,486	1,559	1,284	24,666
132, Mirafiori	3,777	3,470	884	2,016	E								10,147
Argenta, Mirafiori		B	1,063	1,624	4,502	3,262	4,437	M	5,254	4,954	4,241	2,360	31,697
Campagnola Benzina, Mirafiori	483	498	382	353	368	294	93	M	M	22	311	306	3,110
238, Mirafiori	4,921	2,135	1,737	1,856	1,679	1,071	1,157	M	1,307	954	M	M	16,817
242 Fiat, Mirafiori	1,338	1,165	1,165	640	1,150	755	1,260	M	1,005	1,205	890	546	11,119
Ritmo, Rivalto, Mirafiori	14,235	14,339	14,792	14,759	18,302	15,389	16,125	M	18,654	12,415	11,273	9,644	159,927
Ritmo, Cassino, Mirafiori	14,222	15,025	17,144	15,574	16,143	14,413	16,273	762	17,738	9,613	8,954	7,180	153,041
112, Desio	8,247	6,872	7,907	7,888	7,779	8,030	8,622	106	8,552	5,716	4,115	3,435	77,269
Delta, Chivasso	8,099	7,224	5,432	6,476	6,365	4,910	6,287	M	36	1,633	1,940	859	49,261
900 T, , Mirafiori	2,636	2,397	1,994	1,079	3,172	1,574	3,342	140	1,643	2,008	1,171	1,296	22,452
127 Seat (Spain)	3,475	3,498	3,566	3,362	3,302	3,983	1,520	1	6,881	4,669	5,331	4,718	44,306
Panda, (Spain)	M	4,653	5,153	4,930	5,063	4,811	4,563	1	4,040	5,044	4,992	2,438	45,688
Panda, (Spain)	M	6,833	5,714	6,850	7,090	8,689	9,971	1	4,242	7,157	3,375	2,046	61,968
131, (Spain)	2,821	M	629	894	976	690	265	1	2,106	4,028	3,888	2,382	18,680
126, (Poland)	M	11,079	M	33,286	15,783	15,228	8,026	13,115	14,661	5,890	M	M	117,068
147, (Brazil)	9,649	7,001	11,938	9,108	11,125	8,855	7,249	8,818	9,894	10,448	M	17,936	112,021
Total													1,475,316

Source: Ibid. Where missing, the output of August has been incorporated in that of September.

Table A 4.16: Output per month, per line, per plant, 1982

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
Panda , Desio	4,212	4,669	7,015	4,547	5,680	5,527	6,436	593	5,957	5,356	5,490	2,945	58,427
Panda, Termini Imerese	9,871	14,170	15,254	15,311	13,791	14,453	12,575	1,565	14,310	14,511	14,312	10,780	150,903
127, Mirafiori	20,517	19,052	21,925	22,077	22,041	21,959	24,195	1,995	23,402	17,018	11,819	11,359	217,359
Uno, Rivalta						B	739	128	2,899	5,599	7,864	9,993	27,222
Uno, Mirafiori											B	739	739
x1/9, Lingotto	596	676	425	402	399	846	E						3,344
124 Spider, Mirafiori	724	442	445	277	50	79	E						2,017
131, Mirafiori	8,081	7,792	11,516	13,681	8,681	9,466	6,872	1,108	7,428	5,693	3,375	4,326	88,019
131, Cassino	2,465	3,890	3,949	2,271	1,926	2,353	1,739	317	3,095	2,853	2,719	1,402	28,979
Argenta, Mirafiori	4,088	6,072	5,343	4,861	4,557	5,327	3,376	568	3,690	2,660	1,521	1,521	43,584
Campagnola Benzina, Mirafiori	353	382	433	336	397	319	343	39	332	406	499	228	4,067
242 Fiat, Mirafiori	1,733	590	140	305	341	87	333	124	690	176	54	322	4,895
Ritmo, Rivalta	15,833	13,620	17,917	17,775	15,751	17,372	21,624	1,675	11,343	3,471	4,064	4,003	144,448
Ritmo, Rivalta								B*	180	2,537	3,405	5,362	11,484
Ritmo, Cassino	11,408	14,549	17,775	14,189	12,850	15,581	13,397	1,295	21,582	10,630	15,811	14,775	163,842
Beta, Chivasso	M	3,498	471	753	1,528	3,737	1,050	23	2,172	2,075	444	523	16,274
112 Desio	5,195	5,474	7,782	5,003	6,394	8,139	9,161	619	8,793	8,288	8,073	4,627	77,548
Delta, Chivasso	2,888	2,222	4,277	3,769	4,835	4,927	5,222	513	5,694	4,917	2,625	2,511	44,400
Prisma, Chivasso						B	89	8	47	604	1,637	2,745	5,130
900 T, Mirafiori	1,567	886	1,757	848	995	1,577	1,245	M	998	2,161	800	483	13,317
127 Seat, (Spain)	6,795	9,080	10,312	6,438	7,135	10,943	13,318	M	6,531	7,239	9,266	5,229	92,286
Panda, (Spain)	4,516	5,122	4,623	4,440	4,720	3,698	3,789	1,975	6,192	5,910	6,487	4,822	56,294
Panda, (Spain)	2,710	2,885	3,129	2,157	2,131	2,748	3,173	M	2,017	1,167	861	457	23,435
131 Seat, (Spain)	2,627	1,513	5,580	2,473	2,097	3,267	3,890	M	3,291	2,252	3,820	1,640	32,450
126, (Poland)	M	12,195	14,652	11,401	11,107	12,361	19,119	11,370	25,275	1,518	19,713	22,045	160,756
147, (Brazil)	10,619	10,115	13,430	13,895	13,049	13,748	11,942	20,537	5,640	M	20,340	14,205	147,520
Total													1,618,739

Source: Ibid. Where missing, the output of August has been incorporated in that of September. *Ritmo restyling: beginning of the production.

Table A 4.17: Output per month, per line, per plant, 1983

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
Panda, Desio	5,286	4,624	5,109	3,868	6,028	4,616	6,640	1,018	3,866	4,490	4,573	2,948	53,066
Panda, Sicilia	12,372	15,089	16,313	13,439	9,689	13,541	14,690	M	9,705	9,355	12,190	8,899	135,282
127, Mirafiori	9,317	8,095	8,476	5,852	778	E							32,518
Uno, Rivalta	12,063	12,780	15,554	14,405	17,422	15,818	16,399	1,855	14,826	13,441	10,984	7,516	153,063
Uno, Mirafiori , 1st Line	2,771	7,013	9,264	8,670	4,392	M	9,185	1,312	17,293	14,647	8,089	11,965	94,601
Uno, Mirafiori , 2nd Line				B	7,546	15,504	16,811	2,169	16,715	20,961	5,942	11,039	96,687
131, Mirafiori	4,514	4,914	4,612	3,816	1,506	1,539	2,207	M	262	1,009	19	62	24,460
131 Panorama, Cassino			B	781	407	1,391	768	M	118	138	27	143	3,773
Argenta, Mirafiori	1,468	1,447	2,810	1,884	39	E							7,648
Argenta Restyling Mirafiori				B	1,239	2,955	3,195	M	2,074	3,076	2,360	1,320	16,219
Campagnola Benzina, Mirfiori	318	105	110	318	249	28	225	2	139	131	125	90	1,840
242 Fiat, Mirfiori	297	271	172	115	323	230	178	113	724	578	378	172	3,551
Ritmo, Rivalta	8,749	8,060	11,805	9,403	9,867	10,120	10,448	1,622	12,221	11,079	7,268	3,614	104,256
Ritmo, Cassino	19,175	12,145	18,119	16,213	25,280	16,102	18,658	2,664	14,919	7,152	3,582	3,047	157,056
Regata, Cassino					B	1,055	3,717	743	7,712	14,046	16,344	17,381	60,998
Beta, Chivasso	1,501	M	631	621	2,731	757	862	M	1,818	400	1,818	178	11,317
112 Desio	8,248	6,835	7,875	5,846	8,852	6,776	8,567	826	9,083	6,225	6,634	4,864	80,631
Delta, Chivasso	2,735	2,924	3,265	2,796	3,055	3,680	2,361	282	4,192	2,193	3,689	3,108	34,280
Prisma, Chivasso	3,967	4,431	5,238	4,564	5,161	5,496	5,940	622	6,715	6,533	6,327	5,732	60,726
900 T, Mirfiori	722	850	1,684	523	736	623	1,165	0	1,155	1,397	2,122	922	11,899
127 Seat, (Spain)	4,000	5,695	5,105	5,328	5,556	4,106	M	M	M	M	M	M	29,790
Panda, (Spain)	3,812	5,019	6,013	3,977	M	M	M	M	M	M	M	M	18,821
Panda, (Spain)	1,894	2,879	3,009	3,218	5,309	7,653	7,541	136	8,030	7,329	7,767	6,349	61,114
131 Seat, (Spain)	2,420	2,544	995	1,455	1,855	2,971	2,688	M	2,813	2,236	M	M	19,977
126, (Poland)	17,662	22,273	11,621	11,307	24,549	8,333	17,851	13,361	13,494	16,602	15,007	22,560	194,620
147, (Brazil)	12,800	6,343	11,904	11,746	15,423		20,055	11,137		20,595	12,100	10,933	133,036
Total													1,601,229

Source: Ibid. Where missing, the output of August has been incorporated in that of September.

Table A 4.18: Output per month, per line, per plant, 1984

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
Panda, Desio	7,232	2,474	3,151	1,425	1,471	5,688	6,279	852	4,310	2,816	3,920	3,370	42,988
Panda, Sicilia	8,547	12,810	11,269	11,391	13,812	11,338	10,899	M	7,205	7,283	3,495	7,084	105,133
Uno, Rivalta	12,682	11,226	10,413	11,802	14,531	16,117	17,390	2,394	16,977	15,978	8,191	8,329	146,030
Uno, Mirafiori 1st line	13,679	15,479	17,104	12,688	16,103	15,225	17,422	2,047	15,053	11,912	12,452	9,021	158,185
Uno, Mirafiori 2nd line	12,902	32,920	29,131	30,140	34,564	34,353	19,752	14,626	21,501	17,557	15,928	7,630	260,004
Uno, Mirafiori 3rd line								B	2,734	9,798	6,191	6,191	24,914
131, Mirafiori	42	263	37	26	35	3	E						406
131, Panorama	248	482	1,602	1,036	1,167	623	E						5,158
Argenta Restyling , Mirafiori	5,462	1,489	1,154	2,680	1,220	1,227	1,253	M	1,104	995	811	643	18,038
Campagnola Benzina, Mirafiori	156	159	180	177	213	210	198	45	226	273	242	176	2,255
242 Fiat, Mirafiori	569	114	326	374	572	202	301	80	486	364	549	76	4,013
Ritmo, Rivalta	7,786	14,087	12,225	14,941	17,485	14,157	15,092	1,844	9,293	6,912	6,475	2,982	123,279
Ritmo, Cassino	2,029	2,642	2,773	2,638	3,155	3,536	3,894	372	3,480	2,543	1,109	2,471	30,642
Regata, Cassino	20,149	18,788	22,017	19,493	25,284	24,846	24,722	2,955	22,039	13,777	4,402	4,800	203,272
Beta, Chivasso	323	96	1,270	269	318	52	187	M	730	201	84	E	3,530
112 TT	8,622	5,919	8,864	7,614	9,334	9,280	9,076	1,048	6,592	9,273	8,009	4,752	88,383
Delta, Chivasso	4,439	5,586	1,403	3,050	4,538	3,253	5,035	9	55	2,213	1,195	1,076	31,852
Prisma, Chivasso	6,679	6,499	5,347	5,528	6,457	14,146	394	134	5,333	6,625	3,254	3,072	63,468
900 E, Mirafiori	1,229	1,170	1,077	1,194	1,141	1,170	1,353	179	924	1,078	694	1,078	12,287
Thema, Mirafiori							B	21	537	793	640	582	2,573
Panda, (Spain)	4,385	8,086	6,621	5,731	8,556	6,487	8,347	M	6,136	6,142	6,108	4,353	70,952
126, (Poland)	18,601	16,019	18,273	5,218	23,042	22,856	25,515	M	18,723	21,508	31,131	5,170	206,056
147, (Brazil)	11,867	4,729	6,981	8,993	10,103	7,304	10,724	9,541	7,115	8,996	8,164	6,447	100,964
Total													1,715,382

Source: Ibid. Where missing, the output of August has been incorporated in that of September.

Table A 4.19: Output per month, per line, per plant, 1985

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
Panda , Desio	3,624	5,379	2,814	1,397	2,725	2,824	2,258	M	900	6,044	347	244	28,556
Panda, Sicilia	16,440	8,089	10,559	10,564	14,736	9,822	13,341	M	6,093	5,233	8,580	9,842	113,299
Uno, Rivalta	19,073	17,063	18,592	16,714	20,744	17,458	17,263	2,146	17,367	20,746	21,539	20,925	209,630
Uno, Mirafiori 1st line	15,337	12,916	14,240	13,901	16,487	14,764	18,195	1,676	16,386	17,294	14,390	14,181	169,767
Uno, Mirafiori 2nd line	10,865	10,420	10,859	9,633	11,000	9,773	10,035	836	9,455	8,029	6,768	3,926	101,599
Uno, Mirafiori 3rd line	7,482	7,551	6,806	6,483	5,392	3,443	6,067	479	6,448	9,045	9,103	10,987	79,286
Argenta, Mirafiori	544	439	E										983
Campagnola Benzina, Mirafiori	259	279	304	297	319	279	326	25	314	341	281	131	3,155
242 Fiat, Mirafiori	365	-613	1,496	377	630	515	455	E					3,225
Ritmo, Rivalta	11,547	6,376	8,701	9,117	22,976	8,939	4,421	M	5,495	6,186	5,167	3,159	92,084
Ritmo, Cassino	2,649	4,807	3,872	3,356	3,225	2,712	4,444	M	2,701	3,263	3,835	1,148	36,012
Regata, Cassino	20,308	17,611	15,058	17,424	16,835	16,208	17,833	M	9,984	11,389	13,249	4,466	160,365
Croma, Mirafiori								E	313	638	1,053	2,494	4,498
Y10, Mirafiori	695	2,114	4,525	6,742	9,758	9,117	9,651	816	7,805	6,104	3,331	3,240	63,898
112, Desio	4,812	7,121	3,827	3,514	3,816	3,221	3,360	M	1,252	1,594	1,762	1,361	35,640
Delta, Chivasso	2,764	1,984	1,985	1,686	1,826	1,620	2,306	326	3,091	2,221	2,337	1,462	23,608
Prisma, Chivasso	7,193	5,158	8,323	4,846	8,094	7,488	8,027	562	6,374	6,243	6,517	4,523	73,348
900 E, Mirafiori	1,051	675	909	547	1,501	499	1,803	146	526	1,034	841	393	9,925
Thema, Mirafiori	935	1,247	1,908	2,059	2,574	2,585	3,620	374	3,665	4,339	3,681	3,540	30,527
Panda, (Spain)	6,838	5,838	6,391	4,208	6,317	4,530	3,610	M	5,940	9,371	4,561	2,489	60,093
126, (Poland)	17,343	15,548	17,590	15,392	21,442	19,229	12,915	20,799	23,514	20,458	18,061	20,226	222,517
147, Brasi(Brazil)	7,625	5,639	M	11,760	7,112	7,046	5,308	4,889	7,167	7,940	7,317	5,623	77,426
Total													1,599,441

Source: Ibid. Where missing, the output of August has been incorporated in that of September.

Table A 4.20: Output per month, per line, per plant, 1986

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
Panda, Desio	10,269	7,937	7,617	9,919	10,290	10,693	12,949	M	11,280	11,921	9,960	10,302	113,137
Panda ,Temini	11,789	14,054	13,723	15,143	13,992	13,826	16,913	M	15,689	15,742	13,726	14,353	158,950
Uno, Mirafiori 1st line	16,808	18,377	20,291	20,287	19,718	18,955	23,282	M	21,258	21,606	16,624	16,436	213,642
Uno, Mirafiori 2nd line	3,595	4,698	5,569	3,852	4,000	3,788	4,839	M	4,245	3,444	2,311	2,552	42,893
Uno, Mirafiori 3rd line	7,824	7,492	9,227	9,604	10,347	9,723	11,060	M	10,805	11,197	9,000	7,089	103,368
Uno, Rivalta	24,231	24,999	26,862	27,359	27,376	26,918	32,792	M	31,181	30,721	25,892	25,384	303,715
Ritmo, Rivalta	3,513	1,009	E										4,522
Ritmo, Cassino	6,624	7,734	7,339	10,606	10,840	8,740	8,937	M	8,890	7,957	4,294	5,434	87,395
Regata, Cassino	17,016	14,740	11,004	14,632	12,649	13,657	18,319	M	14,180	12,312	6,462	10,737	145,708
Croma, Mirafiori	3,891	5,278	6,192	6,885	7,242	6,718	8,087	M	7,447	7,899	6,650	5,785	72,074
Thema S.W. , Mirafiori												1,183	1,183
Fiorino, Mirafiori	399	310	332	317	362	379	553	M	244	162	137	142	3,337
Campagnola Benzina, Mirafiori	173	170	179	186	188	180	206	9	193	128	2		1,441
900 E, Mirafiori	891	860	929	713	464	856	513	M	450	957	199	410	7,242
A 112 , Desio	1,338	1,871	2,001	1,460	229	E							2,230
Y10, Mirafiori	5,790	7,876	7,927	7,161	7,082	6,625	7,980	M	7,659	7,880	7,410	7,476	80,866
Delta, Chivasso	2,193	1,925	2,100	2,190	2,393	3,091	3,837	M	3,150	3,555	9,112	5,242	38,788
Prisma, Chivasso	7,244	4,697	6,468	5,849	5,701	5,487	6,317	M	5,921	5,751	5,206	5,524	64,165
Thema, Mirafiori	3,969	3,725	4,020	3,776	3,969	3,475	4,290	M	3,957	4,661	4,100	4,420	44,362
Prisma, Rivalta												1,850	
Panda, (Spain)	4,502	4,007	2,295	4,456	E								15,260
126, (Poland)	13,413	27,550	20,300	18,039	19,189	M	45,961	M	M	39,867	15,513	23,729	223,561
147, (Brazil)		8,518	7,691	8,160	7,515	7,295	M	10,477	7,295	M	M	M	56,951
Total													1,785,745

Source: Ibid. Where missing, the output of August has been incorporated in that of September.

Table A 4.21: Output per month, per line, per plant, 1987

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Models and Plants													
Panda, Desio	10,278	10,471	12,090	11,270	10,663	12,109	13,697	604	13,334	13,715	13,161	12,810	134,202
Panda ,Temini Imerese	13,975	15,974	17,096	15,717	15,799	16,628	15,937	4,143	18,777	15,269	12,953	10,495	172,763
Tipo, Casino										87	543	1,252	1,882
Uno Mirafiori 1st line	16,573	18,316	22,686	22,497	20,810	21,236	22,949	780	20,290	20,108	20,178	18,955	225,378
Uno, Mirafiri 2nd line	4,269	5,020	7,854	7,577	6,553	6,871	5,898	142	5,178	4,796	2,705	4,937	61,800
Uno, Mirafiori 3rd line	6,421	5,560	8,227	7,869	9,723	9,998	9,923	273	6,898	7,529	6,901	6,882	86,204
Uno, Rivalta	25,830	52,937	32,604	30,489	30,511	13,297	50,398	1,346	28,921	26,697	22,865	19,557	335,452
Ritmo, Cassino	4,527	6,234	6,702	6,003	5,810	3,376	1,538	48	1,818	2,828	2,611	635	42,130
Regata, Cassino	8,994	15,339	15,502	13,835	11,148	12,851	11,380	485	14,591	14,524	8,798	10,316	137,763
Croma, Mirafiori	5,061	4,678	5,354	5,456	5,784	6,561	6,859	375	6,351	6,424	6,059	5,485	64,447
Tipo, Rivalta					152	220	575	21	530	849	3,081	5,996	11,272
Thema S.W, Mirafiori	430	462	440	409	394	416	471		293	396	299	176	4,186
Fiorino, Mirafiori	79	276	173	179	170	228	247		174	115	100	172	1,913
900 E, Mirafiori	268	656	605	559	666	618	335	6	375	1,109	163		5,360
Y10 Mirafiori	8,508	9,900	11,855	10,754	8,977	9,007	9,702	541	10,389	10,580	10,827	10,417	111,457
Delta, Chivasso	3,651	4,003	5,829	3,575	5,581	2,471	4,290	203	3,842	2,950	3,971	4,662	45,028
Prisma, Chivasso	10,425	2,744	4,598	5,605	9,790	2,084	6,309	274	6,355	4,429	5,126	5,325	63,064
Thema, Mirafiori	4,847	5,030	6,102	4,599	5,319	4,592	5,060	208	4,875	4,654	4,551	3,762	53,599
126, (Poland)	12,347	22,037	17,847										52,231
126 Restyling, (Poland)						1,096	1,648	3,247	4,072	5,377	4,856	5,006	25,302
Duna, (Brazil)		11,043	11,905	12,700	13,042	14,658	9,581	19,460	13,714	11,794	9,766	6,740	134,403
Total													1,880,062

Source: Ibid. Where missing, the output of August has been incorporated in that of September.

Table A 4.22: Monthly capacity utilisation rate, Fiat pants, 1984-1987

Months	Working days	Rivalta	Mir. I	Mir. II	Mir. III	Cassino	Desio	Termini	Chivasso	Chivasso
		Uno + Ritmo	Uno	Uno + Croma + Thema	Uno + Y 10	Ritno + Regata	Panda	Panda	Delta	Prisma
J	19	76.9	90	0	0	89.8	95.2	90	58.4	87.9
F	21	86.1	92.1	196	0	78.5	29.5	122	66.5	77.4
M	21	77	101.8	173.4	0	90.8	37.5	107.3	16.7	63.7
A	19	100.5	83.5	198.3	0	89.6	18.8	119.9	40.1	72.7
M	22	103.9	91.5	196.4	0	99.4	16.7	125.6	51.6	73.4
J	20	108.1	95.2	214.7	0	109.2	71.1	113.4	40.7	176.8
J	22	105.5	99	112.2	0	100.1	71.4	99.1	57.2	4.5
A	6		0	0	0	42.7	35.5	0	0	0
S	20	93.8	94.1	134.4	17.1	98.2	53.9	72.1	0.7	66.7
O	23	71.1	64.7	95.4	53.3	54.6	30.6	63.3	24.1	72
N	20	52.4	77.8	99.6	38.7	21.2	49	35	14.9	40.7
D 84	19	42.5	59.3	50.2	40.7	29.4	44.3	74.6	14.2	40.4
J	20	109.4	95.9	67.9	46.8	88.3	45.3	164.4	34.6	89.9
F	20	83.7	80.7	65.1	47.2	86.2	67.2	80.9	24.8	64.5
M	20	97.5	89	67.9	42.5	72.8	35.2	105.6	24.8	104
A	20	92.3	86.9	60.2	40.5	79.9	17.5	105.6	21.1	60.6
M	22	141.9	93.7	62.5	30.6	70.1	31	134	20.8	92
J	19	99.2	97.1	64.3	22.7	76.6	37.2	103.4	21.3	98.5
J	23	67.3	98.9	54.5	33	74.5	24.5	116	25.1	87.3
A	5		0	0	0	0	0	0	0	0
S	21	77.8	97.5	56.3	38.4	46.5	10.7	58	36.8	75.9
O	23	83.6	94	43.6	49.2	49	65.7	45.5	24.1	67.9
N	20	95.4	89.9	42.3	56.9	65.7	4.3	85.8	29.2	81.5
D 85	19	90.5	93.3	25.8	72.3	22.7	3.2	103.6	19.2	59.5

Sources: The capacity utilisation rate is the actual utilisation as percentage of the optimal capacity utilisation. Daily optimal capacity utilisation was as follow: Rivalta = 1400 cars per day; Mirafiori = 850 cars per day per line; Cassino = 1400 cars per day; Desio = 300 cars per day; Termini Imerese = 500 cars per day; Chivasso = 400 cars per say per line. Source: Mr Malandri, chief engineer at the Department of Technology Development, Fiat Auto, interview with the author, 18-03-1999. Fiat Fondo Sepin (Emplyment File), 5/VIII/1/A. The optimal monthly capacity utilisation has been calculated by multiplying the optimal daily capacity utilisation of each line for the number of working days of each month. By utilising the data on monthly production per line shown by table A4 18-21, the utilisation rate has been calculated.

Table A 4.22: (continued)

Months	Working days	Rivalta	Mir. I	Mir. II	Mir. III	Cassino	Desio	Termini	Chivasso	Chivasso
		Uno + Ritmo	Uno	Uno + Croma + Thema	Uno + Y 10	Ritno + Regata	Panda	Panda	Delta	Prisma
J	20	99.1	105.1	22.5	48.9	90.9	128.4	117.9	27.4	90.6
F	19	97.8	120.9	30.9	49.3	91	104.4	147.9	25.3	61.8
M	21	91.4	120.8	33.1	54.9	67.2	90.7	130.7	25	77
A	21	93.1	120.8	22.9	57.2	92.4	118.1	144.2	26.1	69.6
M	21	93.1	117.4	23.8	61.6	86	122.5	133.3	28.5	67.9
J	20	96.1	118.5	23.7	60.8	86.1	133.7	138.3	38.6	68.6
J	23	101.8	126.5	26.3	60.1	91.2	140.8	147.1	41.7	68.7
A			0	0	0	0	0	0	0	0
S	22	101.2	120.8	24.1	61.4	80.7	128.2	142.6	35.8	67.3
O	23	95.4	117.4	18.7	60.9	67.8	129.6	136.9	38.6	62.5
N	21	88.1	99	13.8	53.6	39.4	118.6	130.7	108.5	62
D 86	21	86.3	97.8	15.2	42.2	59.2	122.6	136.7	62.4	65.8
J	19	97.1	109	28.1	42.2	54.7	135.2	147.1	48	137.2
F	20	189.1	114.5	31.4	34.8	83	130.9	159.7	50	34.3
M	21	110.9	135	46.8	49	81.3	143.9	162.8	69.4	54.7
A	22	99	127.8	43.1	44.7	69.4	128.1	142.9	40.6	63.7
M	20	109	130.1	41	60.8	65.2	133.3	158	69.8	122.4
J	21	45.2	126.4	40.9	59.5	59.4	144.2	158.4	29.4	24.8
J	23	156.5	124.7	32.1	53.9	43.2	148.9	138.6	46.6	68.6
A	2		0	0	0	0	0	0	0	0
S	22	93.9	115.3	29.4	39.2	57.4	151.5	170.7	43.7	72.2
O	22	86.7	114.3	27.3	42.8	60.7	155.9	138.8	33.5	50.3
N	21	77.8	120.1	16.1	41.1	41.8	156.7	123.4	47.3	61
D 87	19	73.5	124.7	32.5	45.3	44.3	168.6	110.5	61.3	70.1

Source: Ibid.

Mr Malandri, Chief Engineer, Department of New Technology Development, Fiat Auto.

Interview with the author, 18-03-1999. Transcript of the most relevant parts of the interview, with regards to qualitative issues.

A: "Between 1984 and 1987, was it possible to shift the production of the Uno to Cassino?"

M: "Such a possibility was not economically viable because it would have required the retooling of the lines upstream the Robogate, as well as the resetting of the Robogate itself. But the main problem was the retooling of the lines upstream the Robogate. By lines upstream the Robogate, I mean the stamping and welding lines processing the platform and body subcomponents."

A: "Why was the retooling of the lines upstream the Robogate necessary, in order to shift the production of the Uno to Cassino?"

M: "Because the stamping and welding lines upstream the Robogate were, and still are, model specific."

A: "In other terms, the set of tools upstream the Robogate was inflexible. Is it correct?

M: "Yes, it is."

A: "This is an interesting point, because it rises the question why Robotics was not deployed upstream the Robogate."

M: "Well, you change technology when the old one proves inefficient. Multiple automated welders upstream basting and finishing were extremely efficient, with a cycle time smaller than a minute and low labour intensity."

A: "Why did you not utilised multiple automated welders at the stage of the monocoque welding?"

M: Before the deployment of robotics, multiple automated welders were utilised in all the spot welding processes upstream the stage of monocoque welding, and in the monocoque basting."

A: "Why not in finishing?"

M: "Because multiple automated welders were by far too inflexible to cope with the high level of complexity involved by the finishing stage."

A: "As far as I know, Fiat tried multiple automated welders for the basting and finishing of the 126 at the Cassino plant between 1972 and 1974 and it was a failure. Is this correct?"

M: " I was not part of that project, but yes, the experiment stopped in 1974."

Appendix
Chapter 6

Table A 6.1: Segment share of total output (percentage), 1968-87

Years	A+B	C+D+E	F	G	H		I	LCV 3500 Kg	Total
			Over 2200	Over 3000	Sport Below 2000	Sport Over 2000	4 WD		
	%	%	%	%	%	%	%	%	
1968	61.7	22	0.6	0	10.9	0	0.1	4.6	100
1969	51.8	32	0	0	11	0	0.2	5	100
1970	43.1	45.1	0.3	0	8.4	0	0.2	3	100
1971	42.5	48.5	0.1	0	6.3	0	0.3	2.3	100
1972	38.8	55.2	0.2	0	3.1	0.1	0.1	2.5	100
1973	46.9	34.1	0.2	0	13.6	0.1	0.1	5.1	100
1974	51.2	39.6	0.1	0	3.8	0	0.1	5.2	100
1975	46.6	41	0	0	3.3	0	0.2	8.8	100
1976	43.2	49.4	0	0	2	0	0.2	5.2	100
1977	52.4	40.1	0	0	2.4	0	0.2	4.9	100
1978	46.8	46	0	0	2.6	0	0.3	4.3	100
1979	39.8	53.7	0	0	2.4	0	0.2	3.8	100
1980	54	40.3	0	0	1.7	0	0.3	3.8	100
1981	58	37.7	0	0	0.7	0	0.2	3.3	100
1982	60.4	34.5	0	0	0.3	0	0.2	4.5	100
1983	58.9	35.7	0	0	0	0	0.1	5.3	100
1984	68	27.3	0	0	0	0	0.1	4.5	100
1985	69.3	25.1	0	0	0	0	0.2	5.4	100
1986	70.1	24.4	0	0	0	0	0.1	5.4	100
1987	76.5	19.1	0	0	0	0	0	4.4	100

Source: Elaboration of data from Archivio Fiat, 'Libro dei numeri di matricola dei veicoli prodotti' (Production File). Before 1977, Lancia output has been extrapolated by Fiat (ed.) *Le fasi della crescita*, 1996 pp 120-121. Lancia did not produce cars below segment C. Segments are defined as follows: A (500-900 cc.), B (900-1100 cc.), C (1100-1300 cc.), D (1300-1600 cc.), E (1600-2200 cc.). Note: 4WD = four wheel drive; LCV = light commercial vehicles.

Translation of relevant parts of the Administration Board Meetings Report, 30th of January 1963, book 33, pp 22-25.

Speaker: Vittorio Valletta, President of Fiat.

"Within the European Common Market, and in particular within the car industry, the problems that we were expecting are now emerging. [....] In 1965 the production capacity of the European industry will exceed demand by 20% [....]. [There is also] evidence of severe price competition caused by the dominant position of the two American champions Ford and General Motors. [...] Within the EEC there are, and will be in the future, Countries with similar production capacity – Germany, France, and in the future the UK – and Countries with inferior production capacity, such as Italy. It will take at least ten years for Italy to catch up. [.....] The Italian view [on the removal of tariffs] has to be re-considered in order to prevent the Italian economy from suffering the competition of those who have the dominant position in terms of production capacity.
As far as the car industry is concerned, Ford and General Motors are in the position to profit from the experience and financial means of their American partners, in order to pursue a strategy based on unbeatable price competition [meaning that Fiat could not be as price competitive as Ford and General Motors]. Actually, there is already evidence that both manufacturers are pursuing such a strategy [...] Asked by the France newspaper L'Equipe (October 1962), Mr. Dreyfus, President of Renault, stated that the European car industry should cooperate in order to achieve a common policy to prevent specific countries or specific manufacturers, either within or outside the EC, to acquire a dominant position in the EEC market. Fiat, through his President Valletta, intends to stress her unconditional agreement with Mr Dreyfus."

Translation of relevant parts of the Administration Board Meeting Report of the 29th of July 1963, book. 34, pp. 1-7.

Speaker: Speaker: Vittorio Valletta, President of Fiat.

"Nobody should believe that the "price war" will resolve the current crisis of overcapacity [here Valletta refers the problem of overcapacity quoted in the preceding meeting of the Board]. We are already at the limit. At the moment, the prices of the Italian cars are competitive, but there is no doubt that the American manufacturers can cut costs to an extent not attainable by the European industry. [...] It has to be stressed that the defence of the economy of individual EEC countries can be already implemented based on the Chapter of the Treaty of Rome concerning the defence of national market against dominant positions."

Translation of relevant parts of the Administration Board Meeting Report of the 4th of February 1964, book 34, pp. 96-99.

Speaker: Vittorio Valletta.

"In 1963, the threat of severe price competition become an actual price war between European and domestic manufacturers in the Italian market. [....] In particular, were not impressed by the unnecessary price reduction of some manufacturers – namely Ford and Volkswagen – who were enjoying a normal [literal translation of the Italian text] success in the Italian market but decided to go for an unnecessary price cut which we interpreted as dumping."

Translation of relevant parts of the Administration Board Meeting Report of the 24th of January 1965, book 35, pp. 179-187.

Speaker: Vittorio Valletta.

"Within the EEC there is even stronger concern about the future of the car industry [due to two main problems]:

1) The overcapacity of the industry in relation to the size of demand and its rate of growth;
2) The severe price competition that overcapacity will induce. In particular, the European subsidiaries of Ford and General Motors would be the leader in the price war.

In order to pursue a collective defence of the European car industry, we have proposed the introduction of production quotas within a regulatory framework similar to that regulating the production of steel. If such a framework cannot be implemented, [our view is that] each individual country will defend the domestic market by applying the chapter of the Treaty of Rome concerning dominant positions.
During meetings with Italian and French authorities [not specified in the text] it has been recognised that the situation is serious and that the matter should be discussed also with the European manufacturers in order to find a common solution."

APPENDIX
CHAPTER 7

Table A7.1: New registrations, Fiat exports, and the Fiat share of the domestic and EC markets, 1965-1987

Year	New registrations (units)	Exports (units)	Fiat share of the domestic market	Fiat Share of the EC market
1965	889,300	289,028	73.66 %	
1966	1,015,000	349,909	74.14 %	
1967	1,162,200	376,219	75.82 %	
1968	1,167,600	521,534	74.55 %	
1969	1,217,900	545,448	70.14 %	
1970	1,363,600	586,496	63.54 %	
1971	1,435,500	577,886	64.39 %	
1972	1,470,400	591,170	63.00 %	
1973	1,449,900	547,245	61.40 %	
1974	1,280,700	554,856	61.90 %	
1975	1,050,900	510,880	56.58 %	
1976	1,187,600	613,100	53.52 %	11.15 %
1977	1,219,200	584,886	54.52 %	11.23 %
1978	1,194,400	503,351	53.60 %	11.44 %
1979	1,397,000	773,143	50.33 %	10.77 %
1980	1,530,500	651,400	51.36 %	12.11 %
1981	1,808,500	693,700	51.30 %	12.78 %
1982	1,851,200	541,400	51.52 %	12.4 %
1983	1,451,500	564,600	55.56 %	12.17 %
1984	1,572,400	574,000	54.44 %	12.78 %
1985	1,653,200	620,494	52.31 %	12.37 %
1986	1,769,200	670,754	54.40 %	12.59 %
1987	1,929,600	725,085	53.73 %	14.13 %

Source: Archivio Storico Fiat, (ed), *Fiat: le fasi della crescita*, pp. 131-135. Enrietti and Fornenego, *Il gruppo Fiat*, 1989, pp. 70-73, tables 5/1 and 5/2. ANFIA (ed), *L'automobile in cifre*, p. 334.

Table A7.2: Monthly variation in prices (%) in the Italian market, various manufacturers, 1981-1987

Year	Month	Fiat	Alfa Romeo	Audi	Citroën	Ford	Opel	Peugeot	Renault	Volkswagen	Volvo	Number of followers in the same or in the subsequent month
1981	Jan.											
1981	Feb.	4.7										
1981	March		2.1	2.6	5.2	4.9	5.9	6		1.7		7
1981	April											
1981	May	12.3	3.1				5.2					
1981	June						2.2				6.3	4
1981	July			5.5	0.76	5.5		4.5	5.9	9		
1981	Aug.	-5.4	0	0.8	-0.47	-2.8		-3.1	-0.4	-0.9	-2.1	
1981	Sept.											
1981	Oct.				0.39	3.6	4.14	8.2	3.4	5.6	-3	
1981	Nov.	7.9	2.4									
1981	Dec.	1.6	1.9	4.2		4.3	3.8	4.9	4.5	4.3		9
1982	Jan.				5.6						15.1	
1982	Feb.											
1982	March	5.3	4.1			3.2			5.9		2.3	9
1982	April			3.3	8.1		4	1.3		2.6		
1982	May					5.2		7.5	1.8		2.1	
1982	June		4.9				4.6			5.6		
1982	July	8	4.7	3.3	4.8							
1982	Aug.					3.9						
1982	Sept.			14.7						7.9	5.4	
1982	Oct.	4.8	7.2		1.5		3.4	4.8	10			
1982	Nov.					3.3						
1982	Dec.	0.3					3.1					1
1983	Jan.											
1983	Feb.	-6.7		6.7	2.5	0.6		2.4	3.4	-0.1		
1983	March		1				4.6				4	
1983	April	6.9	2	7.3	2.1		0.9		2.1			7
1983	May									7.6	4.3	
1983	June											
1983	July					2.7			3.8			
1983	Aug.											
1983	Sept.	6.1		10.5	6.6	1.4	3.6					8
1983	Oct.	-0.1	6.5					8.6		10	1.9	
1983	Nov.		-0.1						5.1			
1983	Dec.			0		1.3	2.8	2.6				

Source: Elaboration of prices from *Quattroruote*, Monthly, 1980-1987.

Table A7.2 (continued)

Year	Month	Fiat	Alfa Romeo	Audi	Citroën	Ford	Opel	Peugeot	Renault	Volkswagen	Volvo	Number of followers in the same or in the subsequent month
1984	Jan.	2.6	9.8						2.5	5.8		
1984	Feb.			0.7	6.3		2.45				3.3	
1984	March											
1984	April	5.4		2.5		5.6			2.5			7
1984	May				2.6		2.2	8.7			1.6	
1984	June		2.6			2.6						
1984	July								2.3			
1984	Aug.					2.3						
1984	Sept.		1.6	8.6			3.6			0.1		
1984	Oct.	5.3			4.3			1.9		0.2		
1984	Nov.	0	1.2			3.7	6.8				4.6	
1984	Dec.			-0.4					-1.5			
1985	Jan.					0.41						
1985	Feb.	1.2	2	-6.8			4.2		2.8	-0.3		5
1985	March				1.65						1.1	
1985	April									6.1		
1985	May			5.7			-0.8	1.8	1.4			
1985	June	1	2.6		0.21	2.4						
1985	July			5.3			3.3					
1985	Aug.	1.4									3.8	2
1985	Sept.							6.3				
1985	Oct.		2.1		1.5	0.7			3.5	4.7		
1985	Nov.			0			1.2					
1985	Dec.	0.8			2.2					1.8	1.2	5
1986	Jan.		0.2					0.9			2.6	
1986	Feb.			2.5	3		6.1		1.91	8.3		
1986	March					-1.1						
1986	April	3.5			0							
1986	May		5.2									1
1986	June	1.5		1.1			4.3	2.9	5.1	1.7		5
1986	July								-2.1			
1986	Aug.										1.8	
1986	Sept.		-0.1	9.3	3.8	1.4				5.4		
1986	Oct.	0.2	0.8				0.8	0.6				
1986	Nov.			0	-0.6							
1986	Dec.					0.5		0.9	3.8	5		

Ibid.

Table A7. 2 (continued)

Year	Month	Fiat	Alfa Romeo	Audi	Citroën	Ford	Opel	Peugeot	Renault	Volkswagen	Volvo	Number of followers in the same or in the subsequent month
1987	Jan.	1.4										
1987	Feb.		0.8	4.6		3.3	9.4	1.9	5.2	0.9	1.2	8
1987	March				1.7							
1987	April							2.4				
1987	May											
1987	June	2	1.05	1		0.96			-1.9			4
1987	July							1.4				
1987	Aug.									6.5	2.2	
1987	Sept.	0.8		4.9		3.1	-4.82		10			
1987	Oct.		3.79									
1987	Nov.				4.28							
1987	Dec.											

Ibid.

Table A7.3: Frequency distribution of the number of followers in the same month or within two months when Fiat increased its prices

Number of competitors	Number of price changes when Fiat was the first mover	Frequency with which a certain number of competitors followed Fiat price rises		Percentage of each observation in the frequency distribution out of the total number of price rises	Cumulative frequency distribution
		Number of followers	Frequency		
9	15	9	2	13.3%	13.3%
		8	2	13.3%	26.7%
		7	3	20%	46.7%
		6	0	0%	46.7%
		5	3	20%	66.7%
		4	2	13.3%	80%
		3	0	0%	80%
		2	1	6.7%	86.7%
		1	2	13.3%	100%

Source: ibid.

Table A7.4: Changes prices, 1984 - 1987

	Fiat	Ford	Opel	Peugeot	Renault	Volkswagen	Price index of consumer goods*
1981	21.1%	15.5%	21.2%	20.5%	13.4%	19.7%	18.7%
1982	18.4%	15.6%	15.1%	13.6%	17.7%	16.1%	16.3%
1983	6.2%	6%	11.9%	13.6%	14.4%	17.5%	15%
1984	13.3%	14.2%	15%	10.6%	5.8%	6.1%	10.6%
1985	4.4%	3.51%	7.9%	8.1%	7.7%	12.3%	8.6%
1986	5.2%	0.3%	11.2%	4.4%	4.91%	15.4%	6.1%
1987	4.2%	7.3%	4.58%	5.7%	13.3%	7.4%	4.6%

*Calculated from the ISTAT price index of consumer goods. Each observation shows the percentage increment on the previous year. Source: ibid.

Table A7.5: Relevant output range, considering the Prisma and the Regata as C segment models

Segments	Fiat actual output				Fiat output mix according to the budget allocation of capacity among models	European average volumes (1985 benchmark)	European norm: typical volumes (1985 benchmark)
	1984	1985	1986	1987			
A	148121	146353	355183	418422	394400	119000	110000
B	675614	595922	663618	708834	498800	350000	440000
C	458077	385417	340578	301139	696000	505000	525000
E	24141	36008	116436	118046	83520	100000	140000

Sources: Elaboration of data from Archivio Storico Fiat 'Libro dei numeri di matricola dei veicoli prodotti', (Fiat Production File), and from Ludvigsen and Associates, *The Cost of non Europe,* p. 33.

Table A7.6: Per unit factory costs at typical annual volumes, segments A - E

	Value in 1985 ECU					Value in 1985 ITL				
Segment	A	B	C	D	E	A	B	C	D	E
Volumes	119,000	350,000	505,000	243,000	100,000	119,000	350,000	505,000	243,000	100,000
Variable costs										
Engine and transmission	575	715	810	1,040	1,550	837,775	1,041,755	1,180,170	1,515,280	2,258,350
Electrical	130	225	450	680	1,160	189,410	327,825	655,650	990,760	1,690,120
Chassis	355	540	855	1040	1,545	517,235	786,780	1,245,735	1,515,280	2,251,065
Interior	250	370	610	835	1,235	364,250	539,090	888,770	1,216,595	1,799,395
Exterior	70	110	205	315	465	101,990	160,270	298,685	458,955	677,505
Body in white	445	535	550	730	925	648,365	779,495	801,350	1,063,610	1,347,725
Pint and assembly	255	3,40	485	575	850	371,535	495,380	706,645	837,775	1,238,450
Total V.C.	2,080	2,835	3,965	5,215	7,730	3,030,560	4,130,595	5,777,005	7,598,255	1,126,2610
Fix costs	1,170	1,375	1,465	1,960	2,370	1,704,690	2,003,375	2,134,505	2,855,720	3,453,090
Total Costs	3,250	4,210	5,430	7,175	10,100	473,5250	6,133,970	7,911,510	10,453,975	14,715,700

Sources: Ludvigsen and Associates, *The Cost of non Europe*, p. 47. The conversion rate is 1 ECU = ITL 1475.

Table A7.7: Per unit factory costs at various levels of output, 1985 ITL

A		B		C		D		E	
Volumes	TC	Volumes	TC	Volumes	TC	Volumes	TC	Volumes	TC
50,000	7,350,565	50,000	18,941000	50,000	28,344,478	50,000	22,525,220	50,000	18,872,521
100,000	5,060,161	100,000	11,495,730	100,000	17,137,234	100,000	14,969,218	100,000	14,715,700
110,000	4,735,250	200,000	7,720,643	200,000	11,435,993	200,000	11,341,288	140,000	13,437,911
160,000	4,153,907	350,000	6,133,970	300,000	9,541,893	243,000	10,453,975	200,000	12,476,291
200,000	3,874,163	500,000	5,386,529	500,000	7,911,510	300,000	9,779,384	220,000	12,199,461
300,000	3,483,687	650,000	4,998,967	525,000	7,596,798	315,000	9,655,539	300,000	11,731,764
500,000	3,123,808	435,000	5,641,504	348,000*	9,050,884	380,000	9,192,213	500,000	10,962,468
394,400*	3,256,395	498,800*	5,401,099	185,773*	11,975,083	500,000	8,589,015	83,520*	15,474,797
148,121*	431,8548	675,614*	4,869,294	151,704*	13,274,727	348,000*	9,441,360	116,436*	14,052,765
146,353*	4,324,376	595,922*	5,098,043	130,705*	14,463,639	272,304*	10,124,693	118,046*	13,974,087
355,183*	3,355,471	663,618*	4,924,660	100,312*	16,994,448	233,713*	10,663,783	24,141*	26,488,260
119,000*	4,722,137	708,834*	4,828,498			209,873*	11,095,240	36,008*	21,594,197
415,280*	3,209,771					200,827*	11,235,509		

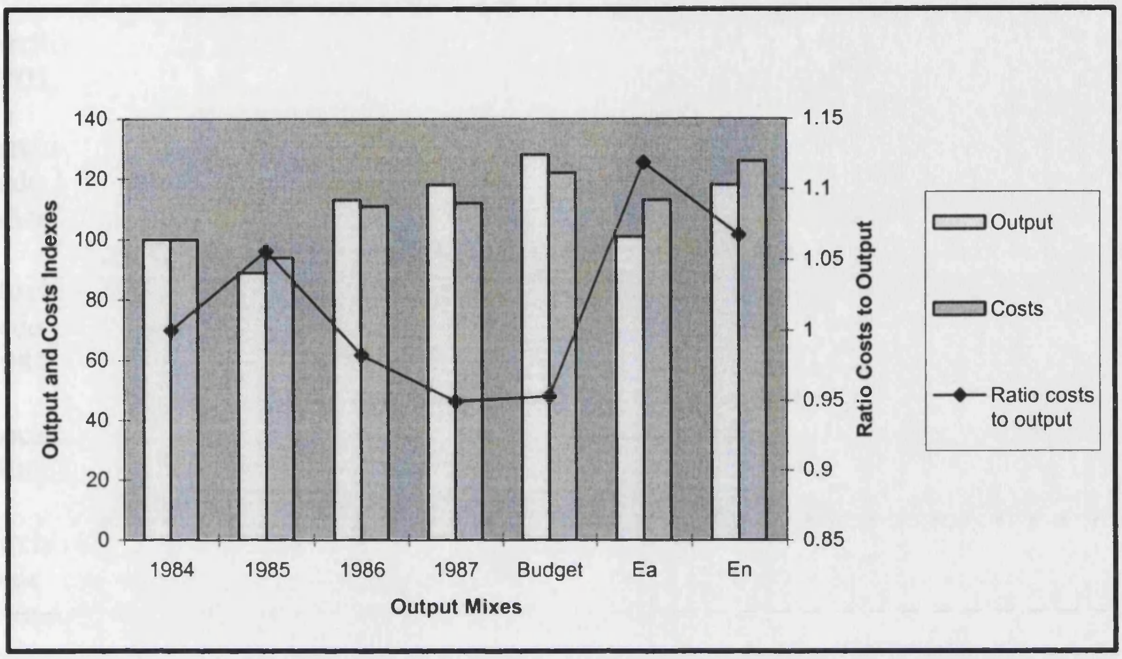
Source: Elaboration of data from Archivio Storico Fiat, 'Libro dei numeri di matricola dei veicoli prodotti'. (Fiat Production File). Costs for Fiat output data have been extrapolated by using the linear regression technique based on costs at various levels of output as reported by Ludvigsen. *The Cost of Non Europe*, pp. 68-72.

Table A7.8: Behaviour of total costs in the relevant output-mix ranges

Costs	1984	1985	1986	1987	Budgret	Ea	En
A	6,395,864,780	6,328,303,720	11,916,389,650	13,414,609,320	12,841,664,000	5,619,180,000	5,194,200,000
B	32,895,645,660	30,380,103,560	32,676,550,320	34,222,505,520	26,940,188,000	21,465,500,000	24,820,400,000
C	22,246,316,750	20,137,188,960	18,903,864,150	17,047,021,280	31,494,000,000	39,950,550,000	39,879,000,000
D	27,568,056,960	24,920,817,190	23,285,409,350	22,562,913,450	32,854,680,000	25,400,790,000	30,803,850,000
E	6,394,468,080	7,775,567,520	16,361,586,720	16,495,748,040	12,923,884,800	14,715,000,000	18,811,800,000
Total	95,500,352,230	89,541,980,950	103,143,800,200	103,742,797,600	117,054,416,800	107,151,020,000	119,509,250,000
Output	1,305,953	1,163,700	1,475,815	1,546,441	1,672,720	1,317,000	1,530,000

Keys: Ea= European average; En= European norm. Source: ibid.

Figure A7.1: Ratios of costs to output at various levels of output and output mixes, assuming typical costs, and considering the Prisma and the Regata as C segment units - 1985 prices



Source: ibid.

Table A7.9: Behaviour of costs, revenues and operating profits in the relevant output-mix ranges, ITL

	1984	1985	1986	1987	Budget	Ea	En
Revnues							
A	9,642,677,100	9,527,580,300	23,122,413,300	27,239,272,200	25,675,440,000	7,746,900,000	7,161,000,000
B	52,900,576,200	46,660,692,600	51,961,289,400	55,501702,200	39,056,040,000	27,405,000,000	34,452,000,000
C	17,299,181,760	14,126,676,480	12,171,249,600	9,341,053,440	32,405,760,000	47,025,600,000	48,888,000,000
D	29,033,052,480	24,918,480,060	22,376,659,260	21,412,174,740	37,103,760,000	25,908,660,000	33,585,300,000
E	4,000,887,930	5,967,605,840	19,296,938,280	19,563,763,580	13,841,769,600	16,573,000,000	23,202,200,000
Tot.	112,876,375,500	101,201,035,300	128,928,549,800	133,057,966,200	148,082,769,600	124,659,160,000	147,288,500,000
Costs							
A	6,395,864,780	6,328,303,720	11,916,389,650	13,414,609,320	12,841,664,000	5,619,180,000	5,194,200,000
B	32,895,645,660	30,380,103,560	32,676,550,320	34,222,505,520	26,940,188,000	21,465,500,000	24,820,400,000
C	22,246,316,750	20,137,188,960	18,903,864,150	17,047,021,280	31,494,000,000	39,950,550,000	39,879,000,000
D	27,568,056,960	24,920,817,190	23,285,409,350	22,562,913,450	32,854,680,000	25,400,790,000	30,803,850,000
E	6,394,468,080	7,775,567,520	16,361,586,720	16,495,748,040	12,923,884,800	14,715,000,000	18,811,800,000
Tot.	95,500,352,230	89,541,980,950	103,143,800,200	103,742,797,600	117,054,416,800	107,151,020,000	119,509,250,000
OP	17,376,023,240	11,659,054,330	25,784,749,650	29,315,168,550	31,028,352,800	17,508,140,000	27,779,250,000

Source: See table A 7.7. Price data from *Quattroruote,* Monthly. Dealers margins have been obtained by ANFIA (Italian Association of Manufactures and Traders).

Primary Sources

Archives

Archivio Storico Fiat, 'Relazioni e Bilanci a Stampa' (Torino sede centrale), 1900-2002; Balance Sheet (Turin Main Archive), 1900-2002.

Archivio Storico Fiat, 'Fondo Crescimone, Sezione Servizi Di Produzione' (Torino, sede Mirafiori) corda 55/7; 'Crscimone File' Production Services Department' (Turin, Mirafiori Archive, location 55/7.

Archivio Storico Fiat, 'Libro dei numeri di matricola delle vetture prodotte' (Torino, sede centrale), 1968-1987; 'Fiat Production File' (Turin, Mirafiori Archive), 1968-1987.

Archivio Storico Fiat, 'Fondo Sepin' (Torino, sede centrale), 1960-77, 5/VIII/1/A; 'Employment File' (Turin, Main Archive), 1960-77, location 5/VIII/1/A.

Archivio Storico Fiat, 'Verbali dei Consigli di Amministrazone, 1900-1966' (Torino, sede centrale) Libri 1-37; 'Unpublished Administration Board Meeting Verbatim Minutes' (Turin, Main Archive), 1900-1966, Books 1-37.

Archivio Storico Fiat , 'Fondo Fiat Capogruppo, Segreteria General Dottor Gioia' (Torino, Sede di Corso Ferrucci), fila XXIII/ 98/6; 'Core Companies File, Fiat General Director File' (Turin, Corso Ferrucci Archive), row XXIII, location 98/6).

Archivio Storico Fiat, 'Direzione Studi Economici, Fondo Pedrana' (Torino, sede centrale), 1/VIII/5/E; 'Pedraana File, Economic Analysis Department' (Turin, Main Archive), location 1/VIII/5/E.

Archivio Storico Fiat. 'Il Giornale dei Capi' pubblicazione interna, (Torino sede centrale), 1950-1980; 'Il Giornale dei Capi' internal company magazine (Turin, Main Archive), 1950-1980.

Archivio Storico Fiat. 'Fiat Quadri',(Torino sede centrale), 1950-1980; 'Fiat Quadri' internal company magazine (Turin, Main Archive), 1950-1980.

Archivio Storico Fiat. 'Quattroruote, ' (Torino sede centrale), 1950-2002; 'Quattorruote car magazine collection' (Turin, Main Archive), 1950-2002.

Interviews

Mr Antoinio Malandri, Chief Engineer, Department of New Technology Development, Fiat Auto. Mr Francesco Scimone, Department of New Technology Development, Fiat Auto. Interview with the author, 18-03-1999. The two managers have provided all the data and information concerning the Robogate and the Fiat production setting, including cycle time and optimal utilisation rates.

Secondary Sources

Bibliography

E. Abe, T. Gourvish (eds), *Japanese Success? British Failure?* (Oxford, 1997).

W.J. Abernathy (ed.), *The Productivity Dilemma: Roadblock to Innovation in the Automobile Industry* (Baltimore, 1978).

W.J. Abernathy, K.B. Clark, A.M. Kantrow, *Industrial Renaissance: Producing a Competitive Future for America* (New York, 1983).

A. Altshuler (ed.), *The Future of the Automobile: The Report of MIT's International Automobile Program* (1984).

F. Amatori, 'Gli uomini del Professore. Strategie, organizzazione, management alla Fiat fra anni Venti e anni Sessanta', in C. Annibaldi and G. Berta (eds), *Grande impresa e sviluppo italiano. Studi per i cento anni della Fiat* (Bologna, 1999), pp. 257-343.

A. Amin (ed.), *Post-Fordism: a Reader* (Oxford, 1995).

ANFIA, *L'automobile in cifre* (Torino1996).

C. Annibaldi, G. Berta (eds), *Grande impresa e sviluppo italiano. Studi per i cento anni della Fiat* (Bologna, 1999).

C. Antonelli, 'Cambiamento tecnologico localizzato e crescita. Il caso della Fiat nelgli anni 1900-1970', in C. Annibaldi and G. Berta (eds), *Grande impresa e sviluppo italiano. Studi per i cento anni della Fiat* (Bologna, 1999), pp. 339-380.

R. Argenzano, D. Veo (eds), *Strategie Industriali e Prospettive di Sviluppo nel Settore Industriale* (Pavia, 1985).

Archivio Storico Fiat (ed.), *Fiat. Le fasi della crescita* (Torino, 1996).

C. W. F. Baden-Fuller (ed.), *Managing Excess Capacity* (Oxford, 1990).

P. Bairati, *Vittorio Valletta* (Torino, 1983).

G. Bamber, 'Technological Change and Unions', in R. Hyman, W. Streek, *New Technology and Industrial Relations* (Oxford, 1988), pp. 204-219.

F. Barca (ed.), *Storia del capitalismo italiano* (Roma, 1997).

F. Barca et al.' La trasformazione societaria di Fiat, Pirelli e Falck dal 1947 ad oggi' in F. Barca (ed.), *Storia del capitalismo italiano* (Roma, 1997), pp.155-185.

T. Barker, 'International Trade and Economic Growth: An Alternative to the Neoclassical Approach', *Cambridge Journal of Economics*, 1977/1 (1977), pp. 153-172.

E. Bartezzaghi, F Turco, 'Flessibilità ed Efficienza nel Manufacturing', *L'Impresa*, (July, 1989), pp. 60-67.

C. Berggren, *The Volvo Experience: Alternative to Lean Production in the Swedish Auto Industry* (New York, 1993).

S. Bergen and M. Piore (eds), *Dualism and Discontinuity in Industrial Society* (Cambridge, 1980).

A. Becchi Collidà, S. Negrelli, *La transizione nell'industria e nelle relazioni industriali: l'auto ed il caso Fiat* (Milano, 1986).

G. Berta, *Conflitto industriale e struttura d'impresa alla Fiat 1919 – 1979* (Bologna, 1998).

G. Berta, *Mirafiori* (Bologna, 1998).

K. Bhaskar, *The Future of the World Motor Industry* (1980).

R. A. Borgelman, M.A. Madique, *Strategic Management of Technology and Innovation* (Homewood, 1988).

P. Bianchi, G. Volpato, 'Flexibility as the Response to Excess Capacity: The Case of the Automobile Industry', in Baden-Fuller (ed.) *Managing Excess Capacity* (Oxford, 1990), pp. 215-246.

D. Bigazzi, 'Mirafiori', in J. Zetlein, and G. Herrigel (eds), *Americanisation and Its Limits. Reworking US Technology and Management in the Post-War Europe and Japan* (Oxford, 2000), pp.163-211.

D. Bigazzi, 'Struture della produzione: il Lingotto, L'America, L'Europa', in C. Olmo (ed.) *Il Lingotto 1915-1939. L'archittettura, l'immagine, il lavoro* (Torino, 1994), pp. 281-336.

D. Bigazzi, 'Management and Labour in Italy, 1906-1945', in S. Tolliday and J. Zeitlin (eds), *Between Fordism and Flexibility* (Cambridge, 1992), pp. 76-96.

G. T. Bloomfield, *The World Automotive Industry* (Newton Abbott, 1978).

G. Bonazzi, *Il Tubo di Cristallo* (Bologna, 1994).

G. Bonazzi, *Sociologia Della Fiat* (Bologna, 2000).

G. Bos, *The Demand for Private Cars* (Rotterdam, 1970).

S. E. Boyle, T. Hogarty, 'Pricing Behaviour in the American Automobile Industry, 1957-1971', *Journal of Industrial Economics,* 1975/2 (December, 1975), pp. 81-95.

R. Boyer, J. P. Duran, *After Fordism* (Basingstoke, 1997).

R. Boyer, E. Charon, U. Jürgens, S. Tolliday (eds), *Between Imitation and Innovation, The transfer and Hybridisation of Productive Models in the International Automobile Industry* (Oxford, 1999).

R. Boyer, E. Charon, U. Jürgens, S. Tolliday, 'Transplant, Hybridisation and Globalisation: What Lesson for the future?', in R. Boyer, E. Charon, U. Jürgens, S. Tolliday (eds), *Between Imitation and Innovation, The transfer and Hybridisation of Productive Models in the International Automobile Industry* (Oxford, 1999), pp. 374-380.

S. Bowden, P. Turner, ' Uncertainty and the Competitive Decline of the British Motor Industry, 1945-1975', *New Political Economy,* 3/1 (1998), pp.103-120.

S. Bowden, J. Maltby, 'Under-Performance, Short-Termism and Corporate Governance: The City and the British Motor Company, 1952-1967' *Financial History Review,* 41/3, (1998), pp. 21-41.

S. Broadberry, H. De Jong, 'Technology and Productivity in Historical Perspective', *European Review of Economic History,* 4, 2, August (2000), pp.115-120.

P. Buran and R. Lanzetti (eds), *Dossier auto. L'industria automobilistica italiana verso le nuove sfide* (Torino, 1989).

J. Button, *Car War. How General Motors Europe Built up the Car of the Future* (1991).

A. Camuffo, G. Volpato, 'Dynamic Capabilities and Manufacturing Automation: Organisational Learning in the Italian Automobile Industry', *Industrial and Corporate Change,* 3, (1996), pp. 813-838.

A. Camuffo, G. Volpato, 'The Labour Relation Heritage and Lean Manufacturing at Fiat', *The International Journal of Human Relations Management,* 6/4 (1995), pp. 795-824.

C. Carr, C. Tompkins, B. Bayliss, *Strategic Investment Decisions: A Comparison of the UK and German Practice in the Motor Components Industry* (Avebury, 1994).

O. Castelluccio, *La politica economica italiana, dal 1946 al 1970* (Torino, 1973).

V. Castronovo, *Fiat 1899 - 1999: cento anni di storia italiana* (Milano, 1999).

V. Castronovo, *Storia economica d'Italia* (Milano, 1999).

V. Castronovo, *L'industria italiana dall'ottocento ad oggi* (Milano, 1980).

V. Castronovo, *Giovanni Agnelli* (Torino, 1977).

CGIL (ed.) *Lavoro, condizioni di lavoro, qualità di vita e di lavoro in una grande fabbrica capitalista. Rapporto conclusivo della conferenza su Fiat Auto* (Torino, 1985).

A D. Chandler, F. Amatori, T. Hikino (eds), *Big Business and the Wealth of the nation* (Cambridge, 1997).

A. D. Chandler, *Scale and Scope. The Dynamics of Industrial Capitalism* (Cambridge, Massachusetts, 1990).

A D. Chandler, and H. Daems (eds), *Managerial Hierarchies: Comparative Perspectives on the Rise of the Modern Industrial Enterprise* (Cambridge, Massachusetts, 1980).

A. D. Chandler, *Strategy and Structure. Chapters in the History of the American Industrial Enterprise* (Cambridge, Massachusetts, 1962).

M. J. Chandra, C. M. Armonosky, 'Analytical Techniques for Justification of Manufacturing Systems', in: H. R. Parsei, A. Mital (eds), *Economics of Advanced Manufacturing Systems* (1992), pp. 113-126.

R. Church, *The Rise and Decline of the British Motor Industry* (Cambridge, 1995).

M. Cimoli, I Musu (eds) *Cambiamento strutturale ed asimmetrie nell'economia italiana* (Milano, 1990).

Commissione Operaia di Lotta Continua, *La Fiat come' è: la ristrutturazione davanti all'autonomia operaia* (Milano, 1975).

V. Comito, *La Fiat tra crisi e ristrutturazione* (Roma, 1982).

G. Contini, 'The Rise and Fall of Shop-floor Bargaining at Fiat 1945-1980', in Tolliday and Zeitlin (eds.), *Between Fordism and Flexibility* (Cambridge, 1992), pp. 144-167.

B. Coriat, *L'Atelier et le Robot: Essai sur le Fordism et la Produsion de Masse a l'Age de l' Eletronique* (Paris, 1990).

M. A Cusumano, *The Japanese Automobile Industry. Technology and Management at Nissan and Toyota* (Cambridge, Massachusetts, 1985).

A. Dal Monte, A. Gianola, *Il mezzogiorno nell' economia italiana* (Bologna), 1978.

L. De. Rosa, *Lo sviluppo economico dell'Italia dal dopoguerra ad oggi* (Roma, 1997).

P. David, 'Clio and the Economics of QWERTY' in U. Witt (ed.), *Evolutionary Economics* (Aldershot, 1993).

A. Dina (ed.), *Modello Robot* (Roma, 1984).

K. Dohse, U. Jurgens, T. Malsh, *From Fordism to Toyotism? The organisation of the Labour Process in the Japanese Automobile Industry*, in *Politics and Society*, 14/2 (1985), pp. 115-146.

A. Enrietti, G. Fornenego, *Il Gruppo Fiat. Dall'inizio degli anni Ottanta alle prospettive del mercato unificato del 92* (Roma, 1989).

Fiat, Dipartimento Personale ed Organizzazione 'Il Robogate', working paper (1984).

Fiat, Ufficio Stampa (ed.), *La curva di produzione ed il suo connubio con l' elettronoica* (Torino, 1977).

Federmeccanica, *Industria metalmeccanica: inovazone e crescita* (Milano, 1978).

J. Foreman–Peck, S. Bowden, A. McKinlay, *The British Motor Industry* (Manchester, 1995).

G. Fornenego, E. Rulliani, *L'industria dell'auto e dei componeneti: integrzione ed internazionalizzazione produttiva* (Milano, 1982).

C. Freeman, *The Economics of Hope. Essays on Technical Change, Economic Growth and Environment* (1992).

M. Freyssenet, A. Mair, K. Shimizu, G. Volpato (eds), *One Best Way? Trajectories and Industrial Models of the World's Automobile Producers* (Oxford, 1998).

M. A. Fuss, L. Waverman, *Cost and Productivity in Automobile Production. The Challenge of Japanese Efficiency* (Cambridge, 1992).

P. Gennaro, G. Scifo, *Parabole di imprenditori ed imprese in cinquant'anni di sviluppo italiano (*Milano, 1997).

D. Giacosa, *Progetti alla Fiat prima del computer* (Milano, 1979).

M. A. Golden, *A Rational Choice Analysis of Union Militancy With Application to the Cases of British Coal and Fiat*, Western Societies Program, Occasional Paper n.26, Centre of International Studies, Cornell University (Ithaca, 1990).

S. Gomulka, *The Theory of Technological Change and Economic Growth* (1990).

Z. Griliches, *Price Index and Quality Change*, (Cambridge, Massachusetts, 1971).

G. Gualerni, *Econoica aperta. Un approccio storico all'economia e politica industriale in Italia: 1860-1972* (Torino, 1991).

G. Guidi, A. Bronzino, L. Germanetto, *Fiat: struttura aziendale ed organizzazione dello sfruttamento* (Milano, 1974).

B. Harrison, *Lean and Mean: The Changing Landscape of Corporate Power* (New York, 1994).

D. A. Hensher, N. C. Smith, *Dimension of the Automobile Demand,* (Amsterdam, 1992).

P. Hirst, J, Zeitlin, 'Flexible Specialisation Versus Post-Fordism: Theory, Evidence, and Policy Implication', *Economy and Society*, 20/1 (1991), pp 70-115.

J. A. Hunker, *Structural Change in the U.S. Automobile Industry* (Lexington, Massachusetts, 1983).

K. Hoffman, R Kaplinsky, *Driving Force. The Global Restructuring of Technology, Labour and Investment In the Automobile and Components Industry* (1988).

C. Horngren, A. Bhimany, G. Foster, S. Datar, *Management and Cost Accounting*, (1999)

R. Hyman, W. Streek, *New Technology and Industrial Relations* (Oxford, 1988).

R. S. Kaplan, *Measures for Manufacturing Excellence* (Boston, 1990).

B. Jessop, 'Fordism 'and post-Fordism: a Critical Reformulation' in M. Storper, A. J. Scott, *Pathways to Industrialization and Regional Development* (1992), pp. 46-69.

D. T Jones, S. J. Paris, 'Plant Size and Productivity in the Motor Industry: Some International Comparisons', *Oxford Bulletin of Economics and Statistics*, 40/2 (1977), pp. 123 –146.

U. Jürgens, T.Malsh, K. Dohse, *Breaking from Taylorism. Changing Forms of Work in the Automobile Industry* (Cambridge, 1993).

M. Kenny, R. Florida, 'Beyond Mass Production: Production and Labour Process in Japan', *Politics and Society*, 16/1 (1988), pp. 125-158.

M. Kenny, R. Florida, *Beyond Mass Production: The Japanese System and its Transfer to the US* (Oxford, 1993).

V. E. Lambson, J. D. Richardson, *Empirical Evidence for Collusion in the U.S. Auto Market?* (Cambridge, Massachusetts, 1992).

J. Laux, *The European Automobile Industry,* (New York, 1992).

W. Lazonick, M. O'Sullivan, 'Organisation, Finance and International Competition' *Industrial and Corporate Change*, 5/1, (1996), pp. 1-49.

G. Lerner, *Operai: viaggio all'interno della Fiat: la vita, le case, le fabbriche di una Classe che non c'è* (Milano, 1988).

W. Lewchuk, *American Technology and The British Vehicle Industry* (Cambridge, 1987).

Ludvigsen Associated Limited, *The Cost of non Europe: The Benefit of the EC 92 in the Car Sector* Office for Official Publications of the European Communities, (Brouxelles, 1988).

S. Linder, *An essay on Trade and Transformation* (New York, 1961).

R. Loke, S. Negelli, 'Il caso Fiat Auto', in M. Regini and C. Sable (eds), *Strategie di riaggiustamento industriale* (Bologna, 1989), pp. 61-94.

Magnusson and J. Ottoson (eds), *Evolutionary Economics and Path Dependence* (1997).

F. Mana, T. Valvo, *Fiat Auto anni 80. Organizzazione, professionalita' e salario* (Milano, 1985).

S. Mariotti, L. Treves, 'Grande impresa e Mezzogiorno: la presenza della Fiat', in Annibaldi and Berta (eds) *Grande impresa e sviluppo italiano* (Bologna,1999), pp. 299-239.

E. Mattina, *Fiat e Sindacati negli anni 80* (Milano, 1981).

G. Maxcy, A. Silberston, *The Motor Industry* (1959).

G. Maxcy, *The Multinational Motor Industry* (1981).

G. P. Maxton, J. Wormland, *Driving Over a Cliff?* (1994).

A. M. McLaughlin, W. A. Maloney, *The European Automobile Industry Multi-level Governance, Policy and Politics* (1999).

R. Merli, 'Il Robogate nella produzione della Fiat Uno', in Dina (ed.), *Modello Robot* (Roma, 1984), pp.129-140.

H. Mintzberg, *Mintzberg on Management* (1989).

H. Mintzberg, *Structures in Five. Designing Effective Organisation* (1983).

M. R. Moccia (ed.), *Bibliografiat* (Torino, 1998).

F. Modigliani, 'New Developments on Oligopoly Front', *Journal of Political Economy* 3 (June, 1958), pp. 215-232.

M. Mogridge, *The Car Market* (1983).

D.B. Montgomery, 'First Mover Advantages', *Strategic Management Journal*, V. 9, Special Issue (1988), pp. 41-58.

M. Moroni, *Production Process and Technical Change* (Cambridge, 1992).

A. Mosconi, E. Rulliani, *Il gruppo nello sviluppo dell'impresa industriale. Con un analisi del caso Fiat* (Milano, 1978).

A. Mosconi, D. Valeo, *Crisi e ristrutturazine del settore automobilistico* (Bologna, 1982).

A. Mosconi, 'Fiat 1968 -1977: gli anni del cambiamento', in A. Mosconi, E. Rulliani, *Il gruppo nello sviluppo dell'impresa industriale. Con un analisi del caso Fia*t (Milano, 1978), pp. 24-75.

S. Musso, 'Production Methods and Industrial Relations at Fiat (1930-1990)', in H. Shiomi, K. Wada (eds), *Fordism Transformed* (Oxford, 1995), pp. 243-268.

S. Musso, 'Le relazioni industriali alla Fiat', in Annibaldi and Berta (eds), *Grande impresa e sviluppo italiano* (Bologna, 1999), pp 165 – 231.

OEEC, *Information computer communications policy. Trends in the information economy Organisation for Economic Co-operation and Development* (Paris, 1986).

R. Nelson, S. Winter, G. Dosi, *The nature and dynamics of organizational capabilities* (Oxford, 2000).

R. Nelson, *The Sources of Economic Growth* (1996).

R. Nelson (ed.), *National Innovation Systems* (Oxford, 1993).

R. Nelson, 'Why Do Firms Differ and Why Does It Matter?', *Strategic Management Journal*, 12, Winter Special Issue (1991), pp. 61-74.

R. Nelson, *Understanding Technical Change as an Evolutionary Process* (Amsterdam, 1987).

R. Nelson, S. Winter, *An Evolutionary Theory of Economic Change* (Cambridge, Massachusetts, 1982).

S. Ori, *Storie di una dinastia. Gli Agnelli e la Fiat* (Roma, 1996).

M. O'Sullivan, 'The Innovative Enterprise and Corporate Governance', *Cambridge Journal of Economics*, 24/4 (2000), pp. 393-416.

G. Owen, *From Empire to Europe: The Decline and Revival of the British Industry Since the Second World War* (1999).

G. Owen, 'From Mass Manufacturer to Niche Player: Product and Marketing Strategy at British Leyland/Rover, from 1968 to 1995', in E. Abe, T. Gourvish (eds), *Japanese Success? British Failure?* (Oxford, 1997), pp. 214-236.

C.S. Park, Y.K. Son, 'An Economic Evaluation Model for Advanced Manufacturing Systems', *Engineering Economics*, 34 (1990), pp. 1-26.

A. Pilkington, *Transforming Rover: Renewal Against the Odds, 1981-1994* (Bristol, 1996).

G. Piluso, 'L'evoluzione dell'azionariato Fiat: assetti proprietari, struttura di gruppo e alleanze finanziarie', in Annibaldi and Berta (eds) *Grande impresa e sviluppo italiano* (Bologna, 1999), pp. 185-256.

M. Piore and C.F. Sabel, *The Second Industrial Divide* (New York, 1984).

M. Porter, *The Competitive Advantage of Nations* (1998).

M. Regini and C. Sable (eds), *Strategie di riaggiustamento industriale* (Bologna, 1989).

A. J. M. Roobeek, 'The Crisis in Fordism and the Rise of a New Technological Paradigm', *Futures*, 19/2 (1987), pp 129-154.

C. Sabel, J. Zeitlin, 'Historical Alternative to Mass Production: Politics, Market and Technology in Nineteenth- Century Industrialization', *Past and Present*, 108 (1985), pp. 133-76.

C. Sabel, *Work and Politics*, (Cambridge, 1982).

G. Sapelli, 'Gli organizzatori della produczione tra struttura d'impresa e modelli culturali', in *Storia d'Italia. Annali. Vol IV: Intellettuali e potere* (Torino, 1981), pp. 591-696.

G. Sapelli, *Organizzazione, lavoro e innovazione industriale nell'Italia tra le due guerre* (Torino, 1978).

Servizio Commissioni Parlamentari della Camera dei Deputati, *Situazine e prospettive dell'industria automobilistica Italiana*, (Roma, 1971).

K. Shimokawa, ' From the Fordist System to the Just-in–Time Production System. A Historical Study of International Shifts in Automobile Production Systems, Their Connection and Their Transformation', *Japanese Yearbook on Business History*, 10 (1993), pp. 83-85.

H. Shiomi, K. Wada (eds), *Fordism Transformed* (Oxford, 1995).

P. Sylos-Labini, *Oligopolio e progresso tecnico* (Milano, 1957).

F. Silva, M. Grillo, M. Prati, *Il mercato italiano del'auto nel contesto europeo* (Milano, 1982).

F. Silva, P. Bianchi, 'Robots, Employment and Industrial Relations in the Italian Automobile Industry', in S. Watanabe (ed.), *Microeletronics, Automation and Employment in the Automobile Industry* (Chichester, 1987), pp. 133-203.

M. J. Smitka, *Competitive Ties. Subcontracting in the Japanese Automotive Industry* (New York, 1991).

M. Storper, A.J. Scott, *Pathways to Industrialization and Regional Development* (1992).

I. Stouder-Nugez, *Ford and the Global Strategies of Multinationals. The North American Auto Industry* (2002).

S. Tolliday, J. Zeitlin (eds), *Shop Floor Bargaining and the State: Historical and Comparative Perspective* (Cambridge, 1985).

S. Tolliday, J. Zeitlin (eds), *Between Fordism and Flexibility. The Automobile Industry and its Workers* (Cambridge, 1987).

S. Tolliday, J. Zeitlin (eds), *Power to Manage? Employers and Industrial Relations in Historical Comparative Perspective* (1991).

S. Tolliday (ed.), *The Rise and Fall of Mass Production*, Vol. 1 (Northampton, 1998).

S. Tolliday (ed.), *The Rise and Fall of Mass Production*, Vol. 2 (Northampton, 1998).

K. Train, *Quantitative Choice Analysis. Theory, Econometrics and Applications to Automobile Industry* (Cambridge, Massachusetts, 1986).

G, Turner, *The Car Makers* (1963).

D. Valeo, *La strategia Fiat nel settore siderurgico* (Torino, 1983).

G. Volpato, *Il caso Fiat. Una strategia di riorganizzazione e di rilancio* (Torino, 1996).

G. Volpato, 'The Automobile Industry in Transition: Product, Market Changes and Firm Strategies in the 1970s and 1980s', in Tolliday and Zeitlin (eds), *Between Fordism and Flexibility* (Cambridge, 1987), pp.193-223.

G. Volpato, *L'industria automobilistica internazionale* (Padova, 1983).

V. Zamagni, *Dalla periferia al centro* (Bologna, 1990).

J. Zeitlin, G. Herrigel (eds), *Americanisation and its Limits: Reworking US Technology and Management in Post-War Europe and Japan* (Oxford, 2000).

S, Watanabe (ed.), *Microelectronics, Automation and Employment in the Automobile Industry* (Chichester, 1987).

P. Wells, M. Rawlinson, *The New European Automobile Industry* (1994).

R. Whipp and P. Clark, *Innovation and the Auto Industry: Product, Process and Work Organisation* (1986).

T. R. Whisler, *The British Motor Industry, 1945-1994. A Case Study in Industrial Decline* (Oxford, 1999).

K. Williams, C. Haslam, S. Johal, *Cars. Analysis, History, Cases* (Oxford, 1994).

K. Williams, C. Haslam, J Williams, ' Ford versus "Fordism": The Beginning of Mass Production?' *Work, Employment and Strategy*, 6/4 (1992), pp. 517-555.

J. P. Womak, D. T. Jones, D. Ross, *The Machine That Changed the World* (New York, 1990).

O. Williamson, S. G. Winter (eds), *The Nature of the Firm: Origins, Evolution and Development* (Oxford, 1991).