The Dundee Jute Industry : An Economic Organisation Study

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Association of Jute Spinners and Manufacturers
Sir Herbert Bonar
Caird (Dundee) Ltd.
Co-operative Wholesale Society (Taybank Jute Works)
Don Brothers Buist Ltd.
Wm. Halley & Sons Ltd.
Hardie & Smith Ltd.
A. & S. Henry Ltd.
Low & Bonar Group Ltd.
Malcolm, Ogilvie & Co. Ltd.
Mr. Lewis Robertson
Scott & Fyfe Ltd.
Scott & Robertson Ltd.
H. & A. Scott Ltd.
The 'Shell' Transport and Trading Co. Ltd.
Sidlaw Industries Ltd.
Dr. H.P. Stout
Thomas Thomson Ltd.
Thomson, Shepherd & Co. Ltd.
Union of Jute, Flax and Kindred Textile Operatives
Victoria Spinning Co. Ltd.

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Introduction

The aim of this thesis is to report on the conducting of an economic organisation study of one particular economic market - referred to broadly and for historical reasons as the Dundee jute industry. The study has therefore been carried out at the partial microeconomic level, and has been conducted within the framework referred to in industrial economics as structure, conduct and performance analysis.[1] The originality claimed by the candidate thus relates not to the design of a particular framework of analysis within which to conduct an individual industry study,[2] but to the carrying out of the study itself and in particular to the use of some statistical data in attempting to arrive at conclusions on various aspects of economic performance. The analysis and conclusions in the study are based not only upon the assembled data (some of them hitherto unpublished, others being used in a novel manner) but also upon a large number of interviews held with senior management in the industry.

So far as the candidate is aware, after a thorough literature search, no other study of this aspect of the jute industry has been carried out. Earlier or contemporary work by Leveson and by McDowall and Draper has been concerned either with management aspects of the industry, or with using the jute industry as an example of a separate individual economic phenomenon.[3]

The topic of this study is the Dundee jute industry. The

epithet Dundee serves to stress not only the high degree of geographical concentration of the U.K. jute industry in that city (some 90% of spinning and weaving in the 1960's), but also the vital importance of the jute industry to Dundee: it accounted directly for some 50% of the city's employment within living memory.[4] Unlike many industry studies this is one of decline rather than of expansion - indeed of dramatic decline in the traditional work of jute spinning and weaving. But it is also an account of survival, in that it contains an analysis of the diversification of the existing "jute" firms both into man-made fibres (predominantly polypropylene) and into other market areas related to the original industry. References in the title and elsewhere in the thesis to the Dundee jute industry thus cover both the traditional market for jute and the new industrial textiles etc.

The structure, conduct and performance approach accounts for the framework of the thesis. Chapter I comprises a historical introduction to the jute industry, and outlines the condition of the market in 1945. Structure refers to the main environmental features of an industry, and Chapter II contains an analysis of the major changes in this market over the period 1960-1977, and in particular over the last decade of the period covered by the study. The aim of this material is to provide an account and an analysis of the major structural changes in the industry over the period with a view to arriving at conclusions both as to the forces which caused the changes and also the impact which the changes had upon competition, efficiency and resource allocation in this particular market.

Chapter III, under the heading of Diversification, examines in

detail the conduct or behaviour of firms in the market: what Bain identifies broadly as "patterns of behaviour that enterprises follow in adapting or adjusting to the markets in which they sell (or buy)".[5] Since diversification undoubtedly embraces the major company strategy in this process of adaptation or adjustment in this particular market, the major emphasis in analysing market conduct is placed upon it, and other features such as product improvement and technological adjustment are subsumed within it.

Market performance is measured and analysed in Chapter IV under a number of headings, with reliance being placed very largely upon a quantitative approach. The purpose of the analytical section of the chapter is to offer an economic interpretation of the purely statistical findings, and to compare these results with the general body of similar empirical studies in industrial economics.

The final chapter offers conclusions on efficiency and resource allocation across the industry, drawing upon the preceding three chapters in particular.

One of the major problems involved in carrying out empirical research in industrial economics is the degree of economic, or more particularly econometric, sophistication which is held to be appropriate; and with this is inevitably linked the issue of a case-study vis-à-vis large-scale statistical approach to any issue. It is in some way a question of balancing the quest for detail and generality - for "realism" and the drawing of formal conclusions. More particularly it could be said to be a question of the relative merits of

these two desiderata. This issue has been responsible for a significant division of approaches to broadly similar topics in industrial economics. On the one hand there are those who favour a more detailed case-by-case approach to arriving at conclusions on industry behaviour. On the other hand there are those who would point out that the general validity of conclusions must lie in the use of cross-sectional and time-series analysis of large volumes of statistical data, and that it is not necessary to have a detailed regard to the highly specific "facts" of each individual case. The problem of choosing between these two approaches was put clearly by Alfred Marshall.

> "If we include in our account merely all the conditions of real life, the problem is too heavy to be handled; if we select a few, then long-drawn-out and subtle reasonings with regard to them become scientific toys rather than engines for practical work."[6]

The relative merit of the large-scale cross-section or time-series study would appear to lie in the greater ability to draw general conclusions based upon statistical analysis of a large number of observations. Such conclusions may be of more value simply because they derive from an overall analysis of an economic issue, or because the large numbers involved allow one more "degrees of freedom" in statistical analysis. The value of the case-by-case approach lies in a greater acquaintance with the facts of a particular industry, a greater appreciation of the quality (or otherwise) of the statistics, and a more secure base upon which to arrive at meaningful economic conclusions - albeit about a smaller part of the economic world involved.[7]

One would like to think that time would eventually bring about a union of the two approaches, or that each would be regarded as being valid in its own right or for its own particular purpose. This does not, however, appear to be the case at the present time. One cannot, moreover, rule out the influence of personal preference on the part of individual authors. Some writers simply prefer to work at the level which incorporates a degree of institutional detail - feeling that "statistical analysis does not always catch the spirit and the bustle of industry when it is taking its pulse and temperature".[8] Others appear to have reservations about the value of the individual-industry study "whose mountain of descriptive material is far too intransigent to be formed and informed by a theoretical framework".[9] Having had experience, as a co-author of published studies, of two very different approaches to the analysis of the economic impact of U.K. competition-policy legislation,[10] the candidate has attempted in this thesis to combine the advantages of each broad approach while accepting the inherent characteristics of case-study work as such. The thesis is constructed at a point along the spectrum of formal analysis and description which will accommodate a sound economic framework, statistical analysis and some institutional detail. It is "historiate", to use the term adopted by Phelps Brown,[11] but operates within the structure, conduct and performance framework of analysis accepted in industrial economics. This analysis is based upon examining the principal elements of market structure (concentration etc.), market behaviour and economic performance, and involves establishing relationships between these areas.[12] Such analysis enables one to emphasise the most appropriate historical details, to pay attention to the most relevant current characteristics of a market, and to draw more general con-

clusions for further analysis than is often possible from a purely historical account of an industry's development or decline. At the same time such a mode of analysis allows one to explore further than would be possible within the confines of formal microeconomic analysis. It is within this industrial economics framework that the following analysis has been carried out, and on the basis of which the final conclusions are offered.

Thus the purpose of this thesis is not simply to set out to describe what happened to the firms which at one time constituted the Dundee jute industry over a particular period of adjustment to new markets and technology. This in itself is of course important; and much time has had to be spent operating in what have been factually largely uncharted waters. The thesis, however, sets out to do more than this. It seeks in particular to do three things. First, to offer an explanation for the events whose course is traced. Second, to test the events of the industry's recent past against various hypotheses founded upon the theory of microeconomics or industrial economics. Third, to assess the resource allocative implications of the findings. Thus in respect of changes in markets and industry structure, an explanation is sought for the changes in the pattern of concentration in the industry, the type of price leadership which at one stage emerged is compared with that which an understanding of economic theory would lead one to expect, and an assessment is made of the impact of such changes and behaviour upon the efficiency of the industry over the period. As regards diversification, an explanation for the poor returns to this corporate strategy is attempted, certain hypotheses regarding diversification, profitability, size and growth are tested

statistically, and again some attempt is made to assess the impact of the strategy upon resource allocation in the industry. In particular in Chapter IV, dealing with market performance across a number of dimensions, a range of statistical tests is carried out on variables such as profitability, growth, productivity, capital investment, and research and development expenditure. The purpose of this is not only to describe, but to compare the behaviour of our group of firms with findings on these phenomena relating to manufacturing industry as a whole, and to offer explanations for any observed differences. The hypothesis here is that our group of firms would be expected to conform to behaviour observed in much larger samples in cross-sectional and time-series analysis. The strands of thought brought out in respect of individual aspects in Chapters II, III and IV are all drawn together in Chapter V in a final attempt to explain the happenings in this industry over the period studied, to compare the findings of our industry with those relating to the U.K. manufacturing sector as a whole, and to offer conclusions on the degree of economic efficiency within the industry.

References

1. In the candidate's view the best reference in this field is still J.S. Bain, Industrial Organization (New York: Wiley, 2nd ed., 1967).

2. See, for example, W.P.J. Maunder, The Bread Industry in the United Kingdom (Loughborough: The University, 1969).

3. See J.H. Leveson, Industrial Organisation of the Jute Industry (Dundee: College of Technology, 1973); and S. McDowall & P. Draper, Trade Adjustment and the British Jute Industry (Glasgow: Fraser of Allander Institute, 1978).

4. For example, data in the Toothill Report show that throughout the 1950's, when total employment in the industry was fairly stable, Scotland accounted for 97% of total jute industry employment in Britain. More recently "location quotients" for Scotland based upon 1968 employment data indicate a figure of 11.2 for Jute - the highest figure, followed by Other Drink Industries, and Explosives and Fireworks at 4.4. The location quotient for a manufacturing industry is the percentage of the individual industry employment in Scotland divided by Scotland's percentage share of total U.K. manufacturing industry. See Inquiry into the Scottish Economy 1960-61 (Edinburgh: Scottish Council (Development & Industry), 1961) Appendix 2; and T.L. Johnston, N.K. Buxton & D. Mair, Structure and Growth of the Scottish Economy (Glasgow: Collins, 1971) pp.78-9 and 98.

   For the year 1911 the proportion of the working population of the city of Dundee accounted for by "textile" employment (overwhelmingly jute) was 48.2%. See A.M. Carstairs, "The Nature and Diversification of Employment in Dundee in the Twentieth Century" in S. Jones (ed.), Dundee and District (Dundee: British Association, 1968) p.320.

5. J.S. Bain, op.cit., p.9.

6. A. Marshall, Principles of Economics (London: Macmillan, 8th ed. 1920) pp.460-1.

7. In the area of the analysis of the outcome of merger activity one could contrast the case-study approach of Vice with the econometric analysis of Meeks. See A. Vice, The Strategy of Takeovers (Maidenhead: McGraw-Hill, 1971); and G. Meeks, Disappointing Marriage: A Study of the Gains from Merger (Cambridge: C.U.P., 1977).

8. T.L. Johnston et al., op.cit., p.100.

9. J. Downie, The Competitive Process (London: Duckworth, 1958) p.20.

10. See the case-study approach of D. Swann, D.P. O'Brien, W.P.J. Maunder and W.S. Howe, Competition in British Industry (London: Allen & Unwin, 1974) as compared with the econometric work of D.P. O'Brien, W.S. Howe & D.M. Wright, Competition Policy, Profitability and Growth (London: Macmillan, 1979).

11. See E.H. Phelps Brown, "The Underdevelopment of Economics", Economic Journal, 1972, Vol. LXXXII, p.9.

12. For example W.S. Howe, Industrial Economics (London: Macmillan, 1978) chapters 3 and 4.

CHAPTER I

Historical Background to 1945

A. Introduction

The purpose of this chapter is twofold. First, to offer a brief economic history of the U.K. jute industry from its origins in the 1830's until 1945. Second, to emphasise some of the most important economic characteristics of the industry in the post-World War II period so as to lay the foundation for the analysis of changing markets and industry structure over the period 1960-1977 in Chapter II. Sections B. - E. below comprise a historical introduction; while Sections F. - J. outline the important economic features of the industry at the conclusion of World War II. It should be emphasised that the function of this chapter is introductory, and that it covers the history of the industry outwith the time period which is the main concern of the study. Thus although a brief economic analysis of the industry's early years is offered, reliance has been placed largely upon secondary sources, as seems appropriate for the introductory material.

B. The Origins of the U.K. Jute Industry

Some form of historical introduction would appear to be necessary to any economic analysis of the Dundee jute industry. More than most industries it has been an economic prisoner of historical developments largely beyond its control. Thus two authors more recently refer to its development as "a catalogue of instability and frustrat-

ion", and highlight the rapid war-time expansions in the 19th century, and long-term contraction punctuated by occasional hectic prosperity within living memory.[1] As a particular example of this tendency one historian, writing of the conditions of the 1850's and 1860's, comments:

> "At the height of the boom any man who could buy or rent a tumbledown mill could make a fortune. After the boom, shrinking markets and wildly fluctuating costs produced a situation in which entrepreneurial skills could have little effect on the downward trend of the industry".[2]

To appreciate the early development of the jute industry it is necessary to know something of the economic history of cotton and linen or flax.[3] Flax spinning and weaving appears to have been in its beginning a peasant occupation. But by the end of the seventeenth century it was both a rural and urban trade, although at this stage the final product was a rather rough and heavy cloth, and finer linens were imported from the Continent. The growth of the linen industry on any scale in the eighteenth century was dependent upon imports of flax, and therefore tended to be concentrated in the north of the country (including the Clyde valley in Scotland), based upon Baltic imports. The histories of cotton and linen were closely intertwined - literally so in the case of union goods with a flax warp and cotton weft. As an example of this interrelationship, the rise in the price of cotton in the mid eighteenth century as demand went ahead of supplies gave linen manufacturers an opportunity to expand into new markets; and by the last quarter of the century the two industries appear to have been of roughly equal size.[4] However, in the closing decades of the eighteenth century increased supplies of raw cotton from

the Southern States of America, and technical innovations in the spinning and weaving of cotton, gave the latter an advantage over linen in both home and export markets. These changes resulted in cotton displacing linen manufacturing on the west coasts; and Lancashire, North-east Ireland and the Clyde valley declined as linen producing centres. It was these same changes which opened up opportunities in the linen trade for centres such as Darlington, Leeds and Dundee.

Historically the jute industry grew out of the linen or flax spinning and weaving trade. There was an established flax industry in Dundee in the late eighteenth century; and although, as mentioned above, linen was superseded by cotton in some markets with a consequent downturn in the industry in parts of the economy, the coarse linen trade of Fife, Angus (then Forfarshire) and Perthshire prospered. For example, by 1822 over 22½m. yards of linen were stamped in Forfarshire, compared with slightly less than 8m in Fifeshire, and 2½m. in Aberdeenshire.[5] The markets catered for were sail canvas, "soldiers' sarking" (i.e. coarse linen shirts for the army) and the clothing for negro slaves in America. Dundee appears to have been the focal point of this prosperity, and in the late eighteenth century rapidly became the centre of what had hitherto been a more dispersed domestic linen industry in its hinterland. What it may have lacked in water power it made up for as a thriving commercial centre. According to Peter Carmichael's autobiography, between 1815 and the early 1830's a sum of not less than £250,000 had been spent on the harbour; by 1833 the Earl Gray dock was under construction; there was a ferry across the Tay, a paddle vessel running to Perth, and a daily coach to Glasgow;

and the Dundee to Newtyle railway was the first to be opened in Scotland in 1851.[6] Dundee was well placed to receive Baltic flax; and while in 1815 (the first year for which such figures are available) Dundee imported 1,221 tons of flax (7% of the total U.K. figure), by 1836 the figure had risen to 30,653 tons - 40% of U.K. imports. Between 1816 and 1833 the population of Dundee expanded from 30,000 to 50,000; and over the period 1811-1835 30 flax spinning mills were opened. Such was the growth and increasing dominance of this area in these trades that by 1867 176 of the total of 197 flax, hemp and jute factories in Scotland were to be found in the counties of Forfar, Perth and Fife.[7] The period of the early nineteenth century was thus one of general prosperity for the traditional Dundee textile industry; and it was into this environment that jute was introduced.

C. The Rise of the Jute Trade

Warden, in his immensely detailed study of the linen trade, tells of the tentative introduction of jute into this country at the end of the eighteenth century and of its use in the manufacture of door mats, ropes etc. The expansion of this experience led to its use in a form of carpeting at Abingdon in Oxfordshire; and in the early 1830's similar experiments were carried out in Dundee.[8] The substitution of jute for flax and hemp was particularly a possibility in Dundee, as compared with other linen centres such as Leeds, because of Dundee's specialisation at the coarse end of the trade. The introduction of jute spinning appears to have been complicated at this time because only at this date was flax spinning by power being introduced, and it was anticipated that the jute fibre would present additional diffi-

culties in the application of power spinning. There was also the problem of securing the acceptance by users of goods made partly or wholly of the new, inferior jute yarn. The commencement of jute yarn production is usually dated from 1833 at the Chapelshade works of Balfour & Meldrum - on the site now occupied by Dundee College of Technology;[9] and, stimulated by the acceptance by the Dutch Government of jute in the place of flax tow in a large coffee bagging contract in 1838, the jute industry began a period of considerable expansion. Some indication of this can be gained from data relating to Dundee jute imports.

Table 1.1

Jute Imports into Dundee (Tons)

1832	182	1843	4,858	1854	16,590
1833	300	1844	5,515	1855	25,894
1834	828	1845	8,313	1856	31,031
1835	1,222	1846	9,230	1857	24,342
1836	16	1847	6,966	1858	30,086
1837	171	1848	8,905	1859	38,405
1838	1,136	1849	12,142	1860	36,965
1839	2,411	1850	14,080	1861	35,716
1840	2,745	1851	16,928	1862	38,277
1841	2,661	1852	16,983	1863	46,983
1842	2,740	1853	15,400		

Source: A.J. Warden, The Linen Trade, Ancient and Modern (London: Longmans Green, 2nd ed. 1867) pp.76 and 633.

The jute industry thus expanded in and contributed to the general prosperity of a city which was becoming a major commercial centre: a city where trade in 1851 exceeded that of any Scots town except Glasgow according to a study of the period.[10]

By the late 1850's jute had begun to overtake flax in importance

as measured by tonnage imports; and by 1863, when jute was enjoying the full benefits of the American Civil War (1861-65), the respective tonnages of flax and jute were 23,474 and 46,983.[11] This was also a period of considerable mechanisation of the industry, as traditional handloom weavers were displaced by power looms. Thus as an ancillary development, the relatively specialist nature of the spinning and weaving machinery dictated the establishment by major textile firms of their own foundries.

Wars were a major source of prosperity for this industry. The Crimean War of 1854-56 brought a demand for tents, sails and soldiers' clothing, while demand for jute and linen during the American Civil War was additionally stimulated by the non-availability of cotton from the Southern States. The earlier Crimean War had provided a further impetus to jute manufacturers as there were fears regarding flax from Russia, which supplied over 85% of Dundee's total flax imports.[12] An additional source of demand for jute goods in the 1850's was the opening up of Australia, with its large British immigrant population, increased trade in primary products and vast need for temporary canvas housing;[13] while an indication of the impact of later increases in demand may be seen in the fact that the price of some goods rose by 50% in 1863 over their 1862 prices.[14] It is from this era that some of the domestic architectural heritage of the textile industry stems. So far as trade itself was concerned:

> "The halcyon days which prevailed during the latter part of the American war, and for some time subsequent thereto, have left their mark on the district. Old mills were rebuilt and extended, and new ones erected; power-loom factories sprung up in all directions, and for a time

> builders and engineers had the entire command of the position. The result has been to transform and beautify and extend towns previously prosperous, and to vivify and invigorate others which were fast falling into decay."[15]

But the period culminating with the American Civil War was to have an impact beyond the immediate prosperity which it created; although prices do appear to have risen dramatically, with raw material cost increases lagging behind those of finished goods.[16] This was more than an era of immense new riches for the textile manufacturers: of "palatial mansions and handsome villas" referred to in the local press. Not surprisingly, given the boom market, it was at this time that backward vertical integration within the industry began. The Cox firm established its own jute presses near Calcutta in 1863; and in 1862 both Cox and Gilroy had become shipowners. This enabled these firms to avoid the direct impact of high shipping rates (insofar as these were the result of a high level of profits for shipowners rather than increased operating costs); and the beginnings of direct importation of raw jute from India rather than through London merchants as previously meant that "the price of raw jute could not be subject to the evil machinations of London speculators."[17] This period was also characterised by forward vertical integration as yarn spinners moved into the weaving and finishing trades; and in retrospect this was also seen to have been one of the greatest periods of technical advance in the industry.[18] To the extent that the mid-century wars brought about some over-expansion and collapse on the part of weaker firms, they also contributed to a trend of concentration in the market and the recognition of the advantages of size and stability. One of the benefits for the city's commerce as a whole stimulated by the

textile boom was improved harbour facilities. The Victoria Dock was opened in 1861, and the Camperdown Dock in 1864.[19]

Set against this trend of expansion in Dundee, however, was the gradual development of jute spinning and weaving in India itself. This began in 1855, and it was only the war-time demands of the mid 1850's to mid 1860's which delayed its impact upon the Dundee industry.[20] In fact the Franco-Prussian war of the early 1870's provided only another temporary military fillip to the industry which was by then beginning to feel much more strongly the impact of the Calcutta jute mills. Just how rapid these sudden expansions of the industry could be may be illustrated by the fact that although the major period of continuous growth of the jute industry had passed, between 1870 and 1874 the number of spindles increased from 94,520 to 185,419, the number of power looms more than doubled, and employment rose by almost 150%.[21] However, Alexander Monfries noted that "a considerable period of wonderful prosperity" had come to an end by 1875; and "from being a paying business the making of jute goods became a losing one and a good deal of machinery was stopped. This was caused in great measure by the erection of mills for the spinning of jute in Calcutta."[22] Calcutta goods were making serious inroads into Dundee markets in America and Australia; and the Dundee trade was finding it difficult to compensate for this in a Continental trade characterised by both the establishment of home jute industries and increased protectionist tariffs. One area of expansion for the Dundee industry, however, was the Scottish linoleum industry based at Kirkcaldy. Nairn's of Kirkcaldy, which dominated the Scottish market, was firmly established in this field by the mid 1850's. It

seems to be generally agreed, nonetheless, that the jute trade was much less profitable from the third quarter of the nineteenth century onwards; although once again military conflict (the Boer War followed by the South African War, and conflict between Russia and Japan in 1904-5) provided oases of prosperity, and there were, as was typical of the jute industry, short periods of hectic demand and high profits.[23]

D. The Early Twentieth Century

Lenman et al. paint a truly unhealthy picture of the industry in the years leading up to 1914. The Dundee industry's share of world raw jute consumption had by 1913 dropped to 13.6%; and by this stage was dwarfed by Calcutta's 53.8%, while it was almost half that of Continental Europe as a whole with 25.7%.[24] In Dundee long-lived jute barons who had made or inherited the fortunes of the 1850's and 1860's appeared unwilling to introduce much change into the industry. These manufacturers, with interests in supplies of raw jute and shipping services, and something of a monopoly of business and social standing in the city, performed the function of a barrier to new competition and new ideas in the industry. Thus in addition to the large size of the major firms in the industry, the existence of both internal and external economies of scale, vertical integration, geographic concentration, and the cyclical nature of demand inevitably constituted traditional barriers to entry to the industry. Accompanying this there is some evidence that by the early years of the 20th century the major entrepreneurs in the industry were no longer as concerned with reinvesting profits in modernising their facilities

as they had at one time been, but were instead significant contributors to the growth of Scottish-based unit trusts whose funds were invested in the United States.[25] Despite a fairly high degree of production concentration in the market,[26] the industry appears to have exemplified typical "cobweb" characteristics of vast over-expansion during the short-lived boom periods, followed by low prices and the industrial conflict of reduced wages and unemployment in the succeeding period. Much of the "profit" in the industry, Lenman points out, came in fact from judicious buying of raw jute, and manufacturing or processing costs were a small proportion of total.[27] Indeed the peak of capital investment in the jute industry appears to have occurred in the late 1860's. Thereafter, as mentioned above, Dundee merchants seem to have considered that the return on investment was greater on the other side of the Atlantic.[28]

The hostilities of 1914-18 once again produced conditions of high demand for the jute industry. By 1915 70% of the Dundee industry's output was for Government Departments: it was boasted that Dundee was producing one million sand bags per day at this time. But although World War I was a period of high, if temporary, profits for the industry, it produced certain trends which were to be of less long-term advantage to the industry as a whole.[29] War-time demand was a demand for coarse jute goods; and Dundee's production geared itself to this for the period, away from the trend of the previous decades of counteracting competition from Calcutta by moving into finer jute goods markets. This meant not only the use of existing plant in these "coarse" markets, but also an element of "technical retrogression" as possibilities for manufacturing improvements were

ignored. Also ignored were foreign markets; and this resulted in local industries being established overseas to serve purely domestic requirements. Not only were these markets protected by high tariff barriers after 1918; in some cases they appear to have exhibited a level of technology superior to that of Dundee.

Despite government restrictions on the industry by the end of World War I (exports were controlled, and there was a system of restricted allocation of raw jute to spinners by 1918), prices had risen markedly since the pre-war years, and there were fears of corresponding reductions in the post-war period. Increased competition from India was also feared. It was estimated that half of Dundee's output was in direct competition with that of Calcutta, and that the cost of production of standard Hessian cloth in 1919 was £45 in Dundee and £15 in Calcutta. Interestingly enough, in the light of the more significant 1948 Board of Trade Report, a Board of Trade working party was established in 1919 to look into the question of trade protection for the Dundee industry. Contrary to policy some 30 years later, the Report of 1919 rejected import controls and suggested that the Dundee industry should concentrate its efforts in those areas where it could compete with the Indian mills and factories. Its recommendations in this respect were couched in unequivocal terms.

> "If jute goods capable of being manufactured in India cannot be made in Dundee and marketed at prices which permit of the payment of an established minimum rate of wages to the workers employed, it appears inevitable that such trade must be lost to the United Kingdom and the industry in this country will find its level in the manufacture of goods which cannot be more economically produced in India. The

> Committee are unable to recommend artificial means to enable the United Kingdom to compete with another portion of the Empire and are of opinion that the industry should be informed as soon as possible that action in the direction of protecting the jute industry against the competition of India is impossible, and that it rests with the manufacturers engaged in the industry to take the necessary steps to economize working expenses to the uttermost and to develop the production and sale of the kind of jute manufactures which are not at present manufactured in India and which are unlikely to be produced there in future.[30]

Because of problems of sea losses of raw material, and general difficulties over supply, the industry had experienced some fluctuations of fortune throughout World War I; and although there was a temporary post-war boom in 1919-20 the remainder of the decade witnessed a resumption of the earlier problems of the industry. These centred around reduced overall demand for jute, and continued competition in many markets from the output of Calcutta mills. The Board of Trade Report of 1948 spoke of the short-lived boom after 1918 being followed by "tumbling prices and a declining demand", with unemployment in the industry by the early 1930's exceeding 50%.[31] The jute industry was not even given much protection from imported goods as India was exempted from the general round of import duties imposed in 1932 by the operation of Imperial Preference. In common with much of the remainder of British industry, rationalisation occurred in an attempt to bring productive capacity into line with reduced demand. In October 1920 a number of old established businesses were brought together to form Jute Industries.[32] A few years later, in 1924, a similar arrangement resulted in the establishment of Low & Bonar; and these two firms dominated the Dundee jute industry.[33]

Thus although there were isolated areas of prosperity in the

industry in the immediate aftermath of World War I, the slump of the late 1920's closed a large part of the industry. And despite hopes that a slimmed-down industry characterised by improved productivity and concentration upon the quality end of the market would generate higher returns, this did not materialise. In total, employment in the industry fell from 41,220 in 1924 to 27,980 in 1938: a fall of 32%. There was an even more rapid decline in female employment over this period - 39% - brought about by the use of new machinery demanding more male operatives. Another index of the industry's declining fortune was its diminished international trading performance. At the end of the nineteenth century the U.K. industry was exporting 75% of its output. This figure never reached 20% in the 1930's; and in 1937 the industry for the first time recorded an import surplus.[34]

E. Conclusions on the Early History of the Jute Industry

The Dundee jute industry, it is agreed, is one which can only be fully understood in its historical context. The city had already, by the early decades of the last century, become a centre for linen manufacture - particularly of the coarse type used for making cotton bags and other forms of packaging. The traditional flax industry progressed with mechanisation, generally high demand for the product and the operation of a linen export bounty. But the continued need to search for cheaper materials, the possibility of spinning jute on flax-spinning machinery, the growing acceptability of jute by former users of flax or hemp, the attractiveness of a raw material (jute) which was free from the risk of interrupted supplies dependent upon Britain's political relationship with Russia, and, in time, the competition which

flax bagging was beginning to experience from Indian jute goods, all stimulated the foundation of a Dundee-based jute industry.[35]

From this period on the industry expanded to a peak of prosperity in the early 1870's. The years of the Crimean War and American Civil War were of major significance in shaping the industry, and Dundee raw jute imports rose from 16,590 tons in 1854 to 71,000 in 1865.[36] This period saw the beginnings of some of the major characteristics of the industry in the twentieth century. Optimistic overtrading on the part of some smaller firms, followed by financial collapse, emphasised the value of size in an industry subject to cyclical sales booms and slumps. The industry also appears from this time to have become more concentrated and more highly integrated. But what was in more than one sense an Indian Summer for the Dundee jute trade was coming to an end; and Lenman suggests that the large orders of the Franco-Prussian War of 1870-73 represented the last period of easy profits.[37] This is not to say that the industry did not continue to grow. In 1873 Dundee jute imports were 139,923 tons; a figure which expanded to 392,025 in 1895.[38] Employment also expanded: from 14,911 persons in 1870 to 43,360 in 1895.[29] The jute industry also appears to have continued its dominance of Dundee employment. The figure for the textile employment as a proportion of the total remained at 48-49% in 1881 and 1911. In 1931 it was still 41%; and only by 1951 had it fallen to 23%.[40] By this time, however, competition was reducing the profitability of the Dundee trade. The difficulties of the jute trade in the last decades of the nineteenth century were brought about by the very rapid expansion of the Calcutta industry (to whom Dundee lost her Australasian and South African

markets and some of her American trade), and the increased protectionist tariffs in Europe. For a time Dundee was able to maintain a technological lead over Calcutta, and to move ahead of that centre into finer jute goods. Profitability may also have been maintained by continued concentration of the Dundee market into larger units, and the decline in the general competitiveness of Dundee goods prior to 1939 may have been disguised by the channelling of Government orders to Dundee rather than overseas, and stipulation of the use of Dundee jute for some users such as beet sugar which was Government subsidised.[41]

The starting point of the main part of this study is nonetheless the demise of a traditional textile industry from its 19th century heyday. It is a study, therefore, of how firms heavily committed to that industry reacted to continued overseas competition and to new technologies such as paper bagging and containerisation. It involves an examination of how and why a relatively small number of firms in a highly localised traditional market, far away from many potential sources of demand for alternative products, reacted to this situation and moved, with a creditable degree of success, into new market areas.

F. Prospects for the Jute Industry in 1945

The immediate background period of the major part of this study commenced with the jute industry emerging from another period of artificially stimulated demand, and with capacity geared to the coarse end of the market. Once again the industry appeared to be

doomed to a consequent period of over-capacity and further loss of neglected markets. As two observers of the contemporary scene wrote :

> "There is little doubt that, if the prospects of the jute industry seemed gloomy before the war (1939-45), they have become even more gloomy since. ... outside Europe as well as inside it, there is a very real danger that the war will have considerably speeded up India's encroachment on Dundee markets ... It seems also very probable that the war will again have stimulated the development of substitutes."[42]

Some part of these gloomy prognostications was based upon a phenomenon encountered by the industry immediately after 1918, and which has already been referred to as "technical retrogression". During World War II Dundee had been very largely geared towards providing basic jute goods for war-time needs. This situation continued for some time after 1945 due, in the first instance, to Indian independence and Partition (see below) which disrupted supplies of raw jute and basic jute goods, and secondly to the outbreak of the Korean War in 1950 which again put the Dundee industry on a war footing. The result of this was that Dundee lost further ground in those specialist export markets which it had been trying to build up prior to 1939: markets in which it avoided direct competition with the Calcutta mills. This problem was reinforced by export quotas from the U.K. which applied until 1952. Thus on the one hand Dundee was losing its place in world export markets through quota restrictions, while on the other the home industry was forced, as a result of the difficulties of the Partition, to expend most of its energies on basic jute goods. For example, prior to 1947 India had supplied two-thirds of U.K. cloth and bag requirements. With the drying up of this source of supply

three quarters of the output of yarn from Dundee mills in the early 1950's was for Hessians.[43]

Not only was this the situation in Britain, but from the early 1950's the Indian mills began a period of modernisation and market reorientation which involved some of the owners and managing agents in what has been referred to as "some fairly ruthless rationalisation". Faced by considerable wage increases, difficulties in obtaining certain supplies of raw jute from East Pakistan, and the growth of jute industries in other east Asian countries, the Calcutta mills installed modernised spinning capacity and automatic weaving machines, and moved into more sophisticated markets such as tufted carpet backing for American customers, and also laminated bags - a sandwich of jute and paper.[44]

Of even more immediate significance to the U.K. industry, however, was the partition of the Indian subcontinent into two independent states - India and Pakistan. The major problem so far as jute was concerned was brought about by the creation of a separate state of East Pakistan which had the effect of dividing the jute growing area of Bengal (in East Pakistan) from the merchanting and production centre around Calcutta (in India).[45] By this event 80% of the jute growing area of Bengal was divided from India, and although economic relations between the two states were initially fairly harmonious, trading and political differences arose which culminated in Pakistan's failure to follow the British 30% devaluation of 1949 which India did. Restrictions on supplies followed; and Britain was faced with a scarcity of finished jute goods from Calcutta (because their mills

lacked raw jute from Bengal), and a reduced supply of raw jute from Pakistan because of handling difficulties.[46] These events, combined with the increased demand occasioned by the Korean war, not only quite obviously forced prices up and thereby endangered jute's competitiveness with other materials, but also meant that Dundee continued to produce basic jute goods rather than diversify away from inevitable Indian competition. The long term effect has been for Pakistan herself to develop a jute manufacturing industry; and most of the jute goods now imported to Dundee are from Pakistan - or Bangladesh as it became in 1970. This latter country enjoys wage levels lower than India, and Bangladesh prices for jute goods may be two-thirds those of India.

G. The Board of Trade Report

In April 1946 a committee was constituted to look into the operation of the U.K. jute industry. The committee's task, in the words of its own terms of reference, was as follows :

> "To examine and inquire into the various schemes and suggestions put forward for improvements of organisation, production and distribution methods and processes in the jute industry, and to report as to the steps which should be taken in the national interest to strengthen the industry and render it more stable and more capable of meeting competition in the home and foreign markets."

In general terms the Committee saw its job as being to recommend the degree and form of protection appropriate to safeguard the Dundee industry from competition from the Calcutta mills. The Committee saw protection as being necessary in the light of the lower level of

Indian wages; and it foresaw no other means of alleviating the growing incursion of Indian goods into Dundee markets traditionally safe from such competition. The Committee was thus aware that even in such markets as quality sacking or in short runs of quality Hessian, where Calcutta had previously not competed with Dundee, there was a risk of the latter losing ground to the former. Furthermore, although the Committee was to be concerned about the structure of the U.K. industry it did not feel that restructuring alone would offer adequate protection from overseas competition. The Committee was thus sympathetic to the need for some degree of general protection for the home industry; and it felt that such protection had to be applied to "standard lines" of jute goods, where there was Indian competition, if the Dundee industry was to expand on a healthy basis of producing both standard and quality lines.[47]

The quid pro quo, as it were, from the industry for this protection was to be re-equipment and reorganisation (i.e. consolidation) on its part, so that long production runs could be achieved, using modern spindles and looms efficiently laid out, and which, the Committee evidently felt, could only be afforded by more substantial enterprises. In other words the Committee saw it as being essential that the company consolidations of the early 1920's, and the concentration of capacity brought about by wartime exigencies, should be continued.[48] Without such means the Committee foresaw a further contraction of the industry, and a vicious circle of lost trade and competitiveness: "high costs, little if any profit, and no reserves available for improvement and development".[49] The Committee did not, however, view the position of the Dundee industry as hopeless;

and a number of manufacturers were at the time of the Report installing new machinery. Indeed paradoxically, in the light of the future contraction of the industry, one of the Committee's worries was over a potential labour shortage.

The major part of the Report's summary and recommendations relates to the disadvantages which the Dundee industry experienced vis-à-vis India in manufacturing or conversion costs. The problem to be solved was how the home industry could cope with this situation; and the major part of the solution was protection. With regard to standard goods (e.g. hessians), there seems to have been no doubt in the minds of Committee members, first, that Dundee should continue to supply these goods, and second, that protection was vital. Thus, "the gap (between conversion costs in India and in the U.K.) is so wide that it is clear that ... the (home) industry, however extensively re-equipped and re-organised, cannot hope to compete with India in the standard lines of hessian unless protection is afforded".[50] From its base in the standard lines the Committee in fact noted that Indian competition had extended to quality sacking etc., and was likely to make further inroads upon carpet yarn and hessian linoleum backing - market areas in which Dundee had hitherto enjoyed some degree of protection by virtue of the high quality standards demanded. It was possibly this further encroachment by Calcutta into Dundee markets which made the Committee feel that if the home industry was to survive at all it had to operate across the whole of the market; and that in turn this was possible only behind some form of trade protection. The Report, therefore, in its conclusion committed itself to a Dundee jute industry producing a wide range of goods (in

fact a complete range other than coarse heavy bags), and which could simply not exist without some form of protection. The Committee finally recommended the continuation or introduction of import duties, ad valorem or specific, to cover the difference in manufacturing costs between Indian and locally produced goods.

It is interesting to note that the Committee's view on the need for and appropriateness of trade protection was contingent upon significant reorganisation of the industry. This was to include both amalgamation and re-equipment, which the Report saw as going hand in hand. Indeed, so far as concentration was concerned, the Report clearly specified the proportion of the industry which it saw as being made up of firms of a minimum size; and this was based upon the possibility and need to secure economies of scale which were available in production of, for example, standard hessians. The largest part of the formal Recommendations of the Report were in the area of regrouping and modernisation, and the offer of Government financial assistance in this context. The remaining Recommendations dealt largely with the need for improvements in the utilisation of capital and labour.

The acceptance of the feelings expressed in the Report thus gave the Dundee jute industry a degree of protection - largely operated through the continuance of Jute Control (see below) - which undoubtedly slowed down its rate of decline.[51] Although the contingent amalgamations among producers did not take place, it has been implied that the stability afforded by Control did encourage modernisation of plant. For example, between 1945 and 1951 an estimated £4 million

was spent by the industry on re-equipment;[52] and this appears to have been a period of considerable modernisation in spinning and weaving, including improved plant layout etc. Furthermore, although the system of protection may have become of diminishing importance over time, the continuing need to discuss the issue probably gave the industry an oligopolistic cohesion which may have militated against severe competition among domestic producers. This is particularly likely in view of the precise form in which Jute Control "equated" or "marked up" prices of imported Indian goods - a system which involved arriving at a consensus as to the appropriate or fair price for Dundee goods. The Government-sponsored system of protection through Control was also accompanied by (or, more questionably, required the support of) a series of restrictive trading agreements which were practised by the industry until struck down by the Restrictive Practices Court in 1963. The Report of the Working Party thus to a not inconsiderable extent contributed to the post-war economic environment of the Dundee jute industry.

H. Jute Control

Some mention must be made of the function of Jute Control because of the influence of this organisation on the post-war industry. Technically it was a means of protecting the U.K. industry from Indian competition. It may also, as mentioned above, have served as a focal point for discussions about pricing in the market.[53]

Originally Control was established in September 1939 and covered raw jute, yarn, waste etc. In 1940 the regulations were extended to

imported jute goods; and although the policy was originally designed to interfere as little as possible with existing arrangements - and to operate through a system of licences for existing merchants - Control eventually became the sole importer of raw jute and jute goods in 1941 and 1942 respectively. Even so, Control still purchased through brokers and shipping agents. A fairly comprehensive system of regulations was established; and this included not only licensing of spinners and weavers, but also licensing and controls over the uses to which finished jute goods could be put. Prices at each stage of the manufacturing process were also laid down.

What distinguished Control from other war-time regulations is that the system was not wholly abandoned after hostilities ceased. Certainly in September 1952 internal controls were relaxed: i.e. the licensing and control of end-use of jute goods were ended. Moreover in 1954 trading in raw jute was returned to private hands. The Government of the day, on the basis of the Board of Trade Report, nonetheless felt that in respect of finished goods the Dundee industry required continued protection. Jute Control thus continued to adjust prices of imported jute goods so as to protect Dundee producers from Indian competition. Imported goods were adjusted on the basis of "equated prices" (by reference to the cost of raw jute) or "mark-up prices" (by reference to landed prices of imported jute goods). From 1954 to 1957 the system of protection was largely based upon equated prices; but from 1957 onwards standard markups became the more common method, until by 1963 this latter system accounted for 90% of Control goods. The general trend over the years was towards a reduced markup; and while the equated prices of the 1954-57 period

appear to have constituted a markup of some 47%, the formal markup in July 1957 was set at 30%, and was reduced in January 1960 to 20%. Further reductions in the markup on some goods, and return of others to free trade occurred during the early 1960's; and in May 1969 all imported goods previously subject to Control were returned to private hands, although quotas were retained in some cases. Although the significance of this form of protection may have diminished with time as Dundee firms moved into market areas which did not attract Indian competition, there were products such as Hessian cloth and bags where a significant output from Dundee was matched by large imports from Calcutta. One report indeed purports to show that a reduction in the level of protection in respect of one category of goods resulted in a 73% reduction in the output of these goods by U.K. producers despite satisfactory levels of overall demand.[54] Nonetheless the proportion of trade affected by such controls directly, i.e. by markups, gradually diminished. This is borne out by studies across the total industry, and also by reference to the situation by individual firms.[55] The changes in technology of the late 1960's greatly altered the situation, and the Joint Textile N.E.D.C. later emphasised in forecasting changes in the industry's fortunes that "any increase in imports following quota revisions is likely to be small compared to the inroads into the domestic market made by polypropylene."[56]

However, the importance of Control was probably greater than is implied by the proportion of the Dundee trade affected at any one time. Prices of non-protected goods may have borne a fixed relationship to those of protected goods; or manufacturers of more specialist goods, where competition among local producers was keen, may have

relied upon goods where prices were effectively set by Control for an element of stability in their profits. Control also maintained a more stable structure in the industry than would otherwise have been the case by a "fair" allocation of raw materials over the period 1939-52, by setting profit margins during this period which allowed less efficient firms to survive which might otherwise have been eliminated by competition, and by ensuring reasonable supplies of material to the industry as a whole during the difficult period of Partition. Indeed the interrelationship between the influence of Control and of the restrictive trading agreements in the industry, and of its geographical concentration, has made it difficult to assess the impact of each independently. What one can say is that each combined with the others to limit the extent of overt price competition in the market.

Control was, therefore, an important part of the economic environment of the jute industry post 1945. It certainly must have given the industry a greater cohesion than would otherwise have existed; and, although latterly its direct impact may have been small, it must have made a contribution to slowing down the rate of contraction of the industry, and perhaps also contributed to the temporary survival of some smaller firms.

I. Markets

With regard to end-use markets, the jute industry in 1945 was still dependent to a very large extent upon relatively unsophisticated uses of its output. Packaging was still the major end use to which jute was put - accounting for about 70% of total output of made-up

jute according to one estimate.[57] This was to be of some disadvantage to the Dundee industry. In the first place it was an unstable market - dependent very much upon the volume of domestic and international trade. This was a derived demand which jute enjoyed only because of its cheapness. Second, the packaging market for jute was the one in which it was most susceptible to Indian competition, being a fairly unsophisticated product. Third, this was to be a market into which new products such as paper and polythene, and new methods such as containerisation, made considerable inroads on the basis of efficiency and marketing appeal.[58]

In its second most important market, however, - namely lineolum backing - jute in 1945 enjoyed considerable advantages. The greater widths and higher quality demanded in this market protected Dundee from Calcutta. An additional advantage in this sector was the nearness of the U.K. linoleum manufacturing centre of Kirkcaldy in Fife.[59] The disadvantage which Dundee was to incur in this market was the rapidly decreasing popularity of linoleum itself. Output reached a peak annual output of 51.6m. sq. metres in 1955, and thereafter rapidly declined to a corresponding figure of 8.9 in 1969 and to 4.0 in 1975.

Other uses of jute in the period after 1945 included carpeting, cordage, and a number of minor uses such as cable insulation, upholstery foundations, padding and stiffening of clothes, and linings for boots and shoes.

An approximate idea of the total situation may be gained from

data provided in the Board of Trade Working Party Report, although the figures relate to 1939 - the last year when output was not influenced by the pre-war buildup of military requirements.

Table 1.2

U.K. Jute Production (tons)

Yarn :	Carpet backing, twines, cordage etc.		50,150	
	Jute carpets		3,050	
	Webbing		600	53,800
Cloth and Bags :				
	Cloth: Hessian	28,200		
	Sacking etc.	7,050	35,250	
	Bags		32,400	67,650
				121,450

Source : Report of Board of Trade Working Party on Jute (H.M.S.O.: London, 1948) pp.17-19.

The same Report went on to warn the Dundee industry:

> "India had for many years supplied the home market for heavy bags made from low quality sacking and bagging; had made such heavy inroads in the hessian bag trade that there was every indication that as time went on the balance of that trade would gradually be lost to India; had made a start in the manufacture of linoleum hessian and brattice cloth; was encroaching more and more on the trade in other widths of hessian up to 72 ins. for non-bag uses; and was beginning to participate in the trade in better quality sackings and tarpaulings. Thus virtually no normal home use for jute cloth and bags is likely to remain free from Indian competition in the future."[60]

The years immediately after 1945 therefore saw the Dundee jute industry at something of a watershed with regard to markets for its output. There was no doubt that India was poised to make further encroachments upon Dundee's traditional markets, and that the total situation was likely to be aggravated by changes in technology such as containerisation and the development of new forms of packaging.

J. Market Structure

Market structure is one of the most important areas of analysis in industrial economics. Not only are some of the dimensions of structure - most obviously concentration - open to quantitative analysis, but both economic theory and the results of empirical research lead one to anticipate that structure in any market is an important determinant of the conduct or behaviour of firms, which in turn influences the performance of the industry. This section looks at the data on market structure in the jute industry around 1945.

It was noted earlier that some circumstances had encouraged concentration of production in the industry: for example, the rapid changes of fortune in the industry, and the incentive to vertical integration. It may also have been hoped that the "rationalisation" process, through which Jute Industries and Low & Bonar evolved in the early 1920's, would have provided for a more orderly contraction of the Dundee industry, and made for a more stable competitive environment for the firms themselves. However, the existence of a class of jute merchants who traded between spinners and weavers meant that

vertical integration was not essential. Also, the advent of the electric motor for powering spinning machinery meant that there were not necessarily the significant economies of scale here that there were previously in the operation of a single large motor for a whole mill. Finally, in common with other industries, a war-time system of raw material allocation and centrally determined prices must have contributed to the survival of small firms.

With regard to the situation prior to World War II, it would appear that firms employing more than 500 employees in 1935, although accounting for only 11% of enterprises, were responsible for 33% of employment and 32% of net output.[61] Data on one conventional measure of market power - the concentration ratio - suggest that in respect of net output and employment the three-firm ratio in 1935 was 35%;[62] while the Evely and Little comparisons of gross output figures for 1935 and 1951 show that the concentration ratio had risen from 30% to 38%, and that the jute industry therefore fell into the medium concentration category.[63] Prior to 1945, therefore, a number of sources indicate that the industry was becoming slightly more concentrated. This was occurring despite any obvious reason for an increase in the optimum size of firm; and much of the incentive may have come from the difficulties which the industry was being faced with in terms of increased Indian competition and loss of other markets to home producers of substitute goods.

Data relating to the immediate post-war period, prepared for the Board of Trade enquiry, indicate both the large number of firms in the market and the high degree of concentration. This data, which applies

to the U.K., showed that in jute spinning there were 26 firms having 38 plants or establishments. For weaving, the corresponding figures were 36 and 45. But within this data further examination reveals Jute Industries as having 24% of spindles and 20% of looms. And although the second largest firm came some way behind, the figures show the four largest spinners accounting for 46% of spindles; with a corresponding figure for looms of 37%.[64] The Board of Trade Report data also reveal a degree of vertical integration in the industry. Eighteen out of 44 firms, and 17 out of 66 establishments, included spinning as well as weaving; and among the largest firms bag-sewing and merchanting (i.e. selling) were also normally carried on.[65]

K. Conclusions

The purpose of the preceding sections of this chapter has been to outline the state of the traditional jute industry in 1945 through both a brief economic history of the trade from its origins to that date, and a summary of the condition of the industry immediately after World War II.

In many ways this point in time represents a logical starting date for any consideration of the industry up to the present time. Despite the industry being well past its major period of growth, and in spite of the difficulties of the 1930's, the trade, for some time largely unchanged in its economic structure or technology, looked forward with hope to the post-War world. However, major changes were about to occur over the next 30 years. Despite Government

and private efforts to modify the forces of import and domestic competition, these were to increase significantly. Domestic markets which at one time seemed large-scale and relatively immune from the pressure of Asian competition were to fall to technological change and import competition. These forces brought about considerable restructuring of the traditional industry over the period from the mid 1960's onwards. Finally, the industry was forced to adopt quite radical technological and product market change for its own survival into the 1970's. It is with an analysis of these changes that the major part of this thesis is concerned.

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2. E. Gauldie (ed.), The Dundee Textile Industry 1790-1885 (Edinburgh: Constable, 1969) p. xv.

3. A brief survey is given in W.G. Rimmer, Marshalls of Leeds: Flax-Spinners, 1788-1886 (Cambridge: University Press, 1960) Ch. 1.

4. Flax spinning and weaving were mechanised about 20 years later than cotton. Thus cotton led the industrial revolution, and the early developments in cotton weaving were coming into general use by the 1750's and 1760's. On the spinning side Hargreaves' spinning jenny, Arkwright's water frame and Compton's mule significantly increased the output and quality of yarns; and these were coming into fairly regular use by the 1790's. Mechanisation of the harvesting of raw cotton in America in the last decade of the eighteenth century also helped to reduce the price of the raw material. Power loom weaving in the cotton industry was common by the 1840's; whereas it appears only to have been introduced into flax at this time, and even in 1860 half of the flax weaving in Dundee still appears to have been done by hand. See P. Dean, The First Industrial Revolution (Cambridge: University Press, 1965) pp.84-9 and 121; and Survey of United Kingdom Jute Industry (London: Times Publishing Co., 1952) p.4.

5. See D. Bremner, The Industries of Scotland (Edinburgh: Black, 1869; rev. ed. David & Charles, 1969) p.224.

6. See "Autobiography of Peter Carmichael" in E. Gauldie (ed.), op.cit., p.59.

7. See D. Bremner, op.cit., p.231.

8. A.J. Warden, The Linen Trade, Ancient and Modern (London: Longmans Green, 2nd ed. 1867) pp.66-69.

9. See T. Woodhouse & A. Brand, A Century's Progress of Jute Manufacture, 1833-1933 (Dundee: David Winter, 1934) pp.15-16.

10. B. Lenman, C. Lythe & E. Gauldie, Dundee and Its Textile Industry 1850-14 (Dundee : Abertay Historical Society, 1969) p.7.

11. See A.J. Warden, op.cit., p.633. One of the historically interesting effects of this expansion of the jute industry was to bring about a revival of the Dundee whaling fleet as whale oil was used in "batching" raw jute to facilitate the initial

manufacturing process of hackling. The raw jute was first treated with an emulsion of oil and water. See S.G.E. Lythe, "The Dundee Whale Fishery", Scottish Journal of Political Economy, June 1964, Vol. XI, pp.165-6.

12. See A.J. Warden, op.cit., p.634.

13. B. Lenman et al., op.cit., p.16.

14. E. Gauldie, op.cit., pp.176-77.

15. A.J. Warden, op.cit., Supplement p.14.

16. See D.C. Carrie, Dundee and the American Civil War, 1861-65 (Dundee : Abertay Historical Society, 1953) p.14.

17. Ibid., p.18.

18. B. Lenman et al., op.cit., p.54.

19. D.F. Carrie, op.cit., p.18.

20. The first jute spinning mill in Calcutta was established in 1855 as a successor to the earlier native cottage industry. The Calcutta mills were equipped with Dundee machinery, and by 1860 jute power loom weaving had become established. From an initial mill output of eight tons per day in 1856 the Indian mills expanded to 2,500 tons per day in 1909: more than three times the output of "their small competitor on the Tay". Much of the increased Indian output was in competition with the Dundee trade, both in Britain and in the important United States market. See D.R. Wallace, The Romance of Jute: A Short History of the Calcutta Jute Mill Industry 1855-1909 (Calcutta: Empire Press, 1909).

21. D. Chapman, "The Development of the Linen and Jute Industries from the Domestic System to the Great War" in R.L. Mackie (ed.) Dundee and District (London : British Association, 1939) p.84.

22. A. Monfries, "Memoir of Peter Carmichael" in E. Gauldie (ed.) op.cit., pp.215-6.

23. Thus, for example, in her thesis on the Cox family, Donaldson writes of the "unbounding prosperity" of the industry in 1912; and another writer tells of the year 1913 being "a very prosperous one for the trade; the volume of business was very considerable and the price level unprecedentally (sic) high". See K. Donaldson, "The Cox Family, the Linen Trade, and the Growth of Lochee, to 1921", Unpublished B.Phil. Thesis, University of Dundee (1972), p.49; and J.P. Day, "The Jute Industry in Scotland During the War", in D.T. Jones et al., Rural Scotland During the War (London: O.U.P., 1926) p.274.

24. See J.P. Day, op.cit., p.267.

25. See B. Lenman & K. Donaldson, "Partners' Incomes, Investment and Diversification in the Scottish Linen Area 1850-1921", Business History, 1971, Vol. XIII, pp.1-18.

26. For example Alexander Monfries concluded from Warden's 1864 data that, taking the Dundee textile industry as a whole, more than half of the output was accounted for by eight out of 61 firms in the industry. In 1871 Baxter Bros. was responsible for one tenth of all Scottish employment in jute, flax and linen. Baxter Bros. employed about 5,000 people in its Dundee mills, and James Cox over 3,000. See E.G. Gauldie, op.cit., pp. xxxiii and 183. Slightly different figures are given in a contemporary history of Dundee, where it was estimated that Cox Bros. had some 5,000 employees, and Baxter about 4,500. See J. Maclaren, The History of Dundee (Dundee: John Durham, 1874) p.339.

27. B. Lenman et al., op.cit., pp.39-40.

28. These funds were channelled through the medium of investment trusts: investing funds in railroad stocks and bonds, land mortgages, range cattle and mining. The movement began in the early 1870's, and by 1880 Dundee had become one of the major centres for investment in America. Evidence suggests that the bulk of such funds came from the merchant and manufacturing class rather than wealthy landowners. See W.T. Jackson, The Enterprising Scot (Edinburgh: University Press, 1968) pp.21-24.

29. These points are based upon O. Graham, The Dundee Jute Industry 1828-1928 (Unpublished Thesis, Dundee University, 1928) pp.125-27.

30. See J.P. Day, op.cit., pp.289-93.

31. See Board of Trade Working Party on Jute Industry (H.M.S.O.: London, 1948) p.9.

32. These included Thomas Bell & Sons, Cox Bros., Gilroy Sons & Col, John N. Kyd & Co., F.S. Sandeman & Sons, J. & A.D. Grimond, and Harry Walker & Sons - a total of twelve units. Jute Industries was, in fact, one of the more successful of Clarence Hatry's financial creations. Many parts of his empire - for example British Glass Industries and the Commercial Corporation of London - failed to survive even a decade. Others, such as Allied Ironfounders and Jute Industries, still operate today, although early in its life-time Jute Industries saw its capital written down from £4.5 million to £1,650,000. See E.V. Morgan & W.A. Thomas, The Stock Exchange: Its History and Function (London: Elite, 1962) pp.206-7. An unpublished manuscript to which the present author had access suggests that with its workforce of 15,000 the newly-formed Jute Industries had about half of the Dundee jute trade.

33. Low & Bonar was formed from five independent units. See W.H.K. Turner, "The Evolution of the Pattern of the Textile

Industry within Dundee", Transactions of the Institute of British Geographers, 1952, Paper 18, p.119. It is interesting to note that Jute Industries was created as a result of activities of financiers outwith the jute industry itself, while Low & Bonar was created by a jute merchant and based largely upon the long-established linen firm of Baxter Bros. See I.E.P. Menzies and D. Chapman, "The Jute Industry" in H.A. Silverman (ed.), Studies in Industrial Organisation (London: Methuen, 1946) p.245.

34. Data in I.E.P. Menzies and D. Chapman, loc.cit., pp.247 and 255. Adopting a rather different approach (comparing exports of home produced goods with retained imports) the Board of Trade Working Party Report recorded a movement into trade deficit by 1931. See Board of Trade, op.cit., p.10.

35. See for example the two papers by D. Chapman: "The Establishment of the Jute Industry: A Problem for Location Theory", Review of Economic Studies, December 1938, Vol. VI, pp.33-55; and "The Development of the Linen and Jute Industries from the Domestic System to the Great War" in R.L. Mackie (ed.), Dundee and District (London: British Association, 1939) pp.80-87.

36. Data given in B. Lenman et al., op.cit., Appendix II.

37. In S. Jones (ed.), op.cit., p.169.

38. D. Lenman et al., op.cit., Appendix II.

39. D. Chapman, in R.L. Mackie (ed.), op.cit., p.84.

40. A.M. Carstairs, "The Nature and Diversification of Employment in Dundee in the Twentieth Century" in S. Jones (ed.), Dundee and District (London: British Association, 1968), pp.320-328.

41. See J.K. Eastham, "An Economic Survey of Present-Day Dundee" in R.L. Mackie (ed.), op.cit., p.97.

42. I.E.P. Menzies and D. Chapman, "The Jute Industry" in H.A. Silverman (ed.), Studies in Industrial Organization (London: Methuen, 1946) pp.260-1.

43. See Financial Times, 12th February 1952.

44. See G. Harrison, Bird and Company of Calcutta (Calcutta: Bird & Co., 1964) pp.262-66 and 295-6.

45. This division was largely based on religion. The vast majority of Indians are Hindus, whereas Pakistanies are Mohammedans.

46. East Pakistan inherited only one port - Chittagong - on Partition, and this had to be built up to take the jute traffic which had previously gone through Calcutta.

47. This may be compared with the generally less sympathetic tone of one study which spoke of the industry as being characterised in the interwar period by "vain hopes, illogical suggestions, and ill considered criticisms (which) have too often taken up effort which could have better been directed towards a policy of trade control and trade reconstruction". See O. Graham, The Dundee Jute Industry 1828-1928 (Dundee: Unpublished Thesis, Dundee University, 1928), p.133.

48. There had been two major compulsory physical concentrations during the 1939-45 period brought about by the need to economise on factory space. Such concentration was largely undone after the war, as factory space was restored to firms. See Financial Times, 29th March 1954, "Survey of the Jute Industry".

49. Report of the Board of Trade Jute Working Party (London: H.M.S.O., 1948) para. 14.

50. Ibid., p.70, U.K. conversion costs were some 70% greater than those in India according to data prepared for the Report. See loc.cit., p.60.

51. One would ideally want to be able to measure the degree of effective protection offered to the industry by Jute Control, and changes therein over the period analysed. Effective protection - as opposed to nominal protection which is simply the tariff rate - not only expresses tariffs, subsidies, import quotas etc. in relation to the value added of the industry (so as to compare, for example, tariffs and quotas on a common basis) but also takes account of the further effect on a protected industry of tariffs etc. on industries which provide the protected industry with its inputs. Unfortunately the necessary data for such an exercise in this particular industry are not available. On effective protection see N. Oulton, "Effective Protection of British Industry" in W.M. Corden & G. Fels (eds.), Public Assistance to Industry (London: Macmillan, 1976) Ch. 3.

52. See Survey of the United Kingdom Jute Industry (London: Times Publishing Co., 1952) p.10.

53. These comments are based upon a number of sources: J. H. Leveson, Industrial Organisation of the Jute Manufacturing Industry (Dundee: College of Technology, 1973), pp.10-11; L. Hamilton, The Consequences of Abrogating Price Agreements in Three Industries (Hull : Unpublished M.Sc.(Econ.) Thesis, University of Hull, 1972) p.202; L.R. 4 R.P., pp.401, 424 and 457.

54. See "Leading Industries" in J.M. Jackson (ed.), The City of Dundee, Vol. 25 of The Third Statistical Account of Scotland (Arbroath: Scottish Council of Social Services, 1977) p.110.

55. For example it has been estimated that in 1960 only around 9% of Dundee trade was directly protected by the markup - reduced

in 1960 by 10% to 20%. See A.H. Carstairs & A.V. Cole, op.cit., p.131. Jute Industries commented at the time that the change would affect only 5-10% of its output. See Financial Times, 15 February, 1960.

56. N.E.D.C. Economic Assessment to 1972 (Joint Textile Committee) (London: N.E.D.C., 1970), p.19.

57. I.E.P. Menzies and D. Chapman, op.cit., p.253.

58. See H. Corteen, "The Textile Industries of Eastern Scotland", Chemistry and Industry, 1949, Vol. IV, p.4.

59. Survey of the United Kingdom Jute Industry (London: Times Publishing Co., 1952), p.21.

60. Board of Trade, op.cit., p.19.

61. Census data quoted in I.E.P. Menzies and D. Chapman, loc.cit., p.243.

62. See M. Leek & A. Maizels, "The Structure of British Industry", Journal of the Royal Statistical Society, Ser.A., 1945, Vol. CVIII, p.187.

63. R. Evely & I.M.D. Little, Concentration in British Industry (Cambridge: University Press, 1960), p.337.

64. Board of Trade, op.cit., Table 11.

65. Ibid., pp.22-23.

CHAPTER II

Analysis of Changing Markets and Industry Structure

A. Introduction

The purpose of this chapter is to trace the principal changes in product markets in respect of what at the end of World War II constituted the Dundee jute industry, and also to indicate the major changes in industry structure. The material in this chapter following the Introduction is thus divided into four sections: analysis of changing markets, analysis of changing market structure, analysis of other changes in market conditions, and a concluding section.

With regard to markets we want to know how the jute industry and its constituent firms responded to the falling off of demand from previous users. Some part of the answer to this issue - indeed a major part - lies in diversification by former jute manufacturers into other market areas altogether (analysed in more detail in Chapter III). Nonetheless, some part of this chapter is devoted to examining changed market areas within the jute industry itself, as well as to the movement by most firms from dependence upon jute to a broader industrial textiles base.

Changes in structure in a market, particularly a declining one, are interesting in that they show us how the constituent firms as a group reacted to external influences. Such changes may also enable

one to say something about the degree of competitiveness in a market - a primary concern of industrial economists. At the level of individual businesses, it is also interesting to know how firms reacted to a sharp falling off in demand for their principal traditional product. Did firms move rapidly into other market areas; did they simply go out of existence; or were they acquired by other companies, either former competitors or firms based in other markets?

In order to make some of the following data and analysis easier to place in an overall context, a brief review is first given of the transition of the jute industry during the post-war period to 1977. This review identifies the major trends and the principal forces at work; and it is in this context that the remainder of the study should be placed.

The jute industry had undoubtedly benefited from the 1939-45 war so far as stimulation of demand was concerned. Indeed, according to a number of people in the trade today looking back, it was only the enormous sandbag contracts of 1938 onwards that enabled the industry to survive the 1930's. These contracts were costed at local conversion rates ("real Dundee prices", as one industrialist put it), and thus ushered in a period during which the local industry was freed from the full impact of Asian competition.

The Dundee industry emerged from World War II under the protection of Jute Control (outlined in the previous chapter); and this system, combined with the trading agreements operated by the

industry itself, not only protected the domestic industry from import competition, but also militated against the emergence of domestic rivalry. The late 1940's and the early 1950's were a period of adjustment for the Dundee industry. Manufacturing premises were gradually returned to the trade from war-time use following concentration. Caird's Ashton Works and James Scott's Mid Wynd Works had, for example, been used for light engineering and jerrican manufacture. Jute at this time was experiencing consistent demand for yarn for woven carpets, and backing cloth for linoleum. In both of these areas the Dundee trade had a technical and transport cost advantage over India; and as will be seen in the main body of this chapter, a high proportion of the output of the Dundee industry went into floorcovering markets. By the mid 1950's however, changes were taking place in these markets. The system of import protection had started to price jute bags out of competition with multiwall paper bags. The latter were being developed by the major paper manufacturers such as Reed and Bowater; and as part of their marketing strategy these latter firms also produced bag-filling plant. From this time on, therefore, the markets for transporting animal feeds etc. were lost to paper bags, while grain, and in time other products, became subject to bulk handling. At this time too the linoleum market began its downward trend towards eventual near extinction, and this situation was one of potential severe loss of trade for the traditional jute industry.

The situation was saved by the advent, in Georgia in the United States, of a tufted carpet industry. Although the backing market for this product looked at one time as if it might be served by cotton,

jute proved to have superior technical characteristics, and became adopted for both primary and secondary tufted carpet backing; that is both the (primary) fabric into which the tufts of a tufted carpet are locked, and the material which is finally placed on top of the latex binding the tufts into the primary backing and which is the (secondary) backing visible as the reverse side of a tufted carpet. The market situation was particularly fortuitous. Only in the early 1950's had U.K. export quotas been relaxed; and the tufted carpet backing market was originally an export one, as the U.K. and European public continued to prefer traditional woven carpets. Furthermore, tufted carpet backing could be made on existing jute looms used to produce linoleum backing. Only limited improvisation and re-equipment was therefore necessary to accommodate minor modifications: for example, twill rather than plain weave was required. In addition, the technical requirements (75% of the backing was 4 yd. width and a further 15% 5 yd.) limited, at least for a time, Asian competition; while transport distances for Indian and Dundee mills were about the same to American markets. Thus the tufted carpet backing market in the late 1950's and the early 1960's was an enormous boon to the U.K. jute industry. For although the U.S. and Canadian markets were eventually lost to Asian competition, the early 1960's saw the beginnings and rapid expansion of a U.K. and European tufted carpet industry. Here was a source of rapidly-expanding demand for jute on Dundee's doorstep, relatively speaking; and the rate of expansion of the market gave the Dundee industry for a time something which it had not experienced for almost a century - a sellers market in jute cloth. On this basis the early 1960's witnessed considerable re-equipment in the industry - for example

with twill weave looms.

The final phase of development covered by this study witnessed, however, the almost total disappearance of the local jute industry on any scale. The cause of this was a man-made fibre - polypropylene - which could be woven into a cloth. It took over from jute both as a (primary) carpet backing material and also in container manufacture. Jute's periodical shortage of supply and unpredictability of price caused it to be ousted by what is essentially a by-product of petroleum refining. The tufted carpet industry in particular took up polypropylene in place of jute on price grounds; and most of the original jute manufacturers have now turned to polypropylene weaving, with some of the larger companies having also established facilities for extruding the polypropylene tape from the chemical chips or granules. Labour usage in particular has declined in the industry as the new looms for weaving polypropylene operate at something like twice the speed of the former jute looms, and can be supervised on the basis of one person for every five or six modern Sulzer looms compared with one person for every two or three jute looms.

Over this period, therefore, the former Dundee jute industry has been transformed into a broader industrial textiles one; and Dundee itself has become a centre of some importance in the new field, with an estimated two-thirds of polypropylene production being carried on in the Dundee and Forfar area. Thus, as mentioned before, this study is one of transition as much as one of decline. As the summary figures below indicate, nonetheless, the history is at least

to begin with one of decline. The purpose of this chapter is now to indicate in more detail the changes in product markets and market structure associated with that decline.

Table 2.1

U.K. Jute Industry

	Output ('000 tonnes) Yarn	Cloth	Employment* ('000)	Number of Firms**
1948	101.9	59.9	20.3	37
1956	144.5	90.1	19.1	39
1960	144.1	83.5	17.2	32
1966	122.8	73.1	17.1	30
1967	113.8	64.6	15.3	30
1968	111.5	59.7	15.2	29
1969	107.9	52.7	15.4	29
1970	87.5	40.9	11.9	25
1971	77.6	32.0	10.3	21
1972	74.7	26.5	9.4	16
1973	68.2	24.2	9.0	16
1974	57.5	20.9	9.4	16
1975	51.1	16.3	8.1	16
1976	52.7	16.1	8.1	15
1977	46.8	13.8	8.0	14

* employees in employment

** full members of the Association of Jute Spinners & Manufacturers.

Sources : output - Annual Abstract of Statistics (London: H.M.S.O.)
employment - British Labour Statistics (London: H.M.S.O.)
firms - Association of Jute Spinners & Manufacturers.

B. Analysis of Changing Markets

The history of changing markets in the context of this industry is essentially that of firms trying to find new uses for jute to replace the loss of traditional floorcovering outlets, and of the same firms going over to the manufacture of synthetic fibres - especially

polypropylene. Difficulties arise in statistical analysis in this area because much of the yarn output of jute manufacturers is used by those firms to make jute cloth - i.e. a large proportion of the firms are vertically integrated; and there may be a danger of "double counting" here in allocating output to various market areas. Many statistics are fairly aggregated; and one study was only able to suggest that half of the yarn output of the industry went into bags and floorcoverings/furnishings.[1]

What does appear to be the case, however, is that many of the Dundee firms in the years immediately after 1945 became heavily committed to supplying the floorcoverings market, and that their fortunes became inextricably linked to the pattern of cyclical demand for floorcoverings in general, and to changes in technology or fashion as linoleum gave way to woven and subsequently tufted carpets, and more recently to tiles. Caird (Dundee) is one particular instance of a firm which became heavily orientated to the linoleum industry in the early 1950's; and this affected the firm's subsequent pattern of diversification (see Chapter III). But other firms were often only slightly less so committed. William Halley & Sons, for example, sold 75% of their yarn and cloth output to the floorcovering industry at this time;[2] and the corresponding figure for Jute Industries - the largest firm in the market - was 60%.[3] For the market as a whole an estimate in the late 1950's put the proportion at around 50%.[4]

The disappearance of traditional markets:

The first major change with which the industry had to contend

was the rapid falling off in demand for linoleum from the early 1960's. Output of linoleum built up after 1945 to an annual peak of 51.6m.sq.m. in 1955, and remained on a high plateau until the end of the decade. From then on, however, demand fell off very rapidly: from 47.8m.sq.m. in 1960 to 30.9 by 1963 and 11.2 by 1968. By 1977 the figure had fallen to 3.6m.sq.m. per annum. In addition to this falling off in total linoleum sales there was a trend as early as the 1950's towards linoleum being backed with bitumenised paper in place of hessian. This process involved impregnating a mixture of waste paper and rags with tar. Nairn of Kirkcaldy had a plant for this process in the 1950's, and used bitumenised paper for backing linoleum sheeting and also linoleum tiles, which constituted another growth area in the 1950's. There was nothing which jute manufacturers could do in the face of the loss of this source of derived demand as consumers moved to soft floor-coverings. But the loss was keenly felt by the Dundee industry as it was a market area in which competition from India and Pakistan had been held at bay by the high quality and modern technology offered by the Dundee trade.

Another major change which was to have a serious effect upon the jute industry was the growth of new methods in the bulk handling of primary commodities. This was a market in which jute had established a powerful position by virtue of the cheapness of the material (including the reusable nature of the ubiquitous jute bag), and its ability to "breathe", while also for some purposes being capable of being made proof against mildew or water. The bulk handling of goods such as wheat, maize, flour and sugar obviously became much

more attractive relative to bagging in those economies where crops were grown on a large scale, where considerable transporting distances were involved, or where labour was expensive. Although some economies had begun bulk handling of crops prior to 1939, this process rapidly gained momentum in less developed countries during the 1950's; and the newer concept of containerisation of the 1960's further ate into market areas where jute sacking and packaging had once predominated. Other minor areas of jute usage which have now been transferred to other materials are twines, road haulage and building site tarpaulins, furnishings, cargo separators and, of course, jute carpets. The loss of these areas to more sophisticated products such as Scotchtape or P.V.C. added to the problems of jute's loss of its major end-use markets.

It is also worth mentioning at this stage that jute was not always competitive with other traditional fibres on a price basis; and that frequent price fluctuations and political uncertainty further diminished the attractiveness of jute in some market areas. Thus, although cotton bags do not normally compete with jute, high prices for the latter or a glut of the former crop have produced times when cotton was preferred: for example in the early 1950's. A more serious problem for manufacturers and users of jute products has been the tendency for raw jute prices to fluctuate rapidly, depending upon crop conditions and the political climate in India and Pakistan. This is initially, of course, a problem for spinners and weavers of jute, who go "long" or "short" on raw material depending upon expectations of future price movements. Thus the chairman of Thomson Shepherd commented in the mid 1950's that "raw jute supplies and

prices over the past year have, as usual, been a matter of constant anxiety";[5] and one manufacturer was quoted as saying "you can be technically as efficient as you like, but you lose money if you buy (raw jute) at the wrong time.[6] With raw jute accounting for about 50% of total costs, this is obviously an area of concern in management. It has even been suggested to the candidate by someone of experience in the industry that one firm at least has survived in the market by buying raw jute (either for stockholding in Dundee, or simply "buying forward") and selling it at an advantageous price to competitor manufacturers. This uncertainty on prices may have fed through to some jute goods users and hastened their adoption of a commodity with a more stable pattern of prices.[7]

The growth of polypropylene:

Undoubtedly the major change in the jute industry over the past two decades has been the growth in this country, following their popularity in the United States, of a market for tufted carpets, and the further development of polypropylene in the market for floorcoverings and containers. In 1957, the first year in respect of which data are available, tufted carpets accounted for about 7% of U.K. carpet output by area. But from an annual output figure of 3.3m.sq.m. in that year, output of tufted carpets rose to 27.8m.sq.m. in 1964 and to 89.7m.sq.m. in 1972. The 1977 output figure of 123.4m.sq.m. means that tufted carpets now account for 73% of U.K. carpet output by area - a proportion which has grown from 59% as late as 1972. These data are of some importance not only in indicating the extent of a market from which jute initially benefited, but also in high-

lighting a major market area where polypropylene has been substituted for jute. The latter was used for wefts and for stuffer warp in woven carpets (the main warp being traditionally made of cotton), and for both primary and secondary backing of tufted carpets. Polypropylene's first use was as primary backing on tufted carpets; but from there its use in floorcoverings has expanded to woven carpet wefts and also of course to producing carpet pile or face yarns.

Polypropylene has also taken the place of jute in other market areas; and this began happening to such an extent in the late 1960's that many of the traditional jute manufacturers moved significantly into polypropylene at that time. Such a dominant feature of the local industry has this been that the local business journal commented on the emergence of polypropylene that "no other development in the long history of the jute industry has made such an impact".[8] Because of the importance of the coming of polypropylene onto the local scene the product deserves a brief technical and economic introduction before taking the market analysis further.

Polypropylene is a synthetic fibre as opposed to the general class of natural (vegetable or animal) fibres. It derives from a class of macro-molecular materials called polymers, which are known to be built up from simple chemical units, monomers. From the class of polymers referred to as linear (long and thin) chemists realised they could form fibres. Because polypropylene solution is made from a manufacturer material (as opposed to those man-made fibres which, like viscose or rayon, contain a natural product and are therefore referred to as "regenerated") it is known strictly as

a synthetic. Other synthetic fibres include Nylon, Terylene and Orlon.

The class of synthetic fibres from which polypropylene derives is known as polyolefins; and of these only polyethylene (polythene) had by the late 1950's achieved commercial success. Polypropylene was responsible for the commercial growth of the polyolefin class from that time; and it owed its original success to the cheapness of its raw material - propylene - available in very large quantities from the petroleum industry.[9] Polymerised propylene can be melted and extruded into tape form, the tape then being wound on to a spool ready for weaving. The cheapness of the raw material and the contour of the tape contributed to its success in yarn and woven form in competition with jute after the first commercial production of tape in the early 1960's; and jute from this period onwards began to suffer from competition in the carpet backing and bag markets - the latter also being competed for by high density polyethylene.[10]

With regard to the general economics of polypropylene production, the major contrast with jute lies in the capital-intensive nature of the total manufacturing process from the petroleum feedstock onwards. One estimate suggests that of total manufacturing costs of polypropylene, capital investment represents 35% of the total as opposed to 26% for the basic feedstock, and 27% for power etc. This implies quite clearly that, unlike the jute industry, polypropylene manufacturing profitability is very sensitive to activity levels, and that raw material price changes have a reduced impact upon total production costs. In the case of jute direct costs (labour and raw materials)

represent around 80% of total manufacturing costs. The other point about polypropylene production is that costs have been generally declining since the mid 1960's. In the U.K., for example, the list price of polypropylene resin fell by 38% in money terms in the decade to 1972; and, as emphasised in more detail below, there have been other factors exerting a downward pressure upon polypropylene prices.[11]

With regard to its market impact, polypropylene use advanced particularly with the adoption of tufted carpets in this country, although latterly the fibre has also been used for woven carpet backing. The rapidity with which the former use of polypropylene took place may be gauged from the fact that its use for the primary backing of tufted carpets rose from less than 10% in 1967 to some 95% in 1974.[12] Not only has jute suffered in some of the more sophisticated markets from the use of polypropylene as a substitute, but even in traditional packaging areas the new fibre may have more marketing appeal, or simply be more efficient. For example, it was reported that in the late 1960's the Australian wool trade was moving from the use of traditional jute wool packs to polypropylene: raising usage of the latter from 400,000 in 1968 to 1,500,000 in 1969.[13] Natural hard fibres such as sisal used for twines and other cordage have also become vulnerable to competition from polypropylene as prices of these have risen steeply. McDowall et al. estimate that for Western Europe as a whole the use of polypropylene for bags and industrial cloth rose from 2,500 metric tons in 1967 to 61,000 metric tons in 1974, and that by the latter date 45% of all sacks produced in the U.K. were made from polypropylene.[14] So far as competition

for jute is concerned, further inroads into this last market have also been made by high-density polyethylene. The basic factors considered in choosing jute packaging are not only the relative price of jute vis-à-vis, say, multi-wall paper bags or products of the polyolefin class, but also product characteristics such as ability to "breathe" or to put up with rough handling or to be re-usable (all of which jute possesses). In those market areas, for example, fertilizers, where reuse is uncommon, where presentation of the packaged commodity is important, or where the packaged product is hygroscopic - i.e. where it has the capacity to absorb water from the air and where this leads to a deterioration in the product's condition - other forms of packaging are competitive. It should be emphasised in this context that the adoption of polypropylene for carpet backing required considerable efforts on the part of producers to eliminate technical problems involved in polypropylene's use in this area. Not only did difficulties arise initially in cutting the woven polypropylene without producing fraying and thus waste of material, but there was also initially a problem of dimensional stability. Further problems encountered in the tufted carpet industry were those of poor bonding between the latex used to lock the face pile tufts into the primary backing and the polypropylene itself, and the shrinkage of the polypropylene during the curing or drying of the rubber latex: up to 20% initially. Finally, polypropylene does not easily accept dyes, and this can produce "grin" as the natural colour of the backing shows through the colours of the surface pile. This last problem was overcome by needling nylon into the primary backing - the former being a fibre which can easily be dyed. Thus in technical terms polypropylene has only come to

compete with jute as a result of considerable investments of effort and money.[15]

With regard to the question of price competition between jute and synthetic substitutes, the first point to note is that bag making and carpet backing do not constitute a large part of total usage of polypropylene or polyethylene. Increases in demand from these areas are thus unlikely to have a major impact upon price. That is, in comparison with jute, the use of polypropylene in its place is characterised by a highly price elastic supply. Furthermore, during the mid 1960's when polypropylene was first being marketed commercially in this context, it was felt that further technical advances, the achievement of production economies of scale together with beneficial "learning" effects, and general competitive pressures would produce a situation such that, relative to prices in general, the cost would fall.[16] That this expectation was borne out may be seen from the fact that over the period 1959-1965 the price of polypropylene fell from 45 pence per lb. to 24 pence per lb., while that of H/D polythene fell over the same period from 42 to 21 pence per lb.[17] The comparative situation is emphasised in a World Bank survey which compared selling prices of raw jute and polypropylene polymer. Taking 1962 as 100 in each case, the 1975 index for polypropylene was 73 (and it had fallen as low as 46 in 1970), while that for jute had climbed steadily over the period to 163 in 1975.[18] Furthermore, with regard to the impact of oil price increases on polypropylene, one has to bear in mind that the effect of such rises will be diluted as one moves along the manufacturing and selling chain from feedstock to final product. One

estimate suggests that a 100% increase in oil prices might lead to a 10%-15% increase in that of a polymer product such as polypropylene film.[19] What also has to be remembered in the price context is that polypropylene production is characterised by a high ratio of fixed to variable costs.[20] This not only offers considerable scope for production economies; but also means that raw material cost increases have a reduced impact upon final product prices compared with the case of jute where the raw material traditionally comprises around 50% of total costs.[21] Finally, it may be noted that although the market supplying the basic polypropylene polymer is oligopolistic, the pressure of competition and the balance between supply and demand in recent years has meant that raw material price increases have frequently been absorbed by petrochemical manufacturers rather than passed on to feedstock users.[22]

Finally in this section, it would have been useful to have been able to trace the changing composition of jute industry output by reference to different end uses. This would have indicated clearly the decline of various jute end-use markets and the reaction to this on the part of manufacturers in terms of moving into other areas. Unfortunately such data over the period of this study are scarce and unsatisfactory.[23] One of the firms in the industry, Scott & Robertson, has published in its Annual Reports a breakdown of end-use markets. These indicate the upward trend in floorcovering uses, a roughly similar pattern in agriculture, and a falling off under the headings of Building, Chemicals, and Food.[24] This end-use analysis, however, refers to the total product output of the firm - both jute and synthetics - and is thus of little value in tracing developments in jute alone when the proportions of jute and synthetics output were

themselves changing significantly over the period. Only one reliable and relevant source in the area of end uses of jute appears to exist. This is reproduced below, and is derived from a World Bank survey. The first table below applies to the U.K., and the latter is given for purposes of comparison.

The most obvious feature of the data in Table 2.2 is the absolute and proportional reduction in the importance of packaging and sacking end uses for jute over the period; and in respect of the U.K. this extends to carpet backing cloth in absolute terms. Output in the U.K. in respect of the first three output classes in Table 2.2 declined by 54%, 52% and 28% over the period. More surprising is the 58% expansion in the use of jute carpet backing cloth within the "developed countries", which can only be accounted for by the continued use of jute as a primary backing cloth for tufted carpets in some economies, and the expansion of its use as a secondary backing. To this extent the experience of the U.K. appears to have differed from that of other jute manufacturing countries.

In summary, the traditional Dundee jute industry has seen demand for its output fall due to a rapid contraction of demand on the part of one major user in the 1950's and 1960's (linoleum), a more gradual erosion of its "transporting" use in the face of new products (paper and polyethylene containers) and techniques (bulk handling and containerisation), and a very rapid loss of its carpet backing (and even woven carpet yarn) market to polypropylene in the late 1960's and early 1970's. Competition for jute has been on the basis of price and technology, and as considered in the Conclusions of this

Table 2.2

United Kingdom: Estimated Consumption of Jute and Jute Goods by Major End Uses

	1965		1968		1970		1971	
	'000 tonnes	%	'000 tonnes	%	'000 tonnes	%	'000 tonnes	%
Bags and sacks	35.0	21	31.0	20	20.0	17	16.0	15
Other packaging, industrial etc. uses	52.0	31	44.0	28	36.0	30	25.0	23
Carpet backing cloth	23.0	14	26.5	17	18.0	15	16.5	15
Carpet yarn	48.5	29	45.8	29	38.0	32	42.0	39
Cordage, cable etc.	5.0	3	5.0	3	4.0	3	3.5	3
Felts and padding	4.0	2	4.0	3	4.0	3	4.0	4
	167.5	100	156.3	100	120.0	100	107.0	99*

* due to rounding.

Source: Grilli, E.R. et al., Jute and the Synthetics, I.B.R.D. Staff Working Paper, No. 171, 1964 Annex II, p.35.

Developed Countries : Estimated Consumption of Jute and Jute Goods by Major End Uses

	1965		1968		1970		1971	
	'000 tonnes	%	'000 tonnes	%	'000 tonnes	%	'000 tonnes	%
Bags and sacks	578	42	566	40	445	35	360	32
Other packaging, industrial etc. uses	350	25	297	21	255	20	221	20
Carpet backing cloth	174	13	246	17	265	21	275	25
Carpet yarn	125	9	118	9	105	8	104	9
Cordage, cable etc.	88	6	84	5	84	7	78	7
Felts and padding	70	5	109	8	104	8	70	6
	1,385	100	1,420	100	1,258	99*	1,108	99*

* due to rounding.

Source: Grilli, E.R. et al., Jute and the Synthetics, I.B.R.D. Staff Working Paper, No. 171, 1974, p.6.

chapter and also in Chapter III the approach of the local industry as a whole has been quite complex. It appears to have accepted the long-term rundown of the jute industry as inevitable; and rather than offer price competition to new products, the profits of jute's last years were invested in the new competitive technology itself.

C. Analysis of Market Structure

Market structure is analysed here because of its importance in determining the conduct or behaviour and performance of the industry, and because changes in the structure of the industry are also the outcome of fundamental changes in the market.

With regard to the statistics, it should be emphasised in dealing with market structure below that the data are used to analyse the changes in market structure as a whole in the industry over the period studied, and are not designed to measure market concentration alone - although the latter is, of course, of considerable interest. It is for this reason, and also because none of the sources of information is itself entirely satisfactory, that a range of types of data has been used. Thus the Census figures (Tables 2.4 and 2.5) give us grouped data on employment; while trade association data provide not only figures on the number of decision-making units in the industry over the largest part of the period studied, but also break these down into size classes by employment (Tables 2.6 - 2.8).

These points regarding the purpose of the data, plus the fact that the figures often do not lend themselves to any more powerful

statistical analysis, explain why certain calculations have not been made. Thus Adelman has criticised the use of "Lorenz type" measurements in general to indicate changes in market concentration where the number of firms in the industry is changing - as is obviously the case in this study. This Adelman points out, produces a situation where, using a Gini Coefficient for example, market concentration appears to fall following the exit of a number of small firms.[25] Two more recent authors have also particularly emphasised the misleading interpretation regarding market concentration to which changes in the variance of the logarithms of firm sizes are open when the total of the population is changing.[26]

Broad changes in industry structure:

With regard to aggregated data, Census of Production figures can be used to give a very broad idea of the most important changes in the structure of the jute industry since 1945. The most unfortunate aspect of this data is the changes in the basis and classification of the material over the period, and this leads to a lack of comparability between sets of figures.

The first interesting statistic is the decline in the number of large enterprises in the industry: defined as those employing 25 persons or more.

Table 2.3

Number of Large Enterprises in the Jute Industry

1954	47	1971	28
1958	48	1973	30*
1963	32	1975	24*
1968	28	1976	25*
1970	25	1977	21**

* More than 20 persons ** More than 50 persons

Note : The data in this table are subject to the same problem as those in Table 2.5 below because enterprises are recorded in more than one employment size category if they have establishments in more than one such class.

Source: Department of Industry, Census of Production PA415.

Of themselves of course the above data may be an amalgam of a picture of decline in the industry and of increased market concentration. However, further examination of Sales data from Census figures shows that these larger enterprises have accounted for a fairly consistent 95% of total industry sales over the period. To the extent that this particular size category of firm was not increasing its share of a declining output further analysis within this group is necessary.

The data in the 1951 Census of Production reflect the position of the industry in the immediate post-war period.[27] Unfortunately the major data relate to "establishments", i.e. basically plants, rather than to firms or enterprises.[28] The other major problem with the 1951 data is that a large part of the industry is accounted for by those eight establishments which employed 500 persons or more. These eight establishments (under 10%) accounted for some 35% of employment, 30% of gross output, and 35% of net output. We do not

know from the Census data, however, the pattern of ownership of these and other establishments; and establishment distribution or concentration obviously underestimates economic market power in an industry of multiplant ownership.[29] The data certainly understate the market power of Jute Industries, which at one stage in the 1920's was estimated to account for half of the Dundee jute trade.[30] The Jute Working Party data relating to 1946 show Jute Industries to account for 24% of spindles and 20% of looms, followed by another firm with corresponding figures of 10% and 6% This source gives three-firm output concentration ratios (measured by capacity) in spinning and weaving of 41% and 32% respectively.[31]

Nonetheless employment distribution on an establishment basis are available with some consistency up to 1963; and these reveal the following situation.

Table 2.4

Establishment Distribution by Employment*

Numbers Employed	Establishments 1951	1954	1958	1963
11 - 99	18	19	18	6
100 - 199	23	29	9	12
200 - 299	15	11	8	4
300 - 399)	9	6	9	5
400 - 499)		3)	13)	9
500 - 749	8**	5)		
750 -1499	-	5	17	28
	73	78	74	64

* includes only larger establishments - employing more than ten persons.

** 500+

Source: Board of Trade, Census of Production, 1951, Vol.6, Trade G; 1954, Vol. 6, Trade H; 1958, Part 80; 1963, Part 79.

Not surprisingly the above data show the falling off in the number of small establishments. Those employing fewer than 200 persons accounted for 56% of establishments in 1951, but only 28% in 1963. Correspondingly, those employing 300 or more persons rose from 23% in 1951 to 66% in 1963; and between 1954 and 1963 the proportion of plants employing 750 persons or more rose from 6% to 44%.

From 1958 onwards Census data provided employment breakdown on an enterprise basis. These are presented in Table 2.5 below.

Table 2.5

Jute Industry Enterprise Distribution by Employment

Numbers Employed	Enterprises								
	1958*	1963*	1968	1970	1972	1973	1975	1976	1977
1 - 99	18	5	25	22	19	23	22	24	24
100 - 199	9	10	10	9	8	10	10	7	8
200 - 299	6	4	11	9	7	7	5	5	3
300 - 399	6	3	4	6**	3***	3***	6**	4***	4***
400 - 749	6	5	5	-	-	-	-	-	-
750 - 4999	3	5		-	4****	4****	-	3****	3****
	48	32	55	46	41	47	43	43	42
	(64)	(44)	(43)	(43)	(35)	(38)	(40)	(39)	(37)

* firms employing 25 or more persons
** 300+
*** 300-499
**** 500+

Note: The figures in brackets for each year represent in all cases the total number of enterprises in the industry. The figures immediately above are larger for 1968-1977 because enterprises may classify themselves in more than one size group on the basis of having establishments in more than one size group.

Sources: Board of Trade/Department of Industry, Census of Production, 1958, Part 80; 1963, Part 79; 1968, Part 102; 1970, Part C102; 1972-77, Business Monitor PA415.

Enterprise data, as indicated above, enable us to say something much more meaningful about the economic power structure in the industry. In general those in Table 2.5 indicate, within their limits, the reduction in numbers among the small and medium sized firms, and the possible growing dominance of the industry by the largest firms.

However, whereas it was useful to note previously the increased proportion of establishments above a certain employment size, this interesting statistic may be misleading so far as firms or enterprises are concerned, as one would expect the distribution of firm sizes in any industry to be characterised by a large number of small-to-medium sized firms and a very small proportion of large businesses accounting for a dominant share of the market. In fact the general finding is that in statistical terms the size distribution of firms is log-normal.[32]

What one would wish to measure is the degree of homogeneity (low variance or standard deviation) of firm size or log of firm size, and so more even distribution of market shares or otherwise. Industries becoming more concentrated would thus tend to be characterised by a rising standard deviation of the distribution of firm sizes. Unfortunately the Census of Production data above do not lend themselves to this analysis because of the changing size classes over the period of analysis, and the open-ended nature of the top size class.

Given the relatively unsatisfactory nature of the Census data, further investigation using trade statistics was carried out. These

data are of two types. The former allows us to analyse the size distribution of firms. The latter, although merely a measure of the total number of firms in the industry, does have the advantage of covering the whole of the study period as well as telling us something of the number of individual decision-making units in the market.

In the first category (size distribution and concentration data) there are two pieces of data. The first of these merely enables us to confirm the market concentration which was taking place in the industry from 1945 until the early 1960's. Further data provided by the international trade association, however, allow us to take the analysis somewhat further over a shorter period.

At the time of the industry's defence of its restrictive trading agreement before the Restrictive Practices Court in 1962 it was pointed out that over the period 1947 to 1962 the number of spinning firms in the industry had fallen from 26 to 18, and that of weavers from 36 to 24. With regard to market concentration, it was shown on the same occasion that the proportion of raw jute consumed by the 7 largest spinners had risen from 63.8% to 70.7% over the period; and in weaving the proportion of looms owned by the 7 largest weavers had risen over the same period from 49.3% to 58.6%. What is also revealed by the data at this time is the continued dominance of the industry by Jute Industries. This was still by far the largest firm in 1962 with an estimated 5,500-6,000 employees; and was only followed at some distance by a group of five or six firms, each employing 750-1,500 persons.[33]

Table 2.6

U.K. Jute Industry: Size Distribution of Firms by Employment

	Size					
	-50	51-100	101-500	501-1,000	1,001+	Total
1957	2	9	23	5	3	42
1958	2	12	16	5	2	37
1959	2	12	16	5	2	37
1960	2	10	15	5	2	34
1961	3	9	15	5	2	34
1962	2	8	15	5	2	32
1963	2	6	16	5	2	31
1964	2	7	15	5	2	31
1965	2	6	15	4	2	28
1966	2	6	14	4	2	28
1967	2	6	14	4	2	28
1968	2	6	14	4	2	28
1969	2	4	14	4	2	26
1970	2	3	13	4	2	24
1971	2	2	11	3	2	20
1972	1	2	11	3	2	19
1973	1	2	11	3	2	19
1974	1	2	10	3	2	18
1975	1	2	8	3	2	16
1976	1	2	7	2	3	15
1977	1	2	6	2	3	14

Data refer to members of the Association of Jute Spinners and Manufacturers.

Difference between the Total column of this Table and that in Table 2.8 may be accounted for by the timing and definition bases of the two sets of data which are from slightly different sources.

Source : Association of European Jute Industries Statistical Yearbook, (Paris: A.E.J.I.).

Unfortunately even these data are not perfect. There appears in particular to be some confusion over the identity of the firms in the 1,001+ employment range. From 1968 to 1977 (1968 was the first year for which individual company employment data were revealed in company Annual Reports) four firms would appear to qualify for inclusion in this category: Sidlaw, Low & Bonar, Scott & Robertson, and Don Bros. Buist. Low & Bonar may have been excluded on the

grounds that jute was only a small part of its total output (around 10% in the mid 1960's according to a senior executive), although the company was a member of the A.J.S.M. until 1975, and had an estimated 10-15% of the industry's output in the mid 1960's. The employment position of the four firms was as follows.

Table 2.7

Employment

	Sidlaw*	Low & Bonar*	Scott & Robertson**	Don Bros. Buist*
1968	5,104	2,788	2,573	1,140
1969	4,963	2,702	2,414	1,103
1970	4,625	2,519	2,124	1,097
1971	3,721	2,295	1,758	1,088
1972	4,669	2,209	1,490	1,070
1973	4,618	2,319	1,530	1,064
1974	4,315	2,283	1,702	1,061
1975	4,177	2,067	1,555	1,053
1976	3,844	2,474	1,287	1,049
1977	3,445	4,112	1,276	1,096

* total U.K. employees
** excludes "associated" companies.

Source : Company Annual Reports & Accounts.

What the data in Tables 2.6 and 2.7 do, however, illustrate is not only the dominance of this particular industry by a small group of relatively large firms, but also the way in which the industry was restructured and the impact upon different size classes of firms of the decline of the traditional market for jute. Most obviously the middle size classes appear to have been worst affected by the market decline. Those firms which in 1957 had 51-500 employees suffered by far the greatest drop in their number - and in the case of those in the 101-500 employees group the drop was particularly rapid during the time of the industry's transition

to polypropylene after the late 1960's.

Relating purely to the number of firms in the industry, we have data on membership of the jute trade association from 1945 to 1977. Membership of the Association of Jute Spinners and Manufacturers is not comprehensive so far as the trade is concerned. Nonetheless it was estimated that in 1962 membership covered 100% of spinning capacity (apart from two small English spinners) and 90% of loom-age.[34] The data in Table 2.8 below refer to full (as opposed to associate) membership of the Association. This is felt to be more appropriate, as associate members include textile machinery manufacturers; but it has had the effect of eliminating a few local firms which were acquired by larger concerns in the 1960's, and thus understates both the rate of contraction of the industry and also the extent of acquisition by larger firms of smaller competitors.[35]

Table 2.8

Full Members of the Association of Jute Spinners & Manufacturers*

1945	39	1956	40	1967	30
1946	39	1957	40	1968	29
1947	39	1958	40	1969	29
1948	37	1959	38	1970	25
1949	38	1960	33	1971	21
1950	38	1961	33	1972	16
1951	38	1962	31	1973	16
1952	40	1963	30	1974	16
1953	40	1964	30	1975	16
1954	40	1965	30	1976	15
1955	40	1966	30	1977	14

* Data as at February of each year.

Source : A.J.S.M., Association Yearbook.

The figures above confirm our picture of an industry whose

decline set in during the mid 1960's and accelerated by the early 1970's. Apart from a sudden increase in the number of disappearances in 1959, when three firms were acquired by other members of the industry and two simply went out of business, the number of independent firms fell quite steadily by almost 25% from 1945 to 1967. From this latter date onwards, however, the number of firms halved in a decade. It is thus during this latter period that there has been the greatest adjustment. Some of the reduction in Association membership over this period reflects continuing firms leaving the jute industry. Low & Bonar, Caird, and Thomson Shepherd all fall into this category. Ignoring for a moment the merger of Unijute and James Scott, dealt with below, this leaves a total of twelve firms which actually went out of independent existence between 1967 and 1977. Of these firms seven were family businesses which ceased to exist due to a combination of the impact of the rapid falling off in demand in the industry and the absence of family succession. The remaining five were acquired by other larger firms within the industry, with no single firm playing a dominant role in this process.

Mergers and acquisitions:

There are broadly two types of change which are responsible for movements in market structure over time: these are "deaths" and "acquisitions". The former occur as firms cease manufacture; the latter are brought about by takeover. It is not always possible, however, to distinguish clearly between these two, as some businesses may be acquired and rapidly closed down by the new parent.

In this case what appears to have been an acquisition may in reality have been a death.

The contraction of the jute industry has produced not only a significant merger, but also a series of acquisitions of smaller businesses by the larger existing firms in the market, as well as a number of deaths or disappearances by minor companies. Undoubtedly the major amalgamation of the period was the merger between Robertson Industrial Textiles (which traded as Unijute) and The Mid Wynd Holding Co. (whose two principal operating subsidiaries were James Scott & Sons and Thomas Boag & Co.). This merger took place in April 1965; and although Scott and Boag were the dominant concerns, with a joint capital of £1,363,047 in contrast to Robertson's £552,989, the joint group became known as Scott & Robertson.[36] It has been estimated that a few years earlier the Mid Wynd Holding Co. was the second largest spinner and weaver of jute in the U.K.;[37] and by the time of the presentation of the first set of combined asset figures for Scott & Robertson the total assets were in excess of £5m. compared with Jute Industries' £6.5m. These asset figures, however, may overstate the market position of Scott & Robertson relative to Jute Industries. The employment data in Table 2.7 suggest a greater dominance by Jute Industries; and estimates within the trade suggest that by the mid-to-late 1960's Jute Industries still had some 45% of jute sales as against just over 20% for Scott & Robertson. This type of merger, nonetheless, and the growth of such firms as Caird (Dundee), H. & A. Scott and others in the middle range, meant that the very largest businesses were beginning to lose some part of their earlier hegemony, particularly as some of the former

giants in the industry - notably Low & Bonar - were becoming less solely committed to the jute industry.

The 1960's was also a time during which the larger spinners and manufacturers were buying up smaller firms. By some people in the industry this has been explained in terms of a shortage of good labour, and therefore the quest to find a suitable workforce rather than additional plant. There is no doubt, however, from the way in which these acquisitions have been subsequently "rationalised" or simply closed down that a process of takeover of small firms and their subsequent closure was felt to be a more "orderly" method by which the industry as a whole could contract its capacity into line with falling demand. The alternative might have been the continued existence of small mills and factories, offering goods at minimal prices on the basis of assets already fully depreciated, and forcing similar price concessions on the part of other firms. Sidlaw Industries, for example, acquired a number of smaller spinning and weaving enterprises over the period from the late 1950's to the mid 1960's, including D. & R. Duke of Brechin, John Lowson of Forfar, Alex Henderson & Sons, Tayport Spinning Co., and more recently South Mills (Textiles) in Dundee. Also into this category of adjustment fall James Scott's earlier acquisition of Mitchell Cotts, Caird's purchase of Alex Moncur, and J. & D. Wilkie's acquisition of fellow Kirriemuir spinner Ogilvie Bros. in 1971.

One interesting characteristic of the falling off in demand for jute in the 1960's was the acquisition by manufacturers of merchanting firms. In depressed times in the past these selling organisations had

acquired a reputation for squeezing prices down to very low levels. Partly to avoid this situation, and more positively to try to capture additional outlets for yarn and cloth, a number of producers engaged in forward vertical integration. In the mid 1960's, for example, H. & A. Scott acquired Alex Laurie, Caird acquired Thomas Manning, and Wm. Halley acquired three merchants in one year : Godfrey, Behrens, and Swinton in 1964. In one notable case the initiative for vertical integration came from the merchanting side. In 1960 Low Bros., a firm of Dundee merchants, took the initiative in creating an enlarged group comprising one of their customers - the Forfar firm of Don Bros. Buist. The firm subsequently expanded horizontally in the jute trade by acquiring the Brechin firm of J. & J. Smart. A further recent (1978) step in backward vertical integration has been the group's acquisition of Thiokol, the major local supplier of extruded polypropylene for tape weaving.

Vertical Integration:

This latter pattern of acquisitions outlined above has helped to produce a situation where an increasing proportion of the jute trade is in the hands of vertically-integrated businesses. The proportion so covered in 1946 was put at around 77% in spinning and 65% in weaving by the 1948 Board of Trade Report.[38] The Restrictive Practices Court was informed in 1962 that 73% of Dundee jute production was accounted for by firms which had spinning, weaving and merchanting departments;[39] and the fact that most of the company deaths of the late 1960's and early 1970's were amongst non-integrated weaving firms contributed further to this trend.

The data in Table 2.9 below show for the period 1954-1977 the number of firms falling into various categories of vertical integration.

Table 2.9

Vertical Integration in U.K. Jute Industry 1954-1977 (No. of Firms)

	Spinner-Weavers	Spinners	Weavers	Total	Spinner-Weavers/Total
1954	16	12	22	50	32%
1955	16	11	14	41	39%
1956	18	10	14	42	43%
1957	17	9	14	40	43%
1958	15	7	13	35	43%
1959	15	7	13	35	43%
1960	15	6	11	32	47%
1961	15	5	11	31	48%
1962	15	5	10	30	50%
1963	15	5	9	29	52%
1964	14	6	9	29	48%
1965	13	5	9	27	48%
1966	13	5	8	26	50%
1967	13	5	8	26	50%
1968	13	5	8	26	50%
1969	13	5	6	24	54%
1970	12	5	5	22	55%
1971	11	4	3	18	61%
1972	11	4	3	18	61%
1973	12	4	3	19	63%
1974	9	5	3	17	53%
1975	9	4	2	15	60%
1976	8	3	3	14	57%
1977	8	3	3	14	57%

Source : Association of European Jute Industries Statistical Yearbook (Paris: A.E.J.I.). It may be noted that for no obvious reason the data in the Total column of Table 2.9 do not exactly correspond with those in Table 2.6 above.

The other piece of information revealed by Table 2.9 is the different death rates of various categories of firms in the Table. Analysis of this (although it does not fully take account of migration from one category to another in the Table) reveals the following.

Table 2.10

Analysis of Death Rates of Firm Categories in Table 2.9

	Spinner-Weavers	Spinners	Weavers	Total
1954-1977	50%	75%	86%	72%
1967-1977	38%	40%	63%	46%

Source: Table 2.9

The data in Table 2.10 confirm the considerably higher death rates among non-integrated firms (especially weavers) compared with integrated businesses, particularly over the period 1967-1977.

The company accounting data used for the statistical tests carried out in Chapters III and IV were also employed at this stage to measure changes in the degree of vertical integration among the surviving firms who were full members of the A.J.S.M. and for whom the necessary accounting data were available over the period 1968-1977. There were 15 such firms, and it is only over this shorter period that U.K. company law has provided for the disclosure of the necessary information to calculate the extent of vertical integration at this level. The measure of vertical integration used is the ratio of value added to sales;[40] and the data were abstracted from the company accounts. Value added was measured as wages (including directors' remuneration) plus gross trading profits; that is, the value added was calculated as sales minus raw materials.[41]

The 10-year average ratios of value added to sales varied considerably across the 15 firms. The 15-firm average was 31.0%;

but the ratios varied from 16.2% (Low & Bonar Group) to 45.2% (J. & D. Wilkie), reflecting possibly the merchanting and electrical engineering activity of the former, and the integrated jute spinning and weaving of the latter. For each of the 15 firms, and also in respect of the 15-firm average, the 10-year series of vertical integration ratios was measured against time and time squared in order to test on a parametric and nonparametric basis for any trend in vertical integration over time. In order to gauge broadly the evidence of such a trend the coefficient of determination (R^2) and the rank correlation coefficient (Rho) between the ratios and both time and time squared were calculated. The average proportion of the variation in vertical integration accounted for by time across the 15 firms on this simple univariate basis was 17.8%, although in only five cases was R^2 greater than 0.25 (and in two of these cases the correlation was negative while in three it was positive). Applying the test of rank correlation there were only three cases where the coefficient Rho was significant at 5%. Similarly in the case of the regression of the vertical integration ratios and time squared the average R^2 was 0.219. There was no evidence from the full regression analysis and the rank correlation of the 15-firm unweighted average vertical integration ratio against time or time squared that any change had occurred over the period 1968-1977.

The fate of smaller businesses:

As mentioned earlier, there has been a number of cases of individual businesses going into liquidation. This happened towards the end of the 1960's, and affected in particular smaller, non-integrated

weaving concerns. In order to examine this question of "deaths" etc. in the industry over the period of the late 1960's and early 1970's in a little more detail a search was undertaken at Companies House in Edinburgh in respect of those businesses which went out of independent existence over this period. There were 12 such firms.[42] As was noted previously a number of small firms was acquired by large businesses. These included D. & R. Duke of Brechin acquired by Sidlaw in 1959 and added to by John Lowson Jr. of Forfar in 1962, and Ogilvie Bros. of Kirriemuir acquired by J. & D. Wilkie in 1971. Both of these firms were quite small. In 1968 Duke & Lowson employed only 300 people, while in the same year Ogilvie Bros. employed 192.

Voluntary liquidation was, however, the most common form of corporate death. Most of those involved were small family businesses. W. G. Grant, for example, despite some attempt at diversification into the building products industry went into voluntary liquidation in 1972, having employed 380 people in 1970. Douglas Fraser & Sons of Arbroath, which in 1967 had a capital employed of over £1m. followed the same path at an earlier date in January 1968. These businesses were among the larger concerns to be eliminated during this period. Others were very much smaller non-integrated concerns specialising in weaving. T.L. Miller, for example, with capital employed in 1968 of only £47,458, ceased jute manufacturing in 1971. The firm continued in business with its merchanting activities, although making considerable losses, only until 1976 when it went into voluntary liquidation. A very similar situation applied in the case of R. G. Kennedy & Co. (Textiles). The company had a capital employed of £60,000 in 1968; and while it

had experienced losses for a number of years from the mid to late 1960's it did not go into liquidation until 1971. Don & Duncan, another non-integrated weaving concern, was slightly larger with a capital employed of £157,773 in 1968. This firm, which had previously manufactured jute sacking, bagging and tarpaulins, went into liquidation in 1970. These few details would again seem to confirm the exposed position of the small weaving concerns during this period of change in the traditional industry.

In summary, the most obvious change in market structure has been that the number of firms originally in the local jute industry declined as the market as a whole contracted. This decline was especially rapid during the period 1967-1977; it affected particularly firms in the middle size category (employing 51-500 persons); and by far the largest "organisational" category of firms to disappear were the non-integrated businesses, particularly weavers. Mergers or acquisitions were a characteristic of the industry. In one notable case this involved a coming together of two firms each previously in the middle-size category. In other cases smaller businesses were acquired by much larger concerns. Deaths in the industry occurred because of a failure to adapt to the new industrial textiles conditions, or an absence of family successors in the business. Despite case histories of individual businesses pursuing a policy of vertical integration, there is no statistical evidence that increased integration was a general characteristic of the industry over the period 1968-1977. The decline of traditional jute manufacturing thus produced a more compact and possibly concentrated industry as a number of smaller, non-integrated constituents

of the market disappeared. The decline in the number of plants per firm also reinforces this impression of compactness. The ratio of establishments to enterprises in the industry, which in the 1958, 1963 and 1968 Census of Production reports stood at 1.41, 1.73 and 1.72 respectively, fell to an average of 1.18 during the period 1970-1977, suggesting that even allowing for the incidence of smaller firms being taken over by larger ones, the industry was rationalising itself so far as eliminating multi-plant operations was concerned.

D. Further Changes in Market Environment

In addition to data on the formal structure of the industry and changes therein, it is important to be aware of changes in the structural environment of the market which were also taking place throughout the 1960's. There were two such elements in the industry over this period. First, the degree of import protection administered by Jute Control, and the issue of import protection in general. Second, the operation of the industry's restrictive trading agreements.

Jute Control:

Jute Control functioned to protect the Dundee industry in three ways. First, there was a complete ban on the import of non-standard goods except for carpet yarns - "excluded goods". This lasted until 1964; and in respect of 1962 it was estimated that the ban afforded absolute protection to 80% of total U.K. jute goods production.[43] Second, there was a system of full import price equation which raised the price of imported Indian jute goods to an ex-works level thought to

be equal to that of an efficient Dundee manufacturer. Third, a system of partial protection was applied after 1957 to a range of goods thereafter known as the Depressed Range. Following representations by the Indian government and producers, certain imported jute goods formerly sold by Control at fully equated prices were sold at a fixed markup. This markup was originally set at 30% in 1957 - compared with the former equated price level equivalent markup of 47%. The Depressed Range largely comprised standard Hessians for bag making; and the markup originally set at 30% was reduced in 1960 to 20%, and again in 1963 to 10%. The Dundee industry was also, of course, protected by means of a normal range of tariffs from non-Commonwealth jute imports, although these were of little significance.

So far as the degree of import protection was concerned, there was throughout the period of the 1950's and 1960's a general reduction in the shelter which Control was able to offer the industry from Indian competition. As outlined in Chapter I, the war-time system of Control was continued with only minor modifications until 1954, when trading in raw jute was returned to private hands. Imported jute goods, however, remained under Control and these were sold at equated or markup prices, which were held to represent prices with which an efficient Dundee manufacturer could compete. The actual markup depended upon the class of goods; and while for some categories held to be of importance to the continuance of the Dundee industry the mark-up was maintained at 45% until the termination of the whole system in May 1969, there were some ranges where the markup had been reduced to 20% in 1960, and some categories (e.g. heavy sacks) where the only protection was a very limited quota system.

In August 1963, a major change was instituted by which previously excluded goods, that is goods in respect of which the Dundee industry had hitherto enjoyed complete protection, were to be imported by Control and marked up by 50%. At the same time the markup on common Hessians was further reduced from 20% to 10%.[44] A year later, in September 1964, the markup on these Hessians was eliminated, and arrangements were made for trade in them to be returned to private hands; while, in respect of those goods previously marked up at 50%, the markup was reduced to 45% in some cases, and to around 35% in others.[45] From May 1969 Jute Control's function of marking up the prices of imported jute goods was terminated; and was replaced by a quota system which placed purely physical limits on the import of such goods.[46]

Following the entry of the U.K. into the E.E.C. in 1973 new Jute Arrangements were concluded which preserved the position of India and Bangladesh vis-à-vis Britain. The common external tariff applied by existing E.E.C. members to such imports continued to apply, but at a reduced rate. Absolute import quotas, however, also apply to the remainder of the E.E.C. countries, and are the sole source of protection for U.K. manufacturers. Currently the level of these is part of the discussions within the context of the Multi Fibre Arrangement between the E.E.C. and the developing countries of the Far East.[47]

Opinions have varied as to the impact of this protection and its removal on the Dundee industry. On the one hand it could be argued that other changes were taking place which had the effect of ousting jute from traditional market areas and which import restrictions

could do little to mitigate. Such, for example, may have been the case with the increased use of paper or polythene bags. There was also little which any form of import protection could do to reduce the trend to bulk transporting or containerisation of the 1960's. On the other hand the trade felt it was necessary to maintain a degree of protection for Dundee manufacturers. What tended to happen, the industry feared, was that as protection was "lowered" in one range of goods so manufacturers of technically adjacent goods suffered. The final impact, it might thus be argued, of one reduction in markup would be felt across other grades of cloth where markup had not been altered.

Appendix Tables 2.4 and 2.5 indicate the level of import penetration for jute yarn and cloth respectively for the period 1951-1977. From these one might have expected to be able to detect some influence of the various changes in the degree of import protection offered by Jute Control. Looking at the 3-year moving average data in particular, for yarn these indicate an unusual pattern of a fall in import penetration up to the late 1950's, a rise from this time until a peak of 3.4% in the mid 1960's, after which the figures fall off to a slightly lower plateau of 1.5%-2.5% for the remainder of the period. With regard to jute goods, a more obvious pattern emerges, although not one which might have been expected in the light of Control regulations. In the case of cloth, import penetration fell from its 1951 level until a low point in the mid 1960's, from which it rose significantly - a rise which could be explained by the 1963 and 1964 reductions in import protection. A further trend which appears significant is the rise in the level of cloth import penetration as the whole U.K. jute

industry declined (see Appendix Table 2.7). This does not appear to have arisen from any change in the level of exports, which, excluding 1976, averaged around 14% of production for the 1970's, but from a rapid rise in the volume of imports themselves. It may be that this is further evidence of a point taken up again later in this chapter, that as the traditional jute industry seemed bound to decline significantly sooner or later as polypropylene increasingly ousted jute from successive previous end-use markets, U.K. jute manufacturers, who had significant interests in polypropylene, did not necessarily seek to fight any rearguard action on the part of jute in the dimension of price competition, but rather enjoyed what were acknowledged inevitably to be jute's last years. This absence of more aggressive competition in jute by Dundee producers as the jute industry declined may be an important explanation for the historically high and increasing levels of import penetration in the 1970's in respect of cloth.

In addition to the more concrete arguments concerning import protection, a further not insignificant effect of Jute Control was that the whole system contributed to a cohesiveness within the industry, which must have broken down as Control's function was gradually eliminated. Thus:

> "One further, very important consequence of protection must be mentioned. The system of equated prices, involving as it did the calculation and publication of a price at which imported goods were to be sold, facilitated the construction of price agreements among home producers, so that for an important part of production there was an absence of price competition, not only between Indian and Dundee goods, but also between the goods of one Dundee producer and another."[48]

It is, of course, in this last sense that Control performed a function similar to that of the industry's trade pricing agreements. Insofar as this is true, then it may also have contributed to what a former member of the industry referred to as a "management desensitisation" over the years from 1945 to the early 1960's. This was, by implication, a period over which management was protected from the full impact of foreign competition, when domestic rivalry was similarly muted, and when many small firm managements were relieved of having to make any real decisions upon pricing at all.

Trade pricing agreements :

As mentioned above, the other major change in the industry's structural environment was the ending of the network of domestic trade pricing agreements in March 1963 following a Restrictive Practices Court decision.[49] These had grown up along the system of Control; and the argument for their retention was largely based upon the inability of Control fully to carry out its functions without the existence of the industry's own network of delivered common price agreements. Control had produced a situation during the war in which it was necessary to have common prices of jute goods in respect of imports and Dundee-produced goods, so that any jute goods user possessing the appropriate Certificate of Approval to obtain jute cloth or yarn should pay the same price regardless of whether Control allocated to him imported or home-produced goods. This means of ensuring an equitable allocation of scarce wartime goods was, as we know, extended after 1945 to become a system for protecting the Dundee industry from import competition. Such imports were sold

through Control at a price which was "equated" or brought into line with that of a notionally efficient Dundee manufacturer; and the mechanism was later simplified by adopting a standard markup for various categories of imported jute goods. In order to arrive at "fair" equated prices both Control and the jute trade association employed independent firms of accountants to determine prices and to monitor manufacturer profitability.

In the industry's view, it was necessary to have, as an adjunct to the formal system of Control, a set of price agreements among domestic producers. These agreements, in the words of the Low & Bonar chairman, were "the necessary lubricating oil which makes the unusual and somewhat involved form of protection (i.e. Control) work smoothly and efficiently".[50] The chairman of Jute Industries further reflected the general view in the trade in stating, "We feel strongly that these agreements play an indispensable part in the general structure of protection for the U.K. industry as an essential support for the operations of the Jute Control".[51] It thus appears to have been the industry's clear view that the intention of Control, safeguarded by strict monitoring of producer costs and profits, was to eliminate import and domestic competition. All that the seven registered trading agreements among domestic producers did was to translate Control's supervision of spinning and weaving ex-works prices into a common price system covering delivered prices and merchanting activities such as folding and baling of cloth. Without these additional arrangements "improper" price competition would have occurred among manufacturers. Thus in the words of the industry's most significant witness at the Restrictive Practices Court hearing :

"We say that this is the case because were there no such complex of agreements to ensure uniform delivered prices to consumers, then the system of import and release of jute goods from India and from Pakistan which the Jute Control operates would be incomplete as a protective measure, would be frustrated in its intentions or would have to be discontinued by reason of difficulties which would arise; for, in the absence of agreements, partly owing to market fluctuations and partly because of the detailed method of pricing used by the Jute Control, imported goods would be available to consumers (against the Jute Control's intentions) at prices lower than those which the Board of Trade acknowledges as appropriate to efficient United Kingdom producers."[52]

In terms of the Act under which the case was decided upon the industry also argued that in the absence of their pricing agreements there would be a considerable reduction in the size of the industry; and given the significance of jute industry employment in Dundee - 35% of manufacturing employees in the city - there would be a considerable increase in unemployment in what was regarded as being a one-industry town.[53] In addition to these major points the industry also argued that in the absence of the trading agreements jute goods users would face a reduction in the range of specialist goods available and an increase in their price, that the flexibility of having an industry on one's doorstep would be lost, that the level of users' stockholding would have to rise, and that the system of common price agreements not only saved customers time in not having to "shop around" to find the lowest price, but was also responsible for creating an environment which had encouraged manufacturers to invest considerable sums of money in new capital equipment which had an impact in keeping down price levels.

These arguments were, however, opposed by the Counsel for the

Registrar of Restrictive Trading Agreements. He argued that the presence of the registered agreements prevented the most efficient firms or specialist merchants from expanding through price competition, and that fixed-price trading agreements sheltered high-cost producers, maintained excess capacity in the industry, and reduced the incentive to firms in general to seek out low-cost methods of manufacture. Finally, on 26th March, 1963, the Court under Lord Cameron gave its judgement. It did not believe that the delivered-price agreements were a necessary adjunct to Jute Control to prevent an undue contraction of the industry. It did not accept that administratively Control would find it impossible to arrive at correct equated or markup prices without the trade association agreements; nor was the Court convinced that the abandonment of the agreements would necessarily bring about a significant increase in unemployment in the area. As a result of this finding by the Court the agreements ceased to operate from that date.

What should not be lost sight of in the midst of the detailed material above is the potential impact of these changes on the industry. The relaxation of import controls and the abolition of the trading agreements obviously increased the degree of international and domestic competition faced by Dundee producers. One would, therefore, expect pressure upon smaller marginal firms - often non-integrated concerns - to increase. These businesses could either cease production altogether or accept an offer of acquisition by a larger company. Either alternative would lead not only to a slimming down of the industry but also to increased market concentration. Such increased concentration might also follow from the freedom for

competitive pricing among domestic producers in the absence of trade pricing agreements. Given the larger financial resources, and possibly also the greater efficiency of the larger as opposed to the smallest firms, the former would benefit from any increased price competition in terms of improved market share. Finally, the uncertainty of the new competitive environment of the early 1960's might have been expected to lead to more forward integration in the market, to a reduced commitment to long-term capital projects in the jute industry, and, for some businesses, to a positive plan to diversify into market areas offering more profits, growth or security.

Assessment:

Very little work has been done by way of assessing the outcome specifically of the ending of protection or the trading agreements in the industry. The view of McDowall et al. was that "It is probably no exaggeration to say that only the Jute Control with its import bans and markups stood between the British jute industry and virtual extinction in the 1950's and early 1960's".[54] Regarding the outcome of the ending of the trading agreements, spokesmen of the trade feared that "their rejection by the Court would create a difficult situation";[55] while the feeling in the industry after the Court's decision was that a considerable strain had thereby been placed upon individual firms by each having subsequently to make economic decisions within its own commercial environment.[56] With regard to import protection, although the total withdrawal of the system by 1960 may well have had a considerable impact upon the Dundee

industry, the fact is that the system was very gradually dismantled over more than a decade from 1954 to 1969. This was a decade, too, during which there were other significant changes taking place within the industry. This was particularly the case in respect of technical substitution in former jute end-use markets; and this situation led the industry's N.E.D.C. to conclude that "any increase in (jute) imports following quota revisions is likely (in its impact) to be small compared to the inroads into the domestic market made by polypropylene".[57] In respect of the ending of the manufacturers' common pricing agreements in 1963, more research has been carried out. The results, however, are inconclusive as regards attributing any subsequent events specifically to this cause. Hamilton, in his thesis on this aspect of the industry, points to the geographical concentration of the market, the continuation of the function of Control after 1963, the healthy state of demand from carpet manufacturers up to 1967, the general absence of excess capacity among producers, the operation of an informal information agreement,[58] and the role of the largest firms as price leaders. All of these conditions, the author concludes, served to dilute the pro-competitive impact of the Restrictive Practices Court's decision; and his "principal conclusion" was that the Court decision "had little or no impact upon the jute industry".[59] These two events must, however, be seen as contributing to the generally changed environment of the jute industry over the 1960's; and although it is recognised that it would be difficult to ascribe particular consequences to either of them alone, this does not mean to say that their impact upon the industry can be ignored.

E. Conclusions

This chapter has dealt with the two principal changes in structure in the traditional Dundee jute industry over the past 20 or 30 years. These were analysed under the headings of changing markets (Section B), and changes in structure - narrowly and broadly defined - (Sections C and D) above.

The context of this whole study is one of the decline of a traditional fibre market as the data in Table 2.1 indicate. One can see the causes of this in three distinct areas. Declining use of products with which jute was associated, and upon which it was at one time heavily dependent (linoleum); displacement of jute from use in a market where the jute-user product has continued to be successful (tufted carpets, where woven polypropylene has taken over as the primary backing material and where polypropylene is also displacing jute in woven carpets); and elimination of jute itself as a means of directly fulfilling certain functions (the case of jute bags and wrappings being displaced by bulk handling and containerisation). These changes came about at different times, at different speeds, and for different reasons. The response of the jute industry has necessarily been different in each case.

The "derived" demand for jute in the linoleum market was the first to go. It began to disappear from the late 1950's onwards; and the speed of decline may be gauged from the fact that U.K. linoleum output declined from its post-war peak of 51.6m.sq.m. in 1955 to 20.8m.sq.m. in 1965 - a decline of 60% over this period. This market was lost to

jute fairly rapidly on the basis of changed consumer tastes away from hard floor-coverings, and as, with the advent of tufting, carpets came within the household budget of an increasing part of the population. Under these circumstances, the members of the jute industry lost a market which was beyond their control. The one fortunate aspect of this particular transition was that, at least initially, the new growth area of tufted carpets supplied the jute industry with a significant replacement for its lost linoleum market.

More dramatic in scale and speed was the elimination of jute from the highly attractive market for the primary backing of tufted carpets. This was a phenomenon of the later 1960's; and from still possessing 71% of this market in 1968 (representing an output of 35.1m.sq.m.), jute's share fell to 12% in 1972 (9.2m.sq.m.).[60] Here the displacement of jute occurred for a mixture of technological and price reasons. With respect to basic developments in man-made fibre technology, the jute manufacturers cannot, of course, be held responsible for these. There does seem to be a general feeling, however, that high prices for jute goods (including the role of Jute Control in the U.K.) did stimulate the fibre applications of polypropylene. Thus according to a United Nations F.A.O. study,

> "Fears about the long-term future availability of jute and jute goods, and the present inconveniences of short-term fluctuations in supplies and prices, have led jute users to welcome the development of domestic substitutes which are free from these drawbacks. And the high price of jute goods in developed countries has made the development of such a substitute economically feasible. In addition to these general factors, there are several specific factors in the bag and the carpet backing markets which have encouraged synthetic substitutes for jute, but these are of less importance than the general considerations outlined above."[61]

On the question of price disparity, the World Bank study concluded that "In general, price differentials between jute and polypropylene replacement fabrics widened substantially in the late sixties and early seventies, to the point where direct price competition between jute and synthetics became almost impossible".[62]

In this instance of displacement the manufacturers in the traditional Dundee market, realising the trend of events which set in during the late 1960's, have largely moved into the displacing technology. The speed with which this move was accomplished, and the degree of involvement in polymer technology, have each varied from firm to firm. Some of the original jute businesses realised fairly rapidly that polypropylene was to be the fibre which would replace jute in many areas, and that it was the one to which they should turn for commercial survival. A number of these firms thus not only used polypropylene tape, but actually extruded polypropylene film from "chips" or granules themselves - slitting the film to produce tape. Thus Low & Bonar and Sidlaw established Polytape in 1966; and other local firms such as H. & A. Scott also established extruding facilities. At the other extreme there were businesses which hung back from entering the new market on such a large scale, and which only entered the weaving sector, using tape produced by specialist extrusion facilities established locally by Thiokol (formerly a subsidiary of W.G. Grace of America, but now owned by the local firm of Don Bros. Buist) and Filtrona (owned by Bunzl Pulp & Paper Co.). In all, however, Dundee appears to have exerted such a locational force in the provision of polypropylene for weaving into a variety of uses that an estimated two-thirds of polypropylene production is now

carried out in the Dundee area, including Forfar.[63]

It has been pointed out in the context of other research that the involvement of the traditional Dundee jute industry in polypropylene may even have contributed to the rapid succession of the latter to the markets of the former. That is, Dundee jute producers, being involved in the expanding polypropylene market, did not have the incentive which specialist jute producers would have had to fight a determined rearguard action on the part of jute by means of keen pricing. Rather they were willing to enjoy what were inevitably the last years of profits of jute in the knowledge that they had safely entered the market for polypropylene which was replacing the traditional fibre. Thus McDowall et al. point out that in the late 1960's and early 1970's polypropylene replaced jute more rapidly in Europe than in the United States, although as polypropylene cloth was slightly more expensive in Europe than America one might have expected the opposite to be the case. Thus despite polypropylene cloth being more expensive in Europe than in the U.S., its price advantage against jute (the proportion by which the price of polypropylene was less than that of jute) was 45% in the U.K. in respect of primary carpet backing cloth compared with 23% in the U.S. in 1972. British jute producers thus seem not to have made any efforts themselves by way of price competition to stem the tide of polypropylene; and the result was that for primary tufted carpet backing jute's share of the market in 1976 in the U.K. was 3% while in the U.S. it was 20%.[64]

The market for jute bags, wrappings and other minor end uses

(such as the household furnishing trade) fell away rather less dramatically to new technologies and substitute products. The trend towards bulk handling and containerisation - essentially the result of new materials-handling engineering, and a response to higher wage costs involved in traditional systems - affected different commodities and different economies at varying times. In this area too, however, a major change occurred over the period from the late 1960's to the early 1970's; and again polypropylene was a significant cause of jute's reduced markets. For example, over the period 1968-1971 jute's share of the free world bag and sack market fell from 88% of the total to 67%. Even this apparently modest proportional reduction in market share resulted in a virtual halving of jute output to this area - from 31,000 tonnes per annum to 16,000 tonnes.[65] The response by the jute manufacturers in this market area has correspondingly been to enter the market for polypropylene bags - a strategy which Scott & Robertson among the local producers have particularly followed.

Regarding changes in market structure, the data here are fairly informative. We can trace the slimming down of the size of the traditional industry by total numbers and with reference to the size distribution of firms; and on the basis of local knowledge we can distinguish among disappearances between "deaths" and "acquisitions", and also identify the acquiring firms in respect of the latter category. As one might expect, the number of firms in the industry has fallen dramatically over the period 1945-1977 - particularly over the last decade of the period. The firms which have disappeared altogether (as opposed to simply leaving the jute industry to engage

totally or largely in synthetics) have predominantly been small and/or non-integrated concerns. At the level of casual observation (in contrast to the basis of statistical testing employed in Chapter IV) size would appear to be an important determinant of survival.

Of concern to the industrial economist, one might want to know what happened to competition among firms over the period studied. Undoubtedly this was muted by the existence of Jute Control and the industry's domestic trade pricing agreements described in Section D above; and it was noted there that the effects of these continued until the mid to late 1960's. One would suggest therefore that, ceteris paribus, growth of the more efficient firms at the expense of the less so was restricted, and marginal firms survived in the industry which would otherwise have been eliminated. It was also undoubtedly the function of these arrangements to allow the industry to sustain a higher level of profitability than would otherwise have been the case.[66] The demise of these arrangements coincided with the occurrence of technological market competition from polypropylene. That the synthetic fibre was so rapidly adopted by a large proportion of the trade is one indication of its competitive potential vis-à-vis jute. At the same time this mixture of natural and synthetic output by most firms in the industry prevents one from using aggregated profitability data (rates of return on capital employed) to measure the extent of competition. One can imagine that with the continuance in business of a number of older firms, the downturn in total demand for yarn and jute goods from the late 1960's onwards created a buyers market. As in most markets, however, the

extent to which firms experienced increased competition varied from one sector of the jute market to another. Thus while demand for woven carpets remained strong the spinning of high quality carpet yarns continued to be profitable, and those firms which specialised in this more demanding sector and which enjoyed something of a technological barrier to entry (Sidlaw, Scott & Robertson, and Thomson Shepherd) enjoyed success beyond the end of the 1960's. This situation may be contrasted with the view of the chairman of Craiks, a small Forfar business now owned by Low & Bonar, who complained by the late 1960's "Not only have we had to contend with a steady falling off in demand, but with a serious and widespread wave of price cutting, resulting in the whittling away of already slender profit margins".[67] This sort of comment, together with the exit from the market of an increasing number of smaller, marginal firms at the turn of the decade, suggests that competitive pressures were increasing - although it should again be emphasised that the source of these was technological change which originated outwith the traditional jute industry. It is with the way in which the firms in general dealt with this outside source of pressure to which we now turn in the following chapter under the heading of diversification.

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1. See "Leading Industries" in J.M. Jackson (ed.), The City of Dundee, Vol. 25 of The Third Statistical Account of Scotland (Arbroath: Scottish Council of Social Service, 1979) pp.113-4.

2. See "The Family Firm of Halley's", Dundee Chamber of Commerce Journal, June 1961, p.860.

3. See Chairman's Statement in Financial Times, 16th February 1960.

4. Financial Times, 10th January 1958.

5. Thomson Shepherd & Co. Ltd., 1956 Report & Accounts, p.3.

6. Quoted in Financial Times, 14th December, 1964.

7. For example, what is striking about a graph of fibre prices over the period 1947-1965 is not so much the total increase in jute vis-a-vis, say, rayon, but the amplitude of jute price fluctuations. Prices rose (in index form) from 100 in 1947 to 145 in 1965 (as against 150 for rayon). However, compared with rayon's steady progress, jute had reached a price index of almost 230 in 1951, and returned to almost 100 in 1959 before rising again to 180 in 1961, 140 in 1962, and 145 in 1965. See L. Briscoe, The Textile and Clothing Industries of the United Kingdom (Manchester: University Press, 1971) p.29.

8. Dundee Chamber of Commerce Journal, December 1971, p.639.

9. For further details see D.C. Hossack, "Polypropylene Tape: Production and End-uses", Textile Institute and Industry, October 1968, Vol. VI, pp.274-6.

10. In fact polypropylene can be produced either in the form of film and slit into tapes having a rectangular section, or it can be produced in staple fibre form and spun into normal yarn of circular section. It is also available for some uses in non-woven or "spun bonded" form.

11. See E.R. Grilli, "The Future for Hard Fibres and Competition from Synthetics", World Bank Staff Occasional Papers, No. 19, 1975, pp.65-9.

12. See S. McDowall, P. Draper & T. McGuinness, "Protection, Technological Change and Trade Adjustment: The Case of Jute in Britain", O.D.I. Review, 1976, Vol. I, pp.47-8.

13. See Financial Times, 9th April 1969.

14. S. McDowall et al., op.cit., p.48.

15. For a fuller discussion of this see R.S. Gay & J.A. Jenkins,

"Industrial Applications of Textiles", Textile Progress, March 1970, Vol. II, pp.10-22; and B.W. Overton, "Sack applications: woven plastics for heavy-duty packaging", Plastics & Polymers, 1969 Conference Supplement, pp.87-90.

16. This point is clearly made in R. McIntosh, The Changing Face of the Jute Industry, Unpublished D.M.S. Dissertation (Dundee: College of Technology, 1969) p.26. This author suggests that bag making and carpet backing took about 5% of total polypropylene output at the end of the 1960's, although the figure appears to have risen by the early 1970's to around 15%.

17. See Financial Times, 11th June 1966.

18. See E.R. Grilli et al., "Jute and the Synthetics", I.B.R.D. Staff Working Paper, No. 171, 1974, p.43; and also the material in Appendix Table 2.2 to this chapter.

19. See J.T. Grayling, "Polypropylene and its Expanding Horizons", Plastics & Polymers, February 1975, Vol. XLIII, p.37.

20. See source in Ref. 11 above; and I.B.R.D. Staff Working Paper, No. 156, 1973, Annex II.

21. Thus although it was pointed out that over the three years to end 1976 the cost of polypropylene polymer in the U.K. had risen by 250% while raw jute prices had risen by only 50%, this relative price change would not necessarily place polypropylene at a great disadvantage over jute. See Dundee Courier & Advertiser, 9th February 1977.

22. See J. Wiemann, "The Jute Policy of the European Community", German Development Institute Occasional Paper, No. 31, 1975, p.29.

23. The local trade association used to circulate an end-use questionnaire annually for completion by members. It has unfortunately not been possible to obtain the results of this.

24. For example, as a proportion of sales by value, Floorcoverings and Furnishings role from 33% in 1965 to a peak of 67% in 1972 and fell back to 54% in 1976. Comparative figures for Agriculture over these years were 21%, 8% and 17%. See Scott & Robertson Ltd., Annual Reports and Accounts.

25. See M.A. Adelman, "The Measurement of Industrial Concentration", Review of Economics and Statistics, 1951, Vol. XXXIII, p.270.

26. See L. Hannah & J.A. Kay, Concentration in Modern Industry (London: Macmillan, 1977) pp.50-52.

27. See Board of Trade, 1951 Census of Production (Jute, Vol. 6, Trade G) (London: H.M.S.O., 1954).

28. In Census terms an establishment "comprises the whole of the

premises under the same ownership or management at a particular address", and comprises "offices, warehouses and other ancillary places of business situated apart from the producing works". The term "small firms" is also used, where these are assumed to have only one plant or establishment.

29. The 1948 Jute Working Party Report indicated that for 1946 there were 38 spinning establishments and 26 firms; and corresponding figures in weaving were 45 and 36. Jute Industries at that time had 10 establishments in jute spinning and weaving. The same Report mentioned four other multiplant firms: one with 4 establishments, one with 3, and two others with 2 plants each. See loc.cit., pp.24-5.

30. "Leading Industries" (Ref. 1), p.121.

31. Board of Trade (1948), op.cit., Table 11. These figures present an interesting discrepancy between earlier contemporary references to the size and significance of firms such as Jute Industries and Low & Bonar, and the lower Census-derived concentration ratios. Although the gap is large, it may at least be partially bridged by contemporary exaggeration of company size, and also, though less likely, the classifying as separate Census enterprises of subsidiaries of large holding companies.

32. See S.J. Prais, The Evolution of Giant Firms in Britain (Cambridge: C.U.P., 1976) Chs. 1 and 2.

33. See Mr. L.F. Robertson's Precognition to the Restrictive Practices Court (1962) pp.4 and 39-40. The Precognition was kindly lent to the candidate by Mr. Robertson.

34. Ibid., p.9.

35. For example, J. & J. Smart of Brechin was not a full member of the Association, and its acquisition by Don Bros. Buist in the early 1960's is not revealed by the data.

36. These data are from the merger prospectus in Financial Times, 1st April 1965.

37. "Leading Industries" (Ref. 1), p.126.

38. Board of Trade, op.cit., 1948, para. 23.

39. L.R.4R.P., p.423.

40. See for example D. A. Hay & D.J. Morris, Industrial Economics: Theory and Evidence (Oxford: O.U.P., 1979) p.528.

41. In practice using the data in published company accounts undoubtedly understates the extent of vertical integration since other expenses in addition to raw materials and wages are deducted before arriving at the figure for trading profits which ought to form part of the value added. It is not con-

sidered that such a flaw in the data should either produce misleading comparisons of degrees of vertical integration between firms at any one time or distort time-series analysis of vertical integration.

42. The companies concerned were Douglas Fraser, Wm. Fergusson,* T.L. Miller, Ogilvie Bros., W.G. Grant, Don & Duncan, R.G. Kennedy (Textiles), Spalding & Valentine, Tayport Spinning,* Burnside Weavers,* Duke & Lowson, and Alex Henderson*. In respect of the four firms asterisked no record was found of their activities at Companies House in Edinburgh, nor any trace of them in the U.K. Company Index. No explanation for these missing firms was suggested by the staff at the Companies Registration Office in Edinburgh.

43. L.R.4R.P., p.452.

44. See Board of Trade Journal, 16th August 1963, pp.328-9.

45. Loc.cit., 4th September 1964, pp.502-3.

46. Loc.cit., 6th December 1969, pp.1519-21.

47. See J. Wiemann, op.cit., p.3.

48. "Leading Industries" (Ref. 1), p.111.

49. The formal record of the case is contained in L.R.4R.P., pp. 339-484.

50. Low & Bonar Ltd., 1960 Annual Report & Accounts, p.14.

51. Reported in Financial Times, 23rd January 1961.

52. Mr. L.F. Robertson's Precognition, p.96.

53. The legislation under which this case was conducted was the Restrictive Trade Practices Act of 1956. This declared such common price agreements to be illegal subject to the registration and defence of the agreements by the parties in the Restrictive Practices Court. The grounds upon which such agreements might be defended were laid down in the Act at Sec. 21(1), and this circumscribed the way in which any such defence could be conducted. In the case of the seven registered agreements in the jute industry the case for the defence was conducted very largely in terms of Sec.21(1)(e) of the 1956 Act. This permits the continued existence of such agreements "if the removal of the restriction would be likely to have a serious and persistent adverse affect on the general level of unemployment in an area ... in which a substantial proportion of the trade ... is situated".

54. S. McDowall et al., op.cit., p.50.

55. Low & Bonar Ltd., 1961 Annual Report & Accounts, p.17.

56. See Dundee Chamber of Commerce Journal, December 1964, p.241.

57. N.E.D.C., Economic Assessment to 1972 (Joint Textile Committee), (London: N.E.D.C., 1970), p.19.

58. After the decision of the Restrictive Practices Court in March 1963 a Jute Information Bureau was established, and was operated essentially by senior Sidlaw Industries personnel. The Bureau's function was to disseminate information on current prices in the industry to all producers, and it would seem that firms pre-notified the Bureau of intended price increases. This system thus operated as a price pre-notification information agreement; and again it would seem that in this context Sidlaw operated as a dominant price leader. After about three years of operation - by the mid 1960's - the Bureau's activities were terminated as fears had arisen that the authorities would regard its operation as a contempt of the Restrictive Practices Court.

59. L. Hamilton, The Consequences of Abrogating Price Agreements in Three Industries, Unpublished M.Sc.(Econ.) Thesis (University of Hull, 1974) pp.210-11.

60. E.R. Grilli et al., op.cit., pp.17-18.

61. United Nations F.A.O., Impact of Synthetics on Jute and Allied Fibres, Commodity Bulletin Series, No. 46 (Rome: United Nations, 1969) p.11.

62. E.R. Grilli et al., op.cit., p.14.

63. See Dundee Courier & Advertiser, 9th February 1977.

64. See S. McDowall & P. Draper, Trade Adjustment and the British Jute Industry: A Case Study (Glasgow: Fraser of Allander Institute, 1978) p.34.

65. E.R. Grilli et al., op.cit., pp.17-18.

66. For an empirical study of the impact upon profitability of trade protection see T. Hitiris, "Effective Protection and Economic Performance in U.K. Manufacturing Industry, 1963 and 1968", Economic Journal, March 1978, Vol. LXXXVIII, pp.107-120.

67. See Craiks Ltd., 1967 Report & Accounts.

Appendix Table 2.1

U.K. Jute Industry Output ('000 tonnes)

	Yarn	Cloth	Raw Jute Consumption
1945	75.1	49.2	73.1
1946	90.4	52.8	89.1
1947	96.8	57.7	96.4
1948	101.9	59.9	101.6
1949	90.1	51.6	89.9
1950	107.1	64.5	108.9
1951	116.4	69.0	113.7
1952	108.0	65.0	106.7
1953	133.8	77.8	132.2
1954	139.8	82.2	137.7
1955	146.8	87.5	145.6
1956	144.5	90.1	142.1
1957	140.0	82.0	139.6
1958	127.2	73.1	124.0
1959	139.8	81.2	137.2
1960	144.1	83.5	141.4
1961	117.4	69.9	116.7
1962	131.9	78.2	130.7
1963	135.9	81.4	134.7
1964	132.9	78.8	131.1
1965	129.5	75.7	128.9
1966	122.8	73.1	122.4
1967	113.8	64.6	113.8
1968	111.5	59.7	110.8
1969	107.9	52.7	107.7
1970	87.5	40.9	86.7
1971	77.6	32.0	77.7
1972	74.7	26.5	77.2
1973	68.2	24.2	68.9
1974	57.5	20.9	59.3
1975	51.1	16.3	52.5
1976	52.7	16.1	51.9
1977	46.8	13.9	46.3

* Home consumption.

Note: all years are 52-week periods.

Source: Annual Abstract of Statistics (London: H.M.S.O.).

Appendix Table 2.2

Comparative Prices of Jute and Polypropylene Cloth

	Jute Hessian 40" 10 oz.	Polypropylene Cloth 36" 12 x 9
	Prices: cents/sq.yd.	
1967	12.8	20.0
1968	12.3	18.0
1969	13.5	13.5
1970	14.2	11.0
1971	16.0	11.3
1972	19.0	12.0
1973	21.5	12.0
1974	21.5	13.0
1975	24.0	14.0

Source : S. McDowall et al., Trade Adjustment and the British Jute Industry: A Case Study (Unpublished monograph, University of St. Andrews, 1976) p.42.

Appendix Table 2.3

U.K. Manufacturers' Sales of Carpets and Rugs and Linoleum

	Carpets and Rugs*			Linoleum*
	Woven Wool	Tufted	Other	
1945	4.0	0.3		15.3
1946	13.0	1.3		22.9
1947	19.2	1.9		25.1
1948	24.8	2.5		35.9
1949	28.4	2.8		43.1
1950	32.9	3.4		42.8
1951	31.5	4.3		38.8
1952	31.4	4.1		31.1
1953	34.7	6.6		38.6
1954	38.5	7.5		49.2
1955	37.7	6.9		51.6
1956	33.9	7.6		46.4
1957	37.1	3.3	8.1	46.5
1958	38.2	4.9	8.4	47.2
1959	38.1	7.5	7.8	48.7
1960	38.5	9.8	9.0	47.8
1961	35.7	11.1	9.0	42.4
1962	34.9	12.8	12.0	38.0
1963	34.9	..	13.7	30.9
1964	36.1	27.8	16.1	29.2
1965	33.7	32.2	18.6	20.8
1966	32.8	36.0	17.6	16.7
1967	29.8	44.1	18.2	13.5
1968	33.4	49.7	20.0	11.2
1969	32.8	52.9	25.3	8.9
1970	31.8	60.7	26.8	7.2
1971	31.4	70.7	29.7	6.1
1972	33.4	89.7	27.7	5.2
1973	32.6	102.2	27.8	5.6
1974	27.1	102.8	27.3	4.6
1975	25.4	109.7	26.1	4.0
1976	24.1	127.8	24.9	3.9
1977	23.1	123.4	22.7	3.6

* million sq. metres (1 sq. yd. = 0.836 sq. metres).

.. not available.

Source : Annual Abstract of Statistics (London: H.M.S.O.)

Appendix Table 2.4

U.K. Jute Yarn Imports and Exports ('000 tonnes)

	Imports	Production	Exports	Imports/ Home Consumption (%)	
1951	4.9	116.4	3.2	4.1	
1952	0.3	108.0	2.1	0.3	2.6*
1953	4.7	133.8	2.1	3.4	2.6
1954	5.9	139.8	2.2	4.1	3.1
1955	2.8	146.8	3.0	1.9	2.1
1956	0.5	144.5	2.8	0.4	1.2
1957	1.7	140.0	3.9	1.2	1.0
1958	1.6	127.2	2.9	1.3	1.5
1959	2.8	139.8	2.7	2.0	1.8
1960	3.0	144.1	2.7	2.1	2.2
1961	2.8	117.4	3.4	2.4	2.3
1962	3.8	131.9	4.1	2.4	2.4
1963	3.2	135.9	4.1	2.4	2.5
1964	3.8	132.9	3.3	2.8	3.1
1965	5.3	129.5	3.0	4.0	3.4
1966	4.2	122.8	2.4	3.4	2.9
1967	1.5	113.8	1.8	1.3	1.9
1968	1.2	111.5	1.5	1.1	1.5
1969	2.2	107.9	1.8	2.0	1.5
1970	1.3	87.5	1.8	1.5	1.8
1971	1.5	77.6	1.4	1.9	2.4
1972	2.8	74.7	2.7	3.7	2.6
1973	1.5	68.2	3.0	2.2	2.4
1974	0.8	57.5	3.0	1.4	1.3
1975	0.2	51.1	2.4	0.4	1.5
1976	1.3	51.7	3.7	2.6	2.7
1977	2.3	46.8	3.0	5.0	

* 3-year moving average.

Source : Association of European Jute Industries Statistical Yearbook (Paris: A.E.J.I.).

Appendix Table 2.5

U.K. Jute Cloth Imports and Exports ('000 tonnes)

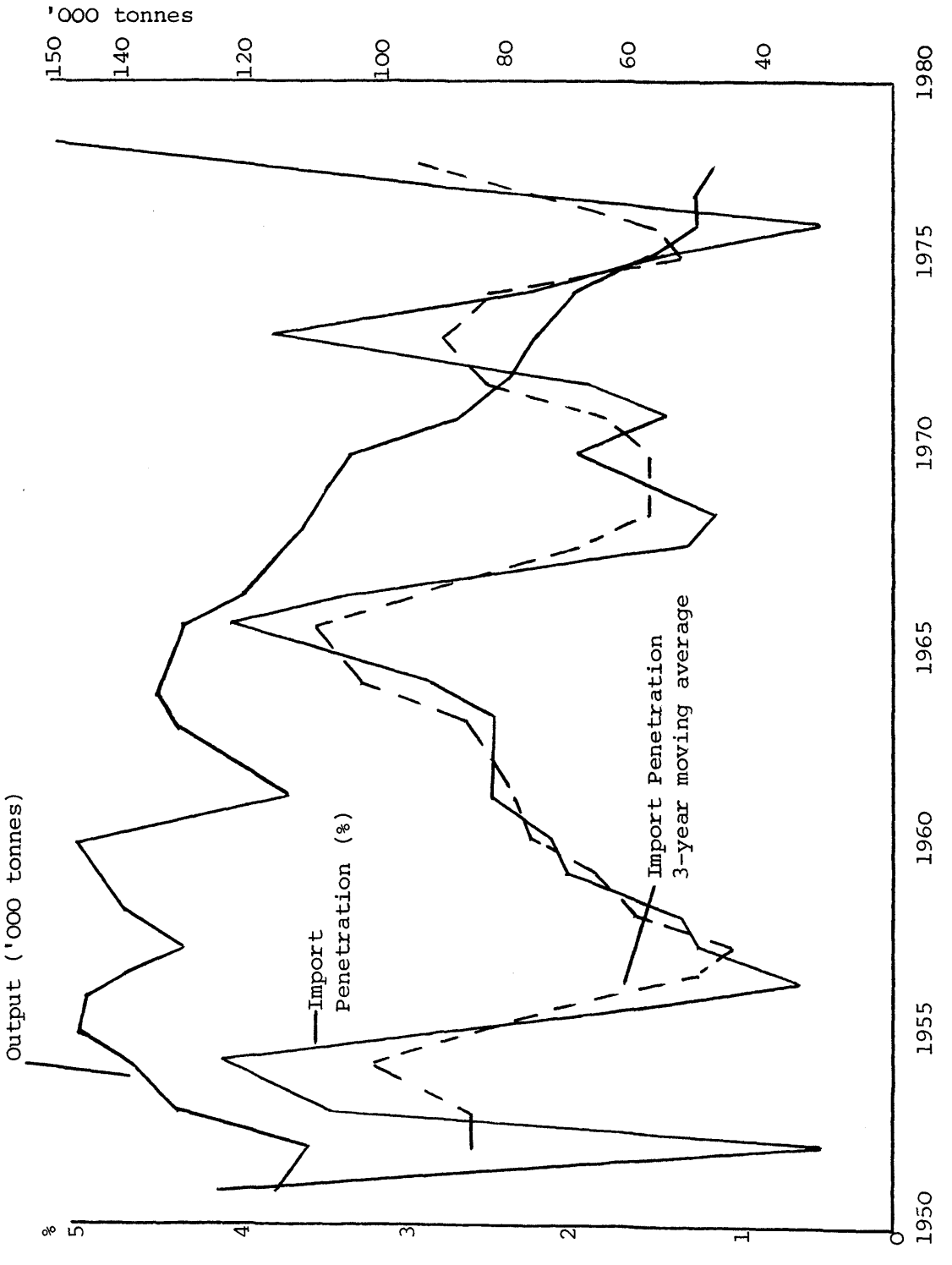
	Imports	Production	Exports	Imports/ Home Consumption (%)	
1951	94.9	69.0	12.8	62.8	
1952	56.8	65.0	11.8	51.6	53.7*
1953	59.5	77.8	9.9	46.7	51.1
1954	87.7	82.2	10.3	54.9	50.1
1955	71.2	87.5	12.5	48.7	49.4
1956	60.9	90.1	14.2	44.5	44.7
1957	49.7	82.0	10.9	41.0	43.8
1958	54.3	73.1	9.2	45.9	44.9
1959	64.5	81.2	10.5	47.7	47.1
1960	65.8	83.5	11.5	47.8	46.5
1961	47.1	69.9	10.1	44.1	45.2
1962	51.9	78.2	11.4	43.7	43.1
1963	49.0	81.4	12.1	41.4	41.8
1964	50.8	78.8	11.0	40.4	37.6
1965	43.3	75.7	8.7	30.9	37.5
1966	46.3	73.1	7.3	41.3	40.7
1967	50.3	64.6	5.5	50.0	47.3
1968	54.9	59.7	6.2	50.6	49.8
1969	43.6	52.7	6.7	48.7	50.5
1970	39.1	40.9	5.0	52.1	51.8
1971	32.1	32.0	5.3	54.6	54.0
1972	27.7	26.5	4.1	55.3	56.3
1973	29.7	24.2	3.6	59.0	57.3
1974	25.4	20.9	2.2	57.6	58.9
1975	20.9	16.3	2.3	60.0	62.5
1976	23.1	15.8	5.9	70.0	66.3
1977	26.2	13.8	2.1	69.0	

* 3-year moving average.

Source : as in Appendix Table 2.4

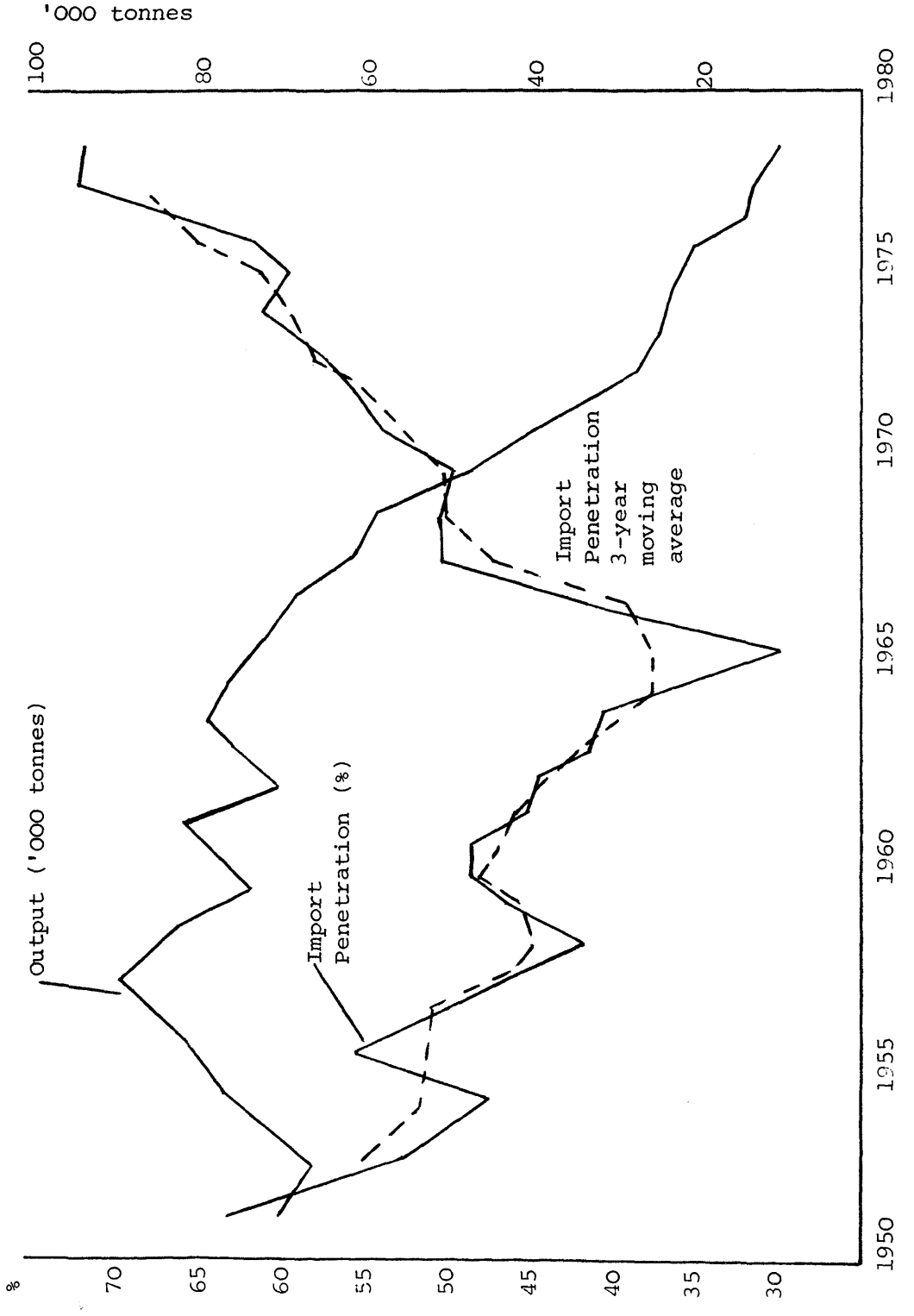
Appendix Table 2.6

U.K. Jute Yarn Import Penetration (%)



Appendix Table 2.7

U.K. Jute Cloth Import Penetration (%)



Chapter III

Diversification

A. Introduction

As mentioned in the Introduction to this thesis, the term Diversification has been adopted to refer to the conduct or behaviour of firms in the industry. As such the term covers a wide spectrum of strategies and attendant issues raised in analysing the behaviour of firms in a market, demand for whose traditional product was under attack both from cheap traditional imports and from new technology in the U.K. itself.

The plan of this chapter is to analyse broadly the response of the former jute firms to the competitive forces mentioned above, to offer short case studies of the progress of a few individual companies, to conduct some statistical tests on company accounting data as they relate to the performance in diversification of the firms, and finally to attempt to draw some conclusions.

The term diversification refers to a strategy on the part of a business firm which takes the company into market areas not obviously or directly related to its existing business. Thus, some of the more obvious forms of business expansion such as manufacturing what was previously bought in, or cases of manufacturers moving into distribution, are referred to as vertical integration; and the term diversification is normally reserved for corporate strategies which involve entering totally new markets.

There appears to have been a trend towards diversification over a large part of British industry during the past twenty years; and "diversified" enterprises now account for a large part of industrial output.[1] What is more interesting are the reasons for this general trend throughout the economy, and for the policy of diversification on the part of individual businesses. The economist must also of course be concerned with the implications of such policies for resource allocation in the economy as a whole.[2]

In respect of individual firms, diversification is normally pursued as a means of achieving a higher growth rate than may be attained within a single market, as a means of reducing the riskiness of earnings associated with dependence upon a single product range, or as a means of escaping from total dependence upon a market which is facing decline. Diversification in this last case may obviously be a prelude to complete exit from a market; and it is with precisely this general situation of diversification in the face of market decline that one is confronted in the case of the Dundee jute industry.

It is recognised in studies of the "jute" industry during the 1960's that a major effort was even then being made by firms to diversify in some broad sense. Leveson, for example, refers to diversification as "perhaps the most important post war development", and instances both the trend towards manufacturing jute products not in competition with the Calcutta mills, and also the adoption of man-made fibres - predominantly polypropylene - to fulfil needs traditionally met by jute. More recently some of the textile manufacturers have been building up their interests in engineering (some of it geared to North Sea oil exploration and drilling), and in activities ancillary to textiles,

such as space dyeing. The result of the former type of diversification within the jute industry, again using Leveson's estimates, was that the Dundee industry moved from a situation in 1950 where it was predominantly dependent upon packaging and sacking to one by the mid-1960's - where such end uses accounted for only about 6% of total output.[3] This change meant that the local industry was much more able to withstand competition from Indian goods; and this was particularly so in respect of the floorcoverings market, where broad cloth of consistently high quality was required for tufted carpet backing. More recently of course the trend has been for former jute businesses to diversify out of this area altogether.

B. Industry Response

Over the period 1945-1977 the total number of firms in what was traditionally the Dundee jute industry fell from 37 to 14. Thus, although the predominant response to the industry's decline has been "death" (i.e. firms ceasing to remain as independent businesses either through total demise or as a result of takeover), a number of firms has survived. Indeed the number of continuing businesses is greater than suggested above on the basis of A.J.S.M. membership, the resignation of some continuing firms from the Association reflecting the diminished importance of jute in their total activities rather than the complete demise of the businesses. Thus, for example, to the 14 full A.J.S.M. members of 1977 one should add back three former full members which continued in business, though without having any jute interests.

Concentrating on continuing businesses, and examining the period from the mid 1960's onwards, it is possible to categorise the response

of these firms to traditional market decline as follows.

Table 3.1

Response of Continuing Firms to U.K. Jute Industry Decline

Continuation of traditional business	Traditionalism
Partial adoption of new technology	Hesitancy
Full adoption of new technology	Innovation
Seeking of new outlets for traditional product	Reorientation
Diversification into "related" fields	Diversification
Diversification into "unrelated" fields	Conglomeration

Although these categories include most of the policies followed by the original jute manufacturing firms, many of the businesses involved have, often simultaneously, followed more than one policy. The categories are, therefore, not mutually exclusive, nor has it been possible to measure realistically the proportion of the total industry at any one time falling into any particular category. The titles in the right-hand column of Table 3.1 are adopted for "shorthand" purposes in the following paragraphs. The problem with trying to measure in any exact way this type of behaviour is not simply one of devising watertight compartments into which firms can be placed, but also that of putting accurate dates upon events and measuring the significance within a firm's total business of certain ventures without the aid of data breaking down company sales or turnover.

Within these limitations, however, and in terms of the 17 firms which continued in independent existence from the early 1960's to 1977, one can suggest the following breakdown into the categories outlined in Table 3.1.

Table 3.2

Responses of Individual Firms

Category	Number	%
Traditionalism	4	24
Hesitancy	1	6
Innovation	7	41
Reorientation	1.5*	9
Diversification	2	12
Conglomeration	1.5*	9
	17	101**

* The response of Sidlaw has been equally divided between these two categories

** Error due to rounding.

Perhaps surprising is the proportion of firms (around a quarter) which have continued in the traditional business of jute spinning and weaving - either spinning woven carpet yarns or weaving sacking. The explanation, however, is that one of these firms is a subsidiary of a larger enterprise which provides the Traditionalist with a captive market (the Victoria Spinning Co. is a subsidiary of woven carpet makers B.M.K.). Of the other three firms in this category, one is in a state of decline resulting from a reduction in orders from established sources, competition in the traditional fibre from more aggressive firms which still produce jute carpet yarn, and displacement by polypropylene. In fact this firm (Buist Spinning Co.) closed down in 1979 and its premises were acquired by Scott & Robertson. The second of these three firms, Wm. Cleghorn, employs some 30 people very largely in preparing jute waste for use as roofing felt. The third enterprise is the Taybank Jute Works of the C.W.S. In common with the remainder of the industry in general, the scale of operations at Taybank has contracted

over recent years. Employment, however, has fallen by only around 25% in the decade to 1977; and in that year the firm employed 415 persons in spinning and weaving. Although the firm was at one time heavily vertically integrated with the Co-operative movement (with a large output of coal and flour bags), 98% of turnover is now accounted for by non-Co-operative sales. Of spinning capacity, two-thirds is for woven carpet wefts, in which market Taybank is estimated to be the third largest producer after Sidlaw and Scott & Robertson. The remaining one-third of spinning output goes to weaving: half to the firm's own looms, half to weavers with none or insufficient spinning capacity. Taybank's own woven output goes overwhelmingly (around 75%) to the roofing felt trade, with smaller amounts going to car-assembly, brattice cloth and minor packaging end uses. This unit has thus survived without adopting polypropylene technology by modernising its spinning capacity to serve the woven carpet industry, and concentrating woven jute output in non-standard markets for which the scale of demand does not attract Indian competition, and in respect of which polypropylene is not presently a substitute. This strategy could not, of course, have been followed by all firms. Traditionalism has, nonetheless, allowed one or two units, including a relatively large employer such as Taybank, to survive in a rapidly contracting market.

The category of Hesitancy includes only one firm; but is of more than passing interest. The situation is one where the firm concerned has undertaken weaving of polypropylene bags on jute-weaving machinery. This has obviously minimised the commitment (financial and technological) of the firm to the new fibre; and although it is possible only to produce unsophisticated goods using this approach (mail bags and coal sacks etc.) this partial adoption of the new technology has allowed

one firm to survive.

The vast bulk of the former jute spinning and weaving firms which have survived have done so by fully adopting the new technology of polypropylene. These are firms which weave polypropylene tufted carpet backing and bags on wide looms designed for this purpose, and which in a number of cases also extrude polypropylene in tape form from granules or chips supplied by the petrochemical industry. It should not be forgotten that such firms may also continue to spin and weave jute. Some of the Innovators, in our terminology, did in fact cease jute spinning and weaving shortly after making a major investment in polypropylene extrusion and weaving. Low & Bonar is the best example of this. Other Innovators, however, such as Don Bros. Buist and Scott & Robertson, continue to spin and weave jute as well as extruding and weaving polypropylene. Such businesses, therefore, continue to compete against the Traditionalists above; the former usually having much more sophisticated jute operations, and therefore limiting the scope for survival of the latter.

Under the heading of Reorientation have been placed the smaller firm of Craiks of Forfar, and also half of the strategy of Sidlaw Industries. These two firms have spent considerable efforts in entering the market for Hessian wall coverings. In the case of Sidlaw the sum is estimated at around £2m. over the five years to 1977. This involves making a fairly high quality of cloth for use as a wall covering, either in its natural or "loomstate" form, or following the application of a pattern or dye. This is a market where jute has taken over from flax on the basis of price; and in general the appeal of Hessian wall coverings is based upon cheapness and the fashion

element of a natural fibre. So far as the jute manufacturers are concerned, this market has two significant characteristics. First, the product is very largely sold loomstate to the decorative wall-covering firms such as Sandersons, so that the final marketing of the goods is not in the hands of the jute firms themselves. Second, although the market for the goods has expanded considerably over the past four or five years, it is overwhelmingly an export one (to Europe and the U.S.) with all the attendant risks of fashion change and dependence upon the external value of Sterling.

Diversification, as the term is used in Tables 3.1 and 3.2, has been a strategy adopted by two firms, both having used their previous experience of the spinning of woven carpet yarn to move into the carpet manufacturing industry. One firm has moved into woven carpets, the other into tufted carpet printing and backing. In both these cases the firms appear to have acknowledged that competition was too great in the traditional jute market, that economic forces appeared to favour the continued survival in the traditional market of the large firms rather than smaller concerns,[4] and that carpet manufacture or printing represented a means of survival involving relatively limited capital outlay and again a limited amount of new technology.

Into our category of Conglomeration fall one small firm and part of Sidlaw's strategy. Again it is worth repeating here that there is an element of judgement involved in placing companies into the various categories, and conceivably other firms could have been classed as Conglomerates. Low & Bonar, for example, has had a very significant heavy electrical engineering subsidiary (Bonar Long) since the immediate post-war period, and has recently developed its own floor-

covering interests (Flotex). The predominant feature of the group has, however, been innovation through Polytape in extrusion and S.F.S. in tape weaving. H. & A. Scott, likewise, has an engineering subsidiary, Lomax & Smith; but again the dominant feature of the firm's strategy has been polypropylene extrusion and tape weaving.[5] Thus Sidlaw and Malcolm, Ogilvie have been formally categorised as Conglomerates because the expansion of their interests unrelated to industrial textiles has been a significant and characteristic part of their strategy for survival. In the case of Sidlaw (detailed in Section C below) this has taken the firm into hardware wholesaling and operations ancillary to North Sea oil exploration and drilling (another area in which Low & Bonar also have interests). As regards Malcolm, Ogilvie, which in 1968 had fewer than 500 employees, although diversified interests (basically Fibro spinning) have not been successful, the "conglomeration" into continuous casting of high quality bronze alloy, begun in the early 1960's, has taken over the company's jute interests with much success.[6] In both of these cases the firms appear to have been prepared to branch out into markets quite unrelated to textiles; and it is interesting that such a policy has been followed by two firms at the opposite ends of the size spectrum within the group of traditional jute manufacturers.

In Chapter II it was noted that firms in the market covered by this study had died either as a result of being acquired by competitors or simply through closing down from a lack of traditional jute spinning or weaving business. This process halved the number of independent businesses formally in the industry in the decade from 1966-1976. This chapter has concentrated upon the surviving firms, and in this section a general view has been presented of how firms used the

strategies of diversification for survival. That the adoption of some strategy was essential may be seen if one is reminded of the decline of the industry up to 1977. Taking 1967 as a base year (100), output of yarn and of cloth had fallen by 1977 to an index level of 41.1 and 21.4 respectively, employment on a similar basis had fallen to 52.3 (although, as noted earlier in Chapter II, the employment statistics probably underestimate the decline in the market), and the number of firms in the industry had (by our formal measure) fallen by 53%.

The predominant response of the surviving firms has been fully to adopt polypropylene technology, although it should again be emphasised that this had not precluded some firms from continuing with jute spinning and weaving at the same time; nor has it precluded such firms from spinning other fibres such as nylon or rayon, or having some non-textile operations.[7] Innovation has fortunately been a strategy open to firms of markedly different size. There appears to be no particular entry barrier to the new market either in terms of large initial capital expenditure, nor in the form of loss of economies of scale by operating with a small number of looms for tape weaving, or "lines" for extruding. (The statistical relationship between firm size and growth is examined in Chapter IV.) It may then be asked why the other firms in the industry did not follow a path of "innovation"; and this question should be applied both to surviving firms and to those which died. With regard to non-surviving firms, much of the answer to the question lies in individual, often family, circumstances. As mentioned in Chapter II, the majority of the firms which failed to survive the 1960's were small, family owned/managed, non-integrated weaving concerns. Their market for tufted

carpet backing and packaging disappeared so quickly to polypropylene that a very rapid decision was forced upon them. To many, the untried technology and additional finance required for entry into polypropylene may have appeared as considerable barriers. Coinciding as these issues did for some firms with additional problems of family succession, such factors may simply have hastened an already largely inevitable decision to terminate the business operations. Among surviving firms, entry into polypropylene was rejected for more positive reasons; although among the firms classed as Traditionalists (and even the single Hesitant) above one either has to recognise exceptional circumstances or to regard the current survival as temporary rather than long-term. Those firms which have chosen a strategy of reorientation, diversification or conglomeration have rejected polypropylene either because there have been forces in their background pulling in another direction (Thomson, Shepherd, for example, had a strong carpet background having been one of the original jute carpet manufacturers), because they felt that they had a special advantage in relation to a unique product (as in Caird's space-dyeing operations, or Malcolm, Ogilvie's continuous bronze casting), or because they felt that by the early 1970's manufacturing capacity in polypropylene tape weaving was becoming almost excessive relative to carpet backing and other demand.

Thus an account of the strategy of diversification across the industry as a whole reveals a situation where, although most firms embraced the new polypropylene technology wholeheartedly, other directions for diversification were found, and where some continuing firms have so far avoided diversification altogether. In the following section a series of short case histories is presented whose

aim is to allow one further to analyse the economic process of diversification, and, together with the results of the statistical analysis in Section D. below, to allow one to arrive at more detailed conclusions in the final section of this chapter.

C. Case Histories

Although the diversification of jute firms is often thought of as being a fairly recent phenomenon, some firms were clearly anticipating a declining future for jute even in the mid 1950's. Leveson's data (ref. 3 above) indicate the results of earlier policies. Thus the chairman of Low & Bonar warned in 1956:

> "During the past year it has become clear that at present price levels in the U.K. jute's position as a packaging material for certain commodities is being more and more challenged by competition from substitutes such as paper and from bulk handling. ... Spinners in the United Kingdom ... are now faced with having to fight off the competition of substitutes by ever-increasing cuts in profit margins, and possibly even by cutting into actual production costs."[8]

Among the smaller companies at this time, Caird (Dundee), for example, recognised that its acquisition of James Prain constituted a valuable non-jute expansion in the current climate.[9]

What these examples indicate is that the recognition of a need to diversify away from an undue dependence upon traditional jute end-use markets was something which had existed for some time in the Dundee industry prior to the late 1960's. It is also a reminder of the fact that diversification of a kind had been going on over this period insofar as Dundee firms had left the cruder jute markets

for sacking and packaging (which Jute Control was gradually opening up to Indian competition throughout the 1960's) and were concentrating upon woven carpet yarns and tufted carpet backing by the mid 1960's - the latter market being in its early years largely an export one to the United States. It was the rapidity of the loss of this latter market to polypropylene in the late 1960's which introduced the need for a much wider strategy of diversification; and it is upon this wider strategy that the analysis in the case histories concentrates. What this section does is to trace the history of diversification in some of the individual firms, and note the motivation, direction and success or otherwise of such a strategy in individual cases.

Low & Bonar Group :

The experience of Low & Bonar exemplifies many of the issues in this area. On the one hand it appears to have been quite far-sighted in recognising the need for moving away from dependence upon jute. On the other, the firm does not always appear to have fully anticipated the "teething" problems of entering new markets and adopting new technologies. Frequently there appear to have been delays in bringing new plant into operation. A final problem faced by many diversifiers was that of moving into a new market area only to find competition there much more severe than anticipated; and in some cases this type of situation was aggravated by a cyclical downturn in demand for such products.

Low & Bonar's diversification has involved the development of new fabric in packaging, and also operations in engineering. Thus in the mid 1950's it developed a plastic proofed tarpauling - Flaxtite - and

also entered into a joint venture to produce transparent packaging made of cellulose film. These policies continued through the development of more sophisticated heavy-gauge polythene sacks - Lobosacks - and by the late 1960's into polypropylene and the company's new product, Flotex - a synthetic floorcovering produced through electrostatic flocking.

The major non-engineering diversification venture has of course been that of polypropylene. Low & Bonar commenced production in 1967 on the basis of two subsidiary companies jointly held with Sidlaw Industries (which in 1977 sold its share to Low & Bonar which then became the sole owner of the two firms). The principal market, to begin with, was tufted carpet primary backing. Since then, however, the Group's subsidiaries Polytape and Synthetic Fabrics (Scotland), operating respectively as extruders and tape weavers, have expanded into other markets for polypropylene. A distinguishing feature of Low & Bonar, however, has been its additional interest in engineering. After World War II the company acquired a controlling interest in Bonar, Long - a transformer manufacturer; and by the mid 1950's had pushed further in this direction by the formation of Sturrock Power Installations in the electrical contracting field, and through Bonar, Long's expansion into switchgear and, later, capacitors. The latest developments in this general area have included the formation of component engineering subsidiaries both to service Bonar, Long and to sell outside the Group (Dudhope Engineering, Logan Engineering, and Haddingtonshire Fabricators), and also the establishment of a service company for North Sea oil exploration and drilling operations. In addition to these the company also has its own subsidiary for producing printing cylinders for the packaging market - Gravure Cylinders. This last company also sells to outside

customers.

Low & Bonar's diversification has not, however, been without its problems. In engineering in particular the problem has been that of operating in markets where output has been subject to a cyclical pattern of demand. In the case of transformers, for example, home new orders rose from around £33m. in 1959 to a peak of almost £70m. in 1963, and then fell again to under £45m. in 1968.[10] The result of this was severe competition and low prices in the late 1950's and very early 1960's, an expansion of earnings up to about 1964, and a subsequent downturn of profits and prices. Thus although Bonar, Long's pre-tax profits expanded from £163,222 in 1959 to £671,007 in 1963, the years which followed witnessed, in the words of successive Annual Reports, "very intensive competition and depressed prices", "minimal profit margins", and again prices which were "wretchedly low". Some idea of the impact of this swing over the 1960's may be gained from the following data.

Table 3.3

Low & Bonar Ltd.: Share of "Engineering" in Pretax Earnings (%)

1960	10.7	1965	27.5	
1961	23.7	1966	27.0	
1962	27.0	1967	25.5	
1963	40.4	1968	10.2	
1964	38.9	1969	(7.6)	i.e. loss

Source : Annual Reports & Accounts

To some extent the Group has suffered similarly in the field of transparent packaging. Here the firm met increased competition and

narrowing profit margins in the early years of its expansion into this market; and competition appears to have remained keen throughout the 1960's. Again, as in the case of jute and heavy electrical equipment, demand for packaging, being a derived demand, is heavily dependent upon the general climate of demand in the economy and, in the case of packaging, the volume of international trade. Thus the packaging subsidiaries' results during the 1970's were disappointing; and the Group's expansion in this area has most recently been by way of acquisition - through the purchase of Bibby & Baron (Holdings) in 1976.

Table 3.4

Low & Bonar Ltd.: Share of "Packaging" in Pretax Earnings (%)

1973	46.5	1975	31.5	1977	23.3
1974	66.3	1976	26.5		

Source: as in Table 3.3

The other characteristic of diversification apparent from Low & Bonar's experience is the longer-than-expected time scale involved in bringing some diversification projects on stream. Such new operations often appear, in addition, to have taken longer than anticipated originally to make a contribution to the company's profits. This latter phenomenon is possibly due to the former plus the adoption of a "conservative" depreciation policy in respect of risky capital-intensive projects. It may be claimed that this is a phenomenon well recognised in business circles, and that "outsiders" adopt an unrealistically short time horizon in expecting new business ventures to generate returns. Indeed the chairman of Low & Bonar warned shareholders in 1955 that

"New developments and new businesses do not become worthwhile profit-earners overnight". Nonetheless, one feels that by any standards the gestation period of some new ventures has been protracted. For example, the transparent packaging interests of the company in the mid 1950's seem to have encountered technical difficulties as well as poor prices before making a contribution to profits. More recently the company's Flotex project, which began in 1972, does not yet (1977) seem to have contributed any profits to the Group. The company earlier admitted in the case of polypropylene that "a good deal of know-how and technical expertise are required to produce a suitable fabric"; but Flotex appears to have presented more intractable problems. Thus, in addition to the inevitable starting losses in 1972, the company admitted in 1973 that "teething troubles ... were taking longer than had been anticipated"; and despite progress in 1974 (Flotex was still making losses), 1975 was a year in which this division "experienced serious technical problems". In 1976 losses approached £½m. on a turnover of just over £2m., while in 1977 sales increased by about 10% but losses remained at around 1976 levels.

Sidlaw Industries:

Low & Bonar's experience has been dealt with at some length because it represents not only a more complex form of diversification in the industry, but also because it highlights some of the significant problems for firms in this policy. The other major company in this market - Sidlaw Industries - has pursued a much more cautious and limited policy of diversification. This company continued for some time into the 1960's to base its activities upon jute; and some 60% of output was geared to floorcovering markets. This covered both jute yarn and cloth

for carpets and linoleum. Thus despite isolated references to the possibility of using spare factory capacity for non-jute goods, the firm continued to demonstrate its faith in its traditional market by re-equipment with technologically advanced jute plant.[11] Even by the early 1970's the company's view was that it intended to remain "pre-eminent within the jute industry";[12] and on this basis was still looking forward to "being able to maintain a profitable jute manufacturing activity for some years ahead".[13]

Nonetheless the need to plan for a future in which jute faced a declining demand from traditional users seems to have been something of which Sidlaw was aware, according to discussions with senior executives. Indeed, at one stage a full-time director was appointed with the sole remit of seeking out appropriate acquisitions; and an American consultant was employed for a similar purpose. As the senior management viewed the position, Sidlaw had only a limited range of options open to it. Acquisition of some of the more efficient of its smaller competitors was on the face of it attractive as a short-term proposition, and was indeed, as noted in Chapter II, implemented to a small extent. But this was not regarded as a long-term solution; and even in the shorter term was felt likely to raise the question of monopoly power in the industry, with a possible response from the Monopolies and Mergers Commission. Other options considered were those of investing abroad, or of integrating forward into carpet manufacture. The latter was, however, rejected on the grounds that existing customers would have been antagonised: a very large part of Sidlaw's yarn and cloth output was already going into woven and tufted carpets by the mid 1960's. It must also have been recognised that to the extent that the ups and downs of the jute industry's fortunes during the 1960's had largely been those

of the floorcoverings market, there would be no escape from these through integrating into a section of the floorcoverings market itself.

Despite the above reasoning, Sidlaw's major diversification at the end of the 1960's was into the closely related polypropylene field; and it was achieved, at one remove as it were, by taking a minority stake in the two Low & Bonar subsidiaries Polytape and S.F.S. These developments were initially on a fairly small scale. By the end of the 1960's less than £½m. had been committed - and more than two-thirds of the company's turnover and profits still at this time came from U.K. spinning and weaving of jute.[14]

In addition to its associate investment in polypropylene, Sidlaw, from the late 1960's onwards, acquired facilities for manufacturing other man-made fibres. These were predominantly rayon and nylon, and were designed to serve the markets for tufted carpet face yarns and children's clothing.[15] The final stage of Sidlaw's diversification programme (coming in the view of one senior manager with the acession of Sir John Carmichael to the chairmanship of the company in 1970) has seen the farthest spreading of the firm's interests from its traditional jute base. In 1972 the company acquired both a hardware wholesaling concern (P. & R. Fleming), and also a stake in the North Sea oil servicing industry through the acquisition of Aberdeen Service Co. (North Sea). Nonetheless the former venture cost £506,000 and the latter £72,000, compared with the expenditure of £1.5m. the same year in respect of South Mills (Textiles). Sidlaw's non-textile ventures have within the period of our study represented a small part of the company's expansion strategy; and while it may be suggested that P. & R. Fleming carried out a "merchanting" function with which Sidlaw was familiar through its jute

operations, one senior executive at Sidlaw frankly admitted that the Aberdeen Service Co. venture was "a step in the dark".

From 1970 onwards Sidlaw began to reduce its dependence upon jute. But in doing so the firm entered into a situation in which it was faced with poorer returns on its traditional investment in jute while not yet reaping the full rewards of its diversified investment. Speaking of the position in the early 1970's the chairman commented

> "The company is in a difficult state of transition. On the one hand, it is not easy to earn a satisfactory level of profits on jute manufacturing when competitive products are becoming increasingly penetrative because of price advantages. On the other hand, profits from the expansion of other activities and entry into new activities have to bear not only development charges but also finance charges until new installations become commissioned and profitable."[16]

Sidlaw's diversification appears to have been somewhat haphazard in its conception, and carried out without full commitment by the firm. The company sought to participate in the oil-related prosperity of north-east Scotland, not only directly through Aberdeen Service Co. but also through "associate" investments in offshore supplies, hotel services and property development (Seaforth Maritime, and Grampian Land); and a similar approach appears to have been adopted with regard to its general engineering and hardware/household goods business diversification. (The firm withdrew from the latter area in 1980.) This is an example, therefore, of a business which has diversified on a rather cautious basis. It has frequently remained close to its textiles/carpeting base; it has expanded principally by acquisition; and some of its diversified enterprises appear to be operated on a "portfolio" basis rather than incorporated into the main business.

Caird (Dundee):

Some of the smaller businesses have followed a different path of diversification, and have moved with success away from their original dependence upon jute spinning and weaving into totally new areas associated with man-made fibres. Caird (Dundee), for example, moved into rayon spinning in the mid 1950's, beginning with the acquisition of James Prain; and although there appear to have been initial difficulties with new equipment, the company continued to pursue a policy of reducing its dependence upon jute, which it recognised could not compete on a price basis with new synthetic packaging materials, and the use of synthetics in other traditional jute end-use areas.[17] The problems of the decline in demand for jute were aggravated in this case by Caird's having committed itself after 1945 almost exclusively to the linoleum industry. Considerable capital investment had been made in the immediate post-war period in broad looms, and the company had a large share of the market for quality backing for linoleum. Thus in the 1960's in addition to cutting back its hessian output in adjustment to the rapid decline in demand for linoleum backing,[18] and producing wider cloths for tufted carpet backing, the firm significantly enlarged its synthetic fibre blending and spinning capacity geared towards the production of carpet pile yarn. Caird, in common with other firms in the market, entered the polypropylene market in the late 1960's - in this case through a joint venture with Smith & Nephew, initially geared to sack and bag production. In the first instance Caird was in fact merely selling bags and sacking made from Smith & Nephew polypropylene.

However, a distinguishing feature of Caird's diversification

programme was that in the long term it chose not to rely upon polypropylene or other synthetic fibres in a direct sense. Indeed although, as mentioned earlier, one of the attractions of the James Prain acquisition of 1956 was the synthetic yarn capacity of the latter, production of this yarn ceased at the end of 1971, only 18 months after the firm had closed its jute works. Caird's new policy involved working on a commission basis for carpet manufacturers, initially in the space dyeing of yarns which enabled tufted carpet manufacturers to produce a colour finish similar to popular woven carpets,[19] and latterly through tufted carpet printing[20] - again initially on a commission basis.[21]

The space dyeing project began in 1969 with a capital investment of £500,000, and additional systems were installed in 1971 and 1972. But in common with other firms' experiences of diversification, this did not prove to be an immediate panacea for the company's ills. Despite the chairman being able to report in 1968 that "non-jute interests now form a substantial part of our business", a sterner warning about undue optimism was delivered to shareholders the following year.

> "Rumours were circulating earlier in the year about the enormous potential of the space dyeing development, which it was suggested would transform the company's fortunes in a relatively short period. I think it is only right, therefore, that I should put this in its proper perspective. I would remind shareholders that your company is still primarily a jute manufacturing company and that the greater part of both the fixed and current assets are invested in this activity. While the newer developments, i.e. Polyweave, the spinning of synthetic fibres and space dyeing will represent an increasing proportion of the turnover in the future the limited capital available for their development will inevitably mean that it will be some time before they can grow to the extent necessary to carry the bulk of the overhead expenses and adequately remunerate the company's capital. We

> have no option, therefore, but to continue to be primarily a jute company for some time ahead and this is bound to be reflected in our profits."[22]

In fact the company suffered over this period from a downturn in demand for tufted carpets, from technical problems in bringing into operation space dyeing equipment, and competition in building up sales of polypropylene products. Rationalisation resulted in the company sinking the largest part of its resources into space dyeing - this venture constituting "by far the most important of our activities" according to the chairman in 1971; and by the early 1970's the firm had invested some £1.5m. in space dyeing, had sold off its polypropylene interests, closed down its synthetic yarn spinning plant, and terminated its jute commitment.

However, 1973 saw the beginning of the second phase of Caird's expansion - tufted carpet printing. Caird realised that it had somewhat saturated the space dyeing market, and that carpet printing was in any case taking over from the space dyeing of carpet yarns. With space dyeing capacity working at only two-thirds of potential, the firm invested heavily in carpet printing plant - about £2.5m. having been spent in the first half of the 1970's. Developments over the past few years have continued to favour the carpet printing side of the business, and a natural expansion of this has been to move into carpet tufting. The final move into carpet backing (i.e. secondary backing with foam) was begun in 1976; and this, of course, brought the company back into closer contact with a business which it had left almost a decade previously. This latest phase of Caird's development has been encouraged by the high transport costs of its U.K. and international customers in sending "white" tufted carpet to Caird for printing and

return. The company thus expanded initially into offering a tufting service, and in 1976 installed carpet backing capacity - still operating on a commission basis. One interesting further development of Caird's new total involvement in carpet manufacture is that carpet wholesalers can commission the firm to supply carpets to their specific requirements; and it has been suggested that this provides wholesalers with a product at much lower cost. Caird also sells a limited amount of its output through its own shops, and has added to its carpet range in recent years by using the weft laying process to produce shag-pile carpets.[23]

The case of Caird (Dundee) illustrates a number of interesting phenomena. First, the firm has gone through a series of stages in its diversification strategy. From a total dependence upon jute, the firm added synthetic pile yarn spinning and polypropylene weaving in the 1950's and 1960's respectively. These, however, together with jute, were phased out by the early 1970's. Space dyeing was invested in heavily in the early 1970's, but suffered from problems of over-capacity in the market as a whole and rapid market and technical obsolescence as carpet printing became a technically feasible way of satisfying changing tastes in the carpet market. The latest phase of investment (carpet printing), begun in 1973, was therefore necessary; and a final development, again caused by competition and capacity problems, has been vertical integration into tufting and backing, and to a minor extent forward into carpet retailing, with the result that the firm is now very largely a carpet manufacturer. Some indication of the phasing out of old interests and the introduction of new ventures can be gained from the following data.

Table 3.5

Caird (Dundee) Ltd.: Disaggregated Annual Output

	Jute ('000 tons)	Space Dyeing ('000 tons)	Carpet Printing ('000 sq.yds.)
1964	13.4	-	-
1965	14.5	-	-
1966	12.8	-	-
1967	7.8	-	-
1968	6.9	-	-
1969	6.1	-	-
1970	1.0	0.8	-
1971	-	2.5	-
1972	-	4.6	-
1973	-	5.7	479
1974	-	4.9	2,191
1975	-	3.4	3,444

Source: calculated from graphs in J. Manson, The Major Changes Undertaken by Caird (Dundee) Ltd. in their Diversification, Unpublished D.M.S. Dissertation (Dundee College of Technology, 1976).

Second, Caird has exhibited financial and technical problems of diversification. The company found difficulty in raising the sums necessary to finance the space dyeing project of the late 1960's; and delays occurred in implementing the carpet printing project until sufficient profits had been generated from the dyeing operations to fund it. Like other firms too, the process of implementing new projects was not without its technical problems. Manson speaks of such ventures "not (being) accomplished without many teething troubles".[24] Specifically with regard to its new ventures in the 1970's, the company found that the space dyeing operation "had taken longer than we ancitipated to build up";[25] and in respect of carpet printing that "the operation of a plant of this type calls for a high degree of skill and expertise and the running in period can be costly

and can last for a considerable time".[26]

Scott & Robertson :

A roughly similar history, so far as reduced dependence upon the jute industry is concerned, was experienced by Scott & Robertson - the result of a merger in 1965 between James Scott & Sons and Robertson Industrial Textiles. By the time of the merger the group had already moved into paper packaging as well as the spinning of man-made fibres, in addition to its traditional broad-loom jute interests. The jute interests were very largely geared to tufted carpet backing, although circular loom capacity was devoted to sack manufacture. By the late 1960's and early 1970's the firm was moving into new fibres: recognising, in the chairman's own words, "the limitations and difficulties which bear upon the jute producing industry".[27] In fact the following year saw the closure of part of the group's jute weaving capacity, and a further extension of the company's man-made fibre activities. The company has nonetheless maintained a presence in the jute industry through woven carpet yarn spinning - the chairman commenting in 1973 that "we have every intention of continuing our jute manufacturing business. I believe that despite the changes which have taken place in the whole reformation of the jute industry in Dundee, there will be left a reduced but viable and profitable trade".[28] The company has, however, continued to expand its commitment to man-made fibres - in common with other firms in the industry establishing subsidiaries outwith the Dundee area nearer supplies of raw materials and major markets. Again in common with other businesses which have diversified into new technology, Scott & Robertson's new ventures have not been without their teething problems. One Annual Report speaks

of the effectiveness of expanded operations being "severely impared by a number of mechanical and design faults in the new plant".[29] The company now, however, appears to have achieved a desired balance between its traditional fibre markets and those based upon new technologies.

Thomson Shepherd & Co.:

As a final example of individual-company strategy one may take a less obviously successful case of diversification, where the company has been acquired by a large international non-textile firm. Thomson Shepherd, which in 1946 added rayon spinning to its predominantly jute carpet business, ceased manufacturing furnishing fabrics in the mid 1950's, and by 1963 had also ceased production of jute carpets after "heavy losses". The firm's other interests at this time continued to be the manufacture of jute yarn, and Fibro (rayon) spinning - the latter based upon raw material from Courtaulds. With the decline in its jute carpet business the company established an engineering subsidiary. Bristol Tool & Gauge (Scotland) Ltd. was bought in 1960 and renamed Seafield Tool & Gauge after the location of the firm's main works. At the same time the company moved into wool carpet manufacture. Production of quality Wiltons began in 1958, and the acquisition of Darville Carpets of Monifieth in 1961 added Axminster to the company's range.[30]

The company's strategy was at that time based upon three broad interests: yarn spinning - Fibro and jute; carpets - jute initially, and a wool at a later date; and engineering - Seafield was added to by Dundee Metal Spraying Co. in 1967. In carpets and yarn the

company suffered from lack of size and an inability to enter the man-made fibre industry on a sufficiently large scale. For example, in 1970 it lost a regular Ministry of Defence contract for its own carpets because of the adoption by the Ministry of new contract procedures favouring large firms. The company estimated that at that time the loss cost it some 15-20% of its carpet turnover. Similarly in 1970, the company experienced "failure of a new product for which we and the trade had high hopes". In the late 1960's the firm suffered from a downturn in woven carpets which affected its own woollen sales and also demand for jute yarn for woven carpet backing; and in 1972 the firm closed down its own viscose rayon spinning unit on the grounds that it was being operated on too small a scale to be profitable. These factors, together with an unfortunate bringing on stream of new textile plant in 1967 just as demand in its various markets was falling off, contributed to poor profits.

Finally, the company's diversification into engineering failed because of an overdependence upon subcontracted jobs. In the late 1960's some customers were lost through bankruptcy as the general level of engineering activity fell; and other customers began taking work back into their own shops which had previously been subcontracted to Seafield. The engineering subsidiaries were thus closed down in 1971, the company having realised, in its own words, that "instead of acting as an insurance against decline in our other activities, they had become a liability".[31] The company then decided to concentrate its efforts largely in woven and tufted carpets, and has recently increased tufted carpet making capacity significantly.[32]

D. Statistical Tests on Diversification

Sections B. and C. of this chapter analysed the conduct or behaviour of firms in the Dundee jute industry in terms of their diversification strategy in largely descriptive terms. Thus an analysis has been offered at an aggregated level of the extent and directions of diversification among the 17 surviving firms in the industry over the period 1965-1977 (Tables 3.1 and 3.2 above); and individual case studies of patterns of diversification within single firms have also been reported. In this section it is intended to use the knowledge of the firms' diversification policies (by interviews with senior management in all of the businesses concerned, as well as by reference to other sources and journal articles) to analyse the impact of diversification at a statistical level.

The first requirement for this analysis was to produce two groups of firms, referred to as Diversified and Non-diversified. It has to be accepted that the basis of classification here is subjective and impressionistic rather than one which is statistically validated. The relevant factors involved in the classification are the extent of non-jute interests, the extent to which firms have adopted new technologies (and so entered new end-use markets), and the relatedness or otherwise of new markets to traditional ones. Taking these criteria, the following classification was adopted.

Table 3.6

Classification of Firms for Analysis of Diversification

Diversified	Non-diversified
Caird (Dundee)	Buist Spinning Co.
Don Bros. Buist	Craiks
Wm. Halley	Hardie & Smith
Low & Bonar	Sidlaw

Malcolm Ogilvie
H. & A. Scott
Scott & Fyfe
Scott & Robertson

Thos. Thomson
Thomson Shepherd
J. & D. Wilkie

This produces a categorisation of 8 Diversified and 7 Non-diversified companies, comprising those 15 firms for whom the necessary information was available over the period 1967-1977.

The next part of the analysis involves deciding what it is that one expects diversified firms to achieve which would distinguish their performance from that of non-diversified firms. Three areas of performance are specified which permit of statistical analysis.

1. Profitability levels (average over 10 years)
2. Profit variability over 10-year period
3. Growth of assets, sales and employment.

The a priori assumption is that diversified firms would have enjoyed higher average profits than non-diversified firms, or would at least have maintained their earlier level of profits. It is also assumed that the variability of rates of return on capital employed over time would be lower for diversified than for non-diversified firms. Finally, it is assumed that the growth rates (of assets, sales or employment) for diversified firms would be higher than in respect of non-diversified firms.[33] In the following tests profit rates are measured relative to the U.K. manufacturing industries average in any year, and growth rates are measured in real terms by reference to appropriate price indices. The first test comprised a simple comparison of means of the various measures, distinguishing between the two categories of firms, and applying a one-tailed t test in the a priori predicted direction. Because of the incidence of

losses and negative growth rates arithmetic rather than geometric means were used. The results were as follows.

Table 3.7

Analysis of Mean Performance of Diversified and Non-diversified Firms

		Diversified (8)	Non-Diversified (7)	t
i.	Mean profit ratio 1968-77 (%)	11.7	7.1	1.0455
	Standard deviation	6.1	9.5	
ii.	Mean profit ratio 1971-77/1968-70	1.344	1.672	0.4706
	Standard deviation	1.124	1.387	
iii.	Average profit variability (residual variance around linear trend) 1968-77	41.8821	130.3715	1.4409*
	Standard deviation	36.7001	156.8743	
iv.	Average coefficient of variation of profit ratios 1968-77	66.5	81.2	0.5385
	Standard deviation	55.9	40.0	
v.	Mean annual asset growth rate 1968-77	1.9	-6.5	1.9091**
	Standard deviation	8.5	7.3	
vi.	Mean annual sales growth rate 1968-77	2.4	-1.2	1.1250
	Standard deviation	6.0	5.3	
vii.	Mean annual employment growth rate 1969-77	-0.7	-4.2	1.1290
	Standard deviation	6.3	4.8	
viii.	Mean opening size :			
	Assets (£'000 1967)	2,881	1,461	0.6320
	Standard deviation	4,924	2,703	
	Sales (£'000 1967)	6,155	3,002	0.7146
	Standard deviation	9,406	5,820	
	Employment (number 1968)	1,098	1,008	0.1119
	Standard deviation	1,021	1,813	
ix.	Mean income per employee 1968-70 (£'000)	0.699	0.630	1.3529*
	Standard deviation	0.058	0.120	

* difference significantly different at 10% (one tailed)

** significant at 5% (one tailed)

The differences in the mean values between the two groups were all in the expected direction with the exception of indicator ii. above relating to profits maintenance. This measure was used to try to determine if, regardless of the actual level of profits, diversification had allowed firms to maintain their existing level of profitability. On this basis the answer, perhaps surprisingly, appears to be no.[34] With regard to the other indicators, iii. was significant at 10%, and the sign of the difference indicates that diversification, although apparently not significantly contributing to increased profitability, can reduce the time variability of profits. Indicators v., vi. and vii. above present an interesting contrast, and also reinforce the need to use different measures of size in this area of statistical testing. The difference in the mean annual asset growth rates was significant at 5% in the expected direction. However, the sales growth rates were not significantly different, and neither were those for employment. The most plausible explanation for this is the more capital intensive nature of the activities of the diversified companies; and it would thus be rash to conclude that in any other sense diversification had contributed to growth. Thus the results relating to diversification and growth in respect of this sample of firms do not confirm the general impression gained in other studies (ref.33).

It was also decided to test at this stage the hypothesis that diversification and size might be related. The assumption of a relationship between size and diversification seems fairly plausible. Large firms are likely to have the professional staff expertise and access to new capital with which to plan and finance diversification. The divorce between control and ownership in such firms may not only result in as great if not a greater emphasis upon growth than in

smaller firms, but also widen the area of perceived market opportunities beyond the confines of a single industry, giving such firms in Penrose terms an enlarged "productive opportunity".[35] The results for this group of firms on diversification and size are presented as indicator viii. in Table 3.7 above, and show quite clearly that there was no difference in opening size between the diversified and non-diversified companies. While in respect of each size measure diversified firms were indeed larger than non-diversified (in terms of assets and sales they were twice as large), there was such a diversity of size within each group that one cannot argue that the two groups were significantly different in size.

Finally in Table 3.7 (indicator ix.) the average incomes per employee in the opening part of the period 1968-1977 (1968-1970) were compared between the two groups of firms. This was done in order indirectly to test the hypothesis that a high technical personnel ratio or quality of staff might be conducive to a policy of diversification on the part of a firm. That is, as in the case of firm size, the diversification variable is dependent upon a high technical personnel ratio as suggested at ref.38. below. For our purpose the independent variable is the average income per employee in each firm over the period 1968-1970 expressed in 1967 terms by reference to the index of earnings for employees in the jute industry given in Appendix Table 4.2 of Chapter IV. The case for adopting this variable is that higher incomes per employee may indicate either that the workforce as a whole within the firm is more highly paid than that of others, or that if shopfloor wages are similar between firms then companies with higher incomes per employee have a greater proportion of their total workforce accounted for by more highly paid managerial staff. In either

case, but more particularly the latter, one would assume that such a higher level of average incomes per employee would be associated with a higher quality of staff which may in various ways assist the firm in following a policy of diversification.[36] In fact the data on this variable in Table 3.7 indicate that there was a significant difference in the levels of incomes per employee between our two groups of firms.

Multiple linear regression was also used to try to establish the contribution of diversification to profitability, profit variability (as measured in Table 3.7) and growth (of sales). Three linear multiple regression equations were used.

1. Profitability = f(Size, Growth, Diversification)
2. Profit variability = f(Size, Growth, Diversification)
3. Growth = f(Size, Profits, Diversification).

Using this analysis, and incorporating diversification as a dummy variable having a value of 1 for Diversified firms and 0 for Non-diversified firms, yields the following results.

Table 3.8

Linear Regression of Profits, Growth, Size and Diversification

Dependent variable: Profitability

	Constant	b*	t	r*
Size (average)	7.8	0.00011	0.6958	0.2054
Growth	(1.2581)	0.91244	2.9965**	0.6704
Diversification		0.74073	0.2130	0.0641

Multiple R^2 = 0.5164 F = 3.916** DW = 2.2261[37]

* partial coefficient

** significant at 5%

Table 3.9

Linear Regression of Profit Variability, Size, Growth and Diversification

Dependent variable : Profit Variability

	Constant	b*	t	r*
Size (average)	130.89	-0.00236	0.8149	-0.2384
Growth	(1.1934)	-6.05879	1.1318	-0.3230
Diversification		-56.04758	0.9170	-0.2665

Multiple R^2 = 0.2897 F = 1.496 DW = 2.4951

*partial coefficient.

Table 3.10

Linear Regression of Growth, Size, Profits and Diversification

Dependent variable : Growth

	Constant	b*	t	r*
Size (opening)	-4.5	-0.00016	0.6928	-0.2045
Profitability	(0.9889)	0.50194	3.1157***	0.6847
Diversification		1.70579	0.6900	0.2037

Multiple R^2 = 0.5255 F = 4.061** DW = 2.5715

* partial coefficient
** significant at 5%
*** significant at 1%

With regard to the contribution of diversification in the multiple regression in Tables 3.8 to 3.10, although again the signs of the b coefficients are in the expected direction, none of them is significant at 10%.

Table 3.11

Zero Order and Partial Correlation Coefficients with Diversification

	Profits	Profit Variability	Growth	Size (average)
Partial	0.2733	-0.3730	-0.1387	0.0028
Zero Order	0.2474	-0.2784	0.3093	0.4949

The data in Table 3.11 emphasise the need for the use of partial correlation coefficients. These correlation coefficients, relating diversification to profits etc., do so (in our case) on the statistical basis of the other variables being equal among all firms. This is particularly necessary when some of these other variables are related both to each other and to diversification. For example, size is fairly closely related to both profit variability and to diversification: the (zero order) Spearman rank correlation coefficients of average size (by sales) with profit variability and diversification are -0.5321 and 0.4949 respectively, which are signficant at 5% and 10% respectively. The partial correlation coefficient table above gives one a measure of the relationship between diversification alone (and not size) and profit variability. It is particularly interesting to note the contrast between the zero-order and partial coefficients in respect of growth and size with respect to diversification.

Finally with regard to linear regression, diversification was treated as the dependent variable, and profitability, size, growth and employee income were chosen as independent variables. The total degree of explanatoriness of these four independent variables was low and the DW statistic revealed signs of autocorrelation. This latter finding is not of course surprising given the dichotomous nature of the dependent variable. The detailed results were as follows.

Table 3.12

Linear Regression of Diversification, Profitability, Size, Growth and Employee Incomes

Dependent variable: Diversification

	Constant	b*	t	r*
Profitability	-0.51	0.00532	0.1983	0.0626
Opening Size (Sales)	(0.9273)	0.00000	0.1993	0.0629
Growth (Sales)		0.01683	0.4544	0.1422
Average Wage (1968-70)		1.43670	0.8024	0.2460

Multiple R^2 = 0.1979 F = 0.6166 DW = 0.8586

* partial coefficient.

These results indicate quite clearly that factors economic or managerial other than those included in the present analysis appear to have a much greater impact upon diversification than those chosen above. Indeed interestingly if one analyses the data for Table 3.12 in terms of stepwise regression, then of the degree of explanatoriness of 19.79% (R^2) offered by the independent variables taken together, 13.70% out of 19.79% is contributed by the fourth independent variable relating to employee incomes. Also from Table 3.12 there appears, perhaps surprisingly in the light of the circumstances of this individual industry, to be no indication that firms which wished to grow found it necessary to diversify.

Nonparametric tests are particularly suitable for investigating a phenomenon such as diversification where we are concerned with a variable which can be measured only on a nominal or classificatory scale (in our case firms are either Diversified or Non-diversified), and where the number of observations is small. We therefore tested for the impact of diversification upon profitability, profit variability and growth, using nonparametric tests relating to two independent samples, and applying one-tailed tests of significance in the directions indicated in the foregoing analysis using parametric tests.

The results of the nonparametric tests were as follows.

Table 3.13

Nonparametric Tests of Diversification

Association of Diversification with:	Fisher's Exact D	Mann-Whitney U*	Randomisation t**	Rho
Profitability	2	0.198	1.0455	0.2474
Growth (Sales)	3	0.232	1.1250	0.3093
Profit Variability	5	0.168	1.4405***	-0.2784
Opening Size (Sales)	2****	0.036****	0.7143	0.4021***
Average Wage 1968-70	2	0.095***	1.3529***	0.3712***

* results given in terms of probability of observed U under H_o, one-tailed test.

** this t is to be interpreted on a nonparametric basis. On this and on these tests in general see S. Siegel, Nonparametric Tests for the Behavioural Sciences (Tokyo: McGraw-Hill Kogakusha, 1956) Ch. 6. These results correspond to the parametric t test in Table 3.7.

*** significant at 10%, one-tailed.

**** significant at 5%, one-tailed.

The results of the range of nonparametric tests confirm our earlier univariate statistical conclusions on both the "causes" and the impact of diversification. There appears on the basis of the nonparametric tests to be evidence at this level of a relationship between diversification and profit variability in the expected direction, and in particular between diversification and opening firm size, and between diversification and our measure of the quality of labour.

E. Conclusions

The bulk of the material in this chapter has been concerned with reporting the results of an analysis of diversification strategies at a

number of levels. The final section affords an opportunity to knit together a number of themes which has emerged. Rather than summarising the findings of Sections B., C., and D., the purpose of the conclusions section is to draw simultaneously upon those approaches to analysing diversification conduct. The themes which have emerged in this chapter are the need for diversification in a declining market, the directions of diversification, the characteristics of diversifying firms, the contribution of diversification to company performance, and the problems encountered by firms in pursuing diversification strategies.

No market which contracted so rapidly as that for traditional jute products could do so without imposing the need for considerable adjustment on the companies involved. Company deaths on a fairly significant scale followed the onset of technological competition from polypropylene in the late 1960's. However, diversification has not been totally necessary for survival in the market. Some three or four companies (including one fairly large unit) have survived without the adoption of new technology. It must also be remembered that jute continues to be a fairly significant part of the operations of firms such as Don Bros. Buist, and Scott & Robertson, as well as Sidlaw and Craiks who have sought new markets for jute in the area of decorative wallcoverings. Thus despite diversifying firms continuing with jute operations, spinning and weaving of jute alone has for some businesses been a viable strategy for survival.

So far as directions of diversification are concerned, the product which displaced jute from many of its end-use areas - polypropylene - has not been adopted by all firms. For some businesses carpet

manufacturing and engineering operations have taken the place of jute with success in the longer term.

Obviously, however, the major strategy followed by continuing firms in the market has been diversification into polypropylene - either weaving slit tape into cloth or also undertaking the extrusion of polypropylene film. One question which arises is whether those surviving firms which have diversified can be identified by any particular statistical characteristic. Firm size is one such variable which suggests itself; either in terms of the effect of the size variable itself or other company characteristics which may accompany size, such as a separation of professional management control from hereditary family ownership.[38] Existing share of the traditional jute market may be another important variable regarding the extent of diversification. Family management, however, is such a pervasive characteristic of this industry that one cannot use its incidence as a means of distinguishing between diversifying and non-diversifying firms. In particular, some of the most successful diversifying firms of all sizes over the period from the mid 1960's to the mid 1970's were controlled and led by shareholding entrepreneurs. One thinks here of the Tough family at Scott & Fyfe, the Low family at Don Bros. Buist, and the Low and Bonar families in the Low & Bonar Group. Company size, as brought out in Table 3.12, is not a significant determinant of diversification; although the results of the nonparametric tests contradict this. In some respects the finding of the parametric tests is surprising, as one might have thought that in respect of a diversification strategy requiring adoption of a new technology which was not only more definitely "science-based" than jute, but also significantly more capital intensive, size would have been a considerable

advantage, or even something of a prerequisite for successful diversification.[39] But despite the need for large capital sums for investment in polypropylene weaving (around £32,000 per 5-metre loom in 1977), neither large initial capital requirements nor economies of scale (or diseconomies through operating at a relatively small scale or low degree of vertical integration) seem to have constituted barriers to entry to smaller firms to the league of diversifiers. So far as the influence of existing market share of the traditional jute industry is concerned and its influence upon diversification policy, those firms which were dominant in the former market - such as Sidlaw, and Scott & Robertson - appear to have put more effort into remaining in the market than other businesses, large or small, whose dependence upon jute was less.[40] While in one sense this is not surprising, it does on the other hand suggest that even where a firm is otherwise well equipped for diversification, a high market share in the traditional industry may act as a brake upon necessary adjustment to new technologies and markets.

An obvious question in this analysis is, did diversification help firms to grow, to increase profits or reduce profit variability? None of the results of the tests gives conclusive positive evidence on this. Although the results in Table 3.7 and the nonparametric tests in Table 3.13 suggest that diversified firms did achieve lower profit variability, no such result appeared from the regression analysis in Table 3.9. Likewise Tables 3.8 and 3.10 revealed no relationship on a multivariate basis between diversification and either profitability or growth (of sales) when other factors such as size, growth and profitability were taken into account. These results could be the outcome of misclassification of the firms in Table 3.6. This,

however, is not felt likely to be a major factor. It may more likely be the case that the results of diversification among firms following this policy have taken some time to come through - much longer than the 10-year period analysed;[41] or that not diversifying may in the short run produce not dissimilar results from diversifying, i.e. poor or variable profitability, or low growth (of sales). Furthermore, if the strategy of diversification was commenced by our Diversified population at different times within the 1968-1977 period, and if the results of such policies came on stream with different speeds, this would tend to produce very heterogeneous responses by those diversified firms - for which hypothesis there is some evidence in Table 3.7.

A final theme which has persisted through the case studies has been that of the difficulties of managing some diversified interests, the encountering of unexpected problems, and the much-longer-than-expected time for the emergence of profits from new ventures. Engineering, interestingly, is an area into which many traditional jute firms have entered, but in which few have been successful in the long term. Don Bros. Buist, Halley, Thomson Shepherd, and H. & A. Scott are examples of companies which have either entered and left the engineering industry within the last 15 years, or whose engineering subsidiaries have remained relatively unsuccessful.[42]

In general, management of diversifying firms appear to have encountered a number of unforeseen technical problems in diversifying;[43] and a further common experience among such firms has been the failure of diversified areas of business to generate earnings sufficiently quickly to compensate either for the large amounts of invested capital or to cover declining profits in traditional textiles. The prospect

of this hiatus may have discouraged or precluded smaller firms from following a policy of diversification. Although this situation has been commented on in the case studies by the chairmen of nearly all of the major firms, the data which perhaps best illustrate the problem are those of a smaller company.

Table 3.14

William Halley & Sons Ltd.

	Spinning, Manufacturing and Merchanting of Textiles*		Distribution of Motor Cars, Agricultural and Horticultural Implements	
	Sales (£'000)	Margin** (%)	Sales (£'000)	Margin** (%)
1968	2,420	6.4	1,632	1.2
1969	2,159	6.2	1,708	1.0
1970	1,946	2.2	1,955	1.8
1971	2,536	(3.0)	2,017	1.6
1972	3,707	1.6	2,816	2.3
1973	4,601	1.8	3,379	2.8
1974	5,294	6.0	3,359	2.8
1975	4,181	0.6	5,405	2.9
1976	4,994	6.5	6,750	2.5
1977	5,773	7.1	9,021	4.4

* In the case of Halley this includes synthetics as well as jute.

** Profit Margin is the pre-tax profit in each sales area as a proportion of turnover.

Source: Company Annual Reports & Accounts.

In the absence of data for capital employed in each area, one can only note the gradual buildup of non-textile sales: from some 40% in 1968 to around half in 1971, and to about 61% in 1977. In respect of average profit margins, the 10-year arithmetic mean for Textiles was 3.5% compared with 2.3% for non-textile activities; although the variability is greater with respect to Textiles, and there is a more distinctly upward trend in the non-textile area. The chairman of the

company himself in this case emphasised the long-term nature of the rewards from diversification, and the short-term pressures on profits and liquidity. Such problems were due "in the main to the time lag between building up profitable diversifications, which utilise much capital, whilst at the same time maintaining the capital employed in our jute manufacturing activity, which is declining in profitability".[44]

As a final point, it may be noted that, although this study has not been able to shed any light on some of the more sophisticated hypotheses regarding diversification,[45] so far as the results of the multivariate parametric tests relating to firm size, profits or profit variability and diversification, or the tendency for an inverse relationship to exist between industry growth and the extent of firm diversification, the findings of this study are largely consistent with those of more specialist analyses in the field insofar as these are directly comparable.[46]

The material in this chapter, dealing with the market conduct or behaviour of firms, has allowed us to indulge in few generalisations. Admittedly there have been some common features relating to the firms in the industry over the period from the mid 1960's to 1977. Most, but by no means all, of the surviving firms from the traditional jute industry have entered the polypropylene field. For most of the diversifying businesses, but again not for all, diversification has been a difficult policy to implement, and for a variety of reasons which this study has not been able fully to investigate. Beyond this few generalisations are possible. Variables such as the size of the firm, the quality of its workforce (and perhaps especially of its management), or the attachment of a business to the traditional jute industry may also have had an influence on market conduct at the

company level. We can only conclude here that with respect to their response to the rapid contraction of the jute industry local firms behaved in a variety of ways with varied outcomes. The following chapter seeks to examine these outcomes at the industry level in more detail under the heading of market performance.

References

1. See P.K. Gorecki, "An Inter-Industry Analysis of Diversification in the U.K. Manufacturing Sector", Journal of Industrial Economics, 1975, Vol. XXIV, pp.131-46; D.F. Channon, The Strategy and Structure of British Enterprise (London: Macmillan, 1973); and M.A. Utton, Diversification and Competition (Cambridge: C.U.P., 1979).

2. These are rather complex issues which defy brief exposition. The candidate has tried to throw some light on them in Industrial Economics: An Applied Approach (London: Macmillan, 1978) Ch. VI.

3. See J.H. Leveson, Industrial Organisation of the Jute Manufacturing Industry, Decline and Diversification (Dundee: College of Technology, 1973) pp.7 and 16-17.

4. Taking employment as a measure of size, these two firms in 1968 had 651 and 639 employees, compared with 5,104 at Sidlaw and 2,573 at Scott & Robertson.

5. Again Wm. Halley owns a motor vehicle and horticultural implement distribution agency, but they too can be thought of as being primarily innovators.

6. For further details see "Malcolm Ogilvie Expand Interests", Cordage, Canvas and Jute World, 1970, Vol. LI, pp.72-78; and "Dens Metals", Scotland, April 1965, pp.12-16.

7. Don Bros. Buist temporarily in the early 1960's had an electronic engineering subsidiary.

8. Low & Bonar Ltd., 1955 Annual Report & Accounts, pp.16-17.

9. Caird (Dundee) Ltd., 1957 Annual Report & Accounts, p.3.

10. Ministry of Technology data quoted in D. Swann, D.P. O'Brien, W.P.J. Maunder & W.S. Howe, Competition in British Industry (Loughborough: The University, 1973) p.107.

11. In 1964, for example, the company embarked on a £200,000 modernisation scheme at one of its mills; and two years later a further £500,000 was authorised for the same purpose at another mill.

12. Quoted from Dundee Chamber of Commerce Journal, September 1971, p.585.

13. Sidlaw Industries Ltd., 1971 Annual Report & Accounts, p.3.

14. See Chairman's statement in Economist, 17th February 1968.

15. The subsidiaries acquired were Thomas Gill & Sons of Yorkshire in 1968, and South Mills (Textiles) of Dundee in 1972.

16. Sidlaw Industries Ltd., 1971 Annual Report & Accounts, p.2.

17. This was, as the Caird chairman pointed out earlier, not merely a case of the up-to-dateness or otherwise of plant. Raw jute accounted for more than 50% of the price of finished goods in many cases.

18. Over its 1964 accounting year the firm experienced a 40% fall in demand for hessian backing for the linoleum industry. See 1964 Annual Report & Accounts, p.3.

19. Space dyeing involves the application of various colours to a nylon yarn which has first been knitted into a tubular fabric. This "sock" passes through the various dyeing processes which ensure that the dyes are applied and sealed on to the material. Once these processes have been completed, the tubular sock is de-knitted or rattled down and wound on to cones which become the basic raw material for tufted carpet manufacture. The effect of tufting with space-dyed yarns is to produce a carpet with semi-random elements. Prior to the advent of carpet printing, this was a very popular style of carpet on the Continent, and some 90% of Caird's output was for Continental tufters.

20. Carpet printing simply involves printing a pattern on to a "white" tufted carpet. The dyes are applied by a series of tubular rollers, each containing a different colour and contributing a separate section of the pattern. The tufted material passes round four to twelve rollers which apply the colours. These dyes are then fixed on to the material by chemical processes, after which the carpet is washed and dried before it is completed by the application of a secondary backing.

21. The recent downturn in demand for carpets, amongst other factors, encouraged Caird to "go vertical", and 95% of the company's carpet printing output is now in respect of its own production of tufted carpets.

22. Caird (Dundee) Ltd., 1969 Annual Report & Accounts, p.4.

23. These details were obtained from a Caird senior executive, and from J. Manson, The Major Changes Undertaken by Caird (Dundee) Ltd. in their Diversification, Unpublished D.M.S. Dissertation (Dundee College of Technology, 1976).

24. Loc.cit., p.11.

25. Caird (Dundee) Ltd., 1970 Annual Report & Accounts, p.4.

26. Loc.cit. (1973), p.3.

27. Scott & Robertson Ltd., 1970 Annual Report & Accounts, p.3.

28. Loc.cit. (1973), p.8.

29. Loc.cit. (1975), p.8.

30. See Dundee Chamber of Commerce Journal, December 1973, pp.675-78.

31. Thomson Shepherd & Co. Ltd., 1971 Annual Report & Accounts.

32. The firm is no longer independent. In 1962 the company, which had until then been owned by the Shepherd family, became an associate of Clermiston Holdings - largely through the Shepherd family selling their shares. By 1966 Clermiston held 57% of the ordinary shares. Further changes in share ownership in 1976 have resulted in the company becoming a subsidiary of Reed International.

33. The likely relationship between diversification and growth is complex. Growth may lead to or cause diversification. That is, diversification may be a function of growth, in the sense that firms with growth ambitions may prefer to or have to satisfy these in markets beyond their primary base if to expand in this base market would lead to serious competition with existing market rivals. A strategy of diversification would be even more imperative here if the primary market is a static or declining one, as is the case in the particular market studied here. Diversification, however, may also facilitate growth. That is, achieved growth may be a function of the existing extent of diversification if diversified enterprises are exempt from the existing market bounds to growth mentioned immediately above. In each case the relationship between growth and diversification is assumed to be positive, and this is the finding of a number of U.K. studies. It is the causal link which is uncertain. See J. Hassid, "Diversification and the Firm's Rate of Growth", Manchester School, March 1977, Vol. XLV, pp.16-28.

34. The test used here was the parametric t test for studying differences between the means of two small samples. See R.D. Mason, Statistical Techniques in Business and Economics (Homewood, Illinois: R.D. Irwin, 4th ed. 1978) pp.294-6.

35. See J. Hassid, "Recent Evidence on Conglomerate Diversification in U.K. Manufacturing Industry", Manchester School, December 1975, Vol. XLIII, at pp.384-7; and E.T. Penrose, The Theory of the Growth of the Firm (Oxford: Blackwell, rev. ed. 1980) p.31.

36. It is realised that some part of this argument ignores other factors such as the tendency for wage levels to vary according to firm size and the proportion of jute/polypropylene work. The size variable is taken account of in the multiple regression in Table 3.12. See C. Craig et al., "Abolition and After: The Jute Wages Council", Department of Employment Research Paper No. 15, Department of Employment, October 1980, pp.44-48.

37. The Durbin-Watson statistic is used to test for serial correlation among the residuals in the least squares regression. That is, it seeks to detect any curvilinear relationship between the dependent variable and the independent variable(s) when the regression equation is measuring the linear relationship. For all of the regression equations in this chapter a two-tailed test for auto-correlation has been used, and unless otherwise indicated the test reveals an absence of such autocorrelation at the 10% level. See W.C. Merrill and K.A. Fox, Introduction to Economic Statistics (New York: Wiley, 1970) pp.415-6.

38. It has been suggested at the general level that increased "professionalism" among managers over the past decade or so has been responsible for the trend towards diversification; and statistical analysis suggests that the "technical personnel ratio" is a significant independent variable in explaining diversification trends. See K.D. George, "The Changing Structure of Competitive Industry", Economic Journal, Special Issue 1972, Vol. LXXXII, pp.355-7; and J. Hassid, "Recent Evidence on Conglomerate Diversification in U.K. Manufacturing Industry", Manchester School, December 1975, Vol. XLIII, pp.388-9.

39. Utton in his study found some evidence of a positive relationship between diversification and company size among the top 200 U.K. manufacturing enterprises in 1974. The relationship appears to apply across all S.I.C. manufacturing industry Orders, but is not generally a very strong one. In the case of our sample of firms casual observation does not suggest a strong relationship in this direction, and parametric statistical analysis is made difficult by the smallness of the sample and the skewed size distribution of the firms. This may be a particular case where the findings of the nonparametric statistical are more reliable. For a brief summary of Utton's findings see M.A. Utton, "Large Firm Diversification in British Manufacturing Industry", Economic Journal, March 1977, Vol. LXXXVII, at pp.103-7.

40. It is interesting to note that in 1967, while other jute manufacturers were together spending some £1.5m. in polypropylene weaving investment, Sidlaw was investing around £1m. at its Manhattan and Douglasfield works installing new jute spinning equipment to produce high-quality yarn for woven carpet manufacture. See "How Jute Meets the New Situation", Dundee Chamber of Commerce Journal, December 1967, pp.595-7.

41. For evidence on this see R. Biggadike, "The Risky Business of Diversification", Harvard Business Review, May-June 1979, pp.103-11.

42. See "The Development of Don Bros., Buist & Co.", Dundee Chamber of Commerce Journal, March 1963, p.1317.

43. Leveson suggests that many more initial technical problems were encountered than firms were prepared to discuss with him in interviews with senior management. See J.H. Leveson, op.cit., pp.42-7.

44. William Halley & Sons Ltd., 1972 Annual Report & Accounts.

45. For example, on the relationship between diversification and research and development expenditure, the relative contributions of internal and external diversification, or the relationship between industry profit margins and diversification.

46. See the references in the literature in refs. 1 and 38 above, and A. Wood, "Diversification, Merger and Research Expenditure: A Review of Empirical Studies" in R. Marris & A. Wood (eds.), The Corporate Economy (London: Macmillan, 1971) Appendix C; M.A. Utton, "Diversification, Mergers and Profit Stability", Business

Ratios, Spring 1969, pp.24-27; L.R. Amey, "Diversified Manufacturing Businesses", Journal of the Royal Statistical Society, Ser. A., 1964 Part II, Vol. CXXVII, pp.251-90; and S.A. Rhoades, "The Effect of Diversification on Industry Profit Performance", Review of Economics and Statistics, May 1973, Vol. LV, pp.146-55.

Chapter IV

Economic Performance

A. Introduction

The major concern of any economic study of an industry must be the way in which the market has operated over a given period. In more formal terms one is examining the resource-allocation and welfare aspects of the market mechanism in a particular area. The concern of the industrial organisation economist is both less formally stated and more open-ended. Bain, for example, defines market performance as "the composite of end results which firms in any market arrive at by pursuing whatever lines of conduct (or behaviour) they espouse".[1] Thus one purpose of presenting the material in this chapter is to bring together data on such "end results" which can be used in arriving at more general conclusions in the final chapter. In this particular case the market performance has been analysed in terms of dimensions reflecting company "financial" performance,[2] the use of labour, investment and modernisation, and research and development. In the final section of this chapter conclusions are offered on the findings detailed in the earlier sections.

As usual in economics studies a severe limiting factor in the analysis is the availability of raw data. None of these below is perfect for the purpose for which it is used; but the data are believed to be the best available. This situation with regard to raw data often means that the economic conclusions cannot be as strongly drawn as one would like. As the advice of R.G.D. Allen below indicates, the

whole issue is one of judgement and balance: perhaps nowhere more so than in the area of economics.

> "The job of the statistician is to get material of the greatest possible accuracy and then to make the best use of it. He should not, however, discard imperfect data if nothing better is available. Not even the most subtle and skilful analysis can overcome completely the unreliability of basic data, but the best can always be made of a bad job. Some material, so rough as to be insufficient for fine analysis, may still support particular conclusions. The skilled statistician knows where he can proceed and where he must stop."[3]

The analysis of market performance in this chapter is carried out at a number of levels. The first function of the data is simply to present measures of economic performance, the characteristics or variables being chosen on the basis of what microeconomic theory regards as being the relevant and salient factors in exploring market performance. The variables chosen here are "financial" measures of performance, measures of labour usage, measures of investment, and of research and development. The data under these headings have been drawn from both primary and secondary sources.

The second purpose of measuring market performance is to use the data gathered as a basis for testing hypotheses based upon microeconomic theory, and for establishing statistical relationships. Thus in addition to simply measuring company profitability, growth, labour productivity, and levels of investment or research it is desirable to measure the trend of the variables against time, to measure the degree of association or explanitoriness between variables, and so arrive at conclusions regarding the relative importance of the range of variables.

The third purpose of measuring individual aspects of market

performance in this study is to formulate conclusions both with regard to performance overall and also in the context of the study as a whole.

Although the individual statistical tests used in each case will be discussed in their specific context, a word needs to be said here about statistical tests in general. First, the statistics used here are to be interpreted as a summary of what the data tell us. Since we are dealing with a relatively small number of observations in each test, and since these constitute our population rather than a sample, the underlying conditions for statistical inference are not necessarily present. Any such findings are of course valid only in respect of our group of firms over our restricted time period. Second, the type of statistical test required in this area of inquiry is one which will measure trends, differences and association so as to allow one to infer economic relationships from the data. There are broadly speaking two types of tests available: parametric and nonparametric. The former require that certain assumptions be made about the population from which the sample statistics are drawn. The most significant for our purpose is that the data in the populations are normally distributed; the other principal one is that populations being compared have equal variances. There is evidence to suggest that the former of these two conditions does not hold for many economic data of the type being analysed here.[4] Thus for our purposes nonparametric or "distribution free" statistical tests are appropriate, and have been used along with the more traditional parametric tests. It is also the case that non-parametric tests are more appropriate where the number of observations is fairly small, as is certainly the case in this study.[5]

B. Company Financial Performance

The function of this first section is to appraise the financial economic performance of those firms falling into the jute industry category: performance here being defined by reference to standard accounting ratios, and thus reflecting only these aspects of a firm's performance.

One of the major difficulties here is that of linking company financial performance as analysed below, and economic efficiency, at either the firm, market or national level. In some respects our additional analysis under other market performance headings will enable us to qualify and extend the results of the accounting analysis. One must nonetheless bear in mind certain qualifications in assuming any correspondence between company and economy performance. These two phenomena have been separated under the respective titles of "business efficiency" and "economic efficiency" by Amey; and only under very restricted conditions, it is argued, can the latter be equated with the former.[6] In most microeconomics studies a firm's profits (expressed as a ratio of its capital employed) are accepted as a measure of the efficiency or surplus created by the excess value of output over the value of the resources used. However, this acceptance, when translated into market terms, ignores such issues as whether the firm is operating at the most efficient scale or point on its cost curve (technical efficiency), or whether the best technical methods or market opportunities available are being used or sought out (X-efficiency). It also fails to recognise the value to society of the resources which the firm has consumed (their opportunity cost); and also the fact that the product or production process employed by the firm (or the act of consumption by users of the product) may have wider spillover effects, in the form of costs or

benefits, on the rest of society (the problem of externalities). Finally, such acceptance also assumes that firms are operating in structurally competitive markets - where conditions of perfect or near perfect competition obtain. Further "upsetting" conditions to this equating of business and economic efficiency include the existence of taxes or subsidies, import or export restrictions etc. Nonetheless, the approach used here is to analyse company accounting data over as great a proportion of the major period of the study as possible in order to study business efficiency as a proxy for economic efficiency.

It is also recognised, of course, that company accounting data themselves are in many respects imperfect for purposes of economic analysis. For example, not only is there little correspondence between the economist's and the accountant's concepts of business income and asset valuation; but within the standard conventions of accounting practice there may be a serious lack of comparability of data over time or between the data relating to small firms and large businesses. It is considered, however, that an examination of such data is indispensable in arriving at a view on company performance. Furthermore, as one author has commented, and whose work is largely based upon the use of company accounting data, these figures are the results of considerable labour by internal company accounting staff, are verified by the auditing profession which itself ensures a degree or standardisation of company final accounts across the economy (or at least within a single industry), and are anyhow the accepted basis of much national income accounting data.[7] Thus despite the widely recognised pitfalls involved in using company accounting data for economic analysis, it was felt that such analysis is indispensable as a basis for broader conclusions on the performance of this particular market.[8]

The analysis of industry performance in terms of company accounting data is perforce largely limited to the period 1968-1977, since it was only with the coming into force of the 1967 Companies Act that company accounting data became statutorily available in respect of smaller (private) companies; and it is also only since that time that turnover and employment data have had to be revealed by firms in their annual reports. Data on profits, assets and sales (turnover) as well as on employment have been used. These were obtained in respect of 16 firms which continued in existence from 1967 to 1977; and data were abstracted directly by the candidate from the annual returns made by the companies concerned and filed at Companies House in London (prior to their remove to Cardiff) and Edinburgh. It has thus been possible to adopt with accuracy the desired definitions of the data outlined above, and these definitions are discussed in more detail below.

Finally it should be emphasised that because of the above-mentioned pitfalls involved in using company accounting data it is not a simple matter to formulate a model of the expected behaviour of such data. What one is basically looking for are changes in the behaviour of profitability, asset, sales and employment data. In analysing profitability data one can examine the average and variability of profits over a period; and with respect to assets and sales one can measure growth and variability. So far as the breakdown of the profitability ratio of rate of return on capital employed into sales margin and capital turnover is concerned, there is no single interpretation of movements in these subsidiary ratios. Increased sales margins, for example, might be taken to reflect greater market power, as against the increased efficiency implied by faster capital turnover. However, sales margin increases may alternatively simply reflect greater customer

preference for the firm's products and so a degree of improved marketing efficiency.[9] For this reason these subsidiary ratios have not been analysed.

Profitability:

Although there is a number of flaws in its computation, the most widely accepted measure of aggregate company performance remains the rate of return on capital employed. In this study the ratio was defined as the profits in any one year after deduction of the usual business expenses (including directors' fees and depreciation) but before deduction of interest on preference shares, debentures, or long-term loans (including bank borrowing), expressed as a ratio of the net assets of the firm, defined correspondingly as total assets less non-bank current liabilities. The ratio adopted here is a measure of the return on the total invested capital in the business without regard to the individual sources of finance. This is felt to be the definition appropriate to the purpose of the study.[10]

Turning to the data on profits (i.e. the profitability ratios) for the 16 firms over the period 1968-1977, three separate areas of investigation suggest themselves. The first basic question asked is, was there a trend of the profit ratios over time? Second, was there any change in the profit performance between the two sub-periods 1968-1972 and 1973-1977? Third, what are the major explanatory variables (both on a univariate and on a multivariate basis) with regard to the profit performance of the 16 firms over the ten-year period?

The initial attempt to answer the first question, on the trend of

profits, involved an analysis of the linear regression of the unadjusted profit ratios of each of the 16 firms, and also of the 16-firm average, against time. In this case the significance and explanatory power of the linear equations were so low that no conclusion as to the trend can be drawn. Thus, using the standard parametric test for trend (the b coefficient of this regression of profitability and time) one cannot establish any discernible trend of the unadjusted profit ratios over this period. So far as nonparametric tests are concerned, the Spearman test for rank correlation indicated a significant relationship in the case of only two firms out of 16.

The above analysis was carried out very much as a "trial run" in order to determine whether any meaningful results arose using unadjusted profits data. More interest centres around the behaviour of "real" profit rates, i.e. adjusted for changes in the general level of profits in the economy. The conversion of the unadjusted to "real" profit rates was carried out by constructing a time series of profit ratios for "Manufacturing Industries" from Business Monitor MA3 "Company Finance". This time series, covering listed and unlisted companies, was converted into index form (1967 = 100), and the unadjusted profit ratios for each firm were multiplied by the reciprocal of the above index for the appropriate year. The result of this computation is a set of profit ratios for each of the 16 firms which tells us how the firm was performing "relative to manufacturing industry as a whole". To look at it another way, changes in the general macro business environment have been eliminated; and it may also be claimed that the general tendency for inflation to increase "historic cost" rates of return on capital employed has also been allowed for. This type of correction, therefore, although not without statistical flaws, is highly desirable in measuring

profit ratios over time, and is indeed absolutely essential if comparisons of individual sub-period profit performance are to be carried out (see below). The results of regressing such data against time are little different from those using unadjusted data. In all but two cases the slope of the regression coefficient was not significant at 10%. The Spearman coefficient of rank correlation likewise failed to suggest any relationship with time.

The final, and admittedly rather crude, approach in measuring the trend of profits was to use the sign of the b coefficient in the linear regression equation for each of the 16 firms as a means of measuring whether across the board there were, say, more increases than decreases in profit rates over time. On this basis nonparametric tests were adopted to indicate whether for the 16 firms as a whole over the ten-year period there was a generally upward or downward trend in profitability. The raw data were as follows.

Table 4.1

Sign of b Coefficient in Regression Equations

		Positive	Negative	Total
Profits Data:	Unadjusted	7	9	16
	Adjusted	6	10	16

The one-sample tests used were the binomial test and chi-squared. These are nonparametric tests designed to measure the extent to which an occurrence deviates from the expected: in our case the null hypothesis being that there was no trend - that one would expect from our group of 16 firms 8 increases and 8 decreases in the trend of profit rates over the period.

Table 4.2

Probability of Observed Results Under Null Hypothesis

	Binomial Test	Chi Squared
Unadjusted	0.454	0.3
Real	0.804	0.5

These results confirm, as did analysis of the 16-firm average of the profit ratios using the Cox-Stuart test for trend, that neither on a parametric nor on a nonparametric basis is there any indication of an upward or downward trend in profits for those 16 surviving firms in the jute industry over the decade to 1977.

The conclusions regarding economic performance which one can draw from this analysis of profit trends must be tentative. Nonetheless, even allowing for the omission from our analysis of those firms which "died" within the period, we can conclude that those 16 continuing firms, which at the beginning of the period accounted for about 85% of Dundee jute spinning and weaving activity, did not as a group suffer any reduction in profitability during a time when output of their traditional product fell by around 65%. As was noted in Chapter III a major response to the decline of the traditional jute market was diversification. This strategy, although it was not pursued by all firms, was adopted by the majority, and may thus have contributed to the maintenance of profit levels over this period.

Finally on this aspect of profitability, the data on adjusted profit ratios were used to calculate the intragroup variability of profits. A simple time series of the variability of profits among the 16 firms in each of the ten years was calculated and measured

against time. This measure tells us whether over the period the group of firms was becoming more or less homogeneous with regard to profitability.

Table 4.3

Linear Regression of Intragroup Profit Variability and Time

Dependent Variable	b	t	R^2	Rho	DW*
Standard deviation	-0.1242	0.3493	0.0150	-0.1273	1.3793
Coeff. of variation	-1.5832	0.2374	0.0070	-0.0303	1.1937

* the Durbin-Watson statistic designed to test for serial correlation among the residuals in O.L.S. regression. See W.C. Merrill & K.A. Fox, Introduction to Economic Statistics (New York: Wiley, 1970) pp.415-16. For all data in this study serial correlation was tested for using a two-tailed test. In this particular case the statistic was not significant at 10%, but within the indeterminate range in respect of the coefficient of variation.

Table 4.3 above shows that the slope of the linear regression equation in respect of both the standard deviation and the coefficient of variation was negative but not significant. The figures for R^2 are very low, and the Spearman coefficients of rank correlation are negative but not significant. The conclusion is that the variability of profits among the group of firms did not change significantly over the period, telling us that as a group the firms became neither more nor less homogeneous with respect to profitability over the period 1968-1977.

Turning to the second major question under the heading of profit performance, that of the performance of the firms over the two sub-periods 1968-1972 and 1973-1977, the first question being asked is: assuming that we can break down the total 10-year period into a first subperiod of initial adjustment to the demise of the market for jute and the rise of polypropylene, and a second subperiod of consolidation

of diversification strategies where appropriate, is it possible to identify these periods by reference to the profit performance of the firms? Comparison was made of the means of the real or adjusted profit ratios in each of the two subperiods for each firm and also in respect of the 16-firm average. It should be noted that in respect of all measures of mean profit rates it is the arithmetic rather than the geometric mean which is used. This is necessary because of the incidence of negative rates of return, i.e. losses, in a number of instances. Using the normal (two-tailed) t test, in no single case among the 16 firms were the subperiod average profit ratios significantly different at 5% (no more were significant at 10%). Additionally the two subperiod means of the 16 firms were treated as 16 paired observations. The appropriate t test applied to these date likewise failed to yield significant results ($t = 1.2353$ where $df = 15$).[11]

Table 4.4

Probability of Observed Results Under Null Hypothesis

Sign Test	0.804
Wilcoxon	T = 51.5

Table 4.4 gives the results of the nonparametric tests applied to the subperiod profitability data. Neither the Sign Test nor the Wilcoxon Matched-Pairs Signed-Ranks Test suggest that the null hypothesis that there was no difference between the adjusted profit ratio means for the two subperiods can be disproved. It must therefore generally be concluded that for the continuing firms in the industry over this period there was no significant change in the mean profit levels from one subperiod to another.

A second, closely related issue under this general heading of sub-

period profit analysis is that of the maintenance by firms of their profit levels relative to one another, and also that of whether profitability in the latter subperiod is in any sense the outcome of profitability in the former. The first issue was examined by means of the Spearman coefficient of rank correlation. Rho was calculated in respect of the 16 pairs of subperiod rates of return. The value of the coefficient was 0.5559, which on a two-tailed basis is significant at 5%.[12] This suggests that there was considerable relative stability of profit levels within the group over the two 5-year subperiods.

Looking at the question of the linear relationship between profits in the latter subperiod (as the dependent variable) and profits in the former, one is not necessarily suggesting a causal relationship between the two. This could only be hypothesised if, for example, profits in the earlier subperiod created growth which transferred a firm into a higher size class, which in turn was associated with increased profitability. What any linear association may, however, suggest is a persistency in a later period of the factors which determined the level of profits in an earlier one. The linear regression in respect of the two subperiods for our group of firms was as follows.

Table 4.5

Linear Regression of Average Profit Ratios in Two Subperiods

Constant	b	t	R^2	DW
6.0	0.5361	3.7359*	0.4991	2.0193**

* significant at 1%; ** not significant at 10%.

Table 4.5 indicates a significant positive relationship between

profits in the two subperiods, with around 50% of the variation in average profitability in 1973-1977 being explained by relative profitability 1968-1972. The b coefficient of less than unity suggests a degree of regression in profitability over the two periods. Companies which performed well 1968-1972 also performed well 1973-1977 but not to the same extent, and similarly for poor performers.[13]

These two pieces of analysis again suggest that there was little disturbance in the profit position of the firms over the two subperiods; and therefore reinforce our earlier conclusion that in terms of relative (i.e. adjusted) profitability the period 1968-1977 was not a particularly upsetting one for the industry.

The third question to be answered in the context of the analysis of profitability is, what appear to have been the major determinants of profits and profit variability in the industry?[14] Using data in respect of the 15 firms for which all the necessary information was available, and taking firstly the 10-year average level of profitability (1968-1977) as the dependent variable, size (in terms of opening and average assets and sales) and growth (also in terms of both assets and sales) were used as possible independent variables. Table 4.6 below presents the results of the regression analysis.

Table 4.6

Linear Regression of Profitability, Size and Growth

Dependent variable: 10-year average profit ratio

Independent Variable	Constant	b	t	R^2	DW**
Average assets	9.8	0.00023	0.7907	0.0459	1.5068
Opening assets	9.9	0.00037	0.6667	0.0330	1.4948
Average sales	9.7	0.00013	0.8565	0.0534	1.4980

Opening sales	9.7	0.00022	0.7658	0.0432	1.4866
Asset growth	4.6	0.5691	3.4936*	0.4844	2.1250
Sales growth	-0.1	0.9587	3.8846*	0.5371	2.0903

* significant at 1%; ** in no case significant at 10%.

As the data in Table 4.6 indicate, the signs of the b coefficients were all in the "expected" direction. In the case of the size variables, however, on no occasion was the t statistic relating to the b coefficient significant at 10%, and the values of R^2 (the coefficient of determination) were low. The effect of growth on average profits over the period was much more pronounced. The t statistic in respect of the b coefficient was significant at 1% with regard to both asset and sales growth, and the coefficient of determination in each case was around 50%. A similar distinction in impact was brought out using multiple linear regression and including size and growth simultaneously as independent variables. This multivariate analysis is essential if one is to distinguish clearly the separate impact of more than one independent variable where there is a strong relationship among the independent variables themselves.[15]

Table 4.7

Multiple Regression of Profitability, Size and Growth

Dependent variable: 10-year average profit ratio

Independent Variables	Constant	b*	t	r*
Size (average assets)	4.3	0.00011	0.5186	0.1481
Growth (assets)		0.55533	3.2724***	0.6866
	Multiple	R^2 = 0.4957	F = 5.897**	DW = 2.2465****
Size (average sales)	-0.7	0.00009	0.7959	0.2239
Growth (sales)		0.93690	3.7193***	0.7318
	Multiple	R^2 = 0.5603	F = 7.646***	DW = 2.0903****

* partial coefficients; ** significant at 5%;

*** significant at 1%; **** not significant at 10%.

For this particular group of firms over this period we can conclude that size was not a significant determinant of profitability, but that there was a significant positive linear relationship between growth and profits. In this latter case we must, however, accept that the analysis so far does not make it clear whether it is growth which is conducive to profitability, or whether it is only profitable firms which are, for example through the generation of internal finance, able to grow. This latter issue is examined below as part of the analysis of growth.

The general findings in this area of the impact of size and growth on profitability so far as U.K. data are concerned are still a matter of some dispute. We may conclude, however, that our findings on the profits-size relationship are not in conflict with those of most U.K. studies.[16]

With regard to profit variability over the period, this was measured in terms of the simple time variability of profits (the standard deviation about the 10-year mean), the time variability relative to the mean (the coefficient of variation), and also variability around the linear trend of profits as measured by the residual variance about the trend.

Table 4.8

Linear Regression of Profit Variability and Size

Independent Variable	Constant	b	t	R^2	DW**
Dependent variable: standard deviation of 10-year profit ratios					
Average assets	8.9	-0.00028	1.5984	0.1642	1.6795
Opening assets	8.9	-0.00052	1.5409	0.1545	1.6711
Average sales	9.0	-0.00015	1.6498	0.1731	1.7026
Opening sales	9.0	-0.00027	1.5864	0.1622	1.7076

Dependent variable:	coeff. of variation of 10-year profit ratios				
Average assets	86.2	-0.00293	1.8363*	0.2059	1.8986
Opening assets	85.9	-0.00529	1.6935	0.1807	1.9333
Average sales	88.0	-0.00162	1.9742*	0.2307	1.8928
Opening sales	87.7	-0.00288	1.7504	0.1984	1.8904
Dependent variable:	residual variance about 10-year linear trend				
Average assets	101.9	-0.00457	1.1505	0.0924	2.0867
Opening assets	102.3	-0.00863	1.1227	0.0884	2.0758
Average sales	104.6	-0.00251	1.2137	0.1018	2.0426
Opening sales	104.7	-0.00459	1.1837	0.0973	2.0185

* significant at 10%; ** not significant at 10%.

These results show that, using parametric tests, size had the effect of reducing profit variability at any level of significance only if this was measured in terms of the coefficient of variation with size measured in terms of average values. As in the case of the profits-size analysis, this finding is not out of line with those of U.K. studies generally.[17]

Finally in this analysis of profitability, the relationship between profits and size or growth, and profit variability and size was checked using a number of nonparametric tests. Of such tests available for testing hypotheses about two independent samples, four were chosen which were appropriate for testing differences in central tendency among populations of our size. These are the Fisher Exact Probability Test, the Mann-Whitney U Test, the Randomisation Test and Spearman's Rho.[18] These nonparametric tests were used to duplicate the analysis of the impact of size upon profitability and profit variability, the fuller analysis of the profits-growth relationship being delayed until the next subsection on growth. The results of the nonparametric tests are presented in Table 4.9 below.

Table 4.9

Nonparametric Analysis of Profits, Profit Variability and Size

	Fisher's Exact D	Mann-Whitney U	Randomisation t	Rho
Profitability and Size:				
Average assets	1	16	1.2272	0.2821
Opening assets	2	11	1.2400	0.0036
Average sales	1	13	1.3333	0.2929
Opening sales	3	20	0.8085	0.1500
Profitability and Growth:				
Assets	1*	11**	2.0750*	0.6130**
Sales	1*	13**	1.9000*	0.6857***
Profit Variability and Size:				
i. Standard deviation:				
Average assets	0	7**	2.0000*	-0.6988***
Opening assets	0	10	1.3793	-0.5179**
Average sales	1**	10*	1.5384	-0.5702**
Opening sales	0**	10**	2.7917**	-0.5845**
ii. Coefficient of variation:				
Average assets	0*	2***	3.1535***	-0.7143***
Opening assets	1	12	0.7946	-0.4500*
Average sales	2	10**	1.6163	-0.6393***
Opening sales	3	18	1.0854	-0.5000*
iii. Residual variance:				
Average assets	0	8**	1.5787	-0.6679***
Opening assets	0	15	1.1960	-0.5643**
Average sales	0*	12*	2.0635*	-0.5321**
Opening sales	0*	14	2.2478**	-0.5643**

Significance levels: *10%, **5%, ***1%.

We are now in a position to summarise the findings on profit performance for this group of firms over the period 1968-1977. These findings may be stated briefly as follows.

1. There was no significant upward or downward trend of profits over the period relative to U.K. manufacturing industry as a whole.[19]

2. As measured by both the standard deviation and coefficient of variation of the intragroup profit ratios in each year, there was no trend of increased or decreased homogeneity of the group as regards firm profitability over the period.

3. Considering the two subperiods 1968-1972 and 1973-1977, there were no significant differences in profit performance among the firms over the two subperiods.

4. The relative profitability of the firms to one another within the group, as measured by the Spearman rank correlation coefficient, did not change significantly over the two subperiods.

5. There was a significant linear relationship between the 16-firm set of average profit ratios for the two subperiods.

6. This particular group of firms over the period 1968-1977 displayed no significant relationship between size and profitability, or between size and profit variability, although the non-parametric tests whose results are summarised in Table 4.9 did suggest that there was a relationship between firm size and profit variability over time. It was also noted that there was a significant positive linear relationship between growth and profits, supported by the results of the non-parametric tests.

The general picture which emerges then is one of stability of profit performance so far as this group of firms is concerned. The profits and profit variability-size relationship is also consistent with comparable U.K. studies. Even accepting that we are studying the performance of a surviving or continuing group of firms (data on those firms which died during the period are not available), some of the results are still a little surprising.

Growth:

The growth variable must be regarded as a particularly important measure of company performance in an industry where the traditional market has been characterised by rapid decline. Growth on the part of an individual firm under such conditions implies either superior performance within the traditional market (significantly increasing market share), or successful diversification in moving into new market areas.

Singh and Whittington in their econometric study of firm growth distinguish between willingness and ability to grow on the part of firms.[20] The former characteristic, willingness, reminds one that not all management/ownership classes of business may have a high desire or incentive to grow; and since the pattern of ownership or management is likely to be related to firm size, with smaller businesses being owner-managed, this suggests that on this ground at least growth may be a function of firm size.[21] With regard to profitability and growth, one would expect a fairly close causal relatiopship from the former to the latter. On the basis of a very simple financial model involving no access to new outside funds (which may not depart so far from reality for our population of firms)[22] the maximum asset growth rate, g, is determined by the product of the profitability of capital employed and the extent of corporate savings. Thus, $g = (P/K)(R/P)$ where P = profits, K = capital employed, and R = retentions. It would be accepted that the thinking behind this expression can be extended to include cases where growth can also be financed externally, as shareholders (existing and potential), debenture holders and bankers will all regard past profit performance by a business as a primary indicator in arriving at their lending decision.

There are two aspects of growth to be examined here. First, what appear to be the causal factors behind growth for our group of firms, and in particular what are the roles of size and profitability? Second, is there any evidence of persistency of growth within the total period 1968-1977? Looking at the first question, data on assets and sales, and on growth of assets and sales were used for the 15 firms for whom these were available. Sales data were expressed in 1967 terms by reference to the Index of Wholesale Prices (Textiles), and assets were

also expressed in 1967 terms by reference to Price Index Numbers for Current Cost Accounting (Textiles, Leather & Clothing). This enabled one to distinguish between the volume growth of assets and sales.[23] It is known that an unpublished series of jute prices is available from the Department of Industry. This index was not used in obtaining real sales data for our firms because it was regarded as too specific in respect of a group of firms which had moved significantly into a range of textile activities (and to a limited extent non-textiles) over the period 1967-1977. It may be argued that the relationship between profitability and growth measured by employment contains a number of complexities concerning labour productivity and profitability. Nonetheless employment data were included for comparative purposes.[24]

The use of both asset, sales and employment data as growth measures was thought necessary as a cross check for a number of reasons. First, expansion of assets by a firm may indicate movement from labour- to capital-intensive methods of production rather than expansion of the scale of an enterprise. Second, a company which is profitable, and which does not pay out all profits as dividend, is by definition expanding its assets base by adding to retained earnings, thus creating a spurious and tautological relationship between profitability and asset growth. This would be so particularly if, as in our case, assets are measured at year-end values. Third, it has been pointed out that different measures of firm size are only "inter-changeable" (i.e. the findings in the type of analysis below are independent of the actual measure of firm size used) if the measures are proportional to each other. This assumes that for two input measures of firm size, for example assets and employment, the production function is homothetic - i.e. the iso-

quants lie parallel to one another and thus the expansion path is linear. Homotheticity is not something which one can assume a priori. Indeed there would appear to be evidence to the contrary.[25] Likewise, the proportionality of measures of firm size such as assets (input) and sales (output) is likely to be upset by the presence of economies of scale, for the existence of which there is considerable evidence.[26] A final problem in using assets as a measure of firm growth in the context of size-growth-profitability studies is that there is some evidence that larger firms revalue their assets more frequently than smaller firms. Such revaluations obviously overstate the growth performance and understate the profitability ratio of larger businesses. Fortunately the general conclusion in Whittington's study was that this tendency did not seriously bias the results.[27] In the case of our population of firms the asset revaluations which had occurred had indeed been carried out by the largest firms. These were, however, minimal and were not corrected for in the asset data used in the tests. Having made these points it may nonetheless be of interest to note the results of the rank correlation analysis of size measures.

Table 4.10

Spearman Rank Correlation Coefficients of Firm Size Measures

Size	Assets/Sales	Sales/Employment	Employment/Assets
Opening	0.9679	0.9705	0.9830
Average	0.9714	0.9634	0.9437
Closing	0.9893	0.9500	0.9500

The first part of the regression analysis involved adopting size as the single explanatory variable in respect of growth. The results are presented in Table 4.11 below.

Table 4.11

Linear Regression of Growth and Opening Size

Dependent variable: 10-year average annual real growth rate 1968-1977*

Size (Opening)	Constant	b	t	R^2	DW**
Assets	-2.5	0.00018	0.2899	0.0064	1.7944
Sales	0.01	0.00005	0.2175	0.0036	1.9888
Employment	-2.0	-0.00026	0.2226	0.0038	2.4977

* in the case of employment the period is 1969-1977 as no 1967 data were available;

** not significant at 10%.

Size appears to explain no significant amount of growth, either in terms of assets, sales or employment. This leads one to the interesting conclusion that, in this market where growth predominantly implied adoption of new technology and significant new investment, firms which were initially large performed no better over the period than their smaller competitors.

The data imply that the performance of firms in this group over the period complied with Gibrat's Law: that the proportionate rate of growth of the firm is independent of initial size. It was decided to test for this explicitly using the approach of Smyth et al.[28] The test here is to regress the opening and closing size values in terms of their natural logarithms. In our case the equation is[29]

$$x_i(1977) = a + bx_i(1968)$$

where x_i represents the various measures of firm size expressed in the form of natural logarithms. If b equals 1, or is not significantly different from 1, then firm growth rate is independent of opening size. The results are reported below.

Table 4.12

Linear Regression of Natural Logarithms of Opening and Closing Firm Size

Size Measure	Constant	b	t*
Assets	-0.178	0.9862	0.0746
Sales	-0.040	1.0129	0.1076
Employment	0.253	0.9248	0.5905

* with respect to 1.

Since in no case is the t statistic in Table 4.12 significant we may conclude that b is not significantly different from unity, and thus that the performance of our group of firms complied with Gibrat's Law. This result is not in conflict with general findings regarding the relationship between firm size and growth. Over different time periods and using different samples of companies slightly different conclusions have been reached by different authors. A fair summary of these studies, however, would be that no clear relationship has emerged between firm size and growth rates.[30]

We now turn to profitability as an explanatory variable in respect of growth.

Table 4.13

Regression Analysis of Growth and Profitability

Dependent variable: growth; profits unadjusted

Growth Measure	Constant	b	t	R^2	DW***
Assets	-10.2	0.7557	3.5116**	0.4868	2.4522
Sales	-5.4	0.5243	3.3674**	0.4660	2.5947
Employment	-6.8	0.4221	2.6899*	0.3576	2.9614

*significant at 5%; **significant at 1%; ***not significant at 10%; in regard to the data on Employment the DW statistic is within the indeterminate range.

Table 4.14

Regression Analysis of Growth and Profitability

Dependent variable: growth; profits adjusted

Growth Measure	Constant	b	t	R^2	DW***
Assets	-9.8	0.8092	3.8406**	0.5316	2.4647
Sales	-5.1	0.5547	3.5808**	0.4966	2.5989
Employment	-6.5	0.4528	2.8954*	0.3920	2.9699

*significant at 5%; **significant at 1%; ***not significant at 10%; in regard to the data on Employment the DW statistic is within the indeterminate range.

Table 4.13 and 4.14 above highlight two points. First, employment growth is much less well explained by profitability than growth of assets or sales, although even in respect of employment the t statistic is highly significant. Second, it is relative or adjusted profitability which has a slight edge, in terms of the coefficient of determination, over the unadjusted profit data in explaining growth in respect of all three growth variables. This suggests, not surprisingly, that it is likely to be an industry's profit performance relative to manufacturing industry as a whole which acts as a stimulus to new investment.

Although we have found no significant relationship between profits and size for this group of firms, it was decided to conduct a multiple regression analysis of growth, profitability and size in order clearly to identify the separate impact of profitability and size upon growth. The results of this analysis are reported in Table 4.15 below.

Table 4.15

Multiple Regression Analysis of Growth, Size and Profitability

Independent Variables	Constant	b*	t	r*	R^2	F	DW
Size (Assets)	-9.6	-0.00015	0.3317	-0.0953	0.5358	6.927***	2.5770**

Profitability		0.82380	3.6991***	0.7300			
Size (Sales)	-4.8	-0.00008	0.4938	-0.1411	0.5358	6.161**	2.8650≠
Profitability		0.57278	3.4968***	0.7105			
Size (Employment)	-6.0	-0.00068	0.7361	-0.2079	0.4183	4.315**	3.1470
Profitability		0.47149	2.9249**	0.6450			

*partial coefficients; ** significant at 5%; *** significant at 1%; **** not significant at 10%; ≠ within indeterminate range.

Table 4.15 highlights the impact of profits as an explanatory variable in respect of growth when the impact of size has been "held constant". It should be noted that the t value in respect of the size variable itself when considered along with profitability is much greater in the case of labour than assets or sales. However, the relative effect of the profitability variable is in the opposite direction. The coefficients of multiple determination in respect of the assets, sales, and employment equations are respectively 0.5358, 0.5066 and 0.4183.

It should be noted that one is so far hypothesising on a cross-sectional basis that growth in this industry over a 10-year period is a function of the 10-year average profit ratio relative to manufacturing industry. Such data do not, however, allow one to answer the question of whether there is any evidence of a causal relationship between profitability and growth. This question may be answered by reference to time-series data.

In an attempt to answer this question the existing set of data on profits, assets and sales for each of the 15 firms and for the period 1967-1977 were used to obtain unweighted 15-firm averages of profits, and sales and asset growth rates for each of the years 1968 to 1977 inclusive. The first relationship measured was that of 15-firm average profitability, and growth of assets and sales in the industry, each in

the form of unweighted averages. Profits and growth were for the same year. The results are presented below.

Table 4.16

Time-Series Analysis of Growth and Profitability

Dependent variable: growth

Growth Measure	Constant	b	t	R^2	DW**
Assets	-10.7	0.93877	1.1327	0.13822	1.8157
Assets*	-12.4	1.24470	0.9998	0.11113	1.7970
Sales	2.5	0.22270	0.2378	0.08380	1.8273
Sales*	12.2	-0.78758	0.5783	0.03948	2.0032

* adjusted profits as independent variable;

**not significant at 10%.

The point which stands out in Table 4.16 is that although none of the t statistics is significant, profitability appears to be more closely associated with asset than sales growth.

In an attempt to establish a clearer causal relationship between profits and growth, the approach above was modified by regressing the 15-firm average of profits in year t-1 against growth in year t. The assumption being that high levels of profit in year t-1 would provide both the incentive and the finance for expansion in year t. Thus the absolute and relative 15-firm average profit ratios for the years 1967-1976 were regressed against the asset and sales growth rates for 1968-1977: 1967 profits to 1968 growth etc. The results were as follows.

Table 4.17

Time-Series Analysis of Growth and Profitability

Dependent variable: growth

Growth Measure	Constant	b	t	R^2	Rho	DW***
Assets	4.7	-0.51415	0.6160	0.04523	-0.1394	2.0022
Assets*	15.1	-1.63075	1.3389	0.18295	-0.3576	1.9700

Sales	15.4	-1.03333	1.2571	0.16496	-0.4788	1.6392
Sales*	31.1	-2.73562	2.6355**	0.46484	-0.6242	1.5391

* adjusted profits as independent variable;

** significant at 5%;

***not significant at 10%.

The surprising feature of these results is the consistent negative sign of the b coefficient, although only in the case of the last independent variable is the coefficient significant. This implies that higher levels of profitability in one year are associated with lower rates of growth the next. For this relationship there would appear to be no immediate economic explanation, although one must emphasise that the relationship was significant only in respect of one of the growth measures used.

The relationship between adjusted profitability and growth was also tested using nonparametric statistics, and the results of this are presented below.

Table 4.18

Nonparametric Analysis of Size, Profitability and Growth

	Fisher's Exact D	Mann-Whitney U	Randomisation t	Rho
Opening Size and Growth:				
Assets	2	19	0.4151	0.0983
Sales	5	24	0.2500	-0.0250
Employment	2	20	0.1351	-0.0716
Growth and Profitability:				
Assets	0**	8**	2.4878**	0.6130**
Sales	2**	7**	3.4643***	0.6857***
Employment	0**	8**	2.4444*	0.5760**

* significant at 10%; ** significant at 5%; *** significant at 1%.

To answer the question relating to the persistency of growth over the whole period, and also to find out whether there was any evidence of a pattern of growth within it, the growth experience of the 15 firms in respect of assets, sales and employment was broken down into the two subperiods 1968-1972 and 1973-1977. (In the case of employment, the absence of 1967 data meant that the two subperiods were 1969-72 and 1973-77). The first task was to compare the (unweighted) average annual growth rates in the two subperiods; and the results of this, in terms of both parametric and nonparametric tests, are presented below in Table 4.19.

Table 4.19

Comparison of Average Annual Growth Rates in Two Subperiods

	Average Annual Growth Rate		t**	t	Prob. Under H_o Sign Test	Wilcoxon
	1968-72	1974-77				
Assets	-2.1	-2.2	0.0387	0.0238	1.000	T = 47
Sales	2.8	-1.3	2.7333***	1.6400	0.118	T = 17***
Employment*	-3.6	-1.1	1.0909	0.8621	1.000	T = 44

* 1969-72 and 1973-77

** the t test used was one which treated the two subperiod averages for each firm as 15 paired observations: see ref. 11.

*** significant at 5%.

From the above table it is clear that, with the exception of both the parametric and nonparametric paired tests in respect of sales data, there was no change in the growth performance of this group of firms between the two subperiods. What is interesting to note is the divergence of the data within the columns of the table, with regard to growth rates. It would appear that the industry's annual rate of decline of

asset volume continued at just over 2% for the whole period, but that the rate of decline of labour slowed down somewhat. Sales, on the other hand, expanded in real terms by 2.8% per annum 1968-1972, while asset and labour inputs were falling, but turned round to decline by 1.3% per annum 1973-1977, a rate of decline lying somewhere between that of assets and employment in the industry.

Given the lack of clear change in the growth rates over the two subperiods, a further question to be asked is, did the relative positions of the firms to one another in respect of their growth rates alter between the two subperiods? The answer is given in terms of the correlation of the ranks of growth over the two subperiods.

Table 4.20

Spearman Rank Correlation Coefficients of Subperiod Growth Rates

	Rho	t
Assets	0.3643	1.4104
Sales	0.5893	2.6300*
Employment	0.3220	1.2263

* significant at 5% (two-tailed).

Table 4.20 suggests that, with the exception of sales growth, there was some disruption to the previous (1968-72) rank order of growth in the following (1973-77) subperiod. This is in contrast to the experience with regard to profit performance (see p.167 above). However, sales growth was an exception to this: firms which did relatively well (or badly) in the former subperiod performed relatively well (or badly) in the latter. It may be that the sales growth data is the most reliable in this instance, as a change in the ranks of asset or employment growth might merely indicate a movement from

labour- to capital-intensive technology by different firms at different times. Firms making this change in, say, subperiod 1 would rank highly on asset growth relative to others; but, having completed the changeover, might be expected to rank below others in the following subperiod. Thus the overall conclusion on the stability of growth in the two subperiods is that, as in the case of profitability, there was no disruption among the firms in terms of growth.

The final piece of analysis carried out here is to test the strength of the relationship between growth in the former subperiod (as the independent variable) and growth in the latter. This was done by means of linear regression, and the results are tabulated in Table 4.21 below.

Table 4.21

Linear Regression of Subperiod Growth Rates

	Constant	b	t	R^2	DW**
Assets	-1.5	0.3190	1.4770	0.1437	1.1170 ≠
Sales	-2.8	0.5369	2.7157*	0.3620	1.2927 ≠
Employment	-0.4	0.2141	1.1706	0.0954	1.9884

* significant at 2%; ** not significant at 10%; ≠ indeterminate.

Once again the sales data stand out as indicating in this case a fairly strong positive relationship between growth in the two subperiods. However, the coefficient of determination is fairly low, indicating only a modest degree of explanatoriness.[31]

A summary of the findings with regard to growth for our group of firms over the period 1968-1977 is as follows. The results apply in

respect of growth in terms of assets, sales and employment, and to parametric as well as nonparametric tests, unless otherwise stated.

1. (Opening) size had no impact upon the 10-year growth record of the firms.

2. In particular, a specific test for the existence of Gibrat's Law (Table 4.12) suggested quite clearly that the proportional rate of growth for firms over the period was independent of firm size.

3. The relationship between 10-year average profits and 10-year average growth was highly significant. That is, firms which were generally over the period profitable also exhibited high growth rates. It was also noted that relative (to U.K. manufacturing industry as a whole) profitability explained a greater proportion of growth performance than absolute profitability. The point was also made that such cross-sectional statistics did not allow one to arrive at clear causal relationships between, say, profitability and growth.

4. Analysis (in Tables 4.16 and 4.17) of 15-firm average profits and growth rates for each year, unlagged and lagged, produced results which were generally not significant.

5. In respect of asset and employment data, there were no significant changes in the growth rates between the two subperiods 1968-1972 and 1973-1977. The reduction in the rate of growth of sales between the two subperiods was significant, although this did not appear in respect of value added (see Appendix to this Chapter).

6. Testing for relative consistency of performance by measuring Rho in respect of growth rates for the two subperiods, only in respect of sales would it appear that the firms performed consistently relative to one another, although again this finding of consistency did not appear in respect of value added.

7. Finally, the growth rates in the latter subperiod were regarded as the outcome of growth in the former (Table 4.21). Only in the case of sales was there a significant (positive) relationship between growth performance in the two subperiods, but again this finding is not supported by the value-added analysis of the Appendix.

8. Despite the "disruption" regarding subperiod ranks and linear relationship concerning growth performance, the data in Appendix Table 9B indicate that over the whole period high growth did not have to be bought at a cost of increased variability of profits. Indeed if anything the opposite appears to be the case.

C. Employment and Labour Productivity

So far as the Dundee jute industry is concerned, some part of the more recent history of labour usage appears to have been shaped by more distant events, including a rather harsh and remote relationship between the "jute barons" of the nineteenth century and their largely unskilled workforce. The dominance of the jute industry in the city of Dundee has not helped matters, for unemployment in the jute industry has meant hard times for the city as a whole. The historical significance of jute employment in the area may be understood from the following data relating to textile employment. That this was largely accounted for by the jute industry may be gathered from the further estimate that in 1924 50% of the "workers in the city (Dundee)" were employed in the jute industry.[32]

Table 4.22

Textile Employment in Dundee as a Proportion of Total

1881	49%
1911	48
1931	41
1951	23
1961	18

Source : A.M. Carstairs, "The Nature and Diversification of Employment in Dundee" in S.J. Jones (ed.), Dundee and District (Dundee: British Association 1968) pp.320 and 329.

A further feature of employment in the industry has been the incidence of unemployment and low wages. Lenman in his recent economic history of Scotland speaks of the scale on which men from Dundee joined the armed forces in 1914 as "a glowing tribute to the recruiting effect

of heavy unemployment and grinding poverty,[33] and instances with regard to the times of depression that in July 1932 there were 37,000 unemployed jute workers in Dundee.[34] Again the Report of the 1948 Board of Trade Working Party, having spoken of the massive unemployment in the jute industry in the 1930's, summed up:

> "Short time, low wages, idle mills and spells of prolonged unemployment were the lot of the jute workers, and since the industry ... was the major one in Dundee, the depression laid a heavy hand on the city and her people suffered acutely."[35]

That this view was not unduly coloured by proximity to the time may be gathered from more recent reference to Dundee as "a city in which industrial relations were poisoned by the low wages of the (jute) industry, by the connection of the employers with the competing jute industry of India and by devastating unemployment between the wars".[36] What has also to be remembered in this context is that in the past the skilled work in the jute industry was predominantly carried out by female labour.[37] It was reportedly said that in Dundee the women worked while the men stayed at home; and employers had a reputation for taking on boys for unskilled work and paying them off when they were old enough to receive an adult wage. With regard to changes in the overall level of employment in the industry, the jute trade lost a large part of its labour force during World War II. Employment in Dundee fell from about 26,000 in 1939 to 11,000 in 1945.[38] Figures relating to Dundee and district show an expansion of this latter figure to around 13,000 in 1950.[39] Appendix Table 4.1 contains a consistent set of data from 1948 to 1977 relating to actual employment in the industry - i.e. employees or insured persons in employment. From the data one can discern two things clearly: the fall in the

total number of persons employed, especially since 1966; and also the changed ratio of male to female workers. The reduction in male employment over the whole period 1948-1977 was 33%, while in the case of females it was 78%. This divergence is again reflected in the change in the ratio of females to males in the industry from 1.6:1 in 1948 to 0.5:1 in 1977. Unemployment data are more difficult to interpret as they represent neither purely a stock of unemployed nor a flow in and out of the jute industry. (Employees unemployed in the jute industry may leave this category to become employed in other industries.) From a consideration of unemployment and industry output data, however, one could suggest that whereas in earlier periods temporary unemployment might later be reduced by reabsorbing labour into the industry, from the mid 1960's there was a final shedding of labour by the industry at a considerable rate.

The impact of the general labour situation in more recent decades has been to make "going into the mill" an unattractive prospect even for more skilled workers; and this has influenced the investment and location decisions of firms in the industry in the period since 1945. The major problem for the industry in the immediate post-war period, however, was that of a shortage of labour. This was brought about by a combination of a reluctance of previous employees to return to the industry after war service, and a lack of new recruits influenced by the image of pre-war unemployment. To these negative supply factors was added the competition for semi-skilled male and female labour which was at that time being offered to the industry by firms in the light-engineering sector which were establishing themselves on the new industrial estates around Dundee's northern perimeter. Wage and labour competition from this source has in fact been a constant talking point in the jute

industry for the past thirty years. The lack of suitable labour was put forward by the industry in the 1950's as a major reason for not being able to meet demand. It has also been said to have influenced decisions on capital-intensive modernisation schemes. Most of such new investment was "costed" on the basis of double shift working so as to write off the new plant over as large an output as possible. Where such double shift working was not possible due to labour shortage, it is possible that there was a reduced incentive to new capital investment.

In more recent times, although the total workforce of the industry has declined rapidly, shortage of suitable labour has nonetheless figured in discussions within the industry. The Financial Times, for example, described labour shortages in the late 1950's as "acute", and spoke of "a great scarcity of workers for both spinning and weaving".[40] It has been held that those firms wishing to expand output were forced to acquire other businesses rather than install more machinery in their own plants, in order to acquire additional labour. More recently, and with the rapid falling away of demand for jute goods, the industry has become more aware of what is openly admitted to be a declining standard of quality of new recruits.[41] Although polypropylene processing does demand a higher standard of operative labour, it is a much more capital intensive manufacturing process; and in this way firms have sought to reduce their dependence upon labour. A further policy has been one of geographical diversification; and much of the expansion in recent years by Dundee-based firms has been in Fife, new industrial estates in South Wales and West Scotland, and even in the industrial Midlands. In these locations the firms may be seeking a more skilled or adaptable labour force, more generous Government assistance, or sites better placed for

marketing and transport of raw materials and finished goods.

It is not easy to measure labour productivity directly from available aggregated data. Isolated figures, however, suggest that the industry has succeeded in improving its performance in this direction. It was pointed out in the early 1950's, for example, that while employment had declined by 40% compared with the pre-war situation, output in the industry was only 25% below the 1939 figure.[42] The British Jute Trade Federal Council was reported as claiming in 1960 that spinning output per worker had increased by 40% over the previous decade;[43] the Financial Times reported in 1962 that in the previous 13 years output per man in yarn spinning had increased by 78%, with a comparable figure for spinning, weaving and finishing of 56%;[44] while the Restrictive Practices Court was informed in 1963 that in jute spinning the number of workers per ton per week had fallen from 3.63 in 1949 to 2.16 in 1961, and that similar improvements had been made in weaving.[45] Finally, the following index was published by the British Jute Trade Federal Council.

Table 4.23

Index of Productivity in Jute Spinning (1949 = 100)

1950	108	1957	140
1951	113	1958	152
1952	114	1959	153
1953	125	1960	160
1954	126	1961	168
1955	133	1962	169
1956	138	1963	170

Source : B.J.T.F.C. quoted in Financial Times, 14th December 1964.

Using the data in Appendix Table 2.1 to Chapter II and Appendix Table 4.1, the following figures emerge from an analysis of output and employment divided into three subperiods representing some stability

after World War II (1945-1960), the beginnings of decline (1961-1969), and the collapse of the traditional jute industry (1970-1977).

Table 4.24

Changes in Employment and Jute Spinning and Weaving Output

	Change in Employment %	Changes in Output% Yarn	Cloth
1948-60	-15.2	+41.4	+39.4
1961-69	- 8.9	- 8.1	-24.6
1970-77	-32.8	-46.5	-66.3

Source : Annual Abstract of Statistics (London: H.M.S.O.).

The results of this type of analysis for the first subperiod are quite unequivocal. Between 1948 and 1960 employment in the industry fell by 15.2% while output of yarn and of cloth rose by 41.4% and 39.4% respectively. Over the period of contraction of output from 1961-69 the reduction in employment, though marginally ahead of that in yarn, was well behind that of cloth. The pattern of data in respect of the most recent figures suggest a falling off in labour productivity; although by this stage there may have begun to be a lack of correspondence between those employees classed as "jute" and those who were fully and solely employed in spinning or weaving jute as opposed to other fibres.

A less direct measure is to compare raw jute consumption per employee over the period 1948 to date, as a measure of the quantity of material processed per employee.

The figures in Table 4.25 below suggest an improvement in labour productivity from 1948 which was sustained until 1960. Thereafter performance appears to have slipped somewhat; although it has remained above the levels of the mid 1950's, and once again may be understated

if some employees not wholly engaged in jute spinning and weaving are included in the industry. This pattern is emphasised if one compares the data for jute with labour productivity indices for U.K. manufacturing industry as a whole and in respect of the Textiles sector. The raw data for this are set out in Appendix Table 4.4 and comprise figures for output per person employed in index form taken from British Labour Statistics together with the original data from Table 4.25 below in index form. The conclusion one arrives at from a comparison of the first two index number columns in Appendix Table 4.4 is that whereas productivity in jute more than kept pace with that in manufacturing industry as a whole from 1950 until 1960, the former compares very unfavourably with the latter from this period onwards, especially during the late 1960's and the 1970's. A comparison with Textiles is only possible from 1963 onwards in terms of data availability, but again in terms of this closer comparison jute shows up very badly.

Table 4.25

Raw Jute Consumption per Employee (tonnes per annum)

1948	5.00	1958	7.65	1968	7.29
1949	5.23	1959	8.12	1969	7.00
1950	6.19	1960	8.22	1970	7.29
1951	6.05	1961	6.91	1971	7.54
1952	6.35	1962	7.51	1972	8.21
1953	6.64	1963	7.92	1973	7.66
1954	6.62	1964	7.58	1974	6.31
1955	7.35	1965	7.37	1975	6.48
1956	7.44	1966	7.16	1976	6.28
1957	7.47	1967	7.44	1977	5.79

Source : Annual Abstract of Statistics (London: H.M.S.O.)

Wages in the jute industry are determined by two Joint Industrial Councils (J.I.C.'s): one covering Dundee employers and unions, the

other non-Dundee (basically Forfar and Kirriemuir) representatives. The J.I.C.'s took over from the Jute Wages Council in 1970, and appear to have inherited a system of fairly stable industrial relations. Data on jute industry wages are not available prior to 1960; but for the period 1960-77 some comparison can be made with manual workers earnings in manufacturing industry as a whole. The following figures are derived from Appendix Tables 4.2 and 4.3.

Table 4.26

Hourly Earnings (£)

	Jute Industry		Manufacturing Industry		Ratios: Jute Industry/ Manufacturing	Ratios: Jute Industry/ Manufacturing	Ratios: Jute Industry
	Men	Women	Men	Women	Men	Women	Men/Women
1960	0.25	0.17	0.32	0.18	0.78	0.94	1.47
1961	0.26	0.18	0.34	0.19	0.76	0.95	1.44
1962	0.28	0.20	0.35	0.20	0.80	1.00	1.40
1963	0.29	0.20	0.37	0.21	0.78	0.95	1.45
1964	0.31	0.22	0.40	0.23	0.78	0.96	1.41
1965	0.33	0.23	0.44	0.25	0.75	0.92	1.43
1966	0.36	0.25	0.46	0.26	0.78	0.96	1.44
1967	0.40	0.27	0.48	0.28	0.83	0.96	1.48
1968	0.42	0.29	0.52	0.30	0.81	0.97	1.45
1969	0.48	0.33	0.56	0.32	0.86	1.03	1.45
1970	0.53	0.33	0.64	0.37	0.83	0.89	1.61
1971	0.56	0.41	0.72	0.42	0.77	0.98	1.37
1972	0.67	0.48	0.82	0.49	0.82	0.98	1.40
1973	0.77	0.58	0.93	0.56	0.83	1.04	1.33
1974	0.93	0.74	1.12	0.73	0.83	1.01	1.26
1975	1.18	0.96	1.40	0.93	0.84	1.03	1.23
1976	1.27	1.13	1.56	1.09	0.81	1.04	1.12
1977	1.32	1.17	1.62	1.13	0.81	1.04	1.13

Source : Appendix Tables 4.2 and 4.3

Taking male employment first - which rose from 51% to 67% of the total over the period 1960-1977 - weekly hours worked in the jute industry do not appear to have differed significantly from those in manufacturing industry as a whole. Earnings per hour in jute have, however, remained below those in manufacturing. The "discount" was 22% in 1960, and had only narrowed to 19% in 1977. This slight narrowing is reflected in

the ratio of 1977 hourly rates to those for 1960: 5.28 for jute, 5.06 for manufacturing. Use of such ratios shows that during the rapid change in hourly rates in 1974-75 the premium of manufacturing wages over jute earnings was narrowed somewhat. Thus, although wages in the jute industry have remained lower than for manufacturing industry as a whole, there has been no increased deterioration by this comparison.

With regard to female earnings the comparative situation is very different. Over the period 1960-77 women too in jute manufacturing have increased their hourly earnings at a slightly faster rate than those in manufacturing in general; the ratios of 1960 to 1977 female hourly rates being 6.88 for jute and 6.28 for manufacturing industry. However, for women in the jute industry this represents an improvement from a situation in which they were earning slightly less per hour (a discount of 5.5% off the figure for manufacturing) to one in 1977 in which they earned a premium of 3.5%. This has been accompanied by a diminishing gap between male and female hourly earnings. In 1960 the ratio of female to male hourly earnings was 0.68 for jute and 0.56 for manufacturing. In 1977 the respective figures were 0.89 and 0.70. Women in the jute industry have thus significantly improved their earnings position; and this does not appear to have been as a result of overtime working.

In general, therefore, incomes from employment in the jute industry have kept pace with the general rise in earnings in manufacturing industry; and figures for weekly hours worked suggest that this reflects underlying basic wage rates rather than excessive overtime at premium rates. The data also suggest that there are no grounds for the hypothesis that the continued existence of the U.K. jute industry, or a reduction in its rate of decline, has been based upon low wages, or a

failure of those wages to keep pace with industry in general.

Finally, it is worth commenting on the generally good industrial relations that have existed in this market. After 1945 the industry appears to have adopted a new approach to employee relations: partly the result of a new, younger group of owners emerging among the larger businesses, and partly arising from a realisation that, following demobilisation, the jute industry might not attract back to it all of those who left in 1939 and 1940. To this last factor was soon to be added competition for semi-skilled labour from new, often American, businesses established on Dundee's recently created industrial estates established around its northern perimeter. It was, in fact, a relative labour shortage in the industry which stimulated both increased mechanisation and the introduction of work study and logical re-deployment of labour. This work was initiated within the industry (one of the first, indeed, to do so) but was often carried out by independent firms of consultants. The result was a new wage system introduced in 1952 based upon job evaluation, and improved labour productivity referred to above. Indeed the situation called forth a "surprised" reaction from two observers that "the employment of industrial consultants has become almost a commonplace throughout an industry where the tradition has long been one of conservatism on the part of both employers and employees".[46] This changed attitude meant not only a fairly rapid acceptance by workers of job evaluation schemes etc., but was also accompanied by a genuine concern for employees on the part of mill and factory owners. For example, an estimated two thirds of establishments in the industry had a personnel officer by the mid 1950's.[47]

Over the restricted time period of 1968-1977 it was possible to

use data on real sales and employment to measure labour productivity at the individual firm level. This approach could only be adopted over this shorter period because of the lack of earlier data. The figure calculated was that of sales at constant 1967 terms per employee per annum.

Throughout this study in respect of data derived from company reports, figures relating to sales rather than output have been used even where, for example in analysing labour productivity, one might have expected to be able to analyse the behaviour of output per head. Sales data have been used not only because they are the data explicitly presented in company annual reports but because the translation of sales into output by means of adjusting for the building up or running down of stocks is not possible on the basis of published data. Company annual reports do contain data on stocks. These data however relate to stocks of raw materials, work in progress and finished goods, whereas it is only the last category which concerns us. Moreover, the stock figure is usually presented in company accounts combined with debtors - another current asset. Over a 10-year period it is not considered that any serious error is likely to arise in using sales data in this way as a surrogate for output.

The data, which were available in respect of 15 firms, are not perfect. On the employment side, part-time staff in the denominator may distort the figure; although it is considered that this is not likely to be a serious source of error because of the small number of those involved. More contentious is the correction for inflation used to produce "real" turnover data over the period. The actual sales figures in each year for each of the 15 firms were restated on the basis

of 1967 prices using the output wholesale prices index (Textiles). It was hoped by such means to indicate the increase or decrease in sales per annum, correcting for the trend of price increases.

The results of the analysis indicate, firstly, a surprising range of averages for sales per employee over the 10-year period. These ranged from £2,040 from a small synthetic spinning firm to £13,170 for a large diversified company (both figures in 1967 terms). The unweighted average for the 15 firms in index form over the period was as follows.

Table 4.27

Sales per Employee at Constant Prices (1968 = 100)

	15-Firm Average	U.K. Manufacturing Industry*
1968	100	100
1969	102	102
1970	108	104
1971	115	106
1972	130	113
1973	131	121
1974	127	119
1975	141	117
1976	140	122
1977	125	122

* The figure here is the volume index of manufacturing output for the U.K. divided in each year by the total number of employees in employment in manufacturing industry and converted into index form 1968 = 100. The source for the data is British Labour Statistics (London: H.M.S.O.). See Appendix Table 4.4

For our industry the data indicate a considerable rise in labour productivity from 1968 up to the mid 1970's. These data are, however, difficult to interpret, especially when compared with those for manufacturing industry as a whole. In particular, one would suspect that because the wholesale price index for Textiles as a whole has probably

lagged behind a more accurate price index for the sales or output of our firms their output has in real terms been overstated.

The data discussed immediately above were also used to try to establish "causes" of the variation in the level of labour productivity within our 15-firm population. Average size was the first independent variable chosen for the linear regression analysis.

Table 4.28

Linear Relationship of Firm Size and Labour Productivity

Dependent variable: 10-year average real sales per employee

Average Size Measure	Constant	b	t	R^2	DW***
Assets	3.13	0.00058	6.7498**	0.7780	1.8101
Sales	3.06	0.00026	6.3053**	0.7536	1.7635
Employment	3.34	0.00119	2.1432*	0.2611	2.0170

* significant at 10%; **significant at 0.1%; ***not significant at 10%.

The unmistakable conclusion is that size, as measured by assets or sales, is very clearly associated with labour productivity. Although the t statistic in respect of labour as a size measure was also significant (at 10%), by comparison with alternative size measures labour performed poorly, as is clearly reflected in the respective coefficients of determination. Another possible influence upon labour productivity is growth, on the grounds that growth yields benefits in terms of learning, or that it gives access to economies of scale. The former effect is simply one aspect of the general hypothesis regarding growth and productivity known as Verdoorn's Law.[48]

Table 4.29

Linear Relationship of Growth and Labour Productivity

Dependent variable: as in Table 4.28

Growth Measure	Constant	b	t	R^2	DW**
Assets	4.72	0.11657	1.5121	0.1496	2.0590
Sales	4.31	0.17076	1.4471	0.1386	1.9727
Employment	4.94	0.22183	1.9545*	0.2272	1.8872

* significant at 10%; ** not significant at 10%.

In respect of growth, the degree of explanation of variations in labour productivity is low compared with size. Furthermore, the roles of the individual size or growth variables are reversed with regard to the parametric test. Growth of employment is significant in terms of the t statistic at 10%; although even here the coefficient of determination is low compared with those in Table 4.28.

Finally, on a bivariate basis, capital per employee was chosen as an independent variable; and this was measured as net assets (from company balance sheets) per employee in real terms, assets being converted into 1967 terms by reference to Current Cost Accounting indices for the appropriate Minimum List Heading. The results of the linear regression indicate the importance of this variable, which on a bivariate basis is more significant than firm size.

Table 4.30

Linear Relationship of Capital Intensiveness and Labour Productivity

Dependent variable: as in Table 4.28

Constant	b	t	R^2	DW**
0.81	1.96390	9.4237*	0.8723	1.2627

* significant at 0.1%;**not significant at 10%, within indeterminate range.

The relative importance of size, growth and capital intensiveness can be seen from the multivariate analysis, including partial correlation coefficients.

Table 4.31

Linear Relationship of Size, Growth, Capital Intensiveness and Labour Productivity

Dependent variable: as in Table 4.28

Independent Variable	Constant	b*	t	r*
Size (Sales)	1.79	0.00023	1.8256**	0.4823
Growth (Employment)		0.04772	1.6013	0.4347
Capital Intensiveness		1.19984	2.7955***	0.6445

Multiple R^2 = 0.9101 F = 37.14**** DW = 1.8818 (not significant at 10%)

* partial coefficients
significance levels: ** 10%, *** 5%, **** 1%.

The conclusion in respect of our group of firms on the average level of labour productivity is that capital intensiveness and average size (in terms of assets and sales) are very significant determinants. Growth appears to offer much less of an explanation, although in the case of growth of employment the coefficient of determination was 0.2272. These relative contributions are highlighted in Table 4.31.

With regard to growth of labour productivity over the period 1969-1977, this was measured as the average annual rate of growth of sales per employee.

Table 4.32

Linear Relationship of Firm Size and Labour Productivity Growth

Dependent variable: 9-year average annual rate of growth of labour productivity

Average Size Measure	Constant	b	t	R^2	DW*
Assets	3.2	-0.00018	1.7615	0.1927	1.5569
Sales	3.2	-0.00008	1.6642	0.1756	1.5311
Employment	3.1	-0.00037	0.9418	0.0639	1.4416

* not significant at 10%.

None of the results in Table 4.32 is significant; although it is interesting to note the negative sign of the b coefficient with respect to all of the size measures. This would suggest, although it must be stressed that the results are not statistically significant, that over this period small firms have demonstrated higher rates of labour productivity growth than larger ones.

The results of the linear regression of the growth of the firms and the growth of labour productivity are presented in Table 4.33 below.

Table 4.33

Linear Relationship of Firm Growth and Labour Productivity Growth

Dependent variable: as in Table 4.32.

Growth Measure	Constant	b	t	R^2	DW*
Assets	2.8	0.02643	0.5046	0.0192	1.6147
Sales	2.7	0.04929	0.6218	0.0289	1.4161
	2.7	-0.03810	0.4707	0.0168	1.6078

* not significant at 10%.

Surprisingly, again none of the results is significant; and in the case of growth of employment, although it must be stressed again that the results are not significant, it would appear that firms which expanded employment less rapidly experienced higher rates of growth in labour productivity.

Table 4.34

Linear Relationship of Capital Intensiveness and Growth of Labour Productivity

Dependent variable: as in Table 4.32

Capital Intensiveness:	Constant	b	t	R^2	DW*
Average	3.6	-0.46508	1.6322	0.1223	2.3188
Growth	2.9	0.10075	1.1685	0.0951	2.1246

* not significant at 10%.

Taking the cross-sectional figures on capital intensiveness - i.e. the average data for each firm over the period 1968-1977, and the corresponding average growth rate 1969-1977 - again none of the results is significant (at 10%). Within these limitations it nonetheless appears

that more highly capital intensive firms had lower rates of growth of labour productivity than less capital intensive. Increases in capital intensiveness over the period may, however, have been associated with faster rates of growth in labour productivity.

The use of sales per person as a measure of labour productivity is not of course ideal. It is true that unless there were violent fluctuations in the level of stocks held then sales and (gross) output should strongly coincide as measures of production and productivity. However, the extent of vertical integration within our group of firms varies quite considerably as we saw in Chapter II. Low levels of vertical integration obviously overstate the labour productivity of a firm relative to that of a business which is highly vertically integrated when sales per person is used as a measure of labour productivity. Moreover, the extent of vertical integration may be related to factors such as firm size used as independent variables in seeking to explain differences in labour productivity among firms. The data in Appendix Table 9A indicate a significant negative relationship between firm size and the extent of vertical integration. In order to avoid this problem the regressions in Tables 4.28-4.34 were recalculated using value added per employee as a measure of labour productivity.

As a preliminary check the 1968-1977 10-year averages of value added per employee and sales per employee together with their corresponding growth rates over the period for each of the 15 firms for which data were available were compared. The results confirmed the need for further analysis of labour productivity using value added as a basis. The rank correlation coefficient (Rho) between the two average measures of labour productivity was 0.5821, which is significant at 5%, while in respect of the respective growth rates it was -0.1559. In more detail the regression analysis, with value added as the dependent variable, was

as follows.

Table 4.35

Linear Regression of 10-year Average Sales and Value Added per Employee, and Growth Rates of Sales and Value Added per Employee

	Constant	b	t	R^2	DW**
Average	0.80	0.1230	4.3463*	0.5915	1.5434
Growth	2.34	0.0434	0.0833	0.0005	2.4816

* significant at 0.1%; ** not significant at 10%.

On this basis the regressions in Tables 4.28-4.34 are presented again below with labour productivity now being measured on the basis of value added. For ease of comparison with the previous results the tables are numbered 4.28′ - 4.34′.

Table 4.28′

Linear Relationship of Firm Size and Labour Productivity

Dependent variable: 10-year average real value added per employee

Average Size Measure	Constant	b	t	R^2	DW***
Assets	1.11	0.00007	3.5000**	0.4769	1.9682
Sales	1.10	0.00003	3.0000*	0.4492	1.9549
Employment	1.14	0.00015	1.5789	0.1524	2.2488
Value Added	1.09	0.00014	2.8000*	0.3613	1.9762

* significant at 5%; ** significant at 1%; *** not significant at 10%.

Table 4.29′

Linear Relationship of Growth and Labour Productivity

Dependent variable : as in Table 4.28′

Growth Measure	Constant	b	t	R^2	DW***
Assets	1.34	0.03079	3.0039*	0.4098	2.2460
Sales	1.24	0.04356	2.6708*	0.3543	2.1626
Employment	1.39	0.05181	3.5102**	0.4866	2.4782
Value Added	1.27	0.03760	2.2222*	0.2758	2.4838

* significant at 5%; ** significant at 1%; *** not significant at 10%.

Table 4.30[4]

Linear Relationship of Capital Intensiveness and Labour Productivity

Dependent variable: as in Table 4.28[4]

Constant	b	t	R^2	DW**
0.74	0.29198	6.3640*	0.7570	1.8885

* significant at 0.1%; ** not significant at 10%.

Table 4.31[4]

Linear Relationship of Size, Growth, Capital Intensiveness and Labour Productivity

Dependent variable: as in Table 4.28[4]

Independent Variable	Constant	b*	t	r*
Size (Value Added)	0.92	0.00002	5.0000**	0.1339
Growth (Employment)		0.02929	3.1906**	0.6932
Capital Intensiveness		0.21468	3.6504**	0.7401

Multiple R^2 = 0.8745 F = 25.54** DW = 2.8089***

* partial coefficients; ** significant at 1%; *** not significant at 10%, within the indeterminate range.

Table 4.32[4]

Linear Relationship of Firm Size and Labour Productivity Growth

Dependent variable : 9-year average annual compound rate of growth of labour productivity on value-added basis

Average Size Measure	Constant	b	t	R^2	DW*
Assets	2.5	0.00006	0.2857	0.0058	2.4753
Sales	2.6	-0.00002	0.2000	0.0036	2.4694
Employment	2.9	0.00032	0.4156	0.0137	2.6197
Value Added	2.3	0.00003	0.0625	0.0004	2.5010

* not significant at 10%.

Table 4.33[4]

Linear Relationship of Firm Growth and Labour Productivity Growth

Dependent variable: as in Table 4.32[4]

Growth Measure	Constant	b	t	R^2	DW*
Assets	2.2	-0.06770	0.6939	0.0357	2.4213
Sales	2.5	-0.16946	1.1793	0.0967	2.4065
Employment	2.1	-0.11821	0.7886	0.0457	2.4685
Value Added	2.4	0.12332	0.8558	0.0534	2.5092

* not significant at 10%.

Table 4.34'

Linear Relationship of Capital Intensiveness and Growth of Labour Productivity

Dependent variable : as in Table 4.32'

Capital Intensiveness:	Constant	b	t	R^2	DW*
Average	3.6	-0.66111	0.9889	0.0700	2.6021
Growth	2.4	0.01278	0.0750	0.0004	2.5036

* not significant at 10%.

Briefly comparing the company accounts based labour productivity analysis on a sales and value added basis one can see that the effect of using the latter basis in a bivariate regression is somewhat to mute the influence of firm size on labour productivity. In the case of the impact of firm growth on labour productivity, measuring the latter on a value added basis greatly increases the impact of growth on average labour productivity. The former change is particularly explained by the relationship between size and the average index of vertical integration revealed in Appendix Table 4.9A. The low degree of explanatoriness of firm size, growth and capital intensiveness with regard to labour productivity growth of Tables 4.32-4.34 was not enhanced in Tables 4.32' - 4.34', indeed the figure for R^2 fell markedly.

It is believed that value added per employee is a more correct measure of labour productivity, and this has therefore been used in

conducting the nonparametric tests in this area. The results of these tests are reported in Table 4.36 below.

Table 4.36

Nonparametric Tests on Labour Productivity on Value-Added Basis

		Fisher's Exact D	Mann-Whitney U	Randomisation t	Rho
Average Labour Productivity:					
Average size :	Sales	0**	8**	1.6957	0.6464***
	Assets	0	6***	1.9048	0.6536***
	Value Added	0	12	1.5600	0.6750***
	Employment	0	12	1.5600	0.4808*
Growth :	Sales	2	13	1.7391	0.6643***
	Assets	1	11**	1.9048	0.7668***
	Value Added	1	13	1.5455	0.6179**
	Employment	1	15	1.5000	0.6810***
Average capital intensiveness		0	8***	2.3000**	0.8382***
Labour Productivity Growth:					
Average size :	Sales	2	28	0.6470	-0.0966
	Assets	1	19	0.1111	-0.0823
	Value Added	0	12	1.2632	-0.0662
	Employment	0	12	1.2632	-0.0358
Growth :	Sales	1	25	0.1667	-0.2469
	Assets	1	23	0.2778	-0.0976
	Value Added	1	20	0.1667	0.1592
	Employment	1	19	1.1579	-0.2310
Capital intensiveness growth		1	14	0.1053	0.0161

Significance levels: *10%, **5%, *** 1%.

The conclusions on employment and labour productivity in the industry are as follows.

1. There was a rapid decline in the total number of employees in employment in the industry from 1967 onwards.

2. This decline was particularly rapid among female rather than male employees, and this is reflected in the changed ratio of female to male employees in the industry. This is a reflection of changes in the technology of the industry.

3. For male employment, although earnings per hour are still around 20% less than those of U.K. manufacturing industry as a whole, this "discount" has not changed significantly over the past decade and a half.

4. For female employees there has been a considerable increase in hourly earnings since 1960. This increase has brought these earnings in jute much more into line with male earnings (although the "female discount" is still in excess of 10%), and has taken jute industry females from a slight discount compared with manufacturing industry as regards hourly earnings in 1960 to a premium position of around 4% in 1977.

5. As regards labour productivity, there appear to have been considerable strides made in this area from 1948 onwards, the period 1948-1960 being a particularly outstanding one. Since 1960 progress has been less obvious - see Tables 4.24 and 4.25 - suggesting some relationship between industry growth and productivity.[49]

6. Over the more restricted period 1968-1977 company accounting data suggest that the average level of labour productivity was significantly influenced by average firm size, growth and capital intensiveness.

7. As regards growth of labour productivity 1969-1977, no obvious causal explanations emerge from the analysis of our population of firms. Neither firm size nor growth were significant independent variables,[50] nor was capital intensiveness.

D. Investment and Modernisation

An important aspect of any industry's performance is the extent to which it has invested in new capital equipment in order to keep its plant up to date and to maintain itself at the forefront of technology. The first approach to examining this issue in the jute industry was to try to construct a time series of total new capital investment since 1945. The data are not entirely satisfactory since they may be

based upon different concepts of new investment. Census data, for example, consider investment as acquisitions less disposals, while business people tend to think in gross (acquisitions only) terms. On the other hand Census data include vehicles as well as plant and buildings, whereas industry estimates will exclude the first category. The data for total new capital investment since 1945, and for annual new investment in each year are given in Appendix Table 4.5.[51] As ref.51 indicates, the new investment data were gathered from a variety of sources, not all of which adopted consistent definitions. From these, however, it was possible to graph total investment from 1945 to 1977, and to read off from the graph data for individual years. The results of this exercise are shown in Appendix Table 4.5 and in graphical form in the following Appendix Tables. Column 1 shows the total, and column 2 the annual investment at each data. These data are expressed in current prices; and although a particular pattern emerges over certain time periods it is possible that this could have been influenced by changing rates of inflation. Fortunately, a by-product of recent concern over inflation accounting has been the publication of a series of price indices of, inter alia, plant and equipment in various industries, running from 1956 to the present time. The appropriate category of these has been used to inflate or deflate the data in column 2 into a common value basis (1970 = 100). This has enabled one to produce in column 4 a series of annual investment figures at 1970 prices. For the period 1948 to 1955 the current price levels for investment have been inflated by an All Industries capital expenditure (machinery and plant) index using the same source as the more disaggregated index and linking the two sets of indices at 1956. No constant price data are available for the period 1945-47, but even the current data are largely estimates up to 1950, so that only by that

latter date do we have an accurate idea of the level of investment in the immediate post-war period.

The graph of total new investment in current values (Appendix Table 4.6) suggests that from 1945 to the later 1950's expenditures were rising at an increased rate. This rate of new investment appears to have slowed down for the first part of the 1960's, but accelerated from around 1964 onwards. It should, of course, be borne in mind that in respect of data stated in current terms an upsurge in the rate of general inflation in the economy could create the impression of increased capital spending, which was nonetheless in real terms fairly static. Thus the restatement of annual levels of investment in constant price terms gives a much more accurate indication of events. These are presented in Appendix Table 4.7, with 3-year moving averages in dotted lines.

Despite the problem of sources of data, the figures reflect what discussions within the industry also suggest. The period following 1945, during which Control and the trading agreements were of significance in the industry, was one of considerable new capital spending. This was the era in which individual electric motors (rather than single motors and multiple drive belts) were introduced into weaving. Circular looms (for bag making) and automatic cop loading were also brought into use in weaving. On the spinning side considerable investment was made in automatic spindles; and by the early 1960's the industry was based entirely upon high-speed or "sliver" spindles. Indeed for 1960 the Financial Times was able to report that only 3% of the spinning machinery was of the "old type" (i.e. mule spinning), while nearly half of the looms were automatic.[52] In addition to

these technical innovations, considerable improvements were being made over this period in plant layout, often in new factory buildings. Indeed the Financial Times had been able to comment by the mid 1950's that "the British (jute) industry today must be classed as one of the most up-to-date textile industries in the world".[53] Even by the early 1960's, when the jute industry had certainly passed the peak of its new capital expansion rate, the same newspaper considered that "Jute has for its size been one of the British industries most conspicuous in modernising plant and equipment".[54]

When asked about the forces behind the spate of new investment in the industry for the decade and a half after 1945 members of the industry have placed some emphasis on the protective environment of Control and the trade pricing agreements. These gave the industry confidence in a more stable future demand, at least with regard to Indian competition. In respect of the impact of the trading agreements, it was argued by the industry:

> "There is no other traditional textile industry which has re-equipped itself to so considerable an extent. It is virtually certain that only a very small proportion of this re-equipment would have been undertaken had there not been a general assurance of economic stability and of future prospects conferred by the combined structure of protection (i.e. Control) and of the Seven Registered Agreements. ... If the agreements were discontinued and protection terminated or rendered inoperative, capital expenditure in the jute industry would be reduced to a small fraction of its present level. In consequence there would be reduced prospect of any future productivity improvement by way of new machinery, and future wage increases would fall very largely upon the final price of the product."[55]

This incentive effect was also embodied in the conclusion of an academic study of the conditions for technical progress in industry. Thus,

"In the jute industry, the greater security given by import controls and by Government purchasing has freed managers from the immediate struggle for existence, and they have been able to give attention to the introduction of new equipment which had been developed in other industries."[56]

These same authors also suggest that a further benefit to the industry from Control's operations was the taking over by Control of the risk and financial cost of stockholding of raw jute. This produced a situation in which firms had additional funds with which to finance new investment in plant etc.[57]

What one cannot judge from the statistics and general discussion on capital investment and its causes is the rate at which new ideas have been adopted by the industry as a whole relative to what they might have been, and the speed and method by which such innovations were adopted across the industry. Some firms have evidently re-equipped substantially and frequently, others have continued to use very old jute machinery, and even continue to weave mixtures or polypropylene on jute looms. Sidlaw, for example, spent around £1,200,000 in 1967 in modernising its jute spinning capacity,[58] while even quite small firms have spent considerable sums merely installing polypropylene weaving equipment. One small business, for example, with fewer than 200 employees in 1977, spent more than £1.5m. over the previous decade (at current prices) investing successively in two generations of polypropylene weaving equipment.

Not surprisingly, the upsurge of new investment spending in the late 1960's was due to the need to equip for polypropylene. McDowall et al. give data at current prices which show the changing emphasis from jute to polypropylene; and while these, in the authors' view,

considerably underestimate the level of investment in synthetics, they nonetheless indicate the trend of investment by jute firms.[59]

Table 4.37

Capital Investment in Jute and Synthetics (£'000)

	Jute	Synthetics
1968	1,648	
1969	742	
1970	438	435
1971	453	880
1972	330	725
1973	683	1,334
1974	474	1,509

Source : S. McDowall et al., Trade Adjustment and the British Jute Industry (unpublished monograph, St.Andrews University), p.120.

E. Research and Development

Closely related to the question of investment in the industry is the issue of research and development. The quality of the former may be influenced by the extent of the latter. Prior to 1946 there was no co-operative or group research carried out in the Dundee jute industry; although reports suggest that the largest firms in the industry had previously established their own individual laboratory facilities for research.[60] In 1946 however, under the auspices and with the financial support of the Department of Scientific and Industrial Research, the British Jute Trade Research Association was formed. The Research Association was a purely voluntary body (in contrast to such industries as wool and flax where joint research was financed by a statutory levy), and was financed by a subscription amounting to ½% of each firm's wage bill. This sum raised by the industry was approximately matched by the D.S.I.R. (later the Ministry of Technology).

Some 97% of jute spinners and manufacturers were members of the Association, and these were joined by merchants, brokers etc. as well as by machinery manufacturers.[61]

The Research Association carried out a number of activities. These may be divided into three categories. First, long-term basic research - covering work designed to discover and examine the molecular basis of the physical and chemical properties of jute. Second, short-term applied research and development - whose purpose was to use research to solve current problems, including the development of new markets for jute products. Third, information, advisory and liaison work - communicating the results of the previous categories of work to firms, and the solving of day-to-day problems for Association members.[62]

Some idea of the scale of work carried out by the Association can be gained from the data in Appendix Table 4.8 which covers the period from its foundation until its winding up in its earlier form and the creation of the Scottish Textile Research Association in 1969.

During its period as a purely jute research association, the B.J.T. R.A. appears to have carried out work of value to its members. Some of its longer-term work never came to fruition. It searched in vain for alternative sources of jute fibre for Dundee, or indeed for alternative natural fibres similar to jute (pineapples seemed a likely area at one time!). Likewise no dramatic breakthrough occurred in respect of new end-use areas for jute. Some work was done on trying to use jute in place of glass fibre in developing new resins; but little came of this. Likewise there were few major advances in jute spinning and weaving machinery for which the Association was responsible. The

Association's achievements were perhaps more general. It undoubtedly acted as a forum on technical matters for the industry. It may also have had the effect of reducing the differences in technical competence among the firms in the industry: bringing more of the firms into line with the technologically more progressive. In this context it must be remembered that, given the basis upon which the industry itself contributed to the Association's finances, the research was overwhelmingly paid for by the largest firms. One trade source estimated that during the 1960's Sidlaw, Low & Bonar, and Scott & Robertson were together contributing some 80% of the industry's total - around 40% of the Association's total income.

With regard to jute itself, what the Association failed to do was to find a replacement for the large-scale standard-product markets such as sacking and linoleum backing which formed the bulk of the industry's output in the immediate post-war period. This, of course, may appear to be demanding much of the Association. What is relevant, however, is that as these markets and that for tufted carpet backing disappeared in the latter part of the 1960's, the jute industry and jute industry research became less viable.

The coming of polypropylene brought about a reorientation of the Association's work. By 1966 the Association had specifically decided that a proportion of its funds - around 30% - should be spent on non-jute work - basically polyolefins.[62] The following year the Association was able to report progress on its research on polypropylene slit tape as an alternative to jute yarn. This non-jute work was reported to account for over 20% of the Association's research effort;[63] and reports indicate that the Association was aware of the end-use

market potential of polypropylene, and also of the implications of such changes for jute.

Inevitably the Research Association decided eventually to reflect its movement away from an undivided interest in jute by a change of name. In 1969 the body became known as the Scottish Textile Research Association.[64] This body continued in existence until 1975 when government matching of industry support for research in this area came to an end. Some idea of the extent of the Association's reorientation may be gained from the following data relating to Government support.

Table 4.38

Research Association Government Grant

	"for Jute Work"	"for Polypropylene Work"
1966-7	£20,387	£ 7,964
1967-8	19,385	9,652
1968-9	15,726	18,310
1969-70	16,337	18,750
1970-1	10,942	25,302

Source : Trade and Industry, 23rd June 1971, p.618.

F. Conclusions

This chapter has been concerned with analysing the market performance of the firms in what was at one time the Dundee jute industry. This performance was specified in terms of "financial" performance revealed through company accounting data, labour productivity, investment and modernisation, and research and development. It was emphasised that the research based upon data relating to individual firms covered only those businesses which were part of the jute industry in 1967, in respect of whom separate accounting data were

available, and which survived until 1977. The results of tests on company accounting data are to be interpreted in the light of the limitations imposed by such data, and also on the basis of the assumptions regarding the manner in which one interprets company accounting data discussed at the beginning of Section B of this chapter.

Turning first to the data on company financial performance analysed in Section B above, the first point to be made is that one's findings broadly conform to the pattern of results of a number of other cross-sectional and time-series studies regarding performance across U.K. manufacturing industries. This is so with regard to such relationships as that between profitability and growth, size and growth, and size and profitability. This is reassuring, for what it suggests is that despite the smallness of sample size the results of the tests can be accepted as not being totally abnormal.

Turning to the data on company financial performance, and first to the results of the analysis of profitability, the findings of our study were the absence of any trend of company profits relative to those for U.K. manufacturing industry as a whole over the total period 1968-1977 (including intra-group profit variability), a remarkable stability of profit performance between the two subperiods 1968-72 and 1973-77 (including a significant maintenance of rank order among the firms and a significant linear relationship between the profit ratios in the two subperiods), and the usual relationship between profitability (as a dependent variable) and average company size and growth (as measured by either assets or sales) and with the two independent variables being incorporated jointly in the multiple linear regression. That is, growth was a significant determinant but size was not. These results,

or the lack of significant difference from expected behaviour, confirm some of our hypotheses and conclusions on the strategy of diversification dealt with in the previous chapter. Not only did surviving firms in the industry maintain their profitability relative to manufacturing industry over a period of quite dramatic change in their traditional markets for jute; but despite individual firms following quite different strategies from one another, the rank order of their profit ratios in the subperiods remained high. Thus we might conclude that not only were the surviving firms successful in surviving but that they even held their ground relative to manufacturing industry as a whole. Surprisingly too, despite following very different survival strategies, the firms were successful in a very homogeneous way, for example with regard to the lack of change in intra-group profit variability over time and the maintenance of rank order of company profitability between the two subperiods. Thus our conclusion is that none of the drama of the period so far as the collapse of traditional markets is concerned worked its way through to company profitability.

In respect of corporate growth, the broad findings with regard to our group of firms were that the rate of growth over the period 1968-1977 (1969-77 with respect to employment) was not significantly dependent upon opening size as measured by either assets, sales or employment, but that average profitability was, however, significantly linearly associated with average growth. As in the case of profitability there was no significant change in the growth rates of firms between the two chosen subperiods. However there was some disturbance to the growth rank order of the firms between the two subperiods. Some findings differed according to the growth measure used. Compared with other figures, sales or value added data were regarded a priori as the most

reasonable to use. Although these findings are not surprising when taken in the context of those of other econometric studies, they are perhaps so with regard to our group of firms. One might have expected, for example, that in our context large firms would have had an advantage in growing (in a declining traditional market) over smaller ones: that their size might have been associated with greater financial weight, or management or technical expertise (perhaps including a body of professional managers separate from traditional owners) which would have stimulated and facilitated a more effective strategy of response to Jute's decline compared with that of the small, family owned businesses. That this has not been the case confirms again the conclusion in this respect in Chapter III on diversification: that success in this area is not clearly associated with identifiable variables such as company size.

With regard to labour productivity, Tables 4.23-4.25 suggest at an aggregated level that the industry had some success in this area in the 1950's, but that performance fell off badly in the late 1960's and 1970's, although one can be far less certain in interpreting recent statistics due to the problem of allocating employees between jute and synthetics areas of work. The data in Table 4.26 are more reliable and tell an interesting story. The point to remember is that there was a considerably greater reduction in female employment in the industry compared with male employment during the main period of adjustment. For example, in 1960 the jute industry employed females and males in almost equal numbers. From that date to 1977 the number of males employed declined by 40% while the number of females fell by 68% to a point where males comprised two-thirds of the work force. This changed position may be taken in conjunction with changes in relative

earnings of males to females in the industry. In 1960, for example, male hourly earnings were almost one and a half times those of females in the industry. Since that time this "male earnings premium" in the industry has declined to around 10% in 1977 as men, although narrowing the gap, have failed to change significantly their position relative to manufacturing industry as a whole, while jute industry women have moved from an earnings discount relative to women in manufacturing industry to a small premium position. There appears, therefore to have been a change in the male/female employment pattern accompanied by one also in relative earnings. That is, as women become more expensive relative to men the industry, it might be argued, began to employ men in greater proportion. It was decided to test statistically the hypothesis that the decreased ratio of females to males might be a response to the reduced male earnings premium. The dependent variable in Table 4.39 below is the ratio of females to males in the industry (from Appendix Table 4.1) while the independent variable is the ratio of male to female hourly earnings in the industry (from Table 4.26 above). The results of the linear regression were as follows :

Table 4.39

Linear Regression of Female/Male Employment and Male/Female Earnings 1960-1977

Dependent variable: ratio of female/male employment

Constant	b	t	R^2	Rho	DW
-0.64	1.0434	3.0679**	0.3855	0.5074*	0.2225

* significant at 2.5%; **significant at 0.5%.

There may thus have been some tendency to change the ratio of male to female employment in the industry in response to a change in relative earnings, although the very low Durbin-Watson statistic

suggests the presence of a non-linear relationship.

Turning to the conclusions on labour productivity derived from company accounting data (value added per employee) and concerning relationships between this measure of labour productivity and other company financial variables, it was noted that size (as measured by assets and sales), growth and capital intensiveness contributed strongly to increased labour productivity when considered on a bivariate regression basis. With regard to the growth of labour productivity, the results were inconclusive so far as the impact of size and growth were concerned. This applied also, rather surprisingly, in respect of growth of capital intensiveness. These results are not in conflict with those across U.K. manufacturing industry. At the same time they do not reveal anything of special significance regarding our group's economic performance over this period.

The data in respect of capital investment and modernisation in the industry, dealt with in Section D above, are of varying degrees of reliability. They do, however, suggest that the industry responded to the potentially more stable environment in the post-1948 period under Jute Control by investing heavily in new plant and equipment. Although it is not possible to offer a precise analysis of this dimension of the industry's performance - for example by relating this industry's new investment to its existing capital stock or making such comparisons with U.K. manufacturing industry as a whole - there does seem to be some impressionistic evidence to suggest that not only had the jute industry in an absolute sense made considerable strides in modernising its equipment over the period of the 1950's, but also that its performance in this direction compared extremely favourably with that of

other textile industries. If the publication of the 1948 Report gave an initial impetus to a high level of investment in the industry, the effective operation of Jute Control and of the industry's trade pricing agreements seem to have been sustaining forces. These, certainly up to the early 1960's, allowed the jute industry to believe that price competition from India and among home producers would be limited. And while this study has elsewhere suggested that such price levels may have hastened the entry and impact of polypropylene upon jute's end-use markets, at the same time the investment must have provided for a higher level of efficiency in jute spinning and manufacturing. Again, imperfect though the data may be, figures suggest that, while continuing to spend significant sums in maintaining its jute plant in a modern state, the industry as a whole invested heavily in synthetics plant and machinery from the late 1960's onwards. This latter direction of spending was largely responsible for the upsurge in total investment figures during the late 1960's and early 1970's.

Finally, with respect to research and development, the industry's voluntary co-operative efforts in this area from 1946 onwards appear from discussions with those involves in this aspect of the industry at the time to have had the effect of improving the quality of product and production methods across the industry. This was achieved by a pooling of resources for research and development in the industry, and by spreading the results of such work more widely across the 97% of spinners and manufacturers in the industry who were members of the B.J.T.R.A. than would otherwise have been the case. As in the area of capital investment expenditure, the industry appears to have responded quickly to the potential for developing polypropylene in terms of the switch of emphasis in its research and development expenditure.

This chapter has illustrated quantitatively a number of features of the traditional jute industry in a period of transition. Several characteristics stand out. First, there is evidence at a market level of a real effort by the industry to accomplish the transition. This is illustrated through the data on capital equipment expenditure and research and development effort. Second, the transition from almost complete dependence upon jute to a wider industrial textiles base and other interests was accomplished with quite remarkable smoothness by all of the surviving firms. This applied particularly to profitability, both relative to U.K. manufacturing industry, and with respect to profit performance within the group of firms and over sub-periods within the years 1968-1977. Third, company size does not appear to have conferred overwhelming advantage on those firms within our group. Larger firms performed no better than smaller ones in respect of average profitability or growth over the period 1968-1977. These larger firms do, however, appear to have had an advantage in terms of the average level of labour productivity; and there is some evidence that the variability of their profits over time was lower than that of smaller competitors. These latter advantages did not however translate themselves into a better performance in the fundamental areas of profitability or growth.

Having summarised our findings and offered some analysis of these in the area of economic performance in this industry in the final section of this chapter, it remains in Chapter V to bring together all of the strands of findings and analysis in the thesis so far.

References

1. J.S. Bain, Industrial Organization (London: Wiley, 2nd ed. 1968) p.10.

2. It should be noted that the term "financial" is used here to refer to data drawn from company accounts. The data actually analysed in the study are those on profits, assets, sales and employment. Wider financial variables such as gearing, liquidity, trade credit, internal/external finance or valuation ratios are not considered to be appropriate to the study.

3. R.G.D. Allen, Statistics for Economists (London: Hutchinson, 2nd ed. 1951) p.14.

4. For skewness in the distribution of size, profitability and growth in a large sample of U.K. data see G. Whittington, The Prediction of Profitability (Cambridge: C.U.P., 1971) pp.20-30; and for skewness and kurtosis in a smaller sample see D.P. O'Brien, W.S. Howe, D.M. Wright & R.J. O'Brien, Competition Policy, Profitability and Growth (London: Macmillan, 1979) pp.7-11.

5. See S. Seigel, Nonparametric Statistics for the Behavioural Sciences (Tokyo: McGraw-Hill Kogakusha, 1958) pp.30-34.

6. See L.R. Amey, The Efficiency of Business Enterprises (London: Allen & Unwin, 1969) pp.1-21.

7. See G. Meeks, Disappointing Marriage: A Study of the Gains from Merger (Cambridge: C.U.P., 1977) p.2.

8. Further difficulties in this area are dealt with in W.S. Howe, Industrial Economics: An Applied Approach (London: Macmillan, 1978) pp.80-83.

9. This issue is dealt with further by Amey who even casts doubt upon the value of the concept of capital turnover. See L.R. Amey, op.cit., p.36.

10. What is obviously being ignored here is the question of capital gearing, and whether the impact of this should be included because, for instance, its incidence varies with the size of firm. Fortunately there appears to be evidence to suggest that the use of variously defined rates of return on capital employed makes no difference to the findings of, for example, size-profitability studies. See J.M. Samuels & D.J. Smyth, "Profits, Variability of Profits and Firm Size", Economica, May 1968, Vol. XXXV, p.128; and G. Whittington, op.cit., p.53.

11. See W.W. Daniel & J.C. Terrell, Business Statistics: Basic Concepts and Methodology (Boston: Houghton Mifflin, 1975) pp. 164-67.

12. For a test for significance of rho see S. Siegel, op.cit., p.212.

13. See G. Whittington, op.cit., pp.84-86.

14. Every attempt has been made in this study to use data in the most correct and meaningful form possible. This has meant correcting data on profits, assets and sales to give figures for these variables, say, relative to the general trend of profits, or to measure changes in the volume of assets or sales during a period of inflation. The need for such corrections arises, first, where on a cross-sectional basis we wish to distinguish between the volume growth of two variables such as sales and assets, or where these are being compared with a true volume measure such as employment. Second, such adjustments are essential where we wish to compare average growth or profit performance over two separate time periods in respect of which "other things" such as manufacturing profitability or the rate of inflation may not have remained constant. Third, in time-series analysis involving any comparison of, say, profitability and size at 't' with the same two variables at, say, 't+5' the risk of any spurious correlation occurring due to a common impact on the two variables of inflation has been removed by dealing with "real" variables.

15. See A. Singh, Take Overs: Their Relevance to the Stock Market and the Theory of the Firm (Cambridge: C.U.P., 1971) p.95.

16. See W.S. Howe, op.cit., pp.86-87.

17. Ibid.

18. See S. Siegel, op.cit., Ch. 6.

19. Analysis of the Durbin-Watson statistic which tests for serial correlation in the residuals did not suggest any particular systematic non-linearity in the trend.

20. A. Singh & G. Whittington, Growth, Profitability and Valuation (Cambridge: C.U.P., 1968).

21. Such a hypothesis is, however, contradicted by the study by Radice who found that within his sample of firms owner-managed businesses were both more profitable and exhibited faster growth rates than non-owner-managed firms. See H.K. Radice, "Control Type, Profitability, and Growth in Large Firms", Economic Journal, September 1971, Vol. LXXXI, pp.547-62.

22. The fact that British industry as a whole relies considerably upon internal finance is amply demonstrated in A.D. Bain, The Control of the Money Supply (Harmondsworth: Penguin, 2nd ed. 1976) pp.118-23.

23. Opening assets or sales is to be preferred as a measure of firm size in this context as differences between firms with regard to average assets or sales are in part a reflection of company growth.

24. The issue of labour productivity is dealt with in a separate section below.

25. See D.J. Smyth, W.J. Boyes & D.E. Peseau, Size, Growth, Profits and Executive Compensation in the Large Corporation (London: Macmillan, 1975) Chs. 1 and 2.

26. See, for example, C.F. Pratten, Economics of Scale in Manufacturing Industry (Cambridge: C.U.P., 1971).

27. See G. Whittington, op.cit., pp.59-65.

28. See D.J. Smyth et al., op.cit., Ch. 4.

29. In the case of assets and sales the independent variables were the 1967 values.

30. For a summary of the literature see W.S. Howe, op.cit., pp.87-8.

31. This may be compared with the results in A. Singh & G. Whittington, op.cit., pp.108-11.

32. Survey of the United Kingdom Jute Industry (London: Times Publishing Co., 1952) p.24. As one can see from comparing different estimates, exact figures should be treated with caution, as definitions of categories of employment and of geographical area are not always consistent.

33. B. Lenman, An Economic History of Modern Scotland (London: Batsford, 1977) p.201.

34. Ibid., p.219.

35. Report of the Board of Trade Working Party on the Jute Industry, (London: H.M.S.O., 1948) p.9.

36. D.G. Southgate, "Politics in Dundee" in S.J. Jones (ed.) Dundee and District (Dundee: British Association, 1968) p.347.

37. For example Walker in his historical study points out that in 1885 females in the jute industry outnumbered males by ten to one; and that with women carrying out the "prestige" tasks in the industry they had created for themselves a separate "aristocracy of labour". See W.H. Walker, Juteopolis: Dundee and its Textile Workers 1885-1923 (Edinburgh: Scottish Academic Press, 1979) pp.32-33.

38. Data given in Financial Times, 31st March 1954.

39. See J.H. Leveson, Industrial Organisation of the Jute Manufacturing Industry (Dundee: College of Technology, 1973) Appendix 4.

40. See Financial Times, 2nd November 1959, and 15th February 1960.

41. See J.H. Leveson, op.cit., p.47. For example in 1968 the chairman of Buist Spinning spoke of the "lack of reliable labour which is tending to restrict production throughout the Dundee area", while in the mid 1970's the chairman of Thomson Shepherd, for example, spoke of the difficulties in the jute department of "costly labour of poor quality and unstable attendance". See Buist Spinning Co., 1968 Annual Report; and Thomson Shepherd, 1975 Annual Report.

42. Financial Times, 29th March 1954.

43. Loc.cit., 15th June 1960.

44. Loc.cit., 30th July 1962.

45. See L.R.4R.P., p.60.

46. C.F. Carter & B.R. Williams, Industry and Technical Progress (London: O.U.P., 1957) p.225.

47. Ibid., p.227.

48. See K.D. George, Industrial Organization (London: Allen & Unwin, 1971) p.25.

49. For further evidence on this at the industry level see the study of 82 manufacturing industries 1954-1973, R. Wragg & J. Robertson "Britain's Industrial Performance Since the War", Department of Employment Gazette, May 1978, pp.513-14.

50. In respect of the impact of firm growth these findings are contrary to those of Wragg & Robertson at the industry level. See ibid., pp.515-16.

51. The sources of this data are as follows: for individual Census of Production years, the Census of Production. For other estimates, 1951 - Survey of U.K. Jute Industry (London: Times Publishing Co., 1952) p.10; 1955 - C.F. Carter & B.R. Williams, op.cit., p.223; 1954-56 - Financial Times, 29th January 1958; 1957 - Dundee Chamber of Commerce Journal, March 1958, p.25; 1961 - L.F. Robertson, Precognition to Restrictive Practices Court, p.40; 1962-63 - Financial Times, 18th November 1963 and 14th December 1964; 1963 - Dundee Courier & Advertiser, 26th February 1964; 1968 - R. McIntosh, The Changing Face of the Jute Industry, Unpublished D.M.S. Dissertation (Dundee College of Technology, 1969) p.12; 1968-74 - S. McDowall, P. Draper & T. McGuinness, Trade Adjustment and the British Jute Industry (unpublished monograph, St. Andrews University) Appendix V; 1977 - Dundee Tayside, Autumn 1977, p.769.

52. Financial Times, 15th June 1960.

53. Loc.cit., 29th March 1954.

54. Loc.cit., 18th November 1963.

55. L.F. Robertson, Precognition, p.112.

56. C.F. Carter & B.R. Williams, op.cit., p.187.

57. Ibid., pp.222-3.

58. Dundee Chamber of Commerce Journal, December 1967, p.595.

59. See S. McDowall et al., op.cit., p.117.

60. See Survey of U.K. Jute Industry, p.11. More specifically it was claimed that two firms in the industry (Sidlaw, and Low & Bonar) had had their own research facilities dating from the

early decades of this century. See H. Corteen, "Science at Work in the Jute Industry", Dundee Chamber of Commerce Journal, September 1958, p.143. Mr. Corteen was the Association's first Director of Research.

61. See "Jute Industry Progress", Dundee Chamber of Commerce Journal, March 1958, p.25. It is interesting to note that the Indian jute industry had financed group research for a decade prior to the establishment of the B.J.T.R.A. See "Jute Research in the U.K. and Abroad", Financial Times, 29th March 1954.

62. See British Jute Trade Research Association, 1966 Annual Report, p.iii.

63. Loc.cit., 1967 Annual Report, p.xx.

64. See H.P. Stout, "Meeting the Challenge to Industry", Dundee Chamber of Commerce Journal, March 1970, p.27. Dr. Stout was the Association's current Director of Research.

65. See generally C. Kennedy & A.P. Thirlwall, "Surveys in Applied Economics: Technical Progress", Economic Journal, March 1972, Vol. LXXXII, pp.11-72.

66. For example in one of McDowall's studies it was pointed out that a given square yardage of polypropylene woven on the most modern looms required only one sixth of the labour of the same area of jute woven on traditional looms. This represents a reduction of 83% in labour usage. See S. McDowall & P. Draper, Trade Adjustment and the British Jute Industry (Glasgow: Fraser of Allander Institute, 1978) p.8.

67. For a discussion of the basis of the formula and of the geometric index alternative see R. Wragg & J. Robertson, "Post-War Trends in Employment, Productivity, Output, Labour Costs and Prices by Industry in the United Kingdom", Department of Employment Research Paper No. 3, June 1978, pp.40-41. These two authors point out that the correlation coefficient in the case of their study between the arithmetic and geometric indices of total factor productivity was 0.94. See ibid., p.41.

68. See M.I. Nadiri, "Some Approaches to the Theory and Measurement of Total Factor Productivity: A Survey", Journal of Economic Literature, 1970, Vol. VIII, pp.1137-77.

69. On this see B.M. Deakin & T. Seward, Productivity in Transport (Cambridge: C.U.P., 1969) Ch. 1.

Appendix Table 4.1

Employment in the Jute Industry ('000)

	Males	Females	Total	Females:Males	Unemployment
1948	7.9	12.4	20.3	1.56:1	388
1949	7.2	10.0	17.2	1.39	1,361
1950	7.1	10.5	17.6	1.48	483
1951	7.7	11.1	18.8	1.44	291
1952	7.0	9.8	16.8	1.40	1,420
1953	8.1	11.8	19.9	1.46	619
1954	9.3	11.5	20.8	1.24	602
1955	8.8	11.0	19.8	1.25	1,087
1956	8.5	10.6	19.1	1.25	1,460
1957	8.6	10.1	18.7	1.17	1,646
1958	7.8	8.4	16.2	1.08	2,613
1959	8.2	8.7	16.9	1.06	1,258
1960	8.8	8.4	17.2	0.95	710
1961	8.3	8.6	16.9	1.04	1,655
1962	8.2	9.2	17.4	1.12	640
1963	8.6	8.4	17.0	0.98	945
1964	8.8	8.5	17.3	0.97	617
1965	8.9	8.6	17.5	0.97	459
1966	8.8	8.3	17.1	0.94	358
1967	8.0	7.3	15.3	0.91	950
1968	8.2	7.0	15.2	0.85	640
1969	8.5	6.9	15.4	0.81	542
1970	6.9	5.0	11.9	0.72	995
1971	6.1	4.2	10.3	0.69	1,415
1972	5.7	3.8	9.4	0.67	1,251
1973	5.5	3.5	9.0	0.64	931
1974	6.0	3.4	9.4	0.56	529
1975	5.3	2.8	8.1	0.53	730
1976	5.0	2.6	7.6	0.52	897
1977	5.3	2.7	8.0	0.51	923

Sources: Department of Employment, British Labour Statistics - Historical Abstract 1886-1968 (London: H.M.S.O., 1971) : and subsequent annual editions of British Labour Statistics.

Appendix Table 4.2

Earnings and Hours Worked in Manufacturing Industry*

	Men Aged 21 and Over		Women Aged 18 and Over	
	Average Weekly Earnings (£)	Average Weekly Hours Worked	Average Weekly Earnings (£)	Average Weekly Hours Worked
1948	7.17	46.5	3.74	41.6
1949	7.40	46.6	3.96	41.7
1950	7.83	47.5	4.16	42.1
1951	8.60	47.8	4.53	41.5
1952	9.24	47.7	4.84	41.8
1953	9.83	47.9	5.16	42.0
1954	10.61	48.5	5.45	42.0
1955	11.55	48.7	5.80	41.8
1956	12.11	48.2	6.00	41.5
1957	12.44	48.1	6.31	41.5
1958	13.06	47.6	6.58	41.2
1959	14.21	47.6	7.07	41.5
1960	15.16	47.4	7.41	40.4
1961	15.89	46.8	7.71	39.6
1962	16.34	46.2	8.03	39.3
1963	17.29	46.8	8.41	39.6
1964	18.67	46.9	8.94	39.3
1965	20.16	46.1	9.59	38.6
1966	20.78	45.0	10.06	38.0
1967	21.89	45.3	10.54	38.0
1968	23.62	45.8	11.31	38.2
1969	25.54	45.7	12.12	37.9
1970	28.91	44.9	13.98	37.7
1971	31.37	43.6	15.80	37.5
1972	36.20	44.1	18.34	37.7
1973	41.52	44.7	21.15	37.5
1974	49.12	44.0	27.05	37.2
1975	59.74	42.7	34.23	36.8
1976	67.83	43.5	40.71	37.2
1977	74.20	45.6	45.00	39.8

* Data are for manual workers in manufacturing industry

Source : Department of Employment Gazette (H.M.S.O.)

Appendix Table 4.3

Earnings and Hours Worked in Jute Industry*

	Men Aged 21 and Over		Women Aged 18 and Over	
	Average Weekly Earnings (£)	Average Weekly Hours Worked	Average Weekly Earnings (£)	Average Weekly Hours Worked
1960	11.79	47.8	7.37	42.4
1961	11.93	45.6	7.54	40.8
1962	12.88	46.4	8.05	40.7
1963	13.43	46.0	8.13	40.5
1964	14.57	46.3	8.85	39.5
1965	15.71	47.0	9.21	39.6
1966	16.56	46.3	9.62	38.4
1967	18.08	45.6	10.36	38.3
1968	18.96	45.5	10.80	37.8
1969	21.47	45.2	12.32	37.7
1970	23.25	44.1	12.52	37.6
1971	25.02	44.9	15.70	38.0
1972	29.40	44.2	18.37	38.1
1973	33.14	43.3	21.72	37.5
1974	40.45	43.5	28.51	38.6
1975	50.50	42.8	34.74	36.1
1976	54.44	43.0	42.48	37.5
1977	56.36	42.7	42.47	36.3

* Figures are those for October each year.

Sources : 1960-69 unpublished Department of Employment figures
1970- Department of Employment Gazette (H.M.S.O.)

Appendix Table 4.4

Labour Productivity Comparisons

	Index of Raw Jute Consumption per Employee	Index of Output per Person Employed (Manuf. Industry)	3*	4**
	1950 = 100	1950 = 100		
1950	100	100		
1951	98	102		
1952	103	99		
1953	107	104		
1954	107	109		
1955	119	113		
1956	120	111		
1957	121	114		
1958	124	114		
1959	131	121		
1960	133	126		
1961	112	125		
1962	121	127		
1963	128	133	100	100
1964	122	144	95	106
1965	119	146	93	111
1966	116	149	91	114
1967	120	155	94	120
1968	118	166	92	140
1969	113	170	88	143
1970	118	172	92	148
1971	122	176	95	162
1972	133	187	104	173
1973	124	201	97	183
1974	102	198	80	172
1975	105	195	82	178
1976	101	203	79	191
1977	94	202	73	201

* as in col. 1 1963 = 100
** as in col. 2 for Textiles 1963 = 100

Sources: Table 4.25, and British Labour Statistics (London: H.M.S.O., various editions).

Appendix Table 4.5

Capital Investment (£'000)

	Cumulative Total	Annual	Price Index*	Annual at 1970 Prices	3-Year Moving Average
1945	500	500	..	..	
1946	1,000	500	..	..	
1947	1,500	500	..	..	
1948	2,000	500	40.3	1,240	
1949	2,500	500	41.2	1,214	1,212
1950	3,000	500	42.3	1,182	1,529
1951	4,000	1,000	45.7	2,190	1,677
1952	4,850	850	51.2	1,660	1,897
1953	5,830	980	53.2	1,840	2,097
1954	7,330	1,500	53.7	2,790	2,133
1955	8,330	1,000	56.6	1,770	1,900
1956	9,830	1,500	60.5	1,140	1,537
1957	10,290	1,090	63.9	1,700	1,327
1958	11,670	750	65.8	1,140	1,177
1959	12,130	460	66.5	690	817
1960	12,600	420	67.5	620	627
1961	13,000	400	70.2	570	630
1962	13,500	500	71.7	700	653
1963	14,000	500	73.0	690	907
1964	15,000	1,000	75.0	1,330	1,143
1965	16,100	1,100	77.9	1,410	1,390
1966	17,250	1,150	80.3	1,430	1,397
1967	18,350	1,100	81.3	1,350	1,577
1968	20,000	1,650	84.7	1,950	1,550
1969	21,250	1,250	90.8	1,350	1,850
1970	24,500	2,250	100.0	2,250	1,953
1971	27,000	2,500	110.7	2,260	2,347
1972	30,000	3,000	118.8	2,530	2,623
1973	34,000	4,000	130.0	3,080	2,863
1974	38,500	4,500	150.9	2,980	2,560
1975	41,500	3,000	185.5	1,620	1,667
1976	42,500	1,000	247.3	400	732
1977	43,000	500	282.0	177	

* From C.S.O., Price Index Numbers for Current Cost Accounting (London: H.M.S.O., 1978).

Sources: see ref. 51.

Appendix Table 4.6

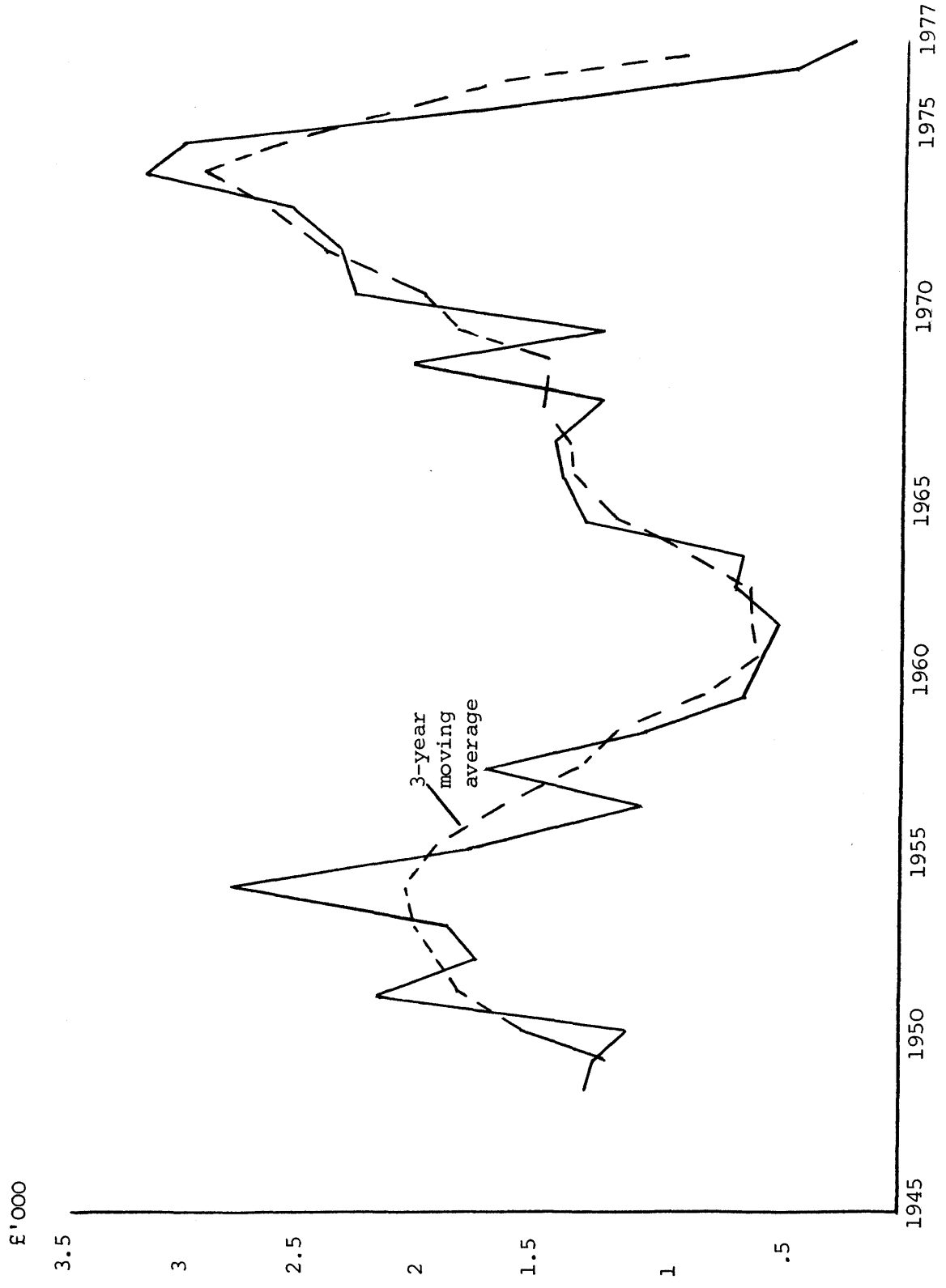
Capital Investment 1945-1977 : Cumulative Total (current prices)

Source : Appendix Table 4.5

Appendix Table 4.7

Annual Capital Investment 1948-1977 at 1970 Prices

Source : Appendix Table 4.5



Appendix Table 4.8

British Jute Trade Research Association

	Income			Member-	
	Industry	Government	Total	ship	Employees
1946-47	..	..	£18,502	138	4
1947-48	£13,463	£10,557	24,020	160	12
1948-49	15,523	13,001	28,524	170	22
1949-50	16,963	14,346	31,309	172	29
1950-51	17,372	14,662	32,034	176	30
1951-52	19,579	14,559	34,138	175	36
1952-53	20,770	16,301	37,071	171	39
1953-54	21,580	17,193	38,773	166	43
1954-55	25,331	19,538	44,869	152	48
1955-56	27,496	20,001	47,497	154	43
1956-57	31,874	20,950	52,824	136	45
1957-58	32,057	21,617	53,674	129	45
1958-59	31,081	20,943	52,024	139	46
1959-60	32,425	24,052	56,477	124	50
1960-61	33,387	23,228	56,615	120	50
1961-62	37,621	24,238	61,859	117	50
1962-63	39,596	27,533	66,129	114	50
1963-64	38,960	25,604	64,764	108	50
1964-65	40,116	26,791	66,907	105	40
1965-66	41,330	28,218	69,548	104	43
1966-67	44,314	31,831	76,145	101	39
1967-68	44,415	34,592	79,007	95	44

Source: British Jute Trade Research Association, Annual Reports.

Appendix Table 4.9A

Linear Regression of Firm Size and Vertical Integration

Dependent variable : 10-year average ratio of value added to sales

Size Measure	Constant	b	t	R^2	Rho	DW
Average assets	0.334	-0.00001	3.2316***	0.3742	-0.4214	1.3346/
Opening assets	0.335	-0.00001	2.5461**	0.3766	-0.3679	1.2518/
Average sales	0.338	-0.00000	3.1561***	0.4196	-0.4679*	1.4121
Opening sales	0.338	-0.00001	3.3972***	0.4134	-0.5393**	1.2931/
Average employ.	0.338	-0.00003	3.4218***	0.2235	-0.4647*	1.2419/
Opening employ.	0.336	-0.00003	1.5211	0.2361	-0.4665*	1.2873/
Growth Measure						
Assets	0.313	-0.00027	0.1125	0.0010	-0.0947	1.1786/
Sales	0.313	0.00013	0.0361	0.0001	0.0393	1.1920/
Employment	0.313	-0.00004	0.0108	0.0000	-0.0054	1.1836/

Appendix Table 4.9B

Linear Regression of Firm Growth and Profit Variability

Dependent variable : Profit variability

	Growth	b	t	R^2	Rho	DW
Profits:	Assets	-0.23631	1.5526	0.1565	-0.4061	2.2983
stand.	Sales	-0.35862	1.5484	0.1557	-0.2574	2.2331
dev.	Emp.	-0.30131	1.2461	0.1067	-0.3059	2.4172
Profits:	Assets	-3.38635	2.7331**	0.3648	-0.6845**	2.3326
coeff.	Sales	-5.21188	2.7826**	0.3732	-0.5357**	2.1021
var.	Emp.	-5.11632	2.6414**	0.3493	-0.6166**	2.3014
Profits:	Assets	-5.31154	1.6037	0.1652	-0.3199	2.2073
resid.	Sales	-8.20612	1.6334	0.1703	-0.1571	2.1244
var.	Emp.	-7.03408	1.3411	0.1215	-0.2252	2.2931

Significance levels : * 10%, ** 5%, *** 1%, **** 0.1%

DW : none of the statistics was significant at 10% - those marked / were within the indeterminate range.

Appendix to Chapter IV

Comparison of Sales and Value Added as Company Size and Growth Measures

Although there are some uncertainties concerning our measure of value added, and although a number of alternative firm size measures have already been used in the tests in this chapter, it was decided to check to see if the findings regarding the impact of company size upon profitability and growth held true where value added was used in place of sales as a company size measure.

There was found to be a strong relationship between opening and average sales and value added data, and between the sales and value added growth measures. The respective coefficients of rank correlation (Rho) were 0.8643, 0.9929 and 0.8786, which were all significant at 0.1%, while the coefficients of determination when the value added measure was adopted as the dependent variable were 0.9469, 0.9436 and 0.6386 respectively. Not surprisingly therefore there was only a minimal change in the findings on the impact of firm size or growth on profitability (Tables 4.6-4.9) using these two different size or growth measures. In respect of the analysis of growth in Tables 4.11-4.18, although the growth-size findings were virtually identical, profitability appeared to explain a slightly lower proportion of value added growth compared with sales growth.

Only in respect of Tables 4.19-4.21 were the value added findings different from those based upon sales growth. Relating to the data in Table 4.19 there was no marked difference in the growth rates of value added between the two subperiods using any of the tests. The figure for Rho in Table 4.20 on a value added basis was 0.2929, which was not significant at 10%; and the t statistic and R^2 figures for Table 4.21 on the basis of value added were 1.3375 and 0.1210 respectively. This latter set of results relating to Tables 4.19-4.21 brings the subperiod output measure findings into line with those based upon input growth measures. It thereby strengthens the contrast between subperiod profit and growth performance. Comparing the findings on p.167 and Table 4.5 with those in Tables 4.20 and 4.21, the conclusion incorporating the value added data is that while there was no significant overall change in the level of profitability or growth rates over our two subperiods, so far as growth is concerned there was some disturbance in the rank order of firms between the two subperiods, and growth in the latter subperiod was much less related to growth in the former than was found to be the case with profitability.

Annex to Chapter IV

Total Factor Productivity

It is recognised that measures of efficiency such as rate of return on capital employed or labour productivity are partial. In particular measures of physical output or sales or value added per employee (labour productivity) cannot be considered in isolation from changes in the amount of capital employed by the business. A common feature of industry, and our group of firms is no exception, is a progressive increase in the ratio of capital to labour employed. Apparent rises in labour productivity may not under such circumstances be the result of increased efficiency in the use of labour itself but of an enhanced ratio of capital to labour.[65] This particular limitation in the use of labour productivity as a measure of efficiency may be especially serious in a case such as the jute industry where considerable changes in technology have occurred.[66] In order to obtain a more reliable indication of changes in the total efficiency of a business over a period of time use may be made of a measure of total factor productivity. This measure, essentially a residual, indicates the part of the growth of output of the firm which is not accounted for by increased inputs of capital and labour. The arithmetic index formula used for our calculations is given below.[67]

$$P = \frac{Q}{aL + bK}$$

where Q is an index of output, L and K are indices of employment of labour and capital respectively, and a and b are the proportions of wages and profits respectively to value added in the base period (a + b = 1). There are two major areas of difficulty in a study such as

this which the use of total factor productivity creates. The first concerns the broader issues of what is actually being measured. The total factor productivity formula above includes only capital and labour inputs, and therefore ignores the contribution of increased materials to output. Furthermore, not only does the formula not allow for the advantages of economics of scale, but it takes no account of learning effects or substitution between capital and labour. Nor, more controvertially, is account taken of changes in the quality of capital and labour. If these types of change are not built into the equation then total factor productivity, as a residual, is overstated.[68] The second area of difficulty concerns the actual measure of labour and capital inputs and proportions in the base year and of value added. In our case labour input is measured as the total number of employees as recorded in the company Annual Reports. This is a reasonable measure of labour input although it does not reveal the number of hours worked and thus ignores overtime or short time working. Capital is measured as total capital employed (fixed and current assets less non-bank current liabilities) measured over the period in real terms by reference to the appropriate C.S.O. Current Cost Accounting index (Textiles, Leather and Clothing, M.L.H. 411-450). The output measure used is value added expressed in real terms by reference to the appropriate wholesale price index. Value added was used in place of sales because it is known that for a proportion of the firms in our group the ratio of value added to sales changed significantly over the 1968-1977 period.[69] Thus the period used for measurement was 1968-1977, and in the base year value added was calculated from the company accounts by reference to data on sales, trading profits, and total remuneration of employees including directors. Material and fuel inputs were assumed to be sales less trading profits, less remuneration of all

employees including directors. Value added was calculated as sales less material for fuel inputs. The proportion of value added accounted for by labour (a in the equation above) was the ratio of all remuneration to total value added, with the remainder being attributed to profits (b in the above equation).

The result of the total factor productivity analysis is interesting. In respect of none of the measures used (assets, sales, employment, or value added) did average size explain any significant proportion of the variation in total factor productivity among the firms. This finding applied in respect of both the parametric and the nonparametric statistical tests, and the Durbin Watson statistics relating to the linear regressions revealed no evidence of autocorrelation. With regard to growth as an explanatory variable the results differed between the growth measures. These are presented below.

Table 4.40

Linear Regression of Total Factor Productivity and Growth

Dependent variable: Total factor productivity 1968-1977

Growth Measure	Constant	b	t	R^2	Rho	DW**
Assets	23.1	-1.41088	1.8997*	0.2173	-0.2609	2.6214
Sales	27.7	-2.33528	2.1210*	0.2571	-0.3536	2.6669
Employment	21.7	-1.85800	1.5627	0.1581	-0.2449	2.7392
Value added	26.0	-0.00978	0.0078	0.0000	-0.0393	2.6301

*significant at 10%; **not significant at 10% or within indeterminate range.

Although none of the values of Rho in the above table was significant, there is obviously evidence of a fairly strong negative linear relationship between asset or sales growth and total factor productivity. Our finding therefore is that although size had no effect upon the

extent of total factor productivity, growth of sales and assets did, in the sense that firms which experienced lower rates of growth achieved higher levels of total factor productivity. Although the explanation for this may be complex (perhaps firms trying to grow at above particular rates encountered lower levels of management productivity) the relationship is consistent with some of our earlier findings. This consistency is brought out if we examine the relationship between total factor productivity and the two partial measures of efficiency - rate of return on capital, and labour productivity. It will be remembered that average profitability and average growth among our firms were strongly related (see Tables 4.6 and 4.9), and also that growth and labour productivity were strongly related when the latter was calculated on a value-added basis (see Tables 4.29[f] and 4.36). Our findings with regard to the relationship between total factor productivity and capital and labour productivity are as follows.

Table 4.41

Linear Regression of Total Factor Productivity and Rate of Return on Capital Employed and Labour Productivity (Value-Added Basis)

Dependent variable : Total factor productivity 1968-1977

	Constant	b	t	R^2	Rho	DW**
Rate of return	38.2	-1.24145	1.4339	0.1366	-0.1357	2.7952
Labour product.	63.4	-29.2927	1.8960*	0.2167	-0.3536	2.7271

* significant at 10%; ** not significant at 10% or within indeterminate range.

Table 4.41 above suggests evidence of a negative relationship between the two partial measures of productivity on the one hand and total factor productivity on the other, while there exists a strong positive relationship between the two partial measures themselves. (In this latter case the rank correlation coefficient was 0.4750, and with

labour productivity as the independent variable the t statistic relating to the b coefficient was 2.3076 and R^2 was 0.2906.)

Our conclusion from this area of study must be that while our two partial measures of productivity appear to be quite strongly related - indeed on a simple bivariate regression basis differences in labour productivity account for about 30% of observed variations in profitability - total factor productivity is clearly measuring something different. This difference is particularly brought out when growth is adopted as the independent variable in explaining differences in total factor productivity. Here, quite contrary to our earlier findings in respect of the influence of growth on labour productivity and the relationship between profitability and growth, firms in our group which achieved lower rates of growth in terms of assets and sales performed better in the dimension of total factor productivity than their faster-growing competitors.

CHAPTER V

Conclusions

A. Introduction

Jack Downie justified his meagre one and a half pages of conclusions at the end of The Competitive Process by a reference to Keynes' famous remark on economics being an "apparatus of the mind", and a suggestion that "it is because economics is as he (Keynes) described it that few books on economic subjects have a very lengthy chapter on conclusions".[1] It nonetheless seems both appropriate and possible to draw a number of conclusions from this study, and these relate both to the behaviour of firms in an individual market and to the broader topic of resource allocation and efficiency in general. Indeed there appears to be a growing realisation and confidence that studies of individual firms or industries can lead on to the formulation of useful generalisations on economic behaviour; and also that the study of firm or individual-industry decision making at the micro-economic level can throw light upon questions of the overall or macro-economic operation of the economy.[2] The same argument must also apply to the conditions governing international competitiveness. Furthermore this relationship between micro and macro performance may be particularly significant in the area of economic growth where a major determinant of the rate of expansion of firms and of an economy is the rate at which new technologies are developed or adopted. This particular study, being one largely concerned with an environment of technological change and of the process of the adaptation to new technology, is one in which it should be especially possible to high-

light certain wider implications on the basis of observation of a single industry.

This study has been one of a declining industry, indeed of an industry demand for whose traditional products for sacking and bags and for yarn and cloth for the carpet industry collapsed very rapidly over a relatively short period of time at the end of the 1960's. To give one example in respect of a major end use, jute's share of the market for the primary backing of tufted carpets fell from more than 90% in 1967 to less than 5% in 1974.[3] In such an environment a number of questions and issues automatically arise. First, was the traditional jute industry in any sense responsible for its own demise, or for the timing or pace of its downfall? Was it the case, for example, that arrangements of one form or another among firms in the jute industry, or simply the general uncompetitiveness of the traditional market, caused new products to take over from jute on a price or quality basis? If such a takeover was in some sense inevitable, was the process speeded up by conduct on the part of jute manufacturers? Second, were changes in demand for jute or in the accompanying technology foreseen by firms in the traditional market? How aware were the original jute manufacturers of the possibility of technical obsolescence in respect of jute yarn and cloth; and what steps were being taken to deal with the situation? For example, were any of the jute manufacturers responsible for major developments in polypropylene? Third, what was the reaction of the original jute manufacturers to the commercial development of polypropylene from the mid 1960's onwards? Fourth, and related to the previous question, how far did the traditional jute manufacturing firms participate in new technology as it related either to jute or to polypropylene? It is in an attempt to answer some of

these questions that these Conclusions are written. The material is covered largely under the same headings but not in the same sequence as in the body of the thesis as a whole.

B. Changes in Markets and Market Structure

As mentioned in the Introduction to this chapter, this study has been one of market decline so far as the traditional jute industry is concerned. This decline came from two sources: radical change in technology (from handling and transporting goods in jute bags to bulk handling and containerisation), and substitution of synthetic fibres (predominantly polypropylene) for jute. To the question, could jute in the long term have competed more effectively against these new methods, the answer must be no. There is no indication that other than dramatically lower jute prices could have preserved a container end-use market for jute, or that polypropylene's inroads into jute's traditional markets were not the result predominantly of better technological performance combined with lower prices given the nature of the synthetic raw material. It was, however, noted in Chapter II that the system of Jute Control and the restrictive trading agreements did have the effect of artificially raising the price of jute above world levels. Control, for example, "marked up" the price of some imports of jute goods by up to 50%; and in other areas there was a complete ban on imports from Calcutta - Dundee prices in some cases being up to 75% above those of potential imports.[4] Furthermore, attention has been drawn to the fact that quite apart from the impact of Control, jute manufacturers in the U.K. do not appear in the late 1960's and early 1970's to have been prepared to fight any rearguard action along the price dimension of competition to maintain the position of jute in its existing markets.

The history of changing markets for firms in the traditional jute industry is that of the disappearance of former jute end uses, and of the efforts by most firms to participate in the necessary technological change to avoid total loss of business. Thus although, as was noted in Chapter III, there are one or two small spinners who have remained entirely in jute, satisfying demand largely for woven carpet yarns, and although many of the large firms still combine jute spinning and weaving with synthetic interests, most firms have moved significantly into polypropylene or other man-made fibres, or into more diversified interests. The result of changes in technology is that although the carpet industry is now responsible for purchasing a much greater share of total jute output - the proportion having risen from around 50% in the late 1950's to 70% by the early 1970's - it can give the jute industry only a fraction of the custom which it once did.

The main point about changes in markets brought about by the growing significance of polypropylene is that the former jute manufacturers are now operating in a much more sophisticated market. Instead of buying on a world market having some of the characteristics of perfect competition on the raw material supply side, the synthetics weavers or extruders are now purchasing their input requirements from the large constituents of the petroleum and chemical oligopolies. These are producing propylene as a by-product of refining crude oil (or natural gas liquids in the case of the United States), the propylene emerging along with ethylene from the by-product naphtha. The attitude towards the production and pricing of these products by the major oil companies is therefore of considerable importance to the Dundee industry. Nor should it be forgotten that although some 65% of textile polypropylene is processed in Dundee and the surrounding area, a major competitor to

these local firms exists in the form of Pachogue Plymouth, the AMOCO subsidiary. This business is a fully integrated concern, being part of Standard Oil of Indiana. So far as sales of polypropylene output are concerned, it has to be remembered that textile uses are largely (70%) dependent upon the tufted carpet industry, characterised by cyclical tradition conditions and concentrated buying power. Thus, although polypropylene has a wide variety of uses in various forms,[5] the local Dundee industry is heavily oriented towards carpet backing and packaging end uses, about 70% of output going into the former and a further 8% into the latter.[6]

One of the questions posed in the introduction to this chapter related to the degree to which the industry as a whole, and individual constituent firms, had recognised the need for change away from dependence upon jute to the new market areas, and had responded to the need. At an individual level there is no doubt that a number of firms responded quickly to the possibilities of textile applications of polypropylene. As early as 1965 Low & Bonar and Sidlaw each acquired a 40% interest in Polytape Ltd., the joint subsidiary of British Ropes (now Bridon) and Plasticisers which had been established to explore the possibility of producing tape yarns from extruded polypropylene film. These two local firms went on to establish their own tape weaving subsidiary Synthetic Fabrics (Scotland). Other firms which invested in some aspects of polypropylene technology at an early date were Don Bros. Buist, Caird, and Scott & Fyfe - the latter two being relatively small firms.[7] Other businesses were more reluctant to enter the polypropylene market so early; and some of course followed other lines of diversification. At first there may have been some doubt as to how far and how rapidly polypropylene

would displace jute in the latter's established end-use areas; and this feature no doubt discouraged some firms from following the example of those quoted above. Indeed generally there seems to have been a lack of appreciation as to just how quickly jute was likely to be superseded by polypropylene. Thus at the end of 1968 one trade source was of the opinion that "for the primary backing of tufted carpets ... polypropylene is seen not so much as a fibre that will make inroads into jute but as an additional fibre"[8] - yet jute was almost entirely eliminated from this market by the early 1970's. Again even at the end of 1971, and instancing in particular the use of jute in woven carpets, the same source felt that "there are still large markets for which jute is technically better, and does a superior job than any known man-made fibre"[9] - although this market too is now increasingly catered for by polypropylene. Thus one can say that although a number of firms in the industry took an early part in the new technology, the pace at which polypropylene was to displace jute was probably underestimated by the trade as a whole.

Another relevant characteristic in this context is the relationship between the rate at which firms in the industry moved into new market areas or adopted new technologies, and variables such as company size and existing commitment to the jute industry. Very few clear relationships have emerged from the research. As indicated in Chapter III (Tables 3.7 - 3.13) there was no statistical relationship revealed by the parametric statistical tests, between size and diversification, although opening size (by sales) was significantly greater for diversified than non-diversified firms in terms of the nonparametric tests which constitute more robust evidence with regard to our group of firms. Again in Chapter IV, as an indirect measure of the

adoption of new technologies and markets, no evidence was found (Tables 4.11, 4.15 and 4.18) of any parametric or nonparametric relationship between opening firm size and growth. (None of the above conclusions is invalidated by the use of value added in the place of sales as the measure of company output.) This evidence certainly does not suggest that large firms had any enormous technical, financial or managerial advantage over their smaller competitors in adapting to new market conditions. Thus while some of the smaller spinning firms have continued to remain entirely in the jute industry - preferring not to have to face the problems of learning new technologies and raising additional capital - others in this size category were among the earliest to invest in the new technology. Likewise, while some large firms have successfully diversified and adopted new technologies, this has by no means been the case with all.

Regarding the relationship between diversification and extent of existing commitment to the traditional jute industry, it is worth noting that Low & Bonar - which although a large firm never occupied a predominant place in the jute industry - has consistently been a diversifier, while Sidlaw - which has traditionally been the market leader in jute - has proved to be less committed to synthetics and not uniformly successful in other diversified areas. The more conservative reaction of Sidlaw with respect to jute is perhaps best summed up by a reported comment by its chairman in 1968: "I'd still rather be in jute 100 per cent. than in synthetics 100 per cent.".[10]

A part of the material in the two previous paragraphs can be illuminated by reference to the concept of barriers to exit.[11] In our case one has in mind barriers not only to the exit of firms in a total sense but also to the transfer of firms into new technologies quite

evidently superseding their existing methods of serving particular markets. There is evidence of both of these phenomena in the jute industry. We saw in Section C of Chapter II that a number of company deaths only occurred finally after many years of financial losses; and the reluctant attitude of some firms as regards leaving their dependence upon jute to invest in polypropylene has been referred to immediately above. It is interesting that at least one survey of the phenomenon of barriers to exit, while referring to the "technical" causes of these such as durable and specific capital assets, specific qualities of a labour force (and the cost of redundancy payments), and regional concentration of producers, also gives considerable emphasis to "the importance of intangible and managerial exit barriers relative to those linked to tangible assets".[12] This relative emphasis receives support from our study of the jute industry. Obviously the industry in the 1960's was characterised by the existence of plant and machinery which was highly durable and specific, and some of which was so old that from the point of view of some accountants its use entailed no charge against the profits of the business. The industry's labour force too was regarded by some as being rather specific and not necessarily adaptable to having to cope with new synthetic fibre technologies. The geographical concentration of the jute industry around Dundee may also have inhibited thinking in terms of any dramatic geographical shift of firms' activities. Nonetheless the different speeds at which various firms reacted to the decline of the traditional jute market, and differences in the rapidity with which they adopted new technologies both lend weight to the emphasis of Caves and Porter upon managerial factors in this area.

Turning now to the changes in the general market environment, it would appear that on the face of it the operation of Jute Control and

of the trading agreements must have protected the Dundee industry from both foreign and domestic competition, and therefore in some sense led to a misallocation of resources. Indeed it was the explicit purpose of these arrangements to protect the local industry. A system such as Control, which in 1962 had the effect of creating an absolute import barrier in respect of 80% of total U.K. jute goods production,[13] could not have had any other effect than to permit the survival of firms which would otherwise have gone out of business. Indeed one study suggests that in the late 1950's and early 1960's the abandonment of Control's import protection would have led to the "virtual extinction" of the Dundee industry.[14] It is difficult to be more precise regarding the impact of Control upon the size of the industry. There were no major exits from the market up to the later 1960's except for five disappearances in 1959, and these did not coincide with changes in Control regulations. This does not, however, mean that the earlier withdrawal of import protection would not have resulted in a much faster slimming down of the Dundee industry. The major adjustment to Control in 1963 and 1964 was not, correspondingly, accompanied by any apparent reduction in the number of firms in the market. Indeed the industry itself did not appear to expect the change to have a dramatic effect.[15] The point about any analysis of the impact of the relaxation and ending of Control is that many other variables were changing at the same time. In particular, the ending of the industry's restrictive trading agreements early in 1963 coincided with a further reduction in tariff restrictions; and the final ending of Control's functions in 1969 and its replacement with a purely quota system of import limitation took place just at the time when polypropylene was beginning to make serious inroads into jute's hold on the tufted carpet backing market. Most commentators would thus agree that Control moved from a

position in the 1950's where it was indispensable to the survival of the Dundee industry to one in the later 1960's where technological change had made it irrelevant.

McDowall et al. have pointed to a more intricate relationship between Control and technological change. The price levels for jute in the U.K. established by Control not only gave domestic producers a cushion with which to finance modernisation and ultimately diversification into synthetics spinning and weaving (including predominantly polypropylene),[16] but also hastened the adoption by carpet manufacturers in this country of polypropylene in place of jute because of the enhanced price differential compared with, say, the situation in the United States.[17] Certainly those in the industry today with whom the matter was discussed concede that the price levels established under Control were fair, and possibly even generous. They admit that such price levels allowed small marginal firms to remain in the market, and accept that there was a wide spread of productive efficiency among manufacturers. However, one can at the same time point to considerable investment in modernised plant over the decades following 1945, and also, as detailed in Chapter IV, to increase in labour productivity. Furthermore, the number of independent businesses in the local industry did fall by 23% from 1945 to 1967, indicating that the arrangements did not guarantee complete survival for all of the firms in the market; and at the very least one can say that no new firms entered the jute market - although textile firms outside Dundee probably considered that they faced considerable barriers to entry through failure to enjoy external economies of scale comparable to Dundee producers in contemplating expansion into the jute market.

Control, therefore, appears to have given the Dundee producers

a temporary protection from inevitable decline. Any loss of welfare along the lines of traditional resource misallocation here appears to have been the price paid for a temporary maintenance of employment in a city dominated by a single declining industry. It might also be possible to argue that the temporary respite from traditional overseas competition granted by Control did more adequately equip the industry to meet the later technological (Schumpeterian) competition. One must, however, at the same time recognise that not only do such arrangements as Control deny domestic consumers access to cheaper goods from overseas (and also artificially deny overseas exporters the opportunity to compete on equal terms with U.K. producers), but also that total consumption of such protected goods is reduced to a level below what it would otherwise have been without protection. This effect, it was suggested, in the jute industry probably eventually led to an increase in the rate at which jute was superseded by polypropylene in major end uses. Furthermore, subsidies to a particular geographically concentrated industry, such as jute, merely protect that industry and encourage it to maintain its hold on its existing labour force, rather than encourage new industries to take up employment in the area. Finally, of course, if a protected industry is not totally concentrated geographically, then firms and employees in this market are protected by tariffs regardless of the total economic conditions of the region in which they are located. It is against these potential sources of resource misallocation that one has to set the benefits for the industry or local employment claimed to arise from tariff or other trade restrictions.[18]

The comments above apply with equal force to any analysis of the impact upon the industry of the trading agreements. The anticompetitive effect of these was continued beyond 1963 by the operation of an inform-

ation agreement and the practice of price leadership - for both of which the industry was indebted to Sidlaw. Both of these arrangements were, however, brought to an end by the mid 1960's, and the impact of this ending is difficult to distinguish from the termination of Control and the emergence of polypropylene. Undoubtedly the trading agreements had, together with the geographical concentration of the industry, created an environment within the market which discouraged rivalry in general. It is unlikely in this context that firms minimised costs or eagerly sought to increase sales through price competition. Such an arrangement could not, however, survive the impact of an entirely new product in respect of which there were non-Dundee competitors, whose technology was new and again originated outwith Dundee, and in respect of which there was considerable international competition.

Again with regard to the price leadership which emerged in the industry following the ending of the trade pricing agreements (see Chapter II ref. 58), this practice does not seem to have survived the impact of polypropylene's entry into traditional jute end-use areas. It is possible that Sidlaw continued to exert some form of nominal leadership of the "barometric" type in the industry by virtue of its size and its earlier role in the Jute Information Bureau. However, the very rapid adoption of polypropylene in the tufted carpet backing market at the end of the 1960's, and the continued loss of market share of woven carpets in favour of tufted (woven carpet manufacturers' sales fell from 29.8 m.sq.m. in 1967 to 25.4 m.sq.m. in 1975, representing a decline in total carpet market share by volume from 32.4% to 15.8% over the period) created market pressures which no desire to maintain prices could overcome. From the late 1960's onwards there is evidence as we have seen (Chapter II ref.67) of "serious and

widespread ... price cutting" having occurred, and this continued into the 1970's with the observation by another company chairman of how "when supply exceeds demand some spinners introduce cut prices and thus set a lower level of profitability".[19] This suggests that as with other potentially anti-competitive structure or conduct characteristics of this market, the rapid contraction of the traditional market was sufficient to nullify any real impact of these.

Given that this study has been one of market decline - and in the period 1967-1977 jute cloth output fell by 79% and yarn output by 59% - it is not surprising that a major feature of market structure has been a sharp reduction in the number of firms. As Table 2.1 in Chapter II indicates, the number of firms fell by 50% over a decade: from 30 in 1967 to 15 in 1976. Some part of this reduction is accounted for by surviving firms such as Low & Bonar, and Caird (Dundee) ceasing to be A.J.S.M. members (our definition of firms in the industry), although this in itself is a fair reflection of their exit from the traditional jute market. The major part of the reduction in numbers over this period however - 12 out of 15 - is due partially to acquisition and largely to the total demise of smaller firms. Of the 12 disappearances, 8 definitely fell into the latter category; and this fate was particularly characteristic of non-integrated weaving concerns, such as R.G. Kennedy, T.L. Miller, and Don & Duncan. Neither these disappearances nor the mergers which took place appear on the face of things to raise any major resource-allocation problems, although the candidate did receive a written communication from a senior director of one firm stating that from 1970 onwards his firm had followed an explicit policy of "under the counter rationalisation" in terms of acquiring and subsequently closing down jute manufacturing facilities of its competitors.

Nonetheless, on the whole the businesses which left the industry at this time were predominantly small and family owned/managed. Furthermore, some of the mergers or acquisitions, such as J.D. Wilkie's taking over of fellow Kirriemuir producer Ogilvie Brothers in 1971, or the earlier more significant merger which created Scott & Robertson, meant improved viability for the firms concerned, and possibly increased competition for the existing large firms in the market. On the other hand some apparent acquisitions, such as Halley's takeover of Spalding & Valentine, or Low & Bonar's acquisition of Wm. Fergusson, were in fact contractions of the traditional industry as the jute operations of the two victims were rapidly closed down. It is interesting, indeed, to note that in only two cases - those of Sidlaw's acquisitions of Duke & Lowson and the Tayport Spinning Co., and Don Bros. Buist's purchase of J. & J. Smart - did major producers in the industry take over and continue in operation additional facilities. In general, therefore, the industry's contraction went ahead in a gradual and "civilised" manner: the only point to notice being that had the smaller family businesses not gone out of existence, then Sidlaw and Scott & Robertson and the remaining larger firms might have found their own continuance in the industry more difficult.

It is impossible to conclude firmly whether those enterprises which did go out of business were the least efficient. Did the decline of the industry (for we have seen that any tendency to more aggressive competition among the firms was earlier kept in check by the operation of Control and the trading agreements) have the effect of eliminating the less efficient firms before the more efficient? In the absence of company accounting data the answer must be inconclusive. Possibly more important causes of demise appear to have been the size

and position within the industry structure (including the extent of integration) on the part of the firms. Because the weaving side of the traditional jute industry declined so much more rapidly than the spinning side (the former by 79% in the decade to 1977 in volume terms compared with 59% in respect of the latter), those firms which were solely weavers were at a particular disadvantage compared with those which also had spinning capacity. The fairly rapid disappearance of the pure weavers at the end of the 1960's also gave the integrated spinners and weavers additional work for their looms at a time when the amount of weaving work was diminishing. As regards the effect of firm size, deaths were much more common among small than large firms; and it may be surmised that in addition to the forces mentioned above, the necessary change to an unfamiliar, capital intensive technology was much less attractive, even where it was possible, for such firms compared with their larger counterparts.

C. Productivity and Investment

Since these two phenomena have a close relationship, it would appear to be sensible to discuss them together in assessing market performance. As usual, the indices for measuring the variables were not perfect for our purpose; but the general conclusion in the former area is that significant improvements in labour productivity were made by the industry. Rather surprisingly, however, in the light of further comments below, the industry does not compare favourably with roughly similar markets in this performance dimension. The following data are from a fairly recent cross-sectional study of labour productivity.

Table 5.1

Annual Average Compound Rates of Growth

	1954-1963		1963-1973		1954-1973	
	Gross* Output	Output per Operative				
Jute	-1.0	1.4	-3.0	2.9	-2.0	2.2
Spinning and Doubling	-3.7	3.3	-1.0	4.3	-2.3	3.8
Weaving	-3.0	4.3	-1.9	4.4	-2.4	4.3
Woollen and Worsted	0.6	2.8	-1.1	3.9	-0.3	3.4
81 Manufacturing Industries Average	2.5	2.9	3.2	4.3	3.0	3.6

Source : R. Wragg & J. Robertson, "Britain's Industrial Performance since the War", Department of Employment Gazette, May 1978, pp.513-15.

* The fuller account of this interesting piece of research indicates clearly that the data refer to volume changes in output and in output per operative (gross output deflated to base-period prices). See R. Wragg & J. Robertson, "Post-War Trends in Employment, Productivity, Output, Labour Costs and Prices by Industry in the United Kingdom", Department of Employment Research Paper No. 3, Department of Employment, June 1978, p.5.

It would seem, therefore, that comparing the jute industry's labour productivity with that of other industries of similar technology and comparable experience of market contraction, and with manufacturing industry as a whole, the performance along this dimension has not been totally satisfactory. It may be claimed that labour productivity in jute is understated if some part of a factory workforce is weaving polypropylene or spinning nylon staple while the whole of the employment of the establishment is regarded as falling into the "jute" category. However, similar problems are likely in the case of the Spinning and Doubling or Weaving categories above due to the movement from cotton spinning and weaving to, for example, spinning of nylon staple or weaving of rayon.[20] It is, of course, difficult to know what sort of impact such imperfections have on statistical comparisons. Our only con-

clusion must be that although improvements in labour productivity seem by themselves to have been reasonable, a still better performance has been achieved in other comparable markets.

With regard to new investment, data was constructed on the basis of comments from a number of sources. The result is Appendix Table 4.5 in Chapter IV. Again the actual data confirm the pattern of the history of the industry. There was significant re-equipment in the immediate post-war period up to the early 1960's, followed by a lull which in turn preceded the investment boom of the late 1960's and early 1970's associated with polypropylene extrusion and weaving. Qualitative assessment of this investment is difficult. It is, however, noticeable that with regard to the most recent round of capital expenditure that the equipment and new developments in this area have come from abroad. Innovation has come not from the traditional home of textile machinery manufacture in this country but from overseas: from Switzerland (Sulzer), Germany (Dornier), and from Italy (Smit). The local textile industry itself, however, appears to have been forward in keeping its machinery up-to-date, and in this respect presents a very different picture to that painted by Caroline Miles of the Lancashire textile industry.

> "A characteristic feature of the British cotton industry over the last fifty years, perhaps even longer, has been its lack of interest in technological development and (in) the use of new production methods and equipment."[21]

The comparison with cotton is an interesting and valid one so far as jute is concerned. Both industries have experienced distinct secular decline over the past decades; in both cases the technology of the traditional industry is relatively static while capable of

continuous improvement; and again both industries, following Government inquiry, have received some form of special support.[22] The contrast between Miles' picture of cotton and our own view of the jute industry is thus to the credit of the latter. The remaining interesting feature of the jute industry in this context is the way in which investment and asset growth has not been the prerogative of larger firms; and while it is on the one hand heartening to find low barriers to such growth in the industry, it is on the other hand perhaps disappointing to see such a relatively poor performance along this dimension by the erstwhile leader of the industry.[23]

D. Accounting or Financial Market Performance

Throughout Section B. of Chapter IV it was pointed out that the findings on the financial or accounting performance of our firms were not out of line with those of U.K.-wide cross-sectional and time-series analysis of company performances. Because of this lack of conflict, the purpose of this section is to interpret and offer conclusions on the statistical findings as they relate to our particular market only.

With regard to profit ratios, the failure to detect any trend over the period 1968-1977, either in respect of unadjusted or relative ("real") profitability, or with regard to intragroup profit variability, is surprising. It will be remembered also that subperiod analysis of profitability performance (using subperiods 1968-1972 and 1973-1977) failed to reveal any "disturbance" in this dimension of market performance. Even allowing for the fact that the data used cover the performance of 16 continuing firms, and therefore ignore that of firms which failed to survive the period of transition, they do give one a

reasonable picture of the industry over a major period of adjustment. It should also be remembered that the market performance of the 16 continuing firms to which our data apply represents the outcome of a variety of strategies in the market, including of course total abandonment of the jute industry in any form by a number of the companies. The profitability and other data thus refer both to continuing jute firms and to those which within the period left the industry.

The absence of any trend in the level or group variability of profits, even in respect of a group of surviving firms in a declining market, is surprising. What it suggests is that there was no financial penalty as a result of the process of transition; and that no one firm made a particularly better or worse job of managing the process of change than any other, and that the (surviving) firms in general managed the process of adjustment quite well. These conclusions are supported by the absence of any relationship between firm size and profitability over the period in Tables 4.6 and 4.9. The data in Tables 4.8 and 4.9 suggest the existence in this particular market of the usual relationship at the firm level between size and the time variability of profits.

The normal or expected relationships between growth and such independent variables as size and profitability were established in Tables 4.11 to 4.15 and 4.18 of Chapter IV. As emphasised in that chapter, what is significant is that growth in this case may be taken as a prime index of relative survival ability and competence in dealing with change. It is clear that size has been of no assistance here. This indicates either that economic scale is of no value or significance in growing, or that "managerial" factors have swamped any

relationship which might have existed between growth and size, with smaller firms having some inbuilt advantage in responding to change. With respect to growth performance, although there was no significant change in average rates between the subperiods 1968-72 and 1973-77, there was evidence of some disruption in growth performance among the firms, and growth in the latter subperiod was not as closely related to growth in the former as was the case with profitability.[24]

E. Comparison with Other Declining Industries

It would seem appropriate to make some brief comparison of the performance of the Dundee jute trade with at least one other declining textile industry in order to note any particular contrasting or parallel conduct or performance. Two obvious industries which could have been used are the Lancashire cotton industry and the Yorkshire woollen trade. Both, as their names imply, are highly localised. The former of these was chosen for individual comparison on the grounds of having more in common with the jute industry; and while no claim is made for a depth of knowledge of this industry such as has been accumulated in respect of jute, sufficient study has been carried out to make relevant comparisons.

As in the case of jute, the Lancashire cotton textile industry has gone through a period of considerable decline this century, as the data below indicate.

Table 5.2

Output of U.K. Cotton Textile Industry

	Yarn '000 tonnes	Woven Cloth m. lin. metres
1946	299.8	1,486
1953	314.0	1,704
1956	270.7	1,473
1963	178.8	927
1970	125.8	627
1977	84.4	368

Source: Annual Abstract of Statistics (London: H.M.S.O.)

In 1914 Lancashire had 40% of world textile capacity, and accounted for 60% of international trade in cotton. The industry in 1912 employed directly around 750,000 people, and was responsible for a quarter by value of U.K. exports.[25] After a temporary post-war boom, which came to an end in 1921, demand slumped as Indian and Japanese markets fell to domestic producers who also ate into some of Lancashire's other export markets. (Prior to World War I some 85% of Lancashire output was exported.) Output of cotton cloth in 1937 at 4,000m.yards was exactly half the corresponding figure for 1912. Rationalisation in the industry occurred as a result of the mergers over this period (the formation of the Lancashire Cotton Corporation under the auspices of the Bank of England in 1929 brought around 15% of spinning capacity into the hands of a single firm, and Combined English Mills was formed in the same year), and of the operation of the Spindles Board established under the 1936 Cotton Spinning Industry Act. The Board, financed by a levy on the industry, paid spinners and weavers to scrap capacity; and by 1937 the industry had reduced its 1912 capacity by about one third, although output, as noted above, had halved over the period.

As in the case of jute, the cotton industry was "concentrated" during World War II. Again as in the case of jute, a Cotton Control was established; and, operating from 1947 as the Raw Cotton Commission, was the sole agency for importing and distributing raw cotton until the trade was returned to private hands in 1954. Demand for cotton goods was buoyant immediately after 1945; and indeed labour shortages were a problem.[26] The industry's inefficiency and poor long-term prospects were, however, recognised, and a number of reports on the industry was published, including one in 1946 by a Board of Trade

Cotton Working Party. This did not, however, recommend a system of price protection for the industry as was to be the case in respect of jute in 1948. Up to 1958 cotton goods imports, largely from developing Commonwealth countries, entered the U.K. from these countries free of tariff or quota restrictions; and only minor restrictions applied in respect of other countries. A system of "voluntary limitation" operated from early 1959, and was expanded in the early 1960's. Such arrangements were never, however, a major part of the U.K. government's policy in respect of the domestic cotton industry. The Cotton Report of 1946 placed more emphasis upon (compulsory) amalgamations and levy-financed machine redundancy and re-equipment: schemes of which the industry had of course had previous experience. It should be noted that the structure of the cotton industry at this time was not unlike that of jute. The market was dominated by a single large firm, J. & P. Coats. There was a group of medium-sized firms, including Fine Spinners & Doublers, and the Lancashire Cotton Corporation, and a large "tail" of small firms. In contrast to the jute industry, however, few of the large firms in cotton were vertically integrated.[27]

The Working Party recommendations outlined above were in fact the solution adopted by the government for the industry as, after 1951, demand - particularly export demand - fell away. Although legislation to implement the recommendations of the Cotton Report was introduced in 1948, the most significant scheme was that introduced by the 1959 Cotton Industry Act. Under this the government bore two-thirds of the cost of paying firms to scrap existing machinery, an industry levy financing the remaining third. A similar compensation scheme for redundant employees was entirely financed by a levy on firms. The 1959 Act also made grants to firms for re-equipment.[28] The impact of the

Act upon the industry can be seen from the following data.

Table 5.4

U.K. Cotton Industry

	1937	1959	1967
Employees ('000)	360	239	100
Spindles (m. ring equivalent)	26	15	4.5
Looms ('000)	520	220	92
Cloth output (m. yds.)	4,000	2,333	1,300

Source : C. Miles, Lancashire Textiles: A Case Study of Industrial Change (London: C.U.P., 1968) Ch. 3.

The 1959 Cotton Industry Act was an important watershed for the industry itself, and also a significant piece of government intervention in private industry.[29] The scrapping compensation scheme was open for acceptance by the firms for only two months - August and September 1959 - and was seen by the government as a once-for-all piece of intervention in the market. The government spent around £17m. in total for the scrapping scheme; and around 50% of the firms in the industry (accounting for some 75% of employment in 1959) took part in it. The effect of the scrapping scheme was greatest in respect of single process, small-scale spinning firms, where the number of such firms (having under 1,001 employees) fell from 82 in 1959 to 40 in 1965; and although the scheme was not as effective as might have been expected in eliminating firms in the very smallest size category, the disappearance of small, non-integrated firms did have the double effect of increasing the proportion of output in the industry accounted for by integrated firms (from 30% in 1959 to 41% in 1965), and reducing the significance of smaller firms. As a proportion of total employment in the industry, firms employing fewer than 1,001 employees fell from 55% in 1959 to 46% in 1964.[30] The net effect

of the scrapping scheme was that of the industry's April 1959 capacity, 48% of spinning spindles, 27% of doubling spindles, and 38% of looms were scrapped.[31] The re-equipment phase of the 1959 Act's provisions was expected to last until 1964. Here, as might be expected from what was said before, the major uptake of grants was by large, integrated firms. Single-process firms accounted for only 31% of re-equipment expenditure, and the average employment size of firms participating in the re-equipment scheme was 594 compared with the industry average of 286.

As in the case of the jute industry, the cotton trade was subject to a number of outside influences over this period, which make the impact of each separate change difficult to assess. In 1959 alone the system of international trade protection was changed, the 1959 Act began to have its effect, and the industry's common minimum price agreement was terminated by the Restrictive Practices Court.[32] In addition, the years after 1959 witnessed continued secular decline of the industry, further pressure from imports, and, as in the case of jute, competition from synthetic fibres.

The 1959 Act and its implementation represented a major force in the post-war history of the cotton industry. Its scrapping provisions met with considerable response. As mentioned above, almost half (48%) of the April 1959 installed spinning plant was scrapped under the 1959 Act scheme; and the corresponding figures for doubling and for weaving were 27% and 38% (see ref.30). The incidence of re-equipment, however, was low. Only around half of the expenditure in this area expected by the Government and the industry was in fact incurred;[33] and the reason most frequently given for this was the failure of the Government

at the same time to give the industry any guarantee on import levels. This was a view concurred in by a subsequent parliamentary inquiry into the impact of the 1959 Act.[34] It was not until 1966 that a system of quantitative controls was applied to cotton imports from countries other than Western Europe, North America and Australia, and which therefore imposed the first restrictions of any kind upon Hong Kong, India and Pakistan which were responsible for the greatest proportion of U.K. imports in this field.[35] These quantitative controls operated until they were entirely taken over by tariffs following Britain's entry into the E.E.C.

In contrast to the jute industry, cotton textiles continued to attract the attention of reports and enquiries until much more recently. The most important of these was the 1969 Report by the Textile Council.[36] The 1969 Report emphasised especially the need for restructuring and for a more vigorous approach to marketing in the industry. In particular it rejected any further scheme containing financial incentives for scrapping plant. The Government followed this analysis of the industry's problems by making funds available to small and medium sized textile firms for re-equipment and expansion through the I.R.C. At the other end of the size spectrum of firms the Government in 1969 announced a general ban on mergers among the largest firms in the industry; although it had to depart from this in allowing the formation of Carrington Viyella in 1970 to prevent the collapse of at least one of the firms.[37]

The cotton industry, so far as changes in demand over the last thirty years or so are concerned, has faced a situation not dissimilar to that of jute. The two industries have, however, responded and

been treated by Governments in rather different ways. In the case of cotton the response by the Government in the post-war period, of which schemes it had pre-war experience, was to encourage the industry to scrap old plant and re-equip with new machinery, and in this respect the 1959 Act was partially successful. At the same time the cotton industry was not until 1966 protected to any meaningful extent from overseas competition by tariffs or other restrictions; and this absence of trade protection may have militated against the complete effectiveness of the 1959 Act's intentions. That is, although the 1959 Act provided some financial incentive on the cost side for the industry to re-equip, it may have been that this set of incentives was insufficient to achieve its intended effect in a total environment of considerable uncertainty regarding the demand situation. It may thus be that cost incentives without regard to demand conditions, and tariff protection in particular, are not sufficient to encourage re-equipment and the adoption of new technology. The experience of the cotton industry indicates that tariff protection and re-equipment subsidies are not necessarily alternative means of promoting the survival of a particular industry. Rather the experience suggests that cost incentives must be accompanied by some assurances to the industry regarding demand.

The jute industry's experience was the obverse of this. Jute Control gave the industry trade protection; but there was no provision for financial assistance for re-equipment. Interestingly, nonetheless, the jute industry's record of performance on re-equipment appears to have been good (see Chapter IV Section E), and part of the credit for this has been accorded to the degree of certainty for producers in the industry provided by Jute Control. It would seem,

therefore, that although there may have been some misallocation of resources arising out of the system of Jute Control, so far as offering a degree of trade protection to the industry and encouraging it to re-equip and compete with imports is concerned Control was a more comprehensive system for achieving such aims than the methods adopted in the case of cotton.[38] The 1959 Act offered the cotton industry only a financial incentive to scrap plant and re-equip. Jute Control, despite not providing a monetary incentive to scrap old machinery and instal new plant, in fact provided the reasonable certainty of short-term future prospects which was evidently sufficient to encourage a very creditable level of new investment in the jute industry until the 1960's.

A further contrast between the two industries lies in the fact that while the cotton industry has been in receipt of continuing attention until comparatively recently, the trade protection which jute enjoyed under Control was being phased out by the mid 1960's, beyond which the industry received no further special assistance from the Government. In some ways this last contrast between the two industries - indicating the greater and continuing degree of attention paid by successive Governments to cotton in comparison with jute - is itself not reflected in the apparent efficacy of the respective policies towards the two industries. Jute Control's protection of the Dundee industry, without which there seems to be no doubt the industry would not have survived in any recognisable form in the 1950's, appears to have served its purpose, and indeed was phased out as it became irrelevant with the advent of polypropylene. In the case of cotton there seems to be much less credit attributed to the various scrapping and re-equipment schemes so far as their impact in mitigating

the effect of overseas trade on the industry is concerned. Mrs. Miles, for example, quotes one senior civil servant as commenting, "My own personal view is that developments in Lancashire have happened pretty much as they would have anyway, even if there had not been this government intervention"; and offers her own view that "There is much truth in this verdict. ... The pace of decline would probably have been much the same in the absence of any adjustment assistance: there is no evidence to suggest that the measures slowed it."[39]

The comparative analysis of the recent experience of the jute and cotton industries in the U.K. indicates that industries in decline due to changes in technology and the impact of import competition can be the subject of very different Government policies. Equally the reaction of such industries to factors affecting this decline and to Government policies can differ significantly; and this fact again reinforces the case made in the Introduction to this thesis for a case-by-case analysis of such situations.

F. Diversification

The term diversification has been used in this study to cover the broad corporate strategy on the part of individual businesses responding to rapid decline in their traditional market. Diversification thus covers the major part of market conduct or behaviour in this industry. It is an example, in this case, of resource reallocation in a market economy.[40]

A number of points are worth making about the jute industry's response to the rapid decline in demand for its traditional product.

In the first place the real pioneering work in the direction of developing textile applications was carried on outwith the Dundee industry. Plasticisers Ltd. (at the time a subsidiary of British Ropes (renamed Bridon), but now owned by Readicut International) is the firm normally credited with the initial development of polypropylene polymer extrusion and weaving. Such developments were, however, fairly rapidly adopted by two of the largest firms in the Dundee industry, Sidlaw and Low & Bonar, who, together with Plasticisers, were the initial shareholders in Polytape, and who were the equal co-owners of Synthetic Fabrics (Scotland). Plasticisers soon withdrew its very small shareholding from this consortium, and when Sidlaw withdrew in the late 1970's this left Low & Bonar as the dominant integrated polypropylene textile manufacturer in Dundee.[41] Low & Bonar was joined in this field fairly rapidly by other businesses large and small. Some of these operated on an integrated basis from an early stage, but a number of others were still at the end of our period of study simply weavers of tape. (A number of such businesses have since integrated backwards into extrusion either by acquiring an extruding subsidiary, or more commonly by purchasing extruding machinery.) Thus, as was suggested in Tables 3.1 and 3.2 in Chapter III, the adoption of the "rival" product and technology was for most firms the natural response to the change in their market environment.[42]

Although it would be difficult to estimate whether the Dundee jute industry firms responded as rapidly as possible to the opportunities of the new technology, it is worthwhile reiterating the point that the operation of Jute Control (albeit in diluted form throughout the 1960's) and the industry's own common pricing agreements probably distorted the introduction of polypropylene as a replacement yarn and fabric for jute.

We have already commented on the fact that there appears to be evidence that the jute industry's raising of the price of its product above the level which would otherwise have existed not only denied customers (predominantly carpet manufacturers) access to cheaper backing material, but also hastened the adoption by these same carpet manufacturers of polypropylene for both woven and tufted carpets compared with the situation in the United States of America.

The statistical analysis of diversification using company accounting data failed to reveal any significant differences in the performance of Diversified and Non-diversified firms over the period 1968-1977 in terms of average profit performance, the maintenance of earlier average profit levels, or growth. There was, however, some evidence that diversification had reduced profit variability over the period, and that those firms which had diversified were initially larger in terms of sales (and also value added) than those which chose not to follow such a strategy. It has to be accepted, however, in the light of the circumstances of the case, that the lack of dramatically conclusive findings may be inevitable. Problems highlighted in this instance were the varied timing of the commencement of a diversification strategy on the part of the companies within our group of Diversified firms, the likely length of the time period over which the policy of diversification would yield returns in terms of increased profits etc., and the possible similarity of economic performance on the part of two groups of firms - one in the initial stages of diversification, the other continuing to operate in a declining market. Furthermore, such findings as those in Chapter III are largely supported by those of a study of diversification across a larger number of companies. The finding of this wider study was that diversification as a corporate strategy did not contribute to enhanced profitability or growth or to

reduced profit variability. Indeed, with particular relevance to our study, the authors of this analysis concluded on this point that "In general ... there is very little evidence that diversification is associated with, let alone causes, high performance in conditions of high technological change and market turbulence."[43]

These results would seem to confirm our own findings that, regardless of the many possible reasons for adopting a strategy of diversification, it is a corporate policy which is unlikely to lead to significant gains in the short run for companies adopting it.

G. Finale

The purpose of this last section is to offer some final comments on the thesis as a whole. These fall under the headings of the usefulness of the structure-conduct-performance model, the issue of conclusions on resource allocation, and the question of the balance between statistical analysis and case-study material in this area of study.

Undoubtedly the structure-conduct-performance model has been an extremely useful framework within which to examine this industry over the past two decades. Without such a framework there is a real danger of accumulating a vast array of quite disjointed material. Whether sufficient data has been available for us to observe all of the interesting hypotheses of the structure-conduct-performance model is more open to doubt. Data on relative production costs, pricing and profit margins broken down by product and by firm are simply not available. Nonetheless it has been possible, for example, to observe

the behaviour of firms in terms of their trade pricing and information agreements in the 1950's and 1960's. It has also been interesting to identify those firms responsible for price leadership and technological change in the industry, and to relate this to other dimensions of the firm's conduct or position in the market. One particularly interesting feature within the structure-conduct-performance model with reference to this study has been the role of barriers to exit from the jute industry, and this too has been commented upon.

Resource allocation is another topic on which one might have been able to comment at greater length had more data been available (e.g. capital expenditure on various forms of plant analysed by firm). Nonetheless our study has been quite a vivid one of market forces at work forcing a reallocation of resources across the industry in response to technological change. We have been able to form an impression of the impact of Jute Control and the industry's trade pricing agreements at various stages of the market's development over the last thirty years. The role of these seems to have changed from one of ensuring the survival of the firms in the industry in the 1950's in the face of Indian competition, to one in the late 1960's of hastening the introduction of polypropylene in the place of jute for tufted carpet primary backing through overpricing jute relative to its cost in other similar economies. One other area where we have been able to comment on resource allocation relates to the adoption of new technology, where it was noted that the adoption of polypropylene weaving and extruding was by no means the preserve of large firms in the market.

Finally, we return to an issue raised in the Introduction to this thesis: that of the balance to be struck in such a study between case-

study material and statistical analysis. There is of course much to be said in favour of presenting a statistical analysis of one's findings as we have done in Chapter IV of this work. Statistical analysis forces a clarity of thought upon the researcher, and also leads to a precise summary of results. Such analysis can even throw up results which are not apparent at first sight from a glance at the data. Such was the case with regard to the data on male/female employment and relative earnings in the industry brought out in Table 4.39 in Chapter IV. There are, however, two reservations regarding statistics which one must raise in respect of this study. In the first place our population (and it is a population, not a sample) of statistics is so modest in size that, even in using nonparametric tests, one runs the risk of being accused of using a statistical sledgehammer to crack a very small empirical nut. Second, case-study work is essential to analyse aspects of an industry not susceptible to statistical analysis, to clarify those cases where there is an absence of expected statistically significant findings, and to explain why statistically significant findings have arisen where they have. Thus one would argue that Chapters III and IV in this thesis are complementary and not contradictory in their approach to the study. Neither of them would be complete or sufficient without the other. It is hoped that together they have contributed to the economic analysis of the jute industry which has been the purpose of this work.

References

1. J. Downie, The Competitive Process (London: Duckworth, 1958) p.194.

2. See, for example, the Introduction to L. Hannah (ed.), Management Strategy and Business Development (London: Macmillan, 1976).

3. S. McDowall et al., "Protection, Technological Change, and Trade Adjustment: The Case of Jute in Britain", O.D.I. Review, Vol. I, 1976, pp.46-7.

4. S. McDowall et al., Trade Adjustment and the British Jute Industry (Glasgow: Fraser of Allander Institute, 1978) p.3.

5. Thus of 1973 output in the U.K. 40% went into injection moulding uses (predominantly for the motor car industry and other technical mouldings), 15% is used in film form (largely for cast packaging), and 40% is used in slit tape or fabric form. It is in this last form that polypropylene has a range of uses from heavy knitwear to tarpaulins. See J.T. Grayling, "Polypropylene and its Expanded Horizons", Plastics and Polymers, February 1975, Vol. XLIII, pp.38-9; and G.O. Thomas, "Polypropylene in the Fibre Industry", Textiles Manufacturer, June 1971, Vol. XCVII, p.241.

6. Based upon membership production data of the British Polyolefin Textiles Association supplied by the Association secretary.

7. See Dundee Chamber of Commerce Journal, September 1968, pp.203-5.

8. Ibid., p.206.

9. Loc.cit., December 1971, p.640.

10. Financial Times, 18th October 1968.

11. See R.E. Caves & M.E. Porter, "Barriers to Exit" in R.T. Masson & P.D. Qualls (eds.), Essays on Industrial Organization in Honor of Joe S. Bain (Cambridge, Mass.: Ballinger, 1976) pp.39-69.

12. Ibid., p.67.

13. L.R.4R.P., p.452.

14. S. McDowall et al., op.cit. (1976), p.50.

15. See Dundee Chamber of Commerce Journal, December 1964, p.241. This may be compared with the earlier situation when in July 1957 certain goods were moved from a full equated price category under Control to the Depressed Range attracting a markup of 30%, reduced in January 1960 to 20%. U.K. output of these goods fell by 73% between 1957 and 1961 despite a healthy overall state of demand. It has not, unfortunately, in this study been possible to analyse the impact of changes in the level of import protection in such detail as the above over the whole of the period of

the operation of Control. See "Leading Industries" in J.M. Jackson (ed.), The City of Dundee, Vol. 25 of The Third Statistical Account of Scotland (Arbroath : Scottish Council of Social Service, 1979), p.110.

16. One firm spoke of having "used the fruits of past commercial summers in jute manufacturing to plant the seeds of new corporate success for themselves". See "Dens Metals", Scotland, April 1965, p.105.

17. Thus in 1972 jute still accounted for 47% of the U.S. primary tufted carpet backing market as compared with a figure of 5% in the U.K. for 1973, to which the latter had fallen from 71% in 1968. This should be taken in conjunction with the price differential (the amount by which polypropylene was cheaper than jute) of 45% in the U.K. and 23% in the U.S. Although both price differentials relate to 1972 they indicate, in the authors' view, a situation for which Control in the U.K. was largely responsible. See S. McDowall et al., Trade Adjustment and the British Jute Industry (unpublished monograph, St. Andrews, 1976), pp.34 and 63-4.

18. See, for example, the treatment of this issue in W.M. Corden & G. Fels (eds.), Public Assistance to Industry: Protection and Subsidies in Britain and Germany (London: Macmillan, 1976) pp. 220-21.

19. Buist Spinning Co., 1977 Annual Report & Accounts.

20. These sort of factors are highlighted as complicating productivity comparisons in R. Robson, The Cotton Industry in Britain (London: Macmillan, 1957) p.249.

21. C. Miles, Lancashire Textiles: A Case Study of Industrial Change (Cambridge: C.U.P., 1968) p.19.

22. Thus in the case of cotton one had a Board of Trade Working Party Report published in 1946 saying many of the things which the 1948 Report on Jute was to echo; while the parallel to Jute Control so far as Government policy was concerned was the 1959 Cotton Industry Act with its purpose of bringing about reorganisation, contraction and re-equipment in the cotton industry.

23. The greatest contrast with Sidlaw's performance in this dimension is Scott & Fyfe of Tayport. From a net asset base of £119,000 in 1967 the scale of the company's investment can be seen from the following data for annual capital expenditure. The data are in current terms, £'000.

1968	£115	1973	£211
1969	26	1974	173
1970	15	1975	31
1971	125	1976	156
1972	115	1977	658

Source: Scott & Fyfe Ltd., Annual Report & Accounts.

24. In respect of all of the statistical tests involving reference to firm size, value added was also used in addition to the sales variable in order to ensure that differences in the extent of vertical integration among our group of firms did not distort our findings relating to the impact of firm size. In only one instance did the use of this additional measure of firm size give one reason to alter the existing conclusions. (See p.238).

25. These figures are taken from L.H.C. Tippett, A Portrait of the Lancashire Textile Industry (London: O.U.P., 1969) pp.1-4. Robson's historical data show that as in the case of jute, the U.K. dominance of the world cotton textile industry was on the wane by the early decades of this century: U.K. cotton mill consumption as a proportion of the world total had fallen from 37% in 1882-4 to 20% in 1910-13. See R. Robson, op.cit., p.2.

26. This labour shortage produced a situation where the U.K.'s inability to meet orders immediately encouraged the growth or expansion of competing industries overseas. The result of this was a situation in which Britain rapidly lost her earlier dominance in both European markets and in the Dominions. See R. Robson, op.cit., p.23.

27. See S.R. Dennison, "The Cotton Industry" in B. Tew & R.F. Henderson (eds.), Studies in Company Finance (Cambridge: C.U.P., 1959), pp.158-62.

28. This again was something which was not new to the industry. The Cotton Spinning (Re-equipment Subsidy) Act of 1948 provided for grants of up to 25% on new spinning machinery for those mills in groups of a size of new fewer than 400,000 spindles. By 1956 the industry had spent £11.9m. on such schemes, and subsidies of £2.8m. had been paid out. See S.R. Dennison, op.cit., pp. 165-6.

29. The most detailed analysis of the 1959 Act is that of Caroline Miles. See C. Miles, "Contraction in Cotton: Some Comments on the 1959 Cotton Industry Act", District Bank Review, June 1965, pp.19-38; "Should the Cotton Industry be Protected?", Loc.cit., June 1966, pp.45-67: and op.cit. (1968), Chs. 4 and 5.

30. See C. Miles, op.cit. (1968), Statistical Appendix.

31. Ibid., pp.60-62.

32. The trading agreement was basically a common minimum price one, and was defended on the basis of providing stability of returns in the industry in the context of which to undertake modernisation, and the need to avoid undue local unemployment. The agreement was struck down by the Restrictive Practices Court in 1959. See A. Sutherland, "The Restrictive Practices Court and Cotton Spinning", Journal of Industrial Economics, October 1959, Vol. VIII, pp.58-79; and also comments on the trading agreement in the same author's "The Diffusion of an Innovation in Cotton Spinning", Journal of Industrial Economics, March 1959, Vol. VII, pp.128-31.

33. See C. Miles, "Protection of the British Textile Industry", in W.M. Corden & G. Fels (eds.), op.cit., p.191.

34. See House of Commons, Fourth Report from the Estimates Committee, Session 1961-62, Assistance to the Cotton Industry (London: H.M.S.O., 1962) para. 26.

35. In 1967 the developing countries and Japan accounted for almost one third of U.K. domestic consumption. See Cotton and Allied Textiles (Manchester: Textile Council, 1969) para. 96.

36. See ref. 35 above.

37. The 1969 Textile Council Report estimated that in the late 1960's the top four companies in the industry were responsible for 47% of spinning, 33% of weaving and 53% of finishing. These comprised Courtaulds, Viyella, English Calico (now Tootal), and Carrington & Dewhurst. See Cotton and Allied Textiles, paras. 69-70.

38. The direct cost of the 1959 Act to the Government in terms of scrapping and re-equipment grants was around £38m. - £11m. for scrapping, and £27m. for re-equipment grants. See C. Miles, op.cit. (1976), pp.190-1.

39. See Ibid., p.205; and for some further support of this view see L. G. Sandberg, Lancashire in Decline (Columbus, Ohio: Ohio State U.P., 1974) p.223.

40. This analysis of diversification has concentrated predominantly on the active policy of former jute spinners and weavers in adjusting to the impact of polypropylene rather than on the inevitable changes in the composition of jute output over a longer period. This latter phenomenon is of course observable in broad terms from Census data. These indicate in the case of jute cloth that whereas in 1963 (the first year for which a breakdown is given) linoleum hessian accounted for 9.7% of sales, and tufted carpet backing for 25.4%; the remaining, predominantly container, uses of jute cloth still accounted for 64.9% of sales by value. By 1968 linoleum hessian accounted for only a minimal proportion of jute cloth sales by value, and tufted carpet backing had risen from its 1963 level of 25.4% to 54.4% five years later. During the 1970's there was a marked fall off in the volume of manufacturers' sales of woven jute in the widest widths (over 230 cms.). Sales of this width fell from 25% of the total in 1972 to 9% in 1977, reflecting not only the generally reduced demand in the various end-use areas, but also the sustained competition in those areas from polypropylene.

41. This rather more committed response by Low & Bonar to the expanding market for polypropylene (see ref. 42 below) compared with that of Sidlaw gives some further support to the findings relating to the rapidity with which already diversified firms respond to new growth market opportunities compared with specialist business diversifying initially. (By the late 1960's Low & Bonar had already diversified into electrical engineering as well as paper packaging, compared with Sidlaw's almost total dependence at this stage upon jute.) See P.K. Gorecki, "The Determinants of Entry by New and Diversifying Enterprises in the U.K. Manufacturing Sector 1958-1962", Applied Economics, June 1975, Vol. VII, pp.139-47.

42. One would like to have been able to comment at this stage on the growth of the market for polypropylene yarn and fabric over our period of study. Unfortunately the British Polyolefin Textile Association which covers this area, and which is based in Dundee, felt unable to provide such data. The only figures available are those in the Business Monitor PQ415 Jute. These indicate that polypropylene woven fabric sales expanded from 24,426 th.kg. in 1972 to 34,350 th.kg. in 1977. Yarn sales rose from 4,232 tonnes in 1974 to 6,000 tonnes in 1977.

43. See P.H. Grinyer et al., "Strategy, Structure, the Environment and Financial Performance in 48 U.K. Companies", Academy of Management Journal, April 1980, Vol. XXIII, pp.193-220.