Industrial Demographics, Industrial Dynamics, and Aggregate Total Factor Productivity Growth in Indonesian Manufacturing, 1975-95

Virginie G. VIAL

London School of Economics and Political Science

Ph.D.

Abstract

After an introductory chapter, chapter 2 reviews and assesses the existing theoretical and empirical literature on TFP growth. A detailed review of the economic and historical literature on productivity growth in Indonesian manufacturing follows. This allows constructing a new methodology for the estimation of aggregate TFP growth in Indonesian manufacturing, using a panel dataset of establishments over the period 1975-95. New estimates are presented and compared with historical evidence.

Chapter 3 further emphasises the issue of establishments' heterogeneity by presenting a meticulous review of both the theoretical and empirical literature on industrial demography.

Chapter 4 investigates further the heterogeneity of manufacturing establishments in terms of productivity, and size. It offers a comprehensive demographic study of manufacturing establishments over the 21-year period, focusing on productivity and size differentials, as well as on establishments' entry and exit. In a second part, relaxing the representative plant hypothesis and taking establishments' turnover effect into account, I present several decompositions of aggregate TFP growth into incumbents' contribution and the contribution of entrants and exiters.

Chapter 5 draws on this literature and tests econometrically the different hypotheses aiming at an explanation of establishments' productivity heterogeneity. Hypotheses are tailored to the Indonesian manufacturing sector through a careful reference to the economic history of the sector.

Chapter 6 offers three detailed historical and economic industry studies, aiming at the discovery of central factors and processes explaining the evolution of the manufacturing sector in terms of productivity change and establishments' demography. It also tests econometrically hypotheses regarding the main factors explaining survival and exit of establishments.

Chapter 7 recalls the results of the reestimation of aggregate TFP growth using a new methodology, and brings together the main outcomes of the subsequent chapters, thereby offering an explanation of aggregate TFP growth with detailed microeconomic mechanisms.

Table of contents

List of Tables and Graphs

Chapter 2

Chapter 4

Chapter 5

Chapter 6

1 Introduction

The study of productivity has been a long standing topic both in the economics and economic history literatures. This interest is mainly motivated by the attempt to explain the tremendous economic growth experienced by all world economies since industrialisation. The mainstream literature indeed points at two main sources of economic growth. The first source is the increase in the use of production factors, leading to an increase in output – this is the extensive component of economic growth. The second source is the increase in productivity stemming from a improved use of factors of production, also called efficiency – this is the intensive component of economic growth. While there are obvious limits to extensive growth, i.e. the limited availability of resources such as intermediate inputs, labour and capital, intensive growth is in theory only limited by the current state of technology, state that is constantly improving. Mainstream economic growth theory states that, if technology is internationally available, all countries should catch up with the leader country, i.e. grow faster than the leader country to attain a similar GDP per capita level. There are however factors that limit the adoption of the latest technologies. These factors are mainly situated in the domain of institutional and social capabilities.

The initial works on economic growth and productivity suggested that the process of catch-up should lead to a global convergence of GDP per capita levels. However, more and more studies point at a global divergence of GDP per capita levels, with possibly localised convergence processes. The question is integral part of the wider quest for an explanation of the wealth and poverty of nations. In the domain of development economics, the question addressed changed from "How do economies grow?" to "Why don't economies grow as fast as they should?".

Asian countries experienced very high rates of economic growth since the 1970s (around 10% p.a.), seemed to be catching up with developed countries, and attracted massive foreign investments. Paul Krugman in 1994, in his famous article "The Myth of Asia's Miracle", is probably one of the first to point at a potential exhaustion of Asian growth, by suggesting that it had mostly been of the extensive kind, drawing a parallel with the USSR during the communist era. Numerous studies dealing with productivity and productivity growth in Asia were published from this period onwards, especially after the 1997 Asian crisis. Indeed, the crisis painfully pointed at potential pitfalls in the process of Asian economic growth. In 1995, Young publishes an article titled "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience", suggesting that Total Factor Productivity growth for East Asian countries had been overestimated, and that economic growth had mainly been driven by factors accumulation.

Indonesia's productivity growth received particular attention mostly after the 1997 crisis, with a series of studies using data on publicly listed companies, assessing various issues linked to companies financing structures and corporate governance. The mainstream idea was that Indonesian companies had wide access to domestic and foreign capital without necessarily presenting transparent accounts, and investors - driven by the euphoria of high returns emerging markets supported by strong economic growth, lent money without always monitoring companies' performance closely.

Less crisis-focused productivity studies concentrated on the Indonesian manufacturing sector, starting as soon as 1990 with Hill's seminal articles "Indonesia's industrial transformation, part 1 and 2". This coincided with the amelioration of the data on the Indonesian manufacturing sector, which now covered all establishments with 20 employees or more from 1975 on, and provided series enabling the estimation of Total Factor Productivity.

The very early stages of Indonesian industrialisation probably date back to the end of the 19th century. This period corresponds to the last decades of Dutch colonialism, period during which colonialists started to develop industries taking advantage of both cheap and abundant natural resources (wood, tea, coffee, spices, rubber, tobacco) and labour. In 1940, the Netherlands fall to Germany, and the government flees to London. In the mean time, Japan suggests that French Indochina and Dutch Indies should join the "East Asia Co-Prosperity Sphere". Japanese start invading the Dutch Indies as soon as 1942, and Sukarno becomes head of the government, but under Japanese military control. Independence is first declared in August 1945, but only takes effect in 1949 after a long war for Independence. During this period, a large chunk of Indonesian manufacturing facilities are destroyed. The Sukarno years, that lasted from 1950 to 1965 did not witness any development in manufacturing, rather "it has been argued that Indonesian economy underwent `structural retrogression' between the late 1930s and the early post-independence years, in the sense that the share of the labour-intensive or traditional sectors in total output increased while that of the modern, capital-intensive sectors declined" (Booth, 1998, p.70). Booth (1998) even indicates that "by 1965 the manufacturing sector's share of GDP was lower than in the late 1920s" (p. 86). Economic recovery shot up as soon as 1966, and accelerated from 1973 with the oil boom, that lasted up to 1980. In 1981, oil prices collapsed, and Indonesia faced a severe crisis, from which it recovered as soon as 1984. The consequences of the crisis triggered a series of deregulatory measures in the domains of trade, finance, and domestic manufacturing regulation. Those measures took effect between 1986 and 1988. A period of investment boom and economic growth followed up to the 1997 crisis.

The combination of a real start of manufacturing development in 1973, and availability of reliable plant-level data from 1975 onwards, leads to most modern long-term studies on Indonesian manufacturing to cover the period 1975 to 1998 (latest available data). From a historical point of view, the period is very interesting to study because it is politically uniform – one ruler, President

Suharto, it starts off with industrial take-off, coinciding with the start of the oil boom, and it encompasses five clear-cut economic sub-periods. The oil boom lasts from 1973 to 1980, characterised by rapid growth of output, rapid expansion of the number of plants, and some industrial diversification. It is followed by three years of economic crisis from 1981 to 1983, with a drop in output or deceleration of output growth depending on sub-sectors. Two years of economic recovery - 1984-85, precede three years of deregulatory measures in 1986 to 1989, during which economic growth is sluggish. After the implementation of those measures, the economy experiences rapid investment and rapid growth from 1989 to mid-1997.[1]

A series of studies dealing with the estimation of Total Factor Productivity (TFP) and Total Factor Productivity Growth (TFPG) followed the release of the manufacturing census, with results ranging from 0.70% p.a. to 1.10% p.a. for the oil boom period, from -4.90% p.a. to 1.10% p.a. for the oil crisis and recovery period, and from 2.10% p.a. to 7.90% p.a. for the deregulation and investment boom period. Those results tell us at least one story: we do not really know what has been productivity growth of the Indonesian manufacturing sector under the Suharto era. The second story is that if the range of TFP Growth estimates is roughly correct, then it seems that manufacturing output growth (on average 10 to 12% p.a.) has been lower than productivity growth: output growth has been mainly extensive.

Chapter 2 starts with the review of the existing theoretical economic literature dealing with productivity issues and measurements. In order to shed some new light on productivity performance in Indonesian manufacturing in this period, Chapter 2 primarily aims at the discovery of the factors explaining the discrepancy of existing TFP Growth estimates. Besides the obvious slight differences in dating historical turning points, and the use of different vintages of datasets, it appears that disagreements stem principally from the calculation of the capital stock series. The second important element of difference regards the estimation of elasticities of output with respect to intermediate inputs, labour, and capital, for which the variations can lead to substantial variations in aggregate TFP Growth rates. Finally, the different methodologies of aggregation of plant-level data into manufacturing data also lead to ample differences in the results. The identification of those factors leads to the elaboration of a revised methodology of the estimation of TFP and TFPG using plant-level data of the Large & Medium Scale Manufacturing Census (called *Statistik Industri*).

Chapter 2 reviews in details the different methodologies and data that have been used to generate a capital stock series using *Statistik Industri*. All authors base the capital stock series on a hypothetical benchmark capital stock estimated for the base year with investment to capital and

[1] Due to data consistency and reliability, I have chosen to cut the period in 1995 rather than 1997.

value added to capital ratios, hypothetical depreciation rates, hypothetical assets' length of life, and a series on investment in different types of assets. I argue that these methodologies rely on numerous assumptions that can potentially bias the results. I propose instead to use a pre-existing capital stock series. This series has the advantage of measuring each plant capital stock as declared in the census without relying on hypothetical assumptions. The drawback of the series is that it only covers plants for a ten-year period, from 1988 to 1998. The shortcoming is overcome by modelling the existing capital stock data with other variables in the dataset - output and employment. The model then allows for a "backward prediction" of capital stock data for years preceding 1988. It also allows for the estimation of the capital stock of plants reporting no capital stock. The generated series are in line with aggregate capital stock growth figures of other historical sources.

The second improvement to the estimation of TFP and TFP Growth rates is the revision of elasticities of output with respect to intermediate inputs, labour, and capital. Most authors estimate TFP and TFPG with a value added production function and two factors of production: labour and capital. They use an accounting methodology, i.e. employment and wage data, to calculate the share of labour in value added, taken as the elasticity of value added with respect to labour. Under the constant returns hypothesis, the elasticities of value added with respect to labour and capital add up to unity. Using this methodology, at ca. 0.8, the elasticity of value added with respect to capital appears to be well above the international benchmark situated between 0.3 and 0.4. Other studies on Indonesian manufacturing point at the potential underreporting of employment figures, supporting the view of an overestimated elasticity of value added with respect to capital. I chose to use a production function based on gross output, with three factors: intermediate inputs, labour, and capital. Using this production function, I estimate elasticities econometrically. My results are in line with international benchmarks.

Incorporating both the revision of the capital stock series and the elasticities of output with respect to factors of production, I estimate yearly TFP and TFP Growth rates for all plants. I obtain aggregate figures for the manufacturing sector using the Divisia Index methodology that weights each component of the production function. I use a similar methodology to obtain TFP and TFP Growth estimates for each 2-digit industry. At the aggregate level, I show that previous estimates might have been overestimated, and find an average TFP Growth rate of 0.78% p.a. over the period 1975-95, compared with previous estimates comprised between 2% and 3% p.a.. This supports this hypothesis of extensive growth.

Finally, I compare aggregate TFP Growth figures calculated using the Divisia Index methodology (weighted average) with the simple average of TFP Growth of plants. I find that simple average figures are higher than weighted average results, underlining the productivity spread across plants, and already suggesting a potential lower performance of larger plants in terms of TFP Growth.

Chapter 2 constitutes a preliminary chapter providing an accurate measure of productivity and productivity growth at the plant level, and already underlines the importance of plant heterogeneity both in terms of productivity growth and in terms of size. Chapter 3 gives the latest state of the literature with regards to plants heterogeneity and aggregate productivity. The first part shows clearly the pitfalls of the usual representative plant hypothesis in the assessment of aggregate productivity growth, and exposes the progress done for the accounting of plant heterogeneity, both from a theoretical and a methodological point of view. In a second section, Chapter 3 underlines the lack of empirical studies dealing with plant heterogeneity and plants demographics in the context of developing countries, while acknowledging the fact that the issue has been discussed for OECD countries in general, and for the US, Canada, and the UK in particular. It presents the methodology and results obtained for the handful of developing countries that have benefited from a study of plants' demography, in relation to the aggregate improvement of productivity. Finally, Chapter 3 presents the state of the empirical literature on plant and companies heterogeneity for the case of Indonesian manufacturing. The last two sections underline the importance of plant heterogeneity and plant demography in the study of both aggregate productivity changes and industrial dynamics. It also emphasises certain heterogeneity in the outcomes, highlighting the necessity of case studies and the importance of the historical and institutional peculiarities of countries.

Chapter 4 draws on the two previous chapters and proposes a detailed study of Indonesian manufacturing plants demography. While Hill (1990a and b) proposes a fairly detailed review of Indonesian manufacturing sector composition and its changes between two sets of benchmark years (1963-1974-1985, and 1963-1975-1986), Chapter 4 proposes a yearly demographic study focusing on output, employment, Total Factor Productivity and Total Factor Productivity Growth over the period 1975-1995. The issues of output and employment distribution across the entire large and medium scale manufacturing sector is important from a historical point of view because it relates directly to the issue of plant size distribution. Indonesian manufacturing is depicted in the economic and political historical literature as dual in terms of plant size. More specifically, the sector includes a few large to very large plants accounting for the majority of output and employment, and a very large number of small and medium size plants. This size distribution duality is directly linked to ownership issues involving different socio-economic groups, and to industrial policy. Chapter 4 offers a detailed study of plant size distribution, entry, and exit. The results help getting some answers and figures about the dominance of large scale plants, and more importantly, help assessing whether this dominance is in the process of strengthening. Complementarily, the study of size distribution allows determining the state of the small and medium scale sector, which, according to the theoretical literature, should be central to the process of economic growth. Other demographic results raise the long-standing question of the state of competition in Indonesian manufacturing, and call for further investigation, issue that is dealt with in Chapter 6 when assessing the factors explaining plant exit.

Size distribution is complemented by the study of productivity and productivity growth by demographic group. In particular, productivity differentials between different size groups are examined. This helps further investigating the issue of changes in the size distribution, and shed some light onto the economic history of the sector. Indeed, over the period under scrutiny (1975-95), but especially in the oil boom period, the state has claimed being supporting the large scale sector of the economy for productive reasons. It has also attempted to support small and medium scale companies, for, it is argued, political reasons, but those support programs are said to have failed. Chapter 4 offers tangible evidence of productivity differential across size groups, with a noticeable change over time. Productivity differentials between the cohorts of entrants, incumbents, and exiters are also examined in order to formulate hypothesis on the effects of industrial demographics on aggregate productivity changes.

The prior descriptive industrial demographic study, focused on size distribution and productivity issues, sets the background to a decomposition of aggregate TFP Growth of the manufacturing sector, aiming at the determination of demographic influence on productivity changes. As demonstrated in Chapter 2, using the Divisia Index methodology to aggregate plant productivity changes takes to some extent plant heterogeneity into account. However, as argued in Chapter 3, this methodology of aggregation excludes the contribution of entry and exit. The first incidence is that taking into account entry and exit change Total Factor Productivity Growth figures. Secondly, and more interestingly, decomposing aggregate Total Factor Productivity Growth allows highlighting some of the mechanisms behind the process of productivity change. The decompositions chosen distinguish between three components: intra-plant productivity change for incumbents, market share reallocation between incumbents, and the effect of plants' entry and exit. This clearly relaxes the representative plant hypothesis, as well as the assumption of a broad technology adopted by all plants at the same time.

Outcomes are clearly in line with both the economic history of the sector and results of the previous demographic study. Additionally, they shed new light on the causes for low productivity growth rates in spite of high output growth rates. In particular, results uncover the existence of two productivity growth processes cancelling each other out: while the replacement of low productivity exiters by high productivity entrants, as well as the market share reallocation from low to high productivity growth incumbents trigger high productivity growth rates, market shares are also reallocated from high to low productivity plants, and incumbents' intra-plant productivity change is negative. Interestingly, as entry and exit occurs mostly in the small and medium scale sector of manufacturing, the results shows the positive importance of this sector in the process of aggregate TFP Growth. The study of the decomposition of aggregate TFP Growth over historical sub-periods allows posing some hypothesis regarding the changes in the mechanisms of aggregate productivity changes taken in their economic and political environment. These hypotheses are examined in Chapter 6.

Chapter 5 investigates the issue of plant heterogeneity and detects factors of different productivity levels across plants. The aim is to identify plant characteristics according to their productivity levels. It is of course necessary to control for different industries that might display intrinsic productivity differences, due to specific technologies of production. Additionally, it has to be demonstrated that productivity heterogeneity is not random. Then, the first tangible obvious factor of productivity differential suggested by the historical literature on Indonesian manufacturing is plant size. The second factor, suggested by the economic literature, is the vintage of the capital stock, that can have an effect on productivity via the technology embodied in the capital stock, and via the broad institutional environment in the period when operations started. The hypothesis of different capital stock vintages also calls for the examination of learning processes. The last hypothesis regards the existence of permanent or quasi-permanent differences across companies – so-called fixed effects. The scarce economic literature on the subject suggests that those differences can be of course size, but also management and labour quality, as well as belonging to a corporate group. A detailed account and analysis of the historical literature suggests that, for the case of Indonesia, further explanatory factors could be of significant importance. The first factor is ownership type, distinguishing between private domestic, private foreign and public ownership. The second factor relates to group membership and patronage (*Bapak Angkat*), a system of support to small plants set up by Indonesian authorities. The third additional factor is participation to the export market. Last but not least, I account for industry as well as plant cronyism. The previous chapter has underlined a strong difference of regime regarding plant size distribution, plant productivity distribution, and aggregate productivity growth before and after 1989. I study plant heterogeneity over the entire period (1975-95), but also over the two important sub-periods: 1975-89, covering to the oil boom, crisis, recovery, and deregulation periods, and 1990-95, corresponding to the post-deregulation era and investment boom.

The aim is underlining once again the effective plant heterogeneity and attempting to explain plants differences, thereby shedding some light on potential microeconomic mechanisms behind the sources of productivity and productivity gains. Beyond this broad question, the chapter aims at answering numerous questions raised by the historical literature on Indonesian manufacturing. Why would the largest plants be necessarily the most productive, even in industries where the optimal size can be relatively small? In those large plants especially, are there too many white collar workers – often family members linked to either ownership or management, and does this affect negatively productivity? Is it confirmed that Indonesian companies did not actively renew their capital stock, resulting in productivity losses? Does ownership type matter in terms of productive performance? In particular, can I confirm that domestic private entrepreneurs' plants are less productive? Additionally, can I confirm that plants with foreign ownership are more productive, owing to their greater exposition to foreign competition and more advanced technologies? For the same reasons, are plants belonging to corporate groups more productive, or do groups protect low productivity activities? Does taking part in the corruption process boost or hamper productivity? Finally, do the answers to those questions change according to the time period?

The examination of partial correlation coefficients between productivity levels or relative productivity (i.e. productivity level relative to the industry average) and potential explanatory factors suggested by the historical review helps setting the framework for a more formal assessment of plant productivity heterogeneity. The following sections test in turn the random draw hypothesis, the capital stock vintage hypothesis, and the fixed effects hypothesis. The first set of results shows that the two most important factors explaining plant relative productivity heterogeneity are plant size and plant initial level of productivity, the latter underlining the importance of initial conditions, but not necessarily those embodied in the age of the capital stock. Further investigation shows that the initial productivity level of plants depends largely of the average productivity level of the sector, and on plant size. The intensity of management also influences productivity levels, but differently across periods, suggesting that services provided by management in the first period are not helpful in the second period. Ownership type matters as well but only in the first period under scrutiny (1975-89). Available for the second period only (1990-95), the group membership and patronage variables have a significant positive impact on initial productivity level. This result challenges previous evidence on the effect of support to small plants through the patronage scheme. Last but not least, the effect of cronyism is assessed, both at the industry and plant levels. Interestingly, as suggested by the historical literature, cronyism does matter, but its effects change with the institutional environment in the 1990s. Another interesting aspect is the comparison of industry versus plant cronyism. Both are found to have opposite effects.

Drawing on Chapters 4 and 5, Chapter 6 offers a study of industrial evolution in Indonesian manufacturing. Chapter 4 has indeed underlined the changing nature of plants distributions in terms of productivity, but also in terms of size. It has raised the question of the factors contributing to this dynamics. While Chapter 4 deals with the effect of entry and exit on aggregate productivity change, Chapter 6 offers three case studies with detailed historical evidence on the following industries: food, beverages, and tobacco ; textile, garments, and leather ; basic metals. These industries differ two by two in their share of output and employment in total manufacturing, in their productivity levels, in their rates of productivity change, and in their composition in terms of number and size distribution of plants. A closer look at the demographic dynamics of those three different industries help informing the different processes behind different industry productivity changes. The comparative study of productivity changes in different industries aims at the discovery of the most efficient industrial evolutionary process in a specific historical, economic, and institutional context. The aim is firstly to contribute to the literature on East-Asian productivity, not only by providing new productivity growth estimates, but also by providing new insights on the microeconomic mechanisms driving aggregate productivity changes. It aims at explaining part of the formation of aggregate productivity growth through evolutionary processes in the context of a developing country, drawing on the particular experience of Indonesia taken in its historical context. The final aim is to explain the poor Total Factor Productivity Growth of Indonesia in spite of the catching-up opportunities.

In a first instance, I propose a comparative study of the three industries: the food, beverages, and tobacco industry displays low productivity growth rates, but represents a large chunk of manufacturing output and employment, with numerous and size-heterogeneous plants, using intensively cheap and abundant labour and natural resources ; the textile, garment, and leather industry presents similar characteristics, but displays very high productivity growth rates ; the basic metals industry presents totally opposed characteristics, with a small share in total manufacturing output and employment, few plants that are generally large, and using capital intensively, but displaying high productivity growth rates. This comparative study principally presents the decomposition of aggregate productivity growth for each industry: the effect of intra-plant productivity growth of incumbents, the effect of market share reallocation between incumbents, and the entry-exit effect. The three industries present similar turnover rates in terms of number of plants, output, and employment, the critical factor is the quality of this turnover.

The second step determines the relationships that might exist between the different elements of aggregate productivity decomposition. Are competitive mechanisms stemming, on one hand from entry and exit, and on the other hand from market share reallocation between incumbents, complementary or alternative? Within the market share reallocation mechanism, is a reallocation of market shares from low to high productivity growth plants necessarily accompanied by a reallocation of market shares from high to low productivity level plants? Does a weak to negative contribution of intra-plant productivity growth for incumbents necessarily translate into a higher positive effect of entries and exits? Are those potential relationships similar across historical time periods?

The third and last step aims at testing a set of factors potentially influencing survival and exit of plants, using a Cox proportional hazard function with panel data. This complements the previous analysis and investigates the issue of competition in Indonesian manufacturing. Indeed, the theoretical literature tends to argue that in a competitive environment, the most important factor driving exit is potentially a lower productivity level. The assessment of this hypothesis sheds some light on the state of competition in the Indonesian manufacturing sector. But of course, in the framework of an uncompetitive environment, additional explanatory variables are added. Firstly, is the relative small size of a plant a factor influencing early exit? Secondly, does the ownership type matter for survival, in particular, are public plants more likely to survive longer? Thirdly, does corporate group membership increase the chances of survival? Fourthly, do the intensity and quality of management and quality of labour make any difference? Finally, does corruption increase the chances of survival?

This last set of questions allows formulating some hypothesis regarding the microeconomic foundations of aggregate TFP Growth in Indonesian manufacturing, and help formulating an agenda for further research in the conclusion.

2 Total Factor Productivity Growth in Indonesian Manufacturing, 1975-1995: Issues in Measurement

2.1 Introduction

Since independence in 1949, large-scale firms and business groups have – in terms of output - dominated the Indonesian industrial structure.[2] These large companies face a myriad of small-scale companies, with an apparent "missing middle". The empirical economic literature stresses that this type of structure is symptomatic of LDCs, and contrasts sharply with structures observed in developed countries. So far, only a few papers have attempted to study firms' demography, and its link with economic growth for the developing world over the second half of the 20th century. Studies include the cases of Israel, Chile, Colombia, Morocco, Taiwan and Korea. As for similar papers studying American industrial structure dynamics, works on Israel, and Chile find that productivity growth stems mainly from within companies productivity growth rather than from companies turnover (i.e. change in industrial structure, reallocation of market shares, etc). It contrasts with findings for British, Colombian, Korean, and Taiwanese manufacturing, where up to half of productivity growth stems from companies' turnover.

Over the period 1975-96, Indonesia has experienced high economic growth rates - on average 9% p.a. - with very distinct phases. It has been characterised by market distortions, and a large-scale-firms-dominated manufacturing. It has however implemented deregulatory reforms in the 1980s, but went through a severe crisis in 1997. Additionally, the historical and economic literature on Asian economic performance has been very controversial, concentrating on the debate over sources of growth - "perspiration" versus "inspiration" (Aswicahyono & Hill, 2002). The main question arising from this stylised picture of Indonesia is the following: What has been the dynamic relationship between the broad institutional environment, industrial structure and economic growth?

The first step toward answering this question - and the aim of this chapter - is to find an accurate measure of economic performance for manufacturing over the period 1975-96.

There are various ways of measuring companies' performance using accounting indicators such as rate of profit, or market-based measures such as share price. Among other things, the main drawback of accounting-based performance measures is the difficulty of disentangling productivity from market power. Market-based performance measures face a number of drawbacks as well, and are only available for firms listed on the stock market. These constitute only a small fraction of the population. By far, the most complete and accurate measure of economic performance is Total Factor Productivity Growth (TFPG), i.e. the growth of output not attributable to an increase in the

[2] I am here only concerned about the formal sector of the economy.

use of inputs - intermediate inputs, labour, and capital. The first part of this chapter reviews the literature on performance measurement and motivates the choice of Total Factor Productivity.

The outbreak of the Asian crisis in 1997 triggered the publication of numerous papers dealing with TFPG measurement for Asia. The debate focused on whether Asian growth had been more extensive or intensive, i.e. whether TFPG had been low or high. While the literature mainly focused on the four Tigers (Singapore, Hong Kong, Taiwan and South Korea), a number of scholars have attempted to estimate TFPG for Indonesian manufacturing, at aggregate or up to 2-digit industry level. Striking is the large discrepancy observed between their respective results, with gaps up to 6 percentage points for 1982-85 and 1986-90 periods.

TABLE 1: TFP Growth at the aggregate and the 2-digit level, comparative results

	Timmer (1999)	Aswicahyono & Hill (1996)	Aswicahyono (1998)			
YEAR	1975-81	1976-81	1976-80	min	max	spread
31-Food, beverages & tobacco	3.70%	-0.20%	2.00%	-0.20%	3.70%	3.9
32-Textile, garments and leather	0.80%	2.10%	0.70%	0.70%	2.10%	1.4
33-Wood products	12.00%	4.20%	-1.80%	-1.80%	12.00%	13.8
34-Paper, printing & publishing	-1.80%	-2.50%	-1.80%	-2.50%	-1.80%	0.7
35-Chemicals, rubber & plastic	-4.90%	-2.00%	-4.00%	-4.90%	-2.00%	2.9
36-Non-metallic minerals	-1.70%	10.30%	6.60%	-1.70%	10.30%	12
37-Basic metals	3.60%	19.00%	12.50%	3.60%	19.00%	15.4
38-Metal products & machinery	5.60%	2.70%	1.90%	1.90%	5.60%	3.7
39-Other manufacturing	2.40%	-1.10%	N/A	-1.10%	2.40%	3.5
Aggregate TFPG	1.00%	0.70%	1.10%	0.70%	1.10%	0.4

	Timmer (1999)	Aswicahyono & Hill (1996)	Aswicahyono (1998)			
YEAR	1982-85	1982-85	1981-83	min	max	spread
31-Food, beverages & tobacco	3.80%	0.40%	-4.10%	-4.10%	3.80%	7.9
32-Textile, garments and leather	3.50%	3.00%	-0.20%	-0.20%	3.50%	3.7
33-Wood products	-2.40%	5.20%	-2.80%	-2.80%	5.20%	8
34-Paper, printing & publishing	2.50%	4.00%	-2.80%	-2.80%	4.00%	6.8
35-Chemicals, rubber & plastic	-2.10%	-0.40%	0.20%	-2.10%	0.20%	2.3
36-Non-metallic minerals	-8.30%	-2.00%	-2.10%	-8.30%	-2.00%	6.3
37-Basic metals	13.60%	7.40%	0.60%	0.60%	13.60%	13
38-Metal products & machinery	-7.80%	-1.00%	-0.80%	-7.80%	-0.80%	7
39-Other manufacturing	8.90%	2.40%	N/A	2.40%	8.90%	6.5
Aggregate TFPG	0.10%	1.10%	-4.90%	-4.90%	1.10%	6

	Timmer (1999)	Aswicahyono & Hill (1996)	Aswicahyono (1998)	Aswicahyono (1998)	Osada (1994)	Osada (1994)			
YEAR	1986-90	1986-91	1984-88	1989-93	1985-90	1987-90	min	max	spread
31-Food, beverages & tobacco	5.60%	3.20%	1.30%	5.10%	-1.00%	4.00%	-1.00%	5.60%	6.6
32-Textile, garments and leather	12.40%	2.30%	2.80%	2.40%	7.30%	2.50%	2.30%	12.40%	10.1
33-Wood products	7.90%	2.00%	5.60%	0.00%	3.60%	-12.80%	-12.80%	7.90%	20.7
34-Paper, printing & publishing	7.50%	6.20%	5.60%	0.00%	13.70%	2.00%	0.00%	13.70%	13.7
35-Chemicals, rubber & plastic	1.70%	3.40%	-0.50%	1.70%	-10.70%	0.50%	-10.70%	3.40%	14.1
36-Non-metallic minerals	7.10%	1.00%	2.10%	1.90%	-4.30%	1.50%	-4.30%	7.10%	11.4
37-Basic metals	8.90%	-3.00%	5.80%	-2.10%	15.00%	-3.70%	-3.70%	15.00%	18.7
38-Metal products & machinery	9.90%	0.40%	1.00%	2.10%	-3.30%	4.80%	-3.30%	9.90%	13.2
39-Other manufacturing	5.60%	1.90%	N/A	N/A	-1.50%	-2.70%	-2.70%	5.60%	8.3
Aggregate TFPG	7.90%	2.10%	5.50%	6.00%	3.60%	2.40%	2.10%	7.90%	5.8

I argue that differences stem mainly from the following factors:

- ✓ The data set used.
- ✓ The elements of the production function using growth accounting methodology, i.e. estimation of a capital stock series, and calculation of the elasticity of output with respect to labour.[3]
- ✓ The degree of aggregation and aggregation method for estimation (aggregate macroeconomic versus firm level)

In the second section, I present the historical background of the study, underlining the link between macroeconomic events, political economy and expected productivity growth. Additionally,

[3] There are other issues such as the degree of aggregation of inputs and the issue of deflators but they only have a comparatively minor impact. The use of different deflators is discussed later on in this chapter.

economic history helps distinguishing relevant sub-periods. The third section discusses data issues for the study of productivity in Indonesian manufacturing. The fourth section presents a new methodology for estimating a capital stock series using fixed assets data, and discusses the choice of elasticity of output with respect to labour. A fifth section displays new TFPG estimates for 1976-95. The last section concludes.

2.2 Firms' performances: A discussion of definitions and measurements

Firms' performances can refer to a wide range of topics, covering profits, equity, technological development, growth, wages, share of production exported or productivity. Diverse approaches may be taken, but each approach should respond to two interrogations. What is the purpose of the study? Which are the measurement problems faced by the indicator used?

I here discuss three types of performance indicators, evaluating each time their advantages and weaknesses. Indeed, it is necessary to have a broad overview of performance measurements in order to choose the most adequate measure. The first part discusses accounting measures, the second part discusses market-based performance indicators, the third part presents different aspects of total factor productivity.

2.2.1 Accounting measures

Analysis carried out for shareholders and investors may concentrate either on accounting measures such as value added and profits, or on market's indicators such as earning per share or Tobin's q. Accounting measures may be suitable for some purposes, but face limits. Indeed, these are often not internationally comparable, especially in the case of developing countries. They may even not be comparable across companies within the same country: for example, a law may enforce accounting standards for large firms - usually a requirement for companies listed on the stock market, but not for small- and medium-scale companies. The issues of accounting standards definition and enforcement, and of transparency and corruption are quite important.

Lerche (1980), in a study on tax efficiency, reports for example that "the Indonesian tax administration, except in relation to a handful of larger companies with reliable accounts, appears to have surrendered to what seem unsurmountable problems in obtaining meaningful information and to have given up individual assessment in many cases. Tax payer information serves at best as a basis for a negotiated tax compromise" (p.44).

This problem is not only symptomatic of the oil boom period, but carries on in the 1990s, as Conroy and Drake (1990) reports, "this point relates also in part to inadequate professional accounting standards and training - in 1988 there were only 390 Certified Public Accountants in the whole private sector" (p.35).

Another major issue faced by accounting indicators is that they do not disentangle productivity from market power. Indeed, a firm may have an excellent rate of profit because it minimises costs and maximises profit. But it may also be the case that the firm only maximises profits through its market power without minimising costs. It is a rather acute problem in Indonesian manufacturing, where the dominance of large-scale companies with monopoly powers has been widely acknowledged (for example in Robison, 1986 ; Hill, 1990a and b). In the case of Indonesian manufacturing, there are even cases where large companies make large profits both because of their monopoly power on the market for final goods, but also because of their monopsonic power on the market for intermediate inputs. Robison (1986) in particular reports the cases of large companies having been granted sole importer licences for intermediate inputs (for example in the basic metals sector). Those companies' gains are two-fold: they can reduce input prices because of their monopsonic power exerted on suppliers for the Indonesian market – although this is limited by the fact that suppliers are situated outside Indonesia and therefore have several customers ; they can increase the price of inputs of competitors, because of their monopoly power conferred by the sole importer licence for inputs. In such a context, accounting measures of performance are far from reflecting the true efficiency of a company.

2.2.2 Market-based indicators

Market's indicators bring about the issue of financial market perfection and the hypothesis that the market prices shares correctly. Indeed, all market indicators of performance include both the share price and other accounting measures in their calculation. A few examples of market-based performance measures are given:

- Earning per Share (EPS) is the company's earnings (usually profits) divided by the number of shares available.
- Price Earning Ratio (PER) is the share price divided by the EPS.
- Price-to-Book Value Ratio is the share price divided by the book value of assets.
- Price-to-Cash Flow Ratio is the share price divided by cash flow.
- Price-to-Sales Ratio is the share price divided by company's sales.

Using share price to measure firms' performance does not tackle the issue of market's mispricing, volatility and speculation. These issues are particularly acute in the framework of emerging markets, as in the case of Indonesia. Using stock prices requires also an adjustment of the measures for risk: a stock may perform better only because it is more risky and not only because the company has a better value. Fisman (2001) for example shows for the case of Indonesian listed companies, that up to a quarter of the valuation of firms could be attributable to political connectedness. It is also worth noting that most of the indicators use accounting measures as well, introducing additional indeterminacy.

Another widely used performance indicator is Tobin's q, which is the present value of future cash flows divided by the replacement cost of intangible assets. This is an interesting indicator, since it does not need risk adjustment or normalisation for a comparison across firms (as opposed to stock returns or accounting indicators). However, this indicator also requires to work under the assumption of capital markets perfection: a firm's market value is supposed to be an unbiased estimate of the present value of its cash flows. Tobin's q is then a measure of the contribution of the firm's intangible assets to its market value. A firm's intangible assets include its organisational capital, reputational capital, monopolistic rents, investments opportunities, etc. Another problem then arises with the estimation of the replacement cost of intangible assets, because it implies to make assumptions on the schedule of assets replacement, and on the depreciation rate. Furthermore, it is not possible to separate the diverse contributions made by – for instance – market power and management efficiency.

These performance indicators are often used in the literature because of their easy availability. In spite of their drawbacks, they offer a great deal of information about companies. They have been widely used in studies dealing with the causes and effects of the Asian crisis of 1997.

2.2.3 Total Factor Productivity (TFP) as a measure of performance

The last category of performance measures regroups all the productivity measures. In the absence of reliable capital stock figures for Indonesian plants, most studies dealing with the manufacturing sector have chosen to rely on labour productivity figures, usually calculated as the ratio of value added per worker. While this measure is useful, it does not give any information on capital productivity, and Hill (1990b) suggests that, "as the industrial data base continues to expand, more work needs to be done on the two key 'missing variables', capital stock and exports. The former is required to generate estimates of total factor productivity (TFP) and capital efficiency and utilisation; estimates of labour productivity in a era of extremely rapid capital stock growth area most imperfect proxy for TFP" (p.103). TFP is by far more appropriate to study and compare plant efficiency in the context of a dual industrial structure, where large-scale capital intensive plants coexist with small- and medium-scale labour intensive plants.

Total Factor Productivity has received a lot of attention at the theoretical level, and has been the subject of numerous empirical studies for developing countries, especially since the 1990s. The following theoretical discussion is based on Barro (1999), and provides a detailed analysis of growth accounting at the macroeconomic level, which may be used in a discussion at the firm level.

2.2.3.1 Measurement issues

Standard growth accounting

TFP Growth is defined as technological progress in a broad sense, including organisational and management progress. It is the part explaining economic growth, after having taken production factors accumulation into account. TFP Growth can be calculated via a neoclassical production function, $Y = F(A, K, L)$, with A the level of technology, K the capital stock and L the quantity of labour. It is also known as the "Solow residual". After differentiation, it becomes:

$$\dot{Y}\big/Y = g + \left(\frac{F_K K}{Y}\right)\left(\dot{K}/K\right) - \left(\frac{F_L L}{Y}\right)\left(\dot{L}/L\right) \qquad (1)$$

with F_K and F_L the factor marginal products.

The rate of technological progress (or TFP Growth or Solow's residual) can then be written as:

$$g = \dot{Y}/Y - s_K\left(\dot{K}/K\right) - s_L\left(\dot{L}/L\right) \qquad (2)$$

where $s_K \equiv RK/Y$ and $s_L \equiv \omega L/Y$ are the respective shares of each factor payment in total product (R is the cost of capital and ω is the cost of labour). The classical assumption is that all the income associated to Y is attributed to one of the factors K and L, i.e. returns to scale are constant : $s_K + s_L = 1$.

Jorgenson and Grichliches (1967) and Jorgenson, Gollop and Fraumeni (1987) demonstrate the importance of disaggregating K and L into quality classes in order to avoid an overestimation of the technical progress. Indeed, such a disaggregation allows accounting for a rise in capital and human capital quality, which would otherwise be captured in the TFP Growth rates.

Equation (2) may be directly used to estimate g using time series data, without econometric techniques. This methodology – known as growth accounting - avoids usual econometric drawbacks, but relies mainly on the quality and availability of the data. In particular, the availability and choice of adequate deflators for output and inputs is central to the reliability of the results. The methodology also assumes that factor social marginal products equal observable factor prices. This relies again on the assumption of markets' perfection.

An alternative consists in estimating g by regressing the growth rate of output on the growth rates of inputs as in equation (1), the intercept is then a measure of g. This procedure avoids the assumption that the factor social marginal products equal observable factor prices. However, it may suffers from simultaneity problems, because the rate of growth of capital $\dot{K}/K$, and the rate of growth of labour $\dot{L}/L$ may vary together with g - technological change may affect factors accumulation. The econometric estimation of g relies on data quality, since measurement errors on factors growth affects the estimation of the coefficients. This is especially true for capital accumulation, because measured capital stock and capital effectively used in production often differ – capacity utilisation is rarely 100%. This in general leads to an underestimation of the contribution of capital growth to economic growth. Finally, the econometric estimation relies on time series data and does not allow for variations of factors shares and technological progress over time. Because of these drawbacks, growth accounting is in general used.

In order to avoid measurement problems, Hsieh (1998) uses the dual approach to growth accounting. This approach states that:

$$g = \dot{Y}/Y - s_K\left(\dot{K}/K\right) - s_L\left(\dot{L}/L\right) = s_K\,\dot{R}/R + s_L\,\dot{\omega}/\omega \qquad (3)$$

The left-hand side of the equation is called the primal estimate and the right-hand side of the equation is called the dual estimate of TFPG: The usual primal estimate equals the share-weighted growth of factor prices. The dual estimate calculation is based on prices rather than quantities. Barro (1999) argues that "the intuition for the dual estimate … is that rising factor prices (for factors of given quality) can be sustained only if output is increasing for given inputs. Therefore, the appropriately weighted average of the growth of the factor prices measures the extent of TFP growth." (p. 123). This is however only true if markets are competitive. If, as in the case of Indonesia, markets for output and inputs are not competitive, and if there exist dual markets, this methodology cannot be applied.

This method may avoid some measurement problems associated with the measurement of inputs quantities. A dual estimation of TFP Growth also offers a comparison opportunity, which can be used as a way of verification. The inequality of the two estimates indicates data discrepancy. Hsieh (1998) shows this for East Asia in general, and Singapore in particular. He argues that capital growth estimations have been overstated in the national statistics, and therefore, the TFP Growth has been underestimated. He corrects for this by computing TFP Growth via the dual approach.

2.2.3.2 Increasing returns, multiple types of factors, R&D and TFP Growth

As seen previously, usual growth accounting makes the assumption that $s_K + s_L = 1$, assuming constant returns to scale, and works under perfect competition. The theoretical literature has however acknowledged the possibility of the existence of increasing returns to scale. A way to account for them, while remaining in a perfect competition framework, is to introduce spillovers in the production function. When spillovers are not accounted for, the standard growth accounting framework may lead to overestimated TFP Growth rates including these spillover effects.

The usual specification is given by the following Cobb-Douglas production function:

$$Y_i = AK_i^{\alpha} K^{\beta} L_i^{1-\alpha} \tag{4}$$

where $0 < \alpha < 1$ and $\beta \geq 0$. There are constant returns to scale for the private inputs K_i and L_i and there are spillovers if $\beta > 0$. These spillovers stem from the economy-wide stock of capital K. Spillovers from the economy-wide stock of capital K stem from the accumulation of physical or human capital.

The growth accounting specification may be then rewritten as:

$$g = \dot{Y}/Y - (\alpha + \beta)(\dot{K}/K) - (1-\alpha)(\dot{L}/L) \tag{5}$$

The estimation of TFP Growth requires then an econometric approach with the usual problems related to simultaneity.

Models with different types of factors, generally allowing for diverse capital and labour qualities, are of the following form[4]:

$$Y = F(A, K_1, K_2, L_1, L_2) \tag{6}$$

Each type of factors is weighted by its income share, under the assumption that factors' income equals factors' marginal product. This can be used to account for different kinds of capital goods and different kinds of labour (skilled and unskilled for example), but may also be used to account for a dual economy (K_1 and L_1 for the urban sector and K_2 and L_2 for the rural sector). This specification allows for a shift in factors quality and reduces the overestimation of TFP Growth. Indeed, in the standard model, TFP Growth would include the effect of a shift in factors quality.

The new stream of endogenous growth offers as well growth accounting alternatives with regard to the issue of Research & Development (R & D), and offers two kinds of model: varieties models, and quality-ladders models.

Varieties models applied to technological change, introduced by Romer (1990) and Grossman and Helpman (1991, ch. 3), use a Spence-Dixit-Stiglitz formulation for the production function:

$$Y = AL^{1-\alpha} \sum_{j=1}^{N} x_j^{\alpha} \tag{7}$$

where A is an exogenous technology factor, L is labour input, x_j is the employed quantity of intermediate input of type j, N is the number of varieties of intermediate inputs used, and

[4] The example is based on two types of each factor but could be extended to the case of n types of factors.

$0 < \alpha < 1$. Y is gross output. There is technological progress when the number of inputs varieties N increases. This progress is endogenous, because the output Y may either be consumed as end product or used as input in the production process.

In this context, TFP Growth is usually computed using the following specification:

$$g = \dot{Y}/Y - s_L\left(\dot{L}/L\right) - s_x\left(\dot{X}/X\right) = \dot{A}/A + (1-\alpha)\left(\dot{N}/N\right) \qquad (8)$$

with $X = Nx$ the total quantity of intermediate inputs.

Equation (8) shows that TFP Growth can be separated into two components: exogenous technological progress (first term of the right-hand side of the equation), and endogenous technological progress stemming from the addition of new varieties of inputs with a weight equal to $(1-\alpha)$. The remaining part α is included in the left-hand side of the equation by the last term: a part α of the discovery of new intermediates contributes to factors accumulation rather than technological progress.

The assumption that each new input variety can be used by each producer can be best suited for general purpose technology with a broad application, but does not take industry or firm specific technologies into account. Furthermore, the model implies that varieties increases, but does not allow for a loss of old varieties as technology progresses. Another limitation is that the measured output Y is gross and includes R & D expenses. Finally, the specification does not resolve the issue of reverse causation where R & D expenses may be caused by a change in exogenous technological progress. In order to avoid this problem, it is possible to use instrumental variables but these are not always available. "Possible instruments include measures of government policies toward R&D, including research subsidies, legal provisions such as the patent system, and the tax treatment of R&D expenditures." (Barro, 1999, p. 132).

Aghion and Howitt (1992) and Grossman and Helpman (1991, ch. 4), introduce another kind of endogenous growth model dealing with technological change, the quality-ladder models. A simple specification is written as:

$$Y = AL^{1-\alpha}\sum_{j=1}^{N}\left(q^{K_j} x_{j_{K_j}}\right)^{\alpha} \qquad (9)$$

where A is the exogenous technological progress, L the labour input, $0 < \alpha < 1$, N is the fixed number of input varieties, $q > 1$ is the proportionate spacing between rungs on a given quality ladder. In this model, endogenous technological progress occurs when inputs jump from a lower to a higher quality.

TFP Growth is usually computed with the following specification:

$$g = \dot{Y}/Y - s_L(\dot{L}/L) - s_x(\dot{X}/X) = \dot{A}/A + (1-\alpha)(\dot{Q}/Q) \quad (8)$$

with $X \equiv \sum_{j=1}^{N} x_{j_{K_j}}$ the total spending on intermediate inputs and $Q \equiv \sum_{j=1}^{N} q^{K_j \alpha/(1-\alpha)}$ an aggregate quality index.

As for the varieties model, technological progress is separated into an exogenous part (first term on the right-hand side), and an endogenous part (second term on the right-hand side). It also presents the same limitations as the varieties model but allows for lower-quality inputs obsolescence, given that an input of lower quality is immediately replaced by an input of the same kind but with a higher quality.

This short review of growth accounting – based on the complete review proposed by Barro (1999) - shows that standard growth accounting has been refined in order to account more of the complexities of the productivity gains phenomenon. The improvements deal primarily with technological progress issues and stem from advancement in endogenous growth research. It shows that different kinds of inputs, spillovers and R & D may be introduced in the models. This in turn puts a greater emphasis on the role of public policies promoting technological change.

Knack and Keefer (1995), Easterly and Levine (1996), or Rodrik (1997) – to quote only a few – add to the debate by introducing measures of institutional quality in models of economic growth. For the case of East Asia, Rodrik (1997) maintains that output growth is mostly attributable to a rapid and substantial capital accumulation, as previously argued by Young (1995) and Rodrik (1995). Institutional quality is said to matter in that it affects the investment rate of the economy. Meanwhile, it is also shown that technological progress in the region as occurred in a labour-saving kind.

Market-based performance definitions are often handy because of data availability at the microeconomic level. In the case of Indonesia, they however suffer from major measurement errors and biases stemming firstly from the monopolistic nature of some manufacturing industries, secondly from the lack of enforcement of accounting standards at the national level, and thirdly from the imperfection of the stock market.

TFP Growth estimation, while requiring more computational efforts, has a number of advantages over market-based and partial productivity performance measures. Using the appropriate deflators, it captures the overall productivity of factors, and, estimated at the plant level, allows comparing the productivity of plants with different factor mixes.

2.3 Historiography

After centuries of Dutch colonial rule and the brief Japanese occupation, Indonesia acceded to independence in 1949. However, by the mid-1960s, Indonesia was still among the least developed countries of the world.

Suharto came into power in 1965, succeeding to Sukarno, and inherited a poor agricultural country, where manufacturing accounted for less than 10% of GDP, against a share of over 40% for agriculture. As shown in Robison (1986), the Dutch colonialists controlled medium- and large-scale manufacturing, leaving little space for the emergence of Indonesian bourgeoisie and entrepreneurship. Most profits were also remitted to the Netherlands, hampering the further development of an industrial base in Indonesia. Later on, Japanese occupation -during the second world war- led to a substantive destruction of existing assets. President Sukarno took over after independence in 1949, and nationalised most of the remaining colonial manufacturing companies, but the Sukarno period is often characterised by economic stagnation. After a coup d'Etat in 1965, Suharto came into power. The new regime implemented liberal policies and conducted what is said to have been a sound macroeconomic management, attracting foreign aid and foreign investment (Booth, 1992 ; Hill, 1996b). Rapid growth started as soon as 1968, and was maintained until 1981, and slowed down in 1982-83.

During the period 1973-80, oil prices quadrupled, relaxing foreign exchange and government revenue constraints. It is generally agreed that Indonesia succeeded better than most other oil exporting countries: It conducted sound macroeconomic and exchange rate management, and investment in infrastructure and agriculture aimed at balanced development and economic growth. Manufacturing sector output grew rapidly at an average annual rate of over 14%. This was however a period of increasing regulation, including establishment of trade barriers, creation of licensing regimes, and State allocation of capital (Booth, 1992). Although the period presented high economic growth rates - comprised between 7% and 10% p.a. - an increasingly complex and opaque regulatory system may have hampered efficiency (Booth, 1992 ; Hill, 1996b).

Similarly to many other developing countries, Indonesia followed a state-led industrialisation policy, with the development of a large public sector dominated by large-scale companies (Robison, 1986 ; Hill, 1990a and b). Large-scale companies are generally state-owned, or at least have state participation in their capital. It has been widely documented that a large number of those companies, through systematic corruption, were granted monopolies via the preferential allocation of import and/or distribution licences (Robison, 1986 ; Hill, 1996a ; Aswicahyono, Hill and Basri, 2000 ; Basri, 2001). Those companies were also given preferential access to (cheap) capital, thereby reinforcing duality within the manufacturing sector.

Studies agree on the fact that, although output growth was rapid during the oil boom, Total Factor Productivity Growth for this period was very low, between 0.7% and 1.1% p.a. on average.[5] The estimation of new TFPG estimates will help shedding some more light on that contrasted period with regard to the sources of growth (intensive versus extensive).

From 1981 on, oil prices started to fall gradually, cutting the engine of growth abruptly. In the early 1980s, GDP growth fell below 5%, owing to a drop in oil exports (imposition of OPEC quotas) and oil prices, and manufacturing and agricultural performance remained poor. Medium- and large-scale manufacturing sector value added grew on average at 9.1% p.a. during 1976-80, against 5.3% p.a. during 1981-83. Drastic macroeconomic management of the crisis led to cuts in government spending and devaluation of the Rupiah. Government however failed to adopt matching microeconomic reforms. Trade remained extremely regulated and the large State enterprise sector did not undergo major restructuration (Booth, 1992 ; Hill, 1996).

TFPG estimates for that period remain close to the oil boom period, between 0.1% and 1.10% p.a. for 1982-85. Aswicahyono (1996), however finds TFPG rates of –4.90% p.a. for the period 1981-83. Two hypotheses may be put forward. The oil crisis may have lowered TFP growth rate (relatively to the oil boom period), because value added dropped more dramatically than inputs, owing to a demand shock for manufacturing. However, the oil crisis could have led to TFP growth rate improvement, owing to exit of less productive firms.

Manufacturing output growth accelerated as soon as 1984, at the rate of 12.93%, to compare to an average of 5.26% p.a. for the recession period. Only after 1985 started the country liberalising the economy. Indonesia turned to export oriented policies to make up for loss of foreign exchange earnings from oil, removing trade barriers and promoting exports of manufactured products. Foreign investment and banking sector were liberalised, supporting private sector development (Hill, 1996, 1997). Numerous studies have shown that, for the Indonesian case, liberalisation tended to dramatically improve efficiency: exporting firms became more productive than non-exporting firms, the number of exporting firms increased, foreign direct investment created forward and backward linkages leading to productivity growth of local firms, and financial market liberalisation helped allocating capital to more productive firms (Sjöholm, 1997a ; Goeltom, 1995). And indeed, TFPG estimates for that period range from 2.10% p.a. (1986-91), to 7.90% p.a. (1986-90). Indonesian manufacturing finally seemed to be on the right path. One of the usual periodisation distinguishes between the liberalisation period (1984-1988) and the post-liberalisation/investment boom period (1989-1993). Aswicahyono (1996) finds TFPG estimates of 5.50% p.a. and 6.00% p.a. for both periods respectively.

[5] See Table 1

By the early- or mid-nineties, in spite and because of market liberalisation, widespread corruption and increasing short-term (foreign) debt started to threaten the system, and the economy collapsed with 1997 crisis. Timmer (1999a) estimates TFPG at 2.1% p.a. for 1991-95, markedly lower than 7.9% for post-liberalisation period.

For the entire period – 1975-95 – previous estimates of average annual TFP growth rate for the Indonesian manufacturing sector are comprised between 1% and 3%. There is clearly scope for improving and refining growth accounting, i.e. proposing an alternative capital stock growth series and using new elasticities of output with respect to intermediate inputs, capital and labour. I first briefly present the data used before tackling those two issues and presenting new TFP growth estimates.

2.4 Data: "Raw" versus "Backcast" datasets

Data commonly used to study Indonesian manufacturing and estimate TFPG is *Statistik Industri* dataset, collected by the Indonesian Central Bureau of Statistics (Biro Pusat Statistik, BPS) on an annual basis. It covers all manufacturing establishment with 20 employees or more. Two versions of this dataset exist: Raw Statistik Industri (RSI), and Backcast Statistik Industri (BSI).

RSI contains only original variables: it is an enumeration of all manufacturing establishments with 20 employees or more, covering the period 1975-1998, and providing 160 variables. Up to 1989 however, the dataset also contains a number of plants with less than 20 employees. In the mid-1980s, the number of firms covered by RSI increased dramatically. This did not correspond to a massive increase in the number of firms' entries, i.e. a growth of manufacturing, and rather corresponded to a large increase in the number of companies "discovered" by enumerators, i.e. an improvement of census coverage. In this respect, RSI is a static dataset: any growth rate calculated with this dataset does not reflect "economic" reality.

This "discovery" drove BPS to provide BSI. BSI provides a "backcast" series of employment, output, input and value added for establishments that were "discovered" after they had actually started operations.[6] BSI is a dynamic dataset. It however only provides "backcast" figures for a narrow selection of variables, excluding investment, capital stock and employment costs figures, so that these have eventually to be backcast for the purpose of estimating TFPG.

In order to illustrate the data presentation, for each dataset and at the aggregate level, I estimate a capital stock series using the Perpetual Inventory Methodology (PIM) as outlined by Timmer

[6] The backcast series are econometric estimates.

(1999), and also estimate TFPG using a standard Cobb-Douglas production function, with alpha the share of labour in value added, and dots designate rate of growth:[7]

$$T\dot{FP} = \dot{Y} - \alpha\dot{L} - (1-\alpha)\dot{K} \qquad (10)$$

TABLE 2: A comparison of BSI and RSI figures

YEAR	No of obs		annual growth		Real Value Added growth		Growth in the No of workers		Capital stock growth		share of labour in value added		TFPG	
	BSI	RSI	BSI	RSI	BSI	RSI	BSI	RSI	BSI	RSI	BSI	RSI	BSI	RSI
1975	7469	7469												
1976	8247	7258	9.9	-2.9	6.1	-5.7	13.1	11.3	8.7	0.7	0.26	0.25	-3.7	-9.1
1977	9075	7656	9.6	5.3	9.1	12.6	4.3	2.1	7.9	1.9	0.27	0.25	2.2	10.7
1978	9908	7832	8.8	2.3	18.1	33.2	6.1	3.9	7.4	1.5	0.24	0.19	11.1	31.2
1979	10829	7960	8.9	1.6	-2.5	-1.0	7.7	4.6	7.7	0.2	0.24	0.19	-10.2	-2.1
1980	11888	8087	9.3	1.6	12.1	13.2	8.6	11.6	5.9	0.2	0.21	0.18	5.7	10.9
1981	13021	7942	9.1	-1.8	10.2	13.2	5.6	3.5	4.6	6.1	0.21	0.18	5.4	7.6
1982	14191	8020	8.6	1.0	2.9	2.1	5.8	5.3	8.2	12.2	0.25	0.22	-4.7	-8.6
1983	15578	7919	9.3	-1.3	1.5	1.8	6.0	2.8	9.5	10.8	0.27	0.23	-7.0	-7.2
1984	17233	8006	10.1	1.1	13.4	18.1	8.8	8.7	8.3	10.1	0.24	0.21	5.0	8.3
1985	19888	**12909**	**14.3**	**47.8**	**16.3**	**42.5**	**8.5**	**34.1**	7.3	**14.7**	**0.24**	**0.21**	**8.7**	**23.7**
1986	20946	12215	5.2	-5.5	13.3	26.1	3.3	-4.9	4.9	5.6	0.23	0.17	8.8	22.2
1987	22118	12778	5.4	4.5	6.9	-7.2	6.4	10.9	2.6	7.9	0.21	0.19	3.5	-15.6
1988	24107	14664	8.6	13.8	9.6	8.4	8.1	14.4	3.8	10.4	0.22	0.20	4.8	-2.8
1989	25731	14676	6.5	0.1	26.4	21.9	13.3	9.0	11.5	23.5	0.20	0.18	14.5	1.0
1990	28037	16536	8.6	11.9	19.8	20.6	11.5	16.4	18.0	22.4	0.20	0.18	3.1	-0.7
1991	30249	16494	7.6	-0.3	-3.2	8.6	-3.3	11.7	17.9	23.7	0.22	0.21	-16.5	-12.7
1992	32348	17648	6.7	6.8	26.8	27.5	13.4	10.1	12.5	13.4	0.22	0.21	14.2	14.8
1993	34058	18163	5.2	2.9	9.6	10.1	7.9	7.6	7.0	7.9	0.21	0.20	2.3	2.2
1994	35988	19016	5.5	4.6	17.9	10.7	6.5	6.4	7.1	8.8	0.21	0.19	11.0	2.4
1995	37852	21551	5.0	12.5	15.0	11.8	9.0	9.0	8.3	8.6	0.20	0.18	6.5	3.1
average 76/95	**20417**	**12133**	**8.1**	**5.3**	**11.5**	**13.4**	**7.5**	**8.9**	**8.5**	**9.5**	**0.23**	**0.20**	**3.2**	**4.0**
standard deviation 76/95			**2.3**	**11.2**	**8.3**	**12.7**	**3.8**	**7.7**	**4.0**	**7.4**	**0.02**	**0.02**	**8.1**	**12.4**

Growth rates calculated on constant IDR 1983 figures

BSI covers a larger number of establishments, and the number of observations rises more rapidly than for RSI, however, average annual growth of added value, number of workers and capital stock is 1.9 to 1.0 percentage point lower than for RSI figures. One of the main reasons is a larger variance of RSI growth rates, showing spurts in establishments "discovery". Main "discovery" year is 1985, when the number of observations increases by nearly 48%, leading to large increases in

[7] Timmer's methodology is presented at length later in this chapter.

other selected variables. Value added increases by 42.5%, total number of workers increases by 34.1%, and capital stock increases by 14.7%.

RSI is clearly not an adequate dataset for working on aggregate TFP Growth. Using RSI overestimates average TFP Growth for 1976-1995 by 0.8 percentage point. It also leads to very different outcomes for each year, where TFPG is more driven by establishments "discoveries" rather than by economic factors. The largest "discovery" made in 1985 (+48% in number of observations for RSI, against 14.3% for BSI), leads to TFP Growth of 23.7%, against 8.7% for BSI.

In order to overcome RSI dynamics problem, I calculate profits levels and profits as a percentage of value added, as shown in Table 3.[8] From 1975 to 1977, RSI figures underestimate profits as a percentage of value added by 7.9 to 15.4 percentage points, as compared to BSI figures. From 1978 to 1995, RSI figures overestimate profits as a percentage of value added by 7 percentage points on average. However, results are more similar and consistent than for TFP Growth estimates.

TABLE 3: Profits

	Real Value added(constant IDR 1983)		Total employment costs (constant IDR 1983)		Capital stock (constant IDR 1983)		Profits (constant IDR 1983)		Profits as % of value added	
	BSI	RSI	BSI	RSI	BSI	RSI	BSI	RSI	BSI	RSI
1975	3181000000	1970000000	858870000	463000000	7274000000	5810000000	867330000	345000000	27.3	17.5
1976	3382000000	1860000000	879320000	473000000	7937000000	5850000000	915280000	217000000	27.1	11.7
1977	3703000000	2110000000	999810000	524000000	8587000000	5960000000	985790000	394000000	26.6	18.7
1978	4438000000	2940000000	1065120000	555000000	9242000000	6050000000	1524480000	1175000000	34.4	40.0
1979	4328000000	2910000000	1038720000	564000000	9979000000	6060000000	1293480000	1134000000	29.9	39.0
1980	4885000000	3320000000	1025850000	612000000	10583000000	6070000000	1742550000	1494000000	35.7	45.0
1981	5412000000	3790000000	1136520000	690000000	11081000000	6450000000	2059280000	1810000000	38.1	47.8
1982	5572000000	3870000000	1393000000	854000000	12030000000	7290000000	1773000000	1558000000	31.8	40.3
1983	5656000000	3940000000	1527120000	892000000	13227000000	8120000000	1483480000	1424000000	26.2	36.1
1984	6470000000	4720000000	1552800000	996000000	14372000000	8980000000	2042800000	1928000000	31.6	40.8
1985	7613000000	7220000000	1827120000	1520000000	15464000000	10400000000	2693080000	3620000000	35.4	50.1
1986	8698000000	9370000000	2000540000	1580000000	16240000000	11000000000	3449460000	5590000000	39.7	59.7
1987	9315000000	8720000000	1956150000	1680000000	16667000000	11900000000	4025450000	4660000000	43.2	53.4
1988	10254000000	9480000000	2255880000	1940000000	17318000000	13200000000	4534520000	4900000000	44.2	51.7
1989	13348000000	11800000000	2669600000	2140000000	19433000000	16700000000	6791800000	6320000000	50.9	53.6
1990	16276000000	14500000000	3255200000	2660000000	23260000000	20900000000	8368800000	7660000000	51.4	52.8
1991	15766000000	15800000000	3468520000	3290000000	27832000000	26500000000	6731080000	7210000000	42.7	45.6
1992	20617000000	20800000000	4535740000	4440000000	31524000000	30300000000	9776460000	10300000000	47.4	49.5
1993	22688000000	23000000000	4764480000	4500000000	33824000000	32800000000	11158720000	11940000000	49.2	51.9
1994	27144000000	25600000000	5700240000	4820000000	36301000000	35800000000	14183560000	13620000000	52.3	53.2
1995	31523000000	28800000000	6304600000	5310000000	39433000000	39000000000	17331800000	15690000000	55.0	54.5
average 75/95	10965190476	9834285714	2391200000	1928714286	18171809524	15006666667	4939628571	4904238095	39.0	43.5
STD 75-95	8349482958	8448364085	1661336583	1610154034	9963839263	11147469818	4743448112	4650806993	9.5	13.1

The gross estimation of the profit rates – that can be interpreted as implied excess return on capital - is very high, on average 39.0% to 43.5% for 1975-1995. Furthermore, over the period, the

[8] Profits are calculated as value added minus employment cost, minus capital cost. For BSI figures, employment costs are calculated as the ratio of employment cost/number of workers (from RSI) multiplied by number of workers (from BSI). Capital cost is set at a hypothetical 20%. For the period 1975-95, deposit interest rate was just over 13% p.a., against just over 21% for the lending interest rate (average for 1986-95), (source, World Bank Development Indicators). Capital stock figures already take depreciation and scrapping into account.

overall rate of profit rises by 100% (BSI figures) or by 200% (RSI figures). There may be three different explanations to these high profit share and growth figures:

(a) some plants have a strong market power (Gershenkronian mechanism of economic growth), (b) the Perpetual Inventory Methodology (PIM) underestimates capital stock figures, and (c) employment costs are underreported. As the remainder of this chapter argues, the three explanations are not mutually exclusive.

The *Raw Statistik Industri* dataset is not suitable for the estimation of TFP Growth at aggregate level, as growth rates are mainly driven by spurts in establishments "discovery". The *Backcast Statistik Industri* is a suitable substitute, because growth in the number of establishments represents firms' entries - and therefore growth of manufacturing, and not random "discoveries".[9] A way forward is taking advantage of both datasets by using the numerous variables available in RSI, and complementing it with BSI backcast figures on newly "discovered" establishments.

Results in tables 2 and 3 also shed some light on discrepancies observed in the literature. While Aswicahyono (1996) and Timmer (1999a) use the BSI dataset, Keuning (1991), and Osada (1994) use the RSI dataset, seeming to miss completely the difference between datasets.[10]

Another source of discrepancy stems from different vintages for the BSI dataset. As some establishments are still being discovered, BSI figures are recalculated for each new version. BSI has been amended several times from 1986 to 1998. I use the 1996 version, while most other authors use the 1993 version.

TFP Growth estimation should therefore be carried out using the latest BSI.[11] Remaining issues in TFP Growth measurement are the construction of a capital stock series, and choice of elasticity of output with respect to labour.

2.5 Growth accounting framework

2.5.1 Construction of a capital stock series

Although conceptually straightforward, the construction of a capital stock series is in practice one of the most difficult task to perform in estimating TFP Growth rates.

The RSI dataset offers two types of relevant variables:

[9] In fact, if "discoveries" were really randomly made, the RSI would be a fair representation of the reality. But at first sight, it seems that previously non-covered establishment belonged mainly to certain groups, for example, after 1979, non-covered establishments seemed to belong to the small-scale firms group.
[10] Mentioned in Timmer (1999), footnote 5.
[11] Since the 1998 version has not yet been made available to me, I am currently using the 1996 version.

- Annual *changes in fixed assets*, distinguishing between five types of assets (land, buildings, machinery, vehicles, and other fixed assets), covering 1975-1998. This series is called the *investment series*.
- Annual *levels of fixed assets*, distinguishing between five types of assets, covering a shorter period (1988-1998). This series is called *fixed assets series*.

2.5.1.1 Previous methodologies

Literature on Indonesian manufacturing usually estimates a benchmark capital stock and constructs a capital stock series from fixed assets investment figures with the Perpetual Inventory Methodology (PIM).[12] Initial benchmark capital stock is estimated using ICVARs (investment to capital and value added to capital ratios). It assumes the steady state and derives capital stock from value added to investment ratios. As I demonstrate further in this chapter, this methodology proves to be inaccurate, especially at the establishment level.

Goeltom (1995), uses RSI 1986' fixed assets figures as a benchmark capital stock and construct a capital stock series for 1981-1993 using PIM and investment figures at establishment level. However, she notes: "This method of back-casting and forecasting the capital stock has one important weakness, that is, some back-casted negative capital stock value might appear whenever investment in that particular year is much larger than the capital stock. I have eliminated all firms in which the capital stock becomes negative in any year" (Appendix 1). Her remark indicates that fixed assets figures do not match investment figures.

Indeed, working on RSI for 1988-98 shows that investment figures (given in the dataset) do not match fixed assets changes computed from fixed assets levels. Furthermore, the difference between given and computed fixed assets investment series is not consistent over time: the two series are correlated at the 3% level only.

I review here the literature and the different methodologies that have been used in core studies of TFP Growth measurement for the Indonesian manufacturing sector. I start with the most recent one, which is considered as the current benchmark and most accurate methodology in the literature.

Timmer (1999a)

Timmer describes his methodology at length in a 1999 article titled "Indonesia's ascent on the technology ladder: Capital Stock and Total Factor Productivity in Indonesian manufacturing, 1975-95".

[12] PIM constructs a capital stock series by adding investment flows to a benchmark capital stock, taking depreciation and scrapping into account.

The method follows Jorgenson, Gollop and Fraumeni (1987), estimating stocks of different types of capital goods K_{it}, in order to account for different marginal productivities. Other studies do not follow this method and assume that capital is perfectly homogeneous. The growth of the capital stock is calculated as follow:

$$\dot{K}_t = \sum_{i=1}^{n} w_{it}\dot{K}_{it} \text{ ,} \qquad (11)$$

where $w_{it} = 1/2\left(v_{it} + v_{it-1}\right)$ and $v_{it} = \frac{r_{it}K_{it}}{\sum_{i=1}^{n} r_{it}K_{it}}$, where r the rental price of an asset is given by its current price divided by its lifetime.

Three types of assets are distinguished: land and buildings, machinery and other capital goods, and vehicles. The gross capital stock of each type of assets is calculated using the Perpetual Inventory Method, which is the summation of past investment flows. Assets are scrapped at the end of their lifetime and repair and maintenance expenditures are supposed to keep the physical production capabilities of an asset constant during its lifetime d. Sales of assets before the end of their lifetime are considered as premature scrapping. The stock of each asset is therefore given by:

$$K_{it} = \sum_{t-d+1}^{t} \left(I_{it} - S_{it}\right) \qquad (12)$$

where K is current investment stock, I are new real investments (land and buildings, machinery and other capital goods, and vehicles), S is the sale of used items, i is a subscript for the asset type, t the time period and d is the asset's lifetime.

These data are however only available in the RSI dataset. After having calculated investment stocks with RSI figures, there is a need for backcasting them in order to make them compatible with the other BSI data. In order to backcast the investment figures, Timmer, "assume[s] that the investment behaviour of firms covered by the SI survey is representative of the investment behaviour of the firms included in the backcast dataset. [He] then calculate[s] the ratio of investment to value added on the basis of the original published data and apply it to the backcast value added data...to arrive at a backcast investment series at the 3-digit level."

Let INV be total investment, VA value added, r the subscript for raw and b the subscript for backcast. Timmer obtains backcast investment figures with the following formula:

$$INV_b = \frac{INV_r}{VA_r} \times VA_b \qquad (13)$$

He uses import price indices (published in *Indikator Ekonomi*, BPS), to deflate machinery and transport equipment, because these are mainly imported. Construction is deflated by the implicit deflator for construction GDP from the national accounts.

Timmer uses Goeltom's (1995) estimates of depreciation rates to calculate assets' lifetime. These rates seem to correspond to other researchers findings such as Hulten and Wykoff (1981, table 1). The rates are 30 years for buildings, 10 for machinery and 5 for vehicles and other transport equipment.

He calculates the average of a three-year (1976-1978) incremental capital value added ratios (ICVARs, i.e. capital stock over value added) at the 2-digit industry level, allowing for a one-year lag, and applies it to gross value added in 1975 to estimate the benchmark capital stock for that year (Table A1 in Timmer, 1999a). Additionally, "to take scrapping into account, the vintages of the capital stock thus estimated must be known. Our estimates of vintage are based on the investment series by type given in Keuning (1988), which allows us to work out the proportion of each asset type in each year" (p.81). Timmer (1999a) "divided the stock over the period determined by its lifetime, using a (stylised) investment distribution. For buildings, (he) assumes that 2% of the stock originated in each year from 1945 to 1954 and 1958 to 1967, and 6% in each year from 1955 to 1957 and 1968 to 1974. For machinery, (he) assumes a figure of 5.3% for 1965-67 and 12% for 1968-74. No investment data were available for vehicles; (his) assumption is that 20% of the stock originated in each year from 1970 to 1974." (footnote 10).

He then calculates TFP Growth using a Cobb-Douglas production function:

$$T\dot{F}P_t = \dot{Y}_t - \alpha_t \dot{L}_t - (1-\alpha_t)\dot{K}_t \qquad (14)$$

where Y is real value added (BSI), L the total number of workers (BSI), K is the capital stock (calculated with RSI and BSI figures), and α is the share of labour in value added (total employment costs over value added) taken from RSI.

Aswicahyono (1998)

Aswicahyono uses a version of the BSI prior to 1996 (probably 1993), and his study concentrates on the 1975-1993 period. He constructs a capital stock series on the basis of the annual capital expenditures reported in the RSI.

He assumes a geometric depreciation pattern and the capital stock is given by:

$$A_t = (1-\delta)\cdot A_{t-1} + I_{t-1} \qquad (15)$$

where A is the capital stock, I is the investment at constant price, δ is the rate of geometric depreciation.

In order to work with BSI figures, Aswicahyono backcasts the investment figures from the RSI. He mentions Timmer's simple methodology, calculating the ratio of investment over value added, as well as the very complicated approach of backcasting investment figures following the same methodology as the BPS. He then describes his choice: "This thesis takes a middle approach, avoiding the use of complicated backcasting methodology on the one hand, while at the same time minimising the bias in the simple scaling method. The idea is to regress the investment series with the variables that appear in both series, and to use the parameters from the regression to predict the investment series for the backcast data. The firm level data of investment, value added, labour, and intermediate inputs in the SI are pooled, and the investment series are regressed on the three remaining variables for each 28 industries. Also included are time dummy variables (1975,1976,...1993) to capture business cycles. The method has intuitive appeal, since the three independent variables have some relation with the investment value. For example, in the case of the clove cigarette industry, a large proportion of investment should be in building since it requires a large warehouse to store the intermediate inputs." (p. 159-160). He uses the following specification:

$$\ln I_i = \alpha_0 + d_{75} + \ldots + d_{93} + \alpha_V \ln VA_i + \alpha_L \ln L_i + \alpha \ln R_i \qquad (16)$$

where I is investment, VA value added, L total number of workers, R intermediate inputs, i the subscript for the firm.

"Another way to interpret the model is that the scaling factor for investment (*Ib/Is*, subscripts *b* and *s* refer to the backcast and SI respectively) is the weighted average of the ratio of value added (*VAb/VAs*), employment (*Lb/Ls*), and intermediate inputs (*Ib/Is*), with the weight being the parameters of the coefficient. The parameters, therefore, give a clue to the relative importance of value added, employment and intermediate inputs ratio in scaling investment series from the SI data. The weight does not always sum to one, indicating the existence of returns-to-scale phenomenon. Hence, a return-to-scale coefficient of greater than unity indicates that large firms require more than proportionate investment than that of the small firms, and vice versa." (p. 160).

This method allows correcting for the under-reporting of investment data. Many authors, starting with Goeltom (1995), notice that many firms report zero investment, and wonder whether this corresponds to zero investment or a non-response. Timmer (1999a) compares investment figures from the RSI with BKPM figures (Investment Coordinating Board, macroeconomic figures) and find that investment seems to be underestimated by 35% in 1992. However, Timmer (1999a) does not account for this in his TFP Growth estimation.

Aswicahyono uses the domestic and imported goods wholesale price index, including the domestic and imports wholesale price index for machinery, except electrical products, electrical machinery and transport equipment, and building. He uses the non-residential and residential building price for the price index of land.

"To get an estimate of benchmark capital stock, the steady state condition is assumed. In the steady state condition, the growth rate of investment will be the same as the growth rate of capital and value added, and the investment capital ratio stays constant." (p. 163).

He proceeds in two steps:

$$\ln I_t = a + b \cdot t \tag{17}$$

where a is the log fitted 1975' investment, i.e. $\ln \hat{I}_{75}$, b is the growth of investment per year, t is the time trend (0, 1,...,18) for (1975, 1976,...,1993). The capital stock in 1974 is then given by:

$$A_{74} = \frac{\hat{I}_{75}}{g_I + \delta} \tag{18}$$

Aswicahyono argues that this method avoids the bias of using only investment data for the start of the period. The growth rate of value added can also be used instead of the growth of investment (if we assume the steady state). Using value added growth could reduce the effects of the errors in the measurement of the investment series.

He uses the same depreciation rates as Goeltom (1995). "Depreciation rates are aggregated using the above numbers and the weight from the SI data. The initial capital stock is then distributed across the five types of assets to get the benchmark capital stock of each type of asset."(p. 165).

He then uses the method developed by Christensen and Jorgenson (1969, 1973) to calculate the capital services of each type of assets, using the following formula:

$$r^t = \frac{PC - \left[\delta p_I^t - \left(p_I^t - p_I^{t-1}\right)\right]A^{t-1}}{p_I^{t-1} A^{t-1}} \tag{19}$$

where p_I^t is the price of investment goods, A is the capital stock, r^t is the rate of return, δ the depreciation rate, and PC the value of property compensation, which is non-wage value added (value added minus wage bill). The rate of return, assumed to be equal for all assets, is calculated as the ratio of property compensation less depreciation and plus capital gains for all assets, to the value of all assets at the beginning of the period. On the other hand, Timmer (1999a) assumes that each asset has a different rate of return.

Osada (1994)

Osada (1994), estimates TFP growth for the period 1985-1990 and mentions Keuning's (1991) capital stock estimates, which have been calculated for 1975, 1980, and 1985 at 1980 constant prices. However, he chooses to work with two different capital stock estimates. "The first estimate is given using the industrial classification of the National Accounts Statistics published by the Central Bureau of Statistics, Indonesia (BPS) and relies on the preliminary results of the capital stock estimation by the BPS. It is worth noting that the BPS does not recommend the use of such capital stock figures. The second estimate classifies manufacturing into nine sectors and uses the capital stock data compiled for this purpose from the data contained in Industrial Statistics published by the BPS" (p. 480). The first TFP estimates include all sectors of the economy and are based on the National Accounts, while the second estimates concentrate on the manufacturing sector, using RSI figures. As argued previously, using the RSI figures is flawed if we consider the calculation of growth of aggregates, because results are mainly driven by the spurts of establishments "discovery". But there are other issues.

Osada (1994) uses a benchmark method in order to estimate the capital stock. He first calculates a nominal net fixed capital formation for each 2-digit sector. He does not mention how he calculates this variable, and we can suppose that he uses the sum of past investment flows. However, we do not know whether he uses the same depreciation rates, and whether or not he takes scrapping into account (normal and premature scrapping). He does seem to assume the homogeneity of capital, i.e. he does not consider different capital services for the three different types of assets. He then deflates this series by the implicit deflator of gross fixed capital formation. This contrasts with Timmer (1999a), who uses different deflators for the three types of assets: import price indices for machinery and transport equipment, implicit deflator for construction GDP from the National Accounts to deflate construction.

Osada (1994) then estimates the average of the incremental capital-output ratio (ICOR) of each sector at the 2-digit level (Timmer, 1999a, uses a 3-digit disaggregation). He then assumes that this ICOR is identical to the capital-output ratio for 1987, and calculates the capital stock for 1987 as the product of ICOR and the value added. Value added is deflated by the manufacturing implicit deflator of the national accounts. Using this as the benchmark, the data for other years are calculated. One discrepancy with Timmer's results (1999a) could be also attributable to different ICOR estimates using different aggregation level.

Keuning (1991)

Keuning estimates capital stocks for the period 1975-85, using the Perpetual Inventory method. He however includes oil and refineries, and small-scale manufacturing. As a result, he obtains capital stock figures that are higher than figures dealing only with medium- and large-scale manufacturing.

In order to take scrapping into account, he uses a Gaussian distribution of discard, while Timmer (1999a) uses a rectangular survival distribution. In other words, Keuning (1991) assumes that "within 6 years after the initial investment nothing is scrapped. After that period, existing stock is retired at an ever-increasing rate. In the beginning, each year a larger proportion of initial investment does not survive, but later, when not so much remains, the survival function becomes convex instead of concave" (p. 94). He adds that "this function should, however, be considered as not more than an informed guess" (p. 94), because the data availability does not allow for a more formal estimation. He deflates investments with a time-series of investment prices. He assumes that the efficiency of capital goods is maintained constant by repair and maintenance expenditures.

He uses lifetimes of 45 years for construction and 22.5 years for machinery and equipment (including transport equipment).

He then estimates an ICVAR in order to estimate a benchmark capital stock. Although he seems to refer to an investment series covering the period 1953-85, he only uses 1975-80 investment figures to estimate ICVARs and the benchmark capital stock for 1975.

2.5.1.2 Previous methodologies: A critic

It is clear that the use of different benchmark years and the estimation of ICVARs over different periods lead to substantial discrepancies in capital stock estimates. Another problem with the use of the ICVAR methodology is that in a period of strong investment, capital stock could be underestimated, and in period of poor investment, capital stock could be overestimated, i.e. the steady state assumption may not hold.

Of particular interest is the deconstruction of the ICVAR methodology to estimate a benchmark capital stock. Most authors calculate ICVARs at the 2-digit level, estimate a benchmark capital stock at the 2-digit level, and then add up those benchmark capital stocks to obtain the aggregate benchmark capital stock. The question is: does the chosen disaggregation level matter?

I first demonstrate that the capital stock calculated with the ICVAR at the aggregate level can only be equal to the capital stock calculated with the ICVARs at the disaggregate level in one case.

Let us assume that the economy has two sub-sectors 1 and 2. At the aggregate level, the ICVAR is calculated as follows:

$$ICVAR = \frac{VA_t}{INV_{t-1}} = \frac{(VA_{1t} + VA_{2t})}{(INV_{1(t-1)} + INV_{2(t-1)})} \quad (20)$$

At the aggregate level, the benchmark capital stock is calculated as follows:

$$KSTOCK_a = ICVAR(VA_{1t} + VA_{2t}) \quad (21)$$

At the disaggregate level, the capital stock is calculated as follows:

$$KSTOCK_d = ICVAR_1 VA_{1t} + ICVAR_2 VA_{2t} \quad (22)$$

and $KSTOCK_d = KSTOCK_a$ if and only if $ICVAR_1 = ICVAR_2$, meaning that all ICVARs are the same across sub-sectors of the economy.

Empirical studies show that this is not the case for the Indonesian manufacturing sector. Working on 1976-1978 figures at the 2-digit level of disaggregation, Keuning (1991) finds ICVARs ranging from 0.21 to 14.99. Timmer (1999a) finds ICVARs ranging from 1.3 to 5.4. Working with the same period and the same disaggregation level, I estimate ICVARs ranging from 1.98 to 10.22. Furthermore, the variance of ICVARs increases at a more disaggregated level.

If the condition $ICVAR_1 = ICVAR_2 = ICVAR$ is not met, then we have:

$VA_{2t}^2 INV_{1(t-1)}^2 + VA_{1t}^2 INV_{2(t-1)}^2 + 2VA_{1t}VA_{2t}INV_1 INV_2 > 0$, implying that (23)

$KSTOCK_d > KSTOCK_a$, i.e. the sum of the disaggregated capital stocks is always more than the capital stock calculated at the aggregate level.

Using the methodology at the aggregate level tends to underestimate the capital stock, while a too detailed degree of disaggregation tends to overestimate it. Since there is no simple way of defining the optimal degree of aggregation, and since establishment level figures are available, it seems more reasonable to rely on establishment level fixed assets figures.

Another issue affecting the use of PIM is the choice of depreciation rates and depreciation patterns. For the case of the Indonesian manufacturing sector, the standard assumption regarding service lives of assets are the ones used by Goeltom (1995). These are 5 years for vehicles, 10 years for plant and machinery, and 30 years for buildings, as used in Timmer (1999a).

Let us compare the assumed assets service lives for Indonesia with data for the USA. The data have been taken from BEA estimates (US Bureau of Economic Analysis).[13] The study gives service lives of different assets at a very detailed level, also differentiating between public and private assets. Service lives for industrial, commercial and office buildings range from 31 to 50 years, against 30 years for Indonesia. Service lives for plant and machinery in the US range from 6 to 33 years, against 10 years for Indonesia. US vehicles have service lives between 5 and 14 years, against 5 years for Indonesia.

Indonesian assets are assumed to have average service lives shorter than US assets. Indeed, Indonesian service lives represent more or less the lower bound of US assets service lives. Assets service lives should be shorter if technological change is faster, if assets are used more intensively, and/or if repair and maintenance is inexistent or ineffective.

Keuning (1991), uses different service lives: 45 years for construction and 22.5 years for machinery and equipment, including transport equipment. These are significantly longer than the ones used by Goeltom, Timmer and Aswicahyono. However, Keuning notes "concerning the maximum length-of-life of each capital good, we have selected lifetimes which are slightly below those for most industrialised countries, on the ground that: (a) wear and tear affects capital goods more in tropical areas; and (b) we could not estimate the vintages of which the capital stock (1958) was composed, and treated that value as 1957 investment instead."

But there are other issues as far as depreciation is concerned.

For example, Timmer (1999a) chooses to assume that the productivity of the capital stock remains constant over its lifetime, and is only scrapped at the end of its lifetime. Goeltom (1995) and Aswicahyono (1998) assume a constant depreciation rate. Keuning (1991) uses a Gaussian distribution of discard. Different sets of assumptions lead to obvious differences in capital stock growth.

Aswicahyono (1998) reviews the literature on depreciation patterns and the evidence points in the direction of the geometric depreciation pattern written as follows:

$$A_t = (1-\delta)\cdot A_{t-1} + I_{t-1} \qquad (24)$$

A final issue is the aggregation of the data by sector. There is no reason to believe that different sectors, and even different establishments within the same sector have the same service lives and retirement pattern for the capital stock.

To summarise, there are four ways of estimating a capital stock series:

[13] US Department of Commerce, August 1999, "Fixed reproductible tangible wealth in the United States, 1925-94".

- Estimate a benchmark capital stock and construct a capital stock series from fixed assets investment figures with the Perpetual Inventory Methodology. I have demonstrated that the estimation of the benchmark capital stock with the ICVAR methodology is inaccurate. This is more likely to be true at the establishment level, for which the steady state assumption may not hold.
- Use historical figures in order to estimate a benchmark capital stock and construct a capital stock series from fixed assets investment figures with the Perpetual Inventory Methodology. While this is feasible at the macroeconomic level, it is impossible to find historical figures for individual establishments. However, a historical macroeconomic benchmark capital stock may be used as a cross check.
- Use fixed assets levels as benchmark capital stock, and construct a capital stock series from fixed assets investment figures with the Perpetual Inventory Methodology. This is an appealing method, however, fixed assets levels and changes do not match and do not bear any consistent relationship.
- Work only on fixed assets (levels) figures: use fixed assets figures given for 1988-98 and backcast figures for 1975-1987. This methodology seems – at the moment - the best suited and the less biased. Since investment and fixed assets figures do not match, there is no reason to trust more one series over the other. And indeed, the literature using the SI dataset agrees in saying that both series suffer from underreporting. I argue that it is more reliable to work on fixed assets figures, because it avoids the artificial and unreliable estimation of a benchmark capital stock for 1975, as well as assumptions on depreciation rates and patterns. It also gives the possibility to estimate more accurately capital stock growth series at the establishment level.

2.5.1.3 New methodology

I propose to estimate a new capital stock series using fixed assets data only, using the two datasets available:

- RSI, static dataset containing all relevant variables, i.e. output, intermediate inputs, labour (number of workers), wages, and fixed assets figures. Fixed assets figures are available for 1988-98, all other variables are available for 1975-98.
- BSI, dynamic dataset containing output, intermediate inputs, and labour (number of workers) for 1975-96.

Two tasks have to be performed:

- Backcast fixed assets data for 1975-87, i.e. perform a backward "prediction" of fixed assets figures at the establishment level for the early period.
- Backcast fixed assets data from RSI to BSI for 1975-1995, i.e. predict fixed assets figures for establishments discovered after 1985 (absent in RSI but present in BSI).

The first step is to choose the adequate deflators to work on constant figures. Timmer (1999a) uses import price indices to deflate machinery and transport equipment, because these are mainly imported, and he uses the implicit deflator for construction GDP from the national accounts to deflate land and buildings. Aswicahyono uses the domestic and imported goods wholesale price index, including the domestic and imports wholesale price index for machinery, except electrical products, electrical machinery and transport equipment, and building. He uses the non-residential and residential building price for the price index of land.

The National Accounts provide a wholesale price index for each 4-digit industry of the SI. I deflate output and intermediate inputs using this index at the 4-digit level. It would be more accurate to decompose intermediate inputs into several components (e.g. electricity, raw materials, etc) and deflate each component with the appropriate price index. This proves however impossible due to the unavailability of adequate price indices. I am however able to use fixed assets data decomposed by type of assets and deflate machinery and other fixed assets with the wholesale price index for machinery (excluding electrical products), and deflate vehicles with the wholesale price index for vehicles. The implicit deflator for construction GDP from the national accounts is only available from 1982 onwards, and I decide to use the implicit deflator for GDP to deflate land and buildings (World Bank Development Indicators). Base year is 1983.

I then "clean" the data by removing all observations with a negative output, intermediate inputs, fixed assets, and employment. All observations displaying output, or fixed assets equal to zero are kept but the value of output, value added or fixed assets is replaced by a missing value.[14]

To "clean" fixed assets data (in current prices), I calculate the difference between computed total fixed assets figures (computed from the breakdown into land, buildings, vehicles, machinery and other), and given total fixed asset data. All observations with a difference above 10% or below – 10% are kept but the value of fixed assets is treated as a missing value in order to be predicted later on. This removes 718 observations out of 56,639 (i.e. 1.27% of the population).

In order to estimate a fixed assets series for all establishments over the period 1975-1995, I need to find a robust statistical relationship between observed fixed assets and other variables available

[14] For example, if an establishment displays fixed assets equal to zero (0), but an output of 10,000, the establishment is kept in the database with fixed assets displaying a missing value (.) and an output of 10,000. In proceeding so, regressions are not polluted by the spurious zeros, and I will additionally be able to predict missing observations for fixed assets later on.

in the dataset. The idea is that fixed assets levels should bear a consistent relationship with output, and labour. [15]

Using observed RSI figures, I run the following regression over the period 1988-95, using Ordinary Least Square:

$$\ln FA = \alpha \ln OUTPUT + \beta \ln LTLNOU + YEAR + Idum + c \qquad (25)$$

where FA is fixed assets, $OUTPUT$ is gross output, $LTLNOU$ is number of workers, $YEAR$ a time trend standing for technological change, $Idum$ a set of eight 2-digit industry dummies, and c a constant. I obtain the following results:

Table 4a: Regressing plant-level capital stock on output and labour

Number of obs	56670						
F(11, 56658)	11395.11						
Prob > F	0						
R-squared	0.6887						
Adj R-squared	0.6886						
lnFA	**Coef.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**	**VIF**	**1/VIF**
ln_OUTPUT	0.589663	138.44	0	0.581315	0.598011	3.53	0.283473
ln_LTLNOU	0.389431	57.51	0	0.376158	0.402703	3.43	0.291494
YEAR	-0.011341	-5.56	0	-0.015341	-0.007341	1.01	0.991943
I32	-0.143907	-10.06	0	-0.171941	-0.115873	1.57	0.636348
I33	0.067622	4.2	0	0.03603	0.099213	1.4	0.714917
I34	0.403002	17.7	0	0.358364	0.44764	1.16	0.85945
I35	0.200593	12.89	0	0.170096	0.23109	1.44	0.696706
I36	0.206683	10.58	0	0.168399	0.244968	1.28	0.783415
I37	0.142198	3.1	0.002	0.052415	0.23198	1.07	0.938678
I38	0.295549	18.03	0	0.263426	0.327673	1.37	0.730156
I39	-0.059097	-1.5	0.133	-0.136131	0.017936	1.05	0.948338
_cons	25.63516	6.31	0	17.6738	33.59651		

Breush-Pagan test indicates no heteroskedasticity

As a test for multicolinearity among independent variables, I compute Variance Inflation Factors (VIFs). As a rule of thumb, a (1/VIF) close to zero indicates serious multicolinerarity. There is here no serious multicolinearity problem.

I then use these coefficients, estimated using RSI, and apply them to BSI data in order to backcast the log of fixed assets. This methodology performs three tasks at once:

- It backcasts fixed assets data for 1975-87, i.e. it "predicts" missing fixed assets data for each establishment for the period 1975-87.

[15] Aswicahyono (1998) uses a similar methodology, using value added, intermediate inputs and labour to backcast investment figures. Since intermediate inputs are part of output, I do not include them in the regression, as it would lead to multicolinearity problems between output and intermediate inputs.

- It backcasts fixed assets data from RSI to BSI, i.e. it "predicts" fixed assets figures for establishments discovered after 1985 (absent in RSI but present in BSI).
- It corrects for under- or misreporting of fixed assets data (spurious zeros, missing values, and underreported fixed assets figures), i.e. it "predicts" fixed assets data for establishments showing gaps in fixed assets data series, reporting zero fixed assets or reporting undervalued fixed assets data.

As Table 4b shows, I obtain on average a very good prediction of fixed assets, and fixed assets distribution is similar for observed and predicted figures.

Table 4b: summary statistics of observed log of fixed assets (lnFA), predicted log of fixed assets using BSI data (lnFA_BSI), residuals (RES1), standard deviation of residuals (STDR1), and stardard deviation of predicted log of fixed assets (STDP1)

Variable	Obs	Mean	Std. Dev.	Min	Max
lnFA	56643	12.76591	1.978903	4.919051	23.03142
lnFA_BSI	240002	11.95166	1.566543	7.571712	19.95103
RES1	56643	0.003126	1.103789	-7.816668	12.04139
STDR1	240002	1.100602	0.00017	1.099224	1.100756
STDP1	240002	0.019322	0.00771	0.009733	0.058862

summary statistics of log of fixed assets (observed and predicted) using same sample

stats	lnFA	lnFA_BSI
N	56643	56643
mean	12.76591	12.76279
p10	10.44441	10.82757
p25	11.2459	11.40434
p50	12.53374	12.5169
p75	14.06723	13.96062
p90	15.43794	15.07323
min	4.919051	8.212639
max	23.03142	19.95103

However, it is necessary to verify that using predicted log of fixed assets to calculate fixed assets growth does not amplify the error of the prediction. Table 4c displays summary statistics of the annual growth rates of all elements of the production function, using the same sample size and composition for observed and predicted variables.

Table 4c: Simple average of annual growth rates of the elements of the production function , using same sample for observed fixed assets growth (Kg_raw) and predicted fixed assets growth (Kg_BSI)

YEAR	OUTg	INPg	Lg	Kgraw (1)	KgBSI (2)	(1) - (2)
1988	3.47%	2.83%	2.48%		1.63%	
1989	12.77%	11.85%	4.20%	1.27%	9.21%	7.94%
1990	13.44%	5.32%	4.09%	6.72%	8.50%	1.78%
1991	2.99%	1.85%	3.86%	-0.59%	2.12%	2.71%
1992	9.51%	6.63%	2.84%	8.36%	5.68%	-2.68%
1993	10.94%	10.43%	4.77%	0.82%	7.21%	6.39%
1994	7.66%	7.25%	2.87%	4.77%	4.74%	-0.03%
1995	3.12%	2.39%	1.80%	1.07%	1.56%	0.50%
Average 89-95	7.99%	6.07%	3.36%	3.20%	5.08%	1.88%

Simple average of observed versus predicted fixed assets annual growth is fairly good, with a spread ranging only from –0.03 to 2.7 percentage points.

For 1989 and 1993 however, predicted fixed assets growth are respectively 8 and 6 percentage points higher than observed fixed assets growth. Indeed, for those years, output grew by 13% and 11%, while observed fixed assets seemed to have grown only by just around 1%. The prediction rescales fixed assets growth to output growth. This corrects for underreporting of fixed assets increase for those particular years, or underestimate TFP growth.

Fixed assets growth between 1988 and 1989 are likely to have been underreported. Crego, Larson et alii (2000) estimate a capital stock series for a large number of countries including Indonesia. They use the Perpetual Inventory Methodology, but use historical investment series from 1913 onwards in order to estimate a benchmark capital stock for 1967. They give a breakdown for manufacturing and agricultural sectors. They report a capital stock growth of 32% in the manufacturing sector for 1989, against 15% for the previous year, and 30% for the following year.

Historical figures from the Indonesian Investment Coordinating Board (BKPM) are available annually from 1967 until 2000. For each year, I compute investment stock as the sum of past investments, so that investment stock in 1975 is the sum of 9 years of investment. Cumulated investment reported by BKPM grew by 32.5% in 1989, and by 18.5% in 1993.

Table 4d: Capital stock growth, comparative figures

all figures in billion 1983 IDR	Manufacturing Fixed Capital, 1983 local currency (Crego et alii, 2000)	Manufacturing Fixed Capital growth (Crego et alii, 2000)	domestic and foreign investment (BKPM)	investment growth (BKPM)	cumulated investment (BKPM)	cumulated investment growth (BKPM)
1967	490.5		210.6		210.6	
1968	1099.9	124.3%	295.0	40.1%	505.6	140.1%
1969	1367.0	24.3%	164.1	-44.4%	669.7	32.5%
1970	1561.5	14.2%	1466.7	793.8%	2136.4	219.0%
1971	1670.8	7.0%	528.7	-64.0%	2665.1	24.7%
1972	2196.2	31.4%	356.6	-32.6%	3021.7	13.4%
1973	2944.4	34.1%	830.9	133.0%	3852.6	27.5%
1974	4306.6	46.3%	780.2	-6.1%	4632.8	20.3%
1975	4871.5	13.1%	1314.0	68.4%	5946.8	28.4%
1976	5611.9	15.2%	652.8	-50.3%	6599.6	11.0%
1977	6299.6	12.3%	677.5	3.8%	7277.1	10.3%
1978	7904.0	25.5%	988.4	45.9%	8265.5	13.6%
1979	10880.6	37.7%	919.4	-7.0%	9184.9	11.1%
1980	13461.2	23.7%	2671.2	190.5%	11856.1	29.1%
1981	14089.9	4.7%	3131.9	17.2%	14988.0	26.4%
1982	15569.8	10.5%	6223.2	98.7%	21211.2	41.5%
1983	18457.6	18.5%	9011.0	44.8%	30222.2	42.5%
1984	20485.5	11.0%	3404.6	-62.2%	33626.8	11.3%
1985	23459.1	14.5%	4703.2	38.1%	38330.0	14.0%
1986	24328.5	3.7%	5762.8	22.5%	44092.8	15.0%
1987	28836.6	18.5%	12601.0	118.7%	56693.8	28.6%
1988	33038.2	14.6%	18861.8	49.7%	75555.6	33.3%
1989	43727.4	32.4%	24537.8	30.1%	100093.4	32.5%
1990	56959.7	30.3%	68496.2	179.1%	168589.6	68.4%
1991	75731.8	33.0%	50241.0	-26.7%	218830.6	29.8%
1992	87756.6	15.9%	39862.0	-20.7%	258692.6	18.2%
1993			47869.7	20.1%	306562.3	18.5%
1994			80644.7	68.5%	387207.0	26.3%
1995			109736.3	36.1%	496943.3	28.3%
average 76-92	**28623.4**	**18.9%**	**14867.4**	**39.6%**	**64947.6**	**25.7%**
average 76-95			**24549.8**	**39.9%**	**114741.1**	**25.5%**
average 76-87	**15782.0**	**16.3%**	**4228.9**	**38.4%**	**23529.0**	**21.2%**
average 88-92	**59442.7**	**25.2%**	**40399.8**	**42.3%**	**164352.4**	**36.4%**
average 88-95			**55031.2**	**42.0%**	**251559.3**	**31.9%**

Let us now look at the predictions for the entire BSI sample and the extended period 1975-95. I first present simple average of plant-level annual growth of output, intermediate inputs, labour and capital.

Table 5: Simple average of plant-level growth of output, value added, intermediate inputs, labour and capital

YEAR	output growth	input growth	labour growth	capital growth
1976	3.76%	2.33%	0.80%	1.55%
1977	-2.85%	-4.03%	0.15%	-2.62%
1978	6.40%	5.06%	0.65%	2.99%
1979	3.12%	9.60%	2.46%	1.75%
1980	4.69%	4.70%	3.17%	2.94%
1981	3.19%	1.97%	1.87%	1.58%
1982	3.29%	3.87%	-0.74%	0.61%
1983	6.59%	8.79%	0.35%	2.96%
1984	8.24%	9.10%	1.57%	4.43%
1985	13.04%	10.96%	1.13%	7.02%
1986	13.27%	12.52%	1.87%	7.57%
1987	0.97%	5.94%	1.59%	0.19%
1988	3.31%	2.80%	2.41%	1.63%
1989	13.19%	11.88%	6.24%	9.21%
1990	13.61%	12.15%	4.13%	8.50%
1991	2.90%	1.79%	3.86%	2.12%
1992	9.48%	6.68%	2.85%	5.68%
1993	10.81%	10.30%	4.78%	7.21%
1994	7.75%	7.33%	2.87%	4.74%
1995	3.12%	2.41%	1.80%	1.56%
average 1976-95	6.39%	6.31%	2.19%	3.58%
1976-88	5.16%	5.66%	1.33%	2.51%
1989-95	8.69%	7.51%	3.79%	5.58%

Average plant output growth over the entire period is 6.39% p.a., with intermediate inputs growing almost as fast at 6.31% p.a., meaning that average plant value added grows very slowly.[16] Average plant capital stock grows faster than employment, with growth rates of 3.58% and 2.19% p.a. respectively.

Average plant output grows significantly faster in the post-deregulation period than in the oil boom and deregulation period, with growth rates of 8.69% p.a. and 5.16% p.a. respectively. In the post-deregulation period, intermediate input growth accelerates as well, but less than output growth, indicating an improvement in average plant value added. However, labour and capital stock growth accelerate faster, suggesting that productivity improvement might not be enormous.

I then present annual growth rates of aggregate output, intermediate inputs, labour and capital as measured with Divisia indices.

Hulten (1973) defines the Divisia Index "as a weighted sum of growth rates, where the weights are the components' share in total value" (p.1017). The rate of change of the Divisia Index D is given by:

[16] Value added is calculated as output minus intermediate inputs.

$$\log(D_t)-\log(D_{t-1})=\sum_{i=1}^{n}\frac{1}{2}[V_{i,t}+V_{i,t-1}][\log(X_{i,t})-\log(X_{i,t-1})] \tag{26}$$

where

$$V_{i,t}=\frac{p_{i,t}X_{i,t}}{\sum_{j=1}^{n}p_{j,t}X_{j,t}} \tag{27}$$

with $\{X_1(t),X_2(t),\dots,X_n(t)\}$ the set of observations which are to be indexed, $\{p_1(t),p_2(t),\dots,p_n(t)\}$ the associated price vector, i denotes establishments, and t time.

For example, the rate of growth of the Divisia Index for gross output is computed using the following formula:

$$\log(D_{OUTPUT,t})-\log(D_{OUTPUT,t-1})=\sum_{i=1}^{n}\frac{1}{2}[V_{i,t}+V_{i,t-1}][\log(OUTPUT_{i,t})-\log(OUTPUT_{i,t-1})] \tag{28}$$

where

$$V_{i,t}=\frac{OUT_{i,t}}{\sum_{j=1}^{n}OUT_{j,t}} \tag{29}$$

where output is in constant IDR (base year 1983).

The same methodology is applied to calculate the rate of growth of Divisia Indices of intermediate inputs, capital, and labour.

In order to calculate the weights for capital, I need to derive capital stock from the log of capital stock using the following formula:

$$KSTOCK=\exp[\log(FA)], \tag{30}$$

Capital stock is the exponential of the log of fixed assets.[17]

The Divisia Index for labour uses data on the number of workers L:

$$\log(D_{LABOUR,t})-\log(D_{LABOUR,t-1})=\sum_{i=1}^{n}\frac{1}{2}[V_{i,t}+V_{i,t-1}][\log(L_{i,t})-\log(L_{i,t-1})] \tag{31}$$

where

[17] As a check for the growth of capital stock Divisia Index, I alternatively use output weights to aggregate capital – because capital stock bears an important and constant relationship to output – and the results do not change significantly.

$$V_{i,t} = \frac{L_{i,t}}{\sum_{j=1}^{n} L_{j,t}} \quad (32)$$

Results are shown in Table 6.

Table 6 : Divisia indices of growth of output, intermediate inputs, labour and capital

YEAR	output growth	input growth	labour growth	capital growth
1976	-5.08%	-4.80%	9.51%	0.86%
1977	2.03%	-0.33%	-1.13%	3.30%
1978	8.60%	4.88%	3.11%	6.83%
1979	7.96%	14.24%	4.73%	7.20%
1980	13.44%	14.12%	7.62%	10.29%
1981	7.38%	5.71%	2.77%	4.80%
1982	4.09%	7.11%	3.37%	3.94%
1983	6.70%	9.78%	3.42%	5.09%
1984	10.69%	10.86%	6.54%	8.25%
1985	11.10%	9.53%	4.22%	7.46%
1986	14.63%	13.50%	3.65%	9.22%
1987	38.58%	34.97%	4.76%	13.39%
1988	-16.35%	-7.89%	6.87%	2.86%
1989	29.05%	31.83%	12.87%	17.49%
1990	13.23%	10.01%	8.46%	10.49%
1991	2.74%	11.21%	8.09%	8.05%
1992	13.19%	15.22%	7.63%	10.55%
1993	5.76%	2.56%	6.36%	6.49%
1994	6.40%	8.54%	5.16%	7.73%
1995	11.82%	10.23%	9.99%	7.58%
average 76-95	**9.30%**	**10.06%**	**5.90%**	**7.59%**
76-88	**7.98%**	**8.59%**	**4.57%**	**6.42%**
89-95	**11.74%**	**12.80%**	**8.37%**	**9.77%**

Over the period 1976-95, aggregate annual capital growth is 7.59%, to compare to aggregate growth of 8.9% p.a. found with PIM on BSI data, 18.9% (1976-92) for Crego & alii (2000) figures, and 25.5% for BKPM cumulated investment figures.[18]

During the oil boom and deregulation period, annual capital stock growth is on average 6.42%, notably slower than in the post-deregulation era, with average growth of 9.77%. The PIM using ICVARs on the *Statistik Industri* dataset gives an average annual growth of capital stock of 6.92% for 1976-1988, against 12.58% for 1989-1996. Crego & alii (2000) find average growth rates of 16.1% (1976-87), and 25.2% (1988-92), while BKPM figures show average growth rates of 21% (1976-87) and 32% (1988-96).

[18] Figures using the PIM methodology using BSI data are based on the raw aggregate capital stock series given in Table 3.

While in line with previous studies using *Statistik Industri* regarding the trend of the capital stock, new capital stock figures using fixed assets data seems to provide a lower bound for Indonesian manufacturing capital stock growth figures, while being very close to the estimates using the PIM.

These results suggest that investment figures (used for the PIM) and fixed assets figures (used for capital stock modelling) from *Statistik Industri* are consistent, but that the ICVAR methodology tended to underestimate the initial benchmark capital stock, thereby overestimating capital stock growth.

It remains however puzzling that estimating capital stock growth with *Statistik Industri* figures – be it with investment or fixed assets figures – leads to an average annual rate of growth twice to three times lower than macroeconomic figures (Crego et alii, 2000, or BKPM figures). Capital stock growth rates calculated here should therefore be considered as a lower bound.

An interesting aspect arises while comparing simple plant average and Divisia Index average growth rates of output, input, labour, and capital. Both series differ greatly, confirming the importance of focusing on plants' heterogeneity, plants' distribution and plants distribution dynamics. All weighted growth rates (Divisia Index) are higher than simple average growth rates, thereby confirming the importance of large plants. I return to this issue while examining TFP Growth results.

Let us now turn to the issue of the elasticity of output with respect to labour.

2.5.2 Elasticity of output with respect to labour

All authors working on Indonesian manufacturing with *Statistik Industri* use similar methodologies in order to calculate α, the elasticity of output with respect to labour. It is calculated as the ratio of total wages – including non-monetary retributions - over value added. α has two main features:[19]

- It stays almost constant over time.
- It has an average value of 0.2.

Some authors (in particular Aswicahyono, 1998 ; Timmer, 1999a) using *Statistik Industri* data question the surprisingly low share of labour in value added, and argue that labour figures might be underreported, especially for family workers. Indeed, usual estimates for OECD countries give a share of labour in value added at 60-70%.

Sarel (1997) re-estimates TFP and TFP Growth rates for several Asian countries including Indonesia. He emphasises the importance of the calculation of factor shares, and shows clearly its

[19] See estimation of α on a yearly basis in Table 2.

impact on TFP and TFP Growth rates. He criticises both the national account and econometric estimation of factor shares, and offers an alternative approach with the calculation of technological factor shares, i.e. elasticities of output with respect to each factor of production.

Presenting a sensitivity analysis for the period 1978-96, he shows that shifting the elasticity of output with respect to labour from 0.75 to 0.50 shifts TFPG from almost 2% a year to -0.25% a year for Indonesia. This divides TFP levels by a hundred. In other words, using a low elasticity of output with respect to labour (at about 20%) would tend to underestimate TFP and TFP Growth rates.

For his sample of South East Asian countries, he estimates a capital share for different sectors, and obtains a capital share of 30.80% for manufacturing (all South East Asian countries), estimate in line with previous international studies. For Indonesia alone, the capital share of the entire economy is estimated at about 35% (the study does not provide a share for Indonesian manufacturing in particular).

I determine new elasticities by estimating the following regression, using only observed figures for the period 1988-1995[20]:

$$\Delta \ln OUT_{t,t-1} = \alpha \Delta \ln INP_{t,t-1} + \beta \Delta \ln L_{t,t-1} + \gamma \Delta \ln K_{t,t-1} + \delta Idum + c \qquad (33)$$

where $\Delta \ln OUT_{t,t-1}$ is the rate of change of gross output between time t and $t-1$, $\Delta \ln INP_{t,t-1}$ is the rate of change of intermediate inputs between time t and $t-1$, $\Delta \ln L_{t,t-1}$ is the rate of change of the number of workers between time t and $t-1$, $\Delta \ln K_{t,t-1}$ is the rate of change of capital (fixed assets) between time t and $t-1$, $Idum$ a set of eight two-digit industry dummies, and c a constant. I obtain the following elasticities:

$\alpha = 0.71$
$\beta = 0.18$
$\gamma = 0.026$

I choose to estimate elasticities using rates of change rather than log levels because I later use those elasticities in a Divisia Index Number based on rates of change.

The details of the results are displayed in table 7.

[20] As a cross check, I estimate the same regression using backcast fixed assets figures over the period 1975-95. Given that fixed assets figures have been predicted using output and labour data, the regression displays multicolinearity problems. However, dropping fixed assets from the equation and estimating the elasticities of output with respect to intermediate inputs and labour yields similar results.

Table 7: Estimated elasticities of intermediate inputs, labour and capital with respect to output, on the period 1988-95, BSI dataset,

F(11, 38431)	10237.31				
Prob > F	0				
R-squared	0.7456				
Adj R-squared	0.7455				
OUTg	Coef.	t	P>|t|	[95% Conf. Interval]	
INPg	0.715904	297.9	0	0.711194	0.720614
Lg	0.179034	35.63	0	0.169184	0.188883
Kg	0.026551	12.83	0	0.022494	0.030608
I32	0.019452	4.27	0	0.010515	0.02839
I33	-0.005679	-1.09	0.278	-0.015938	0.00458
I34	0.002044	0.28	0.781	-0.012374	0.016461
I35	0.006205	1.26	0.207	-0.003432	0.015842
I36	0.010731	1.72	0.086	-0.001531	0.022994
I37	0.014698	1.04	0.3	-0.013101	0.042497
I38	0.016562	3.15	0.002	0.006269	0.026855
I39	0.003122	0.24	0.811	-0.022428	0.028672
_cons	0.014643	4.62	0	0.008431	0.020855

Variable	VIF	1/VIF
I32	1.53	0.651922
I35	1.44	0.693972
I33	1.37	0.727434
I38	1.37	0.727522
I36	1.24	0.805625
I34	1.17	0.858107
INPg	1.14	0.876231
Lg	1.13	0.881105
I39	1.05	0.953961
Kg	1.04	0.958387
I37	1.04	0.96121

The VIF test does not indicate multicolinearity problems.

This means that - in fact - the elasticity of value added (gross output minus intermediate inputs) with respect to labour is 0.65 (against 0.22 for the elasticity calculated as share of wages in value added), and 0.09 for the elasticity of value added with respect to capital.[21]

Alternatively to the inclusion of industry dummies, I estimate elasticities for each 2-digit industry by running the following regression with each of the 9 industry populations:

[21] Those results are obtained by regressing value added rate of change on labour and capital rate of change using the BSI raw data.

$$\Delta \ln OUT_{t,t-1} = \alpha \Delta \ln INP_{t,t-1} + \beta \Delta \ln L_{t,t-1} + \gamma \Delta \ln K_{t,t-1} + c \quad (34)$$

I obtain the following results:

Table 8: Elasticities of output with respect to intermediate inputs, labour, and capital, econometric estimates at the 2-digit level

	elasticity of output with respect to intermediate inputs	elasticity of output with respect to labour	elasticity of output with respect to capital
31-Food, beverages & tobacco	0.7524084	0.1019331	0.0273714
32-Textile, garments and leather	0.6697304	0.2676340	0.0299713
33-Wood products	0.7271595	0.2049208	0.0309931
34-Paper, printing & publishing	0.6728218	0.3076421	0.0478169
35-Chemicals, rubber & plastic	0.7616734	0.1172784	0.0108050
36-Non-metallic minerals	0.6940536	0.1892194	0.0318395
37-Basic metals	0.7168723	0.1864809	0.0501464
38-Metal products & machinery	0.6913947	0.2158866	0.0179731
39-Other manufacturing	0.6079127	0.2697141	0.0004104

All elaticities are significant at the 1% level, VIF test indicates no multicolinearity.

Those results illustrate to which extent it is important to take heterogeneity into account: the elasticity of output with respect to intermediate inputs ranges from 0.60 (other manufacturing) to 0.76 (chemicals, rubber, and plastic), the elasticity of output with respect to labour ranges from 0.10 (food, beverages, and tobacco) to 0.30 (paper, printing, and publishing), and the elasticity of output with respect to capital ranges from 0.0004 (other manufacturing) to 0.05 (basic metals). The limited number of observations for each group at more disaggregate levels renders the econometric estimation of elasticities unreliable below the 2-digit threshold.

I use BSI output, intermediate inputs and labour figures, backcast fixed assets figures and new estimated elasticities to provide new estimations of TFP and TFP growth. I have shown that capital stock growth might have been previously overestimated, and that the elasticity of output with respect to capital has been greatly overestimated: I would expect higher TFP growth rates than what has been previously estimated. However, I estimate TFP growth based on a gross output rather than value added production function. Using directly value added rather than gross output along with intermediate inputs generally overestimates TFP growth rates.

2.6 New Total Factor Productivity Growth estimates

I now turn to TFP growth calculation using the BSI dataset, the new capital stock series, and the new elasticities.

I use the standard Cobb-Douglas production function at the aggregate and at the 2-digit industry level. Aggregation is made following the Divisia Index Number methodology.

I first calculate annual rates of growth of the Divisia Index for each component X of the production function (gross output, intermediate inputs, labour, and capital) at the establishment level i:

$$\log(D_{i,t}) - \log(D_{i,t-1}) = \frac{1}{2}[V_{i,t} + V_{i,t-1}][\log(X_{i,t}) - \log(X_{i,t-1})] \tag{35}$$

where,

$$V_{i,t} = \frac{p_{i,t} X_{i,t}}{\sum_{j=1}^{n} p_{j,t} X_{j,t}} \tag{36}$$

and $\sum_{j=1}^{n} p_{j,t} X_{j,t}$ is the sum of all $p_{j,t} X_{j,t}$ for aggregation at the manufacturing level, and the sum of all $p_{j,t} X_{j,t}$ within each 2-digit industry for aggregation at the 2-digit industry level.

I then sum the plant level Divisia Index rates of growth to obtain annual aggregate rates of growth for each component of the production function:

$$\log(D_{t}) - \log(D_{t-1}) = \sum_{i=1}^{n} \frac{1}{2}[V_{i,t} + V_{i,t-1}][\log(X_{i,t}) - \log(X_{i,t-1})] \tag{37}$$

For the calculation of TFP growth, I use the two following equations:

Aggregate manufacturing level

$$TF\dot{P}G_t = \dot{Y}_t - 0.7159039 I\dot{N}P_t - 0.1790335 \dot{L}_t - 0.0265512 \dot{K}_t \tag{38}$$

where $TF\dot{P}G$ is Total Factor Productivity Growth rate, $\dot{Y}$ is the Divisia Index rate of growth of gross output, $I\dot{N}P$ is the Divisia Index rate of growth of intermediate inputs, $\dot{L}$ is the Divisia Index rate of growth of labour, and $\dot{K}$ is the Divisia Index rate of growth of capital. All components are calculated annually at the aggregate manufacturing level.

2-digit industry level

$$TF\dot{P}G_{31,t} = \dot{Y}_{31,t} - 0.7524084 I\dot{N}P_{31,t} - 0.1019331\dot{L}_{31,t} - 0.0273714\dot{K}_{31,t}$$
$$TF\dot{P}G_{32,it} = \dot{Y}_{32,t} - 0.6697304 I\dot{N}P_{32,t} - 0.267634\dot{L}_{32,t} - 0.0299713\dot{K}_{32,t}$$
$$TF\dot{P}G_{33,it} = \dot{Y}_{33,t} - 0.7271595 I\dot{N}P_{33,t} - 0.2049208\dot{L}_{33,t} - 0.0309931\dot{K}_{33,t}$$
$$TF\dot{P}G_{34,it} = \dot{Y}_{34,t} - 0.6728218 I\dot{N}P_{34,t} - 0.3076421\dot{L}_{34,t} - 0.0478169\dot{K}_{34,t}$$
$$TF\dot{P}G_{35,it} = \dot{Y}_{35,t} - 0.7616734 I\dot{N}P_{35,t} - 0.1172784\dot{L}_{35t} - 0.010805\dot{K}_{35,t} \qquad (39)$$
$$TF\dot{P}G_{36,it} = \dot{Y}_{36,t} - 0.6940536 I\dot{N}P_{36,t} - 0.1892194\dot{L}_{36,t} - 0.0318395\dot{K}_{36,t}$$
$$TF\dot{P}G_{37,it} = \dot{Y}_{37,t} - 0.7168723 I\dot{N}P_{37,t} - 0.1864809\dot{L}_{37,t} - 0.0501464\dot{K}_{37,t}$$
$$TF\dot{P}G_{38,it} = \dot{Y}_{38,t} - 0.6913947 I\dot{N}P_{38,t} - 0.2158866\dot{L}_{38,t} - 0.0179731\dot{K}_{38,t}$$
$$TF\dot{P}G_{39,it} = \dot{Y}_{39,t} - 0.6079127 I\dot{N}P_{39,t} - 0.2697141\dot{L}_{39,t} - 0.0004104\dot{K}_{39,t}$$

where all components are calculated annually at the 2-digit manufacturing level.

Table 9a displays the results at the aggregate level using the Divisia Index methodology. Table 9b displays simple average of growth rates across establishment at the aggregate level: growth rates are calculated at the establishment level, and the aggregate growth rate for a given year is the simple average of all establishments' growth rates.

Table 9a: Output, input, labour, capital and TFP growth rates by year (elasticities estimated on growth rates, no industry dummy)

Divisia Index methodology

	output growth	input growth	labour growth	capital growth	TFPG
1975					
1976	-5.08%	-4.80%	9.51%	0.86%	-3.48%
1977	2.03%	-0.33%	-1.13%	3.30%	2.40%
1978	8.60%	4.88%	3.11%	6.83%	4.34%
1979	7.96%	14.24%	4.73%	7.20%	-3.31%
1980	13.44%	14.12%	7.62%	10.29%	1.62%
1981	7.38%	5.71%	2.77%	4.80%	2.64%
1982	4.09%	7.11%	3.37%	3.94%	-1.74%
1983	6.70%	9.78%	3.42%	5.09%	-1.08%
1984	10.69%	10.86%	6.54%	8.25%	1.46%
1985	11.10%	9.53%	4.22%	7.46%	3.28%
1986	14.63%	13.50%	3.65%	9.22%	4.04%
1987	38.58%	34.97%	4.76%	13.39%	12.33%
1988	-16.35%	-7.89%	6.87%	2.86%	-12.09%
1989	29.05%	31.83%	12.87%	17.49%	3.38%
1990	13.23%	10.01%	8.46%	10.49%	4.18%
1991	2.74%	11.21%	8.09%	8.05%	-7.03%
1992	13.19%	15.22%	7.63%	10.55%	0.57%
1993	5.76%	2.56%	6.36%	6.49%	2.54%
1994	6.40%	8.54%	5.16%	7.73%	-0.89%
1995	11.82%	10.23%	9.99%	7.58%	2.40%
average 76-95	**9.30%**	**10.06%**	**5.90%**	**7.59%**	**0.78%**
76-80	**5.39%**	**5.62%**	**4.77%**	**5.70%**	**0.31%**
81-83	**6.06%**	**7.54%**	**3.18%**	**4.61%**	**-0.06%**
84-88	**11.73%**	**12.19%**	**5.21%**	**8.24%**	**1.80%**
89-93	**12.79%**	**14.17%**	**8.68%**	**10.61%**	**0.73%**
94-95	**9.11%**	**9.38%**	**7.58%**	**7.66%**	**0.75%**
89-95	**11.74%**	**12.80%**	**8.37%**	**9.77%**	**0.74%**

Table 9b: Output, input, labour, capital and TFP growth rates by year (elasticities estimated on growth rates, no industry dummy)

Simple plant-level average

	output growth	input growth	labour growth	capital growth	TFPG
1975					
1976	-1.48%	-2.01%	0.79%	-1.75%	-0.07%
1977	-3.81%	-4.94%	0.16%	-3.07%	-0.25%
1978	6.25%	5.11%	1.43%	3.28%	2.24%
1979	2.98%	8.42%	4.34%	2.53%	-3.93%
1980	5.70%	5.34%	3.96%	3.99%	1.02%
1981	3.49%	2.51%	2.99%	2.31%	1.07%
1982	4.18%	4.73%	1.36%	2.06%	0.49%
1983	6.05%	8.21%	2.76%	3.72%	-0.43%
1984	7.60%	7.83%	3.75%	5.01%	1.15%
1985	10.44%	8.30%	7.62%	8.23%	2.83%
1986	8.59%	8.28%	-0.13%	4.06%	2.61%
1987	2.27%	6.31%	1.61%	1.04%	-2.56%
1988	8.50%	7.94%	7.16%	6.90%	1.29%
1989	14.16%	13.16%	6.59%	10.00%	3.33%
1990	13.40%	11.89%	6.57%	9.52%	3.29%
1991	6.78%	6.00%	5.82%	5.32%	1.22%
1992	11.43%	8.59%	4.64%	7.58%	4.23%
1993	11.19%	10.45%	5.50%	7.78%	2.43%
1994	6.84%	5.89%	3.68%	4.52%	1.84%
1995	3.18%	1.43%	2.88%	2.06%	1.51%
average 76-95	**6.39%**	**6.17%**	**3.67%**	**4.25%**	**1.17%**
76-80	**1.93%**	**2.39%**	**2.14%**	**1.00%**	**-0.20%**
81-83	**4.58%**	**5.15%**	**2.37%**	**2.70%**	**0.38%**
84-88	**7.48%**	**7.73%**	**4.00%**	**5.05%**	**1.06%**
89-93	**11.39%**	**10.02%**	**5.82%**	**8.04%**	**2.90%**
94-95	**5.01%**	**3.66%**	**3.28%**	**3.29%**	**1.67%**
89-95	**9.57%**	**8.20%**	**5.10%**	**6.68%**	**2.55%**

My estimates of annual TFP Growth rates of 0.78% for the period 1976-95 are considerably lower than Aswicahyono (1998) and Timmer (1999a) estimates of 2.7% to 2.8% for 1976-93 and 1976-95 respectively. Indeed, while a lower capital stock growth would tend to increase TFP Growth rates, a much lower elasticity of output with respect to capital more than counterbalance the previous effect. We should also keep in mind that using gross output based rather than value added based production function tends to lower (in our case) TFP Growth rates .

More interesting is to look at TFP Growth rates over relevant sub-periods.[22] During the oil boom period (1976-80), other authors find TFP Growth figures ranging from 0.70% to 1.10% p.a., and I obtain a positive but lower average figure at 0.31% p.a.. Indeed, output grew on average at 5.39% p.a., while inputs grew at 5.62% p.a., labour at 4.77% p.a., and capital at 5.70% p.a.. This result is in line with previous findings displaying low TFP Growth, and could suggest that, in spite of high economic growth rates, the allocation of resources in manufacturing during that period has been rather unproductive. It is however striking to observe a negative plant-level average TFP rate of change (-0.20% p.a.) for the same period: this suggests that some companies have allocated resources more productively than others during that period, again underlining the importance of taking plant heterogeneity into account in the study of aggregate TFP Growth.

During the recession period (1981-83), following oil prices and exports drop, average annual TFPG drops to –0.06%. This again is in line with previous studies, but the results are less dramatic than the negative TFPG estimated by Aswicahyono (1998) for exactly the same time span (–4.9%). The main reason for that productivity drop is the stickiness of intermediate inputs use: average output growth increases slightly from 5.39% p.a. to 6.06% p.a. (but drops from 10% to 6.06% if I compare 1978-80 figures to 1981-83 figures), and intermediate input growth increases from 5.62% p.a. to 7.54% p.a..

If I now compare the changes in simple and weighted (Divisia Index) average of TFPG between the oil boom and the recession period, I find that simple average TFPG improves, while weighted TFPG worsens. This underlines the importance of industrial demography for the purpose of that study. It may be the case that during the recession period, a greater number of firms become more productive, but that large firms become less productive, maybe due to a lack of flexibility during shocks.

From the liberalisation period (1984-88) onward, Indonesia does experience a new surge in TFPG, with an estimate of 1.80% p.a.. This result is more than three times slower than Aswicahyono's (1998) findings at 5.5% p.a. for the same period. Here again, it will be crucial to estimate the effect of firms' distribution dynamics on TFPG. Between recession and liberalisation, weighted average TFPG increases faster than simple average TFPG, suggesting that – size distribution of firms being held constant - liberalisation caused larger firms to become more productive. A decomposition into 2-digit industry productivity growth shows that the surge in productivity occurring in 1987 is mainly attributable to the basic metals industry and the entry of a new large company.[23]

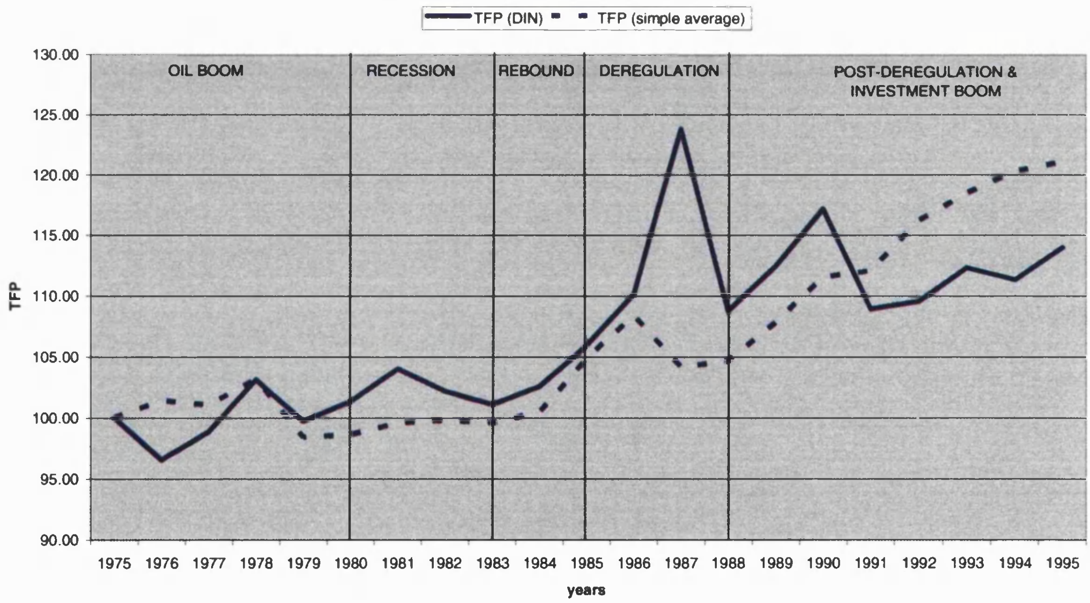
[22] Comparative results have been summarised in Table 1.
[23] This issue is discussed in details in chapter 6.

The post- deregulation period (1989-93) witnesses surprisingly a great drop of TFPG, with a figure of 0.73% p.a.. Aswicahyono (1998) estimates TFPG for the same period at 6.0% p.a., while Timmer (1999a) estimates annual TFPG at 7.9% for the period 1986-90. This large drop in TFP growth rates is due to rapid acceleration of inputs, labour and capital accumulation coupled to a nearly zero increase of output growth. I need here to point at the importance of the choice of sub-periods. The low TFPG figure for 1989-93 is mainly due to a negative TFPG in 1991, year of a halt in output growth. Removing that particular year from the post- deregulation period gives an average TFPG of 2.67%, i.e. 0.87 percentage point higher than TFPG of the deregulation period.

Simple average TFPG increased rapidly, while weighted average TFPG dropped between the deregulation and the post-deregulation periods, suggesting that – size distribution of firms being held constant again – post- deregulation caused smaller firms to become more productive and/or large firms to become less productive.

Finally, the three years preceding the crisis witness a slight rise in TFPG at 0.75% p.a.. Indeed, output growth decelerates massively, but the deceleration of input growth is faster.

Graph 1: TFP level, base 100 in 1975



While aggregate TFP growth over the period 1976-95 has been 0.78% per annum on average, a decomposition into 2-digit industry level shows wide discrepancies across industries, with average TFP growth ranging from –0.45% p.a. for the food, beverages and tobacco industry to 3.69% p.a. for the basic metals industry.

Table 10 displays average annual TFP Growth rates at the 2-digit industry level for the different historical periods.

Table 10: Average TFP growth rates at the 2-digit industry level

Note: industry 35 excludes oil and gas refining

	Vial	Timmer (1999)	Aswicahyono (1998)	Aswicahyono & Hill (1996)	Vial	Timmer (1999)	Aswicahyono (1998)	Aswicahyono & Hill (1996)
	1976-80	1975-81	1976-80	1976-81	1981-83	1982-85	1981-83	1982-85
31 food, beverages & tobacco	0.49%	3.70%	2.00%	-0.20%	-0.13%	3.80%	-4.10%	0.40%
32 textiles, garments & leather	2.56%	0.80%	0.70%	2.10%	1.35%	3.50%	-0.20%	3.00%
33 wood products	-0.45%	12.00%	-1.80%	4.20%	-0.39%	-2.40%	-2.80%	5.20%
34 paper, printing & publishing	-5.28%	-1.80%	-1.80%	-2.50%	-2.88%	2.50%	-2.80%	4.00%
35 chemicals, rubber & plastic	-0.64%	-4.90%	-4.00%	-2.00%	0.28%	-2.10%	0.20%	-0.40%
36 non-metallic minerals	3.86%	-1.70%	6.60%	10.30%	-1.55%	-8.30%	-2.10%	-2.00%
37 basic metals	3.36%	3.60%	12.50%	19.00%	1.13%	13.60%	0.60%	7.40%
38 metal products & machinery	0.23%	5.60%	1.90%	2.70%	-1.02%	-7.80%	-0.80%	-1.00%
39 other manufacturing	1.75%	2.40%	N/A	-1.10%	1.31%	8.90%	N/A	2.40%

	Vial	Timmer (1999)	Aswicahyono (1998)	Aswicahyono & Hill (1996)	Vial	Aswicahyono (1998)	Osada (1994)	Osada (1994)
	1984-88	1986-90	1984-88	1988-91	1989-93	1989-93	1985-90	1987-90
31 food, beverages & tobacco	1.01%	5.60%	1.30%	3.20%	-5.61%	5.10%	-1.00%	4.00%
32 textiles, garments & leather	2.16%	12.40%	2.80%	2.30%	3.22%	2.40%	7.30%	2.50%
33 wood products	2.32%	7.90%	5.60%	2.00%	0.15%	0.00%	3.60%	-12.80%
34 paper, printing & publishing	4.19%	7.50%	5.60%	6.20%	1.80%	0.00%	13.70%	2.00%
35 chemicals, rubber & plastic	1.48%	1.70%	-0.50%	3.40%	4.16%	1.70%	-10.70%	0.50%
36 non-metallic minerals	0.77%	7.10%	2.10%	1.00%	4.37%	1.90%	-4.30%	1.50%
37 basic metals	8.04%	8.90%	5.80%	-3.00%	1.34%	-2.10%	15.00%	-3.70%
38 metal products & machinery	1.85%	9.90%	1.00%	0.40%	5.18%	2.10%	-3.30%	4.80%
39 other manufacturing	4.67%	5.60%	N/A	1.90%	6.29%	N/A	-1.50%	-2.70%

	Vial	Vial	Timmer	Vial	Timmer
	1994-95	1989-95	1991-95	1976-95	1975-95
31 food, beverages & tobacco	6.02%	-2.29%	5.70%	-0.45%	4.70%
32 textiles, garments & leather	-2.68%	1.53%	3.60%	1.92%	4.90%
33 wood products	-0.19%	0.05%	-1.80%	0.43%	4.70%
34 paper, printing & publishing	0.44%	1.41%	3.20%	-0.21%	2.60%
35 chemicals, rubber & plastic	-1.79%	2.46%	-0.30%	1.11%	-1.60%
36 non-metallic minerals	-1.28%	2.76%	-0.50%	1.64%	-0.50%
37 basic metals	3.36%	1.92%	-3.60%	3.69%	5.10%
38 metal products & machinery	3.68%	4.75%	6.90%	2.03%	4.30%
39 other manufacturing	0.61%	4.67%	-2.30%	3.43%	3.30%

Comparing the results with other authors' figures also indicates that changing elasticities of substitution, together with a different aggregation methodology leads to very different outcomes for each industry. Over the entire period, I find that the food, beverages and tobacco industry displays negative rather than positive average TFP Growth (Timmer, 1999a), mostly due to output recession in 1991-92. This result is in line with the historiography of the sector indicating slow productivity gains, slow adoption of new technology, and monopolistic structure (Manning, 1979 ; Robison, 1986 ; Tabor, 1992 ; Tarmidi, 1996 ; Aswicahyono, 1998).[24]

I also find that chemicals, rubber and plastic, together with non-metallic minerals, display positive TFP Growth, while Timmer (1999a) finds they experience an average negative TFP change. For these two industries, my results are more in line with Aswicahyono & Hill (1996) and Aswicahyono (1998).

Looking at sub-periods shows that recession (1981-83) did not reduce TFP Growth rates in all industries: TFP growth worsens for all industries previously displaying positive TFP growth, but improves for wood products, paper, printing & publishing, chemicals, rubber & plastic, industries previously displaying TFP deterioration. The same phenomenon is observed from Aswicahyono's

[24] A detailed review of the literature on this sector is given in chapter 6 of the thesis.

(1998) results. One could argue that in the worse performing sectors, the crisis shakes out the worse performing plants and reallocate market shares to better performing plants, thereby improving 2-digit industry productivity gains. The shake-out might have happened earlier in the best performing industries, so that the crisis results in a loss of productivity. This issue is assessed in following chapters.

The rebound and deregulation period witnessed improving TFP growth in all sectors. This is especially true for the wood products, paper, printing & publishing, basic metals, and other manufacturing.

The post- deregulation period (1989-95) has experienced a global drop in TFP growth, due to the worse performance of several industries: food, beverages and tobacco, wood products, paper, printing and publishing, and basic metals. Indeed, the food, beverages and tobacco and basic metals industries saw output dropping by 27% and 4% respectively in 1991, while output in the wood product and the paper, printing and publishing industries dropped by 21% and 15% respectively in 1993. As argued previously, aggregate weighted average TFP growth (Divisia Index) dropped during the post-deregulation period, while aggregate simple average TFP growth improved, suggesting that the largest establishments drove TFP down during the post-deregulation period. This issue is investigated in following chapters.

Using new capital stock series, new elasticities in the production function, and working at establishment level rather than at aggregate level suggests that Total Factor Productivity Growth may have been less than what has previously been argued.

The results suggest that previous studies, constructing a capital stock series with the Perpetual Inventory Methodology and a hypothetical benchmark capital stock, tended to overestimate capital stock growth. Nevertheless, given the high macroeconomic historical capital stock growth figures, I treat the new estimated series as a lower bound, and new estimates of TFP growth as an upper bound.

Previous studies tended to overestimate greatly the elasticity of output with respect to capital. Working with new elasticities and using a gross output based production function rather than a gross value added production function lowers TFP growth estimates.

Working at establishment level and using Divisia Index Numbers in order to aggregate results leads to TFPG estimates that are lower than simple average figures. This suggests that the dominance of large-scale establishments in terms of output led to lower TFP Growth. However, this feature varies across sub-periods and industries, so that a detailed industrial demographic study is necessary to reach more robust and detailed conclusions.

2.7 Conclusion

Preparing the ground for a study of industrial demography and dynamics in the Indonesian manufacturing sector, in order to shed more light on the mechanisms leading aggregate TFP Growth, this chapter reviews the existing theoretical and empirical literature on Total Factor Productivity Growth estimation for Indonesian manufacturing using *Statistik Industri* dataset. I criticise the usual approach estimating a hypothetical benchmark capital stock – both on the basis of the methodology and on historical evidence. I then derive a new methodology for construction of a capital stock series based on fixed assets figures at the establishment level. It appears that manufacturing capital stock growth seems to have been slightly lower – on average 7.59% p.a. for 1976-95 - than what has been previously calculated using the PIM and ICVAR methodology (8.5% p.a.). The discrepancy mainly stems from an underestimation of the initial benchmark capital stock with the ICVAR methodology. I however treat the new capital stock growth series as a lower bound. Indeed, macroeconomic historical evidence suggests that capital stock grew by 18 to 25% p.a. over the period.

Estimating rather than calculating the elasticities of the production function shows that the elasticity of output with respect to capital had been previously greatly overestimated.

Using the new elasticities, I estimate TFPG at the establishment level rather than at the aggregate level, and present simple TFPG averages, as well as weighted TFPG averages using Divisia Index Numbers. Estimating TFPG at establishment level accounts for different distributions of inputs (capital and labour) across companies. Weighted establishment TFPG averages account for firms' size distribution within manufacturing.

Results suggest that for 1975-1996, TFP Growth rates may have been lower (0.78% p.a.) than what had been previously suggested (2% to 3% p.a.). Dividing the period into relevant historical sub-periods shed light on the evolution of TFPG.

Results confirm that the oil boom period (1975-80) witnessed low but positive TFP Growth (0.31% p.a.). Comparing weighted and simple average TFPG suggests that positive weighted TFPG may largely be due to large-scale firms.

During the oil and export crisis (recession, 1981-83), average weighted TFP Growth worsens, because the use of intermediate inputs does not slow down as fast as output. However, simple average TFPG improves, suggesting that smaller firms withstand the crisis in a better way.

Results for 1984-88, reform and liberalisation period, are in line with previous studies, showing a large improvement of TFP Growth. However aggregate TFP Growth deteriorates slightly during the post-deregulation period (1989-95), mainly because of a halt in output growth in 1991 in most sub-sectors.

Estimation of TFP Growth at the establishment level, and the comparison of simple and weighted TFPG averages have clearly shown the importance of productivity differential across plants according to their size. It also underlines the importance of industrial dynamics. The task is now to explore further plants' demography over the period in order to shed more light on the mechanisms behind aggregate TFP change.

3 Industrial demography: A Review of the Literature Applied on Developing Countries

3.1 Introduction

The discussion of the previous chapter focused on how to measure TFP growth as accurately as possible, and gave a first estimation of TFP Growth for the manufacturing sector using several aggregation methods. In this chapter, the emphasis is put on the micro-dynamics of aggregate TFP growth. In particular, the focus is put on the heterogeneity issue: within the manufacturing sector, and within each sub-industry, technology, factor mix, and therefore TFP and TFP growth may vary across plants. The causes of heterogeneity and turnover are in turn discussed. These include: international trade issues, financial reforms, competition and industrial policy, as well as broad institutional framework.

The previous study has concentrated on providing new estimates of TFP and TFP growth in the Indonesian manufacturing sector, but has also helped underline the importance of industrial heterogeneity in terms of firm's size and productivity. Indeed, calculating productivity growth using different method of aggregation – simple average versus weighted average (using Divisia Index numbers) – shows that different types of firms have different productivity growth rates (and therefore different technologies) within the same industry at each point in time and at different periods. This heterogeneity is in turn affecting the aggregate productivity growth of the manufacturing sector. This review of the literature sheds some new light on the problem of aggregation of microeconomic data into an industry-wide aggregate. It complements the discussion of accurate TFP and TFPG estimation.

In their 1996 book, Roberts and Tybout compile a series of works dealing with industrial demography issues in Developing Countries, including studies covering manufacturing in Chile (Liu, L. & Tybout, J.R., 1996 ; Tybout, J. R., 1996), Columbia (Liu, L. & Tybout, R., 1996 ; Roberts, M.J., 1996), and Morocco (Haddad, M., de Melo, J., and Horton, B., 1996).[25] They survey the theory of industrial evolution and derive a methodology taking into account plant heterogeneity in the estimation and explanation of productivity and productivity growth. Other existing studies of Developing countries industrial demography include Israel (Griliches and Regev, 1992) and Taiwan (Aw, Xiaomin, and Roberts, 1997). More recently, a few scholars have used new methodologies to reassess industrial evolution and its causes using data on Chilean and Colombian manufacturing (Levinshon & Petrin, 2000; Pavcnik, 2002; Fernandes, 2002). Finally, Hahn (2000) investigates the relationship between plant turnover and aggregate TFP growth in Korean manufacturing.

[25] Some chapters include case studies for other countries but do not directly deal with industrial demography.

While the issue of plant productivity heterogeneity has been largely discussed for the case of OECD countries, in particular for the United States, LDCs have not been the focus for studying industrial demography and its dynamics. The latter could however beneficiate greatly from such studies to inform policy. Indeed, LDCs are the countries experiencing dramatic industrial changes, first through rapid industrialisation, rapid technological change (catching-up phenomenon), and quite often, market liberalisation.

In this chapter, I firstly propose to review the theory underpinning the study of industrial evolution at the microeconomic level, as well as the methodology used in industrial demographic studies. In a second part, I review the empirical literature of industrial evolution for LDCs. Finally, I review the scarce literature directly or indirectly linked to industrial evolution in the Indonesian manufacturing sector. The conclusion gives directions for the next chapter, a study of industrial evolution in Indonesian manufacturing.

3.2 Industrial demography: theory and methodology

3.2.1 Theory

Tybout (1996) summarises the role of plant or firm heterogeneity in aggregate productivity improvement in those words:

"*Entry, exit* and *market share reallocations* reflect *three forces*. The *first* involves *long-run shifts in technology and demand patterns* that generate expansion of output and net entry of producers in some sectors, while generating contraction of output and net exit of producers in others. The entry and exit that result as a developing country shifts from the assembly of low technology manufactured goods to the production of higher quality differentiated ones are an example of this long-run adjustment. The *second* force is *short-run or cyclical fluctuations in demand*, such as might arise from changing macroeconomic conditions or trade policy. These could be an important source of entry and exit variations in industries where sunk costs are small so that short-term or hit-and-run entry may be profitable. The *third* factor contributing to turnover is the *replacement of less-efficient producers by more efficient ones* in the same industry. If producers in an industry are heterogeneous in their levels of profit or productivity, market force are likely to generate continual entry and exit, even if demand remains stable" (Roberts, M.J., Tybout, J.R., 1996, p.2, emphasis added). This is of course true if markets are competitive. If markets are not competitive, then market share reallocation and plants turnover are the products of market distortions such as monopolies or corruption.

In general, TFP growth is explained by macroeconomic environment and policy, as well as overall changes in technology. The usual approach is the representative plant approach to productivity and productivity growth modelling. All firms behave following identical production functions, thereby ignoring the heterogeneity of industrial composition. "Productivity growth must thus occur through an orderly shift in the production technology common to all plants or through some general improvement in the quality of inputs." (Tybout, 1996, p.44).

Within the representative plant approach, one strand of the literature concentrates on the effect of product market competition –through industrial and/or trade policy – on entrepreneurial effort on innovation for the production process (Corden 1974, Hart 1983, Martin and Page 1983, Scharfstein 1988, Rodrick 1991).

Another area of study concentrates on the role of scale economies in explaining the link between policy and productivity. Here again, trade policy is the main focus. Thirdly, productivity changes are explained by externalities. This is the core explanation utilised by the "big push" theorists (Rosenstein-Rodan 1943, Murphy, Schleifer and Vishny 1989), scholars focusing on productivity spillovers (Krugman 1991, Matsuyama 1991), or endogenous growth literature focusing on learning-by-doing (Krugman 1987, Lucas 1988).

However, as Tybout (1996) underlines "if technological innovation takes place through a gradual process of efficient plants displacing inefficient ones, or through plant-specific innovation and learning-by-doing, the representative plant assumption embedded in the literature mentioned above is at best misleading" (p.45).

Indeed, the previous works study productivity improvements using the representative plant approach without specifically taking firms heterogeneity and turnover into account, but at the same time concede that heterogeneity exist.

Endogenous growth theory takes part of plant heterogeneity into account by differentiating among different qualities of goods, and/or different qualities of labour. These models work however in a general equilibrium framework, and do not allow detailed microanalysis of industrial composition and evolution. Partial equilibrium models offer greater possibilities regarding industrial demography study (Tybout, 1996).

A stylised fact regarding industry is its heterogeneity in terms of labour and capital intensity, technology, plant's size, and profit. "If the dispersion in these plants characteristics reflects an underlying dispersion in productivity and if entry, exit, or differential growth rates are continually altering market shares, then heterogeneity can be a basis for significant productivity change." (Tybout, 1996, p.43).

The alternative approach to the study of productivity growth allows for changes in market shares, entry and exit, and plant-specific improvement in efficiency. It relaxes the assumption of a unique and widespread technology, and allows for different factor mixes for each plant.

Jovanovic (1982) argues that a widespread empirical observation is that, within an industry, smaller firms grow faster, their rates of growth are more heterogeneous, they are less cost-efficient and more likely to fail than larger firms. He explains this "deviation from the proportional growth law" with a "theory of`noisy` selection". As firms learn about their relative cost-efficiency through market participation, the most efficient ones expand, while the least efficient ones eventually exit. Sunk entry costs and the degree of individual uncertainty affect exit patterns and efficiency. Jovanovic underlines that "enduring differences in size and in growth are no doubt caused by the fixity of capital. This paper shows, I think, that selection matters too." (p. 649). Another interesting feature of Jovanovic's model is that it allows for heterogeneity in industrial composition – firms of different size and efficiency coexist in the same industry at any point in time – while keeping the assumption of perfect market competition – the number of firms is always infinite.

Hopenhayn (1992) proposes a model similar to Jovanovic's (1982) but extending to the case of the steady state equilibrium – entry and exit rates are equal, and so is job creation and destruction; distribution for firm size, profits and value are stationary. Steady state analysis is helpful to analyse the long-run properties of dynamic models. Hopenhayn "use[s] it here to understand how changes in the structural characteristic of an industry [...] affect turnover, growth of firms, and the distributions of size, profits, and value of firms" (p.1129). "Most of Jovanovic's results still hold, but Hopenhayn goes beyond them to describe the long-run effects of changes in fixed costs, aggregate demand, and sunk costs, inter alia, on industry characteristics." (Tybout, 1996, p.45). In a stationary equilibrium, entry and exit will occur if plants face a minimum of fixed costs. If these fixed costs increase, this effect will be to prevent low productivity plants to enter, under the condition that technological change is disembodied. Using the same technological assumption, "changes in aggregate demand are neutral on all life cycle properties and on the rate of turnover in the industry, causing only changes in the total number of firms and the market price for the good in the industry" (p. 1143). Increased sunk entry costs lowers plant turnover, resulting in the continuation of less productive plants, while expected profits and market share of large plants increase. "So policies that inhibit entry reduce average productivity through selectivity effects, and they can appear to exacerbate market power in a setting where all plants are price takers." (Tybout, 1996, p.46).

In earlier studies, some other partial equilibrium models treat production costs as endogenous: firms determine the diffusion of technology, and decide of the best timing to introduce a new technology. The decision depends on several factors such as the costs of adopting the technology, the productivity gain that the technology provides, and the number of firms having already adopted the technology (externalities). Adoption or non-adoption of a new technology has an impact on costs and productivity, in turn affecting entry and exit.

Pakes and Ericson (1987), and Pakes and McGuire (1994) allow for imperfect competition and uncertainty about investment outcomes in their models. Here again, each firm decides whether to invest, to utilise existing capital, or to exit, according to its expectations in terms of return on investment and competition with other firms. "Young firms are more likely to invest in improvements than old firms, so a firm's rate of productivity growth is correlated with its stage in the life cycle" (Tybout, 1996, p.46). But as many authors point out, the framework developed here is too complex to be easily used for empirical work.

Finally, Dixit (1989), and Lambson (1991) point out that in an uncertain institutional framework with constantly changing incentives, firms are less likely to invest in new technology. They usually prefer to shift to labour-intensive technology. This framework also explains the long-term coexistence of firms using different technologies - set up at different periods and under different institutional framework – resulting in productivity heterogeneity.

Another cause for productivity heterogeneity are economies of scale. Plants have different sizes and therefore experience different economies of scale and productivity. The reallocation of market shares also reallocates economies of scale and reshuffles productivity across plants. Tybout notes that there is a "countercyclical tendency in sectoral productivity growth" (1996, p.54): in a period of recession, aggregate productivity may improve because the less productive plants exit; and in period of boom, aggregate productivity may drop because new less productive plants enter. He however concedes that empirical work tends to indicate that, at the plant-level, returns to scale are close to unity, so that economies of scale do not explain a large part of the productivity heterogeneity.

Tybout (1996) mentions four other potential causes of productivity heterogeneity. The first one relates to different capacity utilisations creating productivity differentials. The second is the learning effect: entering plants start to learn and are less productive than incumbents, which have already learned. Thirdly, empirical work shows that plants tends to maintain their productivity ranking over time, probably because of specific managerial skills or permanent plant-level productivity shocks. Finally, different plants may face different externalities: these are however very difficult to isolate empirically.

Tybout (1996) then reviews the correlates of productivity growth components. A feature of Developing Countries' manufacturing sectors is the wide dispersion of plant productivity distribution, which is in general not due to differences in factor stocks. It could be the case that some of the dispersion reflects measurement errors of factor stocks such as labour. However, Tybout, de Melo and Corbo (1991) find that even controlling for heterogeneity of labour, a large part of the productivity dispersion remains. Other studies indicate that export-orientated firms or plants affiliated to a foreign company such as a multinational corporation are more productive than others.

Productivity dispersion suggests that there are large potential productivity gains to achieve through entry, exit and market share reallocation, especially in industries protected from international competition, or in industries where plants are heterogeneous in terms of market orientation (export versus domestic market). However, productivity gains can be impeded because of market imperfections such as barriers to entry and exit, factor markets frictions such as stickiness of the labour market, uncertainty, imperfection of the financial market, etc.

Productivity dispersion can also be viewed as a great potential for low productivity plants to "catch-up", that is the within plant productivity improvement hypothesis.

Does this mean that export- and Foreign Direct Investment promoting policies necessarily imply productivity gains? The answer is yes if the causality is straightforward and runs from policy to productivity. However, it is often the case that highly productive firms tend to decide to export, or that highly productive plants are chosen to be part of an Multinational Company (MNC) or become an MNC themselves. As a result "there is no guarantee that policies to encourage exports or foreign direct investment would reduce the market share of low-productivity firms or move them toward the efficient frontier" (Tybout 1996, p.59).

As mentioned earlier, industrial turnover also correlates with economic shocks: macroeconomic shocks tend to be countercyclical (aggregate productivity improves in downturns), and industry-specific characteristics tend to explain average rates of turnover.

Market share reallocation is another way to improve aggregate productivity, especially when competition increases through different channels such as openness to international trade or deregulation for a specific industry: market shares are reallocated from low to high productivity plants. Another effect of trade liberalisation and domestic deregulation can be that market shares are reallocated from very large to small plants, thereby reducing plant-level economies of scale in the industry, but not necessarily aggregate productivity.

There are not many candidates to explain intra-plant productivity growth. Tybout (1996) argues that, "internal scale effects are probably not a dominant source of efficiency gain because big plants, which dominate the behavior of sector aggregates, are typically scale-efficient" (p. 61), and explicitly dismisses the fact that trade liberalisation improves scale efficiency. Trade liberalisation and foreign ownership may have a small positive impact but it is not a general observation.

The reviewed theoretical literature show that industrial heterogeneity in terms of technology and productivity can occur even in competitive markets for final goods. They show that policy influences industrial composition, industrial change, and productivity through several channels. The first channel is policy affecting the markets for final goods, such as industrial or trade policy. The second channel is the broad institutional framework in which entrepreneurs are meant to take investment decisions and predict return on investment. This institutional framework encompasses financial and regulatory framework, as well as informal institutional environment.

Several types of empirical methodologies have been developed in order to take heterogeneity issues into account while assessing productivity and productivity changes.

3.2.2 Methodology

3.2.2.1 Taking heterogeneity into account

The usual representative plant approach to measuring aggregate TFP growth has been dealt with extensively in chapter 2.

As Tybout (1996) underlines: "clearly this productivity measure has nothing to say about the role of heterogeneity in productivity growth; indeed, the assumptions that lie behind it are inappropriate if technology varies across plants" (p.48).

In the preceding chapter, I have presented a first attempt to take plant-level heterogeneity into account by using different elasticities for each 2-digit sector, and by estimating productivity growth at the establishment level before aggregation using Divisia Index numbers. I have also shown that simple and weighted average TFP growth rates differ greatly, underlining the importance of heterogeneity, and calling for a more detailed study of industrial demography for the Indonesian manufacturing sector.

Tybout (1996) points at several caveats in the representative plants approach. Notably, "some unrealistic assumptions, including frictionless adjustment in factor stocks, competitive product and factor markets, and identical constant returns technologies at all plants" (p.48). Another important limitation is that the usual approach cannot disentangle aggregate productivity growth resulting from economy-wide productivity gains (common to all plants) and aggregate productivity growth resulting from plant-specific productivity gains, market share reallocations, entry, and exit. The microeconomic assessment of productivity growth distinguishes between within firm productivity improvement, market share reallocation among firms with different productivity levels, and changes in the population of firms.

As pointed out in the previous chapter, assessing productivity changes at the plant level is less sensitive to the aggregation bias, and each plant is allowed to have its own technology and factor mix, thereby offering a more real and detailed picture of the manufacturing sector as a whole.

The first approach simply consists in estimating TFP and TFP growth at the plant level. "The other begins by using the micro data to estimate a production function, $Y^* = f(v,t)$. Depending on the application, Y^* may represent either the average or the maximum amount of output attained at the input vector v in period t, and the production function may be estimated either econometrically or as a nonparametric envelope of data points. Given $f(.)$, the efficiency of the i_{th} plant in year t is then imputed as $E_{it} = Y_{it} / f(v_{it}, t_0)$, where Y_{it} is the realised output of the i_{th} plant, v_{it} is its input vector, and the denominator is a benchmark productivity level in period t_0" (Tybout, 1996, p.49).

Baily, Hulten and Campbell (1992) calculate TFP levels at the plant level using:

$$\ln TFP_{it} = \ln Q_{it} - \alpha_K \ln K_{it} - \alpha_L \ln L_{it} - \alpha_M \ln M_{it} \quad (1)$$

They then obtain an aggregate TFP level for time t using:

$$\ln TFP_t = \sum_i \theta_{it} \ln TFP_{it} \quad (2)$$

where θ_{it} is the share of the i_{th} plant in industry output in current currency.

The growth of industry TFP over the period $t-\tau$ to t is then:

$$\Delta \ln TFP_t = \ln TFP_t - \ln TFP_{t-\tau} \quad (3)$$

The aggregation of plant level TFP with market shares is not optimal, and it would be preferable to use Divisia Index numbers, as shown in the previous chapter. However, the formulation of the Divisia Index Number would not allow to disentangle easily aggregate TFP growth stemming from within plants productivity improvements, market share reallocation, entry and exit.

Baily, Hulten, and Campbell (1992) also use an alternative approach, where they calculate relative TFP, which is calculated by relating the deviation of plant output from the industry mean to the deviations of the factor inputs from the industry means:

$$\ln TFP_i = \ln Q_i - \overline{\ln} \overline{Q} - \alpha_K (\ln K_{it} - \overline{\ln} \overline{K}) - \alpha_L (\ln L_{it} - \overline{\ln} \overline{L}) - \alpha_M (\ln M_{it} - \overline{\ln} \overline{M}) \quad (4)$$

where bars indicate industry geometric average values of output and factor inputs.[26] The relative TFP index is adjusted to have mean zero for each industry.

Elasticities of output with respect to inputs are calculated at the plant level using costs shares, not adding to one and therefore avoiding the assumption of constant returns to scale.[27] For the calculation of TFP growth at industry level, they use industry average factor income shares, averaged again over the beginning and ending year of the period of growth. When the focus is on the relative productivities of plants within an industry within a single year, they use – for a given plant – the average of the plant's factor cost shares and the industry shares. "This method is better for giving the relative productivity of a given plant in a single year" (Baily, Hulten, and Campbell, 1992, p.192).

They underline an important property of the relative productivity ranking: "they do not depend upon the output deflator. For a given year a dollar is a dollar, and output is measured in the same units in all plants. And this virtue even extends to some intertemporal comparisons. For example, we can see how plants move in the rankings from one period to the next without introducing errors from the output deflator. The deflators are, of course, important to any calculation of productivity growth over time, for individual plants or for the industry"(Baily, Hulten, and Campbell, 1992, p.192). This discussion also applies to factor inputs deflators (intermediate inputs, labour and capital).

Calculating TFP and TFP growth at the establishment level allows to rank them from the most to the least productive within different categories: at the aggregate manufacturing level, or at a more disaggregate industry level. Doing so for each year of observation allows tracking down plants staying in the population, plants switching industrial sector, as well as entering and exiting plants.

The methodology also allows disentangling aggregate productivity growth stemming either from entrants, exits, or incumbents. It also takes into account changes in output shares. For incumbents, the decomposition allows allocating aggregate productivity growth to plants moving up or down the productivity ladder. This is done using the following specification, where i is the subscript for plants, S designates the group of incumbents, N the group of entrants, X the group of exiters, t the end year, and $t-\tau$ the start year:

$$\Delta \ln TFP = \sum_{i \in S} \left(\theta_{it} \ln TFP_{it} - \theta_{it-\tau} \ln TFP_{it-\tau} \right) + \left(\sum_{i \in N} \theta_{it} \ln TFP_{it} - \sum_{i \in X} \theta_{it-\tau} \ln TFP_{it-\tau} \right) \quad (5)$$

[26] The arithmetic mean of log(X) corresponds to the geometric average of X.
[27] Capital share is based on the rental cost of capital, labour share is based on wages, and intermediate input share is based on inventory rental rates.

"The productivity growth among the stayers can be broken down in two ways. First, their contribution can come from improvements in each plant separately (holding output shares constant) and from changes in the output shares:

$$\sum_{i\in S}(\theta_{it}\ln TFP_{it}-\theta_{it-\tau}\ln TFP_{it-\tau})=\left(\sum_{i\in S}\theta_{it-\tau}\Delta\ln TFP_{it}+\sum_{i\in S}(\theta_{it}-\theta_{it-\tau})\ln TFP_{it}\right)\text{"} \quad (6)$$

(Baily, Hulten and Campbell, 1992, p.193). I note this the BHC decomposition.

They use a second methodology in order to decompose TFP growth into several factors for the stayers. In order to do so, they use the yearly ranking of plants according to their TFP level, and cut the population into quintiles. They then identify groups of plants going up or down by two quintiles or more (UP2 and DWN2 respectively), as well as groups of plants staying either in the two top quintiles (TOP), medium (RST) or the bottom two quintiles (BTM). The obtained decomposition "assess[es] the importance to industry growth of the leading plants, the rising and falling plants, and the plants that stay in the middle" (Baily, Hulten and Campbell, 1992, p.194). The decomposition writes:

$$\begin{aligned}\Delta\ln TFP_t &= \sum_{i\in UP2}(\theta_{it}\ln TFP_{it}-\theta_{it-\tau}\ln TFP_{it-\tau})\\ &+\sum_{i\in TOP2}(\theta_{it}\ln TFP_{it}-\theta_{it-\tau}\ln TFP_{it-\tau})\\ &+\sum_{i\in DWN2}(\theta_{it}\ln TFP_{it}-\theta_{it-\tau}\ln TFP_{it-\tau})\\ &+\sum_{i\in BTM}(\theta_{it}\ln TFP_{it}-\theta_{it-\tau}\ln TFP_{it-\tau})\\ &+\sum_{i\in RST}(\theta_{it}\ln TFP_{it}-\theta_{it-\tau}\ln TFP_{it-\tau})\end{aligned} \quad (7)$$

Haltiwanger (1997) argues that the BHC decomposition may be problematic. Indeed, even if entrants are very productive and exiters very unproductive, if exiters totalise a large market share relatively to entrants, then the net entry could still have a negative effect on aggregate productivity growth. Foster, Haltiwanger and Krizan (1998) propose to decompose aggregate productivity growth relatively to the mean (FHK decomposition):

$$\begin{aligned}\Delta TFP &= \sum_{i\in S}\theta_{it-k}\Delta tfp_{it}+\sum_{i\in S}\Delta\theta_{it}(tfp_{it-k}-TFP_{it-k})+\sum_{i\in S}\Delta\theta_{it}\Delta tfp_{it}\\ &+\sum_{i\in N}\theta_{it}(tfp_{it}-TFP_{it-k})-\sum_{i\in X}\theta_{it-k}(tfp_{it-k}-TFP_{it-k})\end{aligned} \quad (8)$$

where S is the group of incumbents, N the group of entrants, X the group of exiters, $t-k$ the beginning of the period, t the end of the period, θ the market shares in terms of output or employment, tfp total factor productivity of plants, and TFP average tfp, i subscript for plants.

The first term represents incumbents intra-plant productivity growth, the second term stands for the contribution of market share reallocation (it is positive when market share increases for incumbents with above average productivity level at the beginning of the period). The third element is a covariance term. The contribution is positive when market shares are reallocated from plants with declining productivity to plants with increasing productivity. The last two terms stand for the contribution of net entry, which is positive when entrants display productivity higher than the average irrespective of market share.

As Disney, Haskel and Heden (2000) point out "this method [FHK] is vulnerable to measurement error. Suppose that employment is measured with error and that the θ_s are employment weights. Measurement error would give a spuriously high correlation between $\Delta\theta$ and Δtfp understating the covariance effect. In addition it would give a spuriously high correlation between θ_{it-k} and Δtfp, giving a spuriously low within-plant effect." (p.13)

One solution is to use a decomposition proposed by Griliches and Regev (1992) (GR decomposition):

$$\Delta TFP_t = \sum_{i\in S}\bar{\theta}_i \Delta tfp_{it} + \sum_{i\in S}\Delta\theta_{it}\left(\bar{tfp}_i - \overline{TFP}_i\right) + \sum_{i\in N}\theta_{it}\left(tfp_{it} - \overline{TFP}_i\right) - \sum_{i\in X}\theta_{it-k}\left(tfp_i - \overline{TFP}_i\right) \tag{9}$$

where bars stand for time average over base and end year. "The first term measures the within contribution of survivors' productivity growth weighted by time-average market shares. The other terms are all relative to time-average productivity. The advantage of this procedure is that averaging removes some of the measurement error. The disadvantage is that interpretation is more obscure. The within effect will reflect, to a certain extent, external restructuring effects since they affect θ." (Disney, Haskel and Heden, 2000, p.13).

Aw, Chen, and Roberts (1997), in their industrial demographic study of Taiwanese manufacturing, use a multilateral TFP index at the firm level. They use a specification developed by Caves, Christensen and Diewert (1982) and refined by Good, Nadiri and Sickles (1996). This multilateral TFP index "relies on a single reference point that is constructed as a hypothetical firm with input revenue shares that equal the arithmetic mean revenue shares over all observations and input levels that equal the geometric mean of the inputs (which is equivalent to the arithmetic mean of the log of the inputs) over all observations. Each firm's output, inputs, and/or productivity in each year is measured relative to this hypothetical firm and the multilateral index provides transitive comparisons between any subset of the observations. Good, Nadiri and Sickles (1996) discuss an extension of the multilateral index that uses a separate hypothetical-firm reference point for each cross-section of observations and then chain-links the reference points together over time in much the same way as the conventional Tornqvist index of productivity growth. This productivity index is particularly useful in our application because it provides a consistent way of summarizing the cross-sectional distribution of firm productivity, using only information specific to that time period, and how the distribution moves over time", (Aw, Chen, and Roberts, 1997, p.11).

The specification dealing with a single type of output writes:

$$\ln TFP_{ft} = \left(\ln Y_{ft} - \overline{\ln Y_t}\right) + \sum_{s=2}^{t}\left(\overline{\ln Y_s} - \overline{\ln Y_{s-1}}\right)$$
$$- \left[\sum_{i=1}^{n}\frac{1}{2}\left(S_{ift} + \overline{S}_{it}\right)\left(\ln X_{ift} - \overline{\ln X_{it}}\right) + \sum_{s=2}^{t}\sum_{i=1}^{n}\frac{1}{2}\left(\overline{S}_{is} + \overline{S}_{is-1}\right)\left(\overline{\ln X_{is}} - \overline{\ln X_{is-1}}\right)\right] \quad (10)$$

with f the subscript for a firm, t the subscript for time, s the subscript for the base period, i the subscript for input type, n the number of inputs, Y represents output, X the inputs, and S the cost shares of inputs, and bars indicate the average.

Good, Nadiri and Sickles (1996), show that this is the right index to use when working with panel data because it allows both for a comparison between firms and between time periods.

"For a panel data set, both the chaining approach of the Divisia and the hypothetical firm approach of Caves, Christensen and Diewert have appealing features. Chaining allows the information in the cost minimizing shares to be as close as possible to that appropriate for current technology. This is especially important when the cost minimizing shares of subcomponents are changing quickly, or when the time series is long. The hypothetical firm approach provides an unambiguous basis for comparison of observations which have no natural ordering" (Good, Nadiri and Sickles, 1996, p.11).

They add that: "this chained multilateral total factor productivity index also provides a decomposition of TFP change into two components that exploit between and within variations available in panel data for firms. When describing the change in TFP between firm f at time t and t', the first set of terms:

$$\left(\ln Y_{fit'}-\overline{\ln Y}_{t'}\right)-\left(\ln Y_{ft}-\overline{\ln Y}_{t}\right)-\frac{1}{2}\sum_{i=1}^{n}\left[\left(S_{fit'}+\overline{S}_{it'}\right)\left(\ln X_{fit'}-\overline{\ln X}_{it'}\right)-\left(S_{fit}+\overline{S}_{it}\right)\left(\ln X_{fit}-\overline{\ln X}_{it}\right)\right]$$

(11)

describes the change in TFP relative to that of the hypothetical or representative firm (catching up or falling behind or productive efficiency) while the remainder

$$\sum_{s=t}^{t'}\left(\overline{\ln Y}_{s}-\overline{\ln Y}_{s-1}\right)-\sum_{s=t}^{t'}\frac{1}{2}\sum_{i=1}^{n}\left(\overline{S}_{is}+\overline{S}_{i,s-1}\right)\left(\overline{\ln X}_{is}-\overline{\ln X}_{i,s-1}\right) \quad (12)$$

describes the change in productivity for the typical firm (technological innovation or technological change)" (Good, Nadiri and Sickles, 1996, p.12-13).

While these chained indices are appealing for the purpose of comparing different plants, they do not offer the possibility of accounting for market share reallocation, entry and exit in aggregate TFP growth.

The most appropriate solution for the study of Indonesian manufacturing productivity, taking into account plant heterogeneity and studying demographic features such as entry and exit is to calculate TFP at the plant level using the BHC methodology, and then compare aggregate TFP growth decompositions using BHC, FHK and GR specifications.

3.2.2.2 Estimating elasticities using plant-level panel data

The previous studies calculate the elasticity of output with respect to inputs (intermediate inputs, labour and capital) as costs shares. This approach is attractive, because it avoids the econometric estimation of elasticities, and allows each plant to have its own elasticities.

However, as seen in chapter 2, for the case of Indonesian manufacturing, it may be preferable to estimate elasticities using an econometric approach. This is motivated by the observation of errors in the data, especially the under-reporting of wages and/or under-reporting of the number of workers.

I have already underlined and discussed the importance of dealing with the "right" elasticities in the estimation of Total Factor Productivity. I have attempted a first estimation of those elasticities at the aggregate level (time-invariant technology identical for all establishments), as well as at the 2-digit industry level (time-invariant technology identical for all establishments within the same 2-digit industry).

When tackling the issue of heterogeneity and productivity at the plant-level, it is preferable to estimate elasticities at a more disaggregate level (i.e. up to the 5-digit whenever possible) using panel data estimation. This allows accounting for more heterogeneity of production functions and technologies.

Levinsohn and Petrin (2000) offer a review of the main literature regarding the estimation of elasticities using panel data, propose a new alternative estimation procedure to obtain consistent elasticities while "conditioning out serially correlated unobserved shocks to the production technology" (abstract), and apply the methodology to Chilean manufacturing panel data.

They recall the strong potential correlation that can occur between input levels and the unobserved firm-specific shocks, leading to simultaneity problems in the estimation of the production function parameters. "Firms that have a large productivity shock may respond by using more inputs. To the extent that this is true, Ordinary Least Squares estimates of production functions will yield biased parameter estimates, and, by implication, biased estimates of productivity. The fixed effects solution has the unappealing feature of requiring a component of the productivity shock to be fixed over time. Instrumental variables is another alternative, but valid instruments need to be correlated with firm-level input choices and orthogonal to the productivity shock. In many cases, there simply are no valid instruments" (p. 2).

They take Olley and Pakes (1992) alternative estimation methodology as a starting point for developing their own estimation process. Olley and Pakes (1992) use investment to control for the correlation between input levels and the unobserved firm-specific productivity. Instead, Levinsohn and Petrin (2000), use a similar methodology but with intermediate inputs to control for the same phenomenon.

They argue that there are three potential advantages for using intermediate inputs over investment. When using panel data to estimate productivity, the productivity term can be decomposed into a forecastable part (productivity at period t can be predicted by productivity at period $t-1$), and an unforecastable part (the "news"). "The first advantage is that intermediate inputs will generally respond to the entire productivity term, while investment may respond only to the "news" in the unobserved term" (p. 2). Indeed, capital stock may already have adjusted to the forecastable part of the productivity term, and the investment proxy only captures the "news". "Also, productivity may be characterized by two components, a serially correlated component to which investment responds, and a separate firm-time shock that is independent over time, to which investment will not respond, but to which the choice of variable factors (intermediate inputs and labour) will respond" (p.2). The second advantage is that intermediate inputs are not a state variable and therefore make sense from an economic point of view: some intermediate inputs such as electricity are not stocked and may respond entirely to productivity changes rather than reflecting the state of a plant. The third advantage is data-driven. They argue that in most datasets, a relatively large number of plants report zero investment. In most cases, zero investment just corresponds to a strong adjustment to a productivity shock. Using then investment as a proxy will lead to a truncation of the dataset (exclusion of plants reporting zero investment for estimation purposes), and therefore to a sample bias. On the other hand, almost all plants report intermediate inputs such as electricity or raw materials.

Fernandes (2002) uses this methodology applied to Colombian manufacturing panel data and summarises the main idea. "Implicit in the estimation procedure is a structural dynamic model of plant production decision with cross-plant heterogeneity, plant specific uncertainty and the maximisation of the expected discounted values of future net profits" (p. 6).

Each plant observes its productivity ω_{it}^j and chooses the level of variable inputs l_{it}^j, m_{it}^j and e_{it}^j, labour, raw materials and energy, while capital stock is assumed to be a quasi-fixed input k_{it}^j. The production function is then $y_{it}^j = f\left(l_{it}^j; m_{it}^j; e_{it}^j; k_{it}^j; \omega_{it}^j; \varepsilon_{it}^j\right)$, where y_{it}^j represents gross output, ε_{it}^j the "news" (unobserved shock), superscript *j* indexes the industry, subscripts *i* indexes the plant, and *t* indexes time. Productivity is assumed to follow a first-order Markov process, i.e. the expected value of ω_{it}^j conditional on knowing ω_{it-1}^j is the same as the expected value given ω_{it-1}^j, ω_{it-2}^j, etc, and productivity is decomposed into two elements: $\omega_{it}^j = E\left[\omega_{it}^j / \omega_{it-1}^j\right] + \xi_{it}^j$. The production function is a standard Cobb-Douglas in a logarithmic form. "The estimating equation for plant *i* in industry *j* at period *t* is given by:

$$y_{it}^j = \beta_0 + \beta_l l_{it}^j + \beta_e e_{it}^j + \beta_m m_{it}^j + \beta_k k_{it}^j + \omega_{it}^j + \varepsilon_{it}^j \text{" (p. 7).} \qquad (13)$$

The observed productivity ω_{it}^j is known by the managers and is potentially correlated to labour, energy and raw material inputs, and creating a simultaneity problem in the estimation of the parameters of the production function. Fernandes (2002), drawing on Basu (1996), argues that, "the use of raw materials to correct the simultaneity between inputs and unobserved productivity parallels its use to correct for unobserved variation in labor and capital utilization. So our productivity estimates may reflect in part changes in capital or labor utilization" (p. 7).

Under the profit maximising assumption, the demand for raw materials can be written as $m_{it} = m_t(\omega_{it}, k_{it})$: the demand for raw materials is an increasing function of observed productivity conditional on quasi-fixed capital input. This demand function can be inverted and productivity becomes a function of raw materials and capital: $\omega_{it} = \omega_t(m_{it}, k_{it})$.

Omitting the *j* superscript, equation (1) becomes:

$$y_{it} = \beta_l l_{it} + \beta_e e_{it} + \phi_t(m_{it};k_{it}) + \varepsilon_{it} \text{ with } \phi_t(m_{it};k_{it}) = \beta_0 + \beta_m m_{it} + \beta_k k_{it} + \omega_t(k_{it};m_{it}) \quad (14)$$

"Since ε_{it} has zero unconditional mean, $E[\varepsilon_{it}/m_{it};k_{it}]$ is also zero. The difference between (2) and its expectation, conditional on raw materials and capital is given by:

$$y_{it} - E[y_{it}/m_{it};k_{it}] = \beta_l(l_{it} - E[l_{it}/m_{it};k_{it}]) + \beta_e(e_{it} - E[e_{it}/m_{it};k_{it}]) + \varepsilon_{it} \quad (15)$$

Equation (3) is estimated by OLS (with no constant term) –once the conditional expectations are obtained by locally weighted least squares (LWLS) regressions of output, employment and energy on *m* and *k* – to obtain consistent parameter estimates for labor and energy, the variable inputs that do not correct the simultaneity bias" (p.8).

Using LWLS, the authors then regress $(y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_e e_{it})$ on $(m_{it};k_{it})$, corresponding to the estimation of $\phi_t(.)$. $\phi_t(.)$ is generally estimated over different periods in order to account for variations of unobservable ratios of input to output prices. This allows obtaining $\hat{\phi}_t(.)$.

Then, choosing a good candidate value for $(\beta_m;\beta_k)$, say $(\beta^*_m;\beta^*_k)$- such as parameters estimated via OLS on the log-linear production function – they compute A and B such as:

$$A = \omega_{it} \hat{+} \varepsilon_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_e e_{it} - \beta^*_m m_{it} - \beta^*_k k_{it} \quad (16)$$

$$B = \hat{\omega}_{it-1} = \hat{\phi}_t(m_{it-1};k_{it-1}) - \beta^*_m m_{it-1} - \beta^*_k k_{it-1} \quad (17)$$

Using LWLS, A is regressed on B. The constant of this regression as it is evaluated at each observation is called variable C and is $E(\omega_{it}/\omega_{it-1})$, the expected value of ω_{it} conditional to ω_{it-1}.

Using:

$$y_t - \beta_l l_{it} - \beta_e e_{it} - \beta^*_m m_{it} - \beta^*_k k_{it} - E(\omega_{it}/\omega_{it-1}) = \xi_{it} + \varepsilon_{it} \quad (18)$$

they now compute $\xi_{it} \hat{+} \varepsilon_{it}$. In order to estimate β_m and β_k, they then use a grid search to minimise the following moment criterion function:

$$\min_\beta \left[\left(\sum_i \sum_{t=T_{i0}}^{T_{i1}} (\xi_{i,t} \hat{+} \varepsilon_{i,t}) k_t \right)^2 + \left(\sum_i \sum_{t=T_{i0}}^{T_{i1}} (\xi_{i,t} \hat{+} \varepsilon_{i,t}) e_{t-1} \right)^2 \right] \quad (19)$$

However appealing, this complex and time-consuming method of estimating elasticities may not be necessary for Indonesian manufacturing data.[28] Indeed, a feature of the factor shares as calculated with the data is that they remain quasi constant over time, so that it is reasonable to keep the plant-level TFP measures calculated in the previous chapter.

Let us now turn to the review of empirical findings of industrial demographic studies, focusing on Developing Countries, but also giving two examples of developed countries as a benchmark for comparison.

3.3 Industrial demography: Empirical evidence

Studies on Developing countries relating to the link between industrial demography and productivity growth are scarce. The attention has mostly been on OECD countries. This review of the empirical literature picks only a few of the studies on the USA and Canada, while concentrating on the literature dealing with developing countries. So far, only a few of studies covering the following countries have been carried out: Chile, Columbia, Israel, Morocco, Taiwan, and Korea.

Using data on American manufacturing plants, Baily, Hulten and Campbell (1992) propose four patterns of plant dynamics.

"First, it [distribution of productivity among plants] may be the result of a random draw in the level of productivity in each period or of error of measurement" (Baily, Hulten and Campbell, 1992, p.194). If this is the case, productivity levels only reflect random shocks or error on measurement and they change at every period randomly and rankings are not consistent over time.

"Second, it may be the result of a random draw in the growth of productivity rather than in the level" (Baily, Hulten and Campbell, 1992, p.194), and the variance of the productivity distribution will display an increasing variance over time. Under the assumption that there exists a minimum relative productivity level, plants falling below this level will exit and will play a large role in aggregate productivity changes.

"Third, it may be the result of plants of different vintages" (Baily, Hulten and Campbell, 1992, p.194). The assumption is that plants entering at different points in time have different technologies and therefore different productivity levels. If new technologies improve productivity, then older firms will become less productive relatively to young ones over time and will eventually exit. This is an appealing theory, however, it is difficult to deal with because older plants have the possibility of renewing their technology by updating the capital stock. It becomes then necessary to test whether or not new capital stock expenses have an impact on productivity.

[28] In their study of Chilean manufacturing at the 3-digit level, Levinsohn and Petrin (2000) have to estimate 2000 production functions in order to attain the final results.

"Fourth, it may simply reflect permanent plant heterogeneity" (Baily, Hulten and Campbell, 1992, p.194), i.e. not due to plant vintage. In that case, a given plant's productivity can increase or decrease, but productivity in the current period will be a fairly good predictor of plant productivity in the next period. This is modelled as a plant fixed-effect using panel data estimation. They note that "the case in which plant productivity effects persist, turns out to be an important feature in the results" (Baily, Hulten and Campbell, 1992, p.199), and they offer two types of explanation for the existence of plant-specific fixed effects.

The first explanation is linked to returns to scale and utilisation effects. As underlined previously, they allow for increasing returns to scale and empirical evidence shows that scale varies very slowly over time. The implication is that plants of different size have different productivity levels, with persistence in the productivity distribution. "If scale is an important determinant of productivity, this will give rise to persistence in the productivity distribution. If big plants are high in the distribution, then their size will help them stay at the top" (Baily, Hulten and Campbell, 1992, p.199). Utilisation effects may vary a lot in periods of recession. If all plants are affected in the same way, then the productivity distribution will not change much. But if different plants are affected in different ways, then productivity distribution will change as a result of the macroeconomic shock. They concede that the phenomenon is very difficult to model, and limit their empirical observation to the productivity distribution for a given year of economic recession.

The second type of plant-specific fixed effects is concerned with managerial ability: plants with good managers are more productive than plants with bad managers. The literature suggests that different managers have different managerial skills and are each able to manage plants of different size: the greater the skills, the larger the plant he/she can manage efficiently. There are however decreasing returns to scale, implying the larger the firm, the less efficient the manager: "the diminishing returns measure the effects of the loss of productivity resulting from a given manager being spread too thin" (Baily, Hulten and Campbell, 1992, p.201). Therefore plant size could have a negative impact on productivity. But managerial skills are dynamic, this idea relates to Jovanovic's (1982) model where plants (i.e. their managers) learn about their abilities over time, deciding then to stay, expand, or exit. Another pattern of managerial behaviour is the case where managers are slacking off with time, resulting in plant productivity decline, eventually moving back up the productivity ladder once it has hit the bottom.

Finally, differences in plant productivity can stem from difference in the quality of the workforce. This can be tested for using detailed data on wages and on workers skills.

They find that "entry and exit play only a very small role in industry over five-year periods and that the increasing output shares in high-productivity plants are very important to the growth of manufacturing productivity" (Baily, Hulten and Campbell, 1992, p.189). As mentioned before, they also find evidence of persistence of the productivity distribution.

Olley and Pakes (1992) conduct a study using data similar to Baily, Hulten and Campbell (1992), and find that aggregate productivity growth occurred thanks to "a reallocation of capital from less to more productive plants. Note that since this reallocation process seems to be greatly facilitated by entry and exit, an important part of it would not be picked up from the analysis of balanced panels" (Olley and Pakes, 1992, p. 37). Tybout (1996) underlines that, while this confirms that a large part of aggregate productivity growth occurs thanks to output shares reallocation, Olley and Pakes results show that entry and exit matter.

Baldwin and Gorecki (1991) study the effect of entry and exit on aggregate productivity growth in Canadian manufacturing. They recall that in the industrial evolution theory, entry end exit is the mechanism that allows eliminating excess profit and helps the market to remain competitive, and add that, " this argument has been given theoretical elegance by contestability theory" (Baldwin and Gorecki, 1991, p.301). Entry and exit is also a process bringing about technological and organisational change. They first focus on the size of entry and exit: do entry and exit matter in terms of output and employment? Secondly, they distinguish two types of entry: greenfield entry and entry via a merger. Thirdly, they study the behaviour of continuing plants in manufacturing and their relationship to entry and exit. Finally, they assess the dynamic effect of entry, exit and growth path of continuing plants. They find that turnover of plants accounts for 30% of productivity improvement (using value added per worker). They find that greenfield entry has a very small impact on employment, but when merger entry is taken into account, the impact becomes significant (about 3% of employment), i.e. reorganisation of large firms play an relatively important role in industrial evolution. The study shows that entrants are numerous but small, that the infant-mortality rate is high, and that entrants' growth rate is slow. In other words, entry and exit do not have a great impact on output and employment in the short run, but the impact is felt on the medium- to long-term (about 10 years), when non viable entrants have exited (about 50% of a cohort of entrants) and when the remaining entrants have grown. They also find that exit occurs in all groups of the plant-size distribution. Entrants also grow faster than incumbents. Tybout (1996) underlines that in this study "among continuing plants those gaining market share over the decade were more productive than those losing market share. Also, on the basis of medians used to summarize the performance of subgroups, exiting plants were less productive than continuing plants, and entering plants were *more* productive than continuing plants" (p.51).

Griliches and Regev (1992), provide an industrial demographic study of Israeli manufacturing, assessing the role of entry and exit on productivity gains as measured by output per person-year. Unlike the other case studies, they find that plants turnover has little effect and that most productivity gains occur within plants. An interesting feature of the report is the identification of a "shadow of death" effect: plants that are going to exit in the near future are less productive than others.

Tybout (1992) applies the common methodological framework of industrial evolution and productivity change on Chile, Colombia and Morocco, and finds that entry and exit have an important impact on aggregate productivity growth for both Chile and Morocco. "During Chile's severe recession in the early 1980's, net exit increased the market share of incumbents, net exit was the *main* component of productivity change. Net entry did the opposite in Morocco, where macroeconomic expansion was associated with rapid net entry, falling market share for incumbents, and lower aggregate productivity" (Tybout, 1996, p. 52). Most of the turnover concerns small and young plants, which are on average less productive. He also notices the "shadow of death" effect. Tybout finds that the productivity gap between continuing plants, and entering and exiting plants is larger than the productivity gap between entering and exiting plants.

Liu (1993) uses the same panel data on Chilean manufacturing and find that exiting plants are less productive than incumbents, and also display the "shadow of death" effect. Another feature of Chilean manufacturing is that young plant cohorts become more productive as they mature, reflecting the effect of unproductive plants exiting and continuing plants gaining in productivity.

Liu and Tybout (1996) complete the previous analysis by decomposing aggregate productivity growth into intra-plant productivity growth and heterogeneity effects on productivity growth for Chile and Colombia. "They depart from Liu (1993) in several respects, however. First, they use *weighted* averages of plant-level productivity trajectories to construct the productivity growth components...and to examine cohort-specific productivity growth" (Tybout, 1996, p. 53). For Colombia, they find that most of the aggregate productivity growth stems from intra-plant productivity improvement rather than from entry, exit and market share reallocation, although these seem to have a relatively important impact on the short run. This contrasts with the American case where most of the aggregate productivity gains stemmed from reallocation of output shares. "Put differently, entry, exit, and market share reallocations appear to be driven by much more than cross-plant differences in productivity" for Colombia (Tybout, 1996, p. 54). "Nonetheless, the cumulative impact of turnover on productivity is probably substantial. The `shadow of death` effect implies that exiting plants are in a downward spiral, and they might well get worse if they were to hang around. Further, as new plants mature, their weighted average productivity rises rapidly: one-year-old and two-year-old plants are nearly as unproductive as exiting plants, but plants that survive to be four-year-olds match or exceed industry norms. Both phenomena are consistent with the industrial evolution models surveyed earlier. *If this shakedown process were thwarted by institutional barriers to entry, severance pay laws, or attempts to prop up sick firms, the eventual* *effects on industry-wide productivity would probably be much larger than the productivity differential between exiting plants in their last year and entering plants in their first year*" (Tybout, 1996, p.54, emphasis added). Tybout invokes here the possibility of uncompetitive markets and institutional (formal or not) barriers to industrial evolution, but so far, no study deals directly with the impact of the institutional environment on industrial evolution.

More recently, Levinsohn and Petrin (1999) use data on Chilean manufacturing and explore two hypotheses to account for aggregate productivity changes. The first hypothesis is labelled the "real productivity case", where aggregate productivity improvements stem mainly from within firms productivity changes. The second hypothesis is called the "rationalisation case", where within plant productivity remains unchanged and aggregate productivity improvements stem from the expansion of highly productive firms and the exit of less productive firms. They find that the rationalisation case explains much of productivity improvements. However, when an entire industry experiences productivity drop, the real productivity case prevails.

Pavcnik (2002), uses Ericson and Pakes's (1995) Markov-perfect equilibrium model for industry dynamics in order to assess the impact of trade liberalisation on productivity for Chilean manufacturing. She "explicitely incorporates plant exit in the estimation to correct for the selection problem induced by liquidated plants" (p. 245). She finds that within plant productivity growth is due to trade liberalisation for the plants exposed to foreign competition. She also finds that "in many cases, aggregate productivity improvements stem from the reshuffling of resources and output from less to more efficient producers" (p. 245). Indeed, she underlines that the international trade literature most of the times uses the representative plant approach and only considers the impact of trade liberalisation on sectoral productivity improvements. There is however a need to consider the effects of plant heterogeneity in the process. Within an industry, plants with different productivity may coexist because of a lack of competition. Trade liberalisation increases competition and forces less productive plants to exit, thereby reshuffling resources from low to high productivity plants. This occurs when exit costs are not too high. She also points at the costs of such a reshuffling of resources such as labour and capital. The study is important from a policy-making point of view in that it assesses the costs of this reshuffling, as well as the benefits. She finds that plants of industries exposed to foreign competition displayed productivity growth 3 to 10% higher than protected industries. She also finds that exiting plants were on average 8% less productive than incumbents.

Fernandes (2002) uses Levinsohn and Petrin (2000) dynamic industrial framework to study the impact of trade liberalisation on productivity using plant-level panel data on Colombian manufacturing for the period 1977-1991. The framework control for simultaneity between productivity and input demand, and estimates time-varying plant-specific productivity measures.

She finds a strong negative relationship of nominal tariffs on plant productivity. Furthermore, "plant exit plays a minor role in generating productivity gains in face of lower trade protection" (abstract). Tariffs have a stronger negative impact on productivity for larger plants, and for plants engaged in less competitive industries. Trade protection is also found to have a negative impact on plant productivity growth. Her methodology differs from Pavcnik in that trade policy changes differ across industries and over time.

Aw, Chen, and Roberts (1997) provide one of the two only direct industrial demographic study for Asia that I am aware of, with their paper dealing with Taiwanese manufacturing. Their choice is motivated by the peculiarity of Taiwanese manufacturing, dominated by small subcontracting firms in less capital-intensive industries. The authors draw on the previously reviewed theory of industrial evolution, arguing that low barriers to entry and exit favour industrial turnover, where the most efficient firms survive, while the others exit, thereby transferring resources from the least to the most productive firms and improving aggregate productivity. They use Hoppenhayn's model (1992). They find that industrial turnover account for up to 50% of aggregate productivity improvement in Taiwanese manufacturing, which is exceptionally high compared to other case studies. Other results are in line with studies on other countries: entering firms are on average less productive than incumbents, but are a heterogeneous group, where the most productive firms survive and converge toward incumbent firms in terms of productivity, and the least productive exit. They also find that exporting firms are more productive than non-exporting firms. "These patterns are consistent with the view that both the domestic and export market sort out high productivity from low productivity firms and that the export market is a tougher screen" (Aw, Chen, and Roberts, 1997, abstract).

Hahn (2000) uses plant level panel data on Korean manufacturing for the period 1990-98, and aims at estimating the contribution of entry and exit to aggregate productivity growth. He finds that Korean manufacturing display high rates of entry and exit for international standard, and that entry and exit reflects plants productivity differentials. In this study, the contribution of net entry (or exit) to aggregate productivity growth is 45% during expansionary periods and 65% in periods of contraction of the economy. Hahn concludes that "the most obvious lesson from this study is that it is important to establish a policy or institutional environment where efficient businesses can succeed and inefficient businesses fail." In other words, if entry and exit contributes to over half of aggregate productivity gains, then competition policy and enforcement of bankruptcy laws potentially play a central role in triggering productivity gains.

It has been observed that in Developing Countries, plants' entry and exit play a large role in aggregate productivity improvements. It seems to be particularly the case for the two Asian countries studied so far: in both the case of Taiwan and Korea, plants' turnover account for over half of aggregate productivity gains. Another common feature is that entering plants are a heterogeneous group, but are on average less productive than incumbents. A large part of an entry cohort does not survive very long, but the survivors experience high productivity gains. At the other end of the spectrum, exiting plants are less productive than incumbents, and most studies observe the so-called "shadow of death" effect: plants about to exit are a lot less productive than incumbents. Studies linking industry turnover and productivity to international trade issues find that trade liberalisation tends to exacerbate the importance of entry and exit. Other elements of the broader institutional framework – such as barriers to entry or uncertainty – also affects industry and productivity dynamics.

In spite of these broad common findings, all case studies seem to yield different results and display different industrial dynamic patterns. This might however be imputable to the variety of researched topics rather than to fundamental differences of industrial behaviour. What however differs greatly from country to country are the broad policy and institutional environment, and macroeconomic shocks. It is therefore important to put any case study into its historical-economic framework. Studying the impact of plant heterogeneity on aggregate productivity is also a pertinent way to assess the impact of the institutional environment on economic growth.

A number of scholars scratch the issue of uncertainty and institutional framework without explicitly accounting for them empirically. In particular, no account is made for market imperfection stemming from political protection of firms and corruption-related issues. These could turn out to be quite important, be it for Developed or Developing Countries.

3.4 Indonesian manufacturing sector demography: What do we know?

Indonesian manufacturing has received very little attention regarding plant-level analysis in general, and plant-level industrial evolution in particular.

Probably the most important and complete overview of the Indonesian manufacturing sector to date is found in Hill (1990a and b), updated in Hill (1997). The study "examine[s] the pattern and changing structure of industry, focusing on industry composition, regional industrialisation, ownership, scale and wages" (Hill, 1990a, abstract).

Hill (1990a) firstly finds that "employment grew rapidly over the period 1975-86, in large and medium *and* small firms (Table 5: the rates were 5.9% and 5% respectively). Moreover, although productivity growth was more rapid in large and medium firms, there has been no demise of small industry in Indonesia: these firms have been technologically progressive, as indicated by a real annual productivity growth of more than 4%" (p.91). He notes that there aren't almost any cases of declining labour productivity, apart from the food, beverages and tobacco sector, decline that he imputes to the technologically backward and dominant sugar industry. He then interestingly notes that "there are no consistent trends in employment and productivity growth among large and small firms. Indeed, in many industries the trends diverge enormously - low or even negative growth for one, rapid expansion in the other. Case studies would be necessary to identify the disparate factors at work in each case, but the data do at least suggest a pronounced heterogeneity in many industries, with large and small firms in different 'markets' for technology, output and labour. This presumed differentiation may hold the key to the impressive performance of small industry"(pp.91-93). This indicates that at the aggregate level, size might not be a powerful explanatory factor for plant productivity heterogeneity. However, this does not exclude the possibility for size to be a more powerful explanatory factor if specific sectoral effects are controlled for. Besides size and sectoral effects, his findings open up a whole range of possibilities explaining plant productivity heterogeneity: group membership, patronage, ownership, cronyism, etc.

He also observes a wide dispersion of industries' productivity, with a convergence phenomenon, with, for example, the textile industry or the wood products experiencing rapid productivity gains. He touches on the causes of productivity growth, noting that "productivity growth is constrained in some industries by institutional factors (as in sugar), in others (such as rice milling) the technological 'shake-out' had already occurred by 1975, while in others - notably garments - there is no great scope or incentive for dramatic increases in productivity" (p.95). this again underlines the importance of a disaggregated study of productivity growth, and stresses the need to assess the impact of the broad institutional environment on aggregate and plant level productivity growth.

He finds that industrial concentration is fairly high, with "19% of the industries, generating 28% of non-oil manufacturing output, have extremely high concentration (the four largest plants producing at least 70% of industry output), while in 56% of industries, accounting for a similar share of output, concentration is significant (a ratio of at least 40%)" (p.96). He explains these high concentration figures with the need for economies of scale in some industries such as automotive or electrical equipment, but also with government ownership and institutional barriers to entry. He notes however that concentration figures are on the decline.

Looking at plant characteristics, he finds that most plants are privately rather than state or foreign owned, but that privately owned plants belong generally to the small and medium scale sector, while state and foreign owned plants tend to be large. Large plants account for up to 68% of total manufacturing output, and for half of total employment, excluding oil and gas. Hill (1990b) argues that "labour productivity could be expected to be positively correlated with size for a number of reasons: large firms operate at a scale which permits the use of more advanced and capital-intensive technology, and specialist skilled labour; large production runs may lead to enhanced market power and the scope for product differentiation; and to the extent that high value added industries are also scale-intensive, large firms have an advantage" (pp.90-91).

He finds that this is indeed the case for some industries such as weaving, clove cigarettes manufacturing, pharmaceutics, structural metals and motor cycles. He however also finds that "In some [industries], productivity in the very large firms is actually well below that of medium firms; in two extraordinary cases - tea processing and printing - the ratio in the smaller firms exceeds that in the largest!" (p.92). He explains this result by the potential non-significance of economies of scale in those industries, the presence of large inefficient state enterprises (tea processing in particular), product differentiation – with large enterprises specializing in cheap mass market products and SMEs taking the high end of the market (in magazine printing and garment manufacturing). He however shows "clearly that the higher productivity of large firms often derives from their location in high productivity industries, rather than their higher productivity in the same industry" (p.93).

Hill's review of the manufacturing is probably the most complete to date, it covers very well some topics regarding industrial structure and evolution, however, it has so far not covered the issue of plant turnover and market share reallocation, and does not link aggregate TFP change, plant heterogeneity, and industrial dynamics.

Behrman and Deolalikar (1989) get closer to the topic and study survival duration of manufacturing establishment in Indonesia for the period 1975-85, using the *Raw Statistik Industri* dataset. The authors notice that over 50% of establishments present in 1975 did not survive until 1985. They find that establishments with higher survival duration were "older and larger; in more concentrated industries; with larger foreign shares; proportionately fewer family workers; a larger share of their electricity own-produced; and a higher ratio of gifts and donations to value added" (abstract).

Rather than building on a formal theory of plant survival, they "adopt an empiricist approach in this paper, and simply ask how well observed characteristics of establishments at one point in time predict the duration of survival into the future" (p. 215). "Because the distribution of the dependent variable [i.e. survival length in number of years] is limited to the range zero to 10, with a considerable number of observations at both ends, particularly for those who survived at least until 1985, [they] use a two-limit Tobit estimator" (p. 219). They also offer a brief microeconomic description of the manufacturing sector for 1975, looking at the distribution of plants according to several factors such as age, size, ownership, labour and input use at the 5-digit level.

Although helpful and interesting, the study uses the *Raw Statistik Industri* (RSI) dataset rather than the *Backcast Statistik Industri* (BSI) dataset, leading to a potential bias in the sample. As demonstrated in chapter 2, the RSI is of limited use when it comes to study dynamic phenomena.

Behrman and Deolalikar (1989) however underline that they do not study year-to-year survival probability, thereby bypassing the pitfalls of the RSI dataset.

Another interesting result of the paper is that plants with higher average labour productivity display a longer expected survival duration. They however do not embark on TFP and TFP growth estimation.

Bernard and Sjöholm (2003) investigate the impact of foreign ownership on plants' exit probabilities for the period 1975-89. They find that foreign plants are less likely to close down than domestic plants, but that this is mostly due to the larger size of foreign plants. This corroborates the finding that the most important factor influencing closure is the size of plants. Their results also shows that relatively higher labour productivity reduces the chances of exit, while a higher share of non-production workers in total labour force increases these chances. Their results are interesting and provide a good framework for the analysis of the factors influencing plant survival. They could however be reviewed by using TFP rather than labour productivity, and they could extend to the mid-1990s. More importantly, their results show that there is a great need to concentrate on the issue of size in Indonesian manufacturing. It appears to be the most important explanatory factor in survival probabilities. The effects of size need to be researched into more details.

Another article directly related to industrial evolution has been provided by Okamoto and Sjöholm (1999). The study focuses on the automotive sector in Indonesia using data from SI in both 1990 and 1995. The authors follow Baily, Hulten, and Campbell (1992) methodology: they first estimate TFP at the establishment level and use the following specification to account for incumbents, entry and exit at the aggregate level:

$$\Delta \ln TFP = \sum_{i \in S} (\theta_{it} \ln TFP_{it} - \theta_{it-\tau} \ln TFP_{it-\tau}) + \left(\sum_{i \in N} \theta_{it} \ln TFP_{it} - \sum_{i \in X} \theta_{it-\tau} \ln TFP_{it-\tau} \right) \quad (20)$$

where S represents the group of incumbents, N the group of entrants, X the group of exits, t the end period, τ the start period, and θ the plant output share.

They also provide employment and labour productivity measures using the same approach of decomposition.

Okamoto and Sjöholm (1999) find that both labour productivity and TFP fall in all automotive sub-sectors between 1990 and 1995.[29] They find that exiters have a very strong negative impact on productivity growth because of their declining productivity just before exiting. Entries have a positive impact on productivity growth, i.e. entrants show productivity improvements. Incumbents

[29] One drawback of this study is that the way TFP is calculated is not specified.

show no improvement or even deterioration of productivity growth. In the framework of that paper, they do not propose a demographic study of the sector.

In two previous studies, Sjöholm (1997 a and b) also uses Indonesian establishments data for 1980 and 1991. In the first study, he attempts to assess the impact of international trade on productivity growth. In this study, the author uses only two dates, thereby dropping all entries and exits occurring in between 1980 and 1991. Sjöholm (1997a) finds that exporting plants are more productive than non-exporting plants, and that imports of inputs does not seem to matter. Using the same data and methodology, Sjöholm (1997b) assesses the effect of Direct Foreign Investment (DFI) on productivity. He finds that DFI produces spillovers, especially in competitive industries, where competition stems mainly from domestic plants rather than imports.

Goeltom (1995) uses establishment-level panel data over the period 1981-88 in order to assess the relationship between productivity and financial liberalisation. She uses a value added based production function, with a firm-specific fixed effect reflecting the time-invariant efficiency of each plant. As argued in chapter 2, her estimation of a capital stock series is questionable. She however provides several estimation of TFP using different forms for the production function. She then regresses TFP on several factors and finds that, ceteris paribus, larger plants, plants belonging to a conglomerate, and exporting plants tend to be more productive than others. She also finds that age and ownership do not have a significant impact on TFP.

Goeltom also recalls that: "Hill and Kalirajan (1991) argue that older firms have had more time to learn and become more experienced, and are therefore more efficient. On the contrary, Pitt and Lee (1981) and Page (1984) have found that younger firms are more efficient, for they possess the latest and presumably more efficient technology" (p. 56).

The empirical literature on Indonesian manufacturing relating to productivity gains and using plant-level data focuses on different sub-periods: 1975-85, 1975-89, 1981-88, 1980-91, and 1990-95. It will be interesting to carry out a complete study for the period 1975-95. Secondly, the literature does not deal with a detailed demographic study of the manufacturing sector. However, the works point at several interesting results. Behrman and Deolalikar (1989) suggests that plant turnover is an important feature of the sector for the period 1975-95, that survival length is positively influenced by higher labour productivity, suggesting that competitive market forces are at play. These results are corroborated by more recent works in Bernard and Sjöholm (2003). But at the same time, Behrman and Deolalikar (1989) find that survival duration is longer in concentrated industries, and potentially positively related to corruption and cronyism.

The other authors point at the effects of de-regulation: openness to international trade tend to increase productivity, and financial liberalisation has the effect of reallocation capital from low to high productivity plants (Goeltom, 1995). In other words, de-regulation has a positive impact on aggregate productivity gains.

3.5 Conclusion

While the empirical literature dealing with industrial demography in Developing Countries is scarce, the few studies reviewed here suggest that industrial heterogeneity plays an important role in industrial evolution and productivity growth.

The review also shows that a common pattern emerges: entrants are a heterogeneous group but are on average less productive than incumbents, a large percentage of an entrants cohort does not survive very long, only the plants with high productivity and productivity growth remains, there is a shadow of death effect where plants about to exit display lower productivity. However, country case studies constitute a very useful exercise to account for peculiarities of the institutional framework, economic policies, and macroeconomic shocks.

For the case of Indonesian manufacturing, the contribution of the next chapter is to offer a detailed demographic map of the sector over a long period of time (1975-1995), focusing on plant size and productivity distribution, patterns of survival, as well as entries and exits. This will then lead to the decomposition of aggregate TFP growth and assess the contribution of plant turnover. This will represent a first step in unveiling the microeconomic mechanisms behind aggregate productivity gains. The following chapter then assesses potential factors explaining plant productivity heterogeneity, while the last chapter turns to the issue of industrial change.

4 Industrial demography and productivity: The case of Indonesian manufacturing, 1975-95

4.1 Introduction

The literature review dealing with industrial demographic issues has underlined the importance of microeconomic heterogeneity in the dynamic process of productivity growth. It has shown that plants or firms differ in terms of size, factor mix, technology, and productivity, and that productivity dispersion could be a great potential source of productivity gains.

While those issues remain interesting in general, the economic history of Indonesia raises particular issues for the manufacturing sector. So far, no in-depth study has assessed the microeconomic dynamics of the sector, and a number of questions remain open.

In this chapter, I am chiefly interested in the actual dynamics of industrial structure and its link to productivity growth. While a clear link is made with macroeconomic policy and exogenous shocks in order to identify relevant sub-periods, the causality between policy, industrial evolution and productivity changes will be kept aside for chapter 6.

The debate over aggregate TFP growth for Asia has concentrated on the issue of extensive versus intensive economic growth, i.e. growth in the use of inputs versus TFP growth. In chapter 2, I have shown that using different methodologies and assumptions for estimating aggregate TFP growth can lead to the predominance of either hypothesis. However, using a new capital stock series and the Divisia Index methodology, I find that average TFP growth has been positive over the period 1975-1995, at 1.30% p.a..

Even though positive, this average TFP growth figure is considerably lower than the average output growth at 10.24% p.a. for the manufacturing sector. A simple conclusion would be that economic growth has been mostly extensive. But the interesting issue is to explore the reasons why TFP growth has been so low when the catch-up potential was high. As a first step, I propose here to decompose aggregate TFP growth into three elements: intra-plant productivity growth, market share reallocation among incumbents, and the effect of plant turnover (entry and exit). Assessing which components have dragged down aggregate TFP growth will be the first step in assessing why TFP growth has been low.

The issue of industrial heterogeneity and productivity growth is particularly relevant for the case of Indonesia. Indeed, the Indonesian economic historiography has underlined that the industrial sector has long been dominated by large-scale companies in terms of output and value added share, while small-scale plants dominate in terms of numbers. There obviously has been a high degree of industrial heterogeneity, for various historical reasons.

4.2 Industrial heterogeneity in historical context: ownership and policy issues

The size of companies can be influenced by many determinants, such as the level of development of the economy, and industrial specialisation – relating to economies of scale, exposition to foreign competition, etc. In a world of perfectly competitive and free markets, only purely economic factors should determine the size of companies. However, under imperfect markets, ownership issues and industrial policy matter.

It is widely accepted in the literature that Indonesia has long been dominated by large-scale companies in terms of output and value added, and that those few but heavy weights have co-existed with large numbers of small- and medium-scale firms. The large-scale sector has first been controlled by the Dutch colonial capitalists until the second World War, to pass into the hands of the State and the Army after independence under President Sukarno (1949-1965), and expand with large companies under the control of the State and the Generals in collaboration with Chinese and foreign entrepreneurs, especially during the Suharto period (1965-1998), with a clear emergence of conglomerates in the 1980s, the most famous being the so-called "Suharto empire". It is worth underlining that the typical Indonesian conglomerate is family-owned and has close links with the ruling power (through shareholding, and/or personal connection).

Lecraw (1992, p. 2) shows clearly the importance of large-scale economic entities and argues that *"A substantial share of the industrial sector in Indonesia is populated by large, family-owned corporate groups. Although accurate statistics are not available, based on rough estimates, the sales of the top five groups were approximately equal to 10% of the GDP of Indonesia in 1990; the sales of the top 20 groups were equal to about 25% of GDP."*

The issue of capital ownership is relatively well documented. The most complete historical account is given in Robison (1986), and shows that ownership and policy issues are deeply embedded. I use Robison's historical account of ownership issues to shed some light on industrial structure during the Suharto era.

The industrial public sector is one of the most important since independence and constitutes a crucial element of domestic capital for at least four reasons. Since 1950, public property of firms is one of the only means of domestic capital control for Pribumi (indigenous Indonesian). Indeed, Dutch colonisation left only little space for the development of an indigenous bourgeoisie. Economic activities introduced in Indonesia by the Dutch were too capital-intensive for the Pribumi to take active part. Furthermore, the surplus produced by these activities was dominantly remitted to the Netherlands, rather than reinvested in Indonesia. After independence, Indonesian rulers tried to keep domestic capital and industry away from foreign and Chinese influence and property. Large enterprises were managed and owned by the State, the one and only indigenous entity being able to gather enough capital for an industrial development on a large scale.

The second reason for the predominance of industrial public capital is one that is common to many developing countries. From 1970 onwards, a national industrialisation strategy developed, strategy that could only be led by the State in absence of an indigenous bourgeoisie. This one, mainly financed by oil and gas export income, allowed the State to impose certain directions to economic development, aim which could not have been easily achieved with a private industrial sector only.

Thirdly, the objective of the government was also to help the emergence of a private industrial sector. To achieve this, the State concentrated its investments in infrastructure and heavy industries in order to create linkages.

State's presence in industry also permitted political parties' financing, and contributed to the wealth increase of rulers. The allocation of building, supply and distribution contracts offered by the control of large firms helped the construction of a patron-client system ruled by political power. This system of course reinforced State's control over large firms. The State was mainly present in natural resources, banking, manufacture and basic goods distribution sectors.

State's triple function – industrial Pribumi development, political parties and rulers financing, reinforcement of political power – favoured public ownership, ownership concentration, and formation of large-scale companies.

The Army began to take part in economic activities in the early 1950s. At the beginning, it was principally to earn additional revenues, because State's budget was neither sufficient for its usual military functions, nor could cover officials increasing living standards. Military enterprises were built on three types of resources. The first type is constituted by existing firms, which were nationalised and taken over by the Army in 1958. These were mainly in entrepôt, freight and shipping industries. The second source stems from the confiscation of economic entities such as funds, hotels, exclusive agencies for automobile freight and distribution, entities formerly controlled by Sukarno's people. The Army sold also numerous forest exploitation concessions and amassed a certain amount of capital at the origin of new industrial conglomerates. The recipients were mainly military sub-groups and actual and/or retired officials. The third source was a privileged access to supply and building contracts, import licences and loans.

Industrial military activity was driven in partnership with Chinese and foreign capital, because both detained financial and management resources for development. As a consequence, a political-economic alliance between the Army and Chinese and foreign groups supplied the latter with an important political protection. The structure of economic activity took the form of large-scale companies gravitating around political-bureaucratic power centres, often hampering the development of competitive domestic markets. This gave incentives to the government for adopting measures favouring protection and subvention of Pribumi SMEs. Furthermore, the entry of the Army in the business area implied the creation of groups of Generals. These Generals, now managers, acquired a large economic and political power, firstly thanks to their influence in the allocation process of licences, monopolies, concessions, and secondly thanks to their power of public resources appropriation. This allowed of course also an increase in Generals' wealth.

The double objective of military activities' financing and of personal wealth accumulation did increase the lock-in of military firms' capital (firms owned directly by the Army or only controlled by it – Chinese and foreign).

Another important factor in the development of a capitalist class in Indonesia is the profound social and political division between Chinese and Pribumi. Before 1965, a major contradiction within the capitalist class was that its economically dynamic and dominant part was at the same time politically weak and socially persecuted. Chinese capitalist could not transform their financial power into a dominant class power. However, their activities continued to flourish thanks to close familial and inter-personal links within the community (at a national, as well as at an international level), allowing an efficient informal financing.

After the counter-revolution in 1965, growth and the promotion of industrial development gave rise to a climate that was more favourable to Chinese entrepreneurs and allowed them to build joint ventures with foreign and military partners, for who Chinese acted as capital providers and managers. Chinese became then major capital owners in Indonesia under the Suharto era. They base their power on political alliances with the rulers, and also on close financial ties with the South East Asian Diaspora (in particular in Singapore, Hong Kong, Taiwan, Thailand and Malaysia). They also attracted foreign investors attention. However, in spite of all these positive aspects, political pressure subsisted.

The Chinese business community is hermetic by essence, and the non-integration of this group into the Indonesian community just reinforced the phenomenon. This is therefore evident that the ownership structure of Chinese firms remained very protected, concentrated in the hand of few individuals or families.

Since independence, small Pribumi capitalists disappeared and larger scale indigenous capitalists replaced them. These indigenous capitalists owe their existence to an important battle against Chinese and foreign capital. The emergence of those groups under the New Order is principally imputable to the forced integration of Pribumi (individuals and firms) into partly foreign joint ventures, to the building of consortiums and to arrangements concerning distribution and management. Such an integration was made possible by a public legislation assuring Indonesian participation into joint-ventures, imposing restriction on the entry of Chinese and foreign capital in certain sectors. The success of Pribumi firms was also built on a large political protection basis, assuring a privileged access to capital, to diverse licences as well as to supply contracts. These measures rendered Pribumi firms more attractive for foreign investors seeking for a compulsory indigenous business partner.

This global view of the industrial ownership structure in Indonesia shows clearly that the opposition between the different groups for the economic and political power drove to a concentrated ownership structure of firms. In an environment of imperfect competition, each interest group tries to protect its position and to reinforce it. Therefore, widely held firms cannot survive in such an environment, because it would immediately be taken over by one of the interest groups.

But of course, this account of ownership structure deals mostly with large-scale firms: State and Army concentrated on industries with economies of scale, firstly because those were inherited from the colonial period, secondly because the developmental role of the State translated into the investment of heavy industry and infrastructure. As the Chinese worked in partnership with, either the State, or the Army, or foreign ventures, these also specialised on large-scale industry. As a result, Pribumi entrepreneurs were confined into the small- and medium-scale end of the spectrum.

As argued, as one of the objective of the government was to promote the emergence of an indigenous capitalist class, mostly through regulation. Hill (1997) argues that while SMEs have tended to be favoured by government policy in order to help the emergence of an Indonesian bourgeoisie – to counter-balance Chinese and foreign (especially Japanese) entrepreneurship), and complement public-owned industry – it has been with little effect. Indeed, most SMEs promotion has been cancelled by other industrial policy measures. Protection of industries from foreign competition almost only concerned industries with economies of scale (aircraft, automobile, and steel, industries for example). Credit subsidies also targeted larger companies. Hill argues that in a distorted economy - where for example connections with officials are required – transactions costs can only be paid for by larger enterprises, so that "SMI firms have a strong interest in moves towards a liberal commercial environment featuring low and uniform levels of protection, and a transparent and uncomplicated regulatory system" (p.289). This would tend to suggest that if SMEs emerge, it should be after the liberalisation period, provided that liberalisation was effective. Goeltom (1995) shows that this is at least the case – to a certain extent – regarding the financial liberalisation.

The second interesting argument that Hill puts forward is that in ASEAN, most policies promoting SMI were welfare rather than efficiency oriented: "Most official statements stress the importance of SMI as a means of (i) generating employment; (ii) achieving greater equality through a more diverse ownership structure in business; (iii) promoting rural and regional development; (iv) providing a basis for entrepreneurial development; and (v) enhancing the socio-economic status of women and, in Indonesia and Malaysia, redressing the perceived ethnic imbalance in business ownership" (p. 285). This suggests that I should not expect SMI to be more productive than larger enterprises, at least before the liberalisation of the economy.

Robison (1986), summarises the contradictions the government faced regarding the promotion of indigenous entrepreneurship, suggesting that this sector of the economy was disregarded because of a lack of efficiency:

> "On the one hand, economic policy is based upon the maximisation of growth through development of the forces of production, and therefore, of productivity as well as production levels. Giving credit, protection and subsidy to a potentially inefficient sector of the economy contradicted this intention. Similarly, it made sense to build upon the most productive and effective element of national capital, the Chinese. However, these policies confronted significant political problems involving the hostility of the extensive indigenous petty bourgeoisie and the erosion of the state's claim to being nationalist, or even Indonesian. To complicate matters, leading elements of the military and the politico-bureaucrat factions had established business links with large-scale capital, predominantly Chinese." (p. 123)

While it made sense to promote small- and medium scale indigenous companies from a political point of view, from an economic point of view, promotion of a supposedly inefficient section of the economy seemed to be sub-optimal.

To summarise, it is at first sight very difficult to forecast which type of firms are the most productive: (i) because of market distortions and ownership issues, large-scale companies may use market power to prevent entry and/or growth of smaller competitors, and not be forced to exit in case of lack of productivity; (ii) small- and medium-scale enterprises have been promoted, but the aim has been welfare rather than efficiency; (iii) furthermore, industrial protection has mostly been harmful to SMEs. While one can reasonably predict that market distortions favoured the dominance of large-scale plants, and that liberalisation probably triggered a rise of SMEs, it is more difficult to predict which size category has been the most productive and how this has evolved over time.

The period under scrutiny is very interesting to study because it encompasses clear cut historical sub-periods: the oil boom period, followed by the oil crisis period that triggered the liberalisation of the economy in several respects (trade and finance especially), ending with the post-liberalisation and investment boom period.

Pre-liberalisation period, 1975-1985:

Oil boom, 1975-1980:

The start of the Suharto period (1965-1998) coincides more or less with the oil boom period (1973-1980), when most resources were devoted to the formal and large-scale manufacturing sector. Some scholars argue that the government operated sound macroeconomic policy during that period, helping build a solid basis for economic growth. Others argue that policy tended to favour large-scale plants and conglomerates, creating concentrated and uncompetitive sub-sectors, where small plants were prevented from growing to medium size. This "missing middle" could have hampered productivity growth.

This chapter firstly assesses to which extent manufacturing had been dominated by large-scale plants and conglomerates, and to which extent medium sized plants were absent from the manufacturing sector. It also considers whether some manufacturing sub-sectors were less competitive than others by looking at plant turnover.

It secondly considers whether large-scale plants and conglomerates were more productive than small- and medium-size plants. It also studies the dispersion of productivity distribution during the oil boom period as a way to assess the potential for productivity gains: a wide productivity dispersion indicates that productivity gains can be made by market share reallocation from less to more efficient plants, and by the exit of less efficient plants.

Finally, the sources of TFP growth for the oil boom are assessed, distinguishing among entry, exit, market share reallocation, and within plant productivity improvement.

Recession, 1981-1983, and "recovery", 1984-1985:

The second part of the pre-liberalisation period is characterised by a short recession (1981-1983) caused by the oil shock and a drop in exports, immediately followed by a "recovery" period in 1984-1985. Some of the theoretical and empirical literature argues that productivity, and more particularly microeconomic productivity is counter-cyclical: productivity improves during recessions because market shares are reallocated to the most efficient plants, less efficient plants exit the market, and entry of less efficient plants is limited.

This section firstly examines the changes of industrial structure during recession and recovery, in terms of size distribution of plants, concentration and plant turnover, and dispersion of productivity. It also identifies the behaviour of different types of plants during recession, particularly, which ones exit, and which ones grow. This naturally leads to the decomposition of aggregate productivity growth into entry, exit, market share reallocation and within plant productivity improvement effects.

Deregulation period (1986-88), and Post-Deregulation period, 1989-1995:

As a response to recession and to the end of the oil boom period, the Indonesian government implemented a series of deregulatory reforms in the domain of industrial, trade and financial policy. The actual reform period stretched over three years from 1986 to 1988, and was followed by an investment and economic boom thereafter (1989-1995).

Distinguishing between the actual reform period and the post-liberalisation period, this section scrutinises the changes in industrial composition, focusing on size distribution of plants, concentration and plant turnover, and dispersion of productivity, underlining the difference between large-scale and small- and medium-scale plants. It attempts to discover whether liberalisation tended to create a more homogenous and more competitive industrial sector. As previously, it also identifies the behaviour of different types of plants during this period: what types of plants enter and exit, and which plants beneficiate from market share reallocation. The decomposition of aggregate productivity growth into entry, exit, market share reallocation and within plant productivity improvement effects helps shedding some light on different productivity growth estimates for that period. Indeed, while most scholars find that TFP growth had been very high, especially during the post-liberalisation period, I find that taking heterogeneity into account leads to low TFP growth estimates, i.e. the lowest of the entire 20-year period, apart from the recession period.

4.3 Accounting for entry and exit: Data issues

Accounting for entry and exit of establishments is in theory simple. However, in practice, there are a number of issues to be resolved in order to correct or account for data specificity.

As discussed in chapter 2, two datasets exist, the *Raw Statistik Industri* (RSI) and the *Backcast Statistik Industri* (BSI). The BSI is clearly the dataset to use to account for entry and exit, because it should comprise all establishments, especially those that had been omitted in RSI before 1985.

The dataset gives an identification number for each establishment, allowing tracking down establishments throughout the 20-year period (1975-1995). Therefore, a new identification number appearing in the dataset should be counted as entry, while an identification number disappearing should be counted as exit.

However, the dataset only accounts for establishments with 20 employees or more (with some exceptions for the pre-1985 period). Therefore, an establishment may appear and disappear from the dataset because it crossed the 20 employees threshold. These represent only less than 3% of the total number of establishments across the entire period. Discontinuous observations occur mostly for establishments entering the dataset at the beginning of the period, and discontinuity reflects more omission to report than crossing the 20 employees threshold. In some instances, identification numbers can change due to data error. Given the structure and information included in the datasets, these are however almost impossible to detect.

Another important problem is the discrepancy observed between the date of entry in the dataset (apparition of the establishment in the dataset) and the date at which the establishment started operation (that is a series given in the dataset). This can happen when the establishment started operation before 1975, i.e. before the Census started. It can also be the case that an establishment started operation with less than 20 employees. Finally, an establishment could have started operation with 20 employees or more, but the Census failed to take it into account. This exercise is interesting in itself, not only for data cleaning purposes, but also for identifying establishments' growth pattern. I assume that working with BSI minimises Census errors, i.e. that all establishments have been accounted for as soon as they reached the 20 employees threshold. The availability of a birth date allows assessing the age of establishments regardless of their date of entry in the medium- and large-scale manufacturing sector. For establishments entering the dataset after 1975, this provides information on how long establishments stay in the small-scale manufacturing sector before crossing the 20-employee threshold. For establishments present in the dataset in 1975, this provides information on the age distribution of establishments for the start year.

Table 1a: Birth-Entry discrepancy summary statistics (all industries)

variable	mean	p25	p50	p75	p90	p95	max
Discrepancy (nb of years)	8.701307	0	3	10	23	39	93

Table 1b: Birth-Entry discrepancy summary statistics (by 2-digit industries)

Discrepancy (nb of years)	mean	p25	p50	p75	p90	p95	max
31 - Food, beverages and tobacco	10.80686	0	4	14	27	52	92
32 - Textile, garments and leather	9.376421	0	3	12	23	38	92
33 - Wood products	5.175604	0	1	5	13	22	93
34 - Paper, printing & publishing	9.417761	0	3	12	25	39	86
35 - Chemicals, rubber & plastic	8.826372	0	2	9	24	48	92
36 - Non-metallic minerals	8.087739	0	3	9	19	30	92
37 - Basic metals	4.893023	0	1	4	10	27	92
38 - Metal products & machinery	7.231537	0	2	7	19	28	92
39 - Other manufacturing	6.286908	0	1	7	18	25	90

Discrepancy between birth date and date of entry in the dataset concerns 69% of establishments across the entire period.[30] On average, an establishment stays over 8 years in the small-scale sector before entering the medium- and large-scale manufacturing sector. However, half of establishments only remained 3 years or less in the small-scale manufacturing sector before crossing the 20-employee threshold. The top 25% of establishments had to stay 10 years or more in the small-scale sector, and the top 10% remained small in size for 23 years or more.

At the 2-digit industrial level, the food, beverages & tobacco industry (31) presents the longest stay in the small-scale sector before entering the medium- and large-scale manufacturing sector, with 25% of establishments staying under the 20-employee threshold for at least 14 years. Three other sectors present a similar pattern: the textile, garments & leather industry (32), paper, printing & publishing (34), and chemicals, rubber & plastics (35). While this makes sense for the first three sub-sectors, it is surprising to find chemicals, rubber & plastics in this category: one expects this industry to have high fixed costs that require minimum economies of scale. However, this industry includes for example the "manufacture of native preparation" (5-digit codes 35223 and 35224), as well as the "manufacture of soap and cleaning preparations, including tooth paste" (5-digit code 35231), which can be carried out on a small scale using traditional technology. It can also be the case that establishments had less than 20 employees, but were part of a larger company.[31]

At the other end of the spectrum, both the wood products industry (33) and the basic metals industry (37) stand out for entering the medium- and large-scale sector at an early stage: half of establishments entered directly or after only one year, 75% of them entered respectively after 5 or 4 years or less. Indeed, both sectors require a large minimum efficient size.

I then define entry and exit as entry and exit of the medium- and large-scale manufacturing sector: entry and exit are entry and exit from the dataset, under the assumption that the BSI dataset has been correctly updated. On a first account, length of life is therefore length of life in the medium- and large-scale manufacturing sector. On a second account, I use operation starting date as date of entry in order to calculate establishments' "true" age.

Table 2a, b and c give aggregate summary statistics regarding the scope of entry and exit and turnover rates over the entire period. The entry rate is calculated as the number of entrants (or output or employment of entrants) in year t divided by the total number of plants in year t-1 (or total output or employment). The exit rate is calculated as the number of exiting plants (or output or employment of exiting plants) in year t divided by the total number of plants in year t (or total output or employment). The turnover rate is calculated as the sum of the entry and the exit rates.

[30] The variable *disc* is calculated as date of actual birth minus date of entry in the dataset.
[31] We are dealing with establishment- rather than firm-level data.

Number of establishments – life tables

Over the period 1976-94, the average annual entry share in number of establishments was 9.95%, against 5.46% for exit share, and 15.41% for the turnover rate. Focusing on sub-periods, figures regarding the "recovery" period (1984-85) are to be interpreted with caution. At first sight, it looks like the manufacturing sector experienced a boom in entries (entry rate is 19.40% in 1985): these figures might reflect reality to a certain extent because of better economic conditions, but part of it is probably still due to the "discovery" of establishments by the enumerator, especially in 1985.[32] Surprising is the substantial drop in exit share and the increase in entry share during the recession period (1981-83), while I would expect the opposite, due to tougher economic conditions. While entry rates do not change much over the period (apart from the 1984-85 period), exit shares increase substantially from the mid-1980s onwards, i.e. during and in the aftermath of the liberalisation period.

Table 2a: Aggregate annual demographic data (lifetable), number of plants

	YEAR	**total number of plants**	**number of new plants**, start of year	**number of exiting plants**, end of year	**number of continuing plants**	**entry rate** (number of new plants as a % of previous year's total number of plants)	**exit rate** (number of exiting plants as a % of current year's total number of plants)	**turnover rate** (entry plus exit rates)
OIL BOOM	1975	9498		491			5.17	
	1976	9917	910	257	8750	9.58	2.59	12.17
	1977	10477	817	299	9361	8.24	2.85	11.09
	1978	11014	836	301	9877	7.98	2.73	10.71
	1979	11606	893	711	10002	8.11	6.13	14.23
	1980	11974	1079	674	10221	9.30	5.63	14.93
RECESSION	1981	12451	1151	455	10845	9.61	3.65	13.27
	1982	13173	1177	515	11481	9.45	3.91	13.36
	1983	14031	1373	451	12207	10.42	3.21	13.64
REBOUND	1984	15231	1651	1453	12127	11.77	9.54	21.31
	1985	16733	2955	791	12987	19.40	4.73	24.13
DEREGULATION	1986	16987	1045	516	15426	6.25	3.04	9.28
	1987	17707	1236	1848	14623	7.28	10.44	17.71
	1988	18014	2155	924	14935	12.17	5.13	17.30
POST-DEREGULATION	1989	18636	1546	527	16563	8.58	2.83	11.41
	1990	20461	2352	2556	15553	12.62	12.49	25.11
	1991	20101	2196	1406	16499	10.73	6.99	17.73
	1992	20745	2050	1359	17336	10.20	6.55	16.75
	1993	21079	1693	1246	18140	8.16	5.91	14.07
	1994	21784	1951	1164	18669	9.26	5.34	14.60
	1995	22596	1976		20620	9.07		9.07
Averages	**76-80**	**10998**	**907**	**448**	**9642**	**8.64**	**3.99**	**12.63**
	81-83	**13218**	**1234**	**474**	**11511**	**9.83**	**3.59**	**13.42**
	84-85	**15982**	**2303**	**1122**	**12557**	**15.58**	**7.13**	**22.72**
	86-88	**17569**	**1479**	**1096**	**14995**	**8.56**	**6.20**	**14.77**
	89-94	**20468**	**1965**	**1376**	**17127**	**9.93**	**6.69**	**16.61**
	76-94	**15901**	**1530**	**919**	**13453**	**9.95**	**5.46**	**15.41**

[32] The backcast of the dataset took place in 1985 because of this "discovery". Although I am working with the BSI, some error may remain.

Output – life tables

If I look at similar measures but in terms of output, I observe that in fact, while more plants enter towards the end of the period, they represent less in total output (entrants become relatively smaller). Exit rates also increase in terms of output.

Table 2b: Aggregate annual demographic data (lifetable), gross output

	YEAR	**total output**	**output of new plants**, start of year	**output of exiting plants**, end of year	**output of continuing plants**	**entry rate** (output of new plants as a % of previous year's total output)	**exit rate** (output of exiting plants as a % of current year's total output)	**turnover rate** (entry plus exit rates)
OIL BOOM	1975	8.10E+09		2.24E+07	8.08E+09		0.28	
	1976	8.29E+09	4.92E+08	3.73E+07	7.76E+09	6.07	0.45	6.52
	1977	8.72E+09	3.09E+08	7.14E+07	8.34E+09	3.72	0.82	4.54
	1978	9.92E+09	5.31E+08	5.27E+07	9.33E+09	6.09	0.53	6.62
	1979	1.11E+10	4.25E+08	3.45E+08	1.03E+10	4.28	3.11	7.39
	1980	1.29E+10	5.61E+08	1.09E+08	1.22E+10	5.05	0.85	5.89
RECESSION	**1981**	1.43E+10	5.45E+08	1.41E+08	1.36E+10	4.23	0.99	5.22
	1982	1.53E+10	5.41E+08	1.27E+08	1.46E+10	3.79	0.83	4.62
	1983	1.67E+10	4.69E+08	1.65E+08	1.61E+10	3.07	0.99	4.07
REBOUND	1984	1.91E+10	7.29E+08	1.97E+08	1.82E+10	4.37	1.03	5.40
	1985	2.26E+10	1.21E+09	8.49E+08	2.06E+10	6.32	3.75	10.07
DEREGULATION	**1986**	2.59E+10	6.06E+08	2.24E+08	2.50E+10	2.68	0.87	3.55
	1987	3.77E+10	7.23E+08	1.34E+09	3.56E+10	2.79	3.55	6.35
	1988	3.31E+10	1.07E+09	5.23E+08	3.15E+10	2.84	1.58	4.43
POST-DEREGULATION	1989	4.06E+10	1.08E+09	7.05E+08	3.89E+10	3.27	1.73	5.00
	1990	4.86E+10	2.67E+09	2.25E+09	4.36E+10	6.58	4.64	11.22
	1991	5.29E+10	2.20E+09	2.01E+09	4.87E+10	4.54	3.79	8.33
	1992	6.21E+10	2.56E+09	1.65E+09	5.79E+10	4.85	2.65	7.50
	1993	6.77E+10	1.66E+09	1.15E+09	6.49E+10	2.68	1.70	4.38
	1994	7.61E+10	1.88E+09	1.16E+09	7.31E+10	2.78	1.52	4.30
	1995		1.59E+09		8.42E+10	2.09		
Averages	**76-80**	**10186000000**	**463600000**	**123080000**	**9586000000**	**5.04**	**1.15**	**6.20**
	81-83	**15433333333**	**518333333**	**144333333**	**14766666667**	**3.70**	**0.94**	**4.64**
	84-85	**20850000000**	**969500000**	**523000000**	**19400000000**	**5.34**	**2.39**	**7.73**
	86-88	**32233333333**	**799666667**	**695666667**	**30700000000**	**2.77**	**2.00**	**4.77**
	89-94	**58000000000**	**2008333333**	**1487500000**	**54516666667**	**4.11**	**2.67**	**6.79**
	76-94	**30717368421**	**1066368421**	**689810526**	**28959473684**	**4.21**	**1.86**	**6.07**

Employment – life tables

In terms of employment, entry rates remain pretty constant over the period, but exit rates increase.

Table 2c : Aggregate annual demographic data (lifetable), employment (number of workers)

	YEAR	total employ ment	employment of new plants, start of year	employment of exiting plants, end of year	employment of continuing plants	entry rate (employment of new plants as a % of previous year's total employment)	exit rate (employment of exiting plants as a % of current year's total employment)	turnover rate (entry plus exit rates)
OIL BOOM	1975	913167		21181	891986		2.32	
	1976	1056790	60007	10259	986524	6.57	0.97	7.54
	1977	1097877	33002	18492	1046382	3.12	1.68	4.81
	1978	1166286	47475	13808	1105002	4.32	1.18	5.51
	1979	1260192	42887	51401	1165903	3.68	4.08	7.76
	1980	1376578	62698	34240	1279640	4.98	2.49	7.46
RECESSION	**1981**	1447377	62988	26260	1358130	4.58	1.81	6.39
	1982	1539412	65379	27658	1446374	4.52	1.80	6.31
	1983	1626876	61328	30694	1534854	3.98	1.89	5.87
REBOUND	1984	1781812	79758	38853	1663202	4.90	2.18	7.08
	1985	1970428	123133	82911	1764384	6.91	4.21	11.12
DEREGULATION	**1986**	2011481	54795	30407	1926279	2.78	1.51	4.29
	1987	2153673	59569	126527	1967577	2.96	5.87	8.84
	1988	2304686	122425	64130	2118131	5.68	2.78	8.47
POST-DEREGULATION	1989	2643195	112490	60875	2469830	4.88	2.30	7.18
	1990	3009509	181057	212899	2615553	6.85	7.07	13.92
	1991	3226016	161140	136101	2928775	5.35	4.22	9.57
	1992	3498827	150752	136162	3211914	4.67	3.89	8.56
	1993	3705825	105509	118924	3481392	3.02	3.21	6.22
	1994	3910230	143803	113126	3653301	3.88	2.89	6.77
	1995	4180064	120000		4060064	3.07		
Averages	**76-80**	**1191545**	**49214**	**25640**	**1116690**	**4.53**	**2.08**	**6.62**
	81-83	**1537888**	**63232**	**28204**	**1446453**	**4.36**	**1.83**	**6.19**
	84-85	**1876120**	**101445**	**60882**	**1713793**	**5.91**	**3.19**	**9.10**
	86-88	**2156613**	**78930**	**73688**	**2003996**	**3.81**	**3.39**	**7.20**
	89-94	**3332267**	**142458**	**129681**	**3060128**	**4.78**	**3.93**	**8.71**
	76-94	**2146688**	**91063**	**70196**	**1985429**	**4.61**	**2.95**	**7.56**

The overall picture is one of increasing exit rates in the 1990s in terms of number of establishments, output, and employment. Is this phenomenon symptomatic of increasing or decreasing competition? Indeed, the main causes for exit could either be an increasingly self-regulating market where less efficient establishments exit, or be an increasingly distorted market where young small and medium-scale efficient establishments exit because settled large establishments prevent them from growing or deter competition through various mechanisms. This question is investigated in chapter 6 when assessing the factors leading to plant exit.

In terms of number of plants, turnover rate average 15.4% over 1976-94, while output and employment turnover rates average 6.1% and 7.6% respectively: entrants and exiters are numerous but small both in terms of output and employment, relatively to incumbents.

To complement the previous life tables, I provide survival rates by cohort of entrants (1976 to 1994) for each survival length (1 to 19 years). The survival rate is the share of surviving firms in a given year as a percentage of the total number of entrants in the beginning year (share of survivors in a cohort).[33]

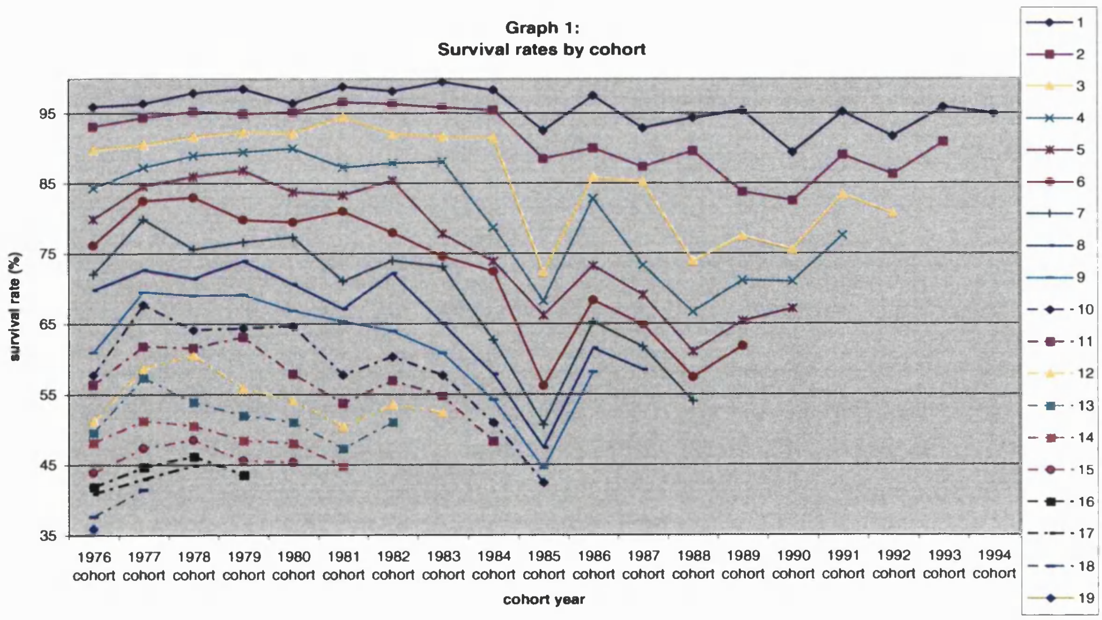
[33] The hazard rate would be calculated as [100%-(survival rate)].

Table 3a: Survival rate by yearly entry cohort

survival length (nb of years)	1976 cohort	1977 cohort	1978 cohort	1979 cohort	1980 cohort	1981 cohort	1982 cohort	1983 cohort	1984 cohort	1985 cohort	1986 cohort	1987 cohort	1988 cohort	1989 cohort	1990 cohort	1991 cohort	1992 cohort	1993 cohort	1994 cohort	average 1976-94	average 1976-79	average 1980-1988	average 1989-94
1	**95.82**	96.33	97.85	98.43	96.39	98.78	98.13	99.49	98.30	92.52	97.51	92.88	94.34	95.41	89.41	95.17	91.71	95.87	**94.96**	95.75	97.11	96.48	93.76
2	**93.08**	94.37	95.22	94.96	95.18	96.61	96.35	95.85	95.46	88.60	90.05	87.46	89.65	83.83	82.57	89.12	86.39	**90.96**		91.43	94.41	92.80	86.57
3	**89.78**	90.45	91.63	92.27	92.12	94.44	92.01	91.62	91.52	72.28	85.84	85.19	73.87	77.43	75.55	83.38	**80.68**			85.89	91.03	86.55	79.26
4	**84.18**	87.15	88.88	89.36	89.90	87.23	87.85	88.06	78.68	68.26	82.78	73.30	66.68	71.15	71.05	**77.56**				80.75	87.39	80.30	73.25
5	**79.89**	84.58	86.00	86.90	83.78	83.32	85.47	77.86	73.96	66.29	73.30	69.17	61.11	65.46	**67.26**					76.29	84.34	74.92	66.36
6	**76.15**	82.50	83.01	79.84	79.52	81.06	77.99	74.65	72.50	56.28	68.42	64.97	57.49	**61.90**						72.59	80.38	70.32	61.90
7	**71.96**	79.80	75.60	76.60	77.29	71.07	74.00	73.12	62.75	50.66	65.26	61.73	**54.01**							68.76	75.99	65.55	
8	**69.78**	72.58	71.41	73.91	70.62	67.16	72.13	65.04	57.84	47.41	61.53	**58.50**								65.66	71.92	62.53	
9	**60.88**	69.52	69.02	69.09	66.82	65.33	63.98	60.82	54.21	44.40	**58.18**									62.02	67.13	59.11	
10	**57.69**	67.69	64.11	64.39	64.69	57.78	60.32	57.68	50.94	**42.47**										58.78	63.47	55.65	
11	**56.37**	61.81	61.60	63.16	57.92	53.78	57.01	54.84	**48.39**											57.21	60.74	54.39	
12	**51.21**	58.63	60.53	55.88	54.12	50.39	53.53	**52.37**												54.58	56.56	52.60	
13	**49.45**	57.28	53.83	51.96	50.97	47.26	**50.98**													51.68	53.13	49.74	
14	**48.13**	51.29	50.60	48.49	48.10	**44.92**														48.59	49.63	46.51	
15	**43.96**	47.37	48.56	45.69	**45.41**															46.20	46.39	45.41	
16	**41.87**	44.68	46.17	**43.56**																44.07	44.07		
17	**40.88**	42.96	**44.86**																	42.90	42.90		
18	**37.58**	**41.37**																		39.48	39.48		
19	**35.82**																			35.82	35.82		

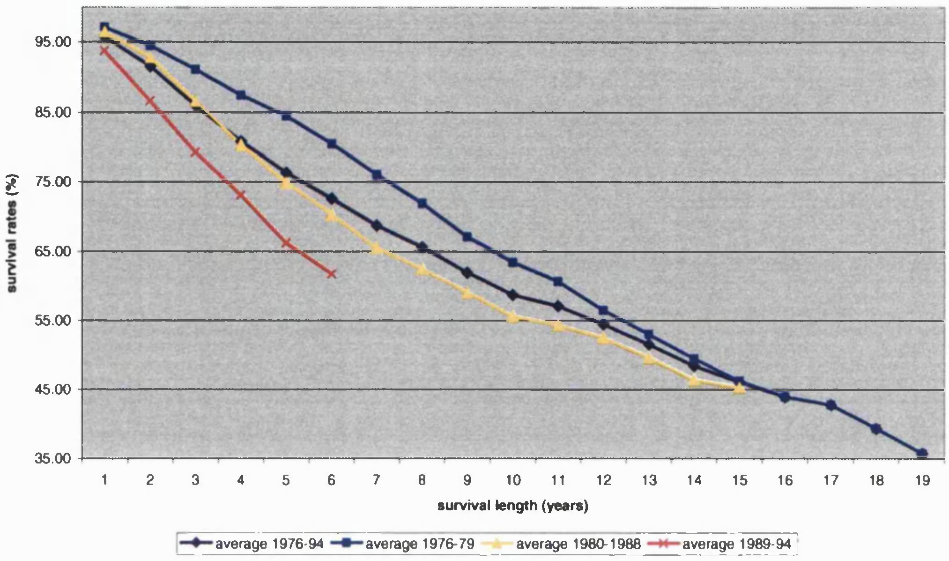
A plant entering in 1976 has 95.8% of chances to survive 1 year, 89.8% of chances to survive 3 years, almost 80% of chances to survive 5 years, 57.7% of chances to survive 10 years, and just over 35% of chances to survive 19 years.

Graph 1 shows the evolution of survival rates through cohorts. The line labelled "1" display the evolution of the one-year survival rate through cohorts, etc. At first sight, it seems that survival rates tends to decline over cohort-years: for example, a plant entering in 1976 had 57.7% of chances to survive 10 years, while a plant entering in 1985 only had 42.5% of chances to survive for the same length of time. One notable cohort is the 1985's cohort that seems to have very low survival rates. Part of it is probably due to the start of the liberalisation period (although survival rates started dropping before that in the early 1980s), but the bulk of it may again be due to plants "discovery" in 1985.



To obtain a smoother picture (graph 2), I calculate average survival rates for groups of cohorts. The graph titled "average 1976-94" display average survival rates of plants having entered between 1976 and 1994, the column titled "average 1976-79" display average survival rates of plants having entered between 1976 and 1979, etc.

Graph 2:
Average survival rates by groups of cohorts



The earlier the entry, the higher the chances of survival: for example, entering in the 1970s gives over 80% of chances to survive 6 years, against just over 70% of chances if entry occurred in the 1980s, and almost 62% of chances if entry occurred in the 1990s. Declining survival rates (or, correspondingly, increasing hazard rates) may stem from several factors. Firstly, if the number of entries increases (with decreasing barriers to entry and/or an increasing number of entrepreneurs), mechanically, the number of failures may increase. That is the "increasing competition" hypothesis. Secondly, it could be the case that plants entering late in the period are "pushed out" by incumbents (which may have acquired some sort of market power). Thirdly, the "quality" of entrants may have dropped over the period (less productive). These correspond to the "decreasing competition" hypothesis. This list of factors is not exhaustive and is complemented in chapter 6 when assessing the reasons for exit.

Table 3b gives annual aggregate distribution statistics on age and survival by cohort. Establishments present in the dataset in 1975 survived on average 16.8 years, and 50% of establishments did not survive up to the end of the period (1995). Among the 50% of establishments that exited the manufacturing sector before the end of the period, 50% survived less than 13 years, i.e. up to 1987. The rest of the survival figures shows that 50% of establishments entering between 1976 and 1988 exited before the end of the period in 1995. 25% of establishments entering between 1989 and 1992 exited before 1995. These figures underline that establishments turnover has been a striking feature of the sector over the entire period and raises of course the question of the impact of plant turnover on aggregate productivity growth.

Table 3b: Survival and age statistics by cohorts

survival

year of entry	mean	p5	p10	p25	p50	p75	p90	p95
1975	16.8	6	8	13	21	21	21	21
1976	16.4	6	8	13	20	20	20	20
1977	16.1	7	8	14	19	19	19	19
1978	15.4	7	8	13	18	18	18	18
1979	14.5	6	8	12	17	17	17	17
1980	13.8	6	8	12	16	16	16	16
1981	12.8	5	7	11	15	15	15	15
1982	12.3	6	7	11	14	14	14	14
1983	11.4	5	6	10	13	13	13	13
1984	10.3	4	5	9	12	12	12	12
1985	9.2	3	4	7	11	11	11	11
1986	9.0	4	5	9	10	10	10	10
1987	8.1	4	4	9	9	9	9	9
1988	7.0	3	3	7	8	8	8	8
1989	6.3	3	4	7	7	7	7	7
1990	5.5	3	4	6	6	6	6	6
1991	4.7	3	4	5	5	5	5	5
1992	3.8	2	3	4	4	4	4	4
1993	2.9	3	3	3	3	3	3	3
1994	2.0	2	2	2	2	2	2	2
1995	1.0	1	1	1	1	1	1	1

age

year of entry	mean	p5	p10	p25	p50	p75	p90	p95
1975	26.6	4	6	12	20	32	63	81
1976	18.2	1	3	6	13	20	37	78
1977	17.3	1	3	6	12	19	33	78
1978	17.8	1	3	6	12	19	37	78
1979	16.4	2	3	6	12	18	33	62
1980	16.1	1	3	6	11	17	31	72
1981	15.9	1	3	5	10	16	33	72
1982	15.2	1	3	6	10	16	29	63
1983	14.2	1	2	5	10	16	29	42
1984	14.2	1	2	5	9	15	28	54
1985	13.6	1	2	4	8	14	28	49
1986	11.6	1	2	4	7	12	22	38
1987	10.8	1	1	3	6	11	20	34
1988	9.7	1	1	3	6	10	19	31
1989	7.9	0	1	2	5	8	16	24
1990	7.8	0	1	2	4	8	16	24
1991	5.6	0	0	1	3	5	12	17
1992	4.6	0	0	1	2	4	10	16
1993	3.2	0	0	1	2	3	7	12
1994	2.4	0	0	0	1	2	6	10
1995	1.5	0	0	0	0	0	5	10

In terms of age, establishments enumerated in 1975 were on average 26.6 years old, 25% of establishments were under 12 years old, 50% were under 20 years old, and 25% were over 32 years old. A striking feature is that as time goes by, entrants become younger: establishments entering the medium- and large-scale manufacturing sector were on average 18.2 years old in 1976, 13.6 years old in 1985 and 1.5 year old in 1995 ; 50% of them were over 13 years old in 1976, against 8 years old in 1975 and brand new in 1995. This can broadly reflect two phenomena: (1) establishments spent less and less time in the small-scale sector before entering the medium- and large-scale manufacturing sector (2) the enumerator became more efficient over the years. The second explanation is for sure part of the story, and it is difficult to disentangle both causes. However, I can reasonably assume that the first explanation plays a role as well: the fact that entrants become younger with time means that (1) some small-scale establishments grow faster and are able to enter the medium- and large-scale manufacturing sector sooner than before, and that more and more establishments enter directly the medium- and large-scale manufacturing sector without going through the small-scale sector. This could have an impact on productivity if younger entrants are more productive than older ones. Furthermore, this could partly explain increasing exit rates over time: it may be the case that because establishments enter with less experience in the small-scale sector of the economy, their survival rate drops. In other words, it could be called a "growth crisis". This may partly be due to the liberalisation of the economy in the 1990s.

4.4 Establishments' size, age, and population distribution

4.4.1 General description

This part assesses the first set of questions for each of the historical sub-periods:

- Do large-scale establishments dominate the manufacturing sector? How does this evolve over time?
- Is there really a "missing middle", i.e. are medium-size plants under-represented? How does this evolve through time?

While those issues are intrinsically interesting, they are also central to the understanding of the competition processes at play in the Indonesian manufacturing sector.

I measure the size of establishments with gross output as well as number of workers. The difficult task is to choose size categories: what is small, medium or large? Goeltom (1995) uses the number of workers as a measure for size, calling small establishments those having less than 100 workers, medium establishments those having between 100 and 499 workers, and large establishments those having 500 or more workers. Using number of workers as a size measure is appealing because the scale is easy to grasp, and does not depend on currency deflators. Hayashi (2003, p.12) reviews the different size categorisation in Asia, and shows that Asian countries tend to treat SMEs as having less than 200 to 300 workers. He chooses 300 workers as a cut-off point, in order to include more plants than the Biro Pusat Statistik (Indonesian Central Census Bureau) definition would allow (cut-off point at 100 workers). I choose to keep Goeltom's categorisation, that, while reflecting US and Canadian standards, goes beyond Hayashi in the inclusion of plants in the SMEs category and might be more appropriate for the study of a population with number of workers per plant ranging from 1 to 116,052.

Labour is however only one input in the production process: capital-intensive establishments could appear smaller than they are, while labour-intensive establishments would appear larger. In the absence of accurate fixed assets figures for all plants, I choose to complement the employment figures with output figures.[34] For the output figures, I only display size distribution without having a clear-cut size categorisation.

[34] In chapter 2, I construct a series the log of capital stock for all plants and all years, however, transforming this measure into fixed assets levels would suffer from measurement errors that would bias any study on size distribution.

TABLE 4: Size distribution of establishments by year, employees and output

OUTPUT in thousand IDR 1983 constant prices

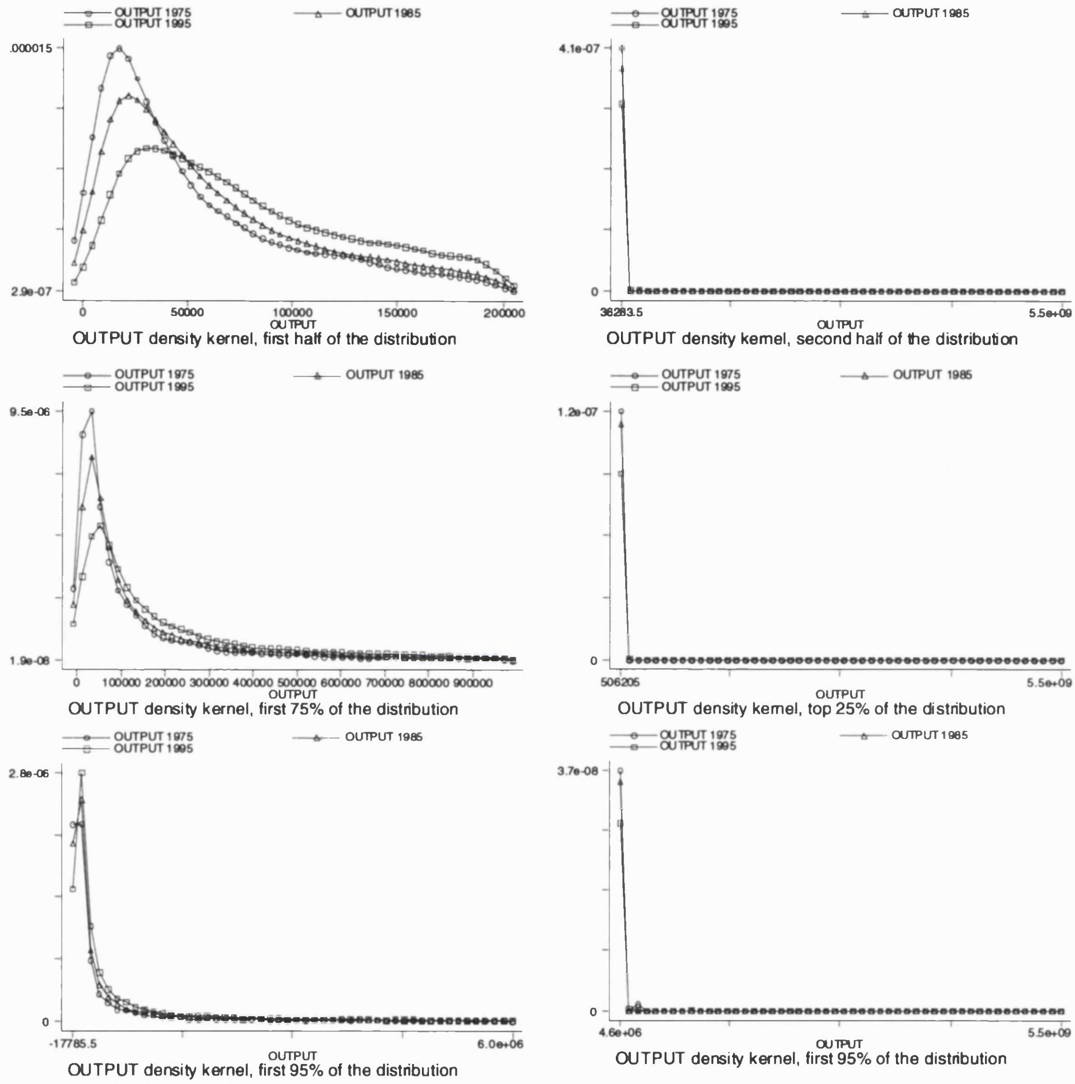
	mean	p1	p5	p10	p25	p50	p75	p90	p95	p99
1975	944112	2583	7024	11481	24003	65409	239444	1211039	3371889	15200000
1976	838450	2179	6101	10115	22671	60111	223341	1131989	3206766	13500000
1977	834781	1954	5736	9479	21580	59096	221283	1162600	3230843	14400000
1978	903026	2087	6329	10404	24071	64093	244788	1246122	3479326	15500000
1979	960714	2298	6532	11239	25234	67311	266526	1373545	3774715	16800000
1980	1079020	2778	7357	12133	26871	73677	299761	1515342	4038054	17700000
1981	1148101	2131	7401	12500	28414	79093	318579	1612686	4242121	17400000
1982	1161495	2431	8202	13364	30206	83098	328575	1629891	4403137	18800000
1983	1192229	2650	8600	14052	31744	86496	346077	1762062	4642954	18400000
1984	1258557	2909	8744	14566	32683	90175	364554	1891699	5012157	18900000
1985	1354550	3425	10673	16838	36272	98385	411198	2037587	5483248	20700000
1986	1526721	3462	10601	17218	38181	105500	441136	2316603	6095384	22600000
1987	2136763	2988	10029	16751	38215	106936	462903	2604983	6754851	29900000
1988	1844263	3959	12277	19696	42531	119032	523761	2803456	7041228	28100000
1989	2190206	5590	14568	22878	47621	139184	634455	3350960	8203897	34500000
1990	2384656	6755	16688	25341	50619	149853	703323	3526743	8509766	36900000
1991	2648322	6167	15791	25230	52966	167440	829599	4285415	9730009	41400000
1992	3006857	6002	16508	26133	57490	185765	957140	4951235	11400000	47100000
1993	3223824	7685	18620	29221	63820	201772	1005130	5397459	12200000	52200000
1994	3503872	7822	19190	30603	68325	209370	1023050	5768691	13900000	54300000
1995	3795568	8436	19736	30443	66723	201145	981334	5965662	14000000	59100000

WORKERS

	mean	p1	p5	p10	p25	p50	p75	p90	p95	p99
1975	98.3	12	19	20	24	34	66	176	368	1129
1976	106.6	10	17	20	24	34	69	190	372	1206
1977	104.8	8	15	20	23	34	69	192	381	1207
1978	105.9	8	15	19	23	33.5	72	199	400	1188
1979	108.6	11	15	19	23	34	74	211	418	1224
1980	115.0	10	15	19	23	35	76	222	444	1347
1981	116.2	10	15	20	24	35	79	230	470	1307
1982	116.9	10	15	19	23	35	77	231	485	1290
1983	115.9	10	15	20	23	34	76	234	477	1277
1984	117.0	10	15	20	23	34	75	232	476	1296
1985	117.8	20	20	21	24	36	79	233	464	1262
1986	118.4	12	18	20	24	35	80	235	462	1272
1987	121.6	11	17	20	24	35	82	238	474	1377
1988	127.9	20	21	21	25	37	88	258	495	1476
1989	141.8	20	21	22	25	39	98	288	574	1660
1990	147.1	20	21	22	25	40	103	302	609	1676
1991	160.5	20	21	22	26	41	112	342	673	1831
1992	168.7	20	21	22	26	42	119	361	711	1927
1993	175.8	20	21	22	26	43	122	379	727	2029
1994	179.5	20	21	22	26	44	123	382	756	2173
1995	185.0	20	21	22	26	43	123	386	742	2145

Table 4 displays the annual distribution of establishments in terms of output and number of workers. In terms of output, in 1975, the median establishment was 52 times smaller than an establishment of the top 5% of the size distribution. This discrepancy remained roughly constant until the recession, when it started to widen from a factor 54 in 1983 to a factor 70 in 1995. Comparatively, the spread between the top 25% and the top 5% of the size distribution remained constant over the period, with the former being roughly 14 times larger than the latter. The same is observed for the spread between the bottom 5% and the median (median plant 9 to 10 times larger than the bottom 5% of plants) and the spread between the bottom 25% and the median (median plant 3 times larger than the bottom 25%). The spread between the top 25% and the median increased slightly from a factor 4 to 5. The striking feature is that, while establishments of the bottom 5% of the size distribution are only 10 times smaller than the median establishment, establishments of the top 5% of the size distribution are 52 (1975) to 70 times (1995) larger than the median establishment. Extremely large establishments evidently represent a heavy weight.

Graphs 3: Output density kernels



Graph 3 presents size distribution of establishments in terms of output. Distributions are represented with density kernels rather than histograms: density kernels are the "continuous" version of histograms, they present smoother graphs and have the advantage of being independent of the choice of the origin. Because of the obvious huge difference in size between the top 5% and the rest, I choose to graph the size distribution of the first and second half of the entire distribution for the years 1975, 1985 and 1995. The first graph shows that over time, the size distribution of the first 50% of the entire size distribution becomes more heterogeneous (the distribution becomes flatter). While the bulk of establishments are small in 1975, their size increase and their number decrease over time, with more establishments in the right-hand tail of the distribution. The same phenomenon is observed when graphing the first 75% and first 95% of the entire distribution – although it is graphically less clear.

In other words, if I omit the extra-large establishments, the output-size structure of the manufacturing sector becomes more heterogeneous over time, with a drop in the dominance of small establishments in terms of numbers, and the possible emergence of a middle class of establishments.

Taking into account the extra-large establishments, the three right-hand side graphs of graph 3 display the size distribution of the top 50%, 25% and 5% of the entire distribution. The extremely narrow and abrupt left-hand picks followed by a very wide right-hand flat line show the particularly heterogeneous size composition of the top quantiles. One could argue that this flat line only represents outliers. Is this really the case?

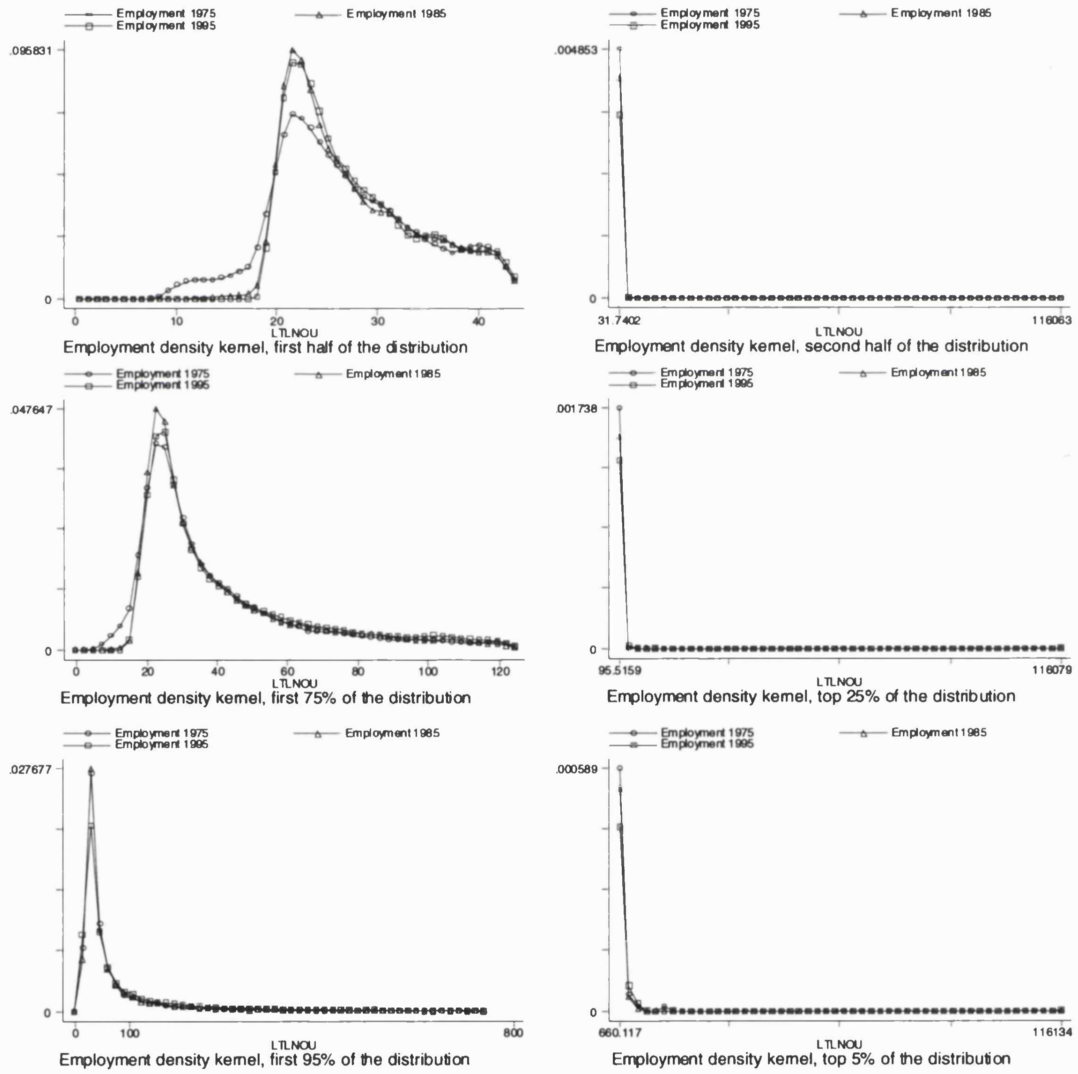
TABLE 5a: share in total output of each output size distribution quantile by year

Year/Quantile	0-5%	5-10%	10-25%	25-50%	50-75%	75-90%	90-95%	95-100%	total
1975	0.023	0.049	0.28	1.09	3.34	8.5	10.7	76.0	100
1976	0.022	0.048	0.29	1.15	3.51	9.2	11.7	74.1	100
1977	0.021	0.046	0.28	1.12	3.41	9.2	11.6	74.3	100
1978	0.021	0.047	0.28	1.13	3.45	9.4	11.6	74.1	100
1979	0.021	0.046	0.28	1.11	3.47	9.6	11.6	73.9	100
1980	0.021	0.046	0.27	1.08	3.48	9.5	11.3	74.3	100
1981	0.018	0.044	0.26	1.08	3.46	9.5	11.4	74.2	100
1982	0.020	0.047	0.28	1.13	3.56	9.5	11.7	73.8	100
1983	0.021	0.048	0.28	1.14	3.66	10.0	12.0	72.8	100
1984	0.020	0.046	0.28	1.12	3.65	10.0	12.4	72.5	100
1985	0.023	0.051	0.29	1.14	3.77	10.3	12.3	72.1	100
1986	0.020	0.045	0.27	1.07	3.62	10.2	12.3	72.5	100
1987	0.013	0.031	0.19	0.77	2.66	7.9	9.7	78.7	100
1988	0.020	0.043	0.25	1.00	3.49	10.2	12.1	72.8	100
1989	0.020	0.043	0.24	0.96	3.48	10.3	12.1	72.9	100
1990	0.022	0.044	0.24	0.94	3.48	10.3	11.7	73.3	100
1991	0.019	0.039	0.22	0.92	3.62	11.1	12.1	72.0	100
1992	0.017	0.036	0.20	0.89	3.61	11.2	12.6	71.4	100
1993	0.019	0.037	0.21	0.92	3.59	11.3	12.8	71.1	100
1994	0.018	0.036	0.21	0.89	3.36	11.0	12.9	71.6	100
1995	0.017	0.033	0.19	0.79	2.98	10.0	12.1	73.9	100

To have a clearer opinion on the dominance of large-scale establishments, let us look at Table 5a, displaying the share in total output of each output size distribution quantile by year. In 1975, the bottom 5% of the size distribution represented 0.023% of total output of the manufacturing sector, while the top 5% of the size distribution represented 76% of the same total output! This last figure dropped to 71.1% in 1994 but rose again to 73.9% in 1995. The smaller half of establishments accounted for 1.4% of total output in 1975 against just over 1% in 1995, while the larger half accounted for the rest. This clearly demonstrates the persistent dominance of large establishments in the Indonesian manufacturing sector in terms of output. This again raises the issue of the level of competition in the Indonesian manufacturing sector.

Is the picture exactly the same in terms of employment? In table 4, similarly to output figures, the median size of establishments in terms of number of workers increases over the period from 34 in 1975 to 43 in 1995. Referring to Goeltom's size classification, 75% of all establishments are small until 1989, and at least 50% of all establishments are small for the period 1990-95. In 1975, the median establishment is at least 11 times smaller than the top 5% of the size distribution in terms of number of workers. This increases to the factor 17 in 1995. In spite of an identical trend, the discrepancy is less spectacular than for output figures, already suggesting a wide dispersion of productivity.

Graph 4 : Employment density kernels



Graph 4 displays the employment-size distribution of the manufacturing sector. The dynamics of the size distribution of the first half of the entire distribution shows a homogeneisation of the manufacturing sector (size convergence). The same phenomenon is observed for the first 75% of the distribution but only up to mid-period – 1985 – date after which the size-distribution diverges slightly again. However, for this chunk of the distribution, as well as for the first 95% of the size distribution, the size convergence phenomenon is rather limited, given the very long right-hand tail of the distributions. This is further emphasised by the three right-hand graphs displaying the top 50%, 25% and 5% of the size distribution.

In summary, the study of establishments' size distribution dynamics shows that the manufacturing sector is becoming more heterogeneous. At the start of the period, small establishments dominate in terms of number, but large and extra-large establishments dominate in terms of output and employment, while there seems to be a "missing middle". At the end of the period, small establishments dominate less in terms of numbers, with the possible emergence of a "manufacturing middle class", but large and extra-large establishments still dominate in terms of output and employment.

TABLE 5b: share in total employment of each employment size distribution quantile by year

Year/Quantile	0-5%	5-10%	10-25%	25-50%	50-75%	75-90%	90-95%	95-100%	total
1975	0.92	0.83	3.8	7.0	11.5	16.1	12.7	47.2	100
1976	0.64	1.06	3.6	6.1	11.0	15.6	12.2	49.9	100
1977	0.55	1.49	2.8	6.6	10.8	15.9	12.7	49.2	100
1978	0.64	0.76	3.3	6.1	11.5	16.2	13.0	48.6	100
1979	0.64	0.75	3.1	6.3	11.3	16.6	13.3	48.1	100
1980	0.62	0.67	2.8	6.3	10.8	16.4	13.6	48.8	100
1981	0.59	1.29	2.8	5.5	11.0	17.1	14.0	47.7	100
1982	0.61	0.71	2.8	6.1	10.6	16.9	14.1	48.2	100
1983	0.59	1.46	2.2	5.8	10.6	17.0	14.3	48.0	100
1984	0.58	1.37	2.4	5.7	10.4	16.5	14.0	49.1	100
1985	0.85	1.00	2.9	6.3	10.8	17.0	13.8	47.4	100
1986	0.63	0.83	3.3	5.5	11.0	17.0	13.6	48.1	100
1987	0.62	1.02	3.1	5.2	10.8	17.1	13.6	48.6	100
1988	1.59	0.00	3.2	5.3	10.8	17.5	13.8	47.8	100
1989	1.25	0.80	2.1	5.2	10.6	17.7	14.1	48.4	100
1990	1.17	0.78	2.0	5.3	10.5	17.7	14.3	48.3	100
1991	0.99	0.69	2.2	4.6	10.4	18.3	14.6	48.2	100
1992	0.96	0.61	2.1	4.5	10.1	18.4	14.8	48.4	100
1993	0.83	0.54	2.0	4.6	10.1	18.1	14.9	48.8	100
1994	0.92	0.56	1.9	4.5	9.9	18.2	14.9	49.1	100
1995	0.91	0.56	1.8	4.2	9.7	17.5	14.5	50.8	100

Table 5b shows that the bottom half of establishments represent 12.5% (1975) to 7.5% (1995) of total employment: Even though small establishments have a heavier weight in terms of number of workers than in terms of output, and in spite of their very large number, they still represent a small share of economic activity.

Furthermore, reasoning in terms of establishments rather than in terms of companies underestimate the dominance of large-scale entities. Indeed, small establishments may belong to larger groups and add to the already huge size of the very large sector of Indonesian manufacturing.[35]

After having clearly made the point that large-scale establishments dominate the manufacturing sector both in terms of output and employment, while small-scale establishments dominate the sector in terms of the number of establishments, let us have a closer look at the "missing middle" hypothesis.

As a first approach, following Goeltom (1995), let us define medium-size establishments as establishments having between 100 and 499 workers.

Table 6 shows clearly that small-scale establishments dominate the sector in terms of number, although this dominance tends to reduce over time: in 1975, small-scale establishments represented over 82% of all establishments, against nearly 71% in 1995. All other three size categories saw their share in the number of establishments rise over the period: in 1975 medium, large and extra large (over 2,000 workers) establishments accounted for 14%, 3% and 0.3% of total establishments, against shares of 21.4%, 6.5% and 1.2% respectively. Clearly, in terms of number of establishments, the "missing middle" starts to emerge, but the share of large and extra large establishments continues to grow.

Of course, the reduction in the number of small-scale establishments results in lower shares in output and employment: in 1975, this size category represented 16.4% of total output and 30.2% of total employment, against 6.9% and 14.7% respectively in 1995.

Although medium-scale establishments grew in numbers over the period, their share in total output and employment dropped from respectively 43.1% and 29.8% in 1975, to 26.2% and 25.5% in 1995.

On the other hand of course, the output and employment share of large and extra-large scale establishments shoots up.

[35] Here I could possibly use 1996 data determining whether or not an establishment is part of a group. However, this would not allow assessing the actual size of these groups.

Table 6: shares of plant size categories in total number of plants, total output, and total employment

YEAR	share of small plants in total nb of plants	share of medium plants in total nb of plants	share of large plants in total nb of plants	share of extra-large plants in total nb of plants
1975	82.5	14.1	3.1	0.3
1976	81.9	14.4	3.3	0.3
1977	81.9	14.3	3.5	0.3
1978	81.2	14.9	3.6	0.3
1979	80.7	15.2	3.7	0.3
1980	80.3	15.3	4.1	0.4
1981	79.4	15.9	4.3	0.4
1982	79.7	15.5	4.4	0.4
1983	79.8	15.5	4.4	0.4
1984	80.2	15.0	4.4	0.4
1985	79.3	16.0	4.3	0.4
1986	79.1	16.4	4.2	0.4
1987	78.5	16.7	4.3	0.4
1988	77.2	17.8	4.5	0.5
1989	75.2	19.0	5.1	0.7
1990	74.1	19.7	5.4	0.7
1991	72.5	20.7	6.0	0.8
1992	71.5	21.2	6.3	0.9
1993	71.0	21.4	6.6	1.0
1994	70.6	21.6	6.6	1.2
1995	70.9	21.4	6.5	1.2

YEAR	share of small plants in total output	share of medium plants in total output	share of large plants in total output	share of extra-large plants in total output
1975	16.4	43.1	29.7	10.8
1976	16.8	40.6	31.9	10.7
1977	17.0	35.9	35.8	11.3
1978	16.7	35.9	35.5	11.9
1979	16.1	33.7	36.7	13.5
1980	15.0	32.1	37.7	15.2
1981	13.8	32.4	37.8	16.0
1982	14.2	31.9	37.8	16.1
1983	14.2	32.6	34.0	19.2
1984	13.9	32.1	33.3	20.7
1985	14.4	31.5	35.2	18.8
1986	12.9	33.2	32.9	20.9
1987	9.8	31.9	28.5	29.9
1988	12.1	31.8	33.5	22.7
1989	11.6	28.7	33.5	26.2
1990	10.9	30.1	32.2	26.9
1991	10.7	29.0	35.0	25.3
1992	10.2	29.3	35.7	24.8
1993	9.1	28.2	36.7	26.0
1994	7.5	27.6	35.1	29.7
1995	6.9	26.2	35.6	31.2

YEAR	share of small plants in total employment	share of medium plants in total employment	share of large plants in total employment	share of extra-large plants in total employment
1975	30.2	29.8	28.3	11.7
1976	27.5	28.2	28.4	15.9
1977	27.6	28.3	30.3	13.8
1978	26.9	29.1	30.6	13.3
1979	26.4	29.4	30.7	13.5
1980	25.1	28.4	31.8	14.8
1981	24.5	29.0	32.6	13.9
1982	24.3	28.4	33.9	13.4
1983	24.2	28.6	33.9	13.3
1984	24.2	27.4	32.8	15.5
1985	25.0	29.0	32.3	13.7
1986	24.2	29.4	31.7	14.8
1987	23.2	28.9	32.5	15.3
1988	22.6	29.7	31.7	16.0
1989	20.0	28.6	33.1	18.3
1990	19.0	28.4	33.7	18.9
1991	17.3	28.1	34.7	19.9

The figures show clearly that in terms of number of establishments, small establishments dominate, while large and extra large establishments have a growing dominance in terms of output and employment. In terms of number of establishments, the "missing middle" seems to emerge, but seems to loose in importance in terms of output and employment. If, as the theoretical literature suggests, the medium-size establishments are the most productive, the disappearance of such a category could have adverse effects on the aggregate productivity growth of the manufacturing sector.

4.4.2 Entrants, incumbents, and exiters

In order to refine the analysis, I examine the three following sub-groups: entrants (establishments entering the medium- and large-scale manufacturing sector in the current year), incumbents (establishments which entered at least the previous year), and exiters (establishments exiting the sector at the end of the current year).

Table 7a: Size distribution statistics (gross output) of entrants, exitors and incumbents by year

average output (constant IDR 1983)

YEAR	entrants	incumbents	exiters	size discrepancy incumbent-entrants as a% of incumbents	size discrepancy incumbent-exiters as a% of incumbents	size discrepancy entrants-exiters as a% of entrants
1976	552579	885289	145092	38%	84%	74%
1977	383900	890482	238845	57%	73%	38%
1978	640530	945824	175232	32%	81%	73%
1979	481947	1036491	485859	54%	53%	-1%
1980	548973	1193839	161606	54%	86%	71%
1981	478800	1253062	309283	62%	75%	35%
1982	469612	1272022	246639	63%	81%	47%
1983	348655	1317198	366423	74%	72%	-5%
1984	445637	1501061	135443	70%	91%	70%
1985	484339	1560005	1072987	69%	31%	-122%
1986	600658	1623847	434926	63%	73%	28%
1987	723387	2431246	724996	70%	70%	0%
1988	538326	2099431	567470	74%	73%	-5%
1989	758135	2343105	1337756	68%	43%	-76%
1990	1180341	2772564	882167	57%	68%	25%
1991	1026220	2948074	1428215	65%	52%	-39%
1992	1324502	3319571	1212916	60%	63%	8%
1993	1019592	3572945	924429	71%	74%	9%
1994	1017900	3901998	995820	74%	74%	2%

median output (constant IDR 1983)

YEAR	entrants	incumbents	exiters	size discrepancy incumbent-entrants as a% of incumbents	size discrepancy incumbent-exiters as a% of incumbents	size discrepancy entrants-exiters as a% of entrants
1976	57911	61824	27802	6%	55%	52%
1977	51063	61671	21153	17%	66%	59%
1978	64564	66293	21143	3%	68%	67%
1979	75348	69395	36600	-9%	47%	51%
1980	73288	78903	30956	7%	61%	58%
1981	57287	85599	30030	33%	65%	48%
1982	64418	88291	33635	27%	62%	48%
1983	55351	94500	37424	41%	60%	32%
1984	58823	113600	27548	48%	76%	53%
1985	56554	114067	97282	50%	15%	-72%
1986	82783	110353	53336	25%	52%	36%
1987	89253	121946	46318	27%	62%	48%
1988	82958	132739	57549	38%	57%	31%
1989	99255	144301	94299	31%	35%	5%
1990	108620	172254	91529	37%	47%	16%
1991	119180	183370	97755	35%	47%	18%
1992	123148	201814	109381	39%	46%	11%
1993	119000	223636	84557	47%	62%	29%
1994	108561	230588	122185	53%	47%	-13%

In terms of output, the average entrant is about 38% (1976) to 74% (1994) smaller than the average incumbent, while the median entrant is 6% (1976) to 54% (1994) smaller than the median incumbent. This suggests that, at the beginning of the period, size distribution of entrants was more heterogeneous than at the end of the period: the population of entrants becomes relatively homogeneous and small-sized relatively to incumbents.

If entrants become a lot smaller than incumbents, and the group of small entrants becomes more homogeneous in terms of size, this could be part of the explanation for relatively lower survival rates and an increase in exit rates. It could be the case that the increased size discrepancy between entrants and incumbents prevent entrants to compete with incumbents for several different reasons: lack of economies of scale, lower efficiency, or facing other uncompetitive barriers to growth.

On the other hand, the size discrepancy between incumbents and exiters remains pretty constant over time: on average over the period 1976-94, the average exiter is 69% smaller than the average incumbent, and the median exiter is 54% smaller than the median incumbent. This suggests that exiters are be small entrants that did not manage to grow or to become efficient.[36] This is supported by the fact that the median exiter is on average 32% smaller than the median entrant, although the gap between the size of the median exiter and the median entrant tend to reduce over time. The difference between the average exiter and the average entrant is a lot more erratic, but the gap between the two groups tends to reduce over time as well.

[36] The reasons for exit will be examined in further details later in chapter 6.

Table 7b: Size distribution statistics (number of workers) of entrants, exitors and incumbents by year

average employment (number of workers)

YEAR	entrants	incumbents	exiters	size discrepancy incumbent-entrants as a% of incumbents	size discrepancy incumbent-exiters as a% of incumbents	size discrepancy entrants-exiters as a% of entrants
1976	67	112	40	40%	64%	41%
1977	41	111	62	63%	44%	-49%
1978	57	112	46	49%	59%	20%
1979	49	116	72	58%	38%	-46%
1980	62	125	51	50%	59%	19%
1981	56	125	58	55%	54%	-4%
1982	57	126	54	54%	57%	6%
1983	45	126	68	64%	46%	-51%
1984	49	137	27	64%	80%	45%
1985	50	134	105	63%	22%	-110%
1986	54	125	59	57%	53%	-9%
1987	54	134	68	59%	49%	-26%
1988	61	141	69	57%	51%	-15%
1989	76	148	116	49%	22%	-51%
1990	82	166	83	51%	50%	-2%
1991	75	176	97	57%	45%	-29%
1992	80	183	100	56%	45%	-25%
1993	65	191	95	66%	50%	-46%
1994	78	195	97	60%	50%	-25%

median employment (number of workers)

YEAR	entrants	incumbents	exiters	size discrepancy incumbent-entrants as a% of incumbents	size discrepancy incumbent-exiters as a% of incumbents	size discrepancy entrants-exiters as a% of entrants
1976	25	35	26	29%	26%	-4%
1977	25	35	23	29%	34%	8%
1978	25	35	24	29%	31%	4%
1979	25	36	28	31%	22%	-12%
1980	25	38	26	34%	32%	-4%
1981	24	38	26	37%	32%	-8%
1982	24	37	25	35%	32%	-4%
1983	23	37	25	38%	32%	-9%
1984	23	40	17	43%	58%	26%
1985	25	40	36	38%	10%	-44%
1986	26	37	27	31%	28%	-4%
1987	26	39	23	33%	41%	12%
1988	26	41	26	37%	37%	0%
1989	29	41	29	30%	29%	-2%
1990	26	44	30	41%	32%	-15%
1991	28	44	32	36%	27%	-14%
1992	28	45	31	38%	31%	-11%
1993	26	47	31	45%	34%	-19%
1994	26	47	30	45%	36%	-15%

The same exercise using number of employees lead to similar conclusions: incumbents are larger than entrants, and become relatively larger over time, exiters are smaller than incumbents, the average exiter becomes smaller over time relatively to the average incumbent, while the median exiter becomes larger over time relatively to the median incumbent.

The main difference between output and employment figures concerns the gap between entrants and exiters: in terms of output, exiters are generally smaller than entrants, but in terms of workers, entrants turn out to be generally smaller than exiters. This suggests that the average and median entrants display a higher labour productivity than the average and median exiter: one reason for exit could be this lower productivity. This issue is investigated further when looking at TFP levels of entrants, incumbents and exiters.

Let us now focus on the size distribution of establishments in terms of number of workers. Most entrants are small (about 90% have less than 100 workers), the rest being medium-sized (about 10% have between 100 and 500 workers), and entry of large establishments is marginal. The same is true for exiters, however, while entrants become smaller over time, exiters become larger. This suggests that entrants remain in the manufacturing sector for a while, grow, and eventually exit, but over the period, establishments grow more rapidly. Finally, incumbents are larger than entrants or exiters, but small establishments still dominate in terms of number of establishments.

TABLE 8: Age distribution of entrants, exitors and incumbents by year

entrants

YEAR	average	p10	p25	p50	p75	p90	p95	p99
1975	16.85	1	4	11	21	42	75	75
1976	9.49	0	0	3	12	23	57	76
1977	9.04	0	0	2	8	22	58	77
1978	9.64	0	0	3	10	26	60	78
1979	9.39	0	1	3	9	24	49	79
1980	9.20	0	0	3	10	23	45	80
1981	9.34	0	1	3	9	24	58	81
1982	9.06	0	1	3	9	22	47	82
1983	8.75	0	1	3	10	23	33	83
1984	9.03	0	1	4	10	22	34	84
1985	8.80	0	1	3	10	22	35	85
1986	7.34	0	0	2	7	18	29	86
1987	7.01	0	0	2	7	17	27	87
1988	6.58	0	0	2	7	15	27	88
1989	5.11	0	0	1	5	13	22	89
1990	5.40	0	0	1	5	13	22	90
1991	3.71	0	0	1	3	10	15	78
1992	3.14	0	0	0	2	8	14	49
1993	2.17	0	0	0	2	6	11	23
1994	1.91	0	0	0	1	5	10	24
1995	1.49	0	0	0	0	5	10	24

exitors

YEAR	average	p10	p25	p50	p75	p90	p95	p99
1975	10.37	1	3	7	16	23	27	52
1976	11.18	1	4	7	16	25	36	54
1977	12.71	2	4	9	19	25	32	55
1978	13.25	2	6	10	18	26	29	57
1979	14.26	3	5	9	19	28	40	79
1980	16.30	3	7	12	22	30	42	80
1981	18.31	4	8	14	24	33	51	81
1982	17.50	4	8	12	23	31	48	82
1983	18.64	5	8	13	26	33	48	83
1984	21.08	6	10	17	27	36	54	84
1985	12.76	1	4	9	16	28	34	85
1986	13.13	2	4	8	16	28	36	86
1987	15.76	3	6	11	20	31	40	87
1988	15.42	2	5	11	20	34	40	88
1989	16.37	2	6	11	20	34	41	89
1990	15.34	2	5	11	20	34	42	90
1991	14.50	2	5	10	19	32	40	91
1992	14.54	1	3	9	19	33	43	92
1993	16.68	2	4	11	21	37	61	93
1994	16.50	2	4	9	20	38	75	94
1995	16.15	1	4	10	20	36	60	95

incumbents

YEAR	average	p10	p25	p50	p75	p90	p95	p99
1976	18.35	2	5	13	23	46	76	76
1977	18.71	3	6	13	23	46	77	77
1978	19.12	3	6	13	24	46	78	78
1979	19.75	4	7	13	24	49	79	79
1980	20.10	4	7	13	25	49	80	80
1981	20.16	4	7	13	25	49	81	81
1982	20.23	4	7	12	25	48	82	82
1983	20.27	3	7	13	25	48	83	83
1984	19.97	4	7	13	24	48	84	84
1985	19.88	3	7	13	25	48	85	85
1986	19.19	3	6	12	24	43	86	86
1987	19.84	3	7	13	24	45	87	87
1988	20.07	4	7	13	24	44	88	88
1989	19.54	3	7	13	23	41	87	89
1990	19.77	3	7	13	23	41	89	90
1991	19.37	2	6	13	22	41	85	91
1992	18.78	2	6	12	22	41	81	92
1993	18.31	2	5	12	22	40	75	93
1994	18.01	2	5	12	22	39	73	94

In terms of age, entrants become younger over time, and are of course younger than exiters.[37] This suggests that entrants spend less and less time in the small-scale sector (under 20-employees), and/or that the enumerator becomes more efficient. For example, in 1976, 25% of entrants were brand new, against 75% of them in 1995.

On the other hand, exiters become older with time, suggesting that survival tend to lengthen, and/or that old establishments are more likely to exit in the second half of the period, corresponding roughly to the deregulation- and post-deregulation period. In 1975, the average exiter was just over 10 years, against 16 years in 1995.

It is however noticeable that the trend can be dichotomised into two sub-periods: 1975-1984, and 1985-95: the average age of exiters increased from 10 to 21 during the first period, dropped to almost 13 years in 1985, only to increase again up to 16 years in 1995. The 1984-85 period is characterised by a strong recovery of the economy after the 1981-83 recession, with a high rate of entries and exits. It could be the case that recession triggered this establishment turnover with a lag, the recession hitting the youngest establishments harder, as it is shown in the survival statistics in Table 9. The age distribution of incumbents remains roughly the same, with 50% of establishment being less than 12 to 13 years old. Since the age distribution of exiters and incumbents do not differ greatly, it is probably the case that age is not crucial in the decision to exit. This will however have to be assessed more precisely.

In summary, medium sized establishments increased in numbers, but their share in total output and employment decreased. Furthermore, this phenomenon is accompanied by an increase in the share of large and extra-large establishments both in terms of output and employment, at the expenses of the small and medium-scale sector. This means that the so-called "missing middle" starts to emerge in terms of number of establishments but not in terms of output or employment where its share drops substantially. By no means does this imply the end of the dominance of large-scale establishments, on the contrary. Rather than a movement towards market homogeneisation, it seems that the sector becomes more heterogeneous and experiences an increase in the dominance of large and extra large entities.

What are the implications of industrial demography in terms of productivity and productivity growth?

[37] I recall here that age is independent from the date of entry in the dataset, as birth date is defined as the year in which the establishment started operations.

4.5 Total Factor Productivity distribution and dynamics

After having provided a detailed demographic picture of the Indonesian manufacturing sector over a 20-year period, I can now turn to the core issue of this chapter: the descriptive study of productivity distribution and its dynamics.

I use TFP figures estimated at the establishment level in chapter 2, TFP is expressed in logarithm. [38] Table 9 displays annual TFP distribution of entrants, incumbents and exiters.

TABLE 9: TFP summary statistics of entrants, incumbents, and exiters, by year

	average TFP				median TFP				standard deviation TFP		
YEAR	entrants	incumbents	exiters	gap entrant-incumbents as % of entrants	entrants	incumbents	exiters	gap entrant-incumbents as % of entrants	entrants	incumbents	exiters
1975			1.27				1.18				0.49
1976	1.42	1.38	1.28	3%	1.33	1.29	1.19	3%	0.49	0.44	0.53
1977	1.41	1.39	1.23	2%	1.32	1.29	1.16	3%	0.42	0.46	0.43
1978	1.47	1.41	1.24	4%	1.37	1.31	1.17	4%	0.47	0.46	0.41
1979	1.45	1.38	1.34	5%	1.36	1.29	1.25	5%	0.46	0.42	0.45
1980	1.47	1.39	1.30	5%	1.38	1.31	1.21	6%	0.43	0.41	0.37
1981	1.47	1.41	1.31	4%	1.38	1.33	1.24	3%	0.43	0.42	0.36
1982	1.46	1.42	1.37	2%	1.39	1.34	1.28	4%	0.39	0.42	0.41
1983	1.44	1.41	1.38	2%	1.38	1.34	1.30	3%	0.37	0.39	0.36
1984	1.46	1.42	1.42	3%	1.38	1.35	1.32	2%	0.44	0.38	0.44
1985	1.45	1.44	1.48	0%	1.37	1.37	1.36	0%	0.43	0.40	0.49
1986	1.51	1.46	1.46	3%	1.44	1.38	1.33	4%	0.40	0.39	0.52
1987	1.48	1.44	1.41	3%	1.41	1.37	1.32	3%	0.38	0.38	0.42
1988	1.47	1.45	1.42	2%	1.39	1.38	1.34	1%	0.42	0.37	0.46
1989	1.51	1.47	1.48	2%	1.42	1.39	1.36	2%	0.45	0.39	0.44
1990	1.55	1.49	1.53	4%	1.44	1.41	1.41	2%	0.48	0.38	0.48
1991	1.49	1.50	1.51	-1%	1.44	1.42	1.42	1%	0.44	0.39	0.45
1992	1.54	1.54	1.56	1%	1.47	1.44	1.45	2%	0.42	0.41	0.45
1993	1.54	1.55	1.51	-1%	1.48	1.46	1.41	1%	0.41	0.40	0.46
1994	1.51	1.56	1.59	-3%	1.44	1.47	1.48	-2%	0.39	0.39	0.47
1995	1.58				1.47				0.45		

Let us first compare the median TFP of the three categories of establishments. In most cases, exiters display a TFP lower than the TFP of entrants and incumbents: establishments with the lowest TFP exit the market, supporting the hypothesis of the existence of competitive market forces. Only in two cases (1992 and 1994) do exiters exhibit a slightly higher TFP than incumbents. If I now turn to average figures, exiters surprisingly display higher TFP than incumbents for 1985 and from 1989 to 1994 with the exception of 1993. Standard deviation figures for exiters' TFP are higher than the TFP standard deviation figures for incumbents, explaining the discrepancy between average and median results: exit is not a "clean" process, and even less so in the 1990s. In order to have a clearer view on these average results, there may be a need to distinguish among different sub-sectors of the economy for those years (1985, 1989-92 and 1994).

[38] In the remaining of the thesis, I use TFP measures calculated at the plant level using elasticities calculated at the 2-digit level.

TABLE 10: average TFP of entrants, exitors and incumbents by industry for selected years

	1985			1989			1990		
	entrants	exiters	incumbents	entrants	exiters	incumbents	entrants	exiters	incumbents
31 - Food, beverages and tobacco	1.35	1.30	1.38	1.41	1.39	1.40	1.47	1.38	1.44
32 - Textile, garments and leather	1.50	1.54	1.44	1.54	1.47	1.51	1.63	1.68	1.51
33 - Wood products	1.51	1.52	1.52	1.50	1.58	1.53	1.51	1.54	1.55
34 - Paper, printing & publishing	1.45	1.46	1.49	1.53	1.43	1.49	1.59	1.49	1.53
35 - Chemicals, rubber & plastic	1.40	1.51	1.50	1.54	1.52	1.49	1.50	1.49	1.51
36 - Non-metallic minerals	1.51	1.52	1.47	1.56	1.44	1.48	1.56	1.54	1.51
37 - Basic metals	1.40	1.58	1.41	1.46	2.60	1.50	1.43	1.83	1.53
38 - Metal products & machinery	1.50	1.59	1.48	1.57	1.54	1.48	1.52	1.50	1.51
39 - Other manufacturing	1.50	1.71	1.53	1.60	1.47	1.54	1.67	1.54	1.58

	1991			1992			1994		
	entrants	exiters	incumbents	entrants	exiters	incumbents	entrants	exiters	incumbents
31 - Food, beverages and tobacco,	1.42	1.36	1.44	1.49	1.40	1.46	1.46	1.47	1.50
32 - Textile, garments and leather	1.53	1.66	1.52	1.63	1.68	1.59	1.63	1.74	1.63
33 - Wood products	1.50	1.56	1.56	1.51	1.53	1.56	1.45	1.53	1.53
34 - Paper, printing & publishing	1.49	1.61	1.55	1.52	1.57	1.57	1.63	1.61	1.60
35 - Chemicals, rubber & plastic	1.53	1.44	1.52	1.53	1.55	1.54	1.53	1.63	1.58
36 - Non-metallic minerals	1.55	1.50	1.52	1.49	1.63	1.53	1.49	1.59	1.55
37 - Basic metals	1.28	1.45	1.51	1.47	1.74	1.46	1.45	1.25	1.59
38 - Metal products & machinery	1.49	1.49	1.51	1.55	1.59	1.55	1.48	1.59	1.57
39 - Other manufacturing	1.44	1.50	1.60	1.47	1.51	1.65	1.55	1.68	1.64

Table 10 shows that all industries but one (31: food, beverages and tobacco) experience at best two years (33: wood products, 34: paper, printing and publishing) and at worse five years (32: textile, garments and leather) where the average exiter is more productive than the average incumbent. This feature seems symptomatic of the post-liberalisation period, when exiters heterogeneity in terms of TFP booms. This suggests first that the period could be split in two: pre- and post-liberalisation period.[39] Secondly, it could be the case that in the post-liberalisation period, gross exit reduces TFP growth. Finally, this could suggest that exits occurring during the post-liberalisation period have other causes than low productivity. It will be interesting to have a closer look at the nature of the reforms in1986-1988, as well as at the investment boom phenomenon after the reforms to start isolating the potential causes for exit.

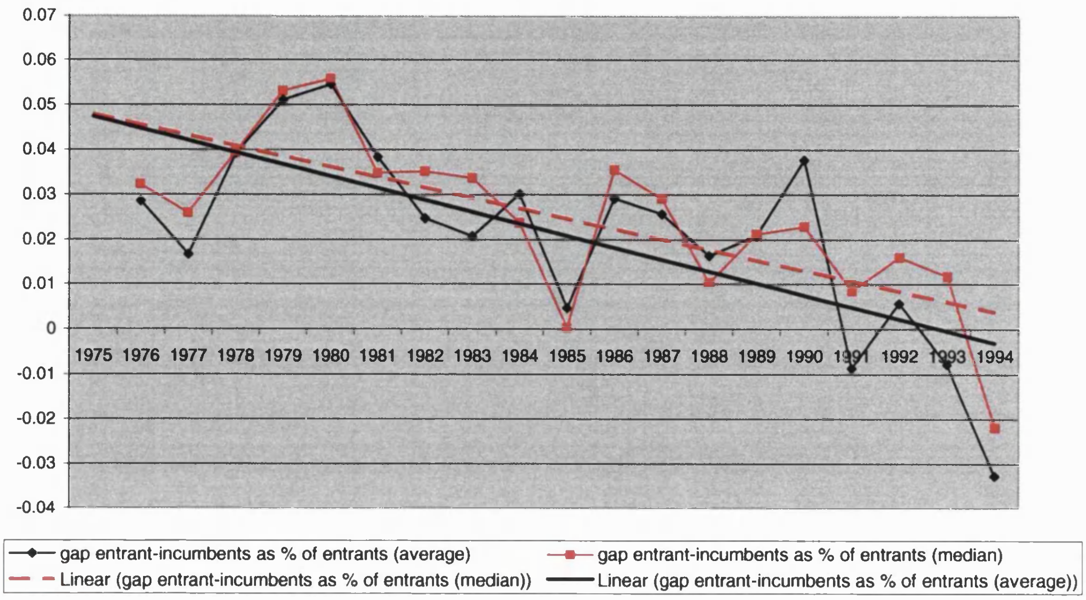
Another striking feature is that entrants display higher average and median TFP than incumbents.[40] This suggests that gross entry should have a positive effect on aggregate TFP growth and incumbents TFP should increase over time.

---

[39] I do not here suggest that liberalisation is the cause for different behaviours of establishments in terms of productivity, this will have to be assessed closely.

[40] The only exceptions are 1991, 1993 (average) and 1994 (average and median).

Graph 5: TFP gap between entrants and incumbents as a % of entrants' TFP

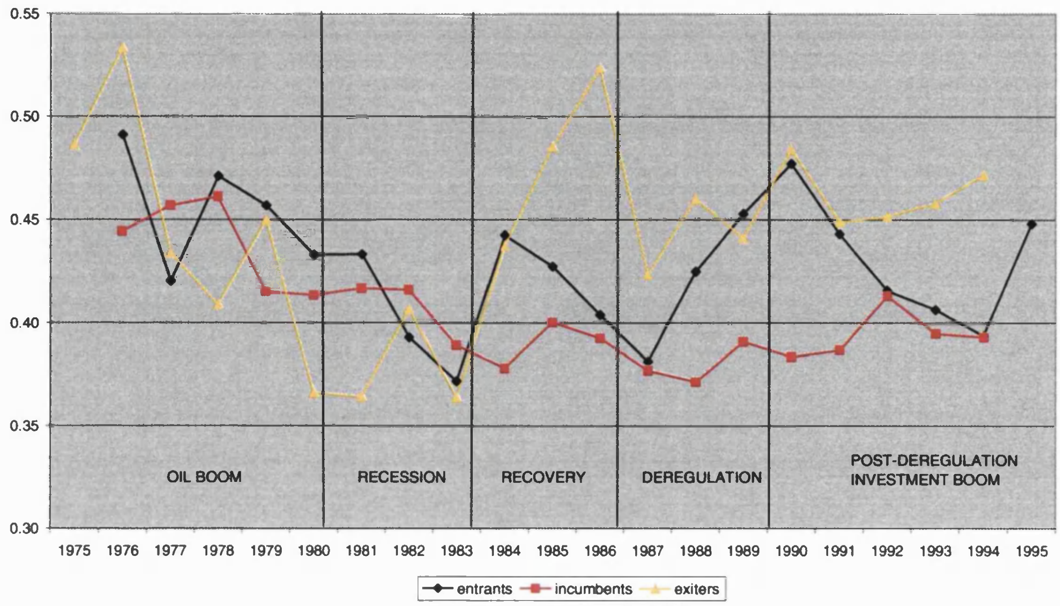


Graph 5 shows clearly that the discrepancy between entrants and incumbents TFP decreases over time, supporting the view that relatively more productive entrants reduce the productivity gap between entrants and incumbents. [41]

The graph also suggests that there might be two sub-periods in the trend: before 1981, the gap was increasing (oil boom), but as soon as recession hit, the gap started to narrow abruptly: recession may have "cleaned" the market of the worse performers. The effect of the reforms (1986-88) is far less clear. The gap becomes nil to negative in the 1990s.

[41] The gap is calculated as TFP of entrants minus TFP of incumbents as a share of TFP of entrants.

Graph 6: TFP standard deviation for entrants, incumbents and exitors

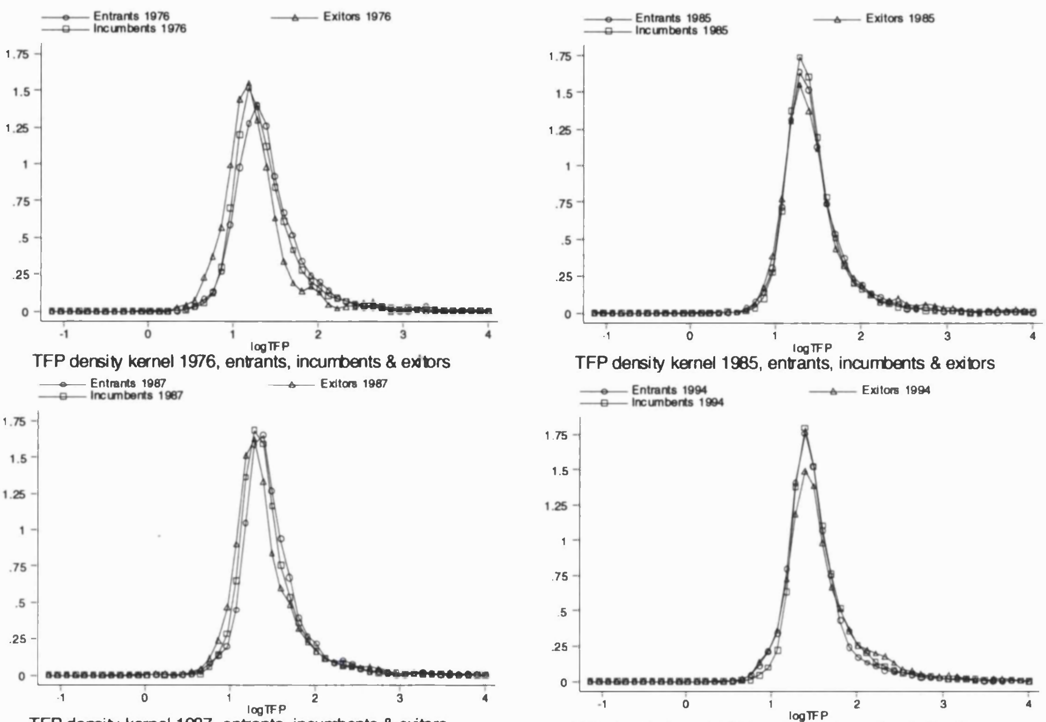


Let us now scrutinise the dynamics of TFP dispersion within the three groups (as measured by TFP standard deviation). Graph 6 shows that incumbents TFP dispersion decreases throughout the period, with a slight increase in the 1990s. The sharpest drop in TFP dispersion seems to occur just before the recession. At the same time, incumbents TFP increased over the period (Table 10). This already suggests a potential convergence of TFP among incumbents that triggered part of the aggregate TFP growth.

Entrants' TFP dispersion experiences more ups and downs: the dispersion drops from the beginning of the period up to the end of the recession in 1983, with the sharpest drop during the recession: the lower TFP bound increases, the upper TFP bound decreases, median TFP remains unchanged, and average TFP drops. Recession triggered more entries than previously, and entrants became a more homogeneous group. Entrants TFP dispersion increased again during recovery, with a slight drop in median TFP. The dispersion fell again sharply during the first two years of the reform period with a slight increase in average and median TFP. The investment boom period saw the dispersion rise again up to 1990, to fall after this date.

More striking is the recovery period: TFP dispersion of exiters shoots up, while the gap between exiters' TFP and incumbents' TFP narrows: while exits in the previous years seemed to reflect competitive market forces via the exit of the least productive establishments, the recovery period witnesses the exit of a large range of establishments not only based on low productivity. This trend continues during the reforms' and post-liberalisation periods but with a lower dispersion of productivity.

Graph 7: TFP density entrants, incumbents, exiters by year



TFP density kernel 1976, entrants, incumbents & exitors

TFP density kernel 1985, entrants, incumbents & exitors

TFP density kernel 1987, entrants, incumbents & exitors

TFP density kernel 1994, entrants, incumbents & exitors

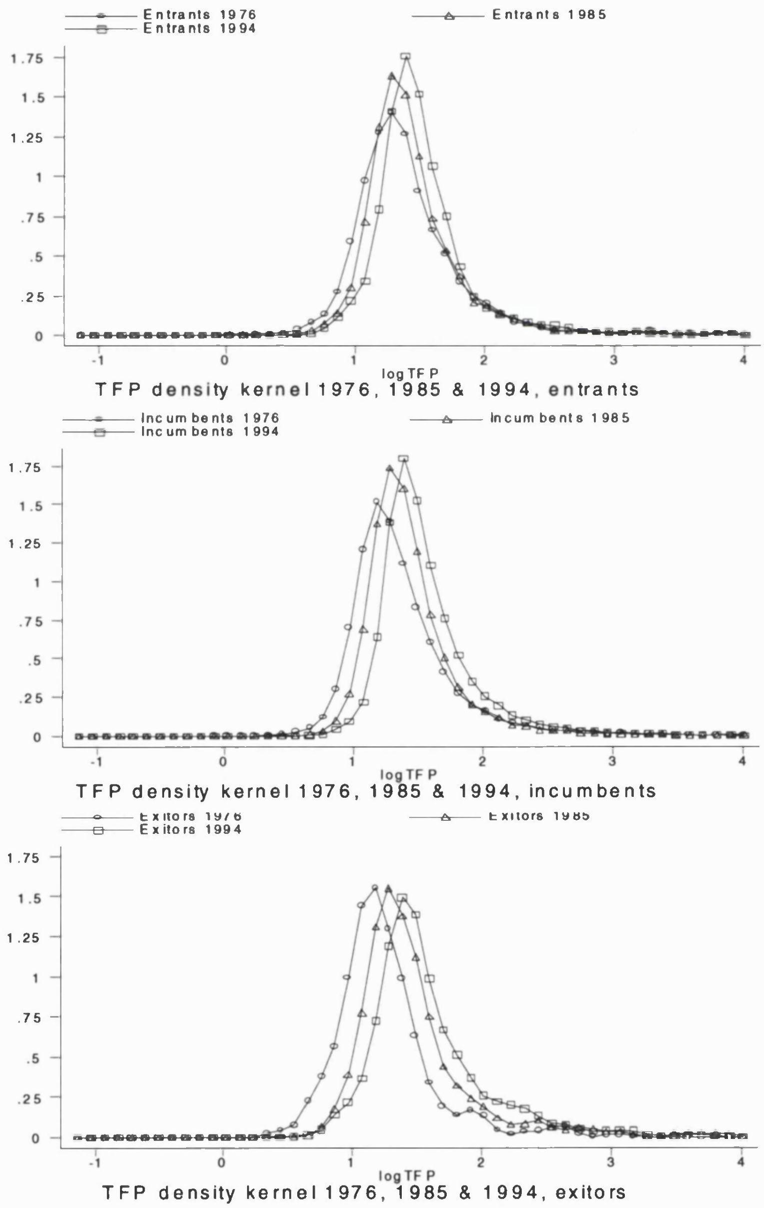
To complete the analysis, I compare the TFP distribution of entrants, incumbents and exiters for four years: 1976 (start year), 1985 (mid-period but potentially biased data), 1987 (mid-period with potentially less biased data), and 1994 (end year). Clearly, for 1975, exiters are less productive than incumbents, which in turn are less productive than entrants. However, the gaps between the three TFP distributions do not appear to be massive. Especially, the gap between incumbents and exiters TFP looks quite narrow and the two distributions overlap. Of course, this does not account for different sectors and other factors, but still, the graph does show that the exit process is not "clean".

The 1987's TFP distributions show the same patterns, but with narrower gaps between the three groups. The last year of observation, 1994, show no obvious differences between the three groups but the higher heterogeneity of the exiters group.

If exiters display lower TFP than entrants and incumbents, then exit should lead to an increase in aggregate TFP. Furthermore, if entrants display higher TFP than incumbents, entry is also a mechanism triggering aggregate TFP growth. I assess this hypothesis in the next section of the chapter, while decomposing aggregate TFP growth. However, as the TFP gap between entrants and incumbents narrows, and TFP of exiters becomes higher than incumbents' TFP, the net entry effect on aggregate TFP growth should slow down over time.

It is also interesting to observe the evolution of TFP distribution for each establishment type over time. The first graph in Graph 8 compares TFP distribution for entrants in 1976, 1985 and 1994. Entrants have become more productive over time and this group has become more homogeneous in terms of productivity.

Graph 8: TFP density dynamics, by establishment type



I observe the same phenomenon of TFP convergence for the incumbents group, with a noticeably thicker base of the right-hand tail of the distribution. This sub-group of plants displaying higher TFP growth could have a positive effect on aggregate TFP growth (possibly "pulling" the rest of incumbents).

The most striking graph shows exiters' TFP dynamics. This group presents a higher TFP growth than both entrants and incumbents, and the right-hand tail becomes a lot thicker over time. This is a clear indication of the aggregate convergence phenomenon. Furthermore, this group become more heterogeneous in terms of TFP over time. If exiters were consistently less productive than incumbents, one could argue that the market has become more exigent and that exiting plant display higher productivity levels – that is the "increased competition" hypothesis. However, I know that if exiters were less productive than incumbents from 1975 to the mid 1980s, the opposite is consistently true in the 1990s. This, again, raises two issues. Is the gross exit process lowering the potential aggregate productivity gains? And what are the reasons for plant exit if it is not a differential in productivity level? I investigate the first question in this chapter, while keeping the second issue for chapter 6.

As a first attempt to determine econometrically whether or not entrants, incumbents and exiters display a statistically significant productivity differential, I regress the log of TFP on the entry and exit dummies, controlling for time and different sectors with year and 2-digit industry dummies. This follows the methodology used by Aw, Chen & Roberts (1997) in their study of Taiwanese manufacturing. This type of regression helps assessing whether or not entrants and exiters have a significantly different average productivity level than incumbents.[42]

Table 11a displays the results of the OLS regression on pooled data for the period 1976-1994. The coefficients on year dummies represent the average incumbent TFP level for that year. I find that on average, entrants are more productive than incumbents (about 1.23% more productive for 1976, positive sign), and that exiters are less productive than incumbents (about 1.24% less productive for 1976, negative sign). The spread between entrants and incumbents, and between exiters and incumbents is of the same amplitude. But of course, this does not account for changes of spread over time. In other words, do the results hold for the entire period?

[42] Since this methodology uses averages, it has limitations.

Table 11a: log(TFP) regressed on entry, exit, years and 2-digit industry dummies (no constant), pooled data 1976-94

Number of obs	300484					
F(29,300455)	.					
Prob > F	0					
R-squared	0.929					
Adj R-squared	0.929					
Root MSE	0.40523					
TFP	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
entry	0.017973	0.002527	7.11	0	0.01302	0.022926
exit	-0.018089	0.003189	-5.67	0	-0.02434	-0.011838
dum76	1.452395	0.007571	191.83	0	1.437556	1.467235
dum77	1.459859	0.007509	194.42	0	1.445142	1.474576
dum78	1.486985	0.007457	199.42	0	1.47237	1.501599
dum79	1.451367	0.007404	196.02	0	1.436855	1.465879
dum80	1.466754	0.007377	198.84	0	1.452296	1.481212
dum81	1.486023	0.00734	202.46	0	1.471637	1.500409
dum82	1.492634	0.007286	204.86	0	1.478354	1.506915
dum83	1.485634	0.007236	205.31	0	1.471452	1.499817
dum84	1.496662	0.007178	208.52	0	1.482594	1.51073
dum85	1.514299	0.007107	213.07	0	1.50037	1.528229
dum86	1.535782	0.007075	217.08	0	1.521916	1.549648
dum87	1.509163	0.007055	213.91	0	1.495335	1.522991
dum88	1.518807	0.007037	215.82	0	1.505014	1.5326
dum89	1.543274	0.007006	220.29	0	1.529543	1.557005
dum90	1.570143	0.006953	225.81	0	1.556515	1.583771
dum91	1.569431	0.006948	225.88	0	1.555813	1.583049
dum92	1.602374	0.006917	231.66	0	1.588816	1.615931
dum93	1.614178	0.006906	233.74	0	1.600643	1.627714
dum94	1.624463	0.006884	235.98	0	1.610971	1.637955
d31	-0.130086	0.006529	-19.93	0	-0.142881	-0.11729
d32	-0.071158	0.006557	-10.85	0	-0.084008	-0.058307
d33	-0.0132	0.006762	-1.95	0.051	-0.026454	5.41E-05
d34	-0.014557	0.007284	-2	0.046	-0.028833	-0.000282
d35	-0.040451	0.006741	-6	0	-0.053662	-0.027239
d36	-0.044031	0.006869	-6.41	0	-0.057494	-0.030568
d37	-0.070366	0.011551	-6.09	0	-0.093005	-0.047728
d38	-0.032964	0.006806	-4.84	0	-0.046303	-0.019625
d39	(dropped)					

Indeed, I have noted earlier that in the 1990s, entrants tended to become less productive than incumbents, and exiters tended to become more productive than incumbents. Table 11b shows the results of the same regression, but on pooled data for the period 1975-89. I find that on average, entrants are more productive than incumbents (about 2.10% more productive for 1976, positive sign), and that exiters are less productive than incumbents (about 3.03% less productive for 1976, negative sign). For this period, the spreads are higher for both entrants and exiters, but the gap between exiters and incumbents is larger than the gap between entrants and incumbents.

Table 11b: log(TFP) regressed on entry, exit, years and 2-digit industry dummies (no constant), pooled data 1976-89

Number of obs	196913					
F(24,196889)	.					
Prob > F	0					
R-squared	0.9253					
Adj R-squared	0.9253					
Root MSE	0.40613					
TFP	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
entry	0.029052	0.003147	9.23	0	0.022884	0.035219
exit	-0.041879	0.004262	-9.83	0	-0.050233	-0.033526
dum76	1.381505	0.013183	104.79	0	1.355666	1.407344
dum77	1.388748	0.013143	105.67	0	1.362988	1.414508
dum78	1.415388	0.013113	107.94	0	1.389688	1.441089
dum79	1.380157	0.01308	105.51	0	1.35452	1.405794
dum80	1.395096	0.013068	106.76	0	1.369483	1.42071
dum81	1.413664	0.013047	108.36	0	1.388093	1.439235
dum82	1.41997	0.013013	109.12	0	1.394466	1.445474
dum83	1.41249	0.012986	108.77	0	1.387038	1.437942
dum84	1.424579	0.012952	109.99	0	1.399193	1.449966
dum85	1.439731	0.012916	111.47	0	1.414416	1.465046
dum86	1.462143	0.012901	113.34	0	1.436857	1.487429
dum87	1.437076	0.012888	111.51	0	1.411816	1.462336
dum88	1.444532	0.012878	112.17	0	1.419291	1.469774
dum89	1.4689	0.012864	114.19	0	1.443688	1.494113
d31	-0.054079	0.012661	-4.27	0	-0.078894	-0.029265
d32	-0.029543	0.012691	-2.33	0.02	-0.054417	-0.004669
d33	0.090498	0.012896	7.02	0	0.065221	0.115774
d34	0.066106	0.013276	4.98	0	0.040087	0.092126
d35	0.038517	0.012834	3	0.003	0.013363	0.063671
d36	0.043616	0.012947	3.37	0.001	0.018239	0.068993
d37	(dropped)					
d38	0.054546	0.012907	4.23	0	0.02925	0.079843
d39	0.070872	0.015291	4.63	0	0.040902	0.100843

Table 11c displays the results for the period 1990-1994. It shows that the trend has been reversed: entrants are less productive than incumbents, while exiters are more productive than incumbents, although the t statistics are lower than for the previous period.

Table 11c: log(TFP) regressed on entry, exit, years and 2-digit industry dummies (no constant), pooled data 1990-94

Number of obs	103571					
F(15,103556)	.					
Prob > F	0					
R-squared	0.936					
Adj R-squared	0.936					
Root MSE	0.40079					
TFP	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**Conf. Interval]**	
entry	-0.007967	0.004215	-1.89	0.059	-0.016227	0.000294
exit	0.010976	0.004771	2.3	0.021	0.001626	0.020327
dum90	1.502569	0.015133	99.29	0	1.472908	1.53223
dum91	1.503818	0.015122	99.44	0	1.474179	1.533457
dum92	1.536361	0.015109	101.68	0	1.506747	1.565976
dum93	1.548218	0.015103	102.51	0	1.518618	1.577819
dum94	1.559325	0.015084	103.37	0	1.52976	1.58889
d31	-0.071331	0.015097	-4.73	0	-0.10092	-0.041742
d32	0.055911	0.015115	3.7	0	0.026286	0.085536
d33	0.009779	0.015297	0.64	0.523	-0.020202	0.039761
d34	0.036324	0.016052	2.26	0.024	0.004863	0.067785
d35	0.013483	0.015349	0.88	0.38	-0.0166	0.043567
d36	-0.0042	0.01549	-0.27	0.786	-0.03456	0.02616
d37	(dropped)					
d38	0.00913	0.015386	0.59	0.553	-0.021025	0.039285
d39	0.069817	0.017539	3.98	0	0.035441	0.104192

Table 12 displays the results of the same exercise on yearly cross-section data.[43] From 1976 to 1989 (if I exclude 1985), entrants are consistently more productive than incumbents, and exiters are consistently less productive than incumbents. In 1990, both entrants and exiters are more productive than incumbents. But from 1991 to 1994, with the exception of 1993, entrants are less productive than incumbents, and exiters are more productive than incumbents.

[43] For clarity purposes, I only report the coefficients on the entry and exit dummies with their significance level. Full results are available from the author.

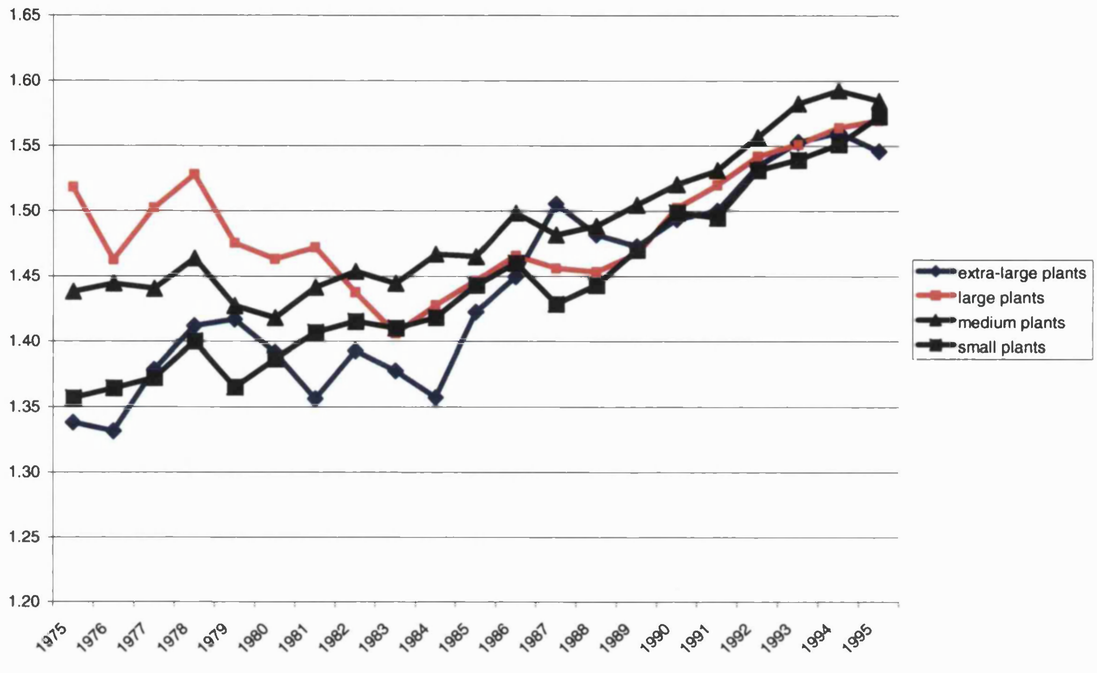
Table 12: log(TFP) regressed on entry and exit dummies, 2-digit industry dummies (not reported), cross-section data, by year

year	stat.	entry	exit	year	stat.	entry	exit
				1985	coef.	-0.007	0.025
					sign. level	40.90%	9.30%
1976	coef.	0.034	-0.079	1986	coef.	0.034	-0.005
	sign. level	2.90%	0.50%		sign. level	0.70%	78.20%
1977	coef.	0.016	-0.116	1987	coef.	0.028	-0.037
	sign. level	33.90%	0.00%		sign. level	1.30%	0.00%
1978	coef.	0.051	-0.149	1988	coef.	0.011	-0.030
	sign. level	0.20%	0.00%		sign. level	23.20%	2.20%
1979	coef.	0.059	-0.055	1989	coef.	0.021	-0.001
	sign. level	0.00%	0.10%		sign. level	4.50%	96.20%
1980	coef.	0.070	-0.099	1990	coef.	0.044	0.029
	sign. level	0.00%	0.00%		sign. level	0.00%	0.10%
1981	coef.	0.048	-0.101	1991	coef.	-0.020	0.006
	sign. level	0.00%	0.00%		sign. level	2.60%	60.70%
1982	coef.	0.026	-0.059	1992	coef.	-0.003	0.015
	sign. level	3.70%	0.20%		sign. level	79.20%	18.40%
1983	coef.	0.025	-0.040	1993	coef.	-0.015	-0.039
	sign. level	2.20%	3.20%		sign. level	14.20%	0.10%
1984	coef.	0.035	-0.004	1994	coef.	-0.050	0.031
	sign. level	0.10%	72.10%		sign. level	0.00%	1.00%

Let us now assess TFP distribution by size category. I define size using the number of workers. I use Goeltom's classification (1995), adding an extra-large category: small establishments have less than 100 workers, medium-scale establishments have between 100 and 499 workers, large-scale establishments have between 500 and 1999 workers, and extra large establishments have 2000 workers and over.

Which size category is the most productive?

Graph 9: Average plant TFP by size category, by year



At the beginning of the period, the average small establishment is less productive than the medium-scale one, which in turn is less productive than the large-scale one, with the extra large establishment being less productive than the previous three. The same pattern is observed for median figures regarding the first three categories, the median extra large establishment is less productive than the medium- and large-scale ones, but slightly more productive than the small establishments.

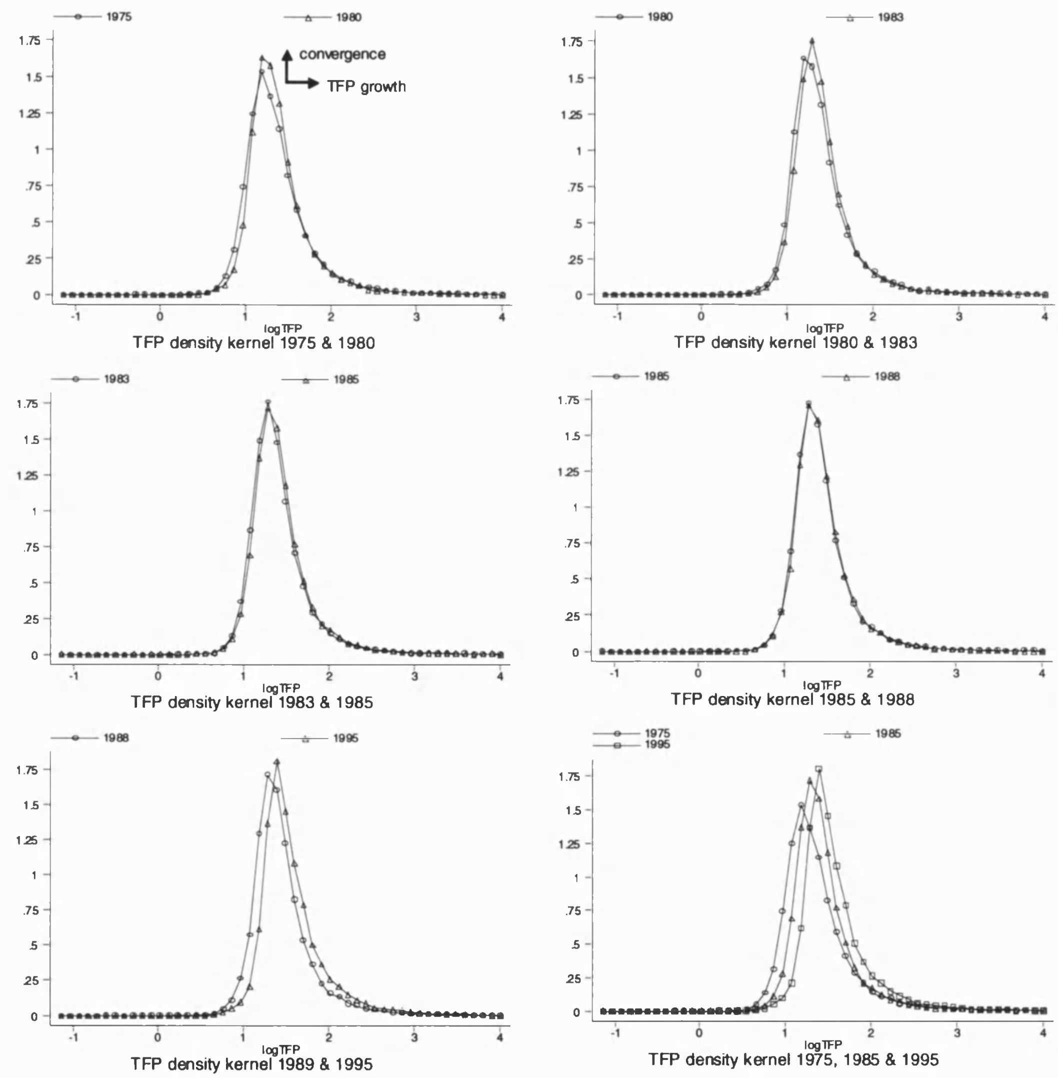
At the end of the period, the most productive average and median establishment is the medium-sized one, followed by the large-scale and small-scale ones, the extra large one arriving last again.

The TFP growth of the *average* extra large and small establishments has been 0.8% a year between 1975 and 1995, against 0.5% a year for medium-size establishments and 0.2% a year for large-scale establishments. The TFP growth of the *median* small establishments has been 0.8% a year between 1975 and 1995, against 0.5% a year for medium-size and extra large establishments and 0.03% a year for large-scale establishments.

It is interesting to note that medium-size establishments became leaders in terms of productivity during the recession (1982), and maintained their position thereafter.

Clearly, while medium-size establishments have become the most productive, the categories that presented the most productivity growth were at the extreme of the distribution, because they were converging towards the most productive medium categories: in 1975, the average extra large and small establishments were respectively 11.8% and 10.5% less productive than the average large-scale establishment; in 1995, the average extra large and small establishments were respectively 1.9% and 0.6% less productive than the average medium-scale establishment. This is already an indication showing that TFP heterogeneity reduction may have led to TFP growth. There is also material to assume that in terms of demographic changes, the recession period appears to have had stronger effects than reforms.

Graph 10: TFP distribution dynamics, historical sub-periods

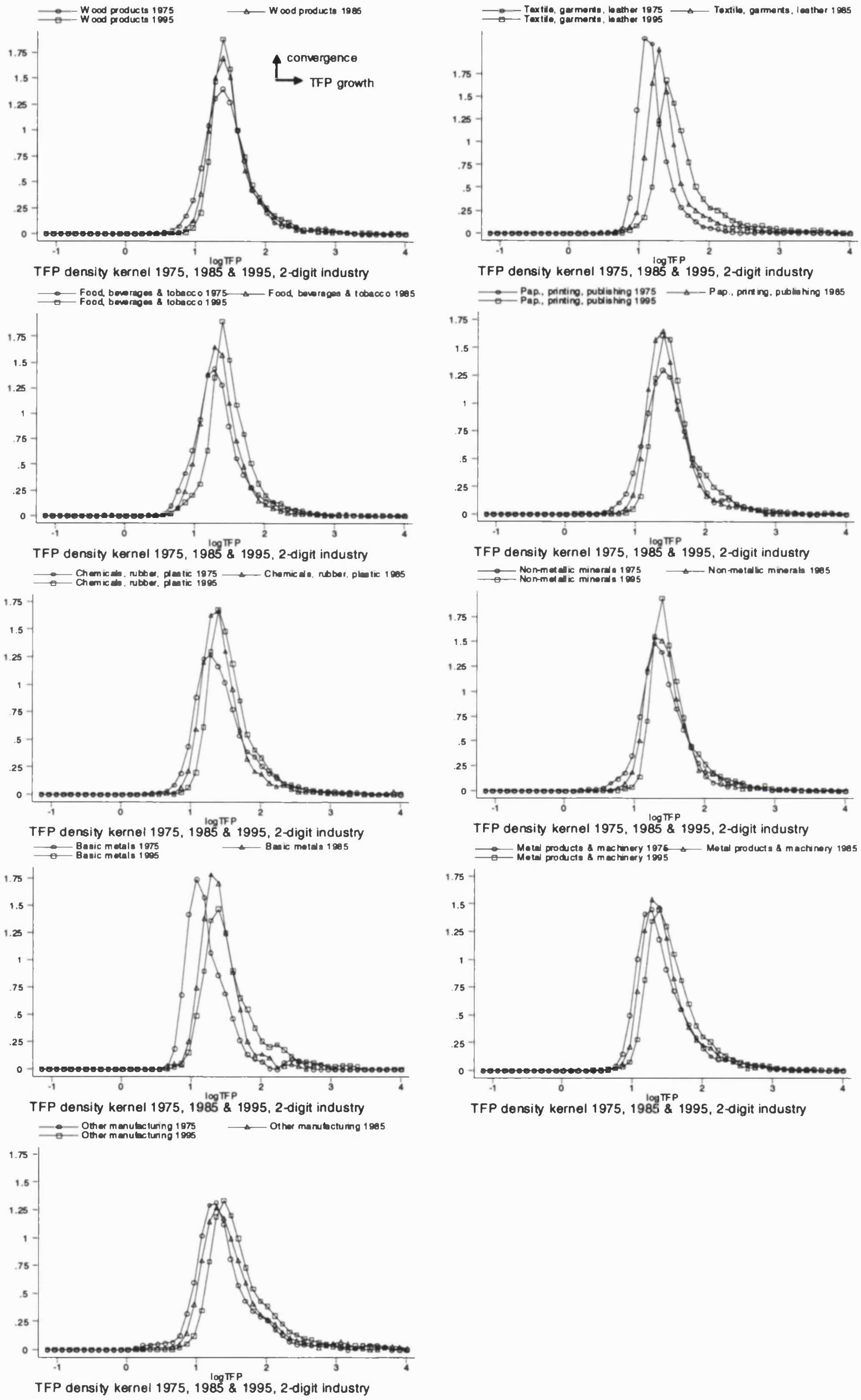


Graph 10 shows the movement of TFP distribution over historical sub-periods. The last graph compares TFP distribution for 1975, 1985 and 1995. The entire manufacturing sector has experienced TFP growth (distribution moves to the right), the sector has experienced convergence in terms of productivity levels (distribution becomes narrower and is higher), and the base of the right-hand tail has become thicker, showing the appearance of a group of very productive plants with similar productivity levels, suggesting a productivity convergence phenomenon within the group of the most productive plants.

How does this decompose in the sub-periods? During the oil boom (1975-80), the manufacturing sector experiences slow TFP growth and substantial convergence. An identical phenomenon is observed during the oil crisis (1980-83). During the recovery period (1983-85), I observe slow TFP growth but the shape of the distribution remains the same, maybe with a slight drop in density (slight divergence). The reform period (1985-88) only experiences a very thin movement of the distribution to the right. The most spectacular TFP growth occurs during the post-liberalisation and investment boom period (1989-95), convergence restart substantially, and the thick base of the right-hand tail appears.

This raises issues to be answered in chapter 6: what impact have the reforms had on TFP growth? How can I link the policy implemented to the process of entry, exit and convergence, and to aggregate TFP growth? Why did relatively highly productive plants exit in the 1990s? If plants having exited in the 1990s had stayed in the manufacturing sector, would TFP growth have been higher?

Graph 11: TFP distribution dynamics by 2-digit industry



Graph 11 displays TFP distribution dynamics at the 2-digit industrial level. This exercise attempts to underline the different behaviour of distinct industries.

All sectors experience TFP growth, however, some have higher TFP growth than others. In both the wood products and the paper, printing and publishing sectors, TFP growth is rather limited, especially for the former. Both sectors experience convergence.

The food, beverages and tobacco sector experiences substantial productivity growth together with strong convergence. This is also true for the chemicals, rubber and plastic sector and the non-metallic minerals sector. These five examples show that convergence can be accompanied either by very small or more substantial TFP growth. However, one should keep in mind that a movement of the distribution to the top without a movement of the distribution to the right could still result in substantial aggregate TFP growth.

Two sectors experience TFP growth without a lot of change in the shape of the distribution (neither convergence nor divergence): the metal products and machinery, and the other manufacturing sectors. Those sectors display an increase of productivity in plants, but no obvious change in the industry composition.

Finally, two sectors display spectacular TFP growth: textile, garments and leather, and basic metals. However, both these sectors display an obvious divergence of plants in terms of productivity.

This short review of productivity distribution dynamics for 2-digit industries raises another issue here: what triggers the highest aggregate productivity growth? Is it plants productivity convergence or divergence? Is it intra-plant productivity growth? Is it the processes of entry and exit? This is partly assessed in the section dealing with aggregate TFP growth decomposition, and investigated into more details in chapter 6, with a detailed historical analysis of individual sub-sectors.

4.6 TFP Growth distribution and dynamics

I have shown that average and median medium-scale establishments become the most productive establishments during and after the recession period. However, this part of the population, although increasing in numbers, tends to decline in terms of output and employment share. In order to complete the analysis, I here examine the behaviour of TFP Growth by demographic category.

TABLE 13: Plant-level TFP Growth rates summary statistics for entrants, exitors, and incumbents, by year

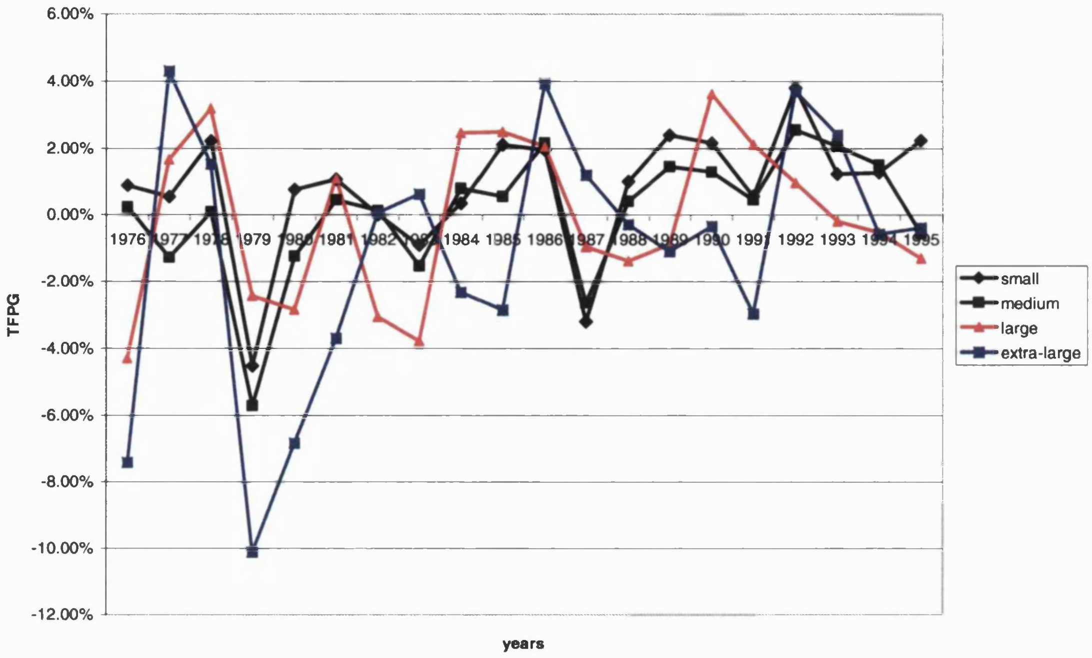
	average			median			standard deviation		
YEAR	entrants	incumbents	exitors	entrants	incumbents	exitors	entrants	incumbents	exitors
1976	0.57%	0.54%	2.07%	-2.33%	-2.36%	-0.93%	0.34	0.34	0.34
1977	-1.23%	0.33%	0.41%	-2.44%	-1.43%	-1.43%	0.28	0.30	0.27
1978	3.52%	1.97%	0.62%	0.01%	0.35%	-1.06%	0.30	0.32	0.27
1979	-4.41%	-4.51%	-6.51%	-3.78%	-3.13%	-3.45%	0.30	0.32	0.40
1980	-0.32%	0.32%	-0.69%	-1.49%	-0.34%	-1.78%	0.18	0.26	0.35
1981	-0.56%	1.03%	-0.97%	-0.29%	0.43%	-0.45%	0.17	0.26	0.31
1982	-1.81%	0.00%	-2.59%	-0.81%	-0.41%	-1.80%	0.19	0.27	0.34
1983	-2.44%	-1.18%	0.13%	-1.83%	-1.30%	0.72%	0.18	0.26	0.31
1984	-0.74%	0.37%	1.67%	-0.38%	0.02%	-0.05%	0.16	0.23	0.36
1985	0.84%	1.60%	6.95%	0.22%	0.70%	0.77%	0.16	0.26	0.46
1986	3.34%	1.96%	3.64%	1.25%	1.12%	1.20%	0.38	0.36	0.58
1987	-3.53%	-2.61%	-5.96%	-4.29%	-2.42%	-4.13%	0.20	0.29	0.40
1988	1.11%	0.75%	1.31%	0.99%	0.78%	1.32%	0.19	0.26	0.32
1989	1.26%	1.99%	3.12%	1.26%	1.32%	3.54%	0.29	0.28	0.28
1990	0.71%	2.04%	2.12%	-0.04%	0.52%	-0.26%	0.30	0.31	0.26
1991	0.64%	0.56%	1.25%	-0.45%	0.09%	0.94%	0.30	0.29	0.29
1992	5.14%	3.20%	5.23%	4.37%	1.92%	3.13%	0.38	0.35	0.31
1993	5.72%	1.34%	1.26%	1.25%	0.35%	1.42%	0.36	0.33	0.39
1994	2.55%	1.23%	0.31%	0.06%	0.77%	-0.27%	0.39	0.32	0.40
1995	6.48%			0.42%			0.33		

Table 13 displays TFPG summary statistics for entrants, incumbents, and exiters by year. The measure of TFP Growth is taken from chapter 2 and has been calculated at the plant level, using elasticities of output with respect to inputs (intermediate inputs, labour and capital) estimated at the 2-digit level on a log level equation.

Average and median exiters' TFP growth appears to be higher than incumbents' TFP growth in most years. This phenomenon manifests itself especially after the recession, from 1982 onwards. This tends to confirm the trend observed graphically. Also, in most years, TFP growth is more heterogeneous for exiters (higher standard deviation). Again, this raises the question of the efficiency of the exit process: if exiters had stayed in the manufacturing sector, would aggregate TFP growth have been higher? This observation is also compatible with the fact that plants about to exit sometimes experience a surge in productivity growth in an ultimate attempt to survive.

The average and median entrant experience in most cases lower TFP growth than incumbents. This is not surprising since entrants display generally a higher TFP level. Also noticeable is the fact that average and median entrant displays negative TFP growth up to the mid 1980s. Meanwhile, the TFP gap between entrants and incumbents is larger during that period. This suggests that the contribution from entrants to aggregate TFP growth stems from the entry of higher TFP level plants rather than from early TFP growth of entrants, especially up to the mid 1980s.

Graph 12: TFP Growth rates averages by year, by size group



Graph 12 displays TFP growth averages by size category. Over the period 1975-95, the average small plant experiences a higher TFP growth than all other three size categories, followed by the medium sized plants, followed by large and extra-large plants, which experience negative TFP rates of change. The ranking is similar in terms of median.

Large and extra-large establishments represent an overwhelming majority in terms of output and employment, but they are the plants that experience the least productivity growth over the period, and in fact, their average productivity change is negative. This suggests that – since aggregate productivity growth is positive – the positive contribution should stem both from small-medium sized plants and entrants.

4.7 TFP Growth decomposition

The earlier sections firstly confirm that large- and extra-large-scale plants increasingly dominate the sector both in terms of output and employment. Meanwhile, the number of medium-scale plants increases at the expenses of the small-scale sector. Secondly, during the oil boom, large-scale plants are the most productive, but medium-scale plants follow closely. Extra-large plants are the least productive. Medium-scale plants become the most productive as soon as 1982. Finally, the bulk of entry and exit occurs with the small- and medium-scale plants sector.

Plant heterogeneity in terms of size, factor proportion and technology results in productivity and productivity growth heterogeneity. The literature, as well as previous empirical evidence, shows that aggregate productivity growth can be decomposed into three elements: intra-plant productivity growth for incumbents, reallocation of market shares among incumbents, and reallocation of market shares from exiters to entrants (net entry effect).

I estimate aggregate TFP Growth using different decompositions into entry, exit, market share reallocation, and within plant productivity growth.

The basic decomposition is carried out using:

$$\Delta \ln TFP = \sum_{i \in S} (\theta_{it} \ln TFP_{it} - \theta_{it-\tau} \ln TFP_{it-\tau}) + \left(\sum_{i \in N} \theta_{it} \ln TFP_{it} - \sum_{i \in X} \theta_{it-\tau} \ln TFP_{it-\tau} \right) \quad (1)$$

where TFP is Total Factor Productivity, i is the subscript for plants, S designates the group of incumbents, N the group of entrants, X the group of exiters, t the end year, and $t-\tau$ the start year.[44]

Following Baily, Hulten and Campbell (1992), I decompose productivity growth among the survivors in two ways (the **BHC decomposition**). Their contribution comes from improvements in each plant separately (holding output shares constant) and from changes in the output shares:

$$\sum_{i \in S} (\theta_{it} \ln TFP_{it} - \theta_{it-\tau} \ln TFP_{it-\tau}) = \left(\sum_{i \in S} \theta_{it-\tau} \Delta \ln TFP_{it} + \sum_{i \in S} (\theta_{it} - \theta_{it-\tau}) \ln TFP_{it} \right)" \quad (2)$$

[44] TFP estimates at the establishment level are taken from chapter 2.

Table 14: Decomposition of aggregate TFP Growth

	Simple average of plant TFPG	divisia index	BHC decomposition (TFP aggregated with market shares)				
YEAR	Aggregate TFPG excluding net entry	Aggregate TFPG excluding net entry	market share reallocation among incumbents	intraplant TFPG for incumbents	total TFPG of incumbents	net entry TFPG	Aggregate TFPG from decomposition
1976	1.39%	-3.51%	-14.43%	-4.22%	-18.65%	9.72%	-8.93%
1977	-0.37%	2.41%	-4.49%	-0.75%	-5.24%	4.97%	-0.27%
1978	2.15%	4.68%	-5.38%	0.95%	-4.43%	9.99%	5.57%
1979	-4.66%	-3.36%	-5.40%	-6.69%	-12.09%	2.24%	-9.84%
1980	0.24%	1.54%	-1.87%	-2.88%	-4.75%	6.37%	1.62%
1981	0.97%	2.70%	-3.70%	1.03%	-2.67%	5.09%	2.43%
1982	0.23%	-1.87%	-3.86%	-4.21%	-8.07%	5.34%	-2.73%
1983	-0.23%	-1.10%	-3.20%	-3.51%	-6.71%	3.03%	-3.68%
1984	0.90%	1.42%	-5.78%	0.71%	-5.07%	4.62%	-0.45%
1985	4.42%	3.30%	-6.80%	0.02%	-6.78%	4.85%	-1.93%
1986	3.37%	3.62%	4.22%	-1.26%	2.96%	2.80%	5.76%
1987	-3.93%	12.58%	11.14%	-0.32%	10.81%	-1.79%	9.02%
1988	0.49%	-12.25%	1.80%	-15.68%	-13.88%	3.34%	-10.54%
1989	3.06%	3.87%	1.05%	-0.50%	0.55%	2.37%	2.92%
1990	3.45%	3.26%	-3.09%	0.58%	-2.51%	11.21%	8.71%
1991	0.48%	-0.69%	0.36%	-3.69%	-3.34%	1.91%	-1.43%
1992	3.66%	5.08%	3.60%	-0.70%	2.90%	3.69%	6.59%
1993	1.97%	2.54%	3.78%	-5.54%	-1.76%	1.00%	-0.75%
1994	1.53%	-0.80%	2.49%	-9.49%	-7.00%	2.15%	-4.85%
1995	0.62%	2.48%	2.33%	5.78%	8.12%	3.33%	11.44%
average 76-94	**1.01%**	**1.23%**	**-1.56%**	**-2.96%**	**-4.51%**	**4.36%**	**-0.15%**
average 76-80	-0.25%	0.35%	-6.31%	-2.72%	-9.03%	6.66%	-2.37%
average 81-83	0.32%	-0.09%	-3.59%	-2.23%	-5.82%	4.49%	-1.33%
average 84-85	2.66%	2.36%	-6.29%	0.36%	-5.93%	4.74%	-1.19%
average 86-88	-0.02%	1.32%	5.72%	-5.76%	-0.04%	1.45%	1.41%
average 89-94	2.36%	2.21%	1.36%	-3.22%	-1.86%	3.72%	1.86%

	FHK decomposition (TFP aggregated with market shares, TFP relative to the average)						GR decompostion (TFP aggregated with market shares and time average market shares, TFP relative to the average - time average)				
YEAR	market share reallocation among incumbents	intraplant TFPG for incumbents	covariance term for incumbents	total TFPG of incumbents	net entry TFPG	TFPG	market share reallocation among incumbents	intraplant TFPG for incumbents	total TFPG of incumbents	net entry TFPG	TFPG
1976	-7.59%	-4.22%	3.55%	-8.26%	2.08%	-6.18%	-5.82%	-2.45%	-8.26%	2.08%	-6.18%
1977	-3.28%	-0.75%	3.03%	-1.01%	1.02%	0.01%	-1.77%	0.76%	-1.01%	1.08%	0.07%
1978	-3.82%	0.95%	4.75%	1.88%	3.15%	5.04%	-1.44%	3.32%	1.88%	3.15%	5.03%
1979	-5.49%	-6.69%	4.28%	-7.89%	0.61%	-7.28%	-3.34%	-4.55%	-7.89%	1.17%	-6.72%
1980	-3.60%	-2.88%	3.51%	-2.97%	1.22%	-1.75%	-1.85%	-1.12%	-2.97%	1.21%	-1.76%
1981	-1.78%	1.03%	2.01%	1.26%	1.00%	2.27%	-0.78%	2.04%	1.26%	1.05%	2.32%
1982	-2.64%	-4.21%	2.45%	-4.39%	1.38%	-3.02%	-1.39%	-2.99%	-4.38%	1.40%	-2.98%
1983	-4.01%	-3.51%	3.46%	-4.06%	0.34%	-3.72%	-2.28%	-1.78%	-4.06%	0.40%	-3.66%
1984	-3.19%	0.71%	1.38%	-1.10%	0.65%	-0.45%	-2.50%	1.40%	-1.10%	0.67%	-0.43%
1985	-3.97%	0.02%	4.37%	0.42%	1.71%	2.13%	-1.79%	2.21%	0.42%	1.51%	1.93%
1986	-3.74%	-1.26%	5.80%	0.79%	0.61%	1.40%	-0.85%	1.64%	0.79%	0.62%	1.42%
1987	-0.21%	-0.32%	12.04%	11.51%	-0.33%	11.17%	5.81%	5.70%	11.51%	0.00%	11.51%
1988	-13.26%	-15.68%	15.26%	-13.68%	0.60%	-13.08%	-5.63%	-8.05%	-13.68%	0.62%	-13.06%
1989	-2.66%	-0.50%	5.16%	2.00%	0.76%	2.76%	-0.03%	2.08%	2.05%	0.78%	2.83%
1990	-2.16%	0.58%	4.30%	2.72%	9.59%	12.31%	-0.01%	2.73%	2.72%	9.71%	12.43%
1991	-5.70%	-3.69%	5.98%	-3.41%	1.39%	-2.02%	-2.71%	-0.70%	-3.41%	1.39%	-2.02%
1992	-5.66%	-0.70%	10.28%	3.91%	1.56%	5.47%	-0.47%	4.44%	3.97%	1.45%	5.42%
1993	-6.67%	-5.54%	10.47%	-1.73%	0.21%	-1.52%	-1.44%	-0.30%	-1.74%	0.81%	-0.93%
1994	-9.28%	-9.49%	12.72%	-6.05%	0.54%	-5.51%	-2.93%	-3.13%	-6.05%	0.62%	-5.43%
1995	-1.55%	5.78%	4.48%	8.72%	0.41%	9.12%	0.70%	8.02%	8.72%	0.41%	9.13%
average 76-94	**-4.67%**	**-2.96%**	**6.04%**	**-1.58%**	**1.48%**	**-0.10%**	**-1.64%**	**0.07%**	**-1.58%**	**1.56%**	**-0.01%**
average 76-80	-4.76%	-2.72%	3.82%	-3.65%	1.62%	-2.03%	-2.84%	-0.81%	-3.65%	1.74%	-1.91%
average 81-83	-2.81%	-2.23%	2.64%	-2.40%	0.91%	-1.49%	-1.48%	-0.91%	-2.39%	0.95%	-1.44%
average 84-85	-3.58%	0.36%	2.88%	-0.34%	1.18%	0.84%	-2.14%	1.80%	-0.34%	1.09%	0.75%
average 86-88	-5.74%	-5.76%	11.03%	-0.46%	0.29%	-0.17%	-0.22%	-0.24%	-0.46%	0.42%	-0.04%
average 89-94	-5.36%	-3.22%	8.15%	-0.43%	2.34%	1.92%	-1.26%	0.85%	-0.41%	2.46%	2.05%

The BHC methodology gives a negative average annual TFP change for 1976-94 at -0.15%, with a strong positive contribution from net entry at 4.36% p.a. and a strong negative contribution from incumbents at –4.51% p.a.. Both intra-plant TFP growth and market share reallocation among incumbents contribute negatively to aggregate TFP growth, with an average of –2.96% p.a. for the former, and –1.56% p.a. for the latter.

The highest positive contribution to aggregate TFP growth from net entry occurs during the oil boom, with an annual average of 6.66%, dropping to 4.49% during the oil crisis. It increases slightly during the short recovery period to 4.74% p.a.. The de-regulation period witnesses the lowest net entry contribution at 1.45% p.a., followed by a strong recovery during the investment boom with an annual contribution at 3.72%.

Incumbents contribution to aggregate TFP growth follows exactly the opposite pattern: strongly negative during the oil boom at –9.0% p.a., it ameliorates during the oil crisis and recovery at respectively –5.8% and –5.9% p.a.. The negative contribution becomes almost nil during de-regulation at –0.04% p.a., but rises again during the investment boom at –1.9% p.a..

While the contribution of intra-plant productivity growth does not show any consistent positive sign over the period, the contribution of market share reallocation becomes positive during de-regulation at 5.72% p.a., to drop slightly during the investment boom at 1.36% p.a..

In summary, were net entry not taken into account, aggregate TFP change would have remained negative over the entire period. As the positive contribution of net entry fades, incumbents' consistent negative contribution to aggregate TFP growth, especially in terms of intra-plant productivity growth, could represent a threat to future aggregate TFP growth. However, one could argue that Indonesian manufacturing is still at an early stage of development in terms of demography.

The Indonesian manufacturing sector started with a low productivity level and low productivity growth in a relatively uncompetitive environment, where however entry and exit was an operating process. At this stage, the only positive contribution to aggregate TFP growth stems from the entry of relatively high TFP plants and the exit of relatively low TFP plants. The very high net entry contribution to aggregate TFP growth during the oil boom period suggests that under adverse conditions for SMI, only very productive plants managed to enter the medium- and large-scale industrial sector. As those entrants become incumbents, incumbents' negative contribution ameliorates to become positive, at least in terms of market share reallocation during market de-regulation. However, the negative contribution of intra-plant productivity growth remains.

Haltiwanger (1997) argues that the BHC decomposition may be misleading. Indeed, even when entrants are very productive and exiters very unproductive, if exiters totalise a large market share (relatively to entrants), then net entry could still have a negative effect on aggregate productivity growth. Foster, Haltiwanger and Krizan (1998) propose to decompose aggregate productivity growth relatively to the mean (**FHK decomposition**):

$$\Delta TFP = \sum_{i\in S}\theta_{it-\tau}\Delta tfp_{it} + \sum_{i\in S}\Delta\theta_{it}\left(tfp_{it-\tau} - TFP_{it-\tau}\right) + \sum_{i\in S}\Delta\theta_{it}\Delta tfp_{it}$$
$$+ \sum_{i\in N}\theta_{it}\left(tfp_{it} - TFP_{it-\tau}\right) - \sum_{i\in X}\theta_{it-\tau}\left(tfp_{it-\tau} - TFP_{it-\tau}\right) \quad (3)$$

where tfp is total factor productivity of plants, and TFP average tfp.

The first term represents incumbents' intra-plant productivity growth, the second term stands for the contribution of market share reallocation (it is positive when market share increases for incumbents with above average productivity level at the beginning of the period). The third element is a covariance term. The contribution is positive when market shares are reallocated from plants with declining productivity to plants with increasing productivity. The last two terms stand for the contribution of net entry, which is positive when entrants display productivity higher than the average, irrespective of market share.

Results are similar to those obtained with the BHC decomposition, with the exception of the market share reallocation effect that worsens over time with the FHK decomposition. However, the FHK decomposition includes an additional covariance term reflecting market share reallocation from declining to increasing productivity plants. In FHK, this term is consistently positive and improves over the period.

As Disney, Haskel and Heden (2000) point out "this method [FHK] is vulnerable to measurement error. Suppose that employment is measured with error and that the θ_s are employment weights. Measurement error would give a spuriously high correlation between $\Delta\theta$ and Δtfp understating the covariance effect. In addition it would give a spuriously high correlation between θ_{it-k} and Δtfp , giving a spuriously low within-plant effect." (p.13) One alternative is to use a decomposition proposed by Griliches and Regev (1992) (**GR decomposition**):

$$\Delta TFP_t = \sum_{i\in S}\bar{\theta}_i\Delta tfp_{it} + \sum_{i\in S}\Delta\theta_{it}\left(\overline{tfp}_i - \overline{TFP}_i\right)$$
$$+ \sum_{i\in N}\theta_{it}\left(tfp_{it} - \overline{TFP}_i\right) - \sum_{i\in X}\theta_{it-\tau}\left(tfp_i - \overline{TFP}_i\right) \quad (4)$$

where bars stand for time average over base and end year.

As opposed to the FHK decomposition, using the GR decomposition leads to an improvement of the within-plant effect. Furthermore, while total incumbents' effect on TFP growth is similar in both FHK and GR, average market share reallocation effect is negative, and the intra-plant contribution is positive, as opposed to both BHC and FHK.

In summary, the contribution of net entry to aggregate TFP growth is consistently positive and always higher than the aggregate rate of TFP change over the period: in relative terms, high productivity entrants replace low productivity exiters, thereby triggering TFP Growth. To a certain extent, the market seems to behave in a competitive way. As the turnover process occurs mainly in the small- and medium-scale sector, these results suggest that any positive TFP change stems from turnover in that sector. What is quite striking is that this effect is at its highest during the oil boom period. During that period, large-scale plants have been the most productive (moderated by the fact that extra-large plants are the least productive), but the catching up process within the small- and medium-scale sector of manufacturing has been accountable for the positive TFP growth rates.

In the first set of results (BHC decomposition), the market share reallocation effect appears to be negative, at least before the deregulation period, meaning that market shares are redistributed from high to low productivity plants. This can seems surprising at first. Considering the FHK decomposition confirms that market share reallocation occurs from high to low productivity plants, but in the mean time, it also appears that market shares are reallocated from low to high productivity *growth* plants (covariance term). Adding up the two terms shows that the market share reallocation effect is in fact positive on average over the entire period.

Intra-plant productivity growth could be considered as being procyclical, in that it turns out to be positive during both the rebound period after the oil crisis, and the investment boom that followed the deregulation period (GR decomposition). However, it is negative during the oil boom period, suggesting that output growth does not necessarily translate into intra-plant productivity growth in a distorted environment. The intra-plant contribution is also negative during the deregulation period, suggesting that it might have been a hard time for all plants.

Comparing the results of the different decompositions of aggregate TFP growth shows two consistencies: (1) net entry effect is on average always high and positive, (2) TFP growth of incumbents is on average always negative, and any positive aggregate TFP growth is due to net entry. The different methodologies also show that it is difficult to decompose accurately incumbents' contribution to aggregate TFP growth.

As a last remark, let us concentrate on average figures for the entire period 1976-1994. The reestimation of aggregate TFP Growth using the BHC decomposition into the effects of entry, exit, market share reallocation and intra-plant productivity growth gives an annual average aggregate TFP Growth of -0.15%, against 1.23% for aggregate TFP Growth estimated using the Divisia Index methodology and 1.01% for the simple average methodology. The discrepancy between both sets of results stems from the use of different weights in the construction of the index numbers. TFP Growth in Chapter 2 is aggregated using different weights for each component of productivity growth: output is weighted with output shares, input is weighted with input shares, labour is weighted with labour shares, and capital is weighted with capital shares. Here, TFP and TFP growth are calculated at the establishment level, and aggregated using output shares only. While the first TFP estimate emphasises the importance of the relative size and the relative use of different inputs, the second TFP estimate simplify the weighting exercise by using output shares only, but emphasizes the decomposition of aggregate TFP Growth decomposition into the effects of entry, exit, market share reallocation and intra-plant productivity growth.

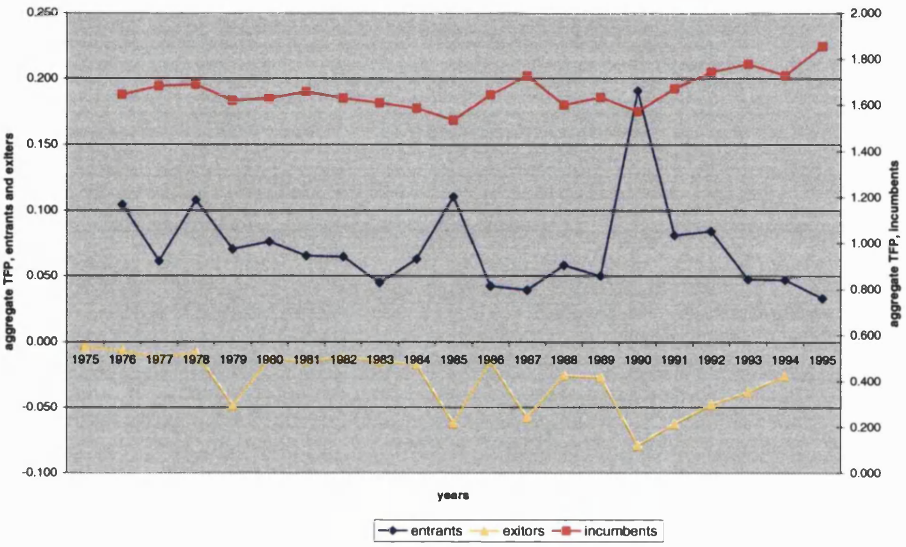
Table 15a: Aggregate TFP of entrants, incumbents, and exitors

	entrants	incumbents	exitors
1975			-0.004
1976	0.104	1.645	-0.007
1977	0.061	1.682	-0.012
1978	0.108	1.689	-0.008
1979	0.071	1.618	-0.048
1980	0.076	1.629	-0.013
1981	0.066	1.658	-0.015
1982	0.065	1.630	-0.012
1983	0.045	1.610	-0.015
1984	0.063	1.587	-0.017
1985	0.110	1.535	-0.062
1986	0.043	1.645	-0.015
1987	0.040	1.726	-0.057
1988	0.059	1.602	-0.025
1989	0.050	1.634	-0.027
1990	0.191	1.572	-0.079
1991	0.081	1.673	-0.062
1992	0.084	1.745	-0.048
1993	0.048	1.779	-0.038
1994	0.047	1.729	-0.026
1995	0.033	1.856	

Table 15b: Aggregate TFP of entrants, incumbents, and exitors, base 100 in 1976

	entrants	incumbents	exitors
1976	100.0	100.0	100.0
1977	58.9	102.2	172.7
1978	103.7	102.7	116.5
1979	68.0	98.4	718.9
1980	73.5	99.1	190.1
1981	63.0	100.8	217.5
1982	62.5	99.1	172.2
1983	43.3	97.9	218.2
1984	60.7	96.5	251.1
1985	106.2	93.3	922.6
1986	41.1	100.0	219.4
1987	38.1	105.0	856.7
1988	56.4	97.4	375.6
1989	48.5	99.4	399.2
1990	183.5	95.6	1172.8
1991	78.4	101.7	930.2
1992	81.3	106.1	710.2
1993	46.1	108.2	565.2
1994	45.6	105.1	386.8
1995	32.0	112.8	

Graph 13: Aggregate TFP levels for entrants, incumbents and exitors



After having looked at the "representative" entrant, incumbent and exiter through average and median figures, let us turn to the aggregate productivity level of each demographic category. Aggregate TFP level for each category is the sum of all n establishments' i TFP levels weighted by their output share θ. For example, aggregate TFP for the incumbents group (noted S) is:

$$TFP_S = \sum_{i=1}^{n} \theta_i TFP_i \qquad (5)$$

For all years, aggregate TFP of entrants is higher than the aggregate TFP of exiters. However, the productivity differential between aggregate entry and aggregate exit tend to reduce over time, explaining the overall decline in the contribution of net entry to aggregate TFP Growth. Indeed, during the reform period, the net contribution drops to an average of 1.45% p.a. The net effect rises again to 3.7% p.a. in the post-liberalisation period, but this reflects mainly what happens in 1990 when entrants' aggregate TFP shoots up comparatively to exiters' aggregate TFP.

At the same time, aggregate TFP of incumbents rose, with two steep rises after 1985 and 1990, while aggregate entrants' productivity shot up and aggregate exiters' productivity dropped dramatically.

What I observe is a phenomenon of convergence between aggregate entrants, and exiters TFP levels, with a rise in aggregate incumbents productivity: as highly productive establishments entered, incumbents productivity increased (maybe due to competition and surely due to assimilation of entrants that became incumbents), and as poorly productive establishments exited, aggregate exiters' TFP increased. The Indonesian manufacturing sector has, to a certain extent, realised potential productivity gains through a reduction in productivity heterogeneity.

Graph 13 sheds also light on exiters productivity as compared to entrants and incumbents. It shows that, although average and median exiters may sometimes be more productive than their counterparts in the entrants and incumbents sub-groups, aggregate exiters' TFP is always lower than entrants' and incumbents aggregate TFP.

4.8 International comparative evidence

How do these life tables compare with previous evidence regarding the Indonesian manufacturing sector? Hill, Aswicahyono, and Bird (1998) look at different indicators among which size distribution dynamics for the period 1977-91 and distinguish among three size groups in terms of employment: 20 to 99 workers, 100 to 499 workers and over 499 workers. They choose to display the value added share of each size group rather than the gross output share.

Table 16: Comparative evidence for industrial size distribution

Indonesia	% of value added			% of gross output		
Years	Current year size group (No employed)			Current year size group (No employed)		
	20-99	100-499	>500	20-99	100-499	>500
1975				16.4	43.1	40.5
1976				16.8	40.6	42.6
1977	9.0	24.2	66.8	17.0	35.9	47.1
1978	8.8	25.2	66.1	16.7	35.9	47.4
1979	8.1	25.7	66.3	16.1	33.7	50.2
1980	7.3	25.0	67.7	15.0	32.1	52.9
1981	6.6	23.8	69.6	13.8	32.4	53.8
1982	6.9	25.1	68.1	14.2	31.9	54.0
1983	6.4	23.3	70.3	14.2	32.6	53.2
1984	6.4	22.7	70.8	13.9	32.1	54.0
1985	12.0	30.3	57.6	14.4	31.5	54.0
1986	8.4	27.3	64.3	12.9	33.2	53.8
1987	7.4	27.0	65.7	9.8	31.9	58.4
1988	9.1	28.6	62.3	12.1	31.8	56.1
1989	7.6	27.4	65.0	11.6	28.7	59.7
1990	7.0	27.3	65.7	10.9	30.1	59.1
1991				10.7	29.0	60.3
1992				10.2	29.3	60.5
1993				9.1	28.2	62.7
1994				7.5	27.6	64.8
1995				6.9	26.2	66.9

Source: Hill, Aswicahyono, and Bird (1998, table 3.5, p.71)

Source: Own calculations

Results are at first sight very similar, confirming the predominance of large-scale establishments, although the dominance seems to be more pronounced in terms of value added. However, in terms of value added, the shares of all size groups tend to remain rather unchanged, while output shares change significantly.

It is a stylised fact that in developing countries, small establishments dominate in terms of numbers. In Chile, over the period 1979-85, their share represented between 92% and 93.7%. In Colombia, between 1977 and 1985, the small scale sector represented between 87.5% and 85.4% (Tybout, 1996, various chapters). In Singapore, between 1965 and 1992, small scale plants represented between 91.7% and 82.1%. Their employment and value added shares diminish to the benefit of medium and large-scale plants. For example, the employment share of plants with 300 employees or more increases from 21.5% to 53.3% between 1965 and 1992, while their value added share increases from 31.1% to 61.2% (H.Hill, 1997, p277). However, these figures do not permit to account for the importance of large and extra-large plants separately.

Table 17 presents additional comparative figures for other countries. The most striking difference between Indonesia and other countries regard the higher survival rates, even when compared to developing countries figures. In their latest study of industrial dynamics for OECD countries, Bartelsman, Scarpetta and Schivardi (2003), find that OECD countries have a 7-year survival rate ranging between 50% and 40%, while Indonesia displays an average 7-year survival rate at 68.8%, about the same as Portugal. This could have two different explanations, depending on the sign of the productivity differential between entrants and incumbents and incumbents and exiters: (1) because entrants are more productive than incumbents, the cohort survival rates are high, or (2) the exit process is not functioning properly, some plants with lower productivity remain in activity.

Table 17: Comparative evidence for industrial demographic statistics

	Entry rates p.a.	Exit rates p.a.	Entry penetration rates p.a. (output)	Gross job addition p.a. (employment entry rates)	Gross job losses p.a. (employment exit rates)	Employment turnover rates p.a.	1-year survival rates	3-year survival rates	5-year survival rates	7-year survival rates	10-year survival rates
UK 1974-79 (Disney, Haskel, & Heden, 2000)	2.5 to 14.5%		1.5 to 6.4%						40%		20%
UK 1989-94 (Bartelsman, Scarpetta & Schivardi 2003)						10%	78%	45%			
US 1972-87 (Baily, Hulten & Campbell, 1992)				9.20%	10.40%	19.60%					
US 1989-94 (Bartelsman, Scarpetta & Schivardi 2003)						3.80%	93%	65%	55%	45%	
Indonesia 1976-94 (Author)	**9.95%**	**5.46%**	**4.21%**	**4.61%**	**2.95%**	**7.56%**	**95.75%**	**85.90%**	**76.30%**	**68.80%**	**58.80%**
Portugal 1989-94 (Bartelsman, Scarpetta & Schivardi 2003)						8%	83%	63%		52%	
Canada 1970-82 (Baldwin & Gorecki, 1991)	4.90%	6.50%		2%	3.20%						40%
Canada 1989-94 (Bartelsman, Scarpetta & Schivardi 2003)						3.00%					
Chile 1979-86 (Liu, 1993, Tybout & Liu, 1996)	6.10%	10.80%	1.60%	12.90%	13.90%	26.80%	73%				
Colombia 1977-85 (Tybout & Liu, 1996)	12.20%	11.10%	4.90%				79%				
Colombia 1977-91 (Fernandes, 2002)				12.50%	12.20%	24.60%					
Morocco 1984-89 (Haddad, De Melo, & Horton, 1996)	13%	6%		18.60%	12.10%	30.70%					
Taiwan 1986 & 1991 (Aw, Chen, & Roberts, 1997)	20.5% & 66.05%	63.07% & 15.70%	25.04% & 38.14%								

In terms of productivity and productivity growth, Baily, Hulten and Campbell (1992) find that for the US over the 1972-87 period, entry and exit have a very small impact on aggregate TFP growth, the bulk of it being attributed to market share reallocation. Using the same data for the Telecommunication sector in particular, Olley and Pakes (1992) find that aggregate productivity growth is mostly due to market share reallocation and plants turnover.

Griliches and Regev (1992), for the Israeli industry over the period 1979-88, find that aggregate labor productivity gains are attributable to intra-plant productivity improvement. While entrants generally display higher productivity than incumbents, turnover only accounts for 10% of productivity gains.

Table 18: Comparative evidence for aggregate TFP Growth decomposition

	Intra-plant productivity growth	Market share reallocation	Entry & exit process
US (Baily, Hulten & Campbell, 1992; Haltiwanger, 1997)	secondary source of aggregate TFP Growth and procyclical	main source of aggregate TFP Growth	marginal contribution
Israel (Griliches & Regev, 1992)	main source of aggregate TFP Growth and procyclical	marginal contribution	marginal contribution
Colombia (Liu & Tybout, 1996)	substantial contribution and procyclical	substantial contribution	substantial contribution
UK (Dysney & Haskel, 2000)	marginal contribution (18% at its most) and procyclical	secondary source of TFP Growth	main source of aggregate TFP Growth (50%)
Taiwan (Aw, Chen & Roberts, 1997)	secondary source of aggregate TFP Growth and procyclical	marginal contribution	main source of aggregate TFP Growth (50%)
Korea (Hahn, 2000)	substantial contribution and procyclical	marginal contribution	main source of aggregate TFP Growth (35% to 45%)
Indonesia (Vial, 2004)	marginal contribution, somehow procyclical, but seems on average negative	substantial contribution from reallocation from low to high TFP Growth plants	main source of aggregate TFP Growth

Baldwin and Gorecki (1991), for Canadian manufacturing 1970-1979, find that entering plants are more productive than incumbents, exiters are less productive than incumbents and turnover accounts for about 30% of aggregate TFP gains.

Tybout (1996, p. 52) also reports that "during Chile's severe recession of the early 1980s, net exit increased the market share of incumbents, improving aggregate productivity...Net entry did the opposite in Morocco, where macroeconomic expansion was associated with rapid net entry, falling market shares for incumbents, and lower aggregate productivity." For Chile (1979-85) net exit accounted for about 30% of aggregate productivity growth, while for Morocco, net entry accounted for about 45% of productivity decline. On the other hand, in Colombia (1977-87), net entry only accounted for about 8% of aggregate TFP growth.

For Taiwan (1981-91), Aw, Chen & Roberts (1997) find that entrants and exiters are less productive than incumbents. However, surviving entrants' productivity level converges with incumbents' productivity level, and net entry can account up to 50% of aggregate TFP growth.

For Korea (1990-98), Hahn (2000) finds that on average, both entrants and exiters display lower productivity levels than incumbents. For the period 1990-95, net entry account for over 45% of aggregate productivity growth, and over 65% for the period 1995-98. The market share reallocation effect is negative for the first sub-period, but improves substantially in the second period. Intra-plant productivity growth played a large positive role in the first sub-period, but becomes negative in the second period.

Indonesian manufacturing data are in line with the UK and New Industrialised Countries in particular, in that entry and exit is a great source of aggregate TFP Growth. Market share reallocation has a slightly positive effect because the reallocation from high to low productivity plants is counterbalanced by the reallocation from low to high productivity growth plants. Intra-plant productivity growth could be considered as being procyclical to a certain extent, with the noticeable exception of the oil boom period.

In Indonesia, because entrants are generally more productive than incumbents, and exiters generally less productive than incumbents, it is far from surprising to find that net entry accounts for most of aggregate productivity gains, and generally counterbalancing the productivity losses of incumbents.

4.9 Conclusion

This chapter proposes a detailed demographic study of the Indonesian manufacturing sector, focusing on size distribution, the process of entry and exit, and the dynamics of TFP Growth. It firstly underlines the importance of the entry and exit process of plants in Indonesia, both in terms of plant, employment and output turnover, but also in terms of productivity gains. It also shows that, while entry rates are in line with international evidence, exit rates – even though rising in the 1990s - tend to be lower than most developing countries. This of course raises the issue of the degree of competition in the Indonesian manufacturing sector. The decreasing cohort survival rates raise the same question: is the market becoming more or less competitive? This issue is investigated in chapter 6 when assessing the factors influencing industrial change and the causes for plant exit.

The second important issue addressed here is the one of the dominance of large-scale plants. I show that, while small-scale establishments dominate in terms of numbers, large- and extra large-scale plants dominate in terms of output, and to a lesser extent, in terms of employment. Over the 20-year period, small-scale plants tend to loose their dominance in terms of numbers, and the dominance of large-scale plants in terms of output and employment increases. The other striking feature is the huge gap between small- and medium-scale plants, and large- and extra-large plants. For example, while establishments of the bottom 5% of the size distribution are only 10 times smaller than the median establishment, establishments of the top 5% of the size distribution are 52 (1975) to 70 times (1995) larger than the median establishment. Over time, the bulk of the size distribution becomes less dispersed around the median – suggesting the possible emergence of a "middle class" of plants, but the huge gap between small- and medium-scale plants and large-scale plants remains.

The third issue dealt with here is the productivity gap between entrants, incumbents, and exiters. I find that, over the 20-year period, the average entrant is more productive than the average incumbent, and that the average exiter is less productive than the average incumbent. This suggests that the process of entry and exit should play a large positive role in aggregate productivity growth.

I also look at the dynamics of the productivity gaps, and find that those tend to reduce over time, suggesting a process of convergence in terms of productivity level. This phenomenon is particularly marked during the post-liberalisation period in the 1990s. Plant heterogeneity is a potential source of productivity gains, and as heterogeneity reduces, potential productivity gains from entry, exit and market share reallocation reduce as well. What is more striking in this process is that for some years, the average exiter becomes more productive than the average incumbent, questioning the hypothesis of exit due only to relatively lower productivity. This issue will be dealt with in the next chapter.

The dynamics of productivity distribution of the entire manufacturing sector shows that it has experienced aggregate productivity growth over the 20-year period, as well as a convergence of plants productivity levels. These phenomena are particularly marked in the 1990s, corresponding to the post-deregulation period.

The analysis of productivity growth by plant-size categories shows that, while large-scale plants increasingly dominate in terms of output and employment, these plants experience average negative productivity changes, suggesting that positive aggregate productivity growth stems from small and medium-scale plants and entrants, with the bulk of entrants belonging to the small and medium size category.

One could argue that the Indonesian manufacturing sector started the period with a low productivity level with low productivity growth in a relatively uncompetitive environment dominated by large entities, but where at least entry and exit was an operating process, suggesting the potential existence of a competitive market for small and medium scale plants. This is compatible with the history of the manufacturing sector, starting with in a heavily regulated and distorted environment favouring large-scale plants. At an early stage of manufacturing development, the only positive contribution to aggregate TFP growth stems from the entry of relatively high TFP plants and the exit of relatively low TFP plants. As those entrants become incumbents, the negative contribution of incumbents becomes less of a burden, to become positive, at least in terms of market share reallocation, especially once the market has been deregulated. However, intra-plant productivity growth still contributes negatively to aggregate productivity growth.

The main source of aggregate productivity growth stems from the entry of high productivity plants and the exit of low productivity plants. But as productivity levels of entrants, incumbents and exiters converge, the net entry effect tends to fade. The process of entry and exit mostly occurs among SMI plants, which could be considered as the relatively competitive sector of manufacturing.

The effects of market share reallocation among incumbents are negative when considering that the reallocation of market shares operates from high to low productivity plants. However, market shares are also reallocated from negative to positive TFP Growth plants. The combined effect is negative throughout the oil boom, oil crisis, and recovery periods, and becomes positive during and after the deregulation period.

Intra-plant productivity growth could be considered as being procyclical (GR decomposition). It is however negative during the oil boom period: in a distorted environment, output growth does not necessarily translate into intra-plant productivity growth. The intra-plant contribution is negative during the deregulation period, suggesting that it might have been a hard time for all plants.

The highest aggregate productivity gains occur after the de-regulation period. However, de-regulation seems to have a stronger positive impact on incumbents' productivity gains than on the net entry effect.

This chapter also raises issues to be answered in the next chapters. What are the explanatory factors of different productivity levels across plants? What impact have the reforms had on TFP growth? What characterises the dynamics of industrial change and aggregate productivity? What are the factors explaining plants' exit, and why did relatively highly productive plants exit in the 1990s?

5 Determinants of industrial performance in Indonesian manufacturing, 1975-95

In chapter 2, I propose a demographic study of the manufacturing sector at the aggregate level; focusing on survival, size distribution and productivity distribution. One of the main results is that Indonesian manufacturing plants are heterogeneous both in terms of size and productivity, and that both size and productivity distributions change over time. More specifically, the dominance of large- and extra-large-scale plants increases over time in terms of output and employment. Simultaneously, plants within the small- and medium scale sector become larger and a more heterogeneous group. In terms of productivity, I find that plant with different sizes display different productivity levels, with ranking changing over time. I also find that different demographic groups (entrants, incumbents and exiters) display different productivity levels, and productivity gaps are narrowing over time (convergence process). Building up on the demographic results, I shed some new light on the process of aggregate productivity growth by decomposing it. The main result is that net entry of plants account for all positive productivity growth over the period 1975-95.

Two main questions then arise:

- How can I explain plant productivity heterogeneity?
- How can I explain changes in the industrial structure?

In this chapter, I aim at answering the first question, while keeping the second question for the following chapter.

5.1 Plant productivity heterogeneity in historical perspective

Plant heterogeneity is a feature of any economy, and especially of developing countries, where the literature has often underlined the existence of dual markets. Dual markets are characterised by the coexistence of large-scale modern industries and small-scale "backward" industries. Backed by the historiography of Indonesian manufacturing, the demographic study of Indonesian manufacturing in chapter 2 has shown the existence of such a duality in the manufacturing sector, especially in terms of plant size. It also shows that the four plants size groups – small, medium, large, and extra-large – display consistent productivity differentials over time, i.e. the ranking of the productivity distributions of each size group does not randomly change every year. This means that, even if there exist productivity differentials within size groups, size must be an important determinant in explaining plant productivity heterogeneity.

Large companies dominate the Indonesian manufacturing sector firstly for historical reasons: independent Indonesia inherited large companies from the Dutch colonialists, and these served as a base for developing a modern – mostly state-owned- industrial sector. The dominance of state ownership in large-scale enterprises is in general explained by the lack of local private entrepreneurship and capital. While this reason can explain the heavy state intervention from independence to the take-off of the Indonesian economy in the beginning of the Suharto period, there has been an evident lack of development of large-scale private domestic entrepreneurship (Robison, 1986).

Robison (1986) reports that large-scale companies have been favoured by economic policies, because of their supposed higher relative productivity. But in the mean time, the state tried to promote small- and medium-scale enterprises (SMEs), mostly for social reasons, i.e. in order to avoid political unrest and reduce income inequality. Thee (1994) provides an overview of the measures taken to improve the participation of SMEs into manufacturing.

Policies, Programs and Organisations for SME Development in Indonesia

Sources: Thee (1994: 101-11), internal documents prepared by the Indonesian Ministry of Industry and Trade, and Hayashi (2003, p.14).

Technology

1969 MIDC (Metal Industry Development Center) established.
1974 BIPIK (Small Industries Development) Program formulated as a technical support program for SMEs.
1979 Under BIPIK program, LIK and PIK (Small Industrial Estates) constructed and technical assistance extended to SMEs in or near LIK/PIK mainly through UPT (Technical Service Units) staffed by TPL (Extension
1994 BIPIK program finished and PIKM (Small-scale Enterprises Development Project) launched.

Marketing

1979 Reservation Scheme introduced to protect markets for SMEs.
1999 Anti-Monopoly Law enacted.

Financing

1971 PT ASKRINDO established as a state-owned credit insurance company.
1973 KIK (Credit for Small Investment) and KMKP (Credit for Working Capital) introduced as government-subsidised credit programs for SMEs.
1973 PT BAHANA founded as a state-owned venture capital company.
1974 KK (Small Credit) administered by BRI (Indonesian People's Bank) launched and later (1984) changed to KUPEDES scheme (General Rural Savings Program) aimed at promoting small business.
1989 SME Loans from state-owned enterprises (1 to 5 % benefits) introduced.
1990 Government-subsidised credit programs for SMEs (KIK/KMKP) abolished and unsubsidised KUK (Credit for Small Businesses) scheme introduced.
1998 The Liquidity Credit Scheme restarted.
1999 The responsibility of directed credit programs transferred from Bank Indonesia (the central bank) to PT PNM (State-owned Corporation for SMEs) and Bank Export Indonesia.
2000 Major government credit programs for SMEs, including KUK, abolished.

General

1973 Ministry of Light Industry and Ministry of Heavy Industry merged into Ministry of Industry.
1976 Deletion (localisation) Programs for commercial cars introduced (motorcycles in 1977 and some other products such as diesel engines and tractors later on).
1978 Directorate General for Small-scale Industry established (in Ministry of Industry).
1984 Foster Father (Bapak Angkat) Program introduced to support SMEs.
1991 Foster Father-Business Partner Linkage extended to a national movement.
1991 SENTRAs (Groups of Small-scale Industry) in industrial clusters organised as KOPINKRA (Small-scale Handicraft Cooperatives).
1993 Deletion Programs for the commercial cars finished and Incentive Systems adopted.
1993 Ministry of Cooperatives started handling small business development.
1995 Basic Law for Promoting Small-scale Enterprises enacted.
1997 Foster Father (Bapak Angkat) Program changed to Partnership Program (Kemitraan).
1998 Ministry of Cooperatives and Small Business added medium business development to its responsibilities.
1998 SME promotion emphasised in People's Economy as a national slogan.
1999 New Automobile Policy announced and Incentive Systems finished.

Hayashi (2003) offers a good review of these programs promoting SMEs and argues that these have not been very effective. In fact, the demographic study proposed in chapter 2 shows that large-scale plants are increasingly dominant, especially in terms of output. Size could explain a good chunk of the productivity differentials between plants, because it influences productivity in many ways.

Firstly, plant size matters because of economies of scale, influencing productivity. Plant size also matters in terms of technology, as small plants generally do not use the same technology as large plants in a similar sector. Hill (1990a) indeed reports that, "case studies would be necessary to identify the disparate factors at work in each case, but the data do at least suggest a pronounced heterogeneity in many industries, with large and small firms in different 'markets' for technology, output and labour" (p.93). Plant size matters also in terms of product differentiation. For example, Hill (1990b) suggests that, "small firms rarely compete directly with larger units, locating instead in different industries, or producing different products in the same industry" (p.92). Plant size matters in terms of flexibility in face of shocks, as they adjust more rapidly, especially in terms of labour and capital utilisation.

Finally, and importantly in the case of Indonesian manufacturing, plant size matters in terms of their relationship to the State. Large plants have a close and preferential relationship to the State, either through direct state ownership, or through connections to state officials via family ties or business links (such as managers). On the other hand, small and medium plants are generally privately owned and have fewer to no ties with the state, unless they are part of a larger group or conglomerate. This can matter in terms of productivity differential because state links can lower input costs in several ways.

Firstly, large plants have an easier and cheaper access to capital, especially - but not exclusively - in the pre-deregulation period. Public large-scale enterprises have benefited from the abundant oil revenues during the oil boom, and private large-scale entities have also benefited from easy access to capital resources. Easy access to capital by large plants is achieved either through the domestic banking market, but large-scale plants have also an easier access to the stock market, and can borrow overseas at lower interest rates. Soesastro and Drysdale (1990) report for example that, "recent events have raised interest rates back to their level before the 1988 deregulation. The costs of intermediation have also returned to pre-1989 deregulation levels, as the spread between credit and deposit rates has risen from around 3-4% in 1989 to over 6%. There is naturally concern about the distributional effects of high interest rates, which are seen to be detrimental to small enterprises. There is also concern about the apparent concentration of funds in the hands of a small number of business conglomerates *(Business News, 3* August 1990). These enterprises can resort to offshore borrowing at lower interest rates, and can raise a large amount of relatively 'cheap' capital in the stock market" (p.20). This problem is only dealt with from 1990 onwards, as Soesastro and Drysdale (1990) continue exposing, "Finance Minister Sumarlin says that there is enough liquidity in the economy, but that the problem is in its distribution *(Bisnis Indonesia,* 8 August 1990). This concern is being addressed by the introduction of a kind of credit allocation system, which has two elements. The first is the establishment of legal lending limits intended to democratise access to credit and prevent concentration of financial power. This regulation, taking effect from October 1990, restricts the aggregate amount of loans and advances that can be made to conglomerate groups. The second is the rule, introduced as an element of *Pakjun* in January 1990, which requires state banks and private domestic banks to allocate a minimum of 20% of their loan portfolios to small-scale enterprises and cooperatives" (pp. 20-21). However, Nasution (1991) adds that it is difficult to assess the results of those programmes because of the low level of accountancy standards and financial transparency in Indonesia, and even reports that "no information exists on who receives credit and how much is received" (p. 27).

Secondly, large plants can also have access to cheaper intermediate inputs through the acquisition of import and distribution licences. For example, Robison (1986) and Chapman (1992) report that the company Krakatau Steel was the sole licenced importer of scrap metal, which made it the sole provider of the main input for the entire industry. Wibisono (1989) reports a similar case in the textile industry, where a company, P.T. Centra Bina Tekstil Indonesia, had been given the monopoly for synthetic fibre importation. Booth (1986) reports interestingly that "although Indonesia has pursued a policy of restricting imports to protect domestic industry since independence, the use of quantitative restrictions to curb the volume of imports has become much more widespread since the early 1980s. The usual form these restrictions take is the granting of a sole import licence to a state trading organisation or the enterprise involved in the domestic production of the particular product. In the first case the import monopoly obviously allows its owner to restrict supplies while at the same time collecting considerable rents, in the second case it affords blanket protection to the domestic producer" (pp.10-11). In fact, the system of import and distribution licences allows the owners to gain a comparative advantage in terms of quantities and costs of intermediate inputs.

There remains however still a wide productivity distribution within each size category –size does not explain everything. In fact, looking at the very different historical sub-periods of the Suharto era, it seems that plants entering the market under different economic, political and institutional environment could differ quite a bit in terms of productivity. It has been argued that during the oil boom, the state provided the economy with a much needed macroeconomic stability, but that it had created a heavily distorted environment, mostly favourable to large-scale, public and crony enterprises. This probably carried on during the deregulation period, with an improvement towards more competitive markets in the 1990s. Does it make a difference in terms of productivity to enter the market under different broad institutional conditions? The literature has concentrated on the effects of liberalisation on plants in general, i.e. incumbents as well as entrants. For example Goeltom (1995) finds that the financial liberalisation results in a more widespread access to capital, and that capital tends to go to more productive plants. Chapman (1992) assesses the impact of the trade liberalisation that has occurred since the mid-1980s in the footwear and steel industry, underlines its unevenness across industries, and shows that where trade deregulation has been fully implemented (for example in the footwear industry), competitiveness has improved dramatically, while sectors where trade deregulation has been patchy (for example in the steel industry), outcomes are more mixed. What those two studies show is that changes in the broad institutional environment have affected all plants. What has not been yet assessed is whether these environmental changes affect the productivity of entrants: are plants entering after deregulation more productive than plants having entered during the protectionist period? In other words, do initial conditions matter more than current conditions?

Initial environmental conditions possibly shape plants capabilities, but the time of entry surely affects productivity through the specific vintage of their capital stock. In a specific year of observation, plants of different vintages hold capital stocks of differing degrees of obsolescence. In a context of technological catch-up, age should account for some of the productivity differentials. The historiography underlines that different industries have upgraded their production technologies at different paces, often influenced by state policy. For example, clove cigarettes industry has upgraded its machinery very late in the oil boom period, mostly because of a struggle for power accompanied by protectionism (Tarmidi, 1996), while the textile, garment and leather industries have experienced a more early and rapid technological change (Hill, 1991). This might explain some of the productivity differentials across industries, but does not account for productivity differentials within industries.

The age of the capital stock of plants matter, because they influence the level of technology of each plant. This is an important issue, but the literature has mainly focused on attempting to generate a reliable capital stock series for plants rather than assessing the impact of capital obsolescence on productivity levels.[45] Different capital obsolescence rates could account for some of the productivity differentials, and plants with an older capital stock should be less productive. In the mean time however, some learning effects linked to age should push up productivity levels. In the case of Indonesian manufacturing, learning effects could take place not only in the area of the production processes, but also in the domain of skills for dealing with the distorted and corrupted

[45] See in particular Keuning (1991) and Timmer (1999). A full discussion of capital stock measurement is provided in chapter 2.

environment.

The historiography underlines the importance of ownership in explaining both size and productivity. From Robison (1986) a broad typology of plants can be drawn, with the small and medium scale sector being primarily privately owned by domestic entrepreneurs, and the large scale sector being the domain of state ownership, with some foreign joint ventures.

The literature agrees on the effect of foreign ownership on productivity, in that it tends to induce relatively higher productivity levels through the adoption of more recent and more effective technologies of production and of organisation. For example, Blomström & Sjöholm (1998), using the *Statistik Industri* dataset for the year 1991, find that "both minority and majority owned foreign affiliates are more [labour] productive than domestic establishments" (p.5). Foreign-owned plants are also supposed to be more productive because they tend to be more export-orientated and more exposed to foreign competition.

Meanwhile, the public sector is supposed to display lower productivity figures because it has tended to be protected from foreign competition, in order to protect both "infant industries" and vested interests. Public enterprises also benefited from soft budget constraints, especially through a facilitated access to cheap public capital through public banks. Bartel and Harisson (1999) indeed argue that "to identify the sources of public sector inefficiency, we use a 1981-1995 panel of all public and private enterprises in manufacturing in Indonesia. Our results suggest that in recent years, *all* of the observed inferior performance of publicly owned manufacturing enterprises in Indonesia is attributable to plants which received loans from state banks and plants which were shielded from import competition" (p.4).

The literature has paid much attention to the effects of public and foreign ownership on productivity, because those two categories represented the largest share of output and value added, however, it is worth recalling that the bulk of plants in Indonesian manufacturing is of private domestic ownership. For example, 95% of plants that entered between 1976 and 1995 had some private domestic ownership. This chunk of the population is supposed to have been less productive than both foreign and public plants because of a lower technological standard, and especially because they did not benefit from a normal access to capital. Hill (1990b) reports that "because private firms lack comparable access to skills, technology, finance and overseas markets, their average labour productivity is a good deal lower" (p.85).

Linked to both the ownership and the size issues is of course the group affiliation question. A small private domestic plant could achieve productivity levels similar to a large foreign plant if it is part of a large foreign group or of a large group that has connections to the government. Groups or conglomerates have an important place in Indonesian manufacturing, and the advantages of being part of a group are the same as the advantages conferred by a large size.

Additionally to group affiliation through ownership, benefiting from the advantages offered by a large group or firm can also through a system of patronage called *Program Keterknitan Sistem Bapak Angkat* (Linking Large and Small Enterprise, including Subcontracting), introduced in the very late 1980s, whereby a large group provides technological help to small and medium plants. According to Sandee, Rietveld, Supratikno, and Yuwono (1994) "this program aims at deepening the industrial structure of Indonesia, and also at reducing inequalities between different types of industrial enterprise, by strengthening the linkages between *industri kecil* [small-scale industry] and large enterprise. (The latter is not solely confined to industrial enterprises but encompasses big business in general.) The program originally aimed to develop industrial subcontracting linkages between large and small industrial enterprises, with the latter functioning as suppliers of inputs through 'putting out' systems. Large industrial firms were encouraged to buy inputs domestically instead of importing, and to buy certain inputs from SKI instead of making these themselves. The concept has been extended to require large scale enterprises to assist SSCI in general, including those in other branches of industry. The support of a large scale industry may include assistance in supply of raw materials, training, technical advice and marketing. Each of the Ministry of Industry programs listed below provides additional opportunities for large firms to fulfill their responsibilities under the *bapak angkat* system" (pp. 122-123). The authors report a number of industries where this program has been put into action, for example, in the case of the metal casting industry "an Indonesian conglomerate is highly active in this cluster [of small plants] through the *bapak angkat* system. It provides long-term training including a study tour to Japan for selected producers" (p.129). This patronage system requires not only large private but also large public enterprises to provide assistance to small scale enterprises. The scheme in fact requires public enterprises to spend 1 to 5% of their net profit on the development of small scale enterprises through the funding of "managerial training, technical assistance, provision of working capital, marketing assistance, and provision of loan guarantees to the formal banking system when SSCI lack collateral to implement feasible economic projects" (Sandee, Rietveld, Supratikno, and Yuwono, 1994, p.123). Hill (1995), and Hayashi (2003) argue that those programs have been mostly unsuccessful.

Of course of great interest in the case of Indonesia is the role that cronyism played in manufacturing. Basri (2001), for example shows how crony capitalists influenced the policy making in the area of trade protection. He shows that crony capitalist formed lobbies that directed trade policy making, and raises the question of the quite successful implementation of trade liberalisation that started in the mid-1980s. He suggests that crony capitalists became involved in some export-orientated sectors, but primarily concentrated in non-tradable sectors, trade and natural resources. Fisman (2001), using data on companies listed on the Jakarta Stock Index for the 1990s, shows that up to a quarter of share values of companies linked to President Suharto was due to political connections. He concludes "The large proportion of value that some firms derive from connections provides support for the perspective that political connections have distorted rates of return, and therefore the allocation of capital, in Indonesia. Moreover, in looking at firm-level data of publicly traded firms, there is no discernible relationship between accounting return on assets and political dependence. This suggests that it is possible that the massive political rents described above are being dissipated through rent-seeking activities. If the proceeds of such rent-seeking are not used productively, then this system of patronage will be a further source of economic inefficiency. Combined with the welfare losses from monopoly pricing, the total drag on the economy from these various factors may be very large" (pp. 21-22). Robison (1986) provides several detailed example of groups acquiring monopolies in certain sectors through political connections, for example in the case of the steel industry or the wheat industry. What is the impact of cronyism on the relative productivity of plants? If advantages prevail, raising sale prices through monopolies on the market for final goods, lowering intermediate inputs prices through the acquisition of sole importer and/or distributor licences, facilitating access to capital, then the effect of cronyism on the measured relative productivity should be positive. The literature also underlines the success of the deregulation program started in the mid-1980s, the effect of cronyism should then be found to be attenuated in the 1990s.

5.2 Explaining plant productivity heterogeneity: A framework for analysis

In their seminal work on US manufacturing, Baily, Hulten, and Campbell (1992) identify four hypotheses to explain plant productivity heterogeneity:

- Productivity heterogeneity is the result of a random draw in productivity levels due to measurement errors and random shocks. As a result, plant productivity ranking is not consistent over time.
- Productivity heterogeneity is the result of a random draw in productivity growth rates due to measurement errors and random shocks. As a result the variance of productivity levels will increase over time.
- Productivity heterogeneity is the result of different plant vintages: (1) different vintages for capital stock and technology trigger different productivity levels, the choice of technology is influenced by the external environment (broad institutional environment and external shocks), as time goes by, old vintage plants become less productive. (2) But new investment has to be accounted for as well. As plants get older, they get less productive unless they invest. I have here to underline that this hypothesis is appealing, but does however contradict the hypothesis where plants become more productive over time

because of learning effects (see, for example, Jovanovic, 1982). The test of the plant vintages hypothesis will have to include the three effects (capital stock vintage, new investment, and learning effects).

- Finally, plant productivity heterogeneity could be the result of permanent plant heterogeneity, with the existence of plant fixed effects, where previous productivity level is a fairly good predictor of current productivity level. (1) The first component of the fixed effect is size, which evolves very slowly over time. Size relates to issues of optimal size and economies of scale, thereby influencing productivity levels. Size can either be proxied by output, employment or capital stock. In the case of asymmetrical macroeconomic shock, size may not adjust instantaneously, but capacity utilisation will change and affect productivity rankings. (2) The second component of the fixed effect is managerial ability. One can first distinguish between good and bad managers, triggering consistent high or low productivity. But even a good manager can trigger low productivity levels if the plant becomes too large (i.e. if the good manager is "spread too thin"): there are decreasing returns to scale for management. In that case, plant size could be negatively correlated with productivity levels. Managers can also slack over time and become efficient again once they have hit the bottom. (3) The third component of the fixed effect can be the quality of the workforce, which can be proxied by data on educational attainment or wages if one made the hypothesis that higher quality workers are able to ask for higher wages. (4) The authors also complement the analysis by looking at the effects of being part of a group of companies on productivity levels: a plant belonging to a large and productive group could beneficiate from positive externalities.

Baily, Hulten, Campbell (1992) control for industry-specific effects (with 5-digit industry dummies) for each hypothesis, and run the tests on each demographic sub-group (entrants, incumbents and exiters). They find that the fixed effect hypothesis turns out to explain most of plant productivity heterogeneity.

While their analysis of the fixed effect explanation seems rather complete when dealing with the case of US manufacturing in the 1980s, the framework has to be amended when dealing with Indonesian manufacturing over the period 1975-95. The first obvious determinant for productivity differentials, which has been used in other studies, is whether or not the plant is exporting part of its production. Exporting plants are expected to be more productive, because they are exposed to international competition.

Another determinant for productivity heterogeneity is ownership type (private versus public, domestic private versus foreign private). Indeed, both the theoretical review in chapter 2 and the historical analysis have shown the importance of ownership in general, and the importance of political economic issues in particular for the case of Indonesian manufacturing.

Political economic issues link naturally to the problem of cronyism that seems to be a feature of the Suharto era. Are plants acting in "crony" sectors more or less productive than plants acting in other sectors? Within individual sectors, are "crony plants" more or less productive than other plants? Basri (2001) provides a dataset of crony sectors dummies at the 5-digit level in order to test for the first hypothesis. For the second hypothesis, I propose to use a plant-level series labelled "gifts, charities, donations" already used in Behrman and Deolalikar (1989) as a proxy for plant cronyism.

The usual Cobb-Douglas production function can be augmented with those variables in order to explain plant-level performance. Many authors point at simultaneity problems using this specification and prefer to regress directly productivity levels on the previous explanatory variables. Following Baily, Hulten, and Campbell (1992), this is the methodology I use to explain plant-level productivity. I have here to recall that the dependent variable being a residual, R-squares are likely to be lower than usual. As a benchmark, Baily, Hulten, and Campbell (1992) publish satisfying results with R-squares ranging from 17% to 32%.

The following table summarises the raw variables available for testing the previous hypothesis:

Variable	Time period
Plant-level TFP	1975-95
Age of plant (derived from year of birth)	1975-95
Investment in capital stock	1975-95
Size (output, and employment)	1975-95
Wages of non- production workers (proxy for management quality)	1975-95
Wages of production workers (proxy for labour quality)	1975-95
Ratio of non-production workers over total number of workers (white collar share)	1975-95
5-digit industry dummies	1975-95
Ownership type (central government, local government, domestic private, foreign private)	1975-95
Gift, charities, donations (proxy for plant-level cronyism)	1975-95

Capacity utilisation	1990-98
Percentage of production exported	1990-98
Conglomerate-related variables: Is the plant a foster parent company? Foster parent company services rendered (type)? Does establishment have foster parent? Foster parent above company provided services (type)? Member of group of companies?	1996
Crony sector dummy	1975, 1987, 1995

I also construct a number of other potential explanatory variables:

TFP and relative TFP

I use plant TFP level calculated in chapter 2. Additionally, I propose to work on relative TFP levels in order to control for specific industrial sectors. Relative TFP is calculated as plant TFP level minus plants TFP average for each 5-digit sector:

$$TFP\_rel_t = TFP_t - \left(\sum_1^n TFP_{it} \Big/ n \right) \quad (1)$$

where n is the number of plants in each 5-digit sector.

Investment variables

The original dataset provides us with a raw investment variable. However, we know from chapter 2 that this variable only exists for a number of plants and for a short time period. I have proposed a methodology to estimate a capital stock for all plants in all years. The methodology generates the log of the estimated capital stock noted. The log of capital stock has allowed calculating yearly capital stock growth for each plant, and can also allow the calculation of the total capital stock growth between the year of entry and the current year of observation as:

$$total\_capital\_stock\_growth_{it,t_0} = \ln capital\_stock_{it} - \ln capital\_stock_{it_0} \quad (2)$$

which is a good measure for total capital stock renewal controlling for the size of companies as measured by capital stock, without causing multicolinearity problems with the TFP measures.

Conglomerates-related variables

These variables only exist for one year, 1996. I transform them into time-unvarying dummies for the period 1989-1996.

be_parent equals 1 if the plant is a foster company, 0 otherwise.

have_parent equals 1 if the plant is has foster company, 0 otherwise.

group_member equals 1 if the plant is member of a group of companies, 0 otherwise.

Export variables

The dataset provides a variable labelled "percentage of production exported" for the period 1990-1998. Using this variable, I create two dummy variables, "exporter" taking value 1 if "percentage of production exported" is more than zero but lower than 80%, 0 otherwise, and "grand exporter" taking the value 1 if "percentage of production exported" is over 79%, 0 otherwise. This helps distinguishing plants almost entirely devoted to the export market and plants participating in both the export and the domestic market.

Percentage Capacity Realised

For the period 1990-95, the dataset provides a variable labelled "Percentage Capacity Realised". I clean this series by replacing all observations above 100% and those equal to 0% by a missing value.

Ownership variables

The dataset provides series on the percentage of plants held by four categories of owners:

- private domestic owners
- foreign owners
- central government
- local government

I clean these series by replacing any observation above 100% by a missing value. I additionally create two types of ownership dummies.

Private domestic dummy equals 1 if private domestic owners hold 50% or more (over 50% definition), and private domestic dummy equals 1 if private domestic owners hold any positive share of capital (any positive share definition).

Foreign dummy equals 1 if foreign owners hold 50% or more (over 50% definition), and foreign dummy equals 1 if foreign owners hold any positive share of capital (any positive share definition).

Central government dummy equals 1 if central government holds 50% or more (over 50% definition), and central government dummy equals 1 if central government hold any positive share of capital (any positive share definition).

Local government dummy equals 1 if the local government holds 50% or more (over 50% definition), and local government dummy equals 1 if local government hold any positive share of capital (any positive share definition).

Crony variables

Basri (2001) constructs a crony dummy variable for the years 1975, 1987, and 1995 at the 5-digit level. The crony dummy equals 1 if the sector is considered as a crony sector for the period 1975-1995, 0 otherwise. The sector is considered as "crony" if it is dominated by crony companies. Basri (2001) takes a narrow definition of rent-seekers and crony capitalists as being those well connected to Suharto's family, i.e. those businesses including members of Suharto's family either as shareholder, manager, or business partner. His work is based on evidence from political studies and press cuttings.

In 1975 the crony influenced sectors are the following:

- Canning & preserving meat
- Canning & preserving fish and other sea food
- Wheat flour & other grain mill products
- Maccaroni, noodles & similar products
- Sawmills planning and other processing
- Ceramics
- Glass and glass products
- Cement
- Motor vehicles

In 1987 the crony influenced sectors are the following:

- Processed meat
- Milk products
- Processed fish
- Refined vegetable & animal oil
- Wheat flour
- Other flours
- Noodles and the like

- Sugar
- Other foods
- Sawn processed wood
- Plywood
- Paper & paper board
- Basic chemicals
- Plastic ware
- Ceramics & earthenware
- Glass & glassware
- Cement & lime
- Basic iron and steel
- Batteries
- Motor vehicles excluding motorcycles
- Motorcycles

In 1995 the crony influenced sectors are the following:

- Processed and preserved meat
- Dairy products
- Processed and preserved fish
- Wheat flour
- Other flours
- Noodles and the like
- Sugar
- Soybean products
- Other foods
- Animal feeds
- Sawmill and preserved wood
- Manufacture of plywood and the like

- Pulp
- Paper & cardboard
- Basic chemicals excluding fertiliser
- Plastic products
- Ceramics & earthenware
- Glass products
- Cement
- Basic iron and steel
- Batteries
- Motor vehicles excluding motorcycles
- Motorcycles

Source: Basri (2001)

I add a plant-specific crony proxy, which is a specific part of the "other expenses" category in plants' accounts and is a variable labelled "gifts charities donations". To my knowledge, only Behrman and Deolalikar (1989) ever made use of this series and also use it as a proxy for plant-level cronyism. I also generate the variable "gifts share" as the share of gifts, charities, donations in total gross output to control for size. These series are available for the entire period. Plants report a series of expenses in the "other expenses" category and include loan interest; gift, charities, donations; representation allowance; royalty; management fee; promotion, advertising; water expenses; telecommunications; travel expenses; preventive environment pollution; R&D and production engineering; human resources and training; and others. It is widely acknowledged that what can be found in some of these other expenses is linked to corruption expenses, especially the "gifts, charities, donations expenses". There are numerous examples supporting the link between those expenses and cronyism. Robison (1986) reports that the P.T. Bogasari, the quasi-monopoly for flour milling "was owned by the Liem group, in partnership with Sudwikatmono, the half-brother of President Suharto, who was also President Director. The articles of association stipulated that, in effect, 26% of profits be set aside for 'charitable' foundations including Mrs Suharto's Yayasan Harapan Kita and Kostrad's Yayasan Dharma Putra" (p.232). In the same book, Robison (1986), in a detailed description of military-owned business groups, reports that "the articles of incorporation of Karana [a deep-sea shipping line] include a dispersal of dividends to various foundations, including Mrs Suharto's Yayasan Kartika Jaya" (p.260). About these Yayasans (Foundations), Robison (1986) adds that "there is a difficulty in distinguishing between companies owned by politico-bureaucrats on behalf of political institutions and those where capital is owned and invested on their own private behalf. Probably there is no clear delineation of these facets in any one firm. Yayasans Harapan Kita, Kartika Jaya and Trikora have members of the Suharto family as shareholders. The degree to which they function as charitable institutions, as sources of funds for the military or for patronage, or as the private investment of the Suharto family is a matter of conjecture. They receive funds both from direct investments and from other companies which specifically set aside a portion of their profits" (p. 345-346). These examples regarding exclusively the Suharto family constitute only a small sample of the existing relationship between the Yayasans and the manufacturing industry. Of course, not all of the corruption is channelled through Yayasans, however, this variable could constitute a good proxy for it.

Internal labour structure proxies

I define two plant-specific labour structure proxies. The first is the number of non-production workers over the total number of workers, and is labelled "white collar share". This variable captures the "managerial intensity" of a plant. This managerial intensity can be either too low, triggering inefficiencies in the organisational process, or too high, especially in the case where a large number of family workers benefit from "fictive" managerial positions. Additionally, I use the share of total non-production workers' wages over total workers' wages in order to control for any super-normal remuneration of non-production workers.

Proxies for management and labour quality

In the absence of data regarding the level of education of workers, I use the average wage for workers as a labour quality proxy. I distinguish between production and non-production workers. The labour quality variable is calculated as total production workers wages, divided by the total number of production workers. The management quality variable is calculated as total non-production workers wages, divided by the total number of non-production workers.

As pointed out previously, I am using two datasets, the "Raw Statistik Industri" (RSI), and the "Backcast Statistik Industri" (BSI). The BSI is more accurate in terms of population, but contains only a limited number of variables: Output, input, labour, capital, age, allowing to generate survival, TFP and relative TFP. All other variables are only available for RSI. Therefore, in order to explain TFP differences across companies, I will test the random draw hypothesis, the capital vintage hypothesis and the fixed effect hypothesis on BSI, but will only be able to specify the fixed effect on the RSI dataset.

5.3 Examining pair-wise correlation between variables

Before modelling and explaining plant-level TFP and relative TFP, I chose to observe the correlation between the different variables.

Random draw hypothesis

Differences in TFP levels and relative TFP can stem from errors in measurement or random shocks. If this is the case, TFP or relative TFP today will not be strongly correlated with TFP or relative TFP yesterday.

Table 1: Correlation between TFP, relative TFP and their one-, two-, and three-year lags

	1975-95	1975-89	1990-95
	TFP	TFP	TFP
lag1 TFP	0.5115*	0.5281*	0.4669*
lag2 TFP	0.5062*	0.5229*	0.4619*
lag3 TFP	0.5116*	0.5301*	0.4651*
	5-digit relative TFP	5-digit relative TFP	5-digit relative TFP
lag1 5-digit relative TFP	0.6737*	0.6985*	0.6347*
lag2 5-digit relative TFP	0.5609*	0.5961*	0.5075*
lag3 5-digit relative TFP	0.4914*	0.5345*	0.4285*

* indicates a correlation significant at the 5% level

Over the period 1975-95, TFP levels are significantly correlated to their lags, by over 50% on average, the correlation is stronger in the pre-1990 period with correlation coefficients above 52%, while the correlation is weaker in the post-1990 period with correlation coefficients just above 46%.

Correlations are stronger when using the relative TFP measure. Over the entire period, relative TFP is significantly correlated to its one-year lag by over 67%, the correlation is even stronger in the pre-1990 period with a correlation over 69%, against 63% for the post-1990 period. The correlation coefficients decrease with the two- and three-year lags.

TFP and relative TFP are strongly and significantly correlated to their lags, suggesting that, while there might be a small percentage of measurement error and random shocks, most of the data are sound and the random draw hypothesis cannot be validated. Further tests will be conducted in the next section.

Demographic factors

How does relative TFP correlate with demographic factors? I chose first to examine survival, age, and entry and exit dummies.

I also create four historical period of entry dummies: the "oilboom entry dummy" equals 1 if the plant entered during the oilboom period (1975-80), the "crisis entry dummy" equals 1 if the plant entered during the crisis (1981-83), the "recovery entry dummy" equals 1 if the plant entered during the recovery period (1984-85), the "deregulation entry dummy" equals 1 if the plant entered during the deregulation era (1986-1989), and the "investment boom entry dummy" equals 1 if the plant entered during the investment boom (1990-95).

Additionally, following Baily, Hulten, and Campbell's methodology (1992), I create another four historical period of entry dummies: "pre_1981" equals 1 if the plant entered during the period 1975-80, "pre_1984" equals 1 if the plant entered during the period 1975-83, "pre_1986" equals 1 if the plant entered during the period 1975-85, and "pre_1990" equals 1 if the plant entered during the period 1975-89.

Table 2: Correlation between relative TFP and demographic factors

	1975-95	1975-89	1990-95
	TFP_5D_rel	TFP_5D_rel	TFP_5D_rel
survival	-0.0095*	-0.0039	-0.0185*
age	-0.0056*	-0.0056*	-0.0055
entry dummy	0.0048*	0.0133*	-0.0110*
exit dummy	-0.0025	-0.0152*	0.0073*
oilboom entry dummy	-0.0169*	-0.0182*	-0.0196*
crisis entry dummy	0.0066*	0.0109*	-0.001
recovery entry dummy	0.0058*	0.0071*	0.0038
deregulation entry dummy	0.0099*	0.0102*	0.0107*
investment boom entry dummy	0.0042*	.	0.0077*
pre_1981 entry dummy	-0.0169*	-0.0182*	-0.0196*
pre_1984 entry dummy	-0.0133*	-0.0125*	-0.0186*
pre_1986 entry dummy	-0.0107*	-0.0102*	-0.0156*
pre_1990 entry dummy	-0.0042*	.	-0.0077*

* indicates a correlation significant at the 5% level

Survival and age are both negatively correlated to relative TFP: as plants grow older, their relative TFP tends to fall, which is compatible with the vintage capital hypothesis, if I assume that survival or age are good proxies for the age of the capital stock. This, of course, does not take into account new investment during plants' lives.

The correlation coefficient between relative TFP and entry and exit dummies corroborates what had been found in the previous chapter. In the pre-1990 period, entrants are more productive than incumbents, and exiters are less productive than incumbents, suggesting that competitive forces might be at play. Correlation coefficients however take the opposite sign for both dummies in the post-1990 period.

The first set of historical period of entry dummies (oilboom, crisis, recovery, deregulation and investment boom entry dummies) suggests that having entered during the oil boom has had a negative effect on relative TFP. On the other hand, having entered during the deregulation period or the crisis seems to result in stronger relative TFP. This could indicate that having entered in a period of soft economic constraints (abundance of capital, less competition, etc) triggered lower relative TFP at the plant level. On the other hand, having entered during a period of stronger economic constraints (more competition, competitive allocation of capital, etc) triggered higher relative TFP at the plant level.

The second set of historical period of entry dummies just seems to reflect the age effect on relative TFP: as plants grow older, they become relatively less productive.

Size

I choose to proxy plant size with four measures: total number of workers, total gross output, total wages, and percentage of capacity realised. The total number of workers has a negative (but not significant) correlation with relative TFP, while total gross output and total wages have a significant positive correlation with relative productivity. Larger sizes could have a positive impact on relative productivity, but those figures suggest that labour-intensive activities could display lower productivity. Wages reflect both size and labour and management quality: while the number of workers (labour intensity) is negatively correlated with relative productivity, wages (labour and management quality) are positively correlated with relative productivity, especially in the pre-1990 period. But the sense of causation still needs to be determined: higher wages, reflecting higher labour and management quality, could trigger higher relative productivity, but the gains of higher relative productivity could also be redistributed in higher wages.

Table 3: Correlation between relative TFP and size measures

	1975-95	1975-89	1990-95
	5-digit relative TFP	5-digit relative TFP	5-digit relative TFP
nb of workers	-0.0005	0.0027	-0.0042
OUTPUT	0.0605*	0.0416*	0.0836*
WAGES	0.0035	0.0069*	0.0028
% capacity realised	0.0187*	.	0.0187*
log number of workers	-0.0106*	-0.0076*	-0.0153*
log OUTPUT	0.1120*	0.1266*	0.0944*
log wages	0.0688*	0.0838*	0.0436*

* indicates a correlation significant at the 5% level

Percentage of capacity realised is significantly and positively correlated to relative productivity. This is a fairly intuitive result: the under-utilisation of assets leads to relatively lower productivity.

Total investment, and initial productivity level

I now examine the correlation between relative TFP and a measure of cumulated capital stock growth (capital stock growth between the year of observation and the year of entry). The measure, "total capital stock growth", presents a strong and significantly positive correlation with relative TFP, about 3% for both periods. The more plants invest, the higher the relative productivity. Of course, the other sense of causation could be present as well: the more productive the plants, the better the investment possibilities. This will be taken into account when testing for the capital vintage hypothesis in order to control for capital stock renewal.

Table 4: Correlation between relative TFP, cumulated capital stock growth, and initial TFP level

	1975-95	1975-89	1990-95
	5-digit relative TFP	5-digit relative TFP	5-digit relative TFP
total capital stock growth	0.0276*	0.0329*	0.0248*
initial TFP	0.4801*	0.5499*	0.3682*

* indicates a correlation significant at the 5% level

Finally, I investigate the correlation between the initial level of TFP, which is the TFP level of plants in their year of entry, and relative TFP for each year. The reason for including this explanatory variable is that it might better capture both year of entry and plants-specific characteristics than the simple year of entry or period of entry dummies. The correlation is strong and positive (48% for the entire period, 55% for the pre-1990 period, but dropping to 37% for the post-1990 period). The higher the initial TFP level, the higher the relative TFP in consequent years. In other words, initial conditions seem to matter a lot when explaining relative productivity.

Conglomerate-related and export variables

I firstly examine the correlation between relative productivity and a set of three conglomerate-related dummies. The strongest and positive correlation is between relative productivity and the group member dummy: a plant member of a larger group of companies is more likely to display higher relative TFP, and/or plants with higher relative productivity are more likely to become part of a larger group of companies. This phenomenon is true throughout the period, but is more acute during the post-1990 era. The correlation between relative productivity and the dummy showing whether or not a plant has or is a parent company ("have_parent" or "be_parent") corroborates this. However, it could be the case that having a parent company is more beneficial than being a parent in terms of relative productivity, especially in the post-1990 period. These results are however to be interpreted with caution, as the dummies only exist for the year 1996 and have been assumed to remain constant for the period 1975-1995.

Table 5: Correlation between relative TFP, conglomerate-related and export variables

	1975-95	1975-89	1990-95
	5-digit relative TFP	5-digit relative TFP	5-digit relative TFP
be_parent	0.0168*	0.0244*	0.0082*
have_parent	0.0326*	0.0265*	0.0381*
group_member	0.0448*	0.0394*	0.0498*
exporter	0.0165*		0.0165*
grand exporter	-0.0116*		-0.0116*

* indicates a correlation significant at the 5% level

The export-related dummies "exporter" and "grand exporter" are only available for the period 1990-95. The partial correlation coefficients suggest that exporting plants are more likely to display higher relative TFP than non-exporting plants. This is not a surprising result, as most studies find similar results that are also supported by the theory: exporting plants are exposed to foreign competition and should therefore be more competitive and more productive. Sjöholm (1997a) reports in the abstract of his paper that, "establishments participating in exports or imports have relatively high levels of productivity. Furthermore, the results suggest that establishments engaged in exports have shown comparable high productivity growth. The larger the share of an establishment's output that is exported the higher its productivity growth."

What is however surprising is the negative and significant coefficient on the dummy for export-devoted plants ("grand exporter", plants exporting 80% of their production and over). The discrepancy stems from the differences in average TFP of the 5-digit sectors: it seems that over the period 1990-95, export-devoted plants belonged to industries where average TFP levels were higher than in other industries. Two thirds of export-devoted plants belong either to the textiles, garments and leather sector (sector 32) or to the wood products sector (sector 33), which display the highest average sector TFP for the 1990s (behind the "other manufacturing" sector). And within those high productivity sectors, export-devoted plants tend to be less productive than their peers, this is especially striking in the wood products sector (one third of all export-devoted plants).

Looking more closely at the economic history of the latter sector, shed some light on those striking results. Pangetsu (1996), in his study of the Indonesian deregulation era, shows that in fact both the forestry and wood products sectors did not benefit from the trade reform package and remained heavily protected, with the old system of import and export licensing still active. For example, in 1989, 82.8% of the wood products sector production was under export restriction. It is therefore not surprising that export-devoted plants, that acquired their export licences via a distorted system rather than on a competitive basis, are less productive than their non-export-devoted counterparts.

Ownership shares

I examine the correlation between relative productivity and two sets of ownership variables described in the previous section. Both sets suggest that private domestic ownership is negatively correlated to relative productivity. This is compatible with historical accounts of weak local bourgeoisie and entrepreneurship, and accounts of lower productivity of small domestic private companies. However, as I have demonstrated in the previous chapter, small plants are not the least productive, so that the argument implying that small domestic private companies are the least productive of the industrial sector only holds partially: relative productivity could be more attributable to ownership than size.

Table 6a: Correlation between relative TFP and ownership variables

	1975-95	1975-89	1990-95
	5-digit relative TFP	5-digit relative TFP	5-digit relative TFP
private domestic dummy	-0.0570*	-0.0623*	-0.0479*
foreign dummy	0.0488*	0.0525*	0.0437*
central government dummy	0.0313*	0.0382*	0.0184*
local government dummy	0.0109*	0.0126*	0.0076*
private domestic ownership share	-0.0615*	-0.0666*	-0.0526*
foreign ownership share	0.0544*	0.0577*	0.0503*
central government ownership share	0.0333*	0.0390*	0.0227*
local government ownership share	0.0141*	0.0170*	0.0082*

* indicates a correlation significant at the 5% level

Table 6b: TFP statistics by 2-digit sectors for all plants and privately owned plants

	All plants, 1975-95				
2-digit sector	Obs	Mean	Std. Dev.	Min	Max
31	95912	**1.402749**	0.3681043	-1.1176	9.956626
32	79965	**1.466603**	0.4823857	-0.6282203	7.535044
33	36061	**1.530209**	0.3850262	-0.0079976	6.605114
34	14660	**1.522698**	0.3806493	0.1967519	4.72717
35	38150	**1.497832**	0.4065378	0.2493532	7.630556
36	28036	**1.494718**	0.3713308	0.1479674	5.645116
37	1985	**1.475499**	0.3828748	0.1789171	4.563709
38	32328	**1.50911**	0.4025633	-0.2263555	7.404039
39	4550	**1.556456**	0.5246292	0.2416836	6.422881
	Privately owned plants, 1975-95				
2-digit sector	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
31	88020	1.381615	0.3479862	-1.1176	6.986887
32	75914	1.465592	0.488535	-0.6282203	7.535044
33	33892	1.530954	0.3862178	-0.0079976	6.605114
34	13298	1.516613	0.3814321	0.1967519	4.72717
35	32747	1.464619	0.3819447	0.2493532	7.630556
36	26518	1.492702	0.3737588	0.1479674	5.645116
37	1568	1.444586	0.3820221	0.1789171	4.563709
38	28425	1.493611	0.3950081	-0.2263555	7.404039
39	4084	1.557407	0.5280965	0.2455875	6.422881

Further investigation in Table 6b shows that over 50% of privately owned domestic plants belong to the food, beverage and tobacco sector (sector 31) and the textiles, garments and leather sector (sector 32), both sectors display the lowest average TFP levels over the entire period and especially in the pre-1990 period. The average TFP in the food, beverage and tobacco sector remains the lowest in the post-1990 period, whereas the textiles, garments and leather sector becomes one the most productive sector.

Clearly and not surprisingly, the highest positive correlation coefficient is between relative productivity and foreign ownership. As other studies have demonstrated (Aswicahyono & Hill, 2002; Bernard and Sjöholm, 2003), foreign ownership seems to have a positive impact on productivity levels through better technology, increased capital-intensity, better management, better competitiveness etc. The advantage drops slightly in the post-1990, but this only seems to reflect the general lower importance of ownership in explaining relative productivity in that period. Indeed, in the post-1990 period, all coefficients drop slightly.

Relative productivity is positively correlated to both central and local government ownership. However, the correlation is stronger for central government ownership, especially in the pre-1990 period, when the State played a very active role in the industrial development. Did the central government pre-empt the most productive sectors and plants? Or did the central government manage its plants in a better way than local governments? Did the State favour central government owned plants? The correlation between relative productivity and central government ownership halves between the two sub-periods: What role played deregulation in this process? Does this show that after a certain stage of development, the State looses it comparative advantage in managing plants (especially when compared to the correlation between relative productivity and foreign ownership)? These questions are addressed in chapter 6 when dealing with industrial dynamics.

Industrial and plant-level crony and bureaucracy indicators

I now turn to the crony proxies presented in the previous section of this chapter. The level of gifts, donations and charities is positively correlated to relative productivity. It is not surprising that gifts, donations and charities figures increase with the size of the plant in both sub-periods (gifts, donations and charities correlates with gross output by roughly 13% over the period). Gifts, donations and charities expenses can be considered as a rough measure for tax reduction/evasion propensity (depending on who is the ultimate recipient of the gift), and/or as a cronyism measure if the person or charity receiving the gifts renders specific services to the company (such as political protection, facilitated access to licences, etc). The larger the plant, the larger the gifts: larger plants can afford to spend more on this item. However, the share of gifts, donations and charities expenses does not significantly correlate with total gross output or even total number of workers, which can let me suppose that there might be some flat rate for the payment of gifts, charities and donations.

Table 7: Correlation between relative TFP, and crony and bureaucracy indicators

	1975-95	1975-89	1990-95
	5-digit relative TFP	5-digit relative TFP	5-digit relative TFP
gifts, charities, donations	0.0084*	0.0105*	0.0103*
gifts share	-0.003	0.0008	-0.0058
plant level crony dummy	-0.0064*	0.0047*	-0.0233*
5-digit crony dummy	0	0	0
white collar share	0.0665*	0.0722*	0.0580*
white collar wages share	0.0469*	0.0504*	0.0423*

* indicates a correlation significant at the 5% level

To account for the size effect, I examine the correlation between the share of gifts, donations and charities in total gross output ("gifts share"). This variable correlates positively with relative productivity in the high cost economy of the pre-1990 period, while the correlation becomes negative in the more competitive post-1990 period. Transforming this share of gifts into a plant level crony dummy (equals 1 if the share is positive, 0 otherwise) confirm the previous results: while it pays off to be a crony plant in the pre-1990s, the returns on such expenses become negative after the deregulation. In the pre-1990 period, the higher the share of gifts, charities and donations, the higher the relative and absolute productivity: either more productive plants are more "taxed" (informally) than less productive ones, and/or plants paying a higher level of gifts, charities and donations see returns on investment in the form of increased productivity (through easier access to licences, infrastructure, administrative facilities, etc). In the 1990s, the higher the share of gifts, charities and donations, the lower the relative and absolute productivity: this could either signal that less productive plants are more likely to spend more on gifts, charities and donations (maybe as a way to stay in the market), and/or that the payment of a large share of gifts, charities and donations hampers productive performance because too much resources are spent on that item without much "return on investment". The 5-digit sector crony dummy is not significantly correlated to relative TFP.

I also use two proxies for the internal market structure, the first is defined as the number of non-production workers over the total number of workers, and the second is defined as the total wages of non-production workers over total wages of all workers. Both correlate positively and significantly with relative productivity. "White collar share", or "management intensity", is positively associated with higher productivity, either that more management triggers a better allocation of resources or that higher productivity is redistributed under the form of more managers. The second variable calculated in terms of wages is a proxy for management quality, which seems to be positively associated with higher relative productivity.

Management and labour quality

Table 8: Correlation between relative TFP and management and labour quality indicators

	1975-95	1975-89	1990-95
	5-digit relative TFP	5-digit relative TFP	5-digit relative TFP
management quality	0.0136*	0.0459*	0.0156*
labour quality	0.0498*	0.0495*	0.0587*

* indicates a correlation significant at the 5% level

Management and labour quality are both significantly and positively correlated to relative productivity, either that better paid workers trigger higher relative productivity or that higher relative productivity is redistributed in higher wages. More interesting is the strong drop in the correlation between management quality and relative productivity in the 1990s, while the correlation between labour quality and relative productivity increases.

5.4 Random draw hypothesis

The random draw hypothesis assumes that differences in productivity levels across plants results from measurement errors, either on the productivity levels or on the productivity growth rates. If this hypothesis is true, productivity levels will be uncorrelated from period to period (random draw for TFP levels) and the overall productivity distribution will display an increasing variance over time (random draw for TFP growth rates). It is necessary to investigate this hypothesis first before tackling other economic-based hypothesis.

As a first test for the random draw hypothesis on TFP levels, I refer to Table 1 and consider correlation coefficients between TFP and relative TFP levels, and their lags. As noted before, the correlation between current TFP (absolute and relative) and past TFP is quite high (ranging between 46% and 69%) and significant at least at the 5% confidence level. Correlation is higher between current relative TFP and the one-year lag for the period 1975-1989. For the period 1990-1995, correlation remains high but drop slightly, confirming a change in the industrial environment and dynamics noted while conducting other tests in this thesis.

A second test for the random draw hypothesis consists in regressing current relative TFP levels on their one-, two-, and three-year lags. Results are shown in Tables 9a, b, and c and confirm previous conclusions: lagged relative TFP explains on average 50% of current relative TFP, with a stronger explanatory power for the pre-1990 period. The regression gives similar results to those presented in tables 9a, b, and c when separating exiters and incumbents, or when running the regression yearly (not reported here). We can reasonably reject the random draw hypothesis on TFP levels: there might be some measurement error, but at least half of the current productivity levels relate to former productivity levels.

Table 9a: Regression of relative TFP on its one-, two-, and three-year lags, full sample, 1975-95

Number of obs	221635	Variable	VIF	1/VIF		
F(3,221631)	63961.82	lag2TFP_5D_rel	2.42	0.41		
Prob > F	0	lag3TFP_5D_rel	1.97	0.51		
R-squared	0.464	lag1TFP_5D_rel	1.9	0.53		
Adj R-squared	0.464	Mean VIF	2.1			
5-digit relative TFP	Coef.	Std. Err.	t	P>|t|	[95% Conf.Interval]	
lag1 5-digit relative TFP	0.5007078	0.0021396	234.02	0	0.4965143	0.5049013
lag2 5-digit relative TFP	0.1462115	0.002404	60.82	0	0.1414996	0.1509233
lag3 5-digit relative TFP	0.1027912	0.0021453	47.91	0	0.0985864	0.106996
_cons	-0.0031122	0.0005701	-5.46	0	-0.0042296	-0.0019949

Table 9b: Regression of relative TFP on its one-, two-, and three-year lags, full sample, 1975-89

Number of obs	129315	Variable	VIF	1/VIF		
F(3,129311)	41878.96	lag2TFP_5D_rel	2.64	0.38		
Prob > F	0	lag3TFP_5D_rel	2.15	0.46		
R-squared	0.4928	lag1TFP_5D_rel	2.07	0.48		
Adj R-squared	0.4928	Mean VIF	2.29			
5-digit relative TFP	Coef.	Std. Err.	t	P>|t|	[95% Conf.Interval]	
lag1 5-digit relative TFP	0.4960067	0.0028326	175.11	0	0.490455	0.5015585
lag2 5-digit relative TFP	0.1502868	0.0031577	47.59	0	0.1440978	0.1564758
lag3 5-digit relative TFP	0.1157459	0.0028051	41.26	0	0.110248	0.1212439
_cons	-0.0046149	0.0007269	-6.35	0	-0.0060396	-0.0031902

Table 9c: Regression of relative TFP on its one-, two-, and three-year lags, full sample, 1990-95

Number of obs	92320	Variable	VIF	1/VIF		
F(3, 92316)	22673.78	lag2TFP_5D_rel	2.16	0.46		
Prob > F	0	lag3TFP_5D_rel	1.76	0.57		
R-squared	0.4242	lag1TFP_5D_rel	1.71	0.59		
Adj R-squared	0.4242	Mean VIF	1.87			
5-digit relative TFP	Coef.	Std. Err.	t	P>|t|	[95% Conf.Interval]	
lag1 5-digit relative TFP	0.5043914	0.0032733	154.09	0	0.4979757	0.5108071
lag2 5-digit relative TFP	0.1401693	0.0037099	37.78	0	0.1328978	0.1474407
lag3 5-digit relative TFP	0.0848137	0.0033393	25.4	0	0.0782687	0.0913587
_cons	-0.0011045	0.000914	-1.21	0.23	-0.0028961	0.000687

Now, to test for the random draw hypothesis on TFP growth rates, I examine TFP distribution statistics by year and by demographic type. This table is taken from chapter 4. As demonstrated in the previous chapter, there is a TFP convergence phenomenon within each demographic group: as time goes by, TFP levels of plants tend to converge. This result goes against the random draw hypothesis on TFP growth rates, since such a phenomenon would result in TFP level divergence.

Table 10: TFP distribution statistics

E=entrants I=incumbents X=exitors

	E	I	X		E	I	X	E	I	X
YEAR	mean TFP	mean TFP	mean TFP	YEAR	median TFP	median TFP	median TFP	standard deviation TFP	standard deviation TFP	standard deviation TFP
1975	1.37		1.27	1975	1.28		1.18	0.45		0.49
1976	1.42	1.38	1.28	1976	1.33	1.29	1.19	0.49	0.44	0.53
1977	1.41	1.39	1.23	1977	1.32	1.29	1.16	0.42	0.46	0.43
1978	1.47	1.41	1.24	1978	1.37	1.31	1.17	0.47	0.46	0.41
1979	1.45	1.38	1.34	1979	1.36	1.29	1.25	0.46	0.42	0.45
1980	1.47	1.39	1.30	1980	1.38	1.31	1.21	0.43	0.41	0.37
1981	1.47	1.41	1.31	1981	1.38	1.33	1.24	0.43	0.42	0.36
1982	1.46	1.42	1.37	1982	1.39	1.34	1.28	0.39	0.42	0.41
1983	1.44	1.41	1.38	1983	1.38	1.34	1.30	0.37	0.39	0.36
1984	1.46	1.42	1.42	1984	1.38	1.35	1.32	0.44	0.38	0.44
1985	1.45	1.44	1.48	1985	1.37	1.37	1.36	0.43	0.40	0.49
1986	1.51	1.46	1.46	1986	1.44	1.38	1.33	0.40	0.39	0.52
1987	1.48	1.44	1.41	1987	1.41	1.37	1.32	0.38	0.38	0.42
1988	1.47	1.45	1.42	1988	1.39	1.38	1.34	0.42	0.37	0.46
1989	1.51	1.47	1.48	1989	1.42	1.39	1.36	0.45	0.39	0.44
1990	1.55	1.49	1.53	1990	1.44	1.41	1.41	0.48	0.38	0.48
1991	1.49	1.50	1.51	1991	1.44	1.42	1.42	0.44	0.39	0.45
1992	1.54	1.54	1.56	1992	1.47	1.44	1.45	0.42	0.41	0.45
1993	1.54	1.55	1.51	1993	1.48	1.46	1.41	0.41	0.40	0.46
1994	1.51	1.56	1.59	1994	1.44	1.47	1.48	0.39	0.39	0.47
1995	1.58		1.57	1995	1.47		1.48	0.45		0.41

These results tend to reject the hypothesis that a difference in productivity levels among plants is merely due to error (random draw hypothesis). These two tests have shown that current productivity levels are evolving rather consistently over time, so that it is reasonable to assume that productivity differential across plants can be explained by economic reasons. I can now examine the second potential explanation for plants TFP differential: the plant vintage hypothesis.

5.5 Plant vintage hypothesis

According to this hypothesis, plant productivity levels differ because they were created at different time periods, with different technologies and under different economic and institutional circumstances. If this hypothesis is true, then the majority of plants created in the same period, say the same year, should have similar TFP levels. It is pertinent to examine this hypothesis in the case of Indonesian manufacturing because the history of the sector presents clear-cut sub-periods corresponding to different broad institutional environments.

The oil boom (1975-80) corresponded to a period of protection from foreign competition, a market of reduced access for foreign investment, highly regulated economy with a complex system of quotas and licences for imports, exports and domestic market distribution and investment, resulting in a highly distorted system labelled as the "high cost economy", and at the same time, plants were evolving in a climate of high economic growth rates. How do plants born in that period compare with plants born either before or after this in terms of relative productivity? Has protectionism acted in favour of productivity, or have the economic distortions resulting from protectionism reduced oil boom plants productivity compared to their non oil boom peers? How do plants started after the oil boom and before the economic rebound (1981-89) perform when compared to their peers? Are those plants, entering during a major restructuration of the economy, different from the others? Are plants entering during the most competitive sub-period (1990-95) the best performers?

Table 11a: Distribution statistics of time-period/plant average relative plants productivity by year of birth

year of birth	nb of obs	mean	sd	p10	p25	p50	p75	p90
1900	15151	0.005117	0.382791	-0.344013	-0.203198	-0.05992	0.119881	0.388341
1901	428	-0.008298	0.369791	-0.373713	-0.237811	-0.091562	0.148802	0.364433
1902	121	-0.058927	0.501912	-0.503434	-0.327387	-0.136493	0.083982	0.301618
1903	106	0.102662	0.412637	-0.240716	-0.152391	0.03506	0.263074	0.487811
1904	95	0.117828	0.305045	-0.190163	-0.087362	0.024522	0.314775	0.527124
1905	92	0.027167	0.345798	-0.487152	-0.238799	0.043344	0.225651	0.482535
1906	208	0.032033	0.409139	-0.313699	-0.201355	-0.051948	0.095342	0.46617
1907	267	0.007198	0.444329	-0.305268	-0.208494	-0.094255	0.124432	0.359832
1908	303	-0.028948	0.459953	-0.377799	-0.226961	-0.098128	0.081247	0.416457
1909	57	0.219	0.672818	-0.260094	-0.184143	0.018087	0.324178	1.122073
1910	504	0.009264	0.396417	-0.37114	-0.236464	-0.078092	0.121484	0.506165
1911	248	0.092203	0.439335	-0.376619	-0.158426	0.051634	0.264282	0.573093
1912	333	0.002624	0.564806	-0.429608	-0.29863	-0.105953	0.059089	0.450505
1913	158	0.167326	0.530269	-0.280323	-0.103475	0.04605	0.146626	0.718222
1914	109	-0.041178	0.254715	-0.335448	-0.190479	-0.104042	0.085867	0.370369
1915	169	-0.076951	0.213708	-0.305798	-0.21012	-0.107997	0.03333	0.181576
1916	164	0.003642	0.275352	-0.262716	-0.163464	-0.022988	0.172311	0.299576
1917	244	0.024476	0.378668	-0.310793	-0.18209	-0.0501	0.154795	0.479633
1918	556	0.256743	0.852068	-0.240059	-0.111653	0.045227	0.284089	0.785772
1919	797	-0.031948	0.309476	-0.313753	-0.204148	-0.07251	0.08273	0.266729
1920	378	0.047628	0.413711	-0.274021	-0.149362	-0.01353	0.136166	0.420476
1921	408	0.010983	0.299763	-0.317964	-0.188899	-0.051815	0.192347	0.448115
1922	202	0.019709	0.308377	-0.322776	-0.129811	-0.025104	0.114251	0.40971
1923	290	-0.014496	0.306813	-0.347836	-0.189571	-0.037535	0.128829	0.337978
1924	197	0.205455	0.490158	-0.241135	-0.123859	0.016487	0.553836	0.918099
1925	376	-0.02835	0.394523	-0.360253	-0.266857	-0.116573	0.078052	0.517968
1926	310	0.0169	0.301955	-0.319904	-0.189533	-0.046893	0.177803	0.449124
1927	457	0.059012	0.448286	-0.407364	-0.218091	0.00949	0.24456	0.558845
1928	355	0.046827	0.408438	-0.316827	-0.190794	-0.033967	0.167926	0.514952
1929	228	0.06472	0.362541	-0.253368	-0.159407	-0.007434	0.171879	0.595441
1930	850	-0.010347	0.349993	-0.361516	-0.221577	-0.07322	0.100693	0.458014
1931	282	0.023619	0.377694	-0.330058	-0.249989	-0.066902	0.172899	0.509053
1932	516	0.013383	0.360401	-0.347832	-0.180946	-0.053173	0.170488	0.520986
1933	301	-0.005777	0.309082	-0.310671	-0.175952	-0.045273	0.108403	0.30621
1934	587	-0.026435	0.28212	-0.299122	-0.199968	-0.083018	0.073683	0.305168
1935	650	0.018163	0.339956	-0.337448	-0.17735	-0.053425	0.156072	0.522226
1936	745	-0.017452	0.350059	-0.366716	-0.208965	-0.049396	0.124751	0.369513
1937	760	0.026533	0.349111	-0.299675	-0.173986	-0.036041	0.113277	0.513452
1938	674	-0.01484	0.319269	-0.308905	-0.225685	-0.108227	0.121122	0.445925
1939	527	-0.037983	0.287897	-0.322043	-0.233749	-0.095479	0.104709	0.275816
1940	646	0.004505	0.335658	-0.280742	-0.203781	-0.08738	0.076561	0.481801
1941	382	-0.023112	0.287808	-0.30427	-0.221566	-0.082185	0.12328	0.282429
1942	529	0.02505	0.349528	-0.266195	-0.170385	-0.047359	0.123035	0.357772
1943	310	-0.026945	0.252975	-0.297238	-0.176914	-0.035652	0.072858	0.204133
1944	123	-0.033113	0.245347	-0.254147	-0.208118	-0.076855	0.074962	0.227669
1945	581	-0.054122	0.336787	-0.364855	-0.217402	-0.087815	0.05933	0.330234
1946	339	-0.033911	0.294086	-0.325627	-0.200943	-0.050129	0.091096	0.26336
1947	785	-0.003055	0.359382	-0.34246	-0.182909	-0.062673	0.10356	0.406363
1948	1591	-0.002374	0.389869	-0.304913	-0.205962	-0.073811	0.082761	0.344665
1949	1397	-0.020215	0.33762	-0.334923	-0.201852	-0.068611	0.093042	0.340034

year of birth	nb of obs	mean	sd	p10	p25	p50	p75	p90
1950	3766	-0.024267	0.347008	-0.345223	-0.209628	-0.077223	0.089957	0.343269
1951	2460	-0.015193	0.332129	-0.315091	-0.194562	-0.067374	0.09684	0.314248
1952	3584	-0.025348	0.342419	-0.34574	-0.219872	-0.085698	0.096168	0.346491
1953	2362	-0.030207	0.369563	-0.332758	-0.21469	-0.078122	0.074327	0.282611
1954	2938	0.000408	0.394595	-0.351646	-0.212605	-0.072287	0.118098	0.373232
1955	3004	-0.005783	0.455705	-0.314265	-0.184491	-0.064861	0.08307	0.272056
1956	3619	-0.019684	0.345437	-0.334838	-0.212304	-0.083267	0.077414	0.350974
1957	3344	-0.009166	0.350944	-0.337538	-0.206521	-0.064161	0.118302	0.37888
1958	3730	-0.032339	0.349713	-0.350432	-0.217474	-0.093188	0.05618	0.353634
1959	2391	-0.037966	0.319147	-0.3347	-0.211237	-0.089102	0.04898	0.319623
1960	6727	-0.020515	0.401459	-0.341901	-0.217738	-0.088678	0.066778	0.336596
1961	3723	-0.040445	0.381876	-0.368208	-0.233821	-0.102106	0.049175	0.310454
1962	5337	-0.034862	0.337461	-0.328623	-0.213448	-0.091245	0.056694	0.280272
1963	4330	-0.036274	0.336702	-0.335342	-0.212337	-0.087558	0.061818	0.268944
1964	4122	-0.039681	0.353124	-0.350975	-0.222507	-0.098191	0.055822	0.2991
1965	4915	-0.023403	0.368058	-0.330214	-0.207407	-0.083802	0.074615	0.31794
1966	2739	-0.004791	0.385199	-0.323112	-0.198793	-0.076436	0.080307	0.359913
1967	4567	-0.027767	0.362164	-0.337734	-0.20786	-0.075125	0.077443	0.30328
1968	6042	0.005782	0.395784	-0.342893	-0.21055	-0.064504	0.109926	0.402764
1969	5584	-0.000625	0.376894	-0.322127	-0.200598	-0.070176	0.092478	0.377699
1970	11675	-0.019089	0.360511	-0.328863	-0.204566	-0.07773	0.08249	0.316057
1971	9784	0.00445	0.355276	-0.30292	-0.192771	-0.057669	0.110625	0.349443
1972	11363	0.004031	0.361484	-0.314241	-0.197907	-0.060992	0.111662	0.384387
1973	9560	-0.002645	0.351615	-0.320494	-0.200871	-0.057197	0.112714	0.336391
1974	11320	0.000937	0.366096	-0.323378	-0.199889	-0.061432	0.107775	0.361559
1975	15189	0.009962	0.405727	-0.313173	-0.199584	-0.059212	0.122949	0.374067
1976	10058	0.011547	0.372117	-0.320095	-0.190949	-0.053221	0.118447	0.383332
1977	7308	0.0118	0.387553	-0.309522	-0.19624	-0.058314	0.111246	0.383861
1978	11185	0.014885	0.382566	-0.31606	-0.194973	-0.059511	0.123503	0.409456
1979	8186	-0.00916	0.343266	-0.322634	-0.201754	-0.068182	0.105662	0.331171
1980	14101	0.026767	0.387912	-0.314667	-0.19034	-0.044306	0.135306	0.434016
1981	8728	0.012416	0.368466	-0.306332	-0.184925	-0.049932	0.124298	0.362844
1982	9981	0.015126	0.376139	-0.310432	-0.19079	-0.058262	0.126593	0.411481
1983	8452	0.005404	0.372157	-0.331282	-0.201205	-0.06157	0.1216	0.392731
1984	8680	0.004916	0.397634	-0.331805	-0.205843	-0.071793	0.116122	0.418548
1985	9236	0.011777	0.397191	-0.328394	-0.20213	-0.064104	0.12375	0.413257
1986	6156	0.020545	0.363768	-0.32558	-0.198997	-0.047338	0.153679	0.429724
1987	6408	0.023832	0.409694	-0.335873	-0.206068	-0.05836	0.138394	0.475184
1988	5897	-0.005676	0.415959	-0.371097	-0.243328	-0.085416	0.119917	0.426491
1989	6678	-0.007514	0.378232	-0.345704	-0.21698	-0.075846	0.109377	0.40269
1990	7853	0.01148	0.437864	-0.358939	-0.22914	-0.080709	0.125005	0.450207
1991	6276	0.009068	0.401654	-0.362279	-0.224021	-0.064381	0.135754	0.472418
1992	4843	0.002427	0.387716	-0.35864	-0.215729	-0.061308	0.140533	0.422571
1993	3359	-0.014289	0.396837	-0.392565	-0.240305	-0.079086	0.12359	0.418578
1994	2708	-0.016787	0.405486	-0.37009	-0.243799	-0.093524	0.093182	0.44321
1995	1493	-0.018208	0.42361	-0.386066	-0.241378	-0.096821	0.098746	0.395763

Table 11b: Distribution statistics of time-period/plant average relative plants productivity by year of entry

year of entry	nb of obs	mean	sd	p10	p25	p50	p75	p90
1975	123469	-0.0102775	0.378169	-0.334161	-0.208087	-0.073826	0.093838	0.352869
1976	11618	-0.010438	0.350762	-0.324163	-0.210275	-0.068032	0.10168	0.341742
1977	10783	-0.0089792	0.351103	-0.320358	-0.200841	-0.066872	0.088029	0.350895
1978	10700	0.0102732	0.362264	-0.308199	-0.191268	-0.058671	0.12242	0.379585
1979	11012	0.0042299	0.388479	-0.334262	-0.205972	-0.057099	0.1228	0.382453
1980	12598	0.0213417	0.373833	-0.31167	-0.183971	-0.040408	0.134139	0.396171
1981	12423	0.0060722	0.362367	-0.316371	-0.190754	-0.058992	0.114738	0.370489
1982	12532	0.0081798	0.372918	-0.30114	-0.186936	-0.0612	0.108763	0.361027
1983	13544	0.0065786	0.345142	-0.306212	-0.187627	-0.053958	0.113182	0.36045
1984	14574	0.007392	0.386051	-0.323112	-0.197724	-0.062447	0.107841	0.389624
1985	21491	0.005515	0.38951	-0.330212	-0.205784	-0.071485	0.125155	0.406603
1986	8130	0.0193656	0.373712	-0.319861	-0.188558	-0.043948	0.143935	0.404948
1987	8526	0.0216049	0.381233	-0.314303	-0.191178	-0.051785	0.140535	0.419147
1988	12805	0.0040821	0.402852	-0.349592	-0.22494	-0.076214	0.123342	0.427182
1989	8494	0.0004636	0.372868	-0.33773	-0.212138	-0.068696	0.118289	0.40018
1990	11361	0.0176492	0.411746	-0.345631	-0.216911	-0.067514	0.139141	0.467407
1991	9711	-0.0021035	0.401979	-0.359875	-0.220229	-0.073925	0.115498	0.430088
1992	7312	0.0149105	0.407274	-0.350041	-0.213795	-0.059702	0.146135	0.445631
1993	4810	-0.0073537	0.396379	-0.378998	-0.227106	-0.076655	0.117487	0.416664
1994	3779	-0.021975	0.394906	-0.362665	-0.242436	-0.097122	0.083731	0.411067
1995	1975	-0.0000848	0.428415	-0.369342	-0.23139	-0.089571	0.120021	0.429253

I propose to observe distribution statistics of relative plants productivity by year of birth and year of entry in tables 11a and b. For example, in table 11b, for plants having entered in 1980, the average relative TFP for the period 1980-95 is 0.0213417. Whatever the indicator chosen (relative productivity distribution by year of birth or year of entry into the medium- and large-scale manufacturing sector), the relative productivity distribution is wide, with standard deviation on average 50 to 100 times larger than the relative productivity mean. I obtain similar results for single years of observation rather than time-period averages.[46]

Relative productivity also depends on the size of the plant.[47] As developed in section 7.1, plant size matters because of economies of scale, differing technologies, differing flexibility in the face of shocks, different relationship to the state and administrative authorities, which, in a distorted environment, can make a difference in terms of productivity.

The plant vintage hypothesis assumes that plants productivity levels differ – after having controlled for the size of plants, firstly because they have been set up within different broad institutional framework and macroeconomic conditions, and secondly because their capital stock have different vintages and therefore different productive potential.

In order to test for the plant vintage hypothesis, I regress plant relative productivity on year of

[46] Results are not reported here. Single years of observation relate to the summary statistics of plants by year of birth or year of entry for, say, the year 1980. These statistics allow controlling for year of observation specificities.
[47] Productivity also depends on the industry the plant is operating in. But since relative productivity has been calculated here as productivity of the plant relative to the 5-digit industry average, the industrial sector effect has already been accounted for.

entry dummies - for example y76 equals 1 if the plant entered in 1976, 0 otherwise, etc up to y95, omitting the start year of the dataset. This set of variables is supposed to capture the effects of the broad institutional framework of the year of entry.

The second explanatory variable is age as measured between year of birth and year of observation - birth can occur earlier than the actual year of entry in the medium- and large scale manufacturing sector. Age is capturing the obsolescence of the initial capital stock. I alternatively use survival as measured between year of entry in the medium- and large scale manufacturing sector and year of observation, dropping the year of entry dummies to avoid multicolinearity problems.

In order to account for any renewal of the capital stock, I introduce a variable accounting for cumulated capital stock growth, defined as total capital stock growth between year of entry and year of observation.

Table 12a: Vintage hypothesis OLS regression analysis

Sub-period: 1975-89										
5-digit relative TFP	Coef.	t	P>|t|	[95% Conf.Interval]		Coef.	t	P>|t|	[95% Conf.Interval]	
initial TFP	0.478032	296.67	0	0.474874	0.48119	0.475007	296	0	0.471862	0.478152
OUTPUT	3.20E-10	7.6	0	2.38E-10	4.03E-10	3.48E-10	8.25	0	2.66E-10	4.31E-10
total capital stock growth	0.036211	35.66	0	0.034221	0.038201	0.032387	32.71	0	0.030446	0.034327
age	-0.000232	-6.37	0	-0.000304	-0.000161					
survival						-0.001037	-7.69	0	-0.001301	-0.000773
entry dummy	0.024659	11.31	0	0.020384	0.028934	0.013065	6.15	0	0.008901	0.01723
exit dummy	0.003443	1.03	0.302	-0.003101	0.009988	-0.006959	-1.98	0.048	-0.013854	-6.44E-05
y76	-0.034784	-10.14	0	-0.04151	-0.028058					
y77	-0.034937	-9.73	0	-0.041977	-0.027896					
y78	-0.035705	-9.77	0	-0.042868	-0.028541					
y79	-0.028608	-7.87	0	-0.035729	-0.021486					
y80	-0.021937	-6.31	0	-0.028751	-0.015123					
y81	-0.031127	-8.8	0	-0.038056	-0.024198					
y82	-0.029667	-8.19	0	-0.036769	-0.022565					
y83	-0.018904	-5.28	0	-0.025928	-0.011881					
y84	-0.024603	-6.97	0	-0.031523	-0.017683					
y85	-0.030721	-10.06	0	-0.036706	-0.024737					
y86	-0.034252	-6.59	0	-0.044437	-0.024067					
y87	-0.031984	-5.8	0	-0.042786	-0.021182					
y88	-0.050783	-9.98	0	-0.060761	-0.040805					
y89	-0.056386	-6.73	0	-0.0728	-0.039973					
_cons	-0.672643	-256.01	0	-0.677792	-0.667493	-0.671221	-213.84	0	-0.677373	-0.665069
Number of obs	200110					200110				
F(20,200089)	4454.73					14753.77				
Prob > F	0					0				
R-squared	0.3081					0.3067				
Adj R-squared	0.308					0.3067				
Sub-period: 1990-95										
5-digit relative TFP	Coef.	t	P>|t|	% Conf.Interval]		Coef.	t	P>|t|	[95% Conf.Interval]	
initial TFP	0.332065	141.39	0	0.327462	0.336668	0.330643	140.99	0	0.326047	0.335239
OUTPUT	8.83E-10	21.65	0	8.03E-10	9.63E-10	8.89E-10	21.8	0	8.09E-10	9.69E-10
total capital stock growth	0.024354	22.63	0	0.022245	0.026464	0.023791	22.5	0	0.021718	0.025864
age	-0.000109	-1.95	0.052	-0.00022	7.26E-07					
survival						-0.00043	-2.45	0.014	-0.000775	-8.54E-05
entry dummy	-0.012629	-2.96	0.003	-0.021006	-0.004253	-0.020328	-5.52	0	-0.02755	-0.013105
exit dummy	0.004685	1.91	0.056	-0.000116	0.009485	0.001886	0.8	0.423	-0.002728	0.0065
y76	-0.012201	-1.59	0.113	-0.02728	0.002878					
y77	-0.031462	-4.15	0	-0.04631	-0.016615					
y78	-0.047518	-6.54	0	-0.061759	-0.033277					
y79	-0.042369	-6.07	0	-0.056052	-0.028686					
y80	-0.013549	-2.14	0.032	-0.025948	-0.001151					
y81	-0.022748	-3.67	0	-0.034891	-0.010605					
y82	-0.007476	-1.29	0.198	-0.018859	0.003907					
y83	-0.003833	-0.71	0.479	-0.014444	0.006778					
y84	-0.019638	-3.84	0	-0.029648	-0.009627					
y86	-0.013678	-2.35	0.019	-0.0251	-0.002255					
y87	0.005832	1.08	0.282	-0.0048	0.016463					
y88	-0.004935	-1.11	0.266	-0.01363	0.00376					
y89	-0.025831	-5.32	0	-0.035351	-0.01631					
y90	-0.005928	-1.41	0.157	-0.014142	0.002286					
y91	-0.011528	-2.59	0.01	-0.02026	-0.002796					
y92	-0.007922	-1.59	0.112	-0.017679	0.001834					
y93	-0.025215	-4.27	0	-0.03679	-0.013641					
y94	-0.029503	-4.38	0	-0.042692	-0.016314					
y95	-0.020039	-2.07	0.039	-0.039029	-0.001049					
_cons	-0.496104	-112.47	0	-0.504749	-0.487459	-0.500566	-113.67	0	-0.509198	-0.491935
Number of obs	124887					124887				
F(25,124861)	848.74					3510.47				
Prob > F	0					0				
R-squared	0.1453					0.1443				
Adj R-squared	0.1451					0.1443				

To account for plant-specific initial technological conditions, I add the initial TFP level of the plant - defined as TFP level in the year of entry, as another explanatory variable. I also control for the demographic type of plant by adding the entry and exit dummies (entry equals 1 if the plant is an entrant, 0 otherwise, and exit equals 1 if the plant is an exiter, 0 otherwise). Finally, I control for plant size with the gross level of output.

I carry out the analysis over two sub-periods: 1975-89 and 1990-95, corresponding to the pre- and post-deregulation eras.

Table 12a show the results for two alternative models:

$$relative\_5digit\_TFP = a.initial\_TFP + b.OUTPUT + d.total\_capital\_stock\_growth + e_1.age + f.entry + g.exit + h_{76,95}.y_{76,95} + c \quad (3)$$

and

$$relative\_5digit\_TFP = a.initial\_TFP + b.OUTPUT + d.total\_capital\_stock\_growth + e_2.survival + f.entry + g.exit + c \quad (4)$$

The second model omits the year of entry dummies for obvious multicolinearity problems occurring with the survival variable. There is no other multicolinearity problem detected by the variance inflation factors, and no heteroskedasticity problem detected by the Breush-Pagan test.[48]

The models explain between 30.8% and 14.4% of relative productivity variance for the first and second sub-periods respectively. The most important factor seems to be the initial TFP level of plants, more markedly during the pre-1990s: the higher the level of TFP in the year of entry, the higher the relative TFP in subsequent years. This confirms that initial technological conditions *at the plant level* matter quite a lot in subsequent relative TFP performance. The drop in both the significance and the coefficient level for that variable explains the halving of the R-square of the models between the two sub-periods. It is probably necessary to recall here that the previous chapter has underlined the puzzling nature of TFP behaviour in the post-1990s, with, for example, exiters being on average more productive than entrants and incumbents.

And indeed, this finding is confirmed again here, with entrants displaying a relative TFP higher than incumbents and exiters displaying a relative TFP lower than incumbents in the pre-1990s, while entrants present a relative TFP lower than incumbents and exiters present a relative TFP higher than incumbents in the post-1990s.

[48] The results of those tests are not reported.

Size matters a lot as well in terms of relative TFP, with larger plants displaying higher relative TFP. This effect increases in the post-1990s period. However, the relationship between size and productivity is neither linear nor quadratic as demonstrated in the previous chapter. The form of the relationship is evolving over time, so that the coefficient on the size variable in this regression is to interpret with caution.

The age factor, measured either by age or survival, has a significant negative impact on plant relative productivity: the older the plant, the lower relative productivity. This tends to reject the positive learning effect of age hypothesis, and to support the hypothesis arguing that as plant grow older, their capital stock become less efficient, and productivity suffers. This effect can be of course counterbalanced by capital stock investment.

Total capital stock growth definitely plays a strong positive role in triggering higher relative TFP, but its effect is more marked in the pre-1990s era: the higher the cumulated capital stock growth, the higher the relative TFP. Initial technological conditions matter, but sustained renewal of capital stock is necessary to maintain a productivity level higher than the average.

The year of entry dummies only bear significance for relative TFP in the pre-1990 period. On average, plants displaying the highest relative TFP entered either during the crisis (1981-83) or during the recovery period (1984-85) as economic conditions were less favourable and the market required possibly higher productivity levels to ensure entry and survival, the third group in terms of relative productivity is composed by plants entering during the oil boom (1976-80), and the last group are plants entering during the deregulation period (1986-89). In the post-1990 period, most year of entry coefficients are not significant and their averages over relevant historical sub-periods are fairly identical.

I also run the same model using panel data random effect regression analysis in order to disentangle the time effect (within effect) and fixed effect of plants (between effect). Results are displayed in table 12b. I choose the random effect specification over the fixed effect specification because the variable accounting for the initial TFP level of plants is fixed over time but varies with each plant. A fixed effect specification would lead to biased results. The within effect, explaining relative productivity changes over time for each plant is fairly low. However, what is of primary interest here is the between effect, accounting relative productivity variations between plants after controlling for the time effect. For the period 1975-89, the model explains 58% of relative productivity variations between plants, against 28% for the period 1990-95. The overall R-squares (combining both within and between effects) are similar to the R-squares found on the pooled data. These results confirm and strengthen previous results found on pooled data.

Table 12b: Vintage hypothesis panel data with random effect regression analysis

Sub-period: 1975-89													
5-digit relative TFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]	5-digit relative TFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
initial TFP	0.526367	0.002728	192.92	0	0.5210196	0.531715	initial TFP	0.521602	0.002719	191.82	0	0.5162728	0.526932
OUTPUT	2.47E-10	4.34E-11	5.7	0	1.62E-10	3.32E-10	OUTPUT	2.56E-10	4.34E-11	5.9	0	1.71E-10	3.41E-10
total capital stock growth	0.05384	0.001168	46.08	0	0.05155	0.05613	total capital stock growth	0.051172	0.001157	44.22	0	0.0489034	0.05344
age	-0.00051	6.28E-05	-8.12	0	-0.0006325	-0.000387	age						
survival							survival	-0.000779	0.000212	-3.67	0	-0.001195	-0.000363
entry dummy	0.025781	0.00185	13.94	0	0.0221547	0.029407	entry dummy	0.021887	0.001811	12.09	0	0.0183381	0.025437
exit dummy	-0.001056	0.002956	-0.36	0.721	-0.0068499	0.004739	exit dummy	-0.004795	0.003045	-1.57	0.115	-0.0107636	0.001173
y76	-0.043695	0.006424	-6.8	0	-0.0562856	-0.031104	y76						
y77	-0.045793	0.006705	-6.83	0	-0.0589341	-0.032653	y77						
y78	-0.052072	0.00665	-7.83	0	-0.0651056	-0.039039	y78						
y79	-0.044284	0.006464	-6.85	0	-0.0569536	-0.031614	y79						
y80	-0.038081	0.006015	-6.33	0	-0.0498691	-0.026292	y80						
y81	-0.046077	0.005915	-7.79	0	-0.0576695	-0.034484	y81						
y82	-0.045152	0.005879	-7.68	0	-0.0566751	-0.033629	y82						
y83	-0.033538	0.005584	-6.01	0	-0.0444829	-0.022594	y83						
y84	-0.040298	0.005264	-7.66	0	-0.050615	-0.029981	y84						
y85	-0.045098	0.004351	-10.37	0	-0.0536257	-0.036571	y85						
y86	-0.052536	0.006855	-7.66	0	-0.0659712	-0.039101	y86						
y87	-0.049271	0.006748	-7.3	0	-0.0624974	-0.036044	y87						
y88	-0.065837	0.005772	-11.41	0	-0.0771505	-0.054524	y88						
y89	-0.071626	0.008258	-8.67	0	-0.0878116	-0.055441	y89						
_cons	-7.30E-01	4.49E-03	-1.63E+02	0.00E+00	-7.38E-01	-7.21E-01	_cons	-0.749672	0.004851	-154.53	0	-0.7591802	-0.740164
sigma_u	0.156788						sigma_u	0.157303					
sigma_e	0.256726						sigma_e	0.257057					
rho	0.271656	(fraction of variance due to u_i)					rho	0.272444	(fraction of variance due to u_i)				
R-sq: within	0.015		Number of obs	200110	Wald chi2(20)	38899.59	R-sq: within	0.0143		Number of obs	200110	Wald chi2(6)	38408.68
between	0.586		Number of groups	27275	Prob > chi2	0	between	0.5811		Number of groups	27275	Prob > chi2	0
overall	0.3073		Obs per group: min	1			overall	0.3059		Obs per group: min	1		
Random effects u_i ~ Gaussian			avg	7.3			Random effects u_i ~ Gaussian			avg	7.3		
corr(u_i, X)= 0 (assumed)			max	15			corr(u_i, X)= 0 (assumed)			max	15		
Sub-period: 1990-95													
5-digit relative TFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]	5-digit relative TFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
initial TFP	0.390096	0.003716	104.98	0	0.382813	0.397379	initial TFP	0.388449	0.00371	104.72	0	0.3811784	0.395719
OUTPUT	1.26E-09	5.76E-11	21.87	0	1.15E-09	1.37E-09	OUTPUT	1.27E-09	5.76E-11	22	0	1.15E-09	1.38E-09
total capital stock growth	0.046814	0.001419	33	0	0.0440331	0.049595	total capital stock growth	0.046317	0.001404	33	0	0.0435661	0.049068
age	-0.000108	9.76E-05	-1.1	0.27	-0.0002987	8.37E-05	age						
survival							survival	-0.000599	0.000263	-2.27	0.023	-0.0011151	-8.24E-05
entry dummy	-0.009128	0.00327	-2.79	0.005	-0.0155367	-0.00272	entry dummy	-0.01212	0.00307	-3.95	0	-0.0181369	-0.006103
exit dummy	7.65E-06	0.001891	0	0.997	-0.003699	0.003714	exit dummy	-0.001258	0.00185	-0.68	0.496	-0.0048834	0.002367
y76	-0.030502	0.013329	-2.29	0.022	-0.0566253	-0.004378	y76						
y77	-0.040773	0.01302	-3.13	0.002	-0.066292	-0.015254	y77						
y78	-0.062028	0.012562	-4.94	0	-0.0866491	-0.037408	y78						
y79	-0.048912	0.012004	-4.07	0	-0.0724404	-0.025384	y79						
y80	-0.022671	0.010971	-2.07	0.039	-0.044174	-0.001167	y80						
y81	-0.031058	0.010725	-2.9	0.004	-0.0520777	-0.010038	y81						
y82	-0.012692	0.010144	-1.25	0.211	-0.0325729	0.00719	y82						
y83	-0.008334	0.00952	-0.88	0.381	-0.0269935	0.010326	y83						
y84	-0.018895	0.008954	-2.11	0.035	-0.036444	-0.001346	y84						
y85	0.003092	0.007606	0.41	0.684	-0.0118146	0.017999	y85						
y86	-0.019119	0.010214	-1.87	0.061	-0.0391386	0.000901	y86						
y87	-0.002457	0.009536	-0.26	0.797	-0.0211474	0.016234	y87						
y88	-0.006751	0.007867	-0.86	0.391	-0.0221686	0.008668	y88						
y89	-0.029298	0.008616	-3.4	0.001	-0.0461842	-0.012412	y89						
y90	-0.005701	0.007505	-0.76	0.448	-0.0204096	0.009009	y90						
y91	-0.011816	0.0077	-1.53	0.125	-0.0269071	0.003276	y91						
y92	-0.01025	0.008032	-1.28	0.202	-0.0259926	0.005494	y92						
y93	-0.023631	0.008723	-2.71	0.007	-0.0407272	-0.006535	y93						
y94	-0.025684	0.008812	-2.91	0.004	-0.0429553	-0.008412	y94						
y95	-0.0178	0.010247	-1.74	0.082	-0.0378831	0.002283	y95						
_cons	-0.588951	0.007604	-77.45	0	-0.603855	-0.574046	_cons	-0.595186	0.006626	-89.83	0	-0.6081726	-0.5822
sigma_u	0.230135						sigma_u	0.230339					

To a certain extent does the plant vintage hypothesis explain plants productivity differentials for the entire period 1975-95, in that age or survival affects negatively relative TFP. The analysis also shows that this effect can be counterbalanced by capital stock renewal. The effect of the year of entry is only significant for the period 1975-89, suggesting that the broad institutional environment in the year of entry does make a difference in the pre-deregulation era, while it does not make any difference in the post-deregulation period when plant level TFP become more unpredictable. In fact, plant size is a much more stable explanatory factor for relative TFP, and its explanatory power and scope increase over the two sub-periods: the larger the plant, the higher the relative productivity. This tends to support the historical evidence and all the advantages linked to a large size. But of course, there is a need for adding more specific explanatory variables such as crony indicators. In fact most of the variance in relative TFP is accounted for by initial TFP levels reflecting plant-specific initial technological conditions in the broad sense. In fact, this result tends rather to support the plant fixed effect hypothesis that is investigated in the next section.

5.6 Fixed effect hypothesis: Explaining initial TFP of plants

While the plant vintage hypothesis focused on the specificity of a plant cohort, the fixed effect hypothesis assumes that plants differ in their productivity levels because of some fixed or quasi-fixed plant-specific characteristics. Two of these plant-specific characteristics have been already used as controls in the previous section. The first is the size, which, if not strictly constant, can be considered as a quasi-fixed factor, as size changes very slowly. The second is the initial level of productivity (TFP in the year of entry). They both occurred as being significant explanatory factors of relative TFP of plants. Indeed, as underlined by the economic and political history of the manufacturing sector, it is not surprising to find that on average, larger plants tends to display higher relative productivity. As for the initial level of TFP, the explanation seems to match some kind of path dependency explanation, where the initial conditions and technologies of production have a strong bearing on subsequent productivity performance.

And in fact, rather than finding the fixed effects influencing yearly relative TFP, that also reflect overall macroeconomic changes, it is probably more pertinent to investigate the fixed or quasi-fixed factors influencing the initial level of TFP, i.e. take the initial level of TFP as dependent variable. In the mean time, this allows getting rid of multicolinearity problems between the initial level of TFP and additional fixed explanatory variables when using the specifications (1) and (2). In order to control for sectoral specificities, I introduce the average 5-digit TFP on the right hand-side of the equation. The average industry TFP at the 5-digit level is calculated as the average TFP of all plants in the 5-digit sector -entrants, but also incumbents and exiters- in the particular year of entry: a plant's initial TFP is linked to the industry TFP average in the year of entry. A plant's initial TFP level should be fairly close to the industrial average: it cannot be well above the sectoral average because it is constrained by the existing technology, and it cannot be well below because it would jeopardise the chance of the plant survival in the very short term. It is relevant to work at the 5-digit level, because it is the level where plants are the most likely to operate in a relatively homogeneous market. Hill (1990b) indeed underlines that "a comparison of scale and productivity at an aggregated (3-digit ISIC) level is inappropriate, because firms of different sizes tend to specialise in different industrial segments" (p. 92).

I treat the dataset as a cross-section, each plant having only one observation in its year of entry. The year of entry differing across plants, I control for it with year of entry dummies, ranging from year 1976 (y76 equals 1 if the plant entered in 1976, 0 otherwise) to year 1995, as for the plant vintage hypothesis. I chose to omit the year 1975 because it is the first year of observation in the dataset, and a dummy would probably not reflect entry in that year.

As for the rest of this chapter, I distinguish between two different sub-periods: pre- and post-1990.

The base of the model is:

$$TFPinit = a.average\_5digit\_TFP + b_{76,95}.y_{76,95} + c \qquad (5)$$

with $average\_5digit\_TFP$ the average industry TFP at the 5-digit level, $y_{76,95}$ the set of year of entry dummies, and c a constant.

As demonstrated in the previous sections, one of the key quasi-fixed specificities of plants is their sizes, especially for both economies of scale and the facilitated access to factors of production, especially capital and intermediate inputs. I expect size to bear a positive relationship with the initial level of TFP.

Another key variable is the type of ownership of the plant. I use three ownership dummies. The first account for any share of foreign ownership, the second accounts for any share of private domestic ownership, and the third account for any share of public ownership (central or local government). I expect the foreign ownership dummy to be positive, the public ownership dummy to be lower than the foreign ownership dummy coefficient. The latter coefficient could still be positive if I consider that being a public company could lower some production costs. The coefficient on the private ownership dummy should be the lowest.

In order to test for any explanatory power of group membership and patronage on initial productivity, I use three dummy variables that are available for the year 1996. I treat these dummies to be constant for the period 1990-95. The two patronage indicators are only relevant for the 1990s, because the program was implemented in the last years of the 1980s. Group membership has always existed in Indonesian manufacturing, but conglomerates really experience a surge in the 1990s. Furthermore, it would not be reasonable to assume this dummy, collected in 1996, to have remained constant from 1975 onwards. The "group_member" dummy equals 1 when an establishment declares being part of a group of companies, 0 otherwise. The patronage dummies are the "be_parent" dummy (equals one if the establishment is a "parent" company in the *Bapak Angkat* system, 0 otherwise) and "have_parent" dummy (equals one if the establishment is a "child" company in the *Bapak Angkat* system, 0 otherwise). Controlling for group membership and patronage is a way to reassess part of the success of the *Bapak Angkat* program.

The quality of labour and management is also a factor that should account for some of the productivity differentials. The only variable that could account for quality is the wages series. However, there are not enough data collected on wages for the sub-sample to be fully representative of the population. Furthermore, about 10% of wage-related data should be treated with caution because presenting unexplained outliers.[49] The only labour and management related variable that can be included in the model is the ratio of non-production workers over total number of workers. This variable accounts for the internal labour structure of plants. I expect the ratio should indicate whether Indonesian manufacturing plants which lack managers under-perform plants with the optimal number of managers. Symmetrically, the ratio should indicate whether plants with too many managers under-perform plants with the optimal number of managers. A large number of managers can be symptomatic of plants where profits are redistributed to a large number of "family workers" employed as "non-production workers".

Participation to the export market is another characteristic of a plant that should make a difference in terms of productivity. In fact, both export dummies are discarded because they turn out to be totally uncorrelated to the initial productivity level.[50] Furthermore, their coefficients turned out to be insignificant when included in the regression, with confidence intervals overlapping the negative and positive range. Most entrants do not start operations with taking part to the export market – only 8.6% of all plants entering between 1990 and 1995 report to be exporting part or totality of their production. Further investigation also shows that the median plant exporting in its year of entry is six times larger than a non-exporting plant in terms of output. The picture is similar in terms of number of workers. It is surely the case that what makes a difference in terms of initial productivity is size rather than market-orientation.

Finally, cronyism has to be accounted for. As discussed in previous sections, two variables can be used as proxies for cronyism. The first is a 5-digit crony dummy (Basri, 2001) based on qualitative evidence of cronyism. But not all plants part of a 5-digit crony sector can be considered as crony (as Basri himself recognises). In fact, Basri defines the crony sector as a sector where a Suharto's crony capitalist was involved in the largest company of the sector (ownership or management) or had been granted a monopoly in the sector. Explaining the initial TFP level of entrants, I expect the coefficient on this 5-digit crony dummy to be negative. Indeed, the majority of entrants belong to the small- and medium-scale category, majoritarily with private domestic ownership. The economic history of manufacturing underlines the peculiar structure of each sector, where large crony plants are granted monopolies either in the upstream and/or the downstream market, and extract rents from other companies. If a plant enters such a sector, it is likely to face constraints at least regarding access to capital, import and distribution licences, resulting in a productivity level lower than the large crony plant. This should particularly be the case in the first sub-period under

[49] I find for example sudden jumps of 300% and over of wage per worker. Manning (1980) also points at the fact that a fair chunk of wages, especially in large entities, are made of gifts and other social benefits. Although those are accounted for in the wage data I use, it is very likely that the reporting of some of those benefits are measured with error.

[50] As a check, I also use a third export dummy that equals 1 for any share of production exported, with the same results.

scrutiny, i.e. the oil boom and deregulation period.

The second proxy for cronyism is measured at the plant level. As discussed in previous sections, a variable that can be used is the series of gifts, charities, donations. From this variable, I create a plant level crony dummy that equals 1 if the plant reports any gifts, charities, donations, 0 otherwise. In the first sub-period, characterised by a high degree of distortions, it is difficult to predict the sign of the coefficient of this dummy. The coefficient could be positive under the "efficient grease" hypothesis, where spending money on corruption pays off in terms of the reduction of costs of production, translating into higher productivity. If this is the case, the sign should become negative after the deregulation period, under the assumption that deregulation has been effective enough to erode the mechanisms of the "high cost economy". However, spending money on gifts, charities, donations, might be a way for low productivity plant to enter the market and stay: the coefficient should then appear negative in the two sub-periods.

Table 13: Regression of initial TFP level on fixed explanatory variables

	PERIOD: 1975-89				
Initial TFP	Coef.	t	P>|t|	[95% Conf.Interval]	
average 5-digit TFP	0.934056	54.25	0	0.9003103	0.967802
OUTPUT	6.64E-09	11.01	0	5.45E-09	7.82E-09
white collar share	0.000651	4.48	0	0.000366	0.000936
private ownership dummy	-0.043817	-1.58	0.115	-0.098239	0.010604
foreign ownership dummy	0.044499	3.67	0	0.0207372	0.068261
public ownership dummy	0.017351	1.77	0.077	-0.001909	0.036611
plant level crony dummy	0.021396	2.73	0.006	0.0060314	0.036761
5-digit crony dummy	-0.012193	-1.87	0.061	-0.024942	0.000557
y76	0.042415	2.57	0.01	0.0100897	0.07474
y77	0.002441	0.14	0.887	-0.031188	0.036069
y78	0.055613	3.26	0.001	0.0221443	0.089081
y79	4.14E-02	2.52	0.012	0.0092316	0.07357
y80	6.37E-02	4.17	0	0.0337454	0.093637
y81	0.036805	2.44	0.015	0.0072646	0.066345
y82	0.026969	1.85	0.064	-0.001572	0.055511
y83	0.023533	1.73	0.084	-0.00312	0.050186
y84	0.033411	2.62	0.009	0.0083801	0.058442
y85	3.56E-03	0.36	0.722	-0.016028	0.023144
y86	0.025731	1.73	0.085	-0.003506	0.054968
y87	0.026116	1.88	0.06	-0.001116	0.053348
y88	0.015674	1.45	0.148	-0.005538	0.036886
y89	0.016186	1.31	0.19	-0.008041	0.040414
_cons	0.096359	2.56	0.011	0.0225153	0.170203
Number of obs	21441				
F(16, 27258)	190.39				
Prob > F	0				
R-squared	0.1636				
Adj R-squared	0.1627				

Note: Variance inflation factors indicate no multicolinearity problems, and Breush-Pagan test indicates homoskedasticity

	PERIOD: 1990-95									
Initial TFP	Coef.	t	P>|t|	[95% Conf.Interval]		Coef.	t	P>|t|	[95% Conf.Interval]	
average 5-digit TFP	0.882408	25.36	0	0.8142001	0.950615	0.888675	25.58	0	0.820562	0.956789
OUTPUT	4.46E-09	14.48	0	3.85E-09	5.06E-09	4.53E-09	14.73	0	3.93E-09	5.13E-09
white collar share	-0.000207	-0.86	0.389	-0.000679	0.000264	-0.000155	-0.64	0.519	-0.000627	0.000317
group_member	0.063818	3.35	0.001	0.0264478	0.101189					
be_parent						-0.027081	-1.13	0.26	-0.074222	0.02006
have_parent						0.053225	2.94	0.003	0.017706	0.088744
plant level crony dummy	-0.036491	-2.45	0.014	-0.06568	-0.0073	-0.041225	-2.78	0.006	-0.070341	-0.012109
5-digit crony dummy	0.011427	1.04	0.301	-0.010212	0.033066	0.013917	1.26	0.207	-0.007716	0.03555
y90	(dropped)					(dropped)				
y91	-0.03273	-2.08	0.038	-0.063645	-0.00182	-0.031363	-1.99	0.047	-0.06228	-0.000446
y92	-0.008504	-0.53	0.595	-0.039832	0.022824	-0.008152	-0.51	0.61	-0.039482	0.023179
y93	-0.036228	-2.21	0.027	-0.068337	-0.00412	-0.036978	-2.26	0.024	-0.069096	-0.00486
y94	-0.055196	-3.52	0	-0.085904	-0.02449	-0.057303	-3.65	0	-0.088061	-0.026545
y95	-0.011529	-0.74	0.462	-0.042263	0.019206	-0.012679	-0.81	0.419	-0.043425	0.018067
_cons	0.207963	3.67	0	0.0969281	0.318999	0.20324	3.59	0	0.092214	0.314266
Number of obs	7741					7741				
F(7, 12066)	88.22					80.7				
Prob > F	0					0				
R-squared	0.1115					0.1114				
Adj R-squared	0.1103					0.11				

Note: Variance inflation factors indicate no multicolinearity problems, and Breush-Pagan test indicates homoskedasticity

Results displayed in Table 13 show that for both sub-periods, the models can explain over 16% of the variance of the initial plants' TFP level. These R-squares are fairly satisfactory given that the dependent variable itself is a residual. Also noticeable is the fact that R-squares are lower for the post-1990 period, again showing that TFP variance might be due to different factors for that period.

For both sub-periods, the bulk of the variance explained by the model is related to the 5-digit TFP average of the sector. This is not surprising, as entering plants need to match a certain productivity standard at the industry level to be able to compete. The increase of the coefficients between the two sub-periods shows the phenomenon of TFP level convergence across plants. This phenomenon is in line with the convergence process described in chapter 4.

The second most important factor explaining initial TFP for both sub-periods is the size of plants as measured by gross output, with a positive and very significant coefficient: the larger the plant, the higher the initial TFP level. But how big is this coefficient? Let me compare the median plant with a plant in the top 10% of the gross output distribution:

Table 14: How big are the regression coefficients? Example for the 1990-95 period.

stats	initial TFP	average 5-digit TFP	(1) average 5-digit TFP of current quantile minus average 5-digit TFP of median	(1)* average 5-digit TFP coef, as a % of average initial TFP	OUTPUT	(1) OUTPUT of current quantile minus OUTPUT of median	(1)*coef of OUTPUT, as a % of average initial TFP
N	12074	12213			12078		
mean	1.536681	1.549556			1067523		
sd	0.434746	0.1312693			1.19E+07		
p10	1.155888	1.410505	-0.130921	-7.52%	19993.38	-91204	-0.03%
p25	1.296915	1.473171	-0.068255	-3.92%	42851.19	-68346	-0.02%
p50	1.45265	1.541426	0	0.00%	111197	0	0.00%
p75	1.66741	1.616303	0.074877	4.30%	366618.7	255422	0.07%
p90	1.983943	1.717503	0.176077	10.11%	1447122	1335925	0.39%

Note: statistics are entrants only over the 1990-95 period, coefficients are taken from Table 13

The median plant has a gross output of 111,197, and the plant at the limit of the top 10% of the gross output distribution has 1,447,122. The difference between both plants is 1,335,925. I multiply this difference by the coefficient found on the gross output variable, which is $4.46\ 10^{-9}$, I find that the result represents only 0.39% of the average initial TFP level: a plant in the top 10% of the size distribution will be at least only 0.39% more productive than the median plant (calculated as a share of average initial TFP).

The effect of the white collar share variable is interesting, because it changes sign with the sub-period, without the variable changing significantly: over the two sub-periods, the average, median and distribution of this variable do not change. Its effect is positive and significant in the pre-1990 period: a larger share of management and support services workers is the sign of higher initial productivity level. However, in the post-1990 period, its effect becomes negative but not significant. Since the values of the white collar share - i.e. the quantities- do not change over the two sub-periods, I interpret these results as being the quality of management and support services within plants that drop between the two sub-periods. This does not necessarily mean that the intrinsic quality of the non-production labour force drops. It can be the sign of existing non-production workers slacking, or it can be the sign of a change in the environment to which the non-production workers are not used to. For example, a manager could have been very good at "greasing" the administration during the first period corresponding to increased cronyism, thereby increasing the productivity of the plant. In a context of increased competition, such skills do not benefit the plant's productivity anymore.

Ownership dummies are only significant in the first sub-period, and are therefore removed from the model in the second sub-period. During 1975-89, having some foreign or public ownership triggers higher initial TFP levels, while private domestic ownership has a lowering effect. This is in line with the historical analysis of ownership in Indonesian manufacturing: private domestic plants are less productive, mainly because of a more difficult access to capital, technology, and intermediate inputs, probably suffering from the various monopolies granted to public and large-scale companies. Mirroring this, public plants are found to be more productive. However, the latter are less productive than foreign plants, which benefit from an even easier access to capital, and more advanced technologies. For the period 1975-89, a foreign entrant is 3.09% more productive than the average entrant.[51] Comparatively, a public entrant is 1.20% more productive than the average entrant, and a private domestic entrant is 3.05% less productive than the average entrant. For the first half of the 1990s, the ownership dummies have no explanatory power regarding the initial level of TFP, be they used along with or without the group membership and patronage dummies. It seems that ownership does not make any difference after the deregulation period, which could be a sign of an increase in the competition of the manufacturing sector.

In the 1990s however, being member of a group of companies has a significant positive effect on initial TFP levels. With a coefficient of over 0.06, being member of a group of companies in the first half of the 1990s could trigger initial TFP being about 4.15% higher than single plants' initial TFP.[52] Indeed, being part of a group of companies can be an advantage in terms of technology, access to capital, transfer of managerial knowledge, etc.

The patronage system (*Bapak Angkat Sistem*), i.e. having a parent company, also has a strong positive effect on initial TFP. In fact, entering the medium- and large-scale manufacturing sector with the support of a parent company could help plants display initial TFP levels 3.46% higher than the others. This somewhat contradict Hill's argument (1995) judging the program to have been inefficient. Being a parent company turns out to have an insignificant effect.

Linking the ownership, group membership and patronage issues, the results could be interpreted as a shift from a system of plant specific productivity-enhancing connections between companies and the state in a distorted market, to a system of plant specific productivity-enhancing connections between companies in a more competitive market.

Let us now have a closer look at the crony dummies. In the first period, it appears that both

---

[51] This percentage is calculated as the coefficient on the foreign ownership dummy (0.044499), times 1 (value of the dummy if the plant is part of a group of companies), divided by the average initial TFP of the sample (1.435651).
[52] This percentage is calculated as the coefficient on the group membership dummy (0.063818), times 1 (value of the dummy if the plant is part of a group of companies), divided by the average initial TFP of the sample (1.536681).

dummies have a significant effect on initial productivity levels. The 5-digit crony dummy has a negative effect, while the plant level crony dummy has a positive effect. It seems that plants entering a sector dominated by a large-scale crony company or in a sector where a monopoly has been granted to a company linked to Suharto's cronies display lower initial productivity level, probably because of higher production costs due to this monopoly. In the mean time, being a crony plant increases the initial productivity level: this is the efficient grease hypothesis. These results are completely in line with the historiography reporting the existence of monopolies hampering the productivity of other plants because they control import of raw material. The most famous example is found in the steel industry, with a monopoly for importing scrap metal granted to P.T. Krakatau Steel. Other examples include the case of the fertilisers production, wheat, sugar or wood.

Interestingly, the effects change quite dramatically in the aftermath of deregulation: as markets are being liberalised and monopolies slowly removed, being in a crony sector does not seems to make any difference anymore. Additionally, spending money on corruption becomes counter-productive, with a negative effect of the plant level crony dummy. This is a strong indication that deregulation and market liberalisation have had some expected effects.

This section has shown that a few plant-specific fixed effects could explain up to a fifth of initial plant productivity heterogeneity. The initial productivity level of a plant is largely explained by the average productivity level of the 5-digit industry it is entering: entrants need to match the industry productivity levels in order to compete. What then determines relative productivity is partly explained by the size of plants (as measured by gross output) with a positive relationship. Being member of a group of companies also helps reaching higher initial TFP levels, and having a parent company (patronage) has comparable effects. Over the two sub-periods, the ratio of managers and support services workers remains pretty constant for entrants. However, the effect of this ratio changes over the two sub-periods, from positive to negative. This suggests that the quality of services provided by this category of workers might have declined. Finally, testing for the effect of cronyism at the 5-digit industry level and at the plant level, I find, for the period 1975-89, that entering a crony sector lowers initial TFP levels, while being a crony plant increases productivity levels. This suggests that during the oil boom and deregulation period, which is characterised by heavy distortions, spending money on gifts, charities, and donations probably greased the system efficiently at the plant level. In the mean time, the existence of crony monopolies within industries created inefficiencies and is linked to lower initial TFP levels for entrants. In the aftermath of deregulation, the adverse effects of monopolies on entrants seem to vanish, while the effects of plant specific cronyism are reverted.

5.7 Conclusion

This chapter investigates the potential economic, historical and institutional reasons for plant productivity heterogeneity. Plant productivity heterogeneity is a feature of any economy, and has been underlined to be symptomatic of developing countries, where large-scale productive enterprises coexists with a multitude of less productive small scale entities. The demographic study of the previous chapter has indeed underlined the duality of the Indonesian manufacturing sector, supported by the account of the sector's economic history.

Size is indeed the obvious explanatory factor of productivity differentials across plants. In the general case, size influences economies of scale, technological level, access to capital, and the larger the size, the higher the potential productivity level. In the case of Indonesian manufacturing, size also influences the cost of intermediate inputs and capital, in that size relates to the relationship of the plant to the state and the authorities. Large plants are found to have more crony connections, thereby lowering the cost of their inputs.

Other factors might however be at play, such as the time of entry of the plant, i.e. the influence of the broad institutional environment in the year of entry. Assessing the influence of this factor helps discovering what matters most of either the conditions in the year of entry or the conditions in the year of observation. The age of plants influence also productivity, in that an obsolete capital stock can be relatively less productive, counterbalanced by the positive effects of potential learning effects linked to age.

The type of ownership is in the case of Indonesia closely linked to the issue of size, with large-scale companies being predominantly state-owned, with a few foreign joint-ventures, while small- and medium-scale plants tend to be privately owned by local entrepreneurs. The historiography underlines the higher productivity of foreign-owned plants and the lower productivity of public enterprises.

Also relating to the issue of size is the question of the group membership and the patronage system. Dealing with data at the establishment level, taking group membership into account is important when assessing productivity differentials, because a small plant being member of a conglomerate can benefit from the same advantages as a large plant. The reasoning is the same with plants having benefited from the patronage system put in place in the mid-1980s, whereby large companies had to provide assistance to small entities of their own industries.

Finally, another important factor at play when assessing relative productivity in Indonesian manufacturing is the issue of cronyism. The literature shows clearly that crony companies benefited from advantages in terms of easy and cheap access to capital and intermediate inputs, relatively to non-crony companies. It also underlines that the non-crony part of sectors dominated by crony companies have suffered in terms of productivity.

The examination of partial correlation coefficients between plant-level relative productivity and a set of explanatory factors derived from the historiography helps setting the framework of analysis and building the appropriate model explaining plant productivity heterogeneity.

The second part of the chapter goes through three hypotheses in order to explain plant productivity heterogeneity. The first hypothesis justifies plant productivity heterogeneity by errors of measurement, either on TFP levels or on TFP growth rates. This is labelled the random draw hypothesis and is rejected, because current productivity levels are highly and significantly correlated to their lags, and because plant productivity levels tend to converge.

Therefore, there must be some tangible "economic" reasons for plant productivity heterogeneity. The second hypothesis, called the "plant vintage hypothesis", argues that plants differ in terms of productivity level because they enter the market in different years under different economic, technological, and institutional conditions. In order to test for this, I regress plant-level relative productivity on year of entry dummies to account for year of entry economic and institutional specificities, initial absolute productivity level to account for the initial plant-level technological conditions, gross output to account for size, age or survival to account for capital stock obsolescence, controlling for capital stock increase and renewal with the total capital stock growth rate since entry. I find that the plant vintage hypothesis, represented by the year of entry dummies, cannot be validated, but that aging has a negative impact on relative productivity, while total capital stock growth has a positive impact. However, the two most important factors explaining annual plant-level relative productivity are the size of plants and the initial level of plant productivity.

The latter results support the plant-specific fixed effect explanation to plant-level productivity heterogeneity. In the last section, I concentrate on explaining plant productivity levels in their year of entry. Indeed, since the initial plant productivity level conditions largely plant productivity in subsequent years, focusing on initial plant productivity levels sheds some light on plant productivity heterogeneity in general. I find that plants' initial productivity levels depend largely on the average productivity level of the 5-digit sector they are entering, but that other factors are involved. In particular, an initial larger size (gross output) affects positively initial productivity, and a fair amount of good quality management also triggers higher productivity. Being part of a group of companies, and in particular, having a parent company in the patronage system, triggers also higher initial TFP levels. I find that plant-level cronyism has a significant positive effect on plant-level productivity in the oil boom period and up to the end of the deregulation period, but that the effect becomes negative during the more liberalised period of the 1990s. I also find that being in a crony sector tends to lower initial productivity levels, probably because of negative externalities stemming from the large crony monopolies. The latter effect becomes insignificant in the 1990s.

6 Determinants of industrial evolution

This chapter investigates the second set of questions raised in chapter 4. How can I explain industrial evolution? The focus is both on the characteristics of industrial change and on the reasons for survival and exit. Together with exploring further the dynamics of aggregate Total Factor Productivity Growth, this chapter informs the issue of selection and competition within Indonesian manufacturing.

We have seen in the previous chapters that a large part of aggregate TFP Growth stemmed from the process of entry and exit, because entrants were more productive than incumbents, and exiters were less productive than incumbents at the aggregate level. However, different industries display different TFP Growth rates: the comparison of some significant industries will help shed some light on the characteristics of industrial change in order to explain different productivity gains over the period. Does a high plant turnover equate high productivity growth rates for all industries? Comparing industries will allow define more precisely the characteristics of plant turnover necessary for large productivity gains. We have also seen that, depending on the sub-period, the market share reallocation among incumbents can offer a positive contribution to aggregate productivity gains. Is this true for all industries? Are there industries more competitive than others in terms of market share reallocation, and are these the ones displaying the highest aggregate productivity gains? Is there and what is the relationship between the turnover and the market share reallocation processes? Answering those questions will give a first account of the state and dynamics of competition in manufacturing over the period 1975-95.

The second set of questions regarding the state and dynamics of competition regards the reasons for plants survival and exit. Is relatively lower TFP the main determinant for exit? And symmetrically, is higher TFP the main determinant for survival? Does this change over time in relation to external shocks and macroeconomic policies? It would be surprising if lower TFP were the main determinant for exit, and higher TFP the main determinant for survival, as this would suggest the existence of perfect market mechanisms. Many other studies have labelled the process of exit as not being a clean process. Indeed, since there are several strategic games and agency problems in the decision to stay or exit, there is no obvious reason why TFP would be the main determinant for exit and survival. For example, within an industry with a small number of players, each player has an incentive to force competitors to exit in order to capture their market share. But if exit costs are too high, low productivity plants may delay the decision to exit. Another example is the case where plant closure would result in high unemployment costs for the State, so that the State could prevent or delay exit. In the same vein, managers and workers can delay or prevent closure decided by the owners in order to protect their jobs. Last but not least, exit may occur only when quasi-rents have been exhausted: a rational plant will exit when the profits expected in the next period are less than the interest that could be gained from reallocating the assets elsewhere. Exit may be delayed or prevented if assets have depreciated very quickly, or if the possibilities of reallocating assets are limited. Last but not least, and particularly relevant in the case of Indonesian manufacturing: exit can be prevented by soft budget constraints on some plants, allowed by political protection, for example via cheap and easy access to credit, or by the non-existence or non-implementation of bankruptcy laws.

6.1 Industries profiles

Before tackling directly the issue of the reasons for plant survival and exit, it is necessary to brush a short overview of individual manufacturing sub-sectors. Indeed, the literature on survival and exit underlines that plants behave differently depending on whether the industry is expanding or declining, both in terms of output and of productivity. Behaviours also depend on the evolution of industrial concentration. Finally, before explaining survival, and exit, there is a need for some historical account of the phenomenon: this has been done in chapter 4 with the demographic analysis of the manufacturing sector, but needs to be complemented by an analysis at a lower level of industrial disaggregation.

I chose to focus on three particular cases: food, beverages & tobacco; textile, garments & leather; and basic metals. The first two sectors are interesting to compare because they both originate during the colonial period, they are composed of both low and high capital-intensive sub-sectors, with an emphasis on labour-intensive activities, they use abundant and cheap natural resources and labour, they are fairly similar in terms of size and industry composition in terms of plants size distribution, the textile, garment and leather industry is growing faster than the food, beverages and tobacco industry, and they are the two main industries in manufacturing. The textile, garment and leather industry is a high productivity growth industry, while the food, beverages and tobacco industry is a very low to negative productivity change industry. Beside these, the basic metals industry is more peculiar. It is the smallest industry in manufacturing at the beginning of the period, in terms of output, employment and number of plants. It is very capital-intensive, very concentrated, and relies on the import of raw material for production. It is gaining in importance within manufacturing, and is the industry with the highest productivity growth rates over the period 1975-89. The following section offers a more detailed historical account of the development of those sectors.

Food, beverages & tobacco

This sector is composed of four 3-digit sub-sectors: the food industry (ISIC 311), the other foods industry (ISIC 312), the beverage industry (ISIC 313), and the tobacco industry (ISIC 314). In

1975, in terms of output, the sector of food, beverages and tobacco is dominated by the manufacture of clove cigarettes, followed by the manufacture of sugar, the manufacture of cooking oil, the milling and cleaning of coffee, and the manufacture of tea. Also noticeable is the large employment share of the manufacture of tobacco. The share of clove cigarettes manufacturing rises throughout the period to attain 30.3% of total output in the food, beverages and tobacco sector in 1995, and a share of over 18% in employment. In 1995, the clove cigarettes manufacturing, and the manufacture of tobacco account for 35.7% of employment and 33.1% of output in the food, beverages and tobacco industry. On the other hand, the sugar industry is on a relative decline, with a share in output dropping from 13.5% in 1975 to 4.6% in 1995. All in all, the share of the cooking oil industry remains unchanged, with the noticeable rise of palm oil, in which Indonesia has a natural comparative advantage, replacing crude animal and vegetable oil. The processing of tea and coffee is on the decline, and other products such as frozen fish, wheat based products, or animal feeds, pulled by domestic demand and rising income levels, start to rise.

Table 1a: Food, beverages, and tobacco sector description

year	5-digit industry code	5-digit industry label	share in 2-digit industry output (%)	share in 2-digit industry employment (%)
1975	31420	manufacture of clove cigarettes	19.0	22.6
1975	31181	manufacture of granulated sugar	13.5	19.6
1975	31151	manufacture of crude animal and vegetable cooking oil	11.8	4.3
1975	31163	Milling and cleaning of coffee	11.5	4.4
1975	31221	Manufacture of processed tea	10.6	4.9
1975	31430	Manufacture of cigarettes	4.7	1.5
1975	31410	Manufacture of dried and processed tobacco	2.1	15.7
1975	31164	Peeling and cleaning of seeds except of coffee	1.3	1.4
1975	31161	Rice milling and husking	1.2	1.9
1985	31420	manufacture of clove cigarettes	30.2	21.8
1985	31181	manufacture of granulated sugar	11.4	14.7
1985	31151	manufacture of crude animal and vegetable cooking oil	8.0	5.3
1985	31163	Milling and cleaning of coffee	4.5	4.6
1985	31144	Manufacture of frozen fish and other similar products	3.4	1.6
1985	31410	Manufacture of dried and processed tobacco	2.8	14.1
1985	31430	Manufacture of cigarettes	2.7	1.2
1985	31221	Manufacture of processed tea	2.7	4.8
1985	31161	Rice milling and husking	1.8	1.7
1985	31340	Manufacture of soft drinks	1.5	1.4
1985	31179	Manufacture of bakery products and the like	1.2	3.8
1985	31164	Peeling and cleaning of seeds except of coffee	1.2	1.1
1985	31171	Manufacture of macaroni, spaghetti, noodles and the like	1.1	2.5
1995	31420	manufacture of clove cigarettes	30.3	18.2
1995	31154	Manufacture of cooking oil made of palm oil	7.7	1.1
1995	31281	Manufacture of prepared animal feeds	6.8	1.3
1995	31144	Manufacture of frozen fish and other similar products	6.5	4.4
1995	31151	manufacture of crude animal and vegetable cooking oil	5.7	4.8
1995	31181	manufacture of granulated sugar	4.6	8.0
1995	31171	Manufacture of macaroni, spaghetti, noodles and the like	3.6	2.9
1995	31340	Manufacture of soft drinks	3.4	2.3
1995	31179	Manufacture of bakery products and the like	3.0	5.5
1995	31410	Manufacture of dried and processed tobacco	2.8	17.5
1995	31221	Manufacture of processed tea	1.5	6.5
1995	31163	Milling and cleaning of coffee	1.4	3.0
1995	31192	Manufacture of food made of chocolate and sugar confectionnery	1.2	1.6

Sugar is one of the oldest cash-crop in Indonesia, and has a long history of state-ownership and industrial concentration. Robison (1986) reports that "Much of lowland Java was operated as a virtual state sugar plantation, and the value of sugar export from the Indies in 1840 constituted 77.4% of the total value of exports and remained at 62% as late as 1880" (p.6). According to Robison, the scale of enterprises in this sector started to increase between 1870 and 1949 accompanied by the appearance of vertical integration and the replacement of smallholders by banks and large trading houses. This phenomenon had been triggered by the increasing capital-intensity of the sugar activities. Sugar production started to decline in the late 19th century, with a big blow during the Great Depression, with the number of mills dropping from 180 in 1929 to 45 in 1933, and production falling from 3 million tons to 0.5 million ton over the same period. "The industry never recovered from this blow, and with the dismantling of the colonial state apparatus after 1945 the private sugar industry was deprived of the power required to enforce the complex and onerous land appropriations upon which sugar cultivation, especially in Java, was based" (Robison, 1986, p.8).

Under the Suharto era, from 1967 onwards, BULOG (state logistic board) regulated the price and distribution of sugar, among other basic staples. BULOG can also have the monopoly of purchase and distribution of staples, or appoint official distributors, what is of course a source for distortions of all sorts, including corruption and the formation of a monopolist market not necessarily resting on productivity. Robison (1986) indeed states that BULOG "has been a major launching pad for domestic corporate capital, through its power to allocate distributorships and contracts, as well as a major source of funds for the private and political needs of the politico-bureaucrats who have controlled it" (p. 229). Tabor (1992) describes the entire sugar cane programme, including the Smallholder Sugar Intensification Project (TRI, Tebu Rakyat Intensifikasi) as "uneconomic" (p.177). Indeed, the promotion of smallholders is said to have prevented the sector from gaining from economies of scale, the intervention of BULOG distorted competition both through the license allocation process and through the setting of domestic prices above world prices, resulting in an implicit tariff on sugar ranging from 50% (1989) to 373% (1985) depending on years for the period 1975-89 (Tabor, 1992). Parastatal corporations (PTPs) have been created in the domain of agricultural production and processing. Tabor (1992) reports that "government policy has been to pamper the PTPs with subsidised investment credits and low cost access to public lands...These benefits have then been offset by high rates of taxation and by assigning the PTPs the social responsibility for smallholder development. The combination of provision of special favours and imposition of development burdens has created endemic PTP mismanagement, marked by a cycle of rapid investment growth (in high price periods), liquidity crises as prices have fallen, and government bailouts" (p.194). And indeed, of plants present in the sugar sector of the Statistik Industri dataset, between 70% and 80% report state ownership between 1975 and 1995, most of the time a 100% state capital share. Adding to this, Tabor describes the sugar sector as being technologically backwards.

The wheat based products industry follow a similar pattern. Indeed, as wheat and flour were also regulated by BULOG, corruption, large state monopolies, and price distortions prevail. For example, the company PT Bogasari Flour Mills is a monopoly in grain milling, and instant noodle production, and is said to have had strong political connections. Indeed, Robison (1986) reports that "the original decision to establish a flour mill in Indonesia was taken in 1970 and a Singapore company, P.T. Prima, was given the licence to begin milling. Then suddenly a company, P.T. Bogasari, was established by Liem Sioe Liong, the Suharto family business associate, to enter the flour milling business also. It was owned by the Liem Group, in partnership with Sudwikatmono, the half-brother of President Suharto, who was also President Director. The articles of association stipulated that, in effect, 26% of profits be set aside for`charitable' foundations including Mrs Suharto's Yayasan Harapan Kita and Kostrad's Yayasan Dharma Putra...At the same time, BULOG revoked Prima's original licence and issued it with a licence to mill for the less lucrative East Indonesia market" (p.232). A following series of similar events led Prima completely out of the Indonesian market. However, this industry has expanded massively, mostly as a result of the strong rising demand triggered by rising income.

Commercial production of palm oil started in 1911 and peaked in 1938, to halve in the aftermath of the independence war. Dutch production facilities were nationalised in 1957, and the sector was renovated in the early 1970s. The sector experienced an export boom from 1967 to 1978, and 90% of production was exported (coconut oil for domestic consumption) (Aswicahyono, 1998). In 1979, the production becomes domestic oriented mostly because coconut oil could not meet the rising pace of domestic demand. To reorient the production towards the domestic market, trade restrictions and price ceilings were introduced. The control was effective with export dropping to 55% of production. The effectiveness of the measures stems mainly from the fact that 60% of the total acreage was public-owned. In 1977 the *Perkebunan Inti Rakyat (PIR)* programme was implemented to encourage private participation in the industry, especially from smallholders, as for the sugar industry. It took the form of land allocation and subsidised interest rates. By 1989 the share of private plantations exceeded the share of public plantations. In the 1990s, both domestic and export production increased steadily. There has been a movement towards vertical integration in order for palm oil processing companies to control the prices of raw materials, and to access profits that are higher in the upstream market. The two leading groups are the Salim Group and the Sinar Mas Group (Aswicahyono, 1998). And indeed, in the mid-1990s, Larson (1996) reports that still 60% of palm oil refineries are owned by 5 big companies. Indonesia, in spite of some market distortions, is, according to Larson (1996), one of the lowest-cost producers of vegetables oil in the world.

By far the largest output contributor to the food, beverages and tobacco sector is the manufacture of cloves cigarettes (called kretek). Manning (1979) reports that in the 1960s, hand-rolled kretek production was competing with foreign-owned white cigarettes, and that the former received price subsidies in the form of higher excise tax and low retail price for white cigarettes. The protection of the hand-rolled kretek went also through a regulation hampering the installation of new production machinery, keeping down the production volumes of both white and kretek machine-rolled cigarettes. Restrictions on new machinery were eased in the mid-1970s, triggering a massive rise in the production of machine-rolled kretek (from 50 million sticks in 1976 to 3.9 billion sticks in 1977, Tarmidi, 1996, p.87). In 1979, restrictions on machinery were removed and the authorities instituted a production ratio of 1:2 between machine-rolled and hand-rolled kretek cigarettes, and the production jumped to 13.6 billions sticks (Tarmidi, 1996, p.87). The ratio was achieved as soon as 1981, and this, together with the oil crisis, probably explains the production slowdown in 1981-83. In the following period, the ratio became 2:3, triggering another rise in production. Bird (1996) reports that in 1990, a clove-trading agency (BPPC) was created and given the monopoly to buy cloves from local producers and sell them to kretek manufacturers, resulting in a 20% increase of production costs. In 1991, the government implemented the equivalent of a tax increase on the purchase of cloves, resulting in a drop in production of kretek cigarettes benefiting the white cigarettes industry. However, the kretek cigarettes industry adapted to the new regulatory environment and production started to rise again after 1992. If we believe Tarmidi (1996), the clove cigarettes industry is one example of domestic production winning the competition against foreign producers. If the kretek cigarettes could initially not compete with white cigarettes, the producers soon reacted to market demand by improving the quality, appearance and packaging of the product, while remaining price competitive. This, coupled with an increase in productivity due to more widespread mechanisation, and the immobility of foreign competitors, insured the Indonesian kretek producers the domination of the domestic market. According to Tarmidi (1996), the number of kretek firms halved between 1972 and 1993, from 287 to 141 firms, and the concentration in the industry increased. Bird (1996) argues that this decline in numbers is mostly due to intense competition among the "competitive fringe" of plants rather than competition between the dominant companies and the "competitive fringe". Bird (1996) also argues that medium- and large plants compete on image, while small plants compete on prices. Furthermore, Castle (1982), mentioned in Aswicahyono (1998) argues that the minimum efficient scale is at about 100 workers, more workers don't make a difference, while less seems to be synonymous of lower productivity. Finally, it seems that most new capital investments were implemented in the late 1970s and the early 1980s.

The overall picture of the food, beverages and tobacco sector is one of a very regulated sector, with high price ceilings, high implicit import protection rates, acting under a very regulated and distorted production and distribution licenses allocation system, resulting in price distortions, and the dominance of large groups with political connections. In the mean time, the entry of small entities has been encouraged, but within such a uncompetitive environment, it is difficult to imagine how those new small plants could fared well. From a technological point of view, it seems that, because of the protection of some vested interest, improvements have been delayed, sometimes until the deregulation period. It will therefore not be surprising to find that this sector did not perform well in terms of Total Factor Productivity Growth.

Textile, garments & leather

Hill (1991) proposes a detailed account of the history of the Indonesian textile and garment industry. This industry regroups three sub-sectors. The oldest industry is the weaving and fabric production industry, while the spinning and synthetic fibre production, and the garment production industries emerged primarily under the Suharto era. While the spinning and synthetic fibre production is capital-intensive, the two other sub-sectors are more labour-intensive.

Table 1b: Textile, garments, and leather sector description

year	5-digit industry code	5-digit industry label	share in 2-digit industry output (%)	share in 2-digit industry employment (%)
1975	32114	Weaving mills except gunny and other sacks	34.4	32.2
1975	32111	Spinning mills	19.5	11.1
1975	32112	Manufacture of threads	14.0	24.2
1975	32210	Manufacture of wearing apparel made of textile (garments)	6.8	7.0
1975	32115	Manufacture of finished textiles	3.4	1.3
1975	32130	Knitting mills	3.1	4.9
1975	32117	Manufacture of batik	2.3	2.5
1975	32123	Manufacture of gunny bags	1.6	2.1
1975	32113	Manufacture of finished yarns	1.4	2.1
1975	32121	Manufacture of made-up textile articles except wearing apparels	1.3	2.5
Note: In 1975, two 5-digit industries are undefined and represent 2.7% of output and 3.3% of labour				
1985	32114	Weaving mills except gunny and other sacks	30.8	31.4
1985	32111	Spinning mills	24.6	14.1
1985	32210	Manufacture of wearing apparel made of textile (garments)	19.1	23.6
1985	32112	Manufacture of threads	5.4	7.1
1985	32130	Knitting mills	4.3	5.6
1985	32121	Manufacture of made-up textile articles except wearing apparels	1.9	2.6
1985	32117	Manufacture of batik	1.5	2.2
1985	32123	Manufacture of gunny bags	1.2	1.1
1985	32115	Manufacture of finished textiles	1.1	1.2
1995	32114	Weaving mills except gunny and other sacks	24.9	21.0
1995	32111	Spinning mills	24.1	11.0
1995	32210	Manufacture of wearing apparel made of textile (garments)	19.1	26.5
1995	32412	Manufacture of sport shoes	12.4	15.9
1995	32130	Knitting mills	4.9	6.4
1995	32411	Manufacture of footwear for daily use	2.9	5.3
1995	32115	Manufacture of finished textiles	2.2	1.7
1995	32116	Manufacture of printed textiles	1.3	1.0
1995	32220	Manufacture of wearing apparel made of leather and the like	1.2	1.3

The weaving industry started in the late colonial era, in the 1920s, was relying on small-scale cottage industry, and on imported yarns. Not much investment was realised after independence. The sector was given priority in the early Suharto era because it was considered as producing basic needs goods, and because domestic demand was rising. The promotion of this sector resulted in high investment upgrading the spinning and weaving technologies of this industry. Indeed, Hill (1991) reports that "the New Order regime dismantled the elaborate yarn allocation system which existed up to 1966, removed the extensive trade and regulatory barriers, and ushered in a virtual technological revolution" (p. 91). In fact hand looms became a residual technology of production as soon as the late 1970s, mostly because of productivity reasons, with a potential acceleration of the process imputable to capital investment subsidies (Hill, 1991). The import substitution policy for the textile industry paid off in the 1970s, but the sector's growth slowed down in 1980-85 with the oil crisis resulting in a weaker domestic demand. However, after 1985, exports grew steadily (Hill, 1991). Even though the sector was protected from imports, the textile sector seems to be a sector that experienced early deregulation for the domestic market, as well as early and rapid upgrading of technology. This might already indicate stronger productivity growth rates than other industries, both because of the technological advance and because of lower market distortions.

According to Hill (1991), "the spinning, fibre and garment industries are much more recent in origin" (p.92), with a manufacturing sector only appearing on a small scale in the 1930s, stagnated until 1968, and expanded "by some fifteen-fold from 1969 to 1988" (p. 92), utilising abundant energy resources in the production of polyester fibre. The manufacturing garments industry only emerged in the 1970s, responding to export opportunities and rising domestic demand (Hill, 1991).

Hill (1991) also reports that the industry uses intensively cheap female labour, and wages in the Indonesian textile industry are at the same time lower than textile workers wages in other countries, and lower than the Indonesian national average wage. This strengthens further the hypothesis of high profitability and productivity of the sector relative to the others.

The industry diversified in the 1970s to produce a large range of natural and synthetic materials. From yarn spinning and weaving, the industry turned heavily to garments manufacturing, helped both by domestic demand in the 1970s and booming demand for exports in the 1980s. Pangetsu (1996) argues that this export boom was pushed by a slowing domestic demand in the aftermath of the oil crisis, and boosted by the abundance of cheap labour, coupled to subsidised interest rates for export credits, un-utilised export quotas, and under-valued real exchange rate. The introduction in 1986 of the BAPEKSTA scheme of duty and VAT exemptions and drawback for inputs to exportables also helped boost exports. Growth rates only started to slow down as cheap competition emerged from China, India and Bangladesh (1993), and as the government introduced the minimum wage policy that did not necessarily correspond to an increase in labour productivity.

In terms of plant size distribution, Hill (1991) reports that the garment industry is mostly dominated by small (5 to 19 employees) and medium size plants (200 to 999 employees), while spinning is dominated by large-scale plants (above 1000 employees). The weaving industry is somewhat in between. The plant size distribution of the three sub-sectors reflects their specific capital-intensities and scale economies. This contrasts with the food, beverages and tobacco industry that is more of a dual market in terms of size, with large-scale monopolies coexisting with weak smallholders. Productivity in the textile sector is also enhanced by vertical integration.

In terms of ownership, Hill (1991) reports that "at one extreme, garments are almost entirely in domestic private hands" (p.99), because the government does not consider the sector as strategic, and because foreign investors do not possess any sort of advantage. The nationalisation of weaving mills after independence explains a somehow larger presence of government ownership in that sector, while foreign investment (mostly North-East Asian) has also been more substantial in spinning and weaving because of a higher capital requirement than for the garment industry.

A rising star in the textile, garment and leather industry of the 1980s is the footwear industry. While footwear accounted only for 5% of total output in the sector in 1975, it rose to 16% in 1995. Up to the 1980s, the only formal plant in the footwear industry was the foreign owned firm Bata. New and mostly foreign investment in the sector flourished in the 1980s as East Asian countries such as Korea and Taiwan had to relocate the production of sport shoes to respond to the appreciation of their currencies, increasing labour costs, and the removal of the Generalised System of Preference facility (Aswicahyono, 1998). Indonesia attracted foreign investment because it produced rubber, provided abundant and cheap labour, and had export orientated incentives.

Chapman (1992) however argues that in spite of deregulation, authorities managed to keep control over the footwear industry and continue protecting large private domestic companies from new domestic competition. He argues that "Footwear, with relatively low 'natural' barriers to entry, was closed to domestic investment, enshrining the existing concentration of the industry. While the liberalisation which began in 1986 included provisions which opened all sectors to investment, provided that 85% of output was planned for export, direct competition for incumbent firms selling into the domestic market remained restricted by licensing of investment" (p.71). Meanwhile, the BAPEKSTA scheme of duty and VAT exemptions and drawback for inputs to exportables introduced in 1986 has been an important pull factor for the development of the export sector in the footwear industry. This sub-sector, mostly pulled by the export industry, is one of the most productive.

In terms of plant size, Chapman (1992) argues that in the footwear industry, if "economies of scale are exhausted at as little as 60 employees..., lack of quality competitiveness may be the greatest handicap in placing small-scale producers on an export competitive footing" (p.82). This suggests that some small and medium plants might be productive, but less than larger plants that can produce high quality and exportable goods.

The overall picture of the textile, garment and leather sector is one of a fairly diversified, competitive, modern sector. In fact, the economic history of this industry explains pretty well the very good performance in terms of productivity gains.

Basic metals

Table 1c: Basic metals sector description

year	5-digit industry code	5-digit industry label	share in 2-digit industry output (%)	share in 2-digit industry employment (%)
1975	37103	Steel rolling industries	38.1	58.2
1975	37204	Manufacture of non-ferrous metal extrusion industries	25.6	10.2
1975	37203	Manufacture of non-ferrous metal rolling industries	16.7	8.6
1975	37100	Iron and steel basic industries	14.6	15.8
1975	37201	Manufacture of non-ferrous metal basic industries	4.4	2.5
1985	37103	Steel rolling industries	69.1	58.6
1985	37201	Manufacture of non-ferrous metal basic industries	21.1	12.2
1985	37101	Iron and steel basic industries	3.5	6.7
1985	37203	Manufacture of non-ferrous metal rolling industries	2.9	6.2
1985	37204	Manufacture of non-ferrous metal extrusion industries	1.7	5.1
1995	37103	Steel rolling industries	45.9	49.2
1995	37201	Manufacture of non-ferrous metal basic industries	35.5	12.9
1995	37101	Iron and steel basic industries	6.7	8.6
1995	37203	Manufacture of non-ferrous metal rolling industries	5.5	11.9
1995	37202	Manufacture of non-ferrous metal smelting industries	2.8	5.2
1995	37102	Iron and steel smelting industries	1.8	7.2
1995	37204	Manufacture of non-ferrous metal extrusion industries	1.3	3.7

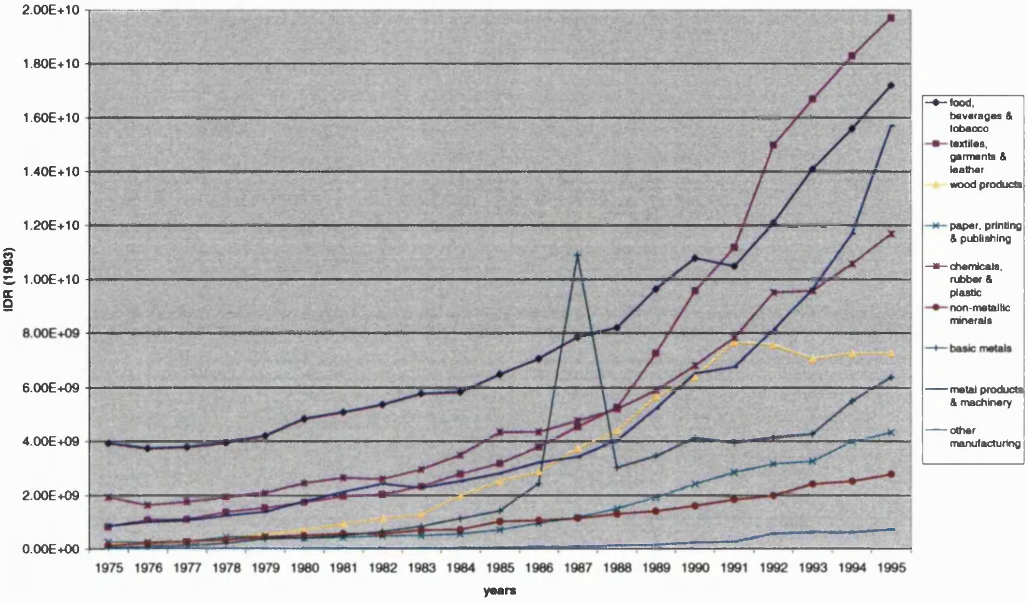
The iron and steel industry suffers from a lack of domestic raw materials, and is dependent upon imported iron ores and scrap metal. The spectacular output growth of this industry has in fact been pulled by a significant domestic demand for basic metal products generated by the economic reconstruction of the country with a strong focus on infrastructure development that started in the late 1960s. Arndt (1975) reports that Indonesia entered the production of iron and steel in 1950 with the full support of the former USSR, with the creation of a large public company, PT Krakatau Steel, but that the political instability of the period hampered the good development of the project that eventually came to a halt in 1965. The authorities rehabilitated the project only in the 1970s, and PT Krakatau Steel started operation in 1978 by producing sponge iron using the abundant and cheap natural gas as main source of energy of production. PT Krakatau started with sponge iron that can use scrap metal as raw material. In 1983 the company started to produce a higher quality product, hot-rolled coil (HRC), and established a joint-venture, PT Cold Rolling Mill Indonesia Utama (PT CRMIU) together with the Franco-Spanish Sesticier SA. Chapman (1992) reports that the cold rolling mill started operations in 1987 (corresponding to the sudden rise in output and productivity in 1987 in the sector 37), but was inefficient and had a very low utilisation rate from the start, creating financial difficulties in spite of government protection, and the plant closed in 1990. Aswicahyono (1998, p. 247) reports that capacity utilisation in the downstream industry dominated by small- and medium-scale firms was very low in the early 1970s, and increased in the second half of the decade together with increase in demand, so that productivity might have risen. The formation of cast iron and steel industry between 1974 and 1980 with 7 new companies might also have had a positive effect on output growth. Output growth declined in the late 1980s as a result of both declining domestic demand and increase of substitution materials such as plastics, fibreglass and asbestos cement.

With regards to liberalisation, Chapman (1992) argues that "Despite the obvious structural differences of the two industries [footwear and steel], there are, in each case, obvious beneficiaries, in the form of a few large state-controlled [for steel] and private enterprises [for footwear], in receipt of residual assistance. In the case of steel, state involvement at critical upstream stages in the industry appears to have been a major factor in determining the extent and effectiveness of the reform" (p.71) For example, there was a real drop in import tariffs for steel, however, the large state-owned producer, PT Krakatau Steel "was the sole accredited importer" (p.74), so that liberalisation was a mere illusion. This is of course affecting companies across the sector, with "severe delivery delays to many of the smaller private sector producers whose only input source was Krakatau Steel or its subsidiaries. Meanwhile, Krakatau Steel itself had the raw material inputs to its basic steel-making process reduced in cost through an export ban on ferrous scrap" (p.74).

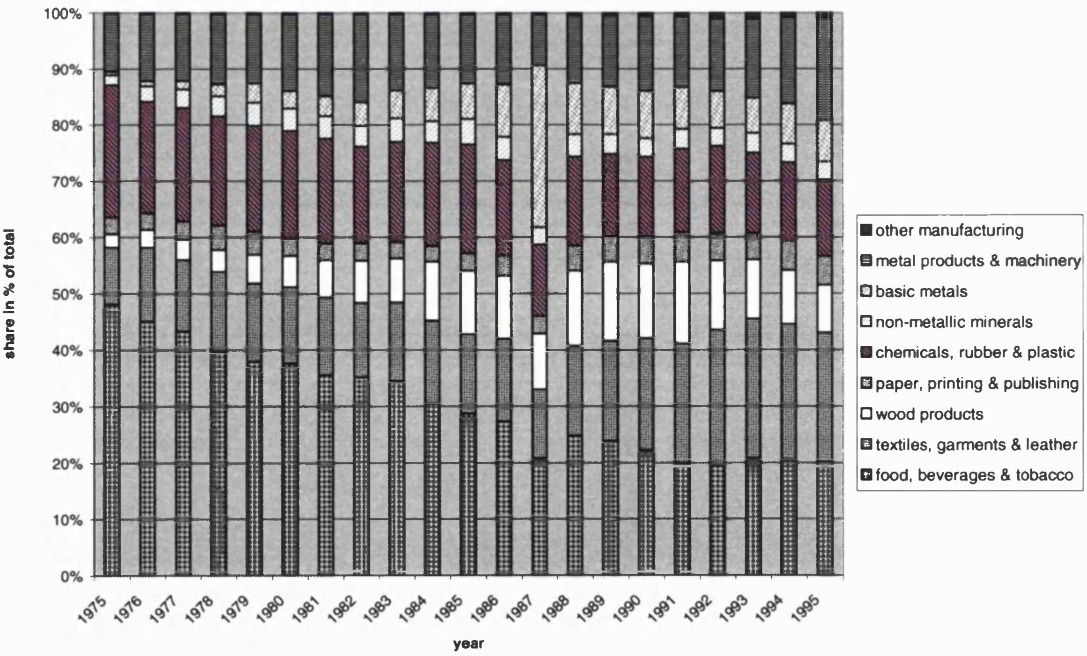
According to him, the result is that both industries present a new duality, with, on one hand, a competitive export sector, and, on the other hand, a protected and inefficient domestic-oriented sector. This evidence also tells us that the liberalisation process should not be granted as being automatically competition-enhancing.

He notes however that the new "BAPEKSTA scheme of duty and VAT exemptions and drawback for inputs to exportables has helped counteract the adverse effects of the continuing upstream licence restrictions in some instances" (p.76).

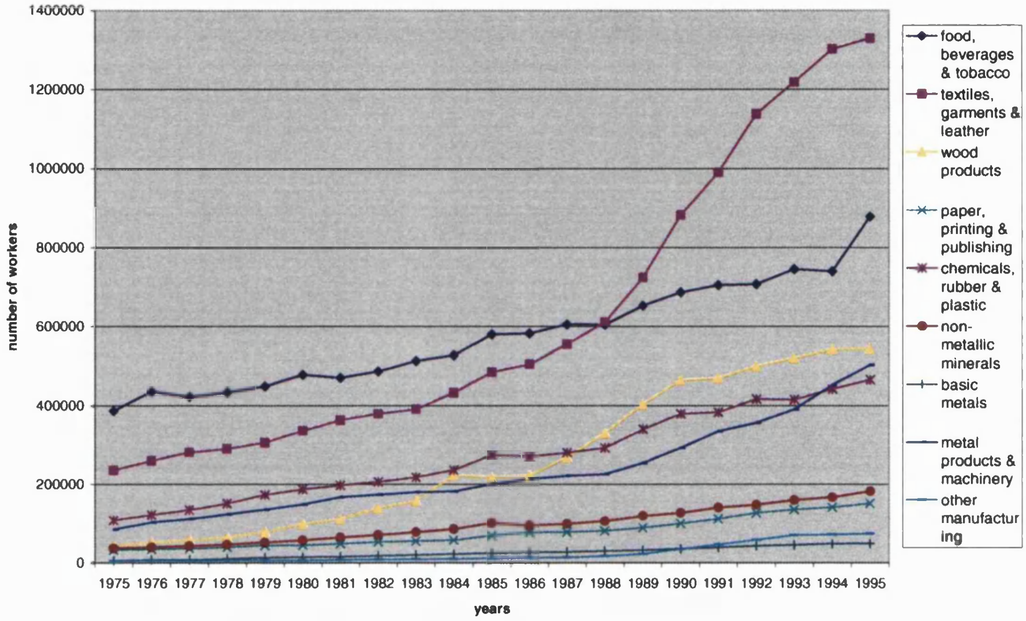
Graph 1: Evolution of gross output in manufacturing, 1975-95, constant Indonesian Rupiah (1983)



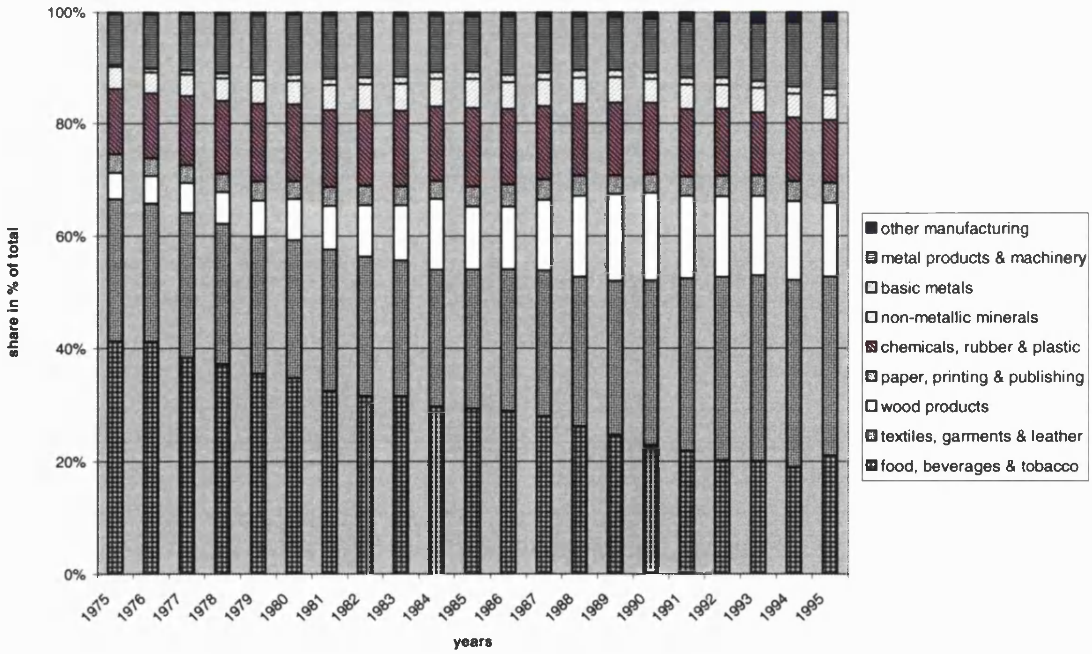
Graph 2: Evolution of industry shares in total gross output, 1975-95



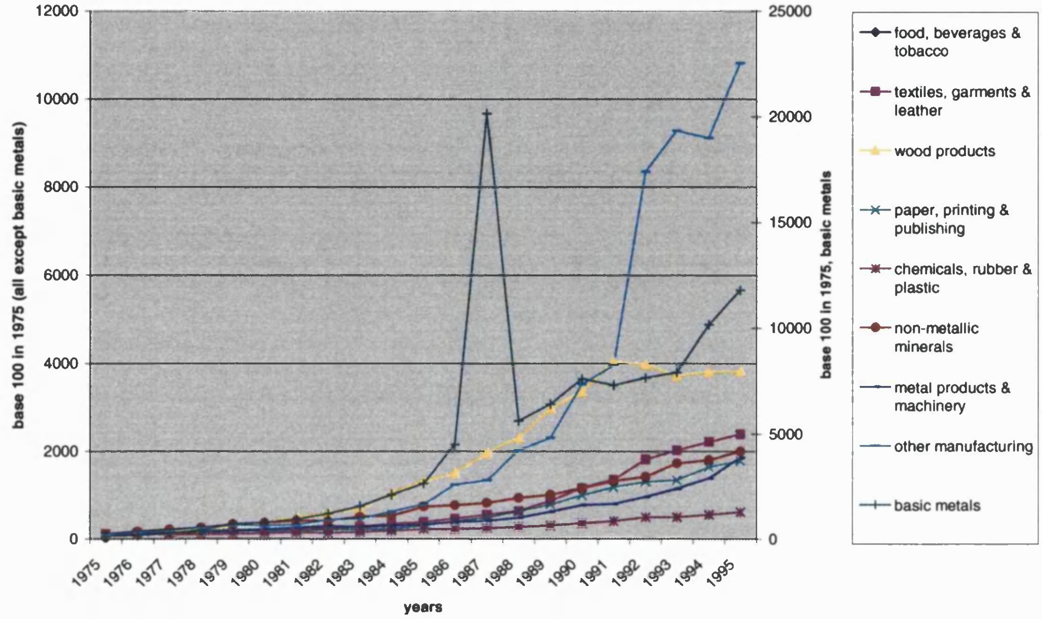
Graph 3: Evolution of number of workers in manufacturing, 1975-95



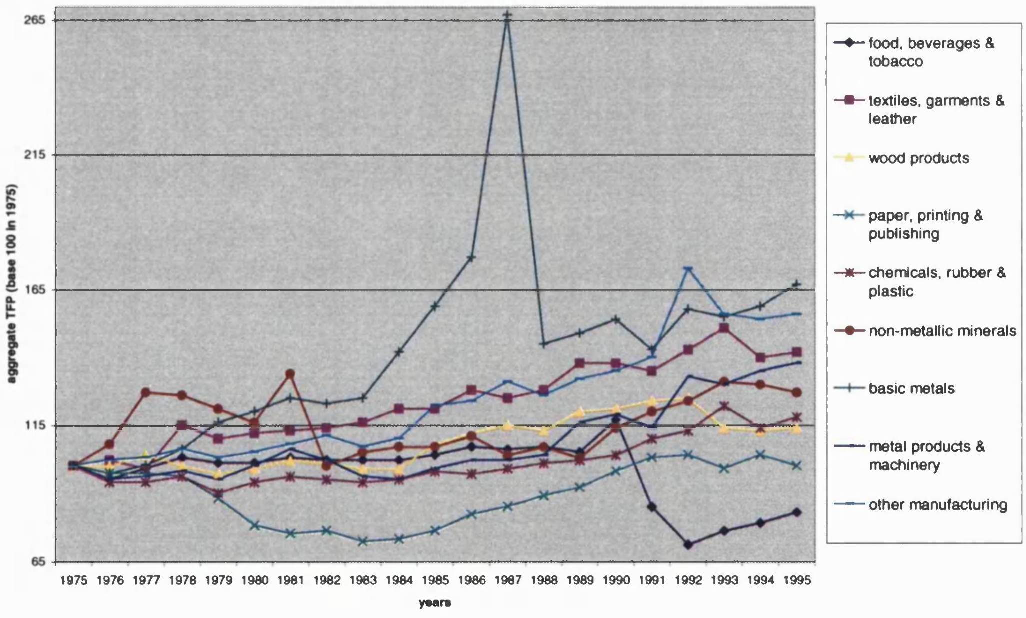
Graph 4: Evolution of industry shares in total employment, 1975-95



Graph 5 : Output evolution, 1975-95



Graph 6 : Evolution of aggregate TFP base 100 in 1975 from Divisia Index Number, 1975-95



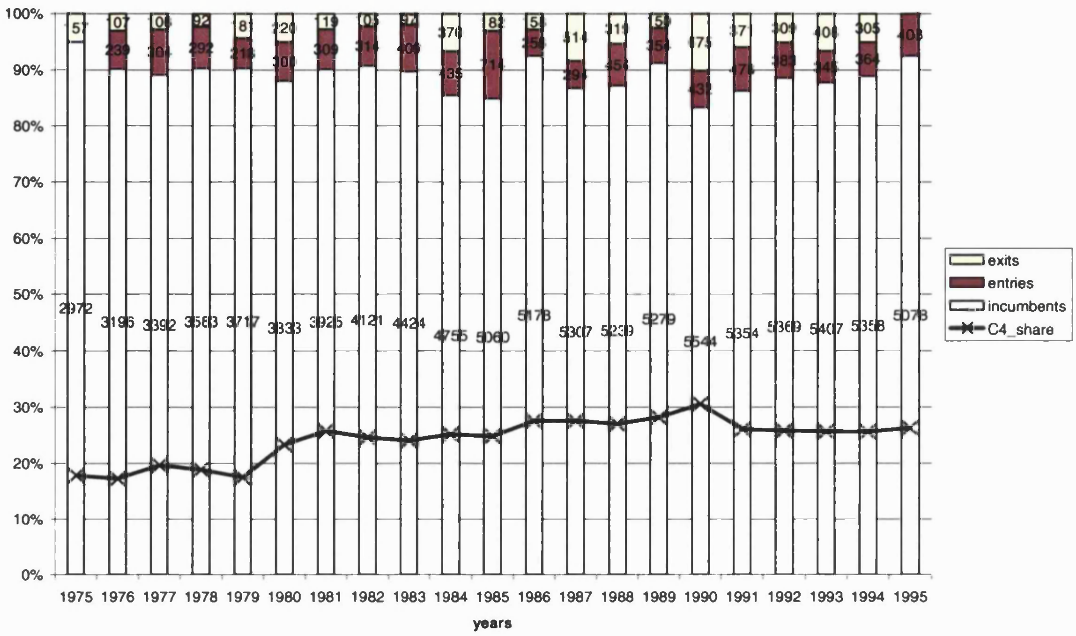
Graph 1 ranks the nine 2-digit industries according to their total gross output over the 21-year period. The first striking feature of the manufacturing sector is the overwhelming dominance of the food, beverages & tobacco sector, at least until 1990 when it is overtaken by the textile, garments

& leather sector, and becomes second in terms of output. The main industries of the food, beverages & tobacco industry are the sectors of sugar, clove cigarettes, cooking oil, cattle food, bread & biscuits, and coffee and tea processing. Hill (1997) argues that these sectors performed relatively badly in terms of productivity in spite of Indonesia's comparative advantage in terms of access to natural resources because of slow adoption of adequate and productive technology. Corroborating this assertion, I find that this sector displays the lowest TFP growth rates over the entire period (graph 6): with a TFP index of 100 in 1975, the industry index ends at a poor 83 in 1995, after having reached a peak at 117 in 1990.

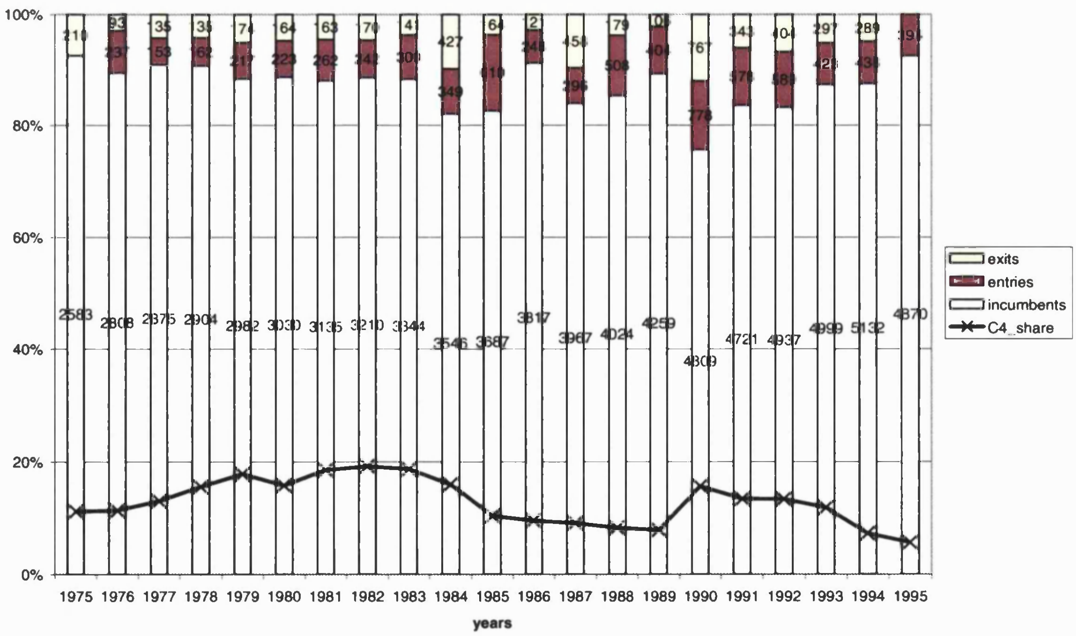
On the other hand, I find that the textile, garments & leather industry plays amongst the highest TFP growth industries: with a TFP index of 100 in 1975, its trend is constantly on the increase to reach 142 in 1995, representing the third highest TFP improvement in manufacturing after both "basic metals", and "other manufacturing" industries. The textile, garments & leather industry is dominated by the yarn, weaving, garments, and footwear sectors, with the last two sectors being the most dynamic in terms of output growth. While the rise in income and in domestic demand had helped output growth, favourable investment incentives in the 1970s, massive investment during the deregulation era, as well as an opening to the export market in the 1980s might have boosted productivity growth.

The food, beverages & tobacco sector represents the largest share of total manufacturing output reaching 48% in 1975, but in constant decline throughout the period, down to 20% in 1991, when the textile, garments & leather sector becomes the largest sector in terms of output with a 22% share. The pattern is fairly similar when looking at employment figures (graph 3 & 4): up to 1987 included, the food, beverages & tobacco sector is the first employer in manufacturing, and is only overtaken from 1988 onwards by the textile, garments & leather sector. Graph 5 shows indeed that if the textile, garments & leather industry has increased ten-fold in terms of output between 1975 and 1995, food, beverages & leather industry output has only been multiplied by 2.5.

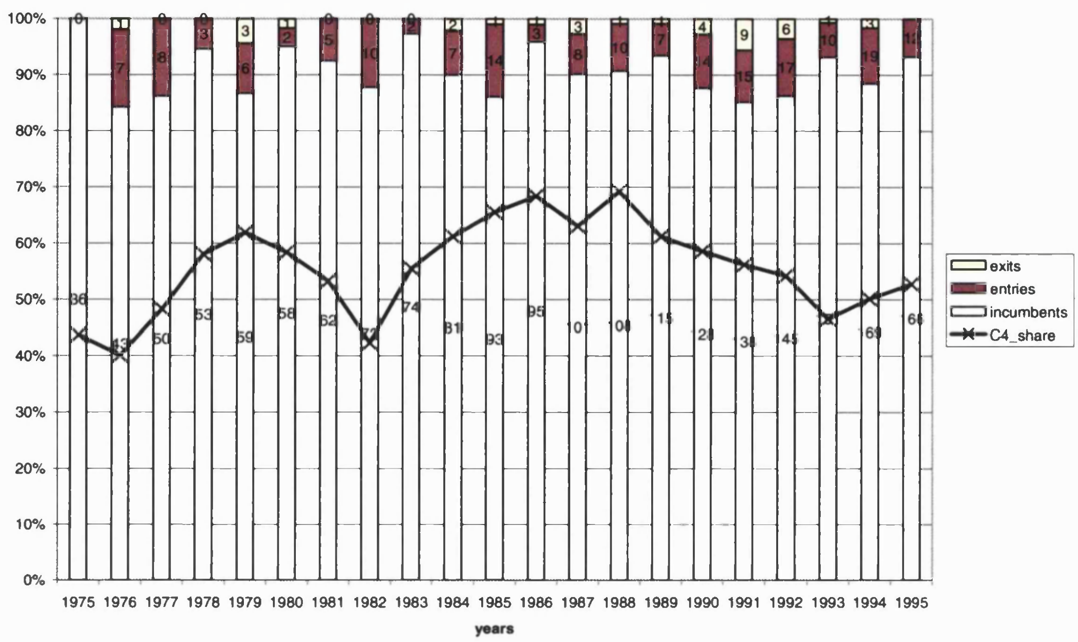
Graph 7: Entries, incumbents & exits in number of plants, and C4 output concentration ratio in the food, beverages & tobacco sector, 1975-95



Graph 8 : Entries, incumbents & exits in number of plants, and C4 output concentration ratio in the textile, garments & leather sector, 1975-95



Graph 9 : Entries, incumbents & exits in number of plants, and C4 output concentration ratio in the basic metals sector, 1975-95



Graph 7 and 8 give more details on both sectors. It is relevant and interesting to contrast and compare the two sectors, because both industries had settled in Indonesia in the early 20th century. They are both taking advantage of the abundance of cheap labour and natural resources. In terms of industrial demography, the comparison is interesting because both sectors presents roughly the same number of plants throughout the period, with 2,600 to 3,000 plants in 1975 and circa 5,000 plants in 1995, with an average of 3% growth p.a. in terms of number of plants. Average turnover rate is slightly lower for the food, beverages & tobacco sector at 13% p.a., against 16% for the textile, garments & leather industry. However, output and employment grow faster for the textile, garments & leather industry, suggesting that plants grow bigger in this sector. However, the C4 concentration ratio – calculated as the output of the four largest plants of the sector as the share of total output of the sector– is a lot lower in the textile, garments & leather industry. In the latter sector, the C4 ratio reaches 11% in 1975 to drop to 6% in 1995, against a rise from 18% in 1975 to 26% in 1995 for the food, beverages & tobacco sector. This could already suggest that competition might be more effective in the textile, garments & leather sector than in the food, beverages & tobacco sector.

The third outstanding industry is the basic metals sector. As shown in graph 1, the sector represented the second smallest industry in 1975, both in terms of output and employment, (just before "other manufacturing"), to become the 6th largest industry (out of 9) in terms of output in

1995, while becoming the smallest industry in terms of employment. What is especially interesting is that it is the industry that displayed the highest aggregate productivity growth of the manufacturing sector (graph 6), from a TFP index of 100 in 1975, to 167 in 1995, with a peak at 267 in 1987.

It is also the smallest industry in terms of number of plants throughout the period, with 36 plants in 1975, rising to 166 plants in 1995. This, combined with the high capital intensity of the activity leads to the highest concentration ratios (C4) of manufacturing, with 44% in 1975, a peak of 69% in 1988, ending at 53% in 1995. Comparing industrial change in this industry with the two previous ones will further inform the relationship between industrial change, competition and productivity gains.

The overview of the three sectors raises at least three important questions.

1 – If entry and exit accounts for most of aggregate TFP growth as shown in chapter 4, and if turnover rates are fairly similar across the three industries, what accounts for such a wide productivity growth divide?

2- What are the main characteristics of industrial change, and what role does it play in aggregate TFP growth in Indonesian manufacturing?

3 -What characterises survival and exit in Indonesian manufacturing?

6.2 Industrial evolution and productivity growth in three industries: food, beverages & tobacco ; textile, garments & leather ; and basic metals

This section aims at giving a fairly detailed account and comparison of industrial structure evolution in the three sectors under scrutiny, explain productivity growth rates for each industry, and account for differences across industries.

Previous graphical evidence has shown that the food, beverages & tobacco sector is one of the largest in terms of output, employment, and number of establishments throughout the period. However, TFP change between 1975 and 1995 is negative and the lowest of the entire manufacturing sector. In chapter 4, I have demonstrated that at the aggregate manufacturing level, any positive TFP change stemmed from the process of entry and exit of plants. The food, beverages & tobacco sector displays an average turnover rate of 13%, which is slightly less than the high productivity growth sector of textiles, garments & leather (16%), but slightly more than the even higher productivity growth sector of basic metals (11%).[53] The first obvious question is:

[53] I recall here that the turnover rate is the sum of entries and exits over the total number of establishments. Turnover rates and spreads between the three industries in terms of output are similar.

1 – If entry and exit accounts for most of aggregate TFP growth as shown in chapter 4, and if turnover rates are fairly similar across the three industries, what accounts for such a wide productivity growth divide?

The first step is to decompose aggregate TFP growth for the three industries following the methodology used in chapter 4, distinguishing between intra-plant productivity growth, market share reallocation among incumbents, and net entry (market share reallocation from exiters to entrants).

I recall here the findings of chapter 2: aggregate TFP growth rates calculated with the decompositions are different from aggregate TFP growth rates calculated with the Divisia Index Number methodology because they do not use the same weighting. However, since the two different methodologies do not affect the ranking of 2-digit industries in terms of TFP growth rates, I consider that I can use the current decomposition methodologies to compare those industries.

Results are displayed in Tables 2 to 4. Differences between the three decompositions are similar to the aggregate manufacturing analysis in chapter 4.

Table 2: TFP Growth decompositions for industry 31: Food, beverages & tobacco

	BHC decomposition (TFP aggregated with market shares)				
YEAR	market share reallocation among incumbents	intraplant TFPG for incumbents	total TFPG of incumbents	net entry TFPG	Aggregate TFPG from decomposition
1976	-3.53%	-4.23%	-7.76%	1.31%	-6.45%
1977	-1.01%	0.00%	-1.00%	0.46%	-0.54%
1978	2.03%	2.81%	4.84%	1.60%	6.45%
1979	-1.49%	-3.65%	-5.14%	3.37%	-1.77%
1980	-1.64%	-4.75%	-6.40%	2.69%	-3.71%
1981	-6.64%	0.43%	-6.21%	7.15%	0.93%
1982	-4.61%	-1.08%	-5.69%	6.20%	0.51%
1983	-3.82%	-0.86%	-4.68%	2.22%	-2.46%
1984	-3.83%	1.57%	-2.26%	3.47%	1.21%
1985	-7.52%	1.67%	-5.85%	4.45%	-1.39%
1986	3.48%	-1.96%	1.52%	3.48%	5.00%
1987	-1.39%	-2.06%	-3.46%	-1.05%	-4.50%
1988	1.24%	0.48%	1.72%	2.76%	4.48%
1989	0.84%	-2.67%	-1.83%	2.19%	0.36%
1990	1.04%	6.08%	7.12%	-0.32%	6.79%
1991	0.54%	-3.40%	-2.85%	-4.33%	-7.19%
1992	9.66%	-4.66%	5.00%	-0.75%	4.25%
1993	4.10%	-1.80%	2.31%	3.89%	6.20%
1994	2.33%	0.80%	3.13%	0.95%	4.09%
average 76-94	-0.54%	-0.91%	-1.45%	2.09%	0.65%
average 76-80	-1.13%	-1.97%	-3.09%	1.89%	-1.20%
average 81-83	-5.02%	-0.50%	-5.53%	5.19%	-0.34%
average 84-85	-5.68%	1.62%	-4.06%	3.96%	-0.09%
average 86-88	1.11%	-1.18%	-0.07%	1.73%	1.66%
average 89-94	3.09%	-0.94%	2.15%	0.27%	2.42%

	FHK decomposition (TFP aggregated with market shares, TFP relative to the average)							GR decompostion (TFP aggregated with market shares and time average market shares, TFP relative to the average - time average)				
	market share reallocation among incumbents (1)	covariance term for incumbents (2)	total effect of market share reallocation among incumbents (1) + (2)	intraplant TFPG for incumbents (3)	total TFPG of incumbents (1) + (2) + (3)	net entry TFPG (4)	TFPG (1) + (2) + (3) + (4)	market share reallocation among incumbents	intraplant TFPG for incumbents	total TFPG of incumbents	net entry TFPG	TFPG
1976	-2.92%	2.05%	-0.88%	-4.23%	-5.11%	0.26%	-4.86%	-1.90%	-3.21%	-5.11%	0.26%	-4.85%
1977	-3.11%	3.38%	0.27%	0.00%	0.27%	0.13%	0.40%	-1.42%	1.69%	0.27%	0.26%	0.53%
1978	-1.55%	3.30%	1.75%	2.81%	4.56%	0.31%	4.87%	0.10%	4.46%	4.56%	0.31%	4.87%
1979	-1.61%	2.63%	1.03%	-3.65%	-2.63%	1.38%	-1.25%	-0.29%	-2.34%	-2.63%	1.38%	-1.25%
1980	-2.65%	2.41%	-0.24%	-4.75%	-5.00%	0.63%	-4.37%	-1.45%	-3.55%	-5.00%	0.64%	-4.35%
1981	-1.87%	0.20%	-1.67%	0.43%	-1.24%	1.75%	0.51%	-1.77%	0.53%	-1.24%	1.74%	0.50%
1982	-2.53%	0.85%	-1.68%	-1.08%	-2.76%	3.09%	0.34%	-2.06%	-0.65%	-2.71%	3.12%	0.41%
1983	-2.92%	1.03%	-1.89%	-0.86%	-2.75%	0.48%	-2.27%	-2.41%	-0.34%	-2.75%	0.47%	-2.28%
1984	-2.16%	0.94%	-1.22%	1.57%	0.35%	0.84%	1.20%	-1.69%	2.04%	0.35%	0.92%	1.27%
1985	-3.92%	1.89%	-2.03%	1.67%	-0.36%	1.39%	1.04%	-2.97%	2.62%	-0.35%	1.25%	0.90%
1986	-1.11%	3.59%	2.49%	-1.96%	0.53%	0.72%	1.25%	0.69%	-0.16%	0.53%	0.83%	1.36%
1987	-1.93%	1.54%	-0.38%	-2.06%	-2.45%	-0.18%	-2.63%	-1.15%	-1.29%	-2.44%	0.04%	-2.40%
1988	-0.50%	1.89%	1.39%	0.48%	1.87%	0.37%	2.25%	0.44%	1.42%	1.86%	0.36%	2.23%
1989	-2.63%	4.06%	1.42%	-2.67%	-1.25%	0.38%	-0.87%	-0.34%	-0.64%	-0.98%	0.28%	-0.70%
1990	-1.55%	4.38%	2.83%	6.08%	8.91%	0.17%	9.07%	0.64%	8.27%	8.91%	-0.02%	8.89%
1991	-5.41%	6.61%	1.19%	-3.40%	-2.21%	-0.14%	-2.35%	-2.11%	-0.10%	-2.21%	-0.27%	-2.47%
1992	-1.47%	5.61%	4.14%	-4.66%	-0.52%	-0.29%	-0.81%	1.68%	-1.85%	-0.17%	-0.40%	-0.57%
1993	-0.47%	3.92%	3.45%	-1.80%	1.65%	1.19%	2.84%	1.47%	0.16%	1.64%	1.24%	2.88%
1994	-2.51%	5.10%	2.58%	0.80%	3.39%	-0.14%	3.24%	0.03%	3.35%	3.39%	0.25%	3.63%
average 76-94	-2.25%	2.92%	0.66%	-0.91%	-0.25%	0.65%	0.40%	-0.76%	0.55%	-0.21%	0.67%	0.45%
average 76-80	-2.37%	2.75%	0.38%	-1.97%	-1.58%	0.54%	-1.04%	-0.99%	-0.59%	-1.58%	0.57%	-1.01%
average 81-83	-2.44%	0.70%	-1.74%	-0.50%	-2.25%	1.77%	-0.48%	-2.08%	-0.16%	-2.23%	1.78%	-0.46%
average 84-85	-3.04%	1.41%	-1.62%	1.62%	0.00%	1.12%	1.12%	-2.33%	2.33%	0.00%	1.08%	1.08%
average 86-88	-1.18%	2.34%	1.17%	-1.18%	-0.02%	0.30%	0.29%	-0.01%	-0.01%	-0.02%	0.41%	0.39%
average 89-94	-2.34%	4.95%	2.60%	-0.94%	1.66%	0.19%	1.85%	0.23%	1.53%	1.76%	0.18%	1.94%

Table 3: TFP Growth decompositions for Industry 32: Textile, garments & leather

YEAR	BHC decomposition (TFP aggregated with market shares) market share reallocation among incumbents	intraplant TFPG for incumbents	total TFPG of incumbents	net entry TFPG	Aggregate TFPG from decomposition
1976	-18.70%	0.60%	-18.10%	17.03%	-1.07%
1977	-2.03%	-4.18%	-6.21%	3.50%	-2.70%
1978	13.85%	1.04%	14.89%	2.88%	17.77%
1979	4.52%	-14.48%	-9.96%	1.66%	-8.30%
1980	-7.82%	-0.78%	-8.59%	11.65%	3.06%
1981	0.14%	-1.48%	-1.34%	3.21%	1.87%
1982	-0.26%	-1.70%	-1.96%	3.80%	1.84%
1983	-0.75%	-0.98%	-1.73%	2.51%	0.78%
1984	-2.33%	0.90%	-1.42%	-0.02%	-1.44%
1985	-7.78%	-4.63%	-12.41%	6.78%	-5.63%
1986	1.67%	0.47%	2.14%	1.02%	3.16%
1987	-4.15%	-5.65%	-9.80%	-6.42%	-16.22%
1988	3.87%	-0.78%	3.08%	5.41%	8.49%
1989	0.45%	2.34%	2.79%	2.06%	4.85%
1990	-21.47%	-2.47%	-23.94%	67.50%	43.56%
1991	-7.92%	-3.40%	-11.31%	4.79%	-6.52%
1992	-13.42%	2.63%	-10.80%	10.55%	-0.25%
1993	4.43%	-6.61%	-2.17%	-1.10%	-3.28%
1994	-1.15%	-28.40%	-29.55%	4.98%	-24.57%
average 76-94	-3.10%	-3.55%	-6.65%	7.46%	0.81%
average 76-80	-2.04%	-3.56%	-5.60%	7.35%	1.75%
average 81-83	-0.29%	-1.39%	-1.68%	3.17%	1.50%
average 84-85	-5.05%	-1.86%	-6.91%	3.38%	-3.54%
average 86-88	0.46%	-1.99%	-1.53%	0.00%	-1.52%
average 89-94	-6.51%	-5.98%	-12.50%	14.80%	2.30%

	FHK decomposition (TFP aggregated with market shares, TFP relative to the average)							GR decompostion (TFP aggregated with market shares and				
	market share reallocation among incumbents (1)	covariance term for incumbents (2)	total effect of market share reallocation among incumbents (1) + (2)	intraplant TFPG for incumbents (3)	total TFPG of incumbents (1) + (2) + (3)	net entry TFPG (4)	TFPG (1) + (2) + (3) + (4)	market share reallocation among incumbents	intraplant TFPG for incumbents	total TFPG of incumbents	net entry TFPG	TFPG
1976	-5.69%	4.01%	-1.68%	0.60%	-1.08%	2.96%	1.88%	-3.68%	2.61%	-1.08%	2.95%	1.87%
1977	-1.37%	2.35%	0.98%	-4.18%	-3.20%	0.47%	-2.73%	-0.19%	-3.01%	-3.20%	0.48%	-2.73%
1978	-0.79%	18.22%	17.43%	1.04%	18.46%	0.45%	18.92%	8.32%	10.15%	18.46%	0.43%	18.90%
1979	-7.85%	13.46%	5.61%	-14.48%	-8.87%	0.50%	-8.37%	-1.12%	-7.75%	-8.87%	0.59%	-8.27%
1980	-2.26%	2.04%	-0.22%	-0.78%	-1.00%	2.65%	1.66%	-1.24%	0.24%	-1.00%	2.68%	1.68%
1981	1.01%	1.45%	2.46%	-1.48%	0.98%	-0.08%	0.90%	1.73%	-0.75%	0.98%	0.01%	0.99%
1982	0.31%	2.40%	2.70%	-1.70%	1.00%	0.37%	1.37%	1.51%	-0.50%	1.00%	0.38%	1.38%
1983	-0.48%	2.45%	1.97%	-0.98%	1.00%	0.35%	1.35%	0.75%	0.25%	1.00%	0.39%	1.38%
1984	-2.41%	2.12%	-0.29%	0.90%	0.61%	-0.17%	0.44%	-1.35%	1.96%	0.61%	-0.36%	0.25%
1985	-6.05%	5.76%	-0.29%	-4.63%	-4.92%	1.32%	-3.60%	-3.17%	-1.75%	-4.92%	1.18%	-3.74%
1986	-4.32%	6.24%	1.91%	0.47%	2.38%	0.08%	2.47%	-1.20%	3.59%	2.39%	-0.01%	2.38%
1987	-4.01%	3.97%	-0.03%	-5.65%	-5.68%	-1.71%	-7.39%	-2.02%	-3.66%	-5.68%	-0.78%	-6.46%
1988	-2.12%	2.21%	0.10%	-0.78%	-0.68%	0.16%	-0.52%	-1.01%	0.32%	-0.68%	0.18%	-0.51%
1989	-1.19%	4.70%	3.51%	2.34%	5.85%	0.88%	6.72%	1.16%	4.69%	5.85%	1.05%	6.90%
1990	-3.50%	3.74%	0.24%	-2.47%	-2.23%	49.55%	47.32%	-1.63%	-0.60%	-2.23%	49.48%	47.25%
1991	-9.93%	2.35%	-7.58%	-3.40%	-10.98%	0.60%	-10.38%	-8.76%	-2.22%	-10.98%	0.04%	-10.94%
1992	-11.16%	6.23%	-4.92%	2.63%	-2.30%	3.03%	0.73%	-8.04%	5.75%	-2.30%	2.95%	0.66%
1993	-9.87%	13.23%	3.36%	-6.61%	-3.25%	-0.18%	-3.42%	-3.25%	0.01%	-3.25%	-0.21%	-3.46%
1994	-28.61%	30.68%	2.07%	-28.40%	-26.33%	1.20%	-25.13%	-13.27%	-13.06%	-26.33%	1.10%	-25.23%
average 76-94	-5.28%	6.72%	1.44%	-3.55%	-2.12%	3.29%	1.17%	-1.92%	-0.20%	-2.12%	3.29%	1.17%
average 76-80	-3.59%	8.02%	4.42%	-3.56%	0.86%	1.41%	2.27%	0.42%	0.45%	0.86%	1.43%	2.29%
average 81-83	0.28%	2.10%	2.38%	-1.39%	0.99%	0.21%	1.21%	1.33%	-0.34%	0.99%	0.26%	1.25%
average 84-85	-4.23%	3.94%	-0.29%	-1.86%	-2.15%	0.57%	-1.58%	-2.26%	0.11%	-2.15%	0.41%	-1.74%
average 86-88	-3.48%	4.14%	0.66%	-1.99%	-1.33%	-0.49%	-1.81%	-1.41%	0.06%	-1.33%	-0.20%	-1.53%
average 89-94	-10.71%	10.15%	-0.56%	-5.98%	-6.54%	9.18%	2.64%	-5.63%	-0.91%	-6.54%	9.07%	2.53%

Table 4: TFP Growth decompositions for industry 37: Basic metals

	BHC decomposition (TFP aggregated with market shares)				
YEAR	market share reallocation among incumbents	intraplant TFPG for incumbents	total TFPG of incumbents	net entry TFPG	Aggregate TFPG from decomposition
1976	-14.44%	-4.29%	-18.73%	15.58%	-3.15%
1977	-60.27%	5.19%	-55.08%	60.62%	5.55%
1978	-2.22%	-4.26%	-6.48%	4.02%	-2.46%
1979	-6.36%	3.75%	-2.61%	7.03%	4.42%
1980	10.80%	0.70%	11.51%	0.49%	11.99%
1981	-5.43%	3.67%	-1.76%	4.64%	2.88%
1982	-17.97%	-4.10%	-22.07%	17.78%	-4.29%
1983	2.37%	-9.73%	-7.37%	0.82%	-6.55%
1984	1.60%	9.50%	11.10%	0.93%	12.03%
1985	4.41%	6.76%	11.16%	1.60%	12.76%
1986	0.09%	2.09%	2.18%	3.00%	5.18%
1987	11.17%	28.00%	39.17%	1.46%	40.63%
1988	13.14%	-52.42%	-39.28%	2.37%	-36.91%
1989	-1.57%	-1.75%	-3.32%	0.28%	-3.04%
1990	-2.40%	6.05%	3.65%	1.73%	5.38%
1991	8.68%	-17.95%	-9.27%	-0.54%	-9.81%
1992	6.00%	8.92%	14.92%	0.48%	15.40%
1993	-5.15%	0.37%	-4.77%	-0.22%	-5.00%
1994	2.63%	-6.79%	-4.16%	2.16%	-2.00%
average 76-94	**-2.89%**	**-1.38%**	**-4.27%**	**6.54%**	**2.26%**
average 76-80	-14.50%	0.22%	-14.28%	17.55%	3.27%
average 81-83	-7.01%	-3.39%	-10.40%	7.75%	-2.65%
average 84-85	3.00%	8.13%	11.13%	1.27%	12.39%
average 86-88	8.13%	-7.44%	0.69%	2.28%	2.97%
average 89-94	1.36%	-1.86%	-0.49%	0.65%	0.16%

	FHK decomposition (TFP aggregated with market shares, TFP relative to the average)							GR decompostion (TFP aggregated with market shares and				
YEAR	market share reallocation among incumbents (1)	covariance term for incumbents (2)	total effect of market share reallocation among incumbents (1) + (2)	intraplant TFPG for incumbents (3)	total TFPG of incumbents (1) + (2) + (3)	net entry TFPG (4)	TFPG (1) + (2) + (3) + (4)	market share reallocation among incumbents	intraplant TFPG for incumbents	total TFPG of incumbents	net entry TFPG	TFPG
1976	-1.99%	3.45%	1.47%	-4.29%	-2.83%	1.23%	-1.59%	-0.33%	-2.57%	-2.89%	1.12%	-1.77%
1977	-4.25%	-2.85%	-7.10%	5.19%	-1.91%	4.82%	2.91%	-5.70%	3.77%	-1.93%	4.82%	2.88%
1978	5.03%	-3.22%	1.81%	-4.26%	-2.45%	0.02%	-2.43%	3.40%	-5.87%	-2.47%	0.02%	-2.45%
1979	0.22%	-0.67%	-0.44%	3.75%	3.31%	6.19%	9.50%	-0.11%	3.42%	3.31%	6.21%	9.51%
1980	5.42%	2.10%	7.52%	0.70%	8.22%	-0.07%	8.15%	6.45%	1.75%	8.20%	-0.07%	8.14%
1981	-0.34%	-0.33%	-0.67%	3.67%	3.00%	-0.21%	2.79%	-0.50%	3.51%	3.01%	-0.21%	2.80%
1982	-4.94%	3.10%	-1.85%	-4.10%	-5.95%	1.70%	-4.25%	-3.33%	-2.55%	-5.88%	1.70%	-4.18%
1983	-8.46%	11.72%	3.26%	-9.73%	-6.48%	0.04%	-6.44%	-2.64%	-3.88%	-6.52%	0.04%	-6.48%
1984	0.54%	2.01%	2.56%	9.50%	12.06%	0.22%	12.27%	1.55%	10.51%	12.06%	0.17%	12.23%
1985	0.97%	4.92%	5.89%	6.76%	12.64%	0.10%	12.75%	3.42%	9.21%	12.64%	0.10%	12.74%
1986	-7.16%	9.18%	2.01%	2.09%	4.10%	0.69%	4.79%	-2.58%	6.68%	4.10%	0.69%	4.80%
1987	0.60%	11.60%	12.20%	28.00%	40.20%	0.25%	40.45%	6.40%	33.80%	40.21%	0.16%	40.37%
1988	-15.22%	30.25%	15.03%	-52.42%	-37.39%	0.42%	-36.97%	-0.09%	-37.30%	-37.39%	0.42%	-36.97%
1989	-9.62%	9.05%	-0.57%	-1.75%	-2.32%	-0.02%	-2.34%	-5.10%	2.77%	-2.33%	-0.02%	-2.35%
1990	-2.66%	1.76%	-0.90%	6.05%	5.15%	0.03%	5.18%	-1.78%	6.93%	5.15%	0.02%	5.18%
1991	-0.69%	9.76%	9.07%	-17.95%	-8.88%	-0.23%	-9.11%	4.19%	-13.07%	-8.88%	-0.07%	-8.95%
1992	3.72%	4.24%	7.96%	8.92%	16.88%	0.21%	17.09%	5.84%	11.04%	16.88%	0.12%	17.00%
1993	-15.19%	9.22%	-5.97%	0.37%	-5.60%	0.02%	-5.58%	-10.59%	4.98%	-5.60%	0.01%	-5.60%
1994	-2.22%	6.78%	4.56%	-6.79%	-2.23%	0.30%	-1.93%	1.18%	-3.40%	-2.21%	0.29%	-1.92%
average 76-94	**-2.96%**	**5.90%**	**2.94%**	**-1.38%**	**1.55%**	**0.83%**	**2.38%**	**-0.02%**	**1.57%**	**1.55%**	**0.82%**	**2.37%**
average 76-80	0.89%	-0.24%	0.65%	0.22%	0.87%	2.44%	3.31%	0.74%	0.10%	0.84%	2.42%	3.26%
average 81-83	-4.58%	4.83%	0.25%	-3.39%	-3.14%	0.51%	-2.63%	-2.16%	-0.97%	-3.13%	0.51%	-2.62%
average 84-85	0.76%	3.46%	4.22%	8.13%	12.35%	0.16%	12.51%	2.49%	9.86%	12.35%	0.14%	12.48%
average 86-88	-7.26%	17.01%	9.75%	-7.44%	2.31%	0.45%	2.76%	1.24%	1.06%	2.31%	0.43%	2.73%
average 89-94	-4.44%	6.80%	2.36%	-1.86%	0.50%	0.05%	0.55%	-1.04%	1.54%	0.50%	0.06%	0.56%

Let us first look at the Baily, Hulten and Campbell (BHC) decomposition of TFP growth and compare the three industries. The textile, garments & leather sector has a slightly higher turnover rate (16%) than the food, beverages & tobacco sector (13%), that in turn has a slightly higher turnover rate than basic metals (11%), but the main difference between the three sectors in terms of turnover is quality: for "fairly" similar turnover rates, net entry effect in terms of productivity gains attains 7.5% p.a. on average for the textile, garments & leather sector, and 6.6% p.a. on average for basic metals, against 2.1% p.a. on average for the food, beverages & tobacco sector. At first sight, for the three sectors, if replacement of low productivity plants by high productivity plants did not occur, average yearly TFP change would be negative. But by how much?

Productivity ranking, when considering incumbents only, depends on the decomposition used. With the BHC decomposition, total incumbents contribution to productivity change reaches -6.7% p.a. for the textile, garments & leather sector, -4.3% p.a. for basic metals, against -1.5% p.a. for the food, beverages & tobacco sector. However, the basic metals industry remains first in terms of incumbents productivity contribution when considering the FHK and GR decompositions that account for market share differential between entrants and exiters and errors of measurement on output shares. From the FHK decomposition, we see that the global market share reallocation (market share reallocation plus covariance term) is best in the basic metals industry, followed by the textile, garments & leather, and the food, beverages & tobacco sectors.

On the other hand, results of the BHC decomposition show that the effect of market share reallocation among incumbents has a negative effect, and even more so for the two most productive industries. Does this imply that competition is not a process operating among incumbents, while operating between entrants and exiters?

In fact, the negative contribution of market share reallocation among incumbents to aggregate TFP growth means that the output of high productivity plants is redistributed to low productivity plants. This can sound counter-intuitive. However, keeping in mind the concept of catch-up, one could argue that plants with the lowest productivity levels are also potentially plants with the highest TFP growth rates. And indeed, results of the FHK decomposition of aggregate TFP growth confirm this hypothesis.

I recall here that the FHK decomposition adds to the BHC one by working relatively to the mean, and by adding a covariance term to the decomposition of incumbents' contribution to aggregate TFP growth. This covariance term represents the contribution of the reallocation of market share from low to high productivity *growth* plants (if the term has a positive sign).

Looking at the results of the FHK decomposition for the three industries under scrutiny shows indeed that reallocation of market share takes place usually from high to low productivity plants (negative effect on aggregate TFPG), but that a further qualification of this process shows that it reallocates market share from low to high productivity *growth* plants, and that this effect more than counterbalances the former negative effect, so that the total effect of market share reallocation is positive for the three industries. In terms of total market share reallocation among incumbents, the ranking is the same as the ranking based on aggregate productivity growth: basic metals; textile, garments & leather; and food, beverages & tobacco.

The ranking changes slightly if we consider the global effect of market rationalisation - among incumbents, and from exiters to entrants- with textile, garments & leather ranking now ahead of basic metals because of a higher net entry effect. It seems that the market rationalisation process is the only cause for any positive productivity gains, while there are no real productivity gains stemming from incumbents intra-plant productivity growth, except when measured with the GR decomposition.

The quality of intra-plant productivity change shapes the dynamics of industrial structure. What determine this dynamics are characteristics of individual plants *as well as* the interaction between plants. In order to explore the mechanisms behind industrial change, the reminder of this section explores the relationship between the different components of aggregate TFP Growth, i.e. intra-plant productivity growth, market share reallocation, and net entry effect.

The second important question to answer is the following:

2- What are the main characteristics of industrial change, and what role does it play in aggregate TFP growth in Indonesian manufacturing?

(1) The net entry and global market share reallocation effects could either be positively or negatively correlated, indicating whether they are complementary or alternative competition mechanisms. It could be the case that the net entry effect is at its highest when global market share reallocation is not operating properly: this is the case of an adverse environment for incumbents' competition accompanied by low barriers to entry and exit. Symmetrically, there is the case where market share reallocation among incumbents is contributing a lot to aggregate productivity growth, leaving little opportunities to entrants. The alternative case would be the one where the two processes feed each other, with competition among incumbents triggering increased entry and exit.

(2) Within the process of market share reallocation, it is interesting to define the relationship between the two terms of the process, i.e. the market share reallocation component and the covariance term in the FHK decomposition. Does a market share reallocation from low to high productivity *level* plants necessarily equal a market share reallocation from low to high productivity *growth* plants? As seen earlier, the relationship is likely to be negative in our case.

(3) Another relationship could take place between the net entry effect and intra-plant productivity growth. We know that the net entry effect is mostly positive for all industries, meaning that exiters are less productive than entrants. We also know that entrants are generally more productive than incumbents. Incumbents' intra-plant productivity growth could be pulled by the entry of more productive plants and the exit of the worse performers.

Table 5: Pair-wise correlation matrix of elements of the FHK decomposition

* indicates a significance at the 5% level

Pooled data

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.5386*				
covterm	-0.3542*	-0.7099*			
intraplant	0.7668*	0.5629*	-0.6310*		
net_entry	0.5311*	-0.014	-0.0654	-0.1077	0.0114

Textile, garments & leather, 1976-95

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.5167*				
covterm	-0.3035	-0.7644*			
intraplant	0.5291*	0.8015*	-0.7654*		
net_entry	0.7981*	0.0393	-0.0924	-0.0862	0.0468

Food, beverages & tobacco, 1976-95

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.4256				
covterm	0.205	-0.1739			
intraplant	0.8558*	0.1617	-0.1374		
net_entry	0.0223	0.0918	-0.5838*	-0.4737*	0.0558

Basic metals, 1976-95

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.6143*				
covterm	-0.4833*	-0.6623*			
intraplant	0.9409*	0.5168*	-0.6518*		
net_entry	0.0688	0.0276	-0.3295	-0.4041	0.1025

All industries, 1976-85

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.5215*				
covterm	0.1248	-0.4174*			
intraplant	0.7763*	0.4603*	-0.4110*		
net_entry	0.1117	-0.1954	-0.2801	-0.4381*	0.2096

All industries, 1986-94

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.5755*				
covterm	-0.5105*	-0.7608*			
intraplant	0.7709*	0.5796*	-0.7057*		
net_entry	0.5737*	0.0282	-0.0895	-0.0959	0.0093

All industries, 1976-89

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.6073*				
covterm	-0.2462	-0.6419*			
intraplant	0.9131*	0.6253*	-0.5616*		
net_entry	0.0913	-0.0402	-0.2364	-0.3408*	0.1055

All industries, 1990-94

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.5567*				
covterm	-0.5685*	-0.8089*			
intraplant	0.5575*	0.5995*	-0.8212*		
net_entry	0.7910*	0.065	-0.14	-0.0993	0.0249

Food, beverages & tobacco, 1976-85

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.3157				
covterm	0.1084	-0.0076			
intraplant	0.9016*	0.0302	-0.0926		
net_entry	0.1554	0.1006	-0.5762	-0.4201	0.0328

Food, beverages & tobacco, 1986-94

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.4258				
covterm	-0.008	-0.6259			
intraplant	0.9034*	0.2526	-0.1836		
net_entry	0.2889	0.5307	-0.2797	0.252	0.0676

Food, beverages & tobacco, 1976-89

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.4004				
covterm	0.1346	0.0731			
intraplant	0.8473*	0.0672	-0.2068		
net_entry	0.1625	-0.1016	-0.4671	-0.4178	0.0918

Food, beverages & tobacco, 1990-94

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.5295				
covterm	-0.7567	-0.8734			
intraplant	0.9509*	0.2441	-0.54		
net_entry	0.2923	0.5498	-0.7497	0.2293	0.1034

Textile, garments & leather, 1976-85

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.4854				
covterm	0.4423	-0.3305			
intraplant	0.6660*	0.6099	-0.3315		

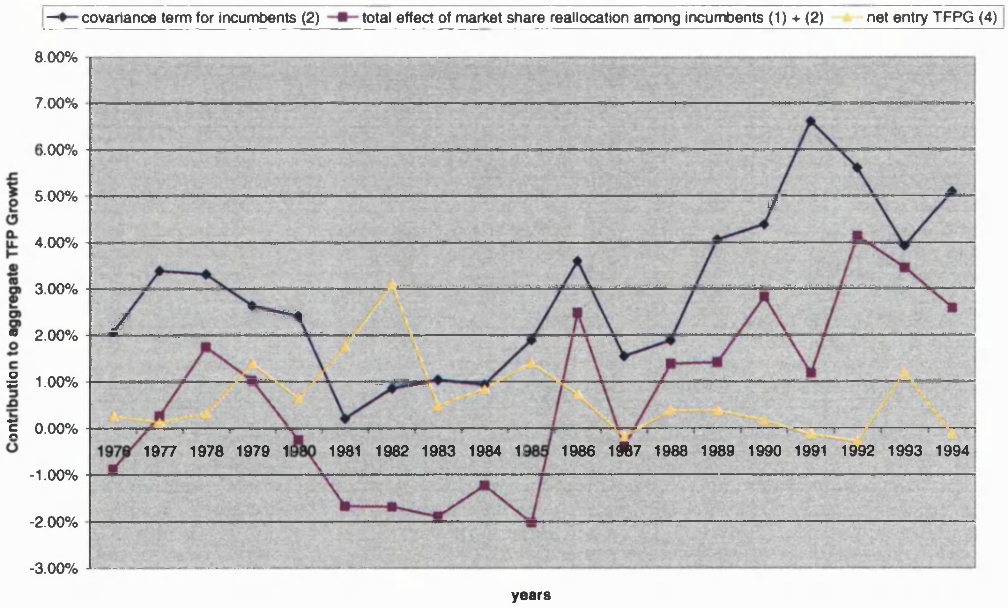
Textile, garments & leather, 1986-94

	tfpg	market share reallocation	covterm	total reallocation effect	intraplant
market share reallocation	0.5875				
covterm	-0.5104	-0.9103*			
intraplant	0.5134	0.8781*	-0.9140*		

To investigate these propositions, I present a pair-wise correlation matrix in Table 5. The variables are the results found using the FHK decomposition of aggregate TFP Growth for 20 years and for the three industries under scrutiny, with a total of 60 pooled observations. The variables are aggregate TFP Growth, the intra-plant productivity growth component, the market share reallocation component, the covariance component (the additional market share reallocation component), and the net entry component.

(1) Net entry and market share reallocation: I find that overall, whatever the sub-period or the plant grouping (all three industries or single industries) the net entry and market share reallocation processes are not significantly correlated. Neither the market share reallocation, nor the covariance terms are significantly correlated to the net entry term. One noticeable and interesting exception is the food, beverages & tobacco sector for the period 1976-94, where the covariance term is strongly and negatively correlated to the net entry term with a correlation coefficient of –58.4%: whenever the net entry effect increases, the reallocation of market shares from low to high productivity growth incumbents is less.

Graph 10 : Market share reallocation effect from low to high productivity growth plants, versus net entry effect: Food, beverages & tobacco, 1976-94



Graph 10 shows the evolution of both effects over the period. In the first half of the period, the net entry effect follows a general upward trend, while the market share reallocation effect is decreasing. The process reverts in the second half of the period, with a booming market share reallocation effect and a declining net entry effect. It seems that for the food, beverages & tobacco industry, external and internal rationalisation processes are alternative rather than complementary processes. Giving a closer look at the figures, I note that in fact, for the three industries, the global market share reallocation process is negatively (but not significantly) correlated to the net entry effect for the pre-liberalisation period, while the correlation coefficient becomes positive during and after market liberalisation. It seems that when distinguishing among the three industries and looking at the entire period, the negative correlation between total market share reallocation effect and net entry is stronger for the lower productivity growth sector, i.e. the food, beverages & tobacco sector.

(2) Looking at the decomposition of the global market share reallocation process, I note that in general the market share reallocation effect and the covariance term are highly negatively correlated: while market shares are reallocated from high to low productivity plants, they are also reallocated from low to high productivity growth plants. This means that low productivity plants are also plants with the highest productivity growth rates. In general, the global effect is positive.

(3) I find that, overall, net entry and intra-plant productivity growth components are not significantly correlated, additionally, correlation coefficients are very low, especially for the food, beverages & tobacco sector, while the textile and garment industry displays correlation coefficients of 20% and 25% in the two periods 1976-89 and 1990-94 respectively, and the basic metals industry displays correlation coefficients of 22% and 55% in the two periods 1976-85 and 1990-94 respectively. So it could be the case that for these two best performing industries, a higher contribution of net entry is accompanied by a higher intra-plant contribution to aggregate productivity growth. Incumbents' intra-plant productivity growth could be pulled by the entry of more productive plants and the exit of the worse performers at least in the two most productive industries, and this process seems to be amplified after the deregulation of the economy.

In this section, I have shown that what explains the different aggregate productivity growth rates of the three industries under scrutiny is not very much the scale of the plants turnover process, but rather the quality of this turnover, and more specifically the spread between the productivity level of entrants and exiters. I also find that for the three sectors, the global market share reallocation process is an alternative rather than a complementary process of plants turnover, at least in the pre-deregulation period, what might explain lower aggregate productivity growth rates in this period. This is especially true for the lowest productivity growth sector, i.e. the food, beverages and tobacco sector. There are some signs of those two rationalisation processes becoming complementary during and after deregulation, hinting at an increase in the competition process, and potentially explaining increasing aggregate productivity growth rates. Finally, I find that for the two industries with the highest productivity gains, incumbents' intra-plant productivity growth could be pulled by the entry of more productive plants and the exit of the worse performers, with this effect increasing after the deregulation of the economy. Overall, the competition process seems to amplify during and after the deregulation, and industries giving the strongest signs of increased competition also display the highest productivity growth rates.

In order to complement those findings, I explore the potential factors of plant exit in the following section.

6.3 Assessing factors for exit

The previous section has underlined the importance of the process of entry and exit for aggregate manufacturing productivity growth, and leads us to answering the third question:

3 -What characterises survival and exit in Indonesian manufacturing?

Indeed, answering this question helps to further qualify the aggregate TFP change mechanisms. I have found that what matters is the *quality* of plants turnover rather than turnover in itself, i.e. especially the spread in productivity between entrants and exiters. What matters as well is the *quality* of market share reallocation, i.e. the productivity and productivity growth spread between plants with declining and plants with increasing market shares. I have shown in the previous section that in some respects, competition increases during and after the deregulation of the economy, with the competitive market share reallocation process becoming complementary rather than alternative to the competitive turnover process, resulting in the acceleration of TFP Growth rates.

Another way of measuring competition is to determine the factors for plants exit. Particularly, competition can be now proxied by the effect of relative productivity on the probability of exit.

But of course, as markets are not perfect, other factors can be added in order to explain the probabilities for exit. In particular, both the historiography and the statistical and analytical study of the *Statistik Industri* dataset have shown the importance of the size of plants. Size is indeed important in many respects. First, size matters in terms of economies of scale, a plant below the optimal size might be inefficient and have more chances to exit, and a plant well above the optimal size might face diseconomies of scale and also face more chances to exit. Second, size matters in terms of the political economy. Within an institutional framework favouring large-scale plants because of their *presupposed* higher efficiency (because the *average* large plant is more efficient), but with no particular individual screen for *effective* higher efficiency, large-scale plants might have more chances of survival, whatever their relative TFP. This means that large plants might have easy (and cheap) access to credit in case of economic difficulties, that they also have easy access to import licenses and can therefore lower they production costs and increase the production costs of competitors if they are sole importer of a specific input, as it has been the case in Indonesian manufacturing, for example in the basic steel industry.

Within the political economic reasons for survival, ownership might matter, as it has been proposed by the historiography. Including a variable for the type of ownership in the assessment of hazard rates is asking whether it makes a difference to have private domestic, public domestic, or foreign ownership. As it is suggested both by the political economy and the economic history of Indonesian manufacturing, domestic private entrepreneurs, especially when not of Chinese origin, have always faced difficulties for different reasons. The first reason is that the private domestic entrepreneurship base is not strong and has not been developed first because Dutch colonialism prevented it, second because the very strong involvement of the State in the economy since independence did not help developing such a base, third because private domestic plants are majoritarily small or medium-sized, size categories that have not received much support and incentives, even in the Suharto era and some failed attempts to promote SMEs. I therefore expect private domestic plants to have higher hazard rates whatever their relative TFP.

The previous argument of course implies that state-owned plants are more likely to survive, because they receive economic support whatever their productivity performances, and because most of them are relatively larger.

It is usually expected that foreign ownership tends to increase survival through higher efficiency. Foreign-owned plants are supposed to be more competitive because they are exposed to international competition, because they benefit from more advanced technologies, and because they benefit from advanced managerial support, etc. In a less competitive environment however, and if efficiency is not the main factor determining survival, there is no reason for foreign ownership to translate into lower hazard rates. One could argue that in a distorted environment, biased in favour of domestic plants, and in particular state plants, foreign plants have less chances of survival. Shorter survival for foreign plants could also imply that these are more subject to competitive pressure and have a harder budget constraint than their domestic-owned counterparts. In fact, the effect of foreign ownership is not predetermined.

Besides plants with some foreign ownership, there is another group of plants that might display lower hazard rates because they benefit from better technologies and support in the broad sense: the plants being member of a group of companies. Group members, even when small, can benefit from economies of scale via, for example, the procurement of inputs by the group. Groups in Indonesia have been heavily supported by the state, as have large plants, and were favoured for credit and licenses access. Large groups can also equal better technologies. On the other hand, being part of a group of companies can also result in higher hazard rates if the internal market is more competitive than the external market, i.e. if lower relative TFP is a determinant for exit that is stronger within than outside groups. As for foreign ownership, group membership has not a predetermined effect on hazard rates.

As plants are operating in a distorted environment that is characterised by high levels of corruption (the "high cost economy"), there is a need to proxy for the direct costs of corruption, i.e. what is paid to "grease" the system. I proxy this with the ratio of "gifts, charities, donations" over total output, relative to the average ratio of the 2-digit sector. Within the information available in the *Statistik Industri* dataset, a large number of plants do report a fair amount of expenses classified in the "other expenses" category. It has been recognised that this category could involve a fair share of corruption-related expenses. I chose here to follow Behrman and Deolalikar (1989) and restrict myself to expenses reported under the "gifts, charities, donations" heading within "other expenses", because this category seems the less likely to correspond to any "formal" economic expenses.

I can expect this ratio to have a lowering impact on hazard rates, i.e. increase the chances of survival in a distorted environment. The expected impact after the deregulation period is more difficult to predict, as it could act in both directions: even after deregulation, a certain level of corruption might remain and lower hazard rates for plants with higher gifts ratios, or a more competitive environment can harm the plants used to pay a high ratio of gifts because these gifts raise their costs without raising their benefits. It could also be the case that these gifts become so low after deregulation that they have no significance in terms of survival chances.

Behrman and Deolalikar also use this variable to explain the duration of survival, find a positive relationship between the ratio of gifts and survival length for the period 1975-86, and interestingly argue that "the significance of gifts and donations is interesting, though of course it does not distinguish between two competing interpretations regarding the direction of causality: (i) those establishments that made more gifts and donations (whether legal or extralegal) were more likely to survive because of reciprocal obligations established by such gifts[54], and (ii) those establishments that were more successful and likely to continue to be more successful were more likely to give larger gifts and donations because the supply of such transfers is income elastic." (pp. 224-225).

Finally, I explore the role of labour using three different variables. The first variable proxies for the quality of support services within the plant, i.e. the quality of management and administration. I

[54] An example of such reciprocal obligations would be preferential tariff, import quota or tax treatment from government agencies.

use the average wage of non-production workers. In a competitive labour market a higher quality should have a positive effect on survival length through a better efficiency of the plant. In a less competitive environment, the effect can either be positive or negative. The effect could be positive because better paid managers have an incentive to lobby the plant-owners and/or the authorities to be complacent about a lower productivity. The effect could be negative if the wage premium for managers is not efficiency-based and if the market for plants is competitive.

Further exploring the effect of support services, I include the ratio of the number of non-production workers over the total number of workers. This proxies for the "support services intensity". In the case where the company has the optimal share of non-production workers, hazard rates can be lowered, or increased when the plant has too little or too many non-production workers.

I then proxy the quality of production workers by their average wage. The comments on the quality of non-production labour quality apply.

To answer the initial question - What characterises survival and exit in Indonesian manufacturing? - and underline the importance of the exit process, I first calculate the survivor function for the population of plants represented in the *Statistik Industri* dataset, with the assumption that all plants exit in 1995. The non-parametric Kaplan-Meier survivor function $\hat{S}(t)$, that is the probability of surviving past time *t*, takes the following form:

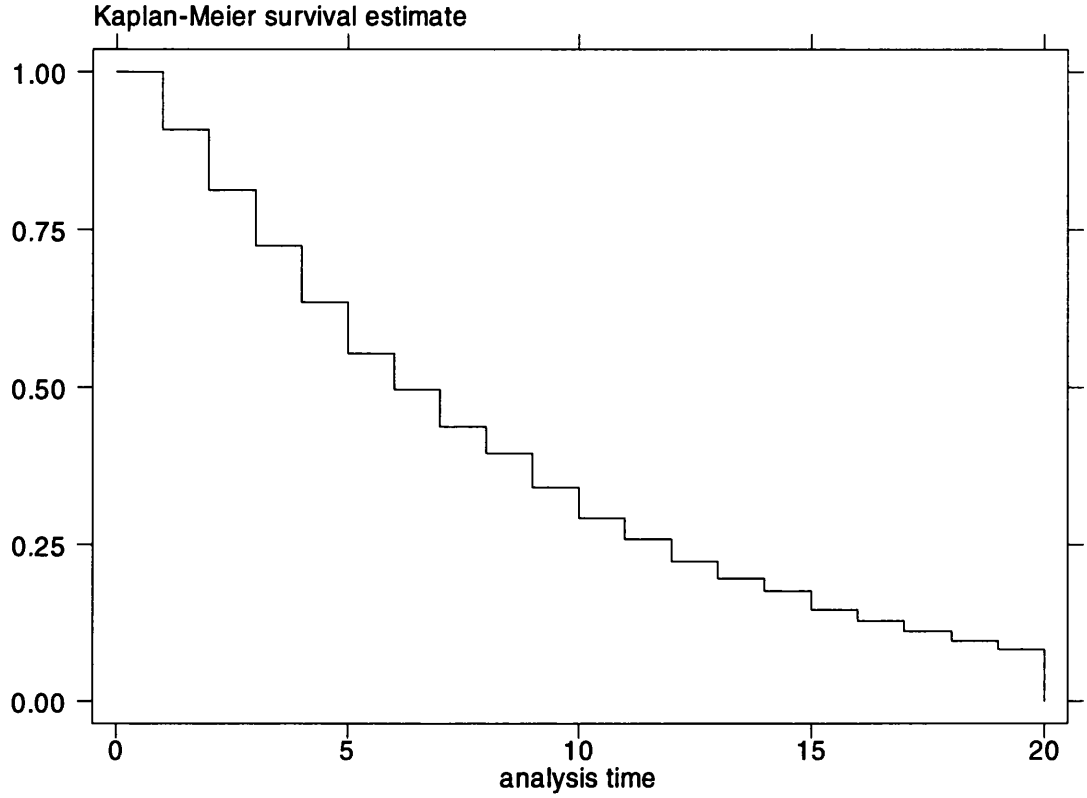
$$\hat{S}(t) = \prod_{j/t_j \leq t} \left(\frac{n_j - d_j}{n_j} \right) \quad (1)$$

Results are displayed in Table 6 and the survivor function is shown in Graph 11. Of plants entering in 1975, only 55.4% survived 5 years, 29.2% survived 10 years, and 8.3% survived 19 years. Confronting the results of this survivor function with turnover figures in graphs 7 to 9 confirms that half of the manufacturing sector as a whole is renewed every 10 years, and entirely renewed every 20 years.

Table 6: Kaplan-Meier survivor function estimates

Time	Beg.Total	Fail	Survivor Function	[95% Conf. Int.]	
1	36642	3349	90.9%	90.6%	91.2%
2	33293	3533	81.2%	80.8%	81.6%
3	29760	3219	72.4%	72.0%	72.9%
4	26541	3263	63.5%	63.0%	64.0%
5	23278	2989	55.4%	54.9%	55.9%
6	20289	2116	49.6%	49.1%	50.1%
7	18173	2138	43.8%	43.3%	44.3%
8	16035	1577	39.5%	39.0%	40.0%
9	14458	1952	34.1%	33.7%	34.6%
10	12506	1793	29.2%	28.8%	29.7%
11	10713	1212	25.9%	25.5%	26.4%
12	9501	1331	22.3%	21.9%	22.7%
13	8170	989	19.6%	19.2%	20.0%
14	7181	741	17.6%	17.2%	18.0%
15	6440	1080	14.6%	14.3%	15.0%
16	5360	658	12.8%	12.5%	13.2%
17	4702	617	11.2%	10.8%	11.5%
18	4085	565	9.6%	9.3%	9.9%
19	3520	492	8.3%	8.0%	8.6%
20	3028	3028	0.0%	.	.

Graph 11



In this section, I aim at testing the hypothesis that asserts that in a relative competitive environment, plant exit because their productivity, relative to the industry average, is lower. This will also help to complement the analysis of the previous section, hinting at the fact that the competition process through market rationalisation operated in a stronger manner in higher productivity growth sectors, and increased in all sectors during and after the deregulation period.

Following Bernard & Sjöholm (2003), I use the Cox proportional hazard function in order to test for a link between survival probability and relative TFP, allowing the baseline hazard to vary by industry, province and year of entry. As the authors note: "This allows us to control for geography, industry, and cohort effects in a non-parametric fashion" (p.9).

Using the same Indonesian manufacturing census, their main aim is testing whether plants with foreign ownership are more likely to survive than others. Beside the ownership dummies "foreign" and "public", they also add two explanatory variables of interest: log employment to control for size, and relative labour productivity.

They find that, taken as only explanatory variables, foreign and public ownership implies a higher survival probability, but when size is controlled for, foreign ownership (defined as 1 if the share of foreign ownership is above 0%, 0 otherwise) implies a lower survival probability, while public ownership (defined in the same manner) still implies a higher survival probability. They find in fact that the strongest effect on survival probabilities comes from the size effect: the larger the plant, the less likely it is to exit. They also find that plants with a relatively higher labour productivity have higher survival probabilities. Regarding the share of non-production workers over the total number of workers, they find that a higher ratio leads to higher hazard rates.

My aim is to broaden their findings by extending the period under scrutiny from 1975-89 to 1975-95, replace relative labour productivity by relative TFP, and add other potentially important explanatory variables related to the institutional environment: the share of gifts, charities and donations in total output of plants, a group membership dummy (equals 1 if the plant belongs to a corporate group), and labour and management quality (respectively defined as average wage of production worker and average wage of non-production worker).

Behrman and Deolalikar (1989) also propose an analysis of survival length factors for the period 1975-86, but using the non-backcast dataset. They find that age has a positive effect on survival length, possibly because of learning-by-doing effects. A larger size increase survival length, and industry concentration as well. They find that state ownership has no significant effect, while foreign ownership increases survival length. A higher number of family workers lower survival length, while the average wage of workers has no impact. They justify the latter result by noting that the dataset has no information regarding labour quality and that the result is therefore not surprising. Labour productivity is shown to improve survival length. The share of gifts in value added increases survival length as well. They also include a number of explanatory variables relating to intermediate inputs that are not discussed here.

Table 7 displays the results. Each variable is first tested for separately in the hazard function over different time periods (1975-94, 1975-89, 1975-85, 1990-94, and 1986-94). Variables are then added to arrive to the final complete model. A hazard ratio of 1 means that the variable does not influence the chances of exit, a ratio below 1 means that the variable is negatively correlated with the chances of exit, and a ratio above 1 means that the variable is positively correlated with the chances of exit.

Table 7: Hazards rate (dependant variable) and plant characteristics explanatory variables), results of the Cox proportional hazard function

	Period: 1975-94	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
	Explanatory variables tested separately, (1) to (9)						
(1)	relative TFP	0.968405	0.021921	-1.42	0.156	0.926379	1.012338
(2)	log employment	0.65824	0.008292	-33.2	0	0.642187	0.674695
(3)	foreign ownership	0.607616	0.029116	-10.4	0	0.553148	0.667448
(4)	public ownership	0.609415	0.071789	-4.2	0	0.483774	0.767687
(5)	gifts share	1.00094	0.000356	2.64	0.008	1.000243	1.001637
(6)	group membership	0.228697	0.156408	-2.16	0.031	0.059857	0.87379
(7)	white collar share	0.998106	0.000737	-2.57	0.01	0.996663	0.999552
(8)	management quality	1	1.02E-06	0.34	0.737	0.999998	1.000002
(9)	labour quality	1.000002	1.25E-06	1.48	0.138	0.999999	1.000004
	Alternative specifications with two or more explanatory variables (10) to (13)						
(10)	relative TFP	0.931593	0.021453	-3.08	0.002	0.89048	0.974604
	log employment	0.658141	0.008299	-33.18	0	0.642075	0.674609
(11)	relative TFP	0.931916	0.021463	-3.06	0.002	0.890785	0.974947
	log employment	0.66066	0.008382	-32.67	0	0.644435	0.677295
	foreign ownership	0.780773	0.038747	-4.99	0	0.708407	0.860532
	public ownership	0.413571	0.052559	-6.95	0	0.322385	0.53055
(12)	relative TFP	0.948321	0.023987	-2.1	0.036	0.902454	0.996519
	log employment	0.642089	0.009051	-31.43	0	0.624592	0.660076
	foreign ownership	0.748419	0.043123	-5.03	0	0.668498	0.837895
	public ownership	0.339154	0.0464	-7.9	0	0.259383	0.443457
	gifts share	1.001103	0.000348	3.17	0.002	1.000421	1.001785
(13)	relative TFP	0.947056	0.02404	-2.14	0.032	0.901091	0.995365
	log employment	0.64115	0.009099	-31.32	0	0.623561	0.659235
	foreign ownership	0.746381	0.043054	-5.07	0	0.666592	0.835721
	public ownership	0.352229	0.048509	-7.58	0	0.268904	0.461372
	gifts share	1.001091	0.00035	3.12	0.002	1.000406	1.001777
	white collar share	1.000998	0.000849	1.18	0.24	0.999334	1.002664

	Period: 1975-89	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
	Explanatory variables tested separately, (1) to (9)						
(1)	relative TFP	0.892917	0.028388	-3.56	0	0.838975	0.950328
(2)	log employment	0.635073	0.01101	-26.19	0	0.613856	0.657024
(3)	foreign ownership	0.680188	0.045093	-5.81	0	0.597308	0.774568
(4)	public ownership	0.530035	0.084614	-3.98	0	0.387632	0.724751
(5)	gifts share	1.000693	0.000515	1.35	0.178	0.999684	1.001704
(6)	group membership	2.828427	2.664948	1.1	0.27	0.446213	17.92868
(7)	white collar share	0.997476	0.000928	-2.72	0.007	0.995657	0.999297
(8)	management quality	0.999884	6.01E-05	-1.93	0.054	0.999766	1.000002
(9)	labour quality	0.999757	0.000146	-1.66	0.097	0.99947	1.000044
	Alternative specifications with two or more explanatory variables (10) to (13)						
(10)	relative TFP	0.863558	0.027289	-4.64	0	0.811696	0.918734
	log employment	0.634705	0.011023	-26.18	0	0.613464	0.656681
(11)	relative TFP	0.862908	0.027292	-4.66	0	0.811041	0.918092
	log employment	0.634223	0.011013	-26.22	0	0.613001	0.65618
	foreign ownership	0.831782	0.05777	-2.65	0.008	0.725923	0.953078
	public ownership	0.358131	0.064428	-5.71	0	0.251716	0.509533
(12)	relative TFP	0.866691	0.032697	-3.79	0	0.804918	0.933203
	log employment	0.594765	0.012437	-24.85	0	0.570883	0.619646
	foreign ownership	0.783051	0.069283	-2.76	0.006	0.658381	0.931328
	public ownership	0.228587	0.04862	-6.94	0	0.150662	0.346816
	gifts share	1.00062	0.000582	1.07	0.287	0.99948	1.001762
(13)	relative TFP	0.868209	0.032787	-3.74	0	0.806268	0.934908
	log employment	0.594521	0.012541	-24.65	0	0.570443	0.619616
	foreign ownership	0.785782	0.06953	-2.72	0.006	0.660669	0.934588
	public ownership	0.243662	0.052925	-6.5	0	0.159185	0.37297
	gifts share	1.000607	0.000585	1.04	0.299	0.999461	1.001755
	white collar share	1.00009	0.001167	0.08	0.939	0.997806	1.002379

	Period: 1990-94	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf. Interval]	
	Explanatory variables tested separately, (1) to (9)						
(1)	relative TFP	1.072676	0.035593	2.11	0.034	1.005134	1.144756
(2)	log employment	0.6880192	0.012818	-20.07	0	0.663351	0.713605
(3)	foreign ownership	0.5277942	0.040175	-8.4	0	0.454645	0.612712
(4)	public ownership	0.7175211	0.122826	-1.94	0.052	0.51301	1.003561
(5)	gifts share	1.001227	0.000604	2.03	0.042	1.000045	1.00241
(6)	group membership	0.1254112	0.130873	-1.99	0.047	0.016221	0.969633
(7)	white collar share	0.9991149	0.001223	-0.72	0.469	0.996722	1.001514
(8)	management quality	1.00E+00	1.03E-06	0.98	0.325	0.999999	1.000003
(9)	labour quality	1.00E+00	1.12E-06	1.94	0.052	1	1.000004
	Alternative specifications with two or more explanatory variables (10) to (13)						
(10)	relative TFP	1.028293	0.035594	0.81	0.42	0.960844	1.100478
	log employment	0.6886227	0.012845	-20	0	0.663903	0.714263
(11)	relative TFP	1.030092	0.035615	0.86	0.391	0.9626	1.102316
	log employment	0.6970677	0.013256	-18.98	0	0.671564	0.72354
	foreign ownership	0.7062276	0.05467	-4.49	0	0.60681	0.821934
	public ownership	0.4860244	0.085441	-4.1	0	0.344367	0.685954
(12)	relative TFP	1.035308	0.036152	0.99	0.32	0.966823	1.108646
	log employment	0.6931483	0.013447	-18.89	0	0.667287	0.720012
	foreign ownership	0.7039359	0.055958	-4.42	0	0.602377	0.822618
	public ownership	0.4682129	0.085364	-4.16	0	0.327532	0.669319
	gifts share	1.001497	0.000508	2.95	0.003	1.000502	1.002493
(13)	relative TFP	1.030544	0.036207	0.86	0.392	0.961968	1.104009
	log employment	0.6909545	0.013498	-18.92	0	0.665	0.717922
	foreign ownership	0.6972	0.055679	-4.52	0	0.596183	0.815333
	public ownership	0.4699271	0.08582	-4.14	0	0.328534	0.672171
	gifts share	1.001504	0.000506	2.97	0.003	1.000512	1.002496
	white collar share	1.001976	0.001238	1.6	0.11	0.999552	1.004406

	Period: 1975-85	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf. Interval]	
	Explanatory variables tested separately, (1) to (9)						
(1)	relative TFP	0.869955	0.036457	-3.32	0.001	0.801357	0.944426
(2)	log employment	0.604966	0.012892	-23.58	0	0.580218	0.63077
(3)	foreign ownership	0.659474	0.051379	-5.34	0	0.566084	0.768271
(4)	public ownership	0.602212	0.128061	-2.38	0.017	0.396955	0.913604
(5)	gifts share	1.00004	0.000909	0.04	0.965	0.998261	1.001822
(6)	group membership	2.828427	2.665048	1.1	0.27	0.446182	17.92992
(7)	white collar share	0.997229	0.001156	-2.39	0.017	0.994966	0.999498
(8)	management quality	0.999679	6.31E-05	-5.08	0	0.999555	0.999803
(9)	labour quality	0.999374	0.000213	-2.94	0.003	0.998958	0.999791
	Alternative specifications with two or more explanatory variables (10) to (13)						
(10)	relative TFP	0.833498	0.034718	-4.37	0	0.768157	0.904399
	log employment	0.603075	0.012902	-23.64	0	0.57831	0.628901
(11)	relative TFP	0.832008	0.034737	-4.41	0	0.766635	0.902955
	log employment	0.603605	0.012897	-23.63	0	0.57885	0.629418
	foreign ownership	0.827289	0.066341	-2.36	0.018	0.706966	0.96809
	public ownership	0.396618	0.095474	-3.84	0	0.24744	0.635732
(12)	relative TFP	0.824891	0.039829	-3.99	0	0.750408	0.906766
	log employment	0.57078	0.014487	-22.09	0	0.543082	0.599892
	foreign ownership	0.735123	0.07972	-2.84	0.005	0.594364	0.909217
	public ownership	0.246732	0.072859	-4.74	0	0.138316	0.440131
	gifts share	0.9997	0.000915	-0.33	0.743	0.997909	1.001494
(13)	relative TFP	0.827047	0.039927	-3.93	0	0.75238	0.909124
	log employment	0.568719	0.014578	-22.02	0	0.540852	0.598021
	foreign ownership	0.735619	0.07986	-2.83	0.005	0.594627	0.910041
	public ownership	0.246815	0.072964	-4.73	0	0.138273	0.440562
	gifts share	0.999695	0.000918	-0.33	0.739	0.997897	1.001496
	white collar share	1.000213	0.001409	0.15	0.88	0.997456	1.002977

	Period: 1986-94	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
	Explanatory variables tested separately, (1) to (9)						
(1)	relative TFP	1.025202	0.027735	0.92	0.358	0.972258	1.081028
(2)	log employment	0.6928585	0.010934	-23.25	0	0.671757	0.714623
(3)	foreign ownership	0.5751266	0.036236	-8.78	0	0.508315	0.65072
(4)	public ownership	0.6132957	0.088298	-3.4	0.001	0.462509	0.813241
(5)	gifts share	1.001127	0.000413	2.73	0.006	1.000318	1.001936
(6)	group membership	0.1254112	0.130873	-1.99	0.047	0.016221	0.969633
(7)	white collar share	0.998758	0.000954	-1.3	0.193	0.996891	1.000629
(8)	management quality	1.000001	1.01E-06	0.91	0.364	0.999999	1.000003
(9)	labour quality	1.000002	1.13E-06	1.9	0.057	1	1.000004
	Alternative specifications with two or more explanatory variables (10) to (13)						
(10)	relative TFP	0.9899932	0.027543	-0.36	0.718	0.937456	1.045475
	log employment	0.6939517	0.010951	-23.15	0	0.672816	0.715751
(11)	relative TFP	0.991588	0.027554	-0.3	0.761	0.939028	1.04709
	log employment	0.6987565	0.011158	-22.45	0	0.677227	0.720971
	foreign ownership	0.7395576	0.047884	-4.66	0	0.651417	0.839624
	public ownership	0.4230004	0.063661	-5.72	0	0.314946	0.568128
(12)	relative TFP	1.007714	0.03	0.26	0.796	0.950598	1.068262
	log employment	0.6813807	0.011706	-22.33	0	0.65882	0.704714
	foreign ownership	0.7460306	0.05155	-4.24	0	0.651537	0.854228
	public ownership	0.3891425	0.061476	-5.97	0	0.285521	0.530371
	gifts share	1.00135	0.000372	3.63	0	1.000621	1.00208
(13)	relative TFP	1.004724	0.030053	0.16	0.875	0.947515	1.065388
	log employment	0.6807309	0.01177	-22.24	0	0.658048	0.704196
	foreign ownership	0.7432827	0.051478	-4.28	0	0.648937	0.851345
	public ownership	0.4120871	0.065772	-5.55	0	0.301392	0.563438
	gifts share	1.001347	0.000371	3.63	0	1.00062	1.002074
	white collar share	1.001399	0.001059	1.32	0.186	0.999325	1.003477

Over the entire period 1975-94, relative plant Total Factor Productivity (relative to the 5-digit TFP average) reduces the chances of exit, but not by much, with a hazard ratio of 0.95. But I have shown in the previous chapters that industrial demographics features are rather different pre- and post 1990s, matching the pre- and post-deregulation dichotomy (the pre-deregulation period including the deregulation period in itself).

I operate this dichotomy when running the proportional Cox hazard function, and I find that in the period 1975-89, a higher plant relative TFP reduces the chances of exit more significantly, with a hazard ratio of 0.86. Bernard & Sjöholm (2003) find also that labour productivity decreases the chances of exit for the period 1975-89. By opposition, relative TFP is not a significant explanatory factor of hazard rates in the 1990s. These results do not come as surprising, as I have already noted in the previous chapters that, even though the aggregate of exiters is less productive than entrants and incumbents in the 1990s, the average exiter is sometimes more productive than the rest, and the dispersion of TFP levels for exiters in the 1990s increases substantially. As a check, I choose 1985 as a turning point rather than 1989, and the results confirm that relative TFP is not an explanatory factor of hazard rates in the second period. It also shows that relative TFP lowers hazard rates more substantially pre-1985 than pre-1989. Finally, the lower significance of the hazard ratio of relative TFP on the period 1986-94, when compared to the significance of the hazard ratio on the period 1989-94 could indicate that 1990 is the turning point in terms of relative TFP effect on hazard rates.

Although in some respects, as demonstrated in the previous section, competition seems to increase during and after deregulation (1985-95), those results tend to indicate that in other respects, competition, as measured by the impact of relative productivity on exit, tends to disappear in the 1990s. This is in line with the now established fact that the net entry effect on aggregate TFP Growth rates reduces in the 1990s, with the market share reallocation process – another sort of competition mechanism - gaining in importance.

In fact, in line with Bernard & Sjöholm (2003), I find that the variable explaining the bulk of hazard ratios is the size of plants: the larger the plant in terms of employment (as measured by log employment), the less likely it is to exit. This effect tends to reduce in the 1990s, but not by much: the dominance of large and extra-large plants increases in terms of output and employment over the period, and this is likely to continue, as large and extra-large plants are less likely to exit, regardless of their relative productivity.

The share of gifts, charities and donations (gifts share), the ratio of non-production workers over total number of workers (white collar share), management and labour quality are calculated relatively to their 5-digit industry average, and do not seem to make much difference in terms of exit probabilities, whatever the period.

Along with size, foreign and public ownership reduce hazard ratios. Being a plant with any level of foreign or public domestic ownership (local or central government) tends to increase the chances of survival, and these chances are a lot higher for public domestic plants. This is not surprising, as the economic history of Indonesia underlines the difficulties of the emergence of a private domestic sector. The causes for private domestic plants higher hazard ratios could stem both from lower relative productivity (which is indeed the case as shown in Table 6a & b, Chapter 5), and from a relative lack of promotion and support by the government. But it is also surely the case that private domestic plants face higher hazard rates because most of the numerous new entrants are small and medium private domestic plants: rather than being a sign of a weakness of the private domestic sector, those results could be interpreted as a sign of the dynamism of this sector. This is investigated further in this section when studying hazard rates for small and medium plants only, as compared with hazard rates for large plants.

Bernard & Sjöholm (2003) find also that foreign and public ownership reduces hazard ratios for the period 1975-89, however, they find that when size is accounted for via the log of employment, then foreign ownership tends to *increase* hazard ratios. I find that when size is accounted for with log employment, foreign ownership still decreases hazard ratios, even if these hazard ratios are higher than when size is not accounted for. My results differ from those of the two authors because of the different ways we have treated data on ownership.[55]

If I look at the results found using the two sub-periods 1975-89 and 1990-94, I find that foreign plants are less likely to exit than private domestic plants, and are less likely to exit in the 1990s. Bernard & Sjöholm (2003) explain the fact that foreign-owned plants are more likely to close than public domestic plants in the following terms: "Multinational firms use the extensive margin available to them to close plants more often than their domestic counterparts" (p.12). My results are slightly different in that foreign plants are more likely to exit than public domestic plants, but less likely to exit than private domestic plants, so that their argument does not hold anymore. Bernard and Sjöholm (2003) also equate foreign plants with multinationals, which is not necessarily the case.

In fact, I find that foreign plants have more chances to stay than private domestic ones, and that these chances to stay increase after the deregulation period: foreign plants might have faced less constraints than private domestic ones in the pre-1990s period, with an easier access to capital and technology, and deregulation eases the operating environment in the 1990s, by, for example, enhancement of competition (i.e. less favours accorded to public domestic plants). It is worth mentioning that using the definition of Bernard and Sjöholm (2003) for the foreign ownership dummy leads to similar improvements between the two sub-periods, with hazard ratios of 0.85 for 1990-94 rather than 1.20 for the pre-1990s period.

Meanwhile, public plants are less likely to exit than private domestic plants, but are more likely to exit in the 1990s, or even as soon as in the second half of the 1980s. This could be interpreted as a sign of the effects of deregulation as well. Public plants could be said to face tighter budget constraints and more pressure of bankruptcy enforcement.

These results suggest that efficiency, as measured by relative TFP, is a factor explaining significantly the survival of plants, even more so in the period of fairly distorted environment, the so-called "high cost economy", (1975-85, and 1975-89), characterised by a climate of favouritism

[55] The authors say to be using the backcast version of *Stastitik Industri*, and take plants with foreign ownership as being plants reporting any positive share of foreign ownership. It is worth noting that they work under the assumption that the reported data on ownership do not present any errors. Indeed, using the data as they are reported leeds to hazard ratios higher than one for foreign plants when accounting for size. However, in the dataset, plants do not systematically report ownership data. Some do not report ownership data all together. I treat these as missing values. Some do report ownership data only for some years, sometimes reporting different values for different years: I use the average of the values reported. Indeed, is missing or changing ownership data due to measurement error or does it reflect reality? It is difficult to disentangle both cases. For example, is a plant reporting 60% foreign ownership for 10 years, with a zero percent measure for mid-period to be said to have switched ownership for one year? Since part of the change in ownership is susceptible to reflect data error, averaging ownership data for each plant over the period probably helps smoothing the error. On the other hand, it does not allow accounting for ownership changes. I create the dummy " foreign " equals 1 for any positive share of foreign ownership. I follow the same methodology for the data on public ownership, with the "public" dummy being equal to 1 for any positive share of central or local government ownership.

for large-, extra-large and state-owned plants through in particular easier access to credit and all sorts of licenses. There is here a strong indication of the existence of a dual economic system. In order for those results to make sense, the size of plants needs to be controlled for.

The findings regarding the effect of plant size on hazard ratio shed some light on the effect of relative productivity in the oil boom and deregulation period (1975-85, and 1975-89). It seems that plant size is the strongest explanatory factor for hazard ratio, in line with the economic history of the sector, a large plant is less likely to exit than a small plant. This can be justified by usual economic reasons. A large plant is less likely to exit because it might be closer to the optimal size, because it has had time to learn from its experience on the market, all of this joining the better efficiency hypothesis. However, in the Indonesian context, a larger plant is more likely to survive because it has access to credit and licenses, probably without having to stick to strong efficiency conditions. Furthermore, it is probably immune from going bankrupt. As demonstrated in chapter 4, the bulk of the entry and exit process is occurring among small plants, with the average exiter being even smaller than the average entrant. Exiters are the smallest category of plants among the three demographics groups (entrants, incumbents, and exiters). It is probably the case that higher relative TFP is a factor explaining survival among the smallest plants. In order to verify this hypothesis, I run the Cox proportional hazard model for the period 1975-89 on two sub-samples with only two explanatory variables (relative TFP and size as measured by log employment): small and medium plants (less than 500 employees), and large plants (500 to 1999 employees). I exclude extra-large plants (2000 employees and over) because as outliers, they introduce a lot of noise when included in the large plants category. The extra-large plants segment of the population is small (about 200 establishments, i.e. about 0.8% of all plants), and over 98% of all observations in the extra-large category have some public ownership.

Results are displayed in Table 8.

Table 8: Hazards rate (dependant variable) and plant characteristics (explanatory variables), results of the Cox proportional hazard function, two sub-samples						
1975-89						
Small and medium plants (less than 500 employees)						
	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.Interval]	
relative TFP	0.8591732	0.0273877	-4.76	0	0.807137	0.914564
log employment	0.5974241	0.011229	-27.41	0	0.575816	0.619843
Nb of obs	118764	Nb of subjects	25029			
Large plants (between 500 and 1999 employees)						
	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.Interval]	
relative TFP	0.6631505	0.2701149	-1.01	0.313	0.29847	1.473412
log employment	1.177332	0.3983114	0.48	0.629	0.606629	2.28494
Nb of obs	6190	Nb of subjects	1411			
1990-94						
Small and medium plants (less than 500 employees)						
	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.Interval]	
relative TFP	1.043359	0.0364091	1.22	0.224	0.974384	1.117216
log employment	0.6534661	0.0141075	-19.71	0	0.626393	0.68171
Nb of obs	73985	Nb of subjects	24520			
Large plants (between 500 and 1999 employees)						
	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.Interval]	
relative TFP	0.8395419	0.1732178	-0.85	0.397	0.560298	1.257957
log employment	0.6258203	0.1527489	-1.92	0.055	0.387874	1.009739
Nb of obs	5909	Nb of subjects	1987			

It is clear from Table 8 that the competitive turnover process during the oil boom and the deregulation period is only occurring among small and medium plants and among the marginal sample of extra-large plants. Indeed, while the coefficient on relative TFP is very significant, presents a narrow confidence interval, and indicates that higher relative productivity lowers hazard rates for small and medium plants, the story for large plants is rather different. For large plants, the coefficient on relative productivity is not significant, and the confidence interval ranges from 0.3 and 1.5, below and above 1.

Within the small and medium plants sample, a larger size (log employment) reduces hazard rates substantially. This is in line with the fact that exiters are the smallest plant group. Given the significance of the relative productivity effect, I suggest that the size variable is probably picking up a fair share of the productivity effect, and that the size effect reflects more an optimal size effect rather than distortions such as better access to credit and licences for larger plants. In the oil boom and deregulation periods, there is a sector of manufacturing that is behaving rather competitively, and this sector regroups small and medium plants.

Interestingly, size is not a significant explanatory factor as far as large plants are concerned. Of course, results obtained using the full sample of plants (small, medium, large and extra-large) show that large plants have more chances of survival than small and medium plants. But *within* the large-scale category, size does not matter, nor does relative productivity. In fact, the most significant variable turns out to be the state ownership dummy (public). This is shown in Table 9.

Table 9: Hazards rate (dependant variable) and plant characteristics (explanatory variables), results of the augmented Cox proportional hazard function, two sub-samples						
1975-89						
Small and medium plants (less than 500 employees)						
	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.Interval]	
relative TFP	0.867253	0.033027	-3.74	0	0.804878	0.934463
log employment	0.552034	0.012661	-25.91	0	0.527768	0.577415
foreign ownership	0.741644	0.068592	-3.23	0.001	0.618687	0.889037
public ownership	0.367502	0.092634	-3.97	0	0.224234	0.602305
gifts share	1.000599	0.0006	1	0.318	0.999424	1.001775
white collar share	1.000221	0.001181	0.19	0.852	0.997909	1.002538
Large plants (between 500 and 1999 employees)						
	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.Interval]	
relative TFP	0.415098	0.169474	-2.15	0.031	0.186477	0.924007
log employment	1.059254	0.381476	0.16	0.873	0.522939	2.145601
foreign ownership	0.935687	0.356006	-0.17	0.861	0.443884	1.972385
public ownership	4.06E-17	3.10E-17	-49.47	0	9.10E-18	1.81E-16
gifts share	0.976187	0.015343	-1.53	0.125	0.946575	1.006726
white collar share	1.027841	0.019737	1.43	0.153	0.989875	1.067263
1990-94						
Small and medium plants (less than 500 employees)						
	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.Interval]	
relative TFP	1.041466	0.036978	1.14	0.253	0.971454	1.116523
log employment	0.651005	0.014604	-19.13	0	0.623002	0.680267
foreign ownership	0.750378	0.063236	-3.41	0.001	0.636133	0.88514
public ownership	0.526426	0.113633	-2.97	0.003	0.344826	0.803666
gifts share	1.001634	0.000496	3.3	0.001	1.000663	1.002606
white collar share	1.002215	0.001276	1.74	0.082	0.999717	1.004719
Large plants (between 500 and 1999 employees)						
	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.Interval]	
relative TFP	1.013742	0.257601	0.05	0.957	0.616069	1.668113
log employment	0.618359	0.153429	-1.94	0.053	0.380223	1.005641
foreign ownership	0.373338	0.10884	-3.38	0.001	0.210839	0.661081
public ownership	0.363223	0.178646	-2.06	0.039	0.138523	0.952413
gifts share	1.016014	0.008437	1.91	0.056	0.999611	1.032687
white collar share	1.00429	0.00882	0.49	0.626	0.987151	1.021727

Within the large plant category, the ones with some state ownership have almost no chances of exit! This is a strong result that confirms and strengthens the historical account of state favouritism towards large public companies, regardless of their relative productivity. When controlling for the ownership type, relative productivity turns out to be a significant factor, relative TFP does lower hazard rates to a certain extent, but the range of effect is very wide, with a coefficient comprised in the interval 0.18 to 0.92, meaning that the effect of relative productivity differs widely across the sample.

Interestingly as well, for the large plant category, the share of gifts is significant at the 12.5% level, with a fairly narrow confidence interval, with an effect reducing hazard rates for the period 1975-89. Testing the effect of the variable independently (as sole explanatory variable) leads to similar results (not reported).

This show rather clearly that there exist at least two separate markets in Indonesian manufacturing for the period 1975-89, the small and medium plants market ruled by fairly competitive mechanisms in terms of survival and exit, and the large scale plants sector dominated by state control, and where competitive mechanisms play a very marginal role.

In the 1990s, relative TFP is not an explanatory factor for exit anymore, neither for the SMEs, nor for the large-scale plants. However, a larger size still lower hazard ratios for SMEs only, and ownership type remains a crucial determinant for both plant categories (SMEs and large plants), with state and foreign ownership increasing the chances of survival. For SMEs, the hazard ratio on foreign-owned plants remains at 0.75, while the hazard ratio on public plants increases from 0.36 to 0.52. More striking is the evolution of the large-scale category: foreign ownership was not a significant explanatory factor of survival up to the 1990s, but becomes significant in the 1990s with a very low hazard ratio at 0.37. On the other hand, hazard ratio for state-owned plants increases from nearly zero in the pre-1990s to 0.36 in the post-1990s. If the competition process through the effect of relative TFP tends to disappear in the 1990s, state-owned plants might be less protected than before, and market mechanisms might be more at play if I consider foreign-owned plants to be more competitive than their domestic counterparts.

6.4 Conclusion

This chapter aimed at investigating a second set of questions raised in chapter 4 by the demographic study of the Indonesian manufacturing sector. Specifically, it investigates some aspects of industrial change.

In a first section, I contrast and compare the historiography of three sub-sector of manufacturing with their economic history as depicted by the demographic study carried out using the *Statistik Industri* dataset. The three sectors under scrutiny are the food, beverages & tobacco sector; the textile, garments & leather sector; and the basic metals sector. The choice is motivated by their relative size, their relative factor intensity, their relative productivity growth, as well as by their characteristics in terms of industrial demography. The food, beverages & tobacco sector dates back to the late colonial period, takes advantage of relatively cheap and abundant natural resources and labour, is a large but relatively declining sector within manufacturing, displays fairly high turnover rates, but is the worse performer in terms of productivity growth over the period 1975-95. Mirroring this, the textile, garments & leather sector also dates back to the late colonial period, benefits from cheap and abundant natural resources and labour as well, but is a rising sector in terms of total output. It also displays fairly high turnover rates, and is one of the best performers in terms of productivity gains. Comparing those two sectors shed some light on the characteristics of industrial change that make a difference in terms of productivity gains, while controlling to a certain extent for industry size, industry age, and benefits in terms of inputs. To complement the analysis, I add a third sector to the comparison. The basic metals sector is the smallest sector in terms of output at the start of the period, but is increasingly important, it is relatively small in terms of number of plants, displays also fairly high turnover rates, depends on imported intermediate inputs, and is fairly capital intensive. In the mean time, it is the sector that has performed the best in terms of productivity gains over the period 1975-95.

Studying the three industry profiles helps raising a number of interesting questions:

1 – If entry and exit accounts for most of aggregate TFP growth as shown in chapter 4, and if turnover rates are fairly similar across the three industries, what accounts for such a wide productivity growth divide?

2- What are the main characteristics of industrial change, and what role does it play in aggregate TFP growth in Indonesian manufacturing?

3 -What characterises survival and exit in Indonesian manufacturing?

The first section answers question 1 by decomposing TFP Growth rates at the 2-digit level, and compare the decompositions for the three industries. I show that the different aggregate productivity growth rates of the three industries under scrutiny is not explained by the scale of the plants turnover process, but rather by the quality of this turnover: the larger the productivity gap between entrants and exiters, the higher the productivity gains. I also find that for the three sectors, in the pre-deregulation period, the global market share reallocation process between incumbents is an alternative rather than a complementary process to plants turnover. This potentially explains lower aggregate productivity growth rates in this period. This is especially true for the lowest productivity growth sector, i.e. the food, beverages and tobacco sector. There are some signs of those two rationalisation processes becoming complementary during and after deregulation, hinting at an increase in the competition process, and potentially explaining increasing aggregate productivity growth rates. Finally, I find that for the two industries with the highest productivity gains, incumbents' intra-plant productivity growth could be pulled by the entry of more productive plants and the exit of the worse performers, with this effect increasing after the deregulation of the economy. Overall, the competition process seems to amplify during and after the deregulation, and industries giving the strongest signs of increased competition also display the highest productivity growth rates.

In the last section, in order to investigate further the hypothesis of increased competition during and after the deregulation period, I assess the impact of different plant characteristics on the probability of exit. I find that higher relative productivity levels lower hazard ratios, but only up to the end of the 1980s. In the 1990s, relative productivity does not seem to affect hazard ratios significantly. This is in line with the results of the demographic study in chapter 4 that demonstrated clearly that the average exiter is not necessarily less productive than the average incumbents in the 1990s, contrasting with the previous period. This partly explains why the net entry effect tends to decrease in the 1990s at the aggregate level. From this point of view, competition could be said to suffer in the 1990s. In fact, competition in the 1990s takes the form of a more efficient market share reallocation process.

While assessing the factors explaining exit, I find that the most important variable remains the size of plants, with larger plants being a lot less likely to exit than smaller plants. This is in line with the fact that most of the turnover process occurs among small and medium-scale plants. This effect is however slightly declining in the 1990s. Indeed, as seen in chapter 4, the average size of exiters and the variance in exiters size tend to increase in the 1990s.

Finally, I find that plants with any level of foreign or public domestic ownership have more survival chances than private domestic plants. This is in line with the historiography accounting for the weakness of the indigenous entrepreneurship and the lack of support of indigenous private plants by the authorities. Also, public domestic plants have more chances of survival than foreign-owned plants after controlling for size and productivity, hinting at the potential crony bias towards public domestic plants. Interestingly, hazard ratios increase for public domestic plants and decrease for foreign plants after the deregulation period. This might be the sign of less protection for public domestic plants and benefit the foreign plants via a more competitive environment.

As size is the main explanatory factor of hazard rates, I separate the population into two sub-samples: the small and medium plants (less than 500 employees), and the large plants (between 500 and 2000 employees), leaving the extra-large plants (over 2000 employees). I show the coexistence of a dual market: the small and medium scale segment of the population behave in a competitive way, at least up to 1990, with relative productivity lowering hazard rates. Size also bears a positive relationship with survival chances. More striking is the fact that the large scale sector does not behave competitively, even in the first period (1975-89). In fact neither relative TFP nor size affects hazard rates for plants within the large scale sector. However, the analysis shows that having some public ownership for a large plant leads to hazard rates close to zero. This is quite a strong result and shows clearly the market dichotomy between SMEs and large-scale plants. It also suggests that market distortions acted probably more through state ownership than payment of corruption fees by private plants.

7 Conclusion

Asian countries are the group of developing countries that have reached the highest economic growth rates in the last 30 years of the 20th century. Sarel (1997, figure 1b, p.9) reports average GDP per capita growth rates between 5% and 5.5% for Indonesia, Thailand, Malaysia and Singapore between 1978 and 1996, comparing with a rate of 1.5% for the US. Economic growth in Asia seemed so impressive that it had been labelled "the East Asian Miracle" (World Bank report 1993).

But the miracle was soon to receive severe criticism by a group of economists, starting with Krugman's famous article in 1994 titled "The myth of Asia's miracle." Krugman argued that there was indeed no miracle, and that most of Asian growth could be accounted for by a rapid accumulation of capital and labour rather than any substantial productivity improvement. This article started the debate of extensive versus intensive growth, i.e. factors accumulation versus productivity improvements. Young, in his "Tyranny of numbers" in 1995, points at the effectively very low to nil Total Factor Productivity growth rates for Singapore, Taiwan, South Korea and Hong Kong from the mid-1960s to the early 1990s.

Sarel (1997) challenges those results and shows that, correcting for the potential erroneous factor income shares used in others studies, annual Total Factor Productivity Growth in selected Asian countries for the period 1978-96 is indeed positive, with rates of 2.2% for Singapore, 2% for Thailand and Malaysia, and 1.2% for Indonesia, against 0.3% for the US. He states that "these results confirm the conclusions of many previous studies, but are in sharp contrast to the conclusions reached in the studies of Alwyn Young, especially regarding the TFP growth rate in Singapore" (p.32-34).

Sarel (1997) points at one of the main problems faced when estimating TFP growth rates, i.e. issues of measurement. In his 1997 article, he mostly focuses on the issue of factor income shares, arguing that for the case of Asian countries in particular, using factor income shares in the production function would tend to overestimate the share of capital, thereby artificially lowering TFP growth estimates. He chooses to estimate technological factor shares, and the result is a fairly standard share to capital. Bosworth and Collins (2003), in their empirics of growth update, also point at issues of measurements. They argue that "careful attention to issues of measurement and consistency goes a long way in explaining the apparent contradictions among findings in the existing empirical literature. Thus, we combine growth accounts and growth regressions with a focus on measurement and procedural consistency to address the issues raised above" (abstract). Indeed, they also acknowledge the fact that the debate has opposed growth accounting versus econometric approach to productivity measurements.

Bosworth and Collins (2003) indicate several types of measurement problems that can explain discrepancies in empirical international comparative studies. In particular, some authors prefer to use investment rate than capital stock growth figures, because this allows them to avoid the choice of hypothetical initial capital stock and rate of depreciation. They underline that this affects greatly the results and that the best choice are capital stock growth figures. They find annual average TFP growth rates for East Asia ranging from 0.9% for the period 1970-80, to 1.3% for the period 1980-90.[56]

A specific debate for the case of Indonesian manufacturing starts in the 1990s when reliable data becomes available. As presented at length in chapter 2, studies find fairly varying estimates from 0.7% to 1.1% p.a. for the oil boom period, from -4.9% to 0.1%p.a. for the oil crisis period, and from 2.1% to 7.9% p.a. for the deregulation and post-deregulation periods (Aswicahyono & Hill 1996, Aswicahyono 1998, Osada 1994, Timmer 1999a).

This thesis contributes both to the debate of intensive versus extensive growth and of issues of measurements. Firstly, I conduct a detailed comparative study of measurement methodologies for TFP growth rates in Indonesian manufacturing, and uncover the main reasons of discrepancies in different TFP growth estimates. Besides the issue of the choice of the adequate dataset to use in the case of Indonesian manufacturing, following Bosworth & Collins (2003), I underline the difference between investment and capital stock figures, and demonstrate how the construction of capital stock growth rates can be improved by using new plant-level capital stock data. Following Sarel (1997), I propose a re-estimation of the elasticities of output with respect to inputs, and show that previous capital factor income share had probably been overestimated. Finally, using the Divisia Index Number methodology, I propose new estimates of aggregate TFP growth for the Indonesian manufacturing sector. I find that correcting for these several types of measurement error lead to TFP growth rates that are lower than previous estimates, especially for the deregulation and post-deregulation era. Those results firstly underline the real importance of measurement issues. They secondly tend to indicate that the growth of the Indonesian manufacturing sector has been more driven by factor accumulation than by Total Factor Productivity improvements, with an average TFP growth rate of 0.78% p.a. over the period 1975-95.

Those results link interestingly with another major debate over Asian growth, i.e. the importance of industrial policy and government intervention in boosting economic growth.

The neo-liberal (or neo-classical or orthodox) strand of the literature on economic development argues that government intervention should be limited to the provision of a sound macroeconomic

[56] Their East Asian sample includes Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan and Thailand.

environment, sufficient and reliable institutions and infrastructures, leaving the market to allocate resources efficiently. Using this framework, the success of Asian countries, and in particular of East Asian countries, has been first analysed as resulting from the provision of such a stable basic environment, combined with trade openness (see for example Krueger, 1995). Criticisms came from specific country case studies showing that the East Asian success owed a lot to government intervention in the domain of industrial and trade policies as well as credit allocation (Wade, 1990). In 1993, the World Bank publishes the report on the "East Asian Miracle" agreeing with this revisionist view, and acknowledging the positive impact of government intervention. The controversy that followed focused on the effectiveness of industrial policy in Asia (Amsden 1994, Kwon 1994, Lall 1994 and 1996, Stiglitz 1996, Temple 1997).

Indeed, probably the most effective way to find an answer to the "Asian Miracle" is to focus on individual countries that presented very different development paths and policies. As Rodrik (1994, p.37) remarks "The [Asian] model encompasses highly interventionist strategies (Japan and Korea) as well as non-interventionist ones (Hong Kong and Thailand); explicitly redistributive policies (Malaysia) as well as distributionally neutral ones (most of the rest); clientelism (Indonesia and Thailand) as well as strong, autonomous states (Korea, Japan and Singapore); emphasis on large conglomerates (Korea) as well as on small, entrepreneurial firms (Taiwan)."

The economic history literature pictures Indonesia as being one of the fast catching-up Asian countries, a member of the Northeast Asian tiger's followers group, with a GDP per capita growth and GDP growth averaging 4% and 9% p.a. respectively over three decades.

While there is a debate between neo-liberals and revisionists for the issue of Asian economic development as a whole, the mainstream economic history literature on Indonesian development is rather homogeneous and neo-liberal. It advocates that, while a sound macroeconomic policy has been crucial to the country's development, industrial policy has been at best ineffective, and at worst detrimental to economic growth. Hill (1996b, p. 150) summarises the mainstream view on Indonesia's development, and argues that "there is very little in the past 25 years of Indonesia's rapid industrial growth that can be attributed to this kind of selective industrial policy. Industrial policy has been interventionist, at times highly so. But there is no persuasive evidence that such intervention has been the key to success. In fact, selective policies have in most instances been costly failures. I assert that the country's industrial success is the result primarily of the adoption of orthodox policies in the realm of macroeconomic management, exchange rate policy, and the provision of public goods such as social and physical infrastructure, together with political stability and security". Hill (1996b) claims that, as opposed to what happened in the Northeast Asian countries, the Indonesian government has been pretty ineffective at "picking the winners", i.e. at directing industrial policy towards the potentially most productive sectors of the economy. In fact, it appears that most of the industrial policy – trade policy, credit allocation, and the role of State enterprises- has been led by political patronage, corruption, and opportunism more than by anything else. Hill (1996b) also maintains that industrial policy targeting small- and medium-scale enterprises (SMEs) was more welfare than efficiency oriented. For the neo-liberals, high economic growth rates and positive productivity growth in Indonesia is mostly attributable to a sound macroeconomic policy that curbed inflation, devalued the currency at the right times, and reacted quickly to external shocks, to better infrastructure, and to financial deepening.

Few opponents to the neo-liberal view argue that targeted industrial policy also mattered to a certain extent, i.e. that the case of Indonesia resembled very much the case - for example - of Korea. Rock (1999) gives a bunch of successful examples. It is worth noting here that those examples regard exclusively large conglomerates that are supposed to have been successful, success that is only vaguely defined.

If we combine both the issue of extensive versus intensive growth and the issue of industrial policy effectiveness, we find that the existing literature argues that Indonesian manufacturing Total factor Productivity growth rates have been similar to those of the Northeast Asian countries over the same period of time (Aswicahyono & Hill 1996, Aswicahyono 1998, Osada 1994, Timmer 1999a), and similar to those of OECD countries during the Golden Age, *but* due mostly to a sound macroeconomic policy, with a failing industrial policy and widespread corruption (Hill 1996b). Does this imply that macroeconomic policy was better in Indonesia, that targeted industrial policy does not make much difference, or that we so far had TFP growth rates wrong for the case of Indonesian manufacturing?

While I do not tackle the first two possibilities, I show clearly in chapter 2 of this thesis that, firstly, we so far had TFP growth rates wrong. In following chapters, I also show that industrial policy had probably more adverse than positive effects on TFP growth rates.

While both neo-liberals and their few opponents seem to agree – implicitly or explicitly - on the fact that policies promoting SMEs failed, Rocks (1999), in an attempt to show that some targeted industrial policy had indeed been successful, gives examples of success stories concerning mostly large conglomerates. Results in chapter 4 regarding the detailed demographic study give further support to the neo-liberal view. I show, firstly, that SMEs display higher average productivity growth rates than large and extra-large plants, and secondly, that the bulk of positive aggregate productivity growth in manufacturing stems from the plants' turnover process occurring among SMEs. In other words, the large-scale sector benefiting from industrial policy has experienced losses in productivity, while the untargeted SMEs sector drove aggregate TFP growth.

The neo-liberal view claims that, because of the distorted industrial policy measures, Indonesia evolved in the context of a "high cost economy", characterised by high transaction costs, widespread corruption, abusive dominance of large companies, and lack of competition, resulting in a poor performance of the industrial sector (Hill 1996b). Opponents to this analysis (Rock 1999), and in some respects the Indonesian State (Robison 1986) - claim that at least some industrial policy measures were well targeted, and that the preference given to the large-scale sector was justified. Firstly, the large-scale sector is said to be more productive, secondly, its existence and prosperity conditions the emergence and further development of the small- and medium-scale industrial base. While both views are defendable from a theoretical point of view, this historical study provides arguments mostly feeding the neo-liberal view.

By looking at the evolution of plant size distribution over the period 1975-95, I show that, while the small- and medium-scale sector becomes more homogeneous, with the possible emergence of a "middle-class" in terms of plants size, the already huge size gap existing between the SME sector and the large-scale sector increases over time, featuring an even more dual industrial structure in the 1990s than in the 1970s. In other words, even if policies favouring the large-scale sector have helped the emergence of a medium-scale sector – fact that remains to be proved – the outcome is still an increased size gap between SMEs and large plants.

The productivity argument might be more convincing. I indeed find that the average *large* plant is the most productive plant. But this result needs be nuanced in three respects. Firstly, this only holds for the oil boom period, i.e. from 1975 to 1981. Secondly, the average *extra-large* plant is one of the least productive throughout the period. Thirdly, even if *large* plants are the most productive during the oil boom, they experience productivity losses throughout that period.

This is an important result, as it reminds us that what matters are productivity gains more than productivity levels, and that the most productivity-enhancing class of plants in an economy is more than often the small- and medium-scale sector.

While assessing potential factors explaining productivity differentials across plants in chapter 5, I also find that being large increases initial productivity levels. Complementarily, independently of plant size, I find that being part of a group of companies or having a foster parent company in the *bapak angkat* system leads to higher initial productivity levels. This confirms that indeed large size plants surely benefit from economies of scale, better technological level, easier access to capital, and potentially lower input costs.

What about the competition issue? Did industrial policy directed towards the large-scale sector prevent competition? Some of the results in chapter 4 can help answering the question. Firstly, the international comparison of plants turnover rates shows clearly that entry rates in Indonesian manufacturing are fairly standard, but that exit rates tends to be low, which could be a first symptom of a lack of competition. Secondly, and more interestingly, the process of entry and exit occurs mostly among small- and medium-scale plants. Of course, exit especially hits SMEs because entrants are themselves SMEs, because the majority of plants belong to the SME sector, and because SMEs face less exit costs than large plants. Additionally, if the large-scale sector benefits from a biased industrial policy, it is less likely to exit. Indeed, I show in chapter 6 that the best way to stay alive in the Indonesian manufacturing sector is to be large, and possibly be of public ownership, while productivity relative to the industry average only plays a minor role. Even more interestingly, while relative TFP plays a small but significant role in determining exit and survival within the SME sector, it is an insignificant explanatory factor for the large-scale sector.

Those results suggest of course the existence of a dual industrial sector in Indonesia. The first sector is composed of large plants, with a declining average TFP growth rates during the oil boom, and a slow growing TFP for the remainder of the period. This sector is very concentrated, fairly uncompetitive, but is increasingly dominant in terms of output and employment. The second sector is very large in terms of number of plants, very dynamic in terms of plants turnover, a lot more competitive, but small in terms of output and employment.

One could argue that in fact, because of entry and exit costs, competition among large plants takes the form of market share reallocation rather than entry and exit. In chapter 4 and 6, I find that the overall market share reallocation contribution to aggregate TFP growth is negative at least for the pre-deregulation period, confirming the lack of competition within the large-scale sector.

Linked to the competition issue is the corruption issue. Using two proxies for corruption, I find in chapter 5 that, at least for the oil boom period, in crony sectors, the initial productivity level of entrants tends to be lower than in other sectors, probably due to negative externalities emanating from large crony plants within the sector. The historiography provides further evidence supporting this hypothesis, with cases of monopolies controlling prices and procurement of inputs of one sector. And indeed, I also find that corruption proxied at the plant level has a positive impact on plants initial productivity level.

All these arguments go of course in the sense of the neo-liberal view of the Indonesian economy. However, it is undeniable that Indonesian manufacturing sector performance improved over the period under scrutiny. Firstly, TFP improved between 1975 and 1995, especially after the deregulation of the economy. Secondly plants productivity levels converged. They converged in general, but the average productivity level of different size groups also converged, showing that competition did play a role, even among large plants. Indeed, while I show that the plant turnover process is the main contributor to aggregate TFP growth during the pre-deregulation era, I also show that global market share reallocation is the main positive contributor to aggregate TFP growth in the post-deregulation era. More precisely, in the first period, the turnover process occurring among SMEs seems to be the only competition process at play, while this process is complemented by market share reallocation in the second period.

On the corruption front, I find for the post-deregulation era that plants in crony sectors do not suffer anymore from lower initial TFP levels, and that the plant level cronyism effect of TFP becomes negative, i.e. that the costs of cronyism have become more important than the benefits.

This is a clear hint that the deregulatory measures might have had a positive impact on industrial performance. It is also clear from aggregate TFP growth rates re-estimation in chapter 2 that those increase dramatically in the second period. Goeltom (1995) observes also that financial deregulation tends to increase industrial performance. Hill and Bird (1996) also find that deregulation coincides with higher TFP growth rates. There is strong evidence as well that deregulation triggered better performance by enhancing exports (see for example Sjöholm, 1997). What is here new is that I am able to identify another of the competitive market mechanisms leading to higher TFP growth rates in the post-deregulation era, namely the market share reallocation process.

Conventional revisionist wisdom about the Asian economic success describes generally an export-oriented policy, with an industrial policy targeted at sectors presenting the highest potential in terms of comparative and competitive advantage, a strong commitment of the state to its developmental purpose, and relatively low levels of corruption and cronyism (see for example Wade, 1990). This study shows clearly that overestimated TFP growth figures, together with sound macroeconomic fundamentals might often have given a truncated picture of Indonesian manufacturing in the Suharto era. While the choice of the "wrong" sectors is often put forward (see for example Aswycahyono, Basri, and Hill, 2000), this study shows clearly that a quasi-exclusive focus of industrial policy on the large-scale sector - irrespective of industry specificities – is probably one of the factors explaining poor productivity growth during the oil boom period. Additionally, the effects of cronyism on the choice of companies and industries to focus industrial policy on are additional explanatory factors.

While I demonstrate how this has had adverse effects on aggregate TFP growth, namely through a lack of fair competition within the large-scale sector, and between the large sector and small and medium sector, another interesting feature of Indonesian manufacturing under the New Order is the existence of a relatively competitive small- and medium-scale sector. The question that then arises is whether or not this sector would have reached such a level of competition if it had been targeted more effectively by industrial policy. Moreover, how has a rather competitive formal sub-market been able to develop within a strongly corrupted regulatory environment?

Lastly, this study has focused on establishments rather than companies. I point at the limitations of such a choice in many parts of the thesis, and especially at the fact that this tends to underestimate the weight of large-scale companies.[57] It also treats small and medium plants part of a group as small and medium companies, and results regarding SMEs might be slightly biased. However, this bias is limited by the fact that only an extremely small fraction of the plants' population declares itself as being part of a group. This underlines clearly the need for collecting archives data on group membership, with the aim in view of identifying groups of plants and conglomerates within the population. By doing so, the analysis could be refined, and a lot could be learned on the internal functioning of Indonesian business groups.

Last but not least, what does this study tell us for 2004 Indonesia?

On September, 23rd 2004, Haryo Aswicahyono writes in *The Jakarta Post* about the current state of Indonesian economy "The resumption to high economic growth path seems to hinge not on new initiatives in industrial policy in which the government picks the winners and caters to specialized interest group. Given the poor quality of our institutions, it is quite likely that the government will only pick losers and encourage corruption. What Indonesia needs is a return to orthodox competition based upon rational economic policies, guarded by efficient, accountable and transparent institutions."

Mentioning a "*return* to orthodox competition" is probably having a biased view of the past. In fact, the results of this thesis tend to show that competition has never been a strong feature of Indonesian manufacturing, at least for the large-scale sector. And as the current literature reports, in spite of a severe economic crisis occurring from 1997 on, and the structural adjustments that have followed, it seems that in Indonesia "the more it changes, the more it remains the same". What Indonesia needs today is not a *return* to competition, but simply a real "*turn*" towards competition, and the eradication of corruption.

[57] The choice is dictated by data availability.

8 Bibliography

Abimanyu, A. (1995). "The Indonesian economy and total factor productivity." Singapore Economic Review **40**(1): 25-40.

Admati, A., P. Pfleiderer, et al. (1994). "Large Shareholder Activism, Risk Sharing, and Financial Market Equilibrium." Journal of Political Economy **102**: 1097-130.

Aghion, P. and P. Howitt (1992). "A model of growth through creative destruction." Econometrica **60**: 323-351.

Aghion, P., M. Dewatripont, et al. (1997). "Corporate governance, competion policy and industrial policy." European Economic Review(41): 797-805.

Ahn, S. (2001). Firm Dynamics and Productivity Growth: A Review of Micro Evidence from OECD Countries, OECD Economics Department.

Alba, P., C. S., et al. (1998). "Thailand's corporate financing and governance structures : Impact on firm's competitiveness." World Bank, Conference on Thailand's Dynamic Economic Recovery and Competitiveness, 20-21 May 1998, UNCC Bangkok, Session 3, Industrial Sector Competitiveness (I) : Technology and Corporate Finance.

Amsden, A. H. (1994). "Why isn't the whole world experimenting with the East Asian model to develop? Review of the *East Asian Miracle*." World Development **22**(4): pp. 627-33.

Aoki, M. (1984). The economic analysis of the Japanese firm, North-Holland.

Aoki, M. (1990). "Toward an Economic Model of the Japanese Firm." Journal of Economic Literature **28**: 1-27.

Aoki, M. and K. Hyung-Ki (1995). "Corporate Governance in Transitional Economies : Insider Control and the Role of Banks." The World Bank, Washington, DC.

Arndt, H. W. (1975). "PT Krakatau Steel." Bulletin of Indonesian Economic Studies **11**(2): 120-126.

Aswicahyono, H. H. and H. Hill (1995). "Determinants of foreign ownership in LDC manufacturing: An Indonesian case study." Journal of International Business Studies **26**(1): 139-158.

Aswicahyono, H. H., K. Bird, et al. (1996). "What happens to industrial structure when countries liberalise ? Indonesia since the mid-1980s." The Journal of Development Studies **32**(3, February): 340-363.

Aswicahyono, H. H. (1998). Total factor productivity growth in Indonesian manufacturing. Canberra, ANU.

Aswicahyono, H. H., M. Chatib Basri, et al. (2000). "How not to industrialise? Indonesia's automotive industry." Bulletin of Indonesian Economic Studies **36**(1): 209-241.

Aswicahyono, H. and H. Hill (2002). "Perspiration' versus `Inspiration' in Asian Industrialisation: Indonesia Before the Crisis." The Journal of Development Studies **38**(3): 138-163.

Aswicahyono, H. (2004). Indonesia: An economy that lacks dynamism. The Jakarta Post. Jakarta.

Aw, B. Y., X. Chen, et al. (1997). Firm-level evidence on productivity differentials, turnover, and exports in Taiwanese manufacturing. Cambridge, MA, NBER.

Baily, M. N., C. Hulten, et al. (1992). "Productivity Dynamics in Manufacturing Plants." Brookings Papers on Economic Activity, Microeconomics: 187-249.

Baldwin, J. and P. Gorecki (1991). "Firm entry and exit in the Canadian manufacturing sector, 1970-1982." Canadian Journal of Economics **24**: 300-23.

Barclay, M. and C. Holderness (1989). "Private Benefits from Control of Public Corporations." Journal of Financial Economics **25**: 371-95.

Barro, R. J. (1999). "Notes on growth accounting." Journal of Economic Growth **4**(June): 119-137.

Bartel, A. P. and A. E. Harisson (1999). Ownership versus environment: Why Are Public Sector Firms Inefficient? Cambridge, MA, NBER.

Bartelsman, E., S. Scarpetta, et al. (2003). Comparative Analysis of Firm Demographics and Survival: Micro-level evidence for the OECD Countries, OECD Economics Department.

Basri, C. and H. Hill (1996). "The political economy of manufacturing protection in LDCs: An Indonesian case study." Oxford Development Studies **24**(3): 241-259.

Basri, M. C. (2001). The political economy of manufacturing protection in Indonesia, 1975-95. Canberra, Australian National University.

Basri, M. C. (2004). Slight economic growth spurt faces head wind. The Jakarta Post. Jakarta.

Basu, S. (1996). "Procyclical productivity: Increasing returns or cyclical utilization?" Quarterly Journal of Economics **111**(3): 719-51.

Behrman, J. R. and A. B. Deolalikar (1989). "Of the fittest? Duration of survival of manufacturing establishments in a Developing Country." Journal of Industrial Economics **38**(2): 215-26.

Bergstrom, C. and K. Rydqvist (1990). "Ownership of Equity in Dual-Class Firms." Journal of Banking and Finance **14**: 255-269.

Berle, A. and G. Means (1932). The Modern Corporation and Private Property. New York, MacMillan.

Bernard, A. B. and F. Sjöholm (2003). Foreign Owners and Plant Survival, NBER.

Bird, K. (1996). "Industrial concentration and competition in manufacturing." The Indonesian Quarterly **XXIV**(2, second quarter).

Bird, K. (1999). "Concentration in Indonesian manufacturing, 1975-1993." Bulletin of Indonesian Economic Studies **35**(1): 43-73.

Biro Pusat Statistik (1975 to 1998). Statistik Industri. Jakarta.

Biro Pusat Statistik (1996). Backcast Data from Statistik Industri. Jakarta.

Biro Pusat Statistik (various issues). Indikator Ekonomi. Jakarta.

Blomström, M. and F. Sjöholm (1998). Technology Transfer and Spillovers: Does Local Participation With Multinationals Matter?, NBER.

Booth, A. and McCawley (1981). The Indonesian economy during the Soeharto era. Kuala Lumpur, Oxford University Press.

Booth, A. (1986). "Survey of recent developments." Bulletin of Indonesian Economic Studies **22**(3).

Booth, A. (1992). The oil boom and after: Indonesian economic policy and performance in the Soeharto era. Singapore, Oxford University Press.

Booth, A. (1998). The Indonesian Economy in the Nineteenth and Twentieth Centuries: A History of Missed Opportunities. London, MacMillan Press.

Bosworth, B. and S. M. Collins (2003). "The Empirics of Growth: An Update." Brookings Papers on Economic Activity(2).

Boucherie, W. (1969). "The textile industry." Bulletin of Indonesian Economic Studies **5**(3): 57-70.

Bresnan, J. (1993). Managing Indonesia: The modern political economy. New York, Colombia University Press.

Bruch, M. and U. Hiemenz (1984). Small and medium scale industries in the ASEAN countries: Agents or victims of economic development? Colorado, Westview Press.

Burkart, M., D. Gromb, et al. (1997). "Large Shareholders, Monitoring, and the Value of the Firm." Quarterly Journal of Economics **112**: 693-728.

Button, K. J. and T. G. Weyman-Jones (1992). "Ownership structure, institutional organisation and measured X-efficiency." AEA Papers and Proceedings **82**(2): 439-445.

Byeon, Y. (1998). "Improved Corporate Governance in Korea." Ministry of Finance and Economy, Seoul, mimeo.

Cahuc, P. (1993). La nouvelle microéconomie, La Découverte.

Castles, L. (1982). Tingkah Laku Agama, Politik dan Ekonomi di Jawa: Industri Rokok Kudus [Religious, political, and economic behaviour in Java: The cigarette industry in Kudus]. Jakarta, PT Grafiti.

Caves, R. E. (1989). International differences in industrial organization. Handbook of Industrial Organization. R. Schmalensee and R. D. Willig. Amsterdam, Elsevier Science Publishers.

Chapman, R. (1992). "Indonesian trade reform in close-up: The steel and footwear experiences." Bulletin of Indonesian Economic Studies **28**(1): 67-84.

Claessens, S., S. Djankov, et al. (1998a). "Expropriation of Minority Shareholders : Evidence from East Asia." World Bank Working Papers.

Claessens, S., S. Djankov, et al. (1998a). "Who Controls East Asian Corporations." World Bank, Discussion Paper 2054.

Claessens, S., S. Djankov, et al. (1998b). "East Asian Corporates : Growth, Financing and Risks over the Last Decade." World Bank Discussion Paper.

Claessens, S., S. Djankov, et al. (1998b). "Diversification and Efficiency of Investment by East Asian Corporations." World Bank Discussion Paper.

Claessens, S., S. Djankov, et al. (1998c). "Corporate Diversification in East Asia: The Role of Ultimate Ownership and Group Affiliation." World Bank Working Paper.

Coase, R. (1937). "The nature of the firm." Economica **vol.4**: 386-405.

Conroy, J. D. and P. J. Drake (1990). "Survey of recent developments." Bulletin of Indonesian Studies **26**(2).

Conyon, M. J. and D. Leech (1993). "Top Pay, Company Performance and Corporate Governance." Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 410.

Corden, W. M. (1974). Trade policy and economic welfare. Oxford, Clarendon Press.

Crafts, N. F. R. (1999). "East Asian growth before and after the crisis." IMF Staff Papers **46**(2, June): 139-166.

Crego, A., D. Larson, et al. (2000). A cross-country database for sector investment and capital, World Bank.

Cubbin, J. and D. Leech (1983). "The effect of shareholding dispersion on the degree of control in British companies: Theory and measurement." The Economic Journal **93**(370): 351-69.

Dasgupta, D., J. Hanson, et al. (1995). The rise in TFP during deregulation: Indonesia 1985-1992. Building on success: Maximising the gains from deregulation, Jakarta.

De Meza, D. and B. Lockwood (1999). "Asset Ownership and Investment Incentives Revisited." Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 562.

Demsetz, H. (1983). "Corporate Control, Insider Trading, and Rates of Return." American Economic

Review **86**: 313-316.

Demsetz, H. and K. Lehn (1985). "The Structure of Ownership: Causes and Consequences." Journal of Political Economy **93**: 1155-77.

Dhawan, R. (2001). "Firm size and productivity differential: Theory and evidence from a panel of US firms." Journal of Economic Behavior and Organization **44**: 269-293.

Dhillon, A. and B. Lockwood (1999). "When are Plurality Rule Voting Games Dominance-Solvable?" Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 549.

Disney, R., J. Haskel, et al. (2000). Restructuring and Productivity Growth in UK Manufacturing, CEPR.

Dixit, A. (1989). "Entry and exit decisions under uncertainty." Journal of Political Economy **97**: 620-38.

Donges, J. B., B. Stecher, et al. (1974). "Industrial development policies for Indonesia." Kieler Studien, Tubingen(126).

Drew Perkel, R. (1998). "A competition law for Indonesia: Fostering a competition Ideology -- Is the IMF ready?" The Indonesian Quarterly **XXVI**(4): 391-433.

Easterly, W. and R. Levine (1996, May). "Africa's growth tragedy: Policies and ethnic divisions." .

Ericson, R. and A. Pakes (1995). "Markov-perfect industry dynamics: A framework for empirical work." Review of Economic Studies **62**: 53-82.

Fama, E. (1980). "Agency Problems and the Theory of the Firm." Journal of Political Economy(88): 288-307.

Fane, G. and C. Phillips (1991). "Effective protection in Indonesia in 1987." Bulletin of IndonesianEconomic Studies **27**(1): 105-125.

Fane, G. and T. Condon (1996). "Trade reform in Indonesia, 1987-1995." Bulletin of Indonesian Economic Studies **32**(3): 33-54.

Fauver, L., J. Houston, et al. (1998). "Capital Market Development, Legal Systems and the Value of Corporate Diversification: A Cross-Country Analysis." Mimeo, University of Florida.

Fernandes, A. (2002). Trade policy, trade volumes and plant-level productivity in Colombian manufacturing industries, Economic Growth Center, Yale University.

Findlay, C. and R. Garnaut (1986). The political economy of manufacturing protection: Experiences of ASEAN and Australia. Sydney, Allen and Unwin.

Foreign Investment Advisory Service (1994). An investment promotion strategy for Indonesia. Washington DC, International Finance Corporation.

Foster, L., J. Haltiwanger, et al. (1998). "Aggregate Productivity Growth: Lessons from Microeconomic evidence", NBER.

Gibson, J. (1966). "Production sharing: Part 1 and 2." Bulletin of Indonesian Economic Studies **3 and 4**: 52-75 and 75-100.

Gillis, M. (1982). "Allocative and X-efficiency in State-owned mining enterprises: Comparisons between Bolivia and Indonesia." Journal of Comparative Economics **6**: 1-23.

Goeltom, M. (1995). Indonesia's financial liberalization: An empirical analysis of 1981-1988 panel data. Singapore, Institute of Southeast Asian Studies.

Good, D. H., M. I. Nadiri, et al. (1996). Index Number and Factor Demand Approaches to the Estimation of Productivity, NBER.

Gorton, G. and F. Schmid (1996). "Universal Banking and the Performance of German Corporations." NBER Working Paper 5453.

Griliches, Z. and H. Regev (1992). "Productivity and firm turnover in Israeli industry: 1979-1988." NBER Working Paper No4059.

Griliches, Z. and H. Regev (1992). Productivity and firm turnover in Israeli industry: 1979-1988. Cambridge, MA, NBER.

Grossman, S. and O. Hart (1980). "Takeover Bids, the Free-Rider Problem, and the Theory of the Corporation." Bell Journal of Economics(11): 42-64.

Grossman, S. and O. Hart (1986). "The costs and benefits of ownership : A theory of vertical and lateral integration." Journal of Political Economy **94**(4).

Grossman, G. M. and E. Helpman (1991). Innovation and growth in the global economy. Cambridge, MA, MIT Press.

Hahn, C. (2000). Entry, Exit, and Aggregate Productivity Growth: Micro Evidence on Korean Manufacturing, OECD.

Haltiwanger, J. (1997). "Measuring and analysing aggregate fluctuations: The importance of building from microeconomic evidence." Federal Reserve Bank of St Louis Economic Review(January-February).

Harianto, F. (1993). "Study on subcontracting in Indonesian domestic firms." Indonesian Quarterly **21**(3): 331-343.

Harianto, F. (1995a). The Indonesian electronics industry. Building on success: Maximising the gains from deregulation, Jakarta.

Harianto, F. (1995b). Technology policy: A Southeast Asian experience. Building on success: Maximising the gains from deregulation, Jakarta.

Harris, M. and A. Raviv (1988). "Corporate Governance: Voting Rights and Majority Rules." Journal of Financial Economics **20**: 203-235.

Harris, J. R., F. Schiantarelli, et al. (1994). "The effect of financial liberalization on the capital structure and investment decisions of Indonesian manufacturing establishments." The World Bank Economic Review **8**(1): 17-47.

Hart, O. (1983). "The Market Mechanism as an Incentive Scheme." Bell Journal of Economics **14**: 366-82.

Hasibuan, N. (1993). "Ekonomi Industri: Persaingan, Monopoli dan Regulasi." .

Hayashi, H. (2003). Development of SMEs in the Indonesian Economy. Canberra, School of Economics, Faculty of Economics and Commerce, Australian National University.

Hill, H. (1982). "State enterprises in a competitive industry: An Indonesian case study." World Development **10**(11): 1015-1023.

Hill, H. (1987a). "Concentration in Indonesian manufacturing." Bulletin of Indonesian Economic Studies **23**(2): 71-100.

Hill, H. (1987b). "Survey of recent developments." Bulletin of Indonesian Economic Studies **23**(3): 1-33.

Hill, H. (1988a). Foreign investment and industrialisation in Indonesia. Singapore, Oxford University Press.

Hill, H. (1988b). "Some neglected issues in factor proportions and ownership: An Indonesian case study." Weltwirtschaftliches Archiv **124**(2): 341-355.

Hill, H. (1990a). "Indonesia's Industrial Transformation, Part I and II." Bulletin of Indonesian Economic Studies **26**(2-3).

Hill, H. (1990b). "Foreign Investment and East Asian Economic Development." Asian Pacific Economic Literature **4**(2): 21-58.

Hill, H. (1991). "The emperor's clothes can now be made in Indonesia." Bulletin of Indonesian Economic Studies **27**(3).

Hill, H. and K. P. Kalirajan (1993). "Small enterprise and firm-level technical efficiency in the Indonesian garment industry." Applied Economics **25**: 1137-1144.

Hill, H. (1994). Indonesia's New Order: The dynamics of socio-economic transformation. Sydney, Allen and Unwin.

Hill, H. (1995a). "Indonesia's great leap forward? Technology development and policy issues." Bulletin of Indonesian Economic Studies **31**(2): 83-123.

Hill, H. (1995b). "Small-medium enterprise and rapid industrialization: the ASEAN experience." Journal of Asian Business **11**(1): 1-31.

Hill, H. (1996a). The Indonesian economy since 1966: Southeast Asia's emerging giant. Cambridge, Cambridge University Press.

Hill, H. (1996b). "Indonesia's industrial policy and performance: Orthodoxy vindicated." Economic Development and Cultural Change **45**(1): 147-174.

Hill, H. (1997). Indonesia's industrial transformation. Singapore, Institute of Southeast Asian Studies.

Hill, H., H. Aswicahyono, et al. (1998). What happened to industrial structure during the deregulation era? Indonesia's Industrial Transformation. H. Hill. Singapore, Institute of Southeast Asian Studies: 55-80.

Holderness, C. and D. Sheehan (1988). "The role of majority shareholders in publicly held companies." Journal of Financial Economics **20**: 317-346.

Holmstrom, B. and J. Tirole (1993). "Market Liquidity and Performance Monitoring." Journal of Political Economy **101**: 678-709.

Hopenhayn, H. (1992). "Entry, exit, and firm dynamics in long-run equilibrium." Econometrica **60**(11).

Hoshi, T., A. Kashyap, et al. (1991). "Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups." The Quarterly Journal of Economics **February**: 33-60.

Hsieh, C.-T. (1998). "What explains the industrial revolution in East Asia? Evidence from factor markets." Paper, University of California Berkeley(January).

Hulten, C. R. (1973). "Divisia Index Numbers." Econometrica **41**(6): 1017-25.

Jammal, Y. (1993). Backcasting manufacturing growth. Jakarta, DSP/BPS.

Jansen, J. C. and A. Kuyvenhoven (1987). "Capital utilisation in Indonesian medium and large scale manufacturing." Bulletin of Indonesian Economic Studies **23**(1): 70-103.

Jensen, M. and W. Meckling (1976). "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure." Journal of Financial Economics(11): 5-50.

Jorgenson, D. W. and Z. Griliches (1967). "The explanation of productivity change." Review of Economic Studies **34**: 249-280.

Jorgenson, D. W., F. M. Gollop, et al. (1987). Productivity and US economic growth. Cambridge, MA, Harvard University Press.

Jovanovic, B. (1982). "Selection and the evolution of industry." Econometrica **50**: 649-70.

Kaplan, S. (1994). "Top Executive Rewards and Firm Performance: A Comparison of Japan and the United States." Journal of Political Economy **102**: 510-546.

Keuning, S. J. (1988). An estimate of fixed capital stock by industry and type of capital good in Indonesia. The Hague and Jakarta, ISS and BPS.

Keuning, S. J. (1991). "Allocation and composition of fixed capital stock in Indonesia: An indirect estimate using incremental capital value added ratios." Bulletin of Indonesian Economic Studies **27**(2): 91-116.

Khanna, T. and K. Palepu (1996). "Is group membership profitable in emerging markets? An analysis of diversified Indian business groups." .

Khanna, T. and K. Palepu (1997). "Why focused strategies may be wrong for emerging markets." Harvard Business Review **75**(4).

Khanna, T. and K. Palepu (1998). "The future of business groups in emerging markets: Long run evidence from Chile." .

Khanna, T. and J. W. Rivkin (1999). "Understanding business groups in emerging markets: Evidence from Chile." Harvard Business School Working Paper.

Khanna, T. and Y. Yafeh (1999). "Business groups and risk sharing around the world." Harvard Business School and Hebrew University mimeograph.

Khanna, T. and K. Palepu (1999a). "Emerging market business groups,foreign investors, and corporate governance." NBER Working Paper Series **No 6955**.

Khanna, T. and K. Palepu (1999b). "Policy shocks, market intermediaries, and corporate strategy. The evolution of business groups in Chile and India." Journal of Economics and Management Strategy **8**(2).

Khanna, T. and J. W. Rivkin (1999b). "Estimating the performance effects of groups in emerging markets." Harvard Business School Working Paper.

Khanna, T. and K. Palepu (1999c). "The right way to restructure conglomerates in emerging markets." Harvard Business Review **July-August**.

Khanna, T. (2000). "Business Groups and Social Welfare in Emerging Markets: Existing Evidence & Unanswered Questions." European Economic Review **44**(4-6): 748-761.

Kim, S. J. and J.-W. Suh (1992). Cooperation in small and medium-scale industries in ASEAN. Kuala Lumpur, Asia Pacific Development Centre.

Kirkpatrick, C. H., N. Lee, et al. (1984). Industrial structure and policy in less developed countries. London, Allen and Unwin.

Knack, S. and P. Keefer (1995). "Institutions and economic performance: Cross-country tests uusing alternative institutional measures." Economics and Politics **7**(3): 207-227.

Krueger, A. O. (1995). East Asian Experience and Endogeneous Growth Theory. Growth Theories in Light of the East Asian Experience. T. Ito and A. O. Krueger. Chicago, University of Chicago Press: pp.5-36.

Krugman, P. (1987). "The narrow moving bank, the Dutch disease, and the competitive consequences of Mrs Tatcher: Notes on trade in the presence of dynamic scale economies." Journal of Development Economics **27**: 41-55.

Krugman, P. (1991). "History versus Expectations." Quarterly Journal of Economics **106**: 651-67.

Krugman, P. (1994). "The myth of Asia's miracle." Foreign Affairs(Nov.).

Kwon, J. K. (1994). "The East Asia Challenge to Neoclassical Orthodoxy." World Development **22**(4): pp. 635-44.

La Porta, R., Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny (1997). "Legal Determinants of External Finance." Journal of Finance **52**(3): 1131-1150.

La Porta, R., F. Lopez-de-Silanes, et al. (1998). "Law and Finance." Journal of Political Economy **106**(6): 1113-1155.

La Porta, R., F. Lopez-de-Silanes, et al. (1999). "Corporate Ownership around the World." Journal of Finance.

Lall, S. (1980). "Vertical inter-firm linkages in LDCs: An empirical study." Oxford Bulletin of Economics and Statistics **42**(3): 203-226.

Lall, S. (1994). ""The East Asian Miracle" Study: Does the Bell Toy for Industrial Strategy?" World Development **22**(4): pp. 645-54.

Lall, S. (1996). "Paradigms of Development: The East Asian Debate." Oxford Development Studies **24**(2): pp. 111-31.

Lambson, V. (1991). "Industry evolution with sunk costs and uncertain market conditions." International Journal of Industrial Organization **9**: 171-96.

Lang, L. H. P. and R. M. Stulz (1994). "Tobin's q, Corporate Diversification, and Firm Performance." Journal of Political Economy **102**: 1248-1280.

Larson, D. F. (1996). "Indonesia's palm oil sub-sector, World Bank.

Lecraw, D. J. (1984). "Bargaining power, ownership and profitability of Transnational Corporations in developing countries." Journal of International Business Studies **15**(1): 27-43.

Lecraw, D. J. (1992). Corporate Groups in Indonesia. Jakarta, Indonesia, World Bank.

Leech, D. (1987a). "Corporate Ownership and Control: A New Look at the Evidence of Berle and Means." Article published by Oxford University Press in its journal Oxford Economic Papers **39 September**(3): 534-51.

Leech, D. (1987b). "Ownership concentration and control in large US corporations in the 1930s: An analysis of the TNEC sample." Journal of Industrial Economics **Vol. 35**(3): 333-342.

Leech, D. (1989). "Power indices and probabilistic voting assumptions." Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 325.

Leech, D. and J. Leahy (1991). "Ownership structure, control type classifications and the performance of large British companies." Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 345.

Leech, D. (1997). "Power Relations in the International Monetary Fund: A Study of the Political Economy of a Priori Voting Power Using the Theory of Simple Games." Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 494.

Leech, D. (1998). "Computing Power Indices for Large Voting Games: A New Algorithm." Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 510.

Leech, D. (1999). "Minority Control: An Analysis of British Companies using Voting Power Indices." Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 529.

Leech, D. (2000a). "An Empirical Comparison of the Performance of Classical Power Indices." Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 563.

Leech, D. (2000b). "Shareholder Power and Corporate Governance." Department of Economics, University of Warwick in its series The Warwick Economics Research Paper Series (TWERPS) n 564.

Leibenstein, H. (1989). "Organizational economics and institutions as missing elements in economic development analysis." World Development **17**(9): 1361-1373.

Leibenstein, H. and S. Maital (1992). "Empirical estimation and partitioning of X-Inefficiency: A data-envelopment approach." AEA Papers and Proceedings **82**(2): 428-438.

Lerche, D. (1980). "Efficiency of taxation in Indonesia." Bulletin of Indonesian Economic Studies **16**(1).

Levinsohn, J. and A. Petrin (1999). When industries become more productive, do firms? Investigating productivity dynamics, NBER.

Levinsohn, J. and A. Petrin (2000). Estimating production functions using inputs to control for unobservables, NBER.

Levy, B. (1988). "The determinants of manufacturing ownership in less developed countries: A comparative analysis." Journal of Development Economics **28**: 127-231.

Levy, B. (1993). "Obstacles to developing indigenous small and medium industries: An empirical assessment." World Bank Economic Review **7**(1): 65-83.

Lindsay, H. (1989). "The Indonesian log export ban: An estimation of foregone exports earnings." Bulletin of Indonesian Economic Studies **25**(2): 111-123.

Little, I. M. D., D. Mazumdar, et al. (1987). Small manufacturing enterprises: A comparative study of Indian and other economies. New York, Oxford University Press.

Liu, L. (1993). "Entry-exit, learning, and productivity change: Evidence from Chile." Journal of Development Economics **42**: 217-42.

Liu, L. and J. R. Tybout (1996). Productivity Growth in Chile and Colombia: The Role of Entry, Exit, and Learning. in Industrial Evolution in Developing Countries: Micro patterns of Turnover, Productivity, and Market Structure. M. J. R. a. J. R. Tybout, published for the World Bank, Oxford University Press: 73-103.

Lucas, R. (1988). "On the mechanics of economic development." Journal of Monetary Economics **22**: 3-42.

MacIntyre, A. (1991). Business and politics in Indonesia. Sydney, Allen and Unwin.

MacIntyre, A. (1994). Business and government in industrialising Asia. Sydney and Ithaca, Allen and Unwin, and Cornell University Press.

Malitz, I. (1989). "A Re-Examination of the Wealth Expropriation Hypothesis: The Case of Captive Finance Subsidiaries." Journal of Finance(46): 1039-1047.

Manning, C. G. (1979). Wage differentials and labour market segmentation in Indonesian manufacturing. Canberra, Australian National University.

Manning, C. (1980). "Fringe Benefits in Manufacturing: Efficiency or Welfare?" Bulletin of Indonesian Economic Studies **16**(2).

Mardjana, I. (1995). "Ownership or management problems? A case study of three Indonesian State enterprises." Bulletin of Indonesian Economic Studies **31**(1): 73-107.

Martimort, D. and T. Verdier (2000). "The internal organization of the firm, transaction costs, and macroeconomic growth." Journal of Economic Growth **5**: 315-340.

Martin, J. P. and P. J. M. Jr (1983). "The impact of subsidies on X-efficiency in LDC industry: Theory and empirical tests." Review of Economics and Statistics **65**: 608-17.

Martin, K. and J. McConnell (1991). "Corporate Performance, Corporate Takeovers, and Management Turnover." Journal of Finance(46): 671-87.

Matsuyama, K. (1991). "Increasing returns, industrialization, and indeterminacy of equilibrium." Quarterly Journal of Economics **106**: 617-50.

Mayer, C. (1996). "Corporate governance, competition and performance." Economics Department Working Papers N°164, OCDE.

McConnell, J. and H. Servaes (1990). "Additional Evidence on Equity Ownership and Corporate Value." Journal of Financial Economics **27**: 595-612.

McLeod, R. H. (1984). Financial institutions and markets in Indonesia. Financial institutions and markets in Southeast Asia. M. T. Skully. London, Macmillan: 48-109.

Meyanathan, S. D. (1994). Industrial structures and the development of small and medium enterprise linkages. EDI Seminar Series. Washington DC, World Bank.

Milgrom, P. and J. Roberts (1992). Economics, organization and management, Prentice Hall.

Mody, A. and D. Wheeler (1987). "Towards a vanishing middle: Competition in the world garnment industry." World Development **15**(10/11): 1269-1284.

Montgomery, C. A. (1994). "Corporate Diversification." Journal of Economic

Perspectives **8**: 163-178.

Montgomery, J. (1997). "The Indonesian financial system : Its contribution to economic performance, and key policy issues." IMF Working Paper, WP/97/45, Asia & Pacific Department.

Montobbio, F. (2002). "An evolutionary model of industrial growth and structural change." Structural Change and Economic Dynamics **13**: 387-414.

Morck, R., A. Shleifer, et al. (1988). "Management Ownership and Market Valuation: An Empirical Analysis." Journal of Financial Economics **20**: 293-315.

Murphy, K. M., A. Schleifer, et al. (1989). "Industrialization and the Big Push." Journal of Political Economy **97**: 1003-126.

Nasution, A. (1991). "Survey of recent developments." Bulletin of Indonesian Economic Studies **27**(2).

Nickell, S. J. (1996). "Competition and Corporate Performance." Journal of Political Economy **104**(4): 724-746.

Nickell, S., D. Nicolitsas, et al. (1997). "What makes firms perform well?" European Economic Review(41): 783-796.

Okamoto, Y. and F. Sjöholm (1999). Protection and the dynamics of productivity growth: The case of automotive industries in Indonesia, Stockholm School of Economics.

Olley, G. S. and A. Pakes (1992). The dynamics of productivity in the Telecommunications Equipment industry. Cambridge, MA, NBER.

Osada, H. (1994). "Trade liberalisation and FDI incentives in Indonesia: The impact on industrial productivity." The Developing Economies **32**(4): 479-91.

Page, J. (1984). "Firm size and technical efficiency: Application of production frontiers to Indian survey data." Oxford Economic Papers **32**.

Pakes, A. and R. Ericson (1987). Empirical implications of alternative models of firm dynamics. Madison, Social Science Research Institute, University of Wisconsin.

Pakes, A. and P. McGuire (1994). "Computing Markov-perfect Nash equilibria: Numerical implications of a dynamic product-differentiated model." Rand Journal of Economics **25**: 555-89.

Palia, D. and F. Lichtenberg (1999). "Managerial ownership and firm performance: A re-examination using productivity measurement." Journal of Corporate Finance **5**: 323-339.

Pangetsu, M. and A. D. Habir (1989). "Trends and prospects in privatization and deregulation in Indonesia." ASEAN Economic Bulletin **5**(3).

Pangetsu, M. (1989). "Economic policy reform in Indonesia." Indonesian Quarterly **17**(3): 218-33.

Pangetsu, M. (1991a). Managing economic policy reforms in Indonesia. Authority and Academic Scribblers: The Role of Research in East Asian Policy Reform. S. Ostry. San Francisco, International Center for Economic Growth: 93-120.

Pangetsu, M. (1991b). Foreign firms and structural change in the Indonesian manufacturing sector. Direct foreign investment in Asia's developing economies and structural change in the Asia-Pacific region. E. D. Ramstetter. Boulder, Westview Press: 35-64.

Pangetsu, M. (1992). An Indonesian perspective. Growth triangle: The Johor-Singapore-Riau experience. T. Y. Lee. Singapore, Institute of Southeast Asian Studies, and Institute of Policy Studies: 75-113.

Pangetsu, M. (1996). Economic Reform, Deregulation, and Privatization: The Indonesian Experience. Jakarta, Centre for Strategic and International Studies.

Pavcnik, N. (2002). "Trade liberalization, exit, and productivity improvements: Evidence from Chilean plants." Review of Economic Studies **69**: 245-276.

Perkins, D. H. (1998). "Ownership and control of Malaysian industry and business services : Rent versus Profit." Development Discussion Paper N°617, Harvard Institute for International Development.

Perotti, E. C. and S. Gelfer (1999). "Red Barons or Robber Barons? Governance and Financing in Russian Financial-Industrial Groups." mimeograph, University of Amsterdam.

Pincus, J. J. (1975). "Pressure groups and the pattern of tariffs." Journal of Political Economy **83**(4): 757-778.

Pitt, M. (1981). Alternative trade strategies and employment in Indonesia. Trade and employment in developing countries. K. A. O. e. al. Chicago, University of Chicago Press. **1**.

Pitt, M. and L. F. Lee (1981). "The measurement and sources of technical efficiency in the Indonesian weaving industry." Journal of Development Economics **9**: 43-64.

Pitt, M. (1991). Indonesia. Liberalizing foreign trade. P. D. e. al. Cambridge MA, Basil Blackwell for World Bank. **5**.

Plunkett, H. J., W. E. Morgan, et al. (1997). "Regulation of the Indonesian cement industry." Bulletin of Indonesian Economic Studies **33**(1): 75-102.

Pomerleano, M. (1998). "The East Asia Crisis and Corporate Finance : The Untold Micro Story." International Finance Corporation, *mimeo*.

Poot, H. e. a. (1990). Industrialization and trade in Indonesia. Yogyakarta, Gadjah Mada University Press.

Poot, H. (1991). "Interindustry linkages in Indonesian manufacturing." Bulletin of Indonesian Economic Studies **27**(2): 61-89.

Prowse, S. (1992). "The Structure of Corporate Ownership in Japan." Journal of Finance **47**: 1121-1140.

Prowse, S. (1994). "Corporate Governance in an International Perspective : a Survey of Corporate

Governance Mechanisms among Large Firms in the United States, the United Kingdom, Japan, and Germany." BIS Economic Papers, n°41, May.

Prowse, S. (1998). "Corporate Governance: Emerging Issues and Lessons from East Asia." World Bank, *mimeo*.

Rajan, R. and L. Zingales (1998). "Which Capitalism? Lessons from the East Asian Crisis." Journal of Applied Corporate Finance.

Ramstetter, E. D. (1999). "Trade propensities and foreign ownership shares in Indonesian manufacturing." Bulletin of Indonesian Economic Studies **35**(2): 43-66.

Roberts, M. and J. Tybout (1996). Industrial evolution in Developing Countries:Micro patterns of turnover, productivity and market structure. NY, Oxford University Press.

Robison, R. (1986). Indonesia : The rise of capital.

Rock, M. T. (1999). "Reassessing the Effectiveness of Industrial Policy in Indonesia: Can the Neoliberals be Wrong?" World Development **27**(4): 691-704.

Rodrik, D. (1991). Closing the technology gap: Does trade liberalization really help? Trade policy, industrialization, and development: New perspectives. G. Helleiner. Oxford, Clarendon Press.

Rodrik, D. (1994). King Kong Meets Godzilla: The World Bank and the East Asian Miracle. Miracle or Design? Lessons from the East Asian Experience. A. Fishlow and alii. Washington D.C., Overseas Development Council.

Rodrik, D. (1995). "Getting interventions right: How South Korea and Taiwan grew rich." Economic Policy **20**(April).

Rodrik, D. (1997). "TFPG controversies, institutions, and economic performance in East Asia." NBER **WP5914**.

Romer, P. M. (1990). "Endogenous technological change." Journal of Political Economy **98, part II**: S71-S102.

Rosenstein-Rodan, P. N. (1943). "Problems of industrialization of Eastern and South-Eastern Europe." Economic Journal **53**: 202-11.

Sandee, H., P. Rietveld, et al. (1994). "Promoting Small Scale and Cottage Industries in Indonesia: An Impact Analysis for Central Java." Bulletin of Indonesian Economic Studies **30**(3).

Sarel, M. (1997). Growth and productivity in ASEAN countries, IMF.

Sato, Y. (1993). "The Salim Group in Indonesia : The Development and Behavior of the Largest Conglomerate in Southeast Asia." The Developing Economies **XXXI**(4).

Scharfstein, D. (1988). "Product-market competition and managerial slack." Rand Journal of Economics **19**: 147-55.

Scherer, F. M. (1970). Industrial market structure and economic performance, Rand Mac Nally.

Schwarz, A. (1994). A nation in waiting: Indonesia in the 1990s. Sydney, Allen and Unwin.

Shepherd, W. F., A. Szirmai, et al. (1998). "Indonesian manufacturing sector output and productivity: An Australian comparative perspective." Bulletin of Indonesian Economic Studies **34**(2): 121-142.

Shleifer, A. and R. Vishny (1986). "Large Shareholders and Corporate Control." Journal of Political Economy **94**: 461-488.

Shleifer, A. and R. Vishny (1997). "A survey of corporate governance." Journal of Finance **52**: 737-783.

Sjöholm, F. (1997a). Exports, imports and productivity: Results from Indonesian establishment data, Stockholm School of Economics.

Sjöholm, F. (1997b). Technology gap, competition and spillovers from Direct Foreign Investment: Evidence from establishment data, Stockholm School of Economics.

Soehoed, A. R. (1967). "Manufacturing in Indonesia." Bulletin of Indonesian Economic Studies **8**: 65-84.

Soehoed, A. R. (1988). "Reflections on industrialisation and industrial policy in Indonesia." Bulletin of Indonesian Economic Studies **24**(2): 43-57.

Soesastro, H. (1989). "The political economy of deregulation in Indonesia." Asian Survey **29**(9).

Soesastro, H. and P. Drysdale (1990). "Survey of recent developments." Bulletin of Indonesian Economic Studies **26**(3).

Soesastro, H. (1993). Trade: The future engine of growth for Indonesia. Private Investment and Trade Opportunities. Honolulu, East-West Center. **10**.

Stiglitz, J. E. (1996). "Some Lessons from the East Asian Miracle." The World Bank Research Observer **11**(2): pp. 151-77.

Stulz, R. (1988). "Managerial control of voting rights." Journal of Financial Economics(20): 25-59.

Szirmai, A. E. (1994). "Real output and labour productivity in Indonesian manufacturing, 1975-90." Bulletin of Indonesian Economic Studies **30**(2): 49-90.

Tabor, S. R. (1992). Agriculture in Transition. The oil boom and after: Indonesian economic policy and performance in the Soeharto era. A. Booth, Oxford University Press.

Tarmidi, L. T. (1996). "Changing structure and competition in the Kretek cigarette industry." Bulletin of Indonesian Economic Studies **32**(3): 85-107.

Temple, J. (1997). "St Adam and the Dragons: Neo-classical Economics and the East Asian Miracle." Oxford Development Studies **25**(3): pp.279-300.

Thee, K. W. and K. Yoshihara (1987). "Foreign and domestic capital in Indonesian industrialization." Southeast Asian Studies **24**(4): 327-349.

Thee, K. W. (1993). Industrial structure and small and medium enterprise development in Indonesia. Washington DC, World Bank.

Thee, K. W. (1994). Indonesia. Industrial Structures and the Development of Small and Medium Enterprise Linkages: Examples from East Asia. S. D. Meyanathan. Washington, D.C., World Bank.

Timmer, M. P. (1999a). "Indonesia's ascent on the technology ladder: Capital stock and total factor productivity in Indonesian manufacturing, 1975-1995." Bulletin of Indonesian Economic Studies **35**(1): 75-97.

Timmer, M. (1999b). The Dynamics of Asian Manufacturing: A Comparative Perspective, 1963-1993. Eindhoven, Eindhoven University of Technology: 261.

Tsurumi, Y. (1980). Japanese investment in Indonesia: Ownership, technology transfer and political conflict. The Indonesian Economy. G. Papanek. New York, Praeger: 295-323.

Tybout, J. R., J. de Melo, et al. (1991). "The effect of trade reforms on scale and technical efficiency: New evidence from Chile." Journal of International Economics **31**: 231-50.

Tybout, J. R. (1992). "Linking trade and productivity: New research directions." World Bank Economic Review **6**(2): 189-211.

Tybout, J. R. (1996). Heterogeneity and Productivity Growth: Assessing the Evidence. Industrial Evolution in Developing Countries: Micro patterns of Turnover, Productivity, and Market Structure.

M. J. R. a. J. R. Tybout, published for the World Bank, Oxford University Press: 43-72.

Tybout, J. (2000). "Manufacturing firms in Developing Countries: How well do they do, and why?" Journal of Economic Literature **XXXVIII**(March 2000): 11-44.

US Bureau of Economic Analysis (1999). Fixed Reproductible Tangible Wealth in the United States, 1925-94, US Department of Commerce.

Vial, V. (1999). Institutions, structures de propriete et performances des entreprises: Une analyse issue de la théorie des institutions - Application au cas de l'Indonésie. Departement d'Economie. Paris, Universite Paris 1 Pantheon-Sorbonne.

Vial, V. (2000). Financial market development, firm's financing patterns and ownership structure: The case of Indonesia 1880-1998. Department of Economic History. London, London School of Economics.

Wade, R. (1990). Governing the Market. Princeton, Princeton University Press.

Warr, P. G. (1984). "Exchange rate protection in Indonesia." Bulletin of Indonesian Economic Studies **20**(2): 53-89.

Warr, P. G. (1992). "Comparative advantage and protection in Indonesia." Bulletin of Indonesian Economic Studies **28**(3): 41-70.

Weinstein, D. and Y. Yafeh (1995). "Japan's corporate groups: Collusive or competitive? An empirical investigation of keiretsu behavior." Journal of Industrial Economics **XLIII**(4): 359-376.

Weinstein, D. and Y. Yafeh (1998). "On the Costs of a Bank-Centered Financial System: Evidence from the changing main bank relations in Japan." Journal of Finance **53**: 635-672.

Weiss, A. and N. Nikitin, "," (1998). "Corporate Governance in the Czech Republic." Boston University, mimeo.

Wibisono, M. (1989). "The politics of Indonesian textile policy: The interests of government agencies and the private sector." Bulletin of Indonesian Economic Studies **25**(1): 31-52.

Williamson, O. (1975). Market and Hierarchies. New York, Free Press.

Williamson, O. E. (1985). The Economic Institutions of Capitalism. New York, NY, The Free Press.

Winkler, A. (1998). "Financial development, Economic Growth and Corporate Governance." Working Paper Series : Finance & Accounting, N°12, February 1998, Johann Wolfgang Goethe-Universität, Frankfurt am Main, Fachbereich Wirtschaftswissenschaften.

Witoelar, W. (1983). Ancillary firm development in the motor vehicle industry in Indonesia. The motor vehicle industry in Asia: A study of ancillary firm development. K. Odaka. Singapore, Singapore University Press: 17-84.

Wolfenzon, D. (1999). "A Theory of Pyramidal Structures." Harvard University, mimeo, February.

World Bank (1993). The East Asian Miracle. Economic Growth and Public Policy. New York, Oxford Univerty Press.

World Bank (2000). Development Indicators. Washington.

Wymenga, P. (1991). "The structure of protection in Indonesia in 1989." Bulletin of Indonesian Economic Studies **27**(1): 127-53.

Yafeh, Y. (1995). "Corporate ownership, profitability, and bank-firm ties: Evidence from the American occupation reforms in Japan." Journal of the Japanese and International Economies **9**: 154-173.

Yoshihara, K. (1988). The rise of ersatz capitalism in Southeast Asia. Singapore, Oxford University Press.

Young, A. (1995). "The tyranny of numbers: Confronting the statistical realities of the East Asian growth experience." Journal of Economics **CX**(3, August): 641-680.

Zingales, L. (1994). "The value of the voting right: a study of the Milan stock exchange experience." The review of Financial Sudies **7**: 125-148.

Zou, L. (1992). "Ownership Structure and Efficiency: An Incentive Mechanism Approach." Journal of Comparative Economics **16**: 399-431.