# FDI and the Dynamics of Productivity: Microeconomic Evidence

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**Abstract**

This paper examines productivity growth in the Indonesian manufacturing sector. We use a longitudinal data set to calculate the effects on aggregate manufacturing productivity growth from improvements within establishments, from reallocation of market shares, and from the turnover of plants. The difference between domestic and foreign owned plants is examined together with a calculation of the foreign owned plants' contribution to overall productivity growth. Productivity growth is mainly explained by reallocation of market shares and from turnover of plants. In addition, we find foreign plants to contribute significantly to overall productivity growth and there is a difference in the causes to productivity growth between foreign and domestic plants.

JEL classifications: D24; F23; O53

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## 1. Introduction

The micro pattern of productivity growth has in recent years become a field of intensive empirical research, and it has been shown that aggregate industry productivity figures hide a complex dynamics of plants' performances. An industry's aggregate productivity can increase through several different mechanisms: from improvements in the productivity in all plants; from increased market shares among plants with relatively high levels and growth of productivity; or through the entrance of plants with high productivity levels and exits of plants with low productivity levels. This paper aims at examining the pattern of productivity growth in a developing country – Indonesia – with a special focus on the heterogeneity of plants' performances.

There is in developing countries an additional dimension of heterogeneity that may be of large importance - that of foreign versus domestic ownership. It is well documented that foreign owned plants have higher productivity levels than domestically owned ones.[1] Less explored is whether foreign and domestic plants exhibit a different pattern of productivity growth. There are reasons to expect such difference since domestic and foreign plants often differ in characteristics such as size, age, and the skill level of their labor force. In addition, they have different access to technology. Multinational corporations (MNCs) conduct a large share of the world's R&D and they posses the bulk of the world's stock of advanced commercial technologies. Most R&D is conducted within the parent company and the results are transferred to affiliates abroad.[2] Although it is possible for other firms to acquire technology through licensing agreements, empirical evidence suggests that such technology is

[1] See e.g. Blomström (1988).
[2] For a discussion see Globerman (1997).

less sophisticated.[3] The productivity gain from new technology is therefore likely to be larger for affiliates of MNCs than for locally owned firms.

Hence, we may expect some differences in productivity growth between domestic and foreign plants in developing countries, but the issue has so far been left out from the literature. Again, this paper examines the microeconomics of productivity growth in the Indonesian manufacturing sector. We contribute to the literature by examining the differences between domestically and foreign owned plants. In addition, we calculate the foreign contribution to the overall productivity growth of the Indonesian manufacturing sector.

Our results show positive manufacturing productivity growth in Indonesia, but the performance differs substantially between sectors. Reallocation effects cause most of the growth: plants with high productivity growth have increased their market shares. Unlike most other studies, we do also find a substantial turnover effect on aggregated productivity. Finally, the foreign share of TFP growth exceeds the foreign output share.

The paper is organized as follows. Section 2 surveys previous literature in the area. Section 3 describes the Indonesian manufacturing sector and section 4 examines the productivity growth. There is also a concluding section.

## 2. The literatures

Before we proceed with our own analysis it is in place to make a survey of previous theoretical and empirical work in the area of firm heterogeneity and productivity. The section is deliberately brief as Caves (1998), and Foster et al. (1998) provide more comprehensive surveys.

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[3] See e.g. Behrman and Wallender (1976), Mansfield and Romeo (1980), Davidson and McFetridge (1985), and McFetridge (1987).

*2.1 Theoretical models*

The field of economic growth has seen a large body of new theoretical research during the last years.[4] This endogenous growth literature focuses on explaining country differences in economic growth and provides several new valuable insights. However, the typical endogenous growth model with homogenous firms is less suited for analyses of differences in firm level growth rates. In other words, while the endogenous growth models may explain why Korea has grown faster than the Philippines (Lucas, 1993), they do not explain why some firms grow faster than others do.

The theoretical literature on heterogeneity and growth is still rather scarce. Most work focuses on uncertainties as the explanation to differences in firms' growth rates. The uncertainty can be, for instance, about the own firm's chances of success in a market. Jovanovic (1982) assumes that firms are uncertain about their costs of production but that the longer they are present on the market, the clearer are they about their possibility to compete. More precisely, the true cost of production is assumed to vary randomly around a fixed known component and the variance decreases with time. Sunk entry costs may then lead firms to enter at a small scale. When the actual cost gets clearer to the firm, it may choose to exit the market if it finds it difficult to compete, or it may choose to expand if it realizes that it is competitive. Hopenhayn (1992) and Hopenhayn and Rogers (1993) construct similar models where the uncertainty is about the firm's future productivity. Sunk costs for entering the market or costs for adjustments of the firm's labor, together with stochastic productivity shocks, generate an outcome of entries and exits of firms. Roberts and Weitzman (1981) and Lambson (1991) have constructed other models, where the uncertainty instead is about future demand or the cost-effectiveness of different technologies. Pakes and Ericson (1987), and Pakes and McGuire (1994) construct models with learning externalities and imperfect competition. Firms can invest in technology, quality upgrading, or stocks of fixed inputs. The outcome of the investment is uncertain and depends on the strategies of the competing firms.

A final branch of models is not built on uncertainty, but on various characteristics of capital investment, such as capital vintages (Caballero and Hammour, 1994, and Campbell, 1997) and technology embodiment (Cooper et al., 1997). Sunkness of investment in capital generates differences in firms' performance.

Hence, there are a number of theoretical models which explain a dynamic industry evolution where firms enter the market and, if successful, grow; and where other firms deteriorate and leave. It is also clear from the theoretical literature that the heterogeneity is caused by different behavior between firms in choice of technology, scale of investment, and quality of products. Again, domestic and foreign firms are likely to differ in such characteristics. As a consequence, there may be a different pattern of productivity growth between foreign and domestic firms.

### *2.2 Empirical results*

The empirical literature on heterogeneity and productivity divides aggregate productivity growth in to different components: improvements within plants - the fixed effect; reallocation of output shares to establishment with high levels or growth of productivity - the share effect; and entry of establishment with high levels of productivity or exit of plants with low levels of productivity - the turnover effect. Slightly different variants of such methodology have been used on data from Canada, (Baldwin and Gorecki, 1991), Chile (Levinsohn and Petrin, 1999), Chile and Colombia (Liu and Tybout, 1996), Israel (Griliches and Regev, 1995), Taiwan (Aw et al., 1997), and U.S. (Bailey et al., 1992, Olley and Pakes, 1996, and Foster et al., 1998). The studies differ in some important respects: in the unit of observation - firms or plants; the

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[4] See e.g. Romer (1986 and 1990), Lucas (1988), and Grossman and Helpman (1991).

status of the country - developed or developing; the methodology - productivity index or econometric estimation; and the measurement of productivity - TFP or labor productivity. Hence, it is not surprising that the studies find different determinants to aggregate productivity growth. Still, some conclusions can be drawn from the literature. Firstly, improvements within firms are in general the most important component of productivity growth. On the contrary, the turnover effect is in most studies of little importance, although there are exceptions such as the study by Aw et al. (1997). The low importance of turnover seems to be caused by small output shares for firms that enter as well as exit the market. However, it has also been found that firms that exit the market have shown a downward trend in productivity and firms that enter the market tend to grow rapidly (Caves, 1998, p.1973). Hence, although turnover has low importance in the short run, it is presumably important in the long run for productivity growth. The share effect, finally, is important in some of the studies, most notably in the studies by Olley and Pakes (1996), Foster et al. (1998), and Levinsohn and Petrin (1999).

## 3. The Indonesian Manufacturing Sector

Manufacturing production was of low importance in Indonesia as late as in the beginning of the 1980s, and the country depended on the oil sector. Government regulations and a general poor investment climate were effectively restraining any expansion of the manufacturing sector with the exception of a few protected industries such as cement, fertilizers and steel (Pangestu 1997, p. 194). Falling prices on oil and other raw materials in the mid 1980s forced the government to attend a new development path with greater emphasis on manufacturing production. Several measures were taken and special attention was given to the FDI regime which since the beginning of the 1970s had been very restrictive. The reforms included reductions in import licensing restrictions and relaxation of foreign investment rules.[5] The emergence of China as a host of foreign direct investment (FDI) in the beginning of the 1990s, and a more favorable investment environment in other parts of Southeast Asia, forced Indonesia to continue the liberalization. Hence, in 1992 foreign investors were allowed to own 100 per cent of the equity in certain projects and in 1994 the number of such projects was increased together with an abolishment of the mandatory reinvestment policy. The severe economic crisis, starting in 1997, has led to further liberalization and deregulation of the Indonesian economy. For instance, the Indonesian government has been pressured by the IMF to open new sectors of the economy to foreign firms. The FDI regime is now as liberal as it was in the late 1960's - before the regulation of the regime started - and is broadly in line with the FDI regimes in most other countries in the region.

The manufacturing sector experienced a rapid growth in output and employment as a result of the various policy changes. For instance, the share of manufacturing in GDP increased from 12 per cent in 1980 to almost 25 per cent in the mid 1990s. The growth in the first half of the 1990s was particularly impressive. Table 1 shows that gross output in the Indonesian manufacturing sector increased with over 100 per cent and employment with 61 per cent between 1990 and 1995. The high growth was not caused by an expansion of a limited number of sectors. Instead, all sectors increased growth in both gross output and employment, with one exception - employment in Rubber products. The growth of gross output and employment are showing a similar sector wise pattern with the highest growth figures in sectors such as Footwear, Electrical goods, Professional goods, and Other manufactures.

As previously said, there has been deliberate efforts to attract FDI to Indonesia since the mid 1980s. The liberalization of the FDI regime coincided with a search for low cost production sites by firms from Japan and other Asian countries. The combined effect was a sharp increase in foreign production in Indonesia. It is seen that foreign growth has been

[5] See e.g. Guillouet (1990), and Thee and Pangestu (1995).

substantial and by wide margin exceeds the domestic plants' growth. The foreign real gross output increased with 212 per cent (compared to 87 per cent for domestically owned plants), and employment with 169 per cent (56 per cent). There are some sectors where both domestic and foreign activities have grown rapidly - Textile, Footwear, Furniture, and Professional goods - but there are also sectors where foreign activity has increased substantially without a similar expansion of domestic plants – Clothes, Leather, Printing, Plastics, Electrical goods, and Other manufactures.

Table 1.

The sector distribution of gross output and employment is shown in Table 2. Textiles overtook Food products and became the largest sector in terms of gross output in 1995 in addition to being the largest employer. Other large sectors are Tobacco, Wood, Electrical goods and Transport equipment. The industry distribution is rather stable between 1990-95, but Electrical goods and Transport equipment have increased their shares substantially.

Table 2.

Despite the rapid expansion of foreign plants, they still only constitute a minor share of total manufacturing, 29 per cent of gross output and 17 per cent of employment in 1995. The foreign share exceeds 50 per cent only in three industries in terms of gross output - Electrical goods, Other manufactures, and Non-ferrous metals - and in two industries in terms of employment – Petroleum refinery and Electrical goods.

To sum up our discussion so far, we have seen that the whole Indonesian manufacturing sector has increased output and employment between 1990 and 1995, but that the growth varies substantially between sectors. Furthermore, the growth has been fueled by an expansion of FDI.

## 4. The Dynamic Pattern of Productivity Growth

### 4.1 *Measurement*

We use two productivity measures: output per employee (labor productivity) and total factor productivity (TFP). To calculate TFP, we use a neoclassical production function with constant return to scale where $Q_{it}$ is output of plant *i* in year *t*, $L_{it}$ is labor inputs, $K_{it}$ is capital inputs, and $M_{it}$ is material inputs including energy:

$$Q_{it} = F(L_{it}, K_{it}, M_{it}). \tag{1}$$

The index of plant-level TFP is measured as

$$\ln TFP_{it} = \ln Q_{it} - \alpha_L \ln L_{it} - \beta_K \ln K_{it} - \gamma_M \ln M_{it}. \tag{2}$$

Then the level of industry productivity in year *t* is represented by the following index:

$$\ln TFP_t = \sum_{i=1}^{n} \theta_{it} \ln TFP_{it}, \tag{3}$$

where $\theta_{it}$ is the share of the *i*th plant in industry output. The growth of the industry TFP over the period $t-\mu$ to *t* is then calculated as

$$\Delta \ln TFP_t = \ln TFP_t - \ln TFP_{t-\mu}. \tag{4}$$

Outputs and inputs are measured in 1993 constant prices. The factor elasticities ($\alpha_L$,$\beta_K$, and $\gamma_M$) in equation (2) are the industry average factor cost shares, averaged again over $t$ and $t$-$\mu$.

Industry productivity growth between $t$- $\mu$ and $t$ in equation (4) can be decomposed into contributions of plants which continued to operate in the same business line for the observed period (stayers), those which entered (entrants) and those which exited (exits). The most widely used decomposition methodology is the one developed by Baily et al. (1992):

$$\Delta \ln TFP_t = \sum_{i\in S} \theta_{it-\mu} \Delta \ln TFP_{it} + \sum_{i\in S} \Delta\theta_{it} \ln TFP_{it} + \left( \sum_{i\in N} \theta_{it} \ln TFP_{it} - \sum_{i\in E} \theta_{it-\mu} \ln TFP_{it-\mu} \right), \quad (5)$$

where $S$, $N$ and $E$ stand for stayers, entrants, and the exits respectively. Productivity growth among the stayers is broken down in two parts: improvements in each plant separately holding output shares constant, and changes in output shares. The former is called fixed effect and the latter, share effect.

However, some drawbacks with the methodology above have recently been discussed in Foster et al. (1998, pp. 16-17). One problem is the treatment of net entry. In equation (5), the contribution of net entry or the turnover effect is measured as the difference between the weighted average of entrants and exiting plants. Even if there are no differences in productivity between entering and exiting plants, we may conclude positive effects of net entry if the output share of the former is greater than that of the latter. This measurement problem is especially significant in the case of rapidly growing countries such as Indonesia, where the number of entering plants are far greater than exiting ones and where the estimates of net entry therefore are biased upwards. There are related problems in the treatment of stayers as well. Therefore, we use an alternative decomposition methodology suggested by Foster et al. (1998, p. 16):

$$\Delta \ln TFP_t = \sum_{i\in S} \theta_{it-\mu} \Delta \ln TFP_{it} + \sum_{i\in S} \Delta\theta_{it} \left(\ln TFP_{it-\mu} - \ln TFP_{t-\mu}\right) + \sum_{i\in S} \Delta\theta_{it} \Delta \ln TFP_{it} + \sum_{\mathrm{i}\in \mathrm{N}} \theta_{\mathrm{it}} \left(\ln TFP_{it} - \ln TFP_{t-\mu}\right) - \sum_{i\in E} \theta_{it-\mu} \left(\ln TFP_{it-\mu} - \ln TFP_{t-\mu}\right). \qquad (6)$$

The first term corresponds to the fixed effect in equation (5). The second one represents a between-plant component that reflects changing shares, weighted by the deviation of initial plant productivity from the initial industry productivity index (share effect). The third component represents changing shares of plants with relatively high productivity growth (covariance effect). The sum of the fourth and fifth terms represents the net entry or turnover effect.

In this decomposition measure, a changing output share leads to positive contribution to industry productivity growth only if a plant's productivity is higher than the initial level of the industry productivity. Similarly, an exiting plant generates positive contribution only if the plant's productivity is lower than the initial average, and an entering plant does so only if the productivity is higher than the initial average.

4.2 *Data*

The data are mainly from three sources: (1) plant-level production data from surveys of manufacturing industries of Indonesia, (2) the wholesale price indices of Indonesia compiled by Biro Pusat Statistik, and (3) the Input-Output Table of Indonesia 1990, Vol. III.

The plant-level data cover all plants with more than 20 employees for the years 1990-95. There were 16,536 plants of this size in 1990 and 21,551 in 1995, but we have for various reasons excluded some of the plants.[6] To calculate TFP growth we have to deflate nominal

[6] This type of data set is likely to suffer from typing errors as well as errors in the response to the questionaire. Therefore, the following establishments were excluded from the analysis: (a) plants with incomplete data, (b) plants with TFP which falls below or exceeds the industry average productivity by 200 per cent, (c) plants with

values of materials and output to obtain real values. It also requires the construction of real capital stocks and the construction of factor cost shares. Real output was obtained by dividing nominal values by the wholesale price index (1993=100). Real material inputs were obtained by dividing nominal values by input deflators that we constructed with the wholesale price index and the 1990 input-output Table of Indonesia (Biro Pusat Statistik, 1991). Due to a lack of reliable series of investment data at the plant level, we used the book value of capital to construct real capital stocks.[7]

To estimate output elasticities, the factor cost shares of labor, capital, and materials were calculated. Labor costs include wages of both production and non-production workers and material costs are expenditures on materials and purchased services. Under the assumption of constant returns to scale, the capital share is obtained by subtracting the labor and material shares from one.

### 4.3 *Results*

Tables 3 and 4 show growth in TFP and labor productivity at a two-digit level of ISIC.[8] The growth pattern is rather similar between the two measures; sectors with high labor productivity growth have in general shown high TFP growth. Moreover, the causes of productivity growth are similar between TFP and labor productivity. There is not, however, any one-to-one correspondence between sector wise rankings of various effects. In other

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no change in any of the included variables over the 1990-95 period, (d) plants which did not respond to the questionaire themselves but where the figures instead were estimated by the statistical office.

[7] It would be preferable to construct capital stocks using annual investment data and an estimate of an initial capital stock. However, Baily et al (1992) reported little differences between results with the book value of capital and those using carefully constructed capital series. One reason could be that capital constitute, in comparison to labor and materials, a minor cost share and that measurement errors in the capital stock therefore generates a relatively small impact on the TFP figures. The book value of capital was deflated by a price index for new capital goods.

[8] Industry productivity growth was calculated at the 3-digit level of ISIC. The results are shown in Tables A.2 and A.3. For reasons of clarity, we show industry productivity growth at the 2-digit level of ISIC in the main text. Output shares were used as weights in aggregating the figures.

words, the sector with for instance the highest fixed effect is not necessarily the same in TFP and labor productivity calculations. Another difference is that the size of labor productivity growth is relatively high, which suggests that accumulation of capital and intermediate products explain large parts of the Indonesian manufacturing growth.

If we concentrate on growth in TFP, it is seen that the aggregate figure for the Indonesian manufacturing sector is close to 10 per cent, or about 2 per cent annually. This figure is similar to growth rates found in many industrialized countries and also broadly in line with Indonesian TFP figures in other studies.[9] Hence, the poor TFP performance in many East Asian countries is not corresponded in the Indonesian manufacturing sector in the first half of the 1990s.[10] However, the TFP performances differ substantially between sectors. Some sectors show very high growth rates; Food, and Other Manufactures have experienced growth of about 30 per cent. On the contrary, Wood products had a negative TFP growth of about 8 per cent. The figures on labor productivity confirms the picture above with Textiles and Chemicals being additional high growth sectors.

If we look at different causes to productivity growth, it is seen that the most important effect is the covariance effect; plants with high increases in productivity have also increased their market shares. This effect is positive in all but one sector and is frequently larger than the total growth rate. The other reallocation effect, the share effect, is negative in most industries, showing declining market shares for plants with relatively high levels of productivity in 1990.

The fixed effect is negative but small in most sectors, but there are a few interesting exceptions. For instance, the fixed effect explains a large part of the growth in the two sectors with the highest TFP growth, Food and Other Manufactures. As previously said, the fixed effect is a measure of productivity growth experienced by general technological

[9] For a survey of the literature see Aswicahyono and Hill (1999). Their own calculations are higher than most other studies. For instance, TFP growth between 1989-1993 is calculated to six per cent annually.

improvements within the plants. Hence, the results suggest that sectors with the highest productivity growth have achieved this growth through technological upgrading.

Finally, the turnover effect amounts to about 4 per cent TFP growth. Hence, the ratio of the turnover effect to total TFP growth is about 0.41, which is substantially higher than in most other studies. The positive effect is caused both by plants with above average productivity levels that enter the market, and by plants with below average productivity levels that exit the market. The former effect dominates. The turnover effect is particularly large and positive in Food; Other Manufactures; and Metal Industries. In the former two sectors because of entries of highly productive plants and in the latter because of exits of plants with low productivity. On the contrary, the turnover effect is negative in Wood and Non-Metal products because of entries of plants with low productivity levels.

Table 3.

Table 4.

As previously said, there are reasons to expect a different pattern of productivity growth between domestic and foreign plants. Tables 5 and 6 divide the productivity figures in contribution by foreign and domestic plants. The domestic contribution to overall TFP growth is 6.3 percentage points. The bulk of this growth is caused by the covariance effect: domestic plants with high productivity growth have increased their market shares.

The foreign plants' contribution to TFP growth exceeds their share of output. More specifically, the foreign average output share between 1990-95 is 25 per cent (see Table 2), whereas the contribution to overall TFP growth is in Table 5 seen to be 29 per cent.[11] The high growth of domestic plants in the large Food, Beverages and Tobacco sector (ISIC 31) has

[10] See e.g. Kim and Lau (1994) and Young (1995) on TFP growth in East Asia.
[11] Calculated as 2.6/(6.3+2.6).

a large positive impact on the overall domestic contribution to productivity growth. By the same token, the Food, Beverages and Tobacco sector shades the superior TFP performance of foreign plants in many other sectors. In fact, foreign plants contribute to a larger share of the growth than the substantially larger number of domestic plants in several sectors - Wood, Chemicals, Non-metal products, Basic Metals, and Other manufactures.[12]

The contribution of foreign plants to productivity growth is significantly less if we instead look at labor productivity. Although the foreign contribution to labor productivity growth exceeds the foreign share of output in some sectors, the total contribution of about 17 per cent is significantly below the foreign output share. One possible explanation to the difference between foreign contributions to TFP and labor productivity, may be that domestic plants have been accumulating more capital or more inputs.

TFP growth among foreign owned plants depends on several factors: the covariance effect is important, but so is the turnover effect. The main difference between domestic and foreign plants is that the covariance effect dominates among the former, while the covariance and the turnover effects are of almost equal importance among the latter. The ratio of the covariance effect to total TFP growth is 0.62 among foreign plants compared to 1.16 among domestic ones, and the ratio of the turnover effect is 0.54 and 0.41 respectively. The high turnover effect among foreign establishments arose more from the entry of relatively productive plants than from exit of relatively low productive ones.

Moreover, whereas the fixed effect is negative among domestic plants, it is in general positive among foreign plants. The difference in the fixed effect between domestic and foreign plants is especially noteworthy in Non-metals, and Basic metal products. Hence, there has been a general negative productivity growth in those domestic plants that were present in 1990, whereas the growth has been positive in the corresponding foreign plants. One explanation can be the possibility of foreign plants to utilize upon the pool of new technology

[12] See Table A.1 for the number of foreign and domestic establishments.

developed in the MNCs parent firms. Still, although the fixed effect is positive among foreign plants, the ratio to total TFP growth is only 0.15.

Table 5.

Table 6.

There might have been a risk that our results above would be biased if domestic and foreign plants were distributed differently within the 2-digit level of ISIC. However, figures at a 3-digit level in Tables A.2 and A.3 in the appendix suggest that the general results remain.[13] One striking feature of the 3-digit figures is the large sector wise differences in TFP growth. Some sectors show very high growth rates; Food, Tobacco, Clothes, Furniture, Non-ferrous metal, and Other manufactures have experienced TFP growth of more than 20 per cent. On the contrary, no less than 10 sectors have had negative TFP growth and Beverage, Footwear, and Professional goods, have had a particular poor TFP development.

*4.4 Discussion*

We did not find general technological improvements, as captured by the fixed effect, to explain much of the productivity growth in the Indonesian manufacturing sector. This contrasts most other studies where the fraction of the fixed effect to total TFP growth ranges from 0.23 to 1.0, and the fraction to labor productivity growth ranges from 0.79 to 1.20 (Foster et al., 1998 p.12). As a comparison, we found a negative effect although foreign plants are exceptions with positive, albeit small fixed effects. Our study also differs by the high turnover effect, which is not found in other countries. The study by Aw et al. (1997) is an exception. They find that the turnover effect is of large importance for the overall productivity growth of the Taiwanese manufacturing sector. It is worth noting that we find a substantial turnover effect despite our choice of methodology, which in comparison with the methodology used by Aw et al. gives a lower effect attributed to turnover.

The fixed effect has in previous studies been found cyclical; it tends to decrease in economic slumps and increase in economic booms. On the contrary, the share and the turnover effects have been found counter-cyclical; plants with low productivity are forced out of the market or face decreasing market shares during economic recessions. Since the Indonesian economy has been experiencing a boom rather then a slump during the studied time period, it seems that Indonesia again stands out as having a different pattern of productivity growth than many other countries.

Institutional factors may be one likely explanation to a relatively low importance of the fixed effect and relatively high importance of the covariance and the turnover effects. Indonesia has during the examined period continued the liberalization that started in the mid 1980s. Hence, trade barriers have been removed together with entry restrictions on FDI and a host of other regulations. In such an environment it is likely that there will be a large turbulence with successful firms taking advantage of export opportunities and increasing their output shares, and weak firms being forced out of the market by increased foreign competition. As a result, share and turnover effects are important. Accordingly, new FDI have not been forced to enroll in domestic ownership sharing. In addition, some foreign firms have been allowed to buy out the domestic owner and thereby gaining full control of the firm. It seems likely that such foreign firms have an incentive to transfer relatively sophisticated technology to their affiliates, since they do not run the same risk of having the technology stolen by a share owner (Blomström and Sjöholm, 1999). Again, this could result in the observed pattern of large covariance and turnover effects among foreign plants and may also explain why foreign plants have a comparable large fixed effect.

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[13] Figures on labor productivity are not shown but are available from the authors on request.

One striking result is the large difference in productivity growth between sectors, and in the causes to this growth. Foster et al. (1998) find similar difference between sectors in US. Hence, the growth pattern differs not only between, but also within countries. An obvious area for future research is to examine what causes this difference between countries and sectors. Possible explanations may include the maturity of the goods and industries, the degree of competition, entry barriers and protection, business cycles, and the R&D intensities.

## V. Concluding Remarks

The Indonesian manufacturing sector has shown a reasonable productivity growth over the 1990-95 period. However, unlike many other countries, the productivity growth was not mainly generated through improvements within plants. Instead, increased market shares for plants with high productivity growth and entry of plants with relatively high productivity levels explains most of the productivity growth.

The contribution of foreign plants to aggregate TFP growth exceeds their output share. The contribution is substantial in some sectors where FDI can bee seen as an important engine of productivity growth. Moreover, there is a difference between domestic and foreign plants in the causes to productivity growth. In the former, the covariance effect is dominant, while in the latter the net entry effect is equally important. In addition, foreign plants have a positive fixed effect which may be caused by their access to technology from the parent firms.

Finally, our results also show that the performance differs substantially between sectors. To investigate what causes the difference is an area for future research.

## Appendix

Table A1.

Table A2.

Table A3.

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