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Foreign Ownership and Productivity in the Indonesian Automobile Industry
Evidence from Establishment Data for 1990–99

Keiko Ito

7.1 Introduction

Many a developing country's government has attempted to utilize foreign direct investment (FDI) in its industrialization and technology development efforts. In the traditional theory of multinational corporations (MNCs), FDI by MNCs is regarded as the movement of managerial resources (in other words, the intangible assets related to technological knowledge in production and marketing as well as managerial know-how). A large body of literature on MNCs suggests that MNCs are more productive than local companies because of the advantages embodied in their managerial resources (e.g., Dunning 1988; Caves 1996; Markusen 1991). Moreover, the entry of MNCs may also affect overall productivity levels by bringing new ideas or increasing the level of competition in the market. This suggests that a larger presence of MNCs may play an important role in increasing productivity levels in the host country as higher-productivity foreign-owned production replaces lower-productivity domestic production.

Taking these hypothesized roles of MNCs as their point of departure, many researchers have investigated productivity gaps between MNCs and local firms, and technology transfer from MNCs to local firms, by conducting descriptive analyses based on interviews and questionnaires or calculating various productivity measures. Using establishment-level data, many studies report that foreign-owned establishments are more efficient

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than local ones, suggesting that foreign ownership seems to be an important determinant of productivity in manufacturing in some countries.[1] On the other hand, there are some studies that found the difference between foreign and local plants not to be pervasive—for example, in Canada and Thailand.[2] Therefore, in light of the findings of previous studies, the so-called "ownership advantage" in the theory of MNCs has not always been corroborated, and MNCs do not always exploit firm-specific advantages in terms of productivity.

There are thus two empirical questions that I seek to shed light on in this paper. First, are foreign plants more productive than local plants, as MNC theory predicts? Second, if so, what are the determinants of the productivity of plants? Even though many previous studies have tried to answer these questions, comprehensive empirical evidence offering conclusive answers—particularly regarding the second question—is very limited.

This paper examines these issues in as much detail as possible, using the establishment-level data provided by Indonesia's Badan Pusat Statistik (BPS or Statistics Indonesia), taking the Indonesian automobile industry as a case. Most automobile firms in Indonesia were established by major Indonesian conglomerates as a joint venture or under a licensing agreement with foreign (principally Japanese) automakers. Despite government efforts to foster the industry for more than thirty years through high degrees of protection and intense policy intervention, the Indonesian automobile sector still remains in its infancy (Okamoto and Sjöholm 2000; Aswicahyono, Basri, and Hill 2000). Although it is difficult to directly test the effect of policy or institutional factors on plant productivity due to data constraints, this paper aims at evaluating the quantitative plant performance as well as investigating the industry characteristics using the establishment-level data.

Given the dominant position of foreign—principally Japanese-affiliated—

1. For example, in their study on the British manufacturing sector, Griffith and Simpson (2001) suggest that foreign-owned establishments have significantly higher labor productivity than those under domestic ownership. Doms and Jensen (1998), using U.S. plant-level data, found that U.S. multinational plants had the highest labor productivity, foreign-owned establishments had the second highest labor productivity, and U.S.-owned nonmultinational plants had the lowest. Using Indonesian establishment-level data, Blomström and Sjöholm (1999), Sjöholm (1999), Takii and Ramstetter (2000), and Takii (2002) all found that foreign establishments showed a higher productivity than local ones. In addition, Aitken and Harrison (1999) also found that in Venezuela plant productivity is positively correlated with foreign participation.

2. In Globerman, Ries, and Vertinsky's (1994) study using Canadian plant-level data, although foreign-owned plants were found to have a higher labor productivity, the differences disappear after size, capital intensity, and the share of nonproduction workers are controlled for. Ramstetter (2001b) compares average labor productivity between groups of foreign MNCs and local plants in Thai manufacturing, using establishment-level data for 1996 and 1998. He found that the vast majority of comparisons revealed that differences between local and foreign plants were statistically insignificant. His other studies also found no strong evidence suggesting that foreign establishments enjoy systematically higher productivity levels than local ones in Thailand (Ramstetter 1999, 2001a).

automakers in the Indonesian market, it might be expected that foreign-affiliated automobile manufacturers and auto parts suppliers should have been at the forefront of the development of the automobile industry in Indonesia. However, Okamoto and Sjöholm (2000), examining productivity performance and its dynamics in the Indonesian automobile industry between 1990 to 1995, concluded that productivity of the overall industry did not improve during that period, although foreign establishments tended to show a better performance than local ones. Rather, all the productivity measures (i.e., gross output per employee, value added per employee, and TFP) decreased from 1990 to 1995. Although their analysis is limited to a simple comparison of descriptive statistics between 1990 and 1995 or between local and foreign establishments, their results imply that the spillover effect of foreign MNCs does not seem to have been strong.

The productivity differentials between local and foreign plants in the automobile industry have been investigated in other countries as well. Okamoto (1999) analyzed the impact of Japanese FDI on the productivity of the U.S. auto parts industry using establishment-level data. She calculated the relative TFP index for each establishment and found that Japanese-affiliated plants were less productive than their U.S. counterparts in 1992. Griffith (1999) estimated the production function of the U.K. automobile industry, using data on individual establishments located in the United Kingdom over the period from 1980 to 1992. Her results suggest that foreign-owned establishments in this industry have significantly higher levels of output per worker (more than twice as high as domestic-owned establishments). However, these differences can be almost entirely explained by differences in input levels. That is, foreign plants invest more in physical capital, use a higher level of intermediate inputs, and pay their workers higher wages. Ito (2004) investigated the efficiency gap between foreign and local establishments and the determinants of productivity in the Thai automobile industry, using establishment-level data in 1996 and 1998. Mainly relying on the 1996 data, I calculated various partial productivity measures such as output per employee, value added per employee, capital per employee, output per capital, inventory ratios, price-cost margins, and so on, as well as the relative TFP index. In the simple comparison of those productivity measures between foreign and local establishments, foreign establishments were found to exhibit significantly higher labor productivity, capital-labor ratios, and higher wages. However, the capital productivity was significantly lower for foreign establishments than for local ones in the motor vehicle bodies and the motor vehicle parts industries. The results of the regression analyses are analogous to Griffith's results and provided no strong evidence that foreign establishments enjoy higher productivity after controlling for factor intensities. Moreover, there was no evidence that foreign plants achieved higher TFP because of their advantages in managerial resources. Therefore, the results of Griffith and Ito

raised the question why domestically owned establishments were not investing in capital and/or paying their workers the same wages as foreign-owned establishments.

The aforementioned study by Okamoto and Sjöholm (2000) suggested that in the Indonesian automobile industry foreign-owned establishments tended to display higher productivity than local ones. Taking Okamoto and Sjöholm's findings and methodology as its point of departure, this paper pursues this line of enquiry further by using data for a much longer period and examines in detail the determinants of productivity and its growth by conducting regression analyses and a cost function estimation as well as a simple comparison of descriptive statistics as employed by Okamoto and Sjöholm. To this end, given the deficiencies in the BPS's establishment-level data,[3] various productivity measures will be calculated and analyzed in order to obtain robust results. First, various characteristics of automobile establishments are examined by calculating some partial productivity measures such as average variable cost and labor productivity, and other descriptive statistics. Second, by conducting ordinary least squares (OLS) regressions, determinants of the partial productivity and TFP are investigated. Third, the cost structure is examined by using the cost function framework. Finally, the growth of TFP is calculated based on the estimated cost function, and the contribution of different sources to TFP growth rate are investigated.

The remainder of the paper is organized as follows. Section 7.2 provides an overview of the development of the Indonesian automobile industry and discusses industrial organization aspects of the industry. In section 7.3, using establishment-level data, various partial productivity measures are calculated and compared in time series and between local and foreign establishments. A statistical examination of the difference between the two groups is also conducted. Section 7.4 describes the econometric model of the cost function estimation and states the methodology for the decomposition of TFP growth. Then a summary of the primary results obtained from the model estimation is presented. The final section offers some concluding remarks.

7.2 Overview of the Indonesian Automobile Industry

7.2.1 Development of the Indonesian Automobile Industry

In Indonesia, as in many other developing countries, the automobile industry is viewed as the leading edge of industrialization and skilled job cre-

3. The BPS microdata have a number of deficiencies related to nonreporting and apparently incorrect entries. For example, there were a number of apparent mistakes in the information on foreign ownership shares (e.g., foreign ownership shares of 100 percent for all but one or two random years and shares of 0 in the other years), which I corrected. Probably most problematic are the data on capital stock for each establishment. We should be cautious in using capital stock data, because their reliability is doubtful.

ation, as well as a fundamental source of positive spillovers. The Indonesian government has been nurturing the industry within the country since the late 1960s.[4] As in other Asian or Latin American countries, foreign automakers have been playing an important role in the development of the local automobile industry. Since the "new order" government assumed power in 1968, the automobile industry has received special treatment through local content rules, entry barriers, and foreign ownership restrictions (Hill 1996; Aswicahyono, Anas, and Rizal 2000). An import ban on completely built-up (CBU) cars was introduced in 1971 and remained in force until 1993, when it was replaced by tariffs ranging from 175 to 275 percent. In 1977, the government introduced a deletion program that required assemblers to use locally produced components. However, the program, which was intended to provide an opportunity for supporting industry to develop, turned out to be unsuccessful, probably due to a lack of technological capabilities of local producers, high profits required by distributors, the small production scale owing to market fragmentation, and the presence of foreign principals that kept their local agents as distributors rather than full manufacturers (Aswicahyono, Anas, and Rizal 2000). Moreover, the government used a licensing system that limited production of certain functional components such as transmissions and brake systems to one or two companies in order to ensure a minimum production scale. The system, however, not only hindered competition within the parts industry, but also led to cost increases due to small-lot production over a wide variety of products, since the one or two licensed companies were compelled to produce multiple parts under multiple brands (Takayasu, Ishizaki, and Mori 1996). As a result, although Indonesia is the second largest automobile market in the Association of Southeast Asian Nations (ASEAN)–4 countries (as of 1995), the number of auto parts manufacturers lags far behind that in Thailand (table 7.1). However, quite a few foreign auto parts suppliers (most of them Japanese) have established an affiliate in Indonesia due to the local content requirements and have been supplying major parts to automobile assemblers. The liberalization of the licensing system in 1993 and the expansion of automobile production in response to market growth in the early 1990s have brought an accelerating influx of both local and foreign parts manufacturers.[5] As in the other

4. The automobile industry is considered strategic for the following reasons: First, it supplies equipment used to meet the transportation requirement of the public; second, it creates employment opportunities in that sector and facilitates the introduction of high technology into its own and other markets; and third, it generates income for the government from import duties and taxes (Aswicahyono, Anas, and Rizal 2000).

5. The government implemented a number of deregulation packages in the 1990s. In 1993, the deletion program was replaced by an incentive program. The latter, designed to promote local parts, provided incentives to parts suppliers in the form of lower import duties on imported components, subcomponents, semifinished parts, and raw materials based on the extent of local content achieved. In 1995, the remaining components of commercial vehicles that had reached a local value-added ratio of 40 percent and of passenger cars that had reached a local value-added ratio of 60 percent were exempted from import duties. The 1995

Table 7.1 **Structure of the Automobile Parts Industry in ASEAN Countries (as of January 1998)**

	Indonesia		Thailand		Malaysia		The Philippines		ASEAN-4	
Year	Units	Shares (%)	Units	Shares (%)	Units	Shares (%)	Units	Shares (%)	Units	Share (%)
					Total Number of Parts Manufacturers					
1998	150–200		750–800		200–250		150–200		1,300–1,500	
					Japanese Affiliates or Subsidiaries					
1998	82	(46.9)	209	(27.0)	61	(27.1)	54	(30.9)	406	(30.0)
					U.S. and European Affiliates or Subsidiaries					
1998	7	(4.0)	21	(2.7)	19	(8.4)	5	(2.9)	406	(4.0)

Source: Poapongsakorn and Wangdee (2000), table 2.

ASEAN-4 countries, most of the automobiles sold in Indonesia are made by Japanese automakers (table 7.2).

Figure 7.1 shows the development of automobile production since the 1960s. Despite the protection by the government, automobile production stagnated until the late 1980s. However, the industry displayed impressive growth from the early 1990s just until the financial crisis. The crisis heavily affected the industry: Automobile production dropped by about 85 percent from 389,000 units to 57,000. Although automobile production rapidly recovered from 1999 to 2000, the number of cars produced in 2000 remained below precrisis levels.

In terms of value added, the contribution of the automobile industry to the manufacturing sector increased more than threefold, from 1.6 percent in 1975 to 5.3 percent in 1990, although this subsequently declined to 4.6 percent in 1996. The share of the automobile industry in total manufacturing employment, however, remained at only 1.4–1.5 percent throughout this period. Despite the rigorous protection and state intervention, the size and significance of the Indonesian automobile industry is still quite small compared with Thailand, where the contribution of the automobile industry to the manufacturing sector reached about 15 percent in terms of value added and 4.7 percent in terms of employment in 1996 (Aswicahyono, Anas, and Rizal 2000; Ramstetter 2001a; Ito 2004).

deregulation package also removed restrictions on investments in the automobile industry for the production of new cars. Although deregulation packages suggested a shift in the government's policy paradigm from protectionism toward a market-oriented approach, the Soeharto Administration later launched the National Car Project, which contradicted the earlier market-oriented posture. However, following the International Monetary Fund (IMF) reform program in 1998 after the crisis, the government agreed that it would discontinue the granting of special tax, customs, and credit privileges to the National Car Project (Aswicahyono, Anas, and Rizal 2000).

Table 7.2 Automobile Markets in ASEAN Countries

Year	Indonesia Units	Indonesia Shares (%)	Thailand Units	Thailand Shares (%)	Malaysia Units	Malaysia Shares (%)	The Philippines Units	The Philippines Shares (%)	ASEAN-4 Units	ASEAN-4 Shares (%)
					ASEAN Market Sales[a]					
1995	384,449	(27.7)	571,580	(36.9)	285,792	(4.1)	128,162	n.a.	1,369,983	n.a.
1996	337,399	(27.4)	589,126	(31.1)	364,789	(43.1)	162,095	n.a.	1,453,409	n.a.
1997	392,185	(30.6)	363,156	(22.8)	404,837	(41.6)	144,434	n.a.	1,304,612	n.a.
1998	167,234	n.a.	201,055	n.a.	198,787	(115.7)	86,751	n.a.	653,837	n.a.
1999	93,814	n.a.	218,330	n.a.	288,547	n.a.	74,415	n.a.	675,106	n.a.
					Sales by Japanese Manufacturers[b]					
1995	365,520	(95.1)	514,704	(90.0)	83,393	(29.2)	111,808	(87.2)	1,075,425	(78.5)
					Sales by U.S. and European Manufacturers[b]					
1995	17,137	(4.5)	46,322	(8.1)	21,706	(7.6)	1,127	(0.9)	86,292	(6.3)

Sources: Takayasu et al. (1996), tables 3, 8, 13, 17; Nikkan Jidosha Shinbun-sha (2000), *Jidosha Sangyo Handbook 2001* (Handbook of Automobile Industry 2001).

[a]Import shares in parentheses.

[b]Market shares in parentheses.

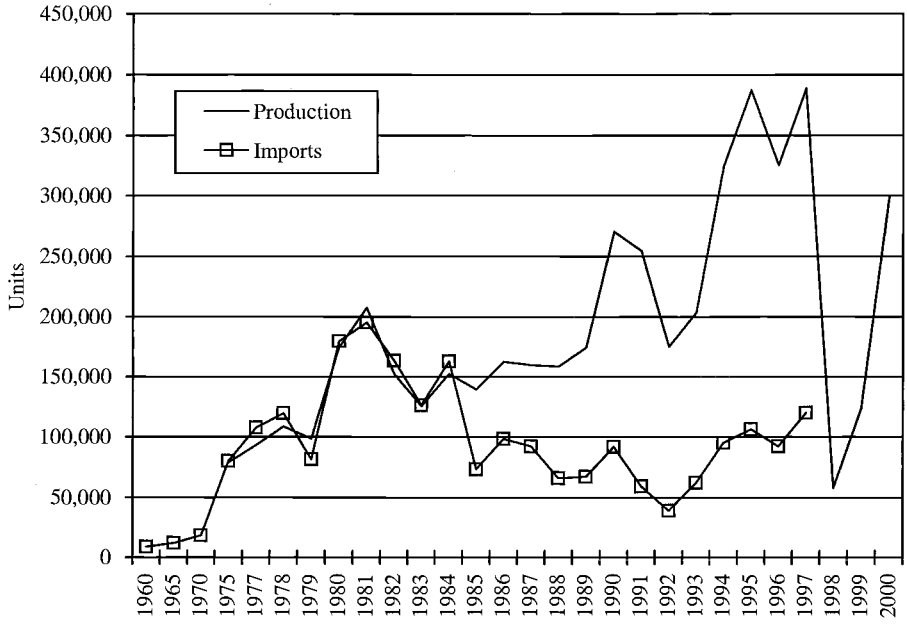

Fig. 7.1 Motor vehicle production and imports in Indonesia

Source: Nikkan Jidosha Shinbun-sha (various years).

7.2.2 Ownership and Market Structure

In the Indonesian automobile industry, foreign (particularly Japanese) firms have always been dominant players in the assembly and component sectors, except for the small-scale replacement parts segment—a pattern not untypical in developing countries. Tables 7.4 and 7.5 provide a detailed picture of the major automobile assemblers in Indonesia. Most major automobile manufacturing companies are joint ventures between local conglomerates and Japanese, European, or U.S. automakers established with the aim of gaining access to world-class technology. In 1995, there were fourteen major automobile assemblers (table 7.3). As shown in tables 7.3 and 7.4, all the assemblers rely on foreign partners, although the modalities of MNC entry have varied, depending on the regulatory environment and foreign partners' preferences.[6] Until recently, however, foreign partners were rarely able to acquire majority ownership. Another key feature of ownership patterns is a small number of local joint venture participants. The Astra group owns three manufacturers, Indomobil (Salim) group owns four, Krama Yudha group owns two, and so on. This characteristic derives in part from the highly regulated environment, in which the government virtually selected the major domestic business groups that were to participate in the industry (Aswicahyono, Basri, and Hill 2000). As a result, the Astra group holds a market share of over 50 percent, and the sum of the market shares of the three major groups (Astra, Indomobil, and Krama Yudha) reaches about 90 percent. Moreover, some assemblers produce more than one foreign brand name. Aswicahyono, Basri, and Hill point out that this feature prevents some foreign partners from having durable and close relationships with the local partner and making a major commitment to upgrading the technological capabilities of the local firm.

The Astra group, which laid its business foundations in the manufacturing of automobiles and machinery, holds a number of firms producing automobile components. According to a directory of automobile parts manufacturers (FOURIN 2000), there were 158 such automobile companies in Indonesia in the late 1990s. Out of the 158, 76 were Japanese-affiliated firms and 23 were under the control of the Astra group. Out of the 76 Japanese-affiliated firms, 15 were joint ventures with Astra group firms. Sato (1996) provides comprehensive and very detailed information on the Astra group and shows the high degree of the Astra group's vertical integration from body and general components to core components. According to her research, the Astra group is the only automaker that procures all

6. See Aswicahyono, Basri, and Hill (2000) for details. Entry to the components sector has generally been less restrictive, and in technologically less demanding segments there are some domestically owned firms that do not have formal tie-ups with foreign firms (Aswicahyono, Basri, and Hill 2000).

Table 7.3 **Major Automobile Manufacturers in Indonesia, 1995**

Group	Market Share (%)	Ethnic Group of Local Shareholders	Local Firm	Started Operation (date of establishment)	Foreign Partner	
					Joint Venture	Contract
(1) Astra	54.5	Government + Chinese	(a) Toyota Astra Motor	1972 (Apr. 1971)	Toyota (49%)	
			(b) Gaya Motor	(1955)		Daihatsu, Isuzu, Nissan, BMW, Ford, Peugeot
			(c) Pantja Motor	1974		Isuzu, Nissan
(2) Indomobil (Salim)	20.9	Chinese	(a) Indomobil Suzuki International	1991 (Mar. 1990)	Suzuki (49%)	
			(b) Ismac	1973 (Oct. 1971)		Nissan Chrysler
			(c) National Assemblers	1974 (Oct. 1971)		Mazda, Volvo, Hino
			(d) GM Buana Indonesia		GM (60%)	
(3) Krama Yudha	19.5	Pribumi[a]	(a) Krama Yudha Kesuma Motor	1981 (1970)		Mitsubishi
			(b) Krama Yudha Ratu Motor	1973 (Jun. 1973)		Mitsubishi
(4) Imora	1.3	Chinese	Prospect Motor	1975 (Jun. 1973)		Honda
(5) Bimantara	2.3	Pribumi[a] (Soeharto's son)	(a) German Motor	(1970)	Mercedes Benz (35%)	
			(b) Tricitra Karya	1995		Hyundai
(6) Starsauto	n.a.		Starsauto Dinamika	1995		Daewoo
(7) Humpus	0.0	Pribumi[a] (Soeharto's son)	Kia-Timor Motors		Kia (35%)	

Sources: Aswicahyono, Basri, and Hill (2000), table 3, pp. 220–21; Nomura (1996), table I-5, pp. 96–99.

[a]Pribumi is an Indonesian term referring to indigenous groups.

Table 7.4 **Major Automobile Manufacturers in Indonesia, 1998**

Group	Market Share (%)	Ethnic Group of Local Shareholders	Local Firm	Started Operation (date of establishment)	Foreign Partner	
					Joint Venture	Contract
(1) Astra	50.6	Government + Chinese	(a) Toyota Astra Motor	1972 (Apr. 1971)	Toyota (49%)	
			(b) Gaya Motor	(1955)		Isuzu, BMW, Ford, Peugeot
			(c) Pantja Motor	1974	Isuzu (12.5%)	
			(d) Astra Daihatsu Motor	(1992)	Daihatsu (40%)	
			(e) Astra Nissan Diesel Indonesia	1996	Nissan Diesel (12.5%)	
(2) Indomobil (Salim)	21.0	Chinese	(a) Indomobil Suzuki International	1991 (Mar. 1990)	Suzuki (49%)	
			(b) Ismac Nissan Manufacturing	1996 (1973)	Nissan (35%)	Audi, Volvo, Ssangyong
			(c) Ismac	1973 (Oct. 1971)		Mazda, Volvo, VW, Audi, Nissan, Chrysler
			(d) Hino Automobil Indonesia	Suspended	Hino (39%)	
(3) Krama Yudha	18.1	Pribumi[a]	(a) Krama Yudha Kesuma Motor	1981 (1970)	MKM (Mitsubishi Krama Yudha Motors & Mfg.) (99%)	
			(b) Krama Yudha Ratu Motor	1975 (Jun. 1973)		Mitsubishi

(4) Imora	1.8	Chinese	Honda Prospect Motor	(1992)	Honda Group (49%)	
(5) Bimantara	1.0	Pribumi[a] (Soeharto's son)	(a) Tricitra Karya	1995	Hyundai, Ford	
			(b) Bimantara Hyundai Indonesia	1999 (planned)	Hyundai (50%)	
(6) Starsauto	0.2		Starsauto Dinamika	1995		Daewoo
(7) Humpus	5.0	Pribumi[a] (Soeharto's son)	Kia-Timor Nasional	1998 (planned)	Hyundai (30%)	
(8) Mercedes-Benz Group Indonesia	1.3	Europe	Mercedes-Benz Group Indonesia	(1970)	DaimlerChrysler (95%)	
(9) GM	1.1	U.S.A.	GM Buana Indonesia	1994	GM (100%) *wholly owned by GM in 1997	

Sources: Aswicahyono, Basri, and Hill (2000), table 3, pp. 220–221; Nomura (1996), table I-5, pp. 96–99; FOURIN (2000).

[a]Pribumi is an Indonesian term referring to indigenous groups.

six functional components such as engines, chassis frames, brakes, and transmissions, within the group.[7]

After the 1997 Asian economic crisis, local partners' financial difficulties as well as sweeping liberalization allowed foreign investors to increase their ownership or newly acquire shares in Indonesian automobile firms, as can be seen in table 7.4. However, the Astra group still keeps the leading position in the Indonesian automobile industry.

7.3 Microdata and Productivity Measurement

7.3.1 The Data

The data used in this study are establishment-level unbalanced panel data for the period from 1990 to 1999 provided by Indonesia's BPS for the motor vehicle industry (BPS various years-a).[8] The data set provides information for each establishment on detailed industry classification, geographical location, type of ownership, starting year of commercial production, output, value added, materials and energy used, number of workers, wages, inventory, book value of fixed assets, and so on. Although each establishment is labeled by the same identification code for every year, the name of the establishment is not provided by the BPS. Moreover, for reasons of confidentiality, it is not allowed to expose the raw data or indexes for an establishment and to match the establishment data with other corporate data sources.[9] This study performs a thorough analysis of plant productivity at the five-digit Indonesian Standard Industrial Classification (ISIC) industry level: that is, motor vehicles (automobile assemblers, ISIC 38431/34100), motor vehicle bodies (automobile body suppliers, 38432/34200), and motor vehicle components and apparatuses (automobile parts suppliers, 38433/34300).[10] Table 7.5 shows the number of establishments,

7. With regards to these functional components, the government used a licensing system, as mentioned previously in this section. In this situation, the Astra group secured licenses for all items because Astra was in a favorable position to secure the limited licenses (Sato 1996).

8. The establishment-level data were collected for the Industrial Survey conducted annually by the BPS. Covered in the survey are large and medium establishments (i.e., all establishments employing twenty workers or more). The response rate of the annual survey is around 75–85 percent—for example, 85 percent, 84.47 percent, and 75.35 percent for the years 1991, 1995, and 1999, respectively.

9. Indeed, it is extremely difficult to identify the name of the establishment by matching it with the *Manufacturing Industry Directory* provided by the BPS, for the following reasons: (1) The directory only includes categories such as detailed industry, geographical location, and number of workers, but does not include other information such as starting year of operation and fixed assets; (2) many establishments agglomerate in some particular regions or subregions, which makes it difficult to use the location information as a key criterion; (3) information on the number of workers, which often varies in a short period, is not a good criterion particularly for medium or small establishments.

10. The ISIC was changed beginning with the 1998 survey. For the motor vehicles industry, for example, the ISIC code had been 38431 before 1998 but was changed to 34100 in 1998.

Table 7.5 **Industry Definitions by Five-Digit Indonesia Standard Industrial Classification and Employment, Output, and Value Added, by Industry**

	Motor Vehicles (38431/34100)[a]		
	1990	1995	1999
No. of Establishments (in which foreign-owned establishments)			
BPS	10	14	13
	(2)	(5)	(8)
This sample	7	7	5
	(2)	(3)	(3)
No. of Persons Engaged (share of which accounted for by foreign-owned establishments)			
BPS	7,642	14,181	10,533
This sample	5,675	7,626	5,437
	D	(75.7%)	(85.0%)
Value of Gross Output (unit: millions of rupiahs) (share of which accounted for by foreign-owned establishments)			
BPS	1,812,352	4,573,780	3,434,349
This sample	1,190,773	2,911,686	3,101,157
	D	(81.7%)	(98.1%)
Value Added at Market Prices (unit: millions of rupiahs) (share of which accounted for by foreign-owned establishments)			
BPS	854,399	2,160,723	1,741,803
This sample	663,256	1,527,761	1,537,402
	D	(92.2%)	(96.9%)
Main Country of the Investors of Foreign-Owned Establishments (this sample)			
Japan	1	1	2
United States	0	1	0
Germany	0	0	0
Korea	0	0	0
Others	1	1	1
Unknown	0	0	0
Foreign Ownership Share of Foreign-Owned Establishments (this sample)			
Distribution (%)			
0 < & <30	0	0	0
30 =< & < 50	1	2	2
50 =< & <70	1	1	0
70 =< & <90	0	0	1
90 =< & <100	0	0	0
100	0	0	0
Range (%)			
Minimum share	49	49	49
Maximum share	57	60	70

(*continued*)

Table 7.5 (continued)

	Motor Vehicle Bodies (38432/34200)[a]		
	1990	1995	1999
No. of establishments (in which foreign-owned establishments)			
BPS	118	124	81
	(7)	(2)	(1)
This sample	54	60	39
	(0)	(0)	(1)
No. of Persons Engaged (share of which accounted for by foreign-owned establishments)			
BPS	18,824	17,831	7,381
This sample	8,792	9,723	4,483
	n.a.	n.a.	D
Value of Gross Output (unit: millions of rupiahs) (share of which accounted for by foreign-owned establishments)			
BPS	340,133	429,871	293,416
This sample	104,444	179,785	144,216
	n.a.	n.a.	D
Value Added at Market Prices (unit: millions of rupiahs) (share of which accounted for by foreign-owned establishments)			
BPS	151,402	160,594	188,572
This sample	41,846	57,991	105,865
	n.a.	n.a.	D
Main Country of the Investors of Foreign-Owned Establishments (this sample)			
Japan	0	0	0
United States	0	0	0
Germany	0	0	0
Korea	0	0	0
Others	0	0	0
Unknown	0	0	1
Foreign Ownership Share of Foreign-Owned Establishments (this sample)			
Distribution (%)			
0 < & <30	0	0	0
30 =< & < 50	0	0	1
50 =< & <70	0	0	0
70 =< & <90	0	0	0
90 =< & <100	0	0	0
100	0	0	0
Range (%)			
Minimum share	n.a.	n.a.	60
Maximum share	n.a.	n.a.	60

Table 7.5 (continued)

	Motor Vehicle Component and Apparatus (38433/34300)[a]		
	1990	1995	1999
No. of establishments (in which foreign-owned establishments)			
BPS	68	121	150
	(8)	(16)	(41)
This sample	34	44	75
	(6)	(8)	(17)
No. of Persons Engaged (share of which accounted for by foreign-owned establishments)			
BPS	11,622	29,185	23,755
This sample	8,247	16,318	15,950
	(27.4%)	(26.4%)	(38.2%)
Value of Gross Output (unit: millions of rupiahs) (share of which accounted for by foreign-owned establishments)			
BPS	988,156	3,531,507	5,049,558
This sample	687,163	2,543,486	3,583,401
	(62.9%)	(51.0%)	(65.4%)
Value Added at Market Prices (unit: millions of rupiahs) (share of which accounted for by foreign-owned establishments)			
BPS	329,198	1,014,521	2,478,389
This sample	274,140	765,440	1,695,000
	(63.1%)	(68.6%)	(67.1%)
Main Country of the Investors of Foreign-Owned Establishments (this sample)			
Japan	4	6	7
United States	0	0	0
Germany	0	0	1
Korea	0	0	1
Others	0	0	0
Unknown	2	2	8
Foreign Ownership Share of Foreign-Owned Establishments (this sample)			
Distribution (%)			
0 < & <30	1	1	0
30 =< & <50	1	1	1
50 =< & <70	4	5	4
70 =< & <90	0	1	5
90 =< & <100	0	0	3
100	0	0	4
Range (%)			
Minimum share	25	25	40
Maximum share	65	70	100

Sources: Author's calculations based on BPS establishment-level data (various years-a).

Notes: BPS figures are calculated from the raw data set provided by the BPS. "This sample" figures are calculated from the data set compiled for my analyses in this paper. n.a. = not available.

[a]Industrial classification code for BPS, *Statistik Industri* (various years-d). The industry code was changed in 1998. D = suppressed to avoid disclosure of data of individual establishments.

employment, output, and value added in each five-digit industry in 1990, 1995, and 1999. Because many observations in the raw data provided by the BPS do not contain sufficient information or because there are not contiguous time series observations for many establishments, such deficient observations were excluded from the sample used for the productivity analysis in this paper. The number of establishments included in the final compilation by the BPS, *Statistik Industri* (BPS, various years-d) is ten, for example, in the motor vehicles industry (38431/34100) for the year 1990, which is shown in the row labeled "BPS" in table 7.5. However, after the unreliable observations have been eliminated, the sample used in this study contains seven establishments for motor vehicles in 1990 shown in the next row in table 7.5, labeled "This sample." While "foreign-owned establishments" in this study are defined as those where the foreign ownership share is more than zero, in the present sample the foreign ownership share in fact exceeded 25 percent in all cases. In terms of gross output and value added, the share of foreign-owned establishments is extremely high at more than 80 percent in the motor vehicles industry and 50–70 percent in the motor vehicle component industry. However, in terms of the number of establishments and employment, the foreign share is relatively small. As for the nationality of foreign establishments, it was found that the majority of foreign-owned establishments were Japanese-affiliated ones. The table also shows that quite a few establishments newly entered the Indonesian automobile industry during the sample period, particularly in the motor vehicle component industry after 1995. As mentioned in the previous section, this trend is attributable to the economic boom in Indonesia and neighboring ASEAN countries in the early 1990s, the introduction of the incentive program, and the liberalization of the licensing system in 1993.[11]

Table 7.6 shows a set of descriptive statistics on the sampled establishments by detailed industry in 1990, 1995, and 1999.[12] The table shows that the different indicators move quite differently over time in each of the three sectors, which might in part be due to heterogeneity among the establishments and to the small sample size, particularly in the motor vehicles in-

11. Table 7A.1 summarizes the entry and exit flows in the data set compiled for the analysis in this paper.

12. The statistics for the overall motor vehicle industry (at the four-digit ISIC level or the two-digit level in the new ISIC) are presented in table 7A.2. The upper panel of table 7A.2 gives the simple mean of each variable for all the sampled establishments, while the bottom panel of table 7A.2 gives the simple mean only for the large establishments in the sample. Table 7A.2 shows that employment, output, and value added per establishment increased in the period from 1990 to 1995 but then decreased from 1995 to 1999 in real terms. Capital stock and wages, however, increased in the period from 1990 to 1999 in real terms. Moreover, regarding productivity measures, average variable cost and value added per employee deteriorated during the period from 1990 to 1995 but recovered during 1995 to 1999. Output per employee improved from 1990 to 1999. These productivity measures indicate that the average productivity increased from 1995 to 1999 in real terms despite the 1997 financial crisis and the succeeding economic disorder.

Table 7.6 **Descriptive Statistics of the Sample of Establishments, by Detailed Industry (simple average)**

	Motor Vehicles (38431/34100)		
	1990	1995	1999
No. of observations	7	7	5
Herfindahl index	0.828	0.659	0.949
No. of employees	811	1,089	1,087
Output per establishment[a]	217,000	357,000	275,000
Value added per establishment[a]	146,000	220,000	184,000
Capital stock per establishment[a]	11,100	52,400	68,500
Years in operation	18.4	23.4	18.6
Productivity measures			
Average variable cost[b]	0.40	0.50	0.58
Output per employee[a]	108.9	225.1	83.7
Value added per employee[a]	70.6	85.4	57.6
TFP (in logarithm)	3.5	3.0	2.6
Inventory ratios (%)			
Total inventory	n.a.	23.1	21.4
Final goods inventory	n.a.	10.6	11.6
Work-in-process inventory	n.a.	1.3	3.6
Raw materials inventory	n.a.	11.9	9.5
Other indicators			
Capital-labor ratio[a]	17.8	52.5	66.9
Share of nonproduction workers (%)	24.3	27.5	33.5
Production worker wages[c]	4,479	6,749	4,699
Nonproduction worker wages[c]	8,893	11,235	6,868
Price-cost margin (%)[d]	58.6	50.5	34.9
Export share in output (%)	0.0	0.0	20.0
Import ratio (%)	44.6	27.7	39.6
	Motor Vehicle Bodies (38432/34200)		
	1990	1995	1999
No. of observations	54	60	39
Herfindahl index	0.088	0.089	0.381
No. of employees	163	162	115
Output per establishment[a]	2,441	2,540	1,580
Value added per establishment[a]	1,127	970	1,215
Capital stock per establishment[a]	1,455	2,355	3,226
Years in operation	9.8	14.7	15.6
Productivity measures			
Average variable cost[b]	0.73	0.72	0.64
Output per employee[a]	14.6	14.1	7.9
Value added per employee[a]	5.9	5.6	4.9
TFP (in logarithm)	2.7	2.5	2.3

(*continued*)

Table 7.6 (continued)

	Motor Vehicle Bodies (38432/34200)		
	1990	1995	1999
Inventory ratios (%)			
Total inventory	n.a.	20.5	33.3
Final goods inventory	n.a.	2.2	5.1
Work-in-process inventory	n.a.	8.1	12.4
Raw materials inventory	n.a.	14.0	20.6
Other indicators			
Capital-labor ratio[a]	26.7	27.9	34.3
Share of nonproduction workers (%)	14.1	19.1	24.0
Production worker wages[c]	1,763	1,883	1,454
Nonproduction worker wages[c]	3,749	2,839	3,210
Price-cost margin (%)[d]	26.5	27.7	30.2
Export share in output (%)	1.1	0.8	0.0
Import ratio (%)	5.8	3.5	5.7
	Motor Vehicle Component and Apparatus (38433/34300)		
	1990	1995	1999
No. of observations	34	44	75
Herfindahl index	0.175	0.174	0.087
No. of employees	243	371	213
Output per establishment[a]	25,600	49,600	21,300
Value added per establishment[a]	14,000	16,100	13,200
Capital stock per establishment[a]	6,507	10,500	17,600
Years in operation	9.4	13.2	10.7
Productivity measures			
Average variable cost[b]	0.54	0.64	0.61
Output per employee[a]	87.2	85.1	82.0
Value added per employee[a]	43.6	25.2	54.1
TFP (in logarithm)	2.6	2.4	2.2
Inventory ratios (%)			
Total inventory	n.a.	27.4	33.2
Final goods inventory	n.a.	8.2	7.2
Work-in-process inventory	n.a.	4.0	4.5
Raw materials inventory	n.a.	16.3	24.9
Other indicators			
Capital-labor ratio[a]	24.8	24.7	88.4
Share of nonproduction workers (%)	21.3	18.9	19.9
Production worker wages[c]	2,707	2,966	3,286
Nonproduction worker wages[c]	7,200	8,655	18,083
Price-cost margin (%)[d]	44.4	39.5	32.9
Export share in output (%)	0.0	4.0	9.6
Import ratio (%)	42.9	47.7	40.0

Source: Author's calculations based on BPS establishment-level data (various years-a).

Notes: Some of the observations were not included because of missing values or recording mistakes. n.a. = not available.

[a]In 1993 millions of rupiahs. For price deflators, see appendix A.

[b]Average variable cost is defined as the sum of labor and intermediate input costs divided by output.

[c]In 1993 1,000 rupiahs. For price deflators, see appendix A.

[d]Price-cost margin is defined as (value added – wages paid)/output.

dustry. For example, in the motor vehicles industry, labor productivity measured by output per employee in real terms increased from 1990 to 1995 but decreased from 1995 to 1999, whereas it decreased throughout the entire period in the motor vehicle bodies and the motor vehicle component industries. Production worker wages, on the other hand, first increased but then decreased in the motor vehicles and the motor vehicle bodies industries, but rose in both periods in the motor vehicle component industry. In contrast, uniform movements for all three industries could be observed for output, which grew from 1990 to 1995 but then shrank, and for capital stock per establishment, which increased throughout the period. TFP, finally, deteriorated throughout the period from 1990 to 1999.[13]

Comparing the various statistics across industries, the table presents many interesting observations: The Herfindahl index measured by output share of each establishment is extremely high in the motor vehicles industry, implying a high concentration in this industry. The average price-cost margin is also high, particularly in the motor vehicles industry, which again suggests a lack of competition in the industry. It should be noted, however, that the price-cost margin diminishes in 1999 in the motor vehicles and the motor vehicle component industries. This trend might reflect the demand contraction after the crisis, although the price-cost margins nevertheless remain at quite a high level.[14] The shares of nonproduction workers as well as wages are both higher in the motor vehicles industry than in other industries, which might be a reflection of the fact that motor vehicle assembler establishments are owned by a large company. Total inventory ratios are high at around 20–30 percent in every industry, and import ratios are also high in the motor vehicles and the motor vehicle component industries. Another notable observation is that the export share in output goes up remarkably in the motor vehicles and the motor vehicle component industries during this period.

7.3.2 Productivity Differences between Foreign and Local Establishments

Table 7.7 compares a set of descriptive statistics of foreign and local establishments by detailed industry.[15] The first two columns give the mean

13. Following Baily, Hulten, and Campbell (1992) and Okamoto (1999), TFP of the *i*th establishment in each industry for year t is defined as follows: $\ln \mathrm{TFP}_{it} = \ln Y_{it} - \alpha_L \ln L_{it} - \alpha_K \ln K_{it} - \alpha_M \ln M_{it}$, where Y_{it} is real gross output, and L_{it}, K_{it}, and M_{it} are labor, capital, and intermediate inputs for the *i*th establishment in year t. α_L, α_K, and α_M are factor income shares of labor, capital, and intermediate inputs, averaged over industries and years of the period from 1990 to 1999.

14. Average price-cost margins are in the range from 26 percent to 59 percent in table 7.6. These figures seem to be high compared with those in Thailand and Japan. The price-cost margins are around 25 percent in the Thai automobile industry and around 20 percent in the Japanese automobile industry (Ito 2001, 2004).

15. Table 7A.3 presents a comparison between large foreign and large local establishments in the overall motor vehicle industry. Given that most local establishments are much smaller in size than foreign ones, it appears more meaningful to compare productivity measures between establishments of similar size. The table shows that the size of establishments measured

Table 7.7 **Descriptive Statistics of the Sample of Establishments by Ownership in the Motor Vehicle Industries, by Detailed Industry (simple average)**

	Motor Vehicles (38431/34100)											
	1990–96 pooled		1990		1995		1999		Ratio of Foreign to Domestic			
	DO	FO	DO	FO	DO	FO	DO	FO	1990–96	1990	1995	1999
No. of observations	31	19	5	2	4	3	2	3				
No. of employees	426	1,843***	407	1,821	464	1,923	409	1,540	4.3	4.5	4.1	3.8
Output per establishment[a]	80,457	504,258***	24,144	699,903	114,633	679,119	13,381	449,704	6.3	29.0	5.9	33.6
Value added per establishment[a]	27,502	345,394**	14,230	477,003	29,185	475,109	11,139	299,881	12.6	33.6	16.3	27.0
Capital stock per establishment[a]	10,083	70,312***	7,228	20,753	16,941	99,631	11,668	106,417	7.0	2.9	5.9	9.1
Years in operation	21.6	18.2	19.2	16.5	26.0	20.0	16.0	20.3	0.8	0.9	0.8	1.3
Average variable cost[b]	0.61	0.52	0.42	0.35	0.52	0.47	0.56	0.59	0.9	0.8	0.9	1.1
Output per employee[a]	177.4	149.7	57.5	237.3	265.3	171.5	20.5	125.9	0.8	4.1	0.6	6.1
Value added per employee[a]	59.4	90.0	33.6	162.9	63.3	115.0	16.9	84.8	1.5	4.8	1.8	5.0
TFP (in logarithm)	3.3	3.3	3.4	3.9	2.8	3.2	2.5	2.6	1.0	1.1	1.2	1.1
Total inventory (%)[c]	26.1	39.3	n.a.	n.a.	13.8	35.5	46.6	4.5	1.5	n.a.	1.4	0.1
Final goods inventory (%)[c]	3.7	6.1	n.a.	n.a.	0.6	23.9	28.8	0.1	1.6	n.a.	2.6	0.0
Work-in-process inventory (%)[c]	13.5	3.1	n.a.	n.a.	0.9	1.9	8.3	0.5	0.2	n.a.	40.8	0.1
Raw materials inventory (%)[c]	54.7	20.3	n.a.	n.a.	0.1	10.7	17.9	3.9	0.4	n.a.	2.2	0.2
Capital-labor ratio[a]	25.5	43.2	20.1	12.3	39.0	70.4	28.6	92.5	1.7	0.6	1.8	3.2
Share of nonproduction workers (%)	26.6	27.1	27.1	17.3	23.6	32.8	31.1	35.0	1.0	0.6	1.4	1.1
Production worker wages[d]	4,852	6,417	4,082	5,469	6,223	7,449	4,198	5,033	1.3	1.3	1.2	1.2
Nonproduction worker wages[d]	9,692	11,125	7,399	12,627	9,545	13,489	3,889	8,854	1.1	1.7	1.4	2.3
Price-cost margin (%)[e]	45.8	48.5	56.8	63.2	48.4	53.1	43.7	29.0	1.1	1.1	1.1	0.7
Export share in output (%)	0.0	3.8	0.0	0.0	0.0	0.0	0.0	33.3	n.a.	n.a.	n.a.	n.a.
Import ratio (%)	31.7	52.3*	42.9	48.8	18.3	40.1	0.0	66.1	1.6	1.1	2.2	n.a.

Motor Vehicle Bodies (38432/34200)												
No. of observations	416	0	54	0	60	0	38	1				
No. of employees	164	n.a.	163	n.a.	162	n.a.	80	1,445	n.a.	n.a.	n.a.	18.1
Output per establishment[a]	2,588	n.a.	2,441	n.a.	2,540	n.a.	650	36,916	n.a.	n.a.	n.a.	56.8
Value added per establishment[a]	1,159	n.a.	1,127	n.a.	970	n.a.	398	32,266	n.a.	n.a.	n.a.	81.2
Capital stock per establishment[a]	1,827	n.a.	1,455	n.a.	2,355	n.a.	2,628	25,946	n.a.	n.a.	n.a.	9.9
Years in operation	12.5	n.a.	9.8	n.a.	14.7	n.a.	15.4	23.0	n.a.	n.a.	n.a.	1.5
Average variable cost[b]	0.72	n.a.	0.73	n.a.	0.72	n.a.	0.66	0.15	n.a.	n.a.	n.a.	0.2
Output per employee[a]	14.7	n.a.	14.6	n.a.	14.1	n.a.	7.4	25.5	n.a.	n.a.	n.a.	3.5
Value added per employee[a]	6.7	n.a.	5.9	n.a.	5.6	n.a.	4.4	22.3	n.a.	n.a.	n.a.	5.1
TFP (in logarithm)	2.6	n.a.	2.7	n.a.	2.5	n.a.	2.3	3.3	n.a.	n.a.	n.a.	1.5
Total inventory (%)[c]	19.8	n.a.	n.a.	n.a.	20.5	n.a.	32.7	55.6	n.a.	n.a.	n.a.	1.7
Final goods inventory (%)[c]	1.5	n.a.	n.a.	n.a.	2.2	n.a.	5.0	10.0	n.a.	n.a.	n.a.	2.0
Work-in-process inventory (%)[c]	3.7	n.a.	n.a.	n.a.	8.1	n.a.	11.9	30.9	n.a.	n.a.	n.a.	2.6
Raw materials inventory (%)[c]	13.5	n.a.	n.a.	n.a.	14.0	n.a.	20.7	17.2	n.a.	n.a.	n.a.	0.8
Capital-labor ratio[a]	27.2	n.a.	26.7	n.a.	27.9	n.a.	34.7	18.0	n.a.	n.a.	n.a.	0.5
Share of nonproduction workers (%)	18.3	n.a.	14.1	n.a.	19.1	n.a.	23.9	27.2	n.a.	n.a.	n.a.	1.1
Production worker wages[d]	1,954	n.a.	1,763	n.a.	1,883	n.a.	1,480	473	n.a.	n.a.	n.a.	0.3
Nonproduction worker wages[d]	3,413	n.a.	3,749	n.a.	2,839	n.a.	3,278	750	n.a.	n.a.	n.a.	0.2
Price-cost margin (%)[e]	29.4	n.a.	26.5	n.a.	27.7	n.a.	28.7	85.2	n.a.	n.a.	n.a.	3.0
Export share in output (%)	0.6	n.a.	1.1	n.a.	0.8	n.a.	0.0	0.0	n.a.	n.a.	n.a.	n.a.
Import ratio (%)	4.1	n.a.	5.8	n.a.	3.5	n.a.	5.8	0.0	n.a.	n.a.	n.a.	0.0
Motor Vehicle Component and Apparatus (38433/34300)												
No. of observations	255	55	28	6	36	8	58	17				
No. of employees	255	452***	214	377	334	539	170	358*	1.8	1.8	1.6	2.1
Output per establishment[a]	18,456	99,905***	11,407	92,067	29,636	139,366	9,497	61,520**	5.4	8.1	4.7	6.5
Value added per establishment[a]	6,820	48,892***	6,797	47,806	6,371	59,967	6,091	37,433**	7.2	7.0	9.4	6.1
Capital stock per establishment[a]	8,724	22,625***	5,450	11,439	9,013	17,345	12,786	34,077**	2.6	2.1	1.9	2.7
Years in operation	11.1	10.8	9.5	9.2	13.3	12.9	11.4	8.2	1.0	1.0	1.0	0.7
Average variable cost[b]	0.63	0.51**	0.55	0.46	0.66	0.55	0.57	0.74	0.8	0.8	0.8	1.3

(*continued*)

Table 7.7 (continued)

	Motor Vehicle Component and Apparatus (38433/34300)											
	1990–96 pooled		1990		1995		1999		Ratio of Foreign to Domestic			
	DO	FO	DO	FO	DO	FO	DO	FO	1990–96	1990	1995	1999
Output per employee[a]	61.0	152.2***	69.1	172.1	66.6	168.5	42.8	215.7*	2.5	2.5	2.5	5.0
Value added per employee[a]	24.6	71.8***	33.1	92.7	16.3	65.4	27.4	145.4*	2.9	2.8	4.0	5.3
TFP (in logarithm)	2.3	3.0***	2.5	3.2**	2.3	3.1*	2.1	2.4	1.3	1.3	1.3	1.1
Total inventory (%)[c]	20.4	24.0	n.a.	n.a.	27.9	24.9	41.1	10.2**	1.2	n.a.	0.9	0.2
Final goods inventory (%)[c]	4.6	4.4	n.a.	n.a.	9.0	4.7	8.9	2.3***	1.0	n.a.	0.5	0.3
Work-in-process inventory (%)[c]	2.6	1.0***	n.a.	n.a.	3.7	5.4	5.6	1.1**	0.4	n.a.	1.5	0.2
Raw materials inventory (%)[c]	11.7	13.8	n.a.	n.a.	15.5	19.8	31.1	6.8	1.2	n.a.	1.3	0.2
Capital-labor ratio[a]	35.2	52.9	25.0	24.3	24.2	26.9	63.1	174.7*	1.5	1.0	1.1	2.8
Share of nonproduction workers (%)	20.3	24.1*	20.6	24.5	18.2	21.6	18.8	23.7	1.2	1.2	1.2	1.3
Production worker wages[d]	2,499	4,680***	2,245	4,864**	2,448	5,299**	1,930	7,912**	1.9	2.2	2.2	4.1
Nonproduction worker wages[d]	6,789	10,497***	5,825	13,617*	8,632	8,757	8,104	49,782	1.5	2.3	1.0	6.1
Price-cost margin (%)[e]	38.6	48.3**	43.2	49.9	37.9	46.9	38.6	47.7	1.3	1.2	1.2	1.2
Export share in output (%)	3.7	3.0	0.0	0.2	4.9	0.0**	5.0	25.3*	n.a.	n.a.	n.a.	5.1
Import ratio (%)	40.6	65.9***	38.1	65.4	43.8	65.4	32.2	64.6***	1.6	1.7	1.5	2.0

Source: Author's calculations based on BPS establishment-level data (various years-a).

Notes: Some of the observations were not included because of missing values or recording mistakes. The *t*-tests are performed based on the assumption of unequal variances. n.a. = not available; DO = domestic-owned; FO = foreign-owned.

[a]In 1993 millions of rupiahs. For price deflators, see appendix A.

[b]Average variable cost is defined as the sum of labor and intermediate input costs divided by output.

[c]Inventory data are not available for 1990 and 1991.

[d]In 1993 1,000 rupiahs. For price deflators, see appendix A.

[e]Price-cost margin is defined as (value added – wages paid)/output.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

values for domestic and foreign-owned establishments for years before the financial crisis (i.e., from 1990 to 1996). In addition, the local-foreign comparisons are conducted for the years 1990, 1995, and 1999. *T*-tests are also performed to examine the statistical difference between the domestic and the foreign-owned establishments. The four columns from the right show the ratio of foreign- to domestic-owned establishments.

Table 7.7 indicates that foreign establishments tend to be larger than local ones in terms of employment, output, value added, and capital stock. Wages and labor productivity, measured by output per employee, value added per employee, and TFP, are significantly higher for foreign establishments in the motor vehicle component industry. However, these differences are not statistically significant in the motor vehicles industry, which again might be due in part to heterogeneity among the establishments and to the small sample size. One interesting observation is that inventory ratios tend to be higher for foreign establishments but are lower in 1999 in the motor vehicles and the motor vehicle component industries (statistically significant in the latter). The import ratios tend to be much higher for foreign establishments in the motor vehicles and the motor vehicle component industries, and they are statistically significant in some cases. In addition, the capital-labor ratio and the share of nonproduction workers are higher for foreign establishments in many cases, but the difference is not statistically significant.

7.3.3 Comparing Productivity Trajectories

The last thing to be done in this section is to compare the productivity trajectories of foreign and local establishments, controlling for industrywide time effects as well as observable plant-specific productivity determinants like age and size. Four productivity proxies are used here: average variable cost (AVC), output per employee in real terms (LAB), value added per employee in real terms (VALAB), and total factor productivity (TFP). Average variable cost is defined as the sum of labor and intermediate input costs divided by output in real terms. To purge these productivity measures of industrywide time effects and observable plant-specific characteristics, each is expressed in logarithms and regressed on time dummies (D_{jt}, specific to year t and the jth five-digit ISIC industry), age of the establishment (AGE), age of the establishment squared, size of the establishment (SIZE), and size of the establishment squared. Both age and size are measured in logarithms. Establishment size is measured by employment and normalized on mean industry employment.[16] In addition, interaction terms of age

by output, value added, and capital stock is generally larger for foreign establishments, and that wages, labor productivity, the capital-labor ratio, and the import ratio tend to be higher for foreign establishments.

16. It might be preferable to use capital stock data instead as the size variable. However, given the poor reliability of capital stock data, we used employment data as a proxy for the size variable.

variables and the dummy variable for foreign establishments (FOR) are included in order to see the marginal difference of the age effects between local and foreign establishments. The following equations are estimated:

$$(1)\quad \ln(\text{PRODUCTIVITY}) = \sum_{j=1}^{J}\sum_{t=1}^{T} \gamma_{jt} D_{jt} + \beta_1 \ln(\text{AGE}_{it}) + \beta_2[\ln(\text{AGE}_{it})]^2 + \beta_3 \ln(\text{SIZE}_{it}) + \beta_4[\ln(\text{SIZE}_{it})]^2 + \varepsilon_{it}$$

$$(2)\quad \ln(\text{PRODUCTIVITY}) = \sum_{j=1}^{J}\sum_{t=1}^{T} \gamma'_{jt} D_{jt} + \beta'_1 \ln(\text{AGE}_{it}) + \beta'_2[\ln(\text{AGE}_{it})]^2 + \beta'_3\text{FOR}_{it} \cdot \ln(\text{AGE}_{it}) + \beta'_4\text{FOR}_{it} \cdot [\ln(\text{AGE}_{it})]^2 + \beta'_5 \ln(\text{SIZE}_{it}) + \beta'_6 [\ln(\text{SIZE}_{it})]^2\beta'_7\text{FOR}_{it} + \varepsilon'_{it}$$

with PRODUCTIVITY = AVC, LAB, VALAB, and TFP.

The residuals from the regressions using equation (1) are then used as the indexes of deviation from time- and industry-specific productivity norms. In order to see whether the productivity difference between foreign and local establishments is significant or not, the dummy variable for foreign establishments (FOR) is added in equation (2).

Table 7.8 presents the regression results of the equations. The scale effects are strongly significant in all equations. Labor productivity measures (output per employee and value added per employee) and TFP improve with age, but the marginal difference of the age effects between local and foreign establishments is not statistically significant. In labor productivity equations (4) and (6), the coefficients on the dummy variable for foreign establishments (FOR) are positive and significant, suggesting that foreign establishments enjoy higher labor productivity than local ones. However, in TFP equation (8), the coefficient on the dummy variable for foreign establishments (FOR) is negative and not significant.[17]

Using the residuals of equations (1), (3), (5), and (7) in table 7.8, unweighted average trajectories for residuals of average variable cost, output per employee, value added per employee, and TFP are calculated and presented by plant ownership type in figure 7.2. In panel A through panel D, foreign-owned establishments are shown to be substantially and consistently more efficient than local ones. Although the gap in labor productivity (output per employee and value added per employee) between local and

17. An extremely large assembler establishment in terms of both employment and output is included in the data set. When conducting regression analyses without this outlier establishment, the results were almost identical. However, the coefficient on the dummy variable, FOR, became insignificant for the equation of value added per employee, although the coefficient on FOR for the equation of output per employee remained positive at the 10 percent significance level.

Table 7.8 Determinants of Productivity (ordinary least squares regressions)

	Dependent Variable			
	ln(average variable cost)		ln(real output per employee)	
	(1)	(2)	(3)	(4)
ln(AGE)	0.006	0.042	0.498*	0.761***
	(0.05)	(0.32)	(1.87)	(2.76)
$(\ln(AGE))^2$	0.007	–0.003	–0.158**	–0.211***
	(0.23)	(–0.11)	(–2.60)	(–3.43)
FOR · ln(AGE)		–0.877		–0.763
		(–1.56)		(–0.89)
FOR · $(\ln(AGE))^2$		0.221		0.212
		(1.61)		(0.94)
ln(SIZE)	–0.080***	–0.065***	0.390***	0.296***
	(–4.32)	(–4.21)	(10.06)	(8.76)
$(\ln(SIZE))^2$	–0.003	–0.004	–0.082***	–0.090***
	(–0.32)	(–0.47)	(–3.90)	(–5.06)
FOR		0.470		1.593**
		(0.88)		(2.24)
No. of observations	1,134	1,134	1,134	1,134
F	4.88***	4.82***	18.76***	20.21***
Adj. R^2	0.118	0.145	0.327	0.378
	ln(real value added per employee)		ln(Total Factor Productivity)	
	(5)	(6)	(7)	(8)
ln(AGE)	0.274	0.529*	0.275*	0.228
	(1.05)	(1.95)	(1.91)	(1.51)
$(\ln(AGE))^2$	–0.117**	–0.165***	–0.082***	–0.074**
	(–1.99)	(–2.76)	(–2.60)	(–2.27)
FOR · ln(AGE)		–0.458		0.561
		(–0.55)		(1.05)
FOR · $(\ln(AGE))^2$		0.109		–0.096
		(0.50)		(–0.71)
ln(SIZE)	0.385***	0.302***	0.166***	0.135***
	(10.13)	(9.20)	(8.26)	(7.90)
$(\ln(SIZE))^2$	–0.078***	–0.082***	–0.015	–0.019*
	(–3.78)	(–4.64)	(–1.35)	(–1.94)
FOR		1.427**		–0.363
		(2.06)		(–0.76)
No. of observations	1,124	1,124	1,125	1,125
F	23.74***	24.38***	11.56***	11.23***
Adj. R^2	0.382	0.430	0.246	0.275

Source: Author's calculations.

Notes: The numbers in parentheses are t-statistics based on White's robust standard errors (White 1980). All equations include interaction of year dummies with industry dummies.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

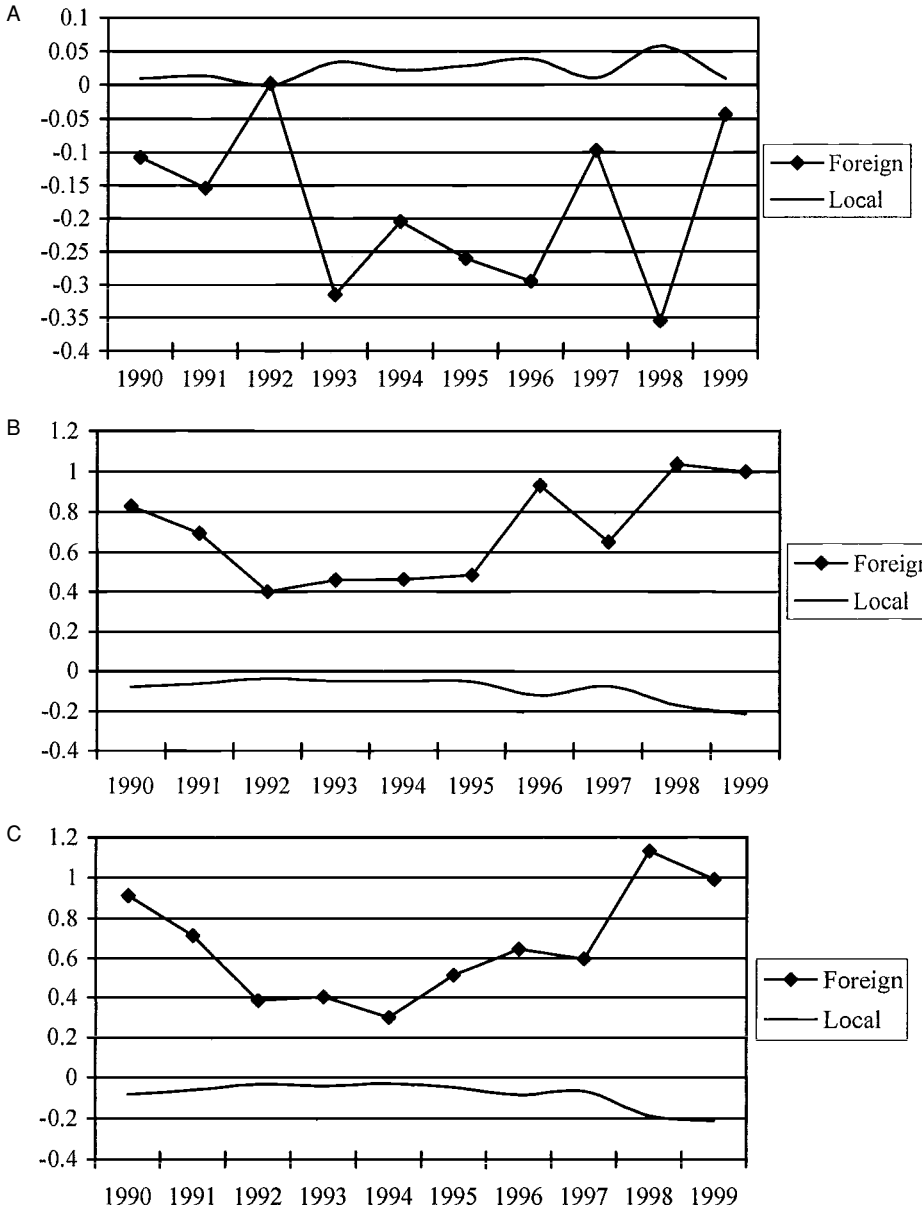

Fig. 7.2 Path of productivity residuals (purged of time, age, and size effects): *A,* path of average variable cost residuals (from eq. [1] in table 7.8); *B,* path of average labor productivity residuals (measured as output per employee, from eq. [3] in table 7.8); *C,* path of average labor productivity residuals (measured as value added per employee, from eq. [5] in table 7.8); *D,* path of average total factor productivity residuals (from eq. [7] in table 7.8).

Source: Author's calculations based on equations (1), (3), (5), and (7) in table 7.8.

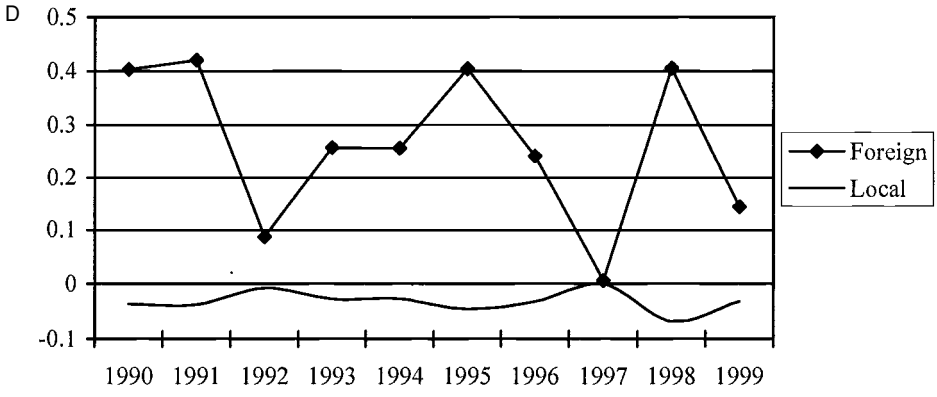

Fig. 7.2 (cont.)

foreign establishments seems to be smaller around 1992 to 1995, it becomes larger from 1996 onward. The trajectories of the average variable cost residuals and TFP residuals fluctuate during the period, and there is no clear trend for both foreign and local establishments.

7.4 Total Factor Productivity Growth and Its Decomposition

7.4.1 The Model Specification

So far, the various productivity measures show that foreign-owned establishments tend to be larger in size and show higher productivity than local ones. In terms of labor productivity, the difference between local and foreign establishments is statistically significant. Although the average TFP level tended to be higher for foreign-owned establishment, the gap in TFP levels between local and foreign establishments became insignificant after industrywide time effects and observable plant-specific characteristics such as age and size were controlled for. In this section, in order to investigate the determinants of productivity growth, the cost function framework is employed to analyze the source of TFP growth as well as the cost elasticities for foreign and local establishments. Moreover, the cost function framework is advantageous because it can endogenize the impact of capital utilization.[18] Although the establishment-level data are available for up to 1999, the cost function analysis relies on the 1990–96 data since the after-crisis data are not very appropriate for the cost function analysis.[19]

18. There is no information on the number of hours worked in the database. Although the survey asks the percentage of actual production to production capacity during the year, the quality of the capacity utilization data is too poor to be used for the analysis.

19. For the after-crisis period, it would be very difficult to separate the effect of economies of scale from the effect of low demand. With this regard, the author thanks Francis T. Lui and an anonymous referee for their comments.

Following Fuss and Waverman (1992), Nadiri and Nandi (1999), Kawai (2000), and so on, the variable cost function in the translog form is specified for the purpose of estimation. Since physical capital stock is considered as a quasi-fixed input in the short run, the variable cost function is given by[20]

$$
\begin{aligned}
(3)\quad \log \mathrm{VC}_t = {} & (a_0 + df_0 \cdot \mathrm{FOR} + a_T \cdot T) + a_L \cdot \log\left(\frac{P_{Lt}}{P_{Mt}}\right) + a_Y \cdot \log Y_t \\
& + a_K \cdot \log K_t + (a_L + df_L \cdot \mathrm{FOR}) \cdot \log\left(\frac{P_{Lt}}{P_{Mt}}\right) \\
& + (a_Y + df_Y \cdot \mathrm{FOR} \cdot \log Y_t + (a_K + df_K \cdot \mathrm{FOR}) \cdot \log K_t \\
& + a_{LT} \cdot \log\left(\frac{P_{Lt}}{P_{Mt}}\right) \cdot T + a_{YT} \cdot \log Y_t \cdot T + a_{KT} \cdot \log K_t \cdot T \\
& + \frac{1}{2} a_{LL} \cdot \left(\log\left(\frac{P_{Lt}}{P_{Mt}}\right)\right)^2 + a_{YL} \cdot Y_t \cdot \log\left(\frac{P_{Lt}}{P_{Mt}}\right) \\
& + a_{KL} \cdot K_t \cdot \log\left(\frac{P_{Lt}}{P_{Mt}}\right) + \frac{1}{2} a_{YY} \cdot (\log Y_t)^2 \\
& + a_{YK} \cdot \log Y_t \cdot \log K_t + \frac{1}{2} a_{KK} \cdot (\log K_t)^2 + \frac{1}{2} a_{TT} \cdot T^2
\end{aligned}
$$

In the foregoing equation, the following regularity conditions are imposed:

$$
\begin{aligned}
(4)\quad & a_L + a_M = 1 \\
& a_{LL} + a_{LM} = a_{ML} + a_{MM} = 0 \\
& a_{KL} + a_{KM} = a_{YL} + a_{YM} = 0
\end{aligned}
$$

The definitions of the variables in equation (3) are as follows. The two variable factors are labor and materials. The average wage rate is normalized by the material's price (P_{Lt}/P_{Mt}), and the variable cost (VC_t) is in real terms. Output and physical capital stock are denoted by Y_t and K_t, respectively. Intercept and slope dummy variables are used to capture the difference in production technology between foreign and local establishments. A dummy variable, FOR, takes zero for local establishments and 1 for foreign ones. An index of time (T) represents disembodied technological change. Subscript t is used to represent time.

Taking derivatives with respect to the natural logarithm of labor and material prices (P_{Lt}, P_{Mt}), and using Shephard's lemma, one obtains the labor share function as

$$
\begin{aligned}
(5)\quad S_{Lt} = {} & a_L + df_L \cdot \mathrm{FOR} + a_{LT} \cdot T + a_{LL} \cdot \log\left(\frac{P_{Lt}}{P_{Mt}}\right) + a_{LY} \cdot \log Y_t \\
& + a_{KL} \cdot \log K_t
\end{aligned}
$$

20. A subscript i, which represents plant i, is omitted in the following equations for simplicity.

The variable cost function (3) and the labor share function (5) are jointly estimated by using the time series and cross-section establishment-level data from 1990–96. A maximum likelihood method is employed. Several elasticities are derived as follows:

$$(6)\quad \varepsilon_{Yt} = a_Y + a_{YT}\cdot T + a_{LY}\cdot \log\left(\frac{P_{Lt}}{P_{Mt}}\right) + a_{YK}\cdot \log K_t + a_{YY}\cdot \log Y_t + df_Y\cdot \mathrm{FOR}$$

$$\varepsilon_{Kt} = a_K + a_{KT}\cdot T + a_{KL}\cdot \log\left(\frac{P_{Lt}}{P_{Mt}}\right) + a_{KK}\cdot \log K_t + a_{YK}\cdot \log Y_t + df_K\cdot \mathrm{FOR}$$

$$\varepsilon_{Tt} = a_T + a_{LT}\cdot \log\left(\frac{P_{Lt}}{P_{Mt}}\right) + a_{KT}\cdot \log K_t + a_{YT}\cdot \log Y_t + a_{TT}\cdot T$$

Moreover, the calculated TFP growth rate can be decomposed into several factors by applying formula (7).[21]

$$(7)\quad \log\frac{\mathrm{TFP}_t}{\mathrm{TFP}_{t-1}} = \frac{1}{2}\left[\left(1-\frac{\mathrm{VC}_t}{\mathrm{TC}_t}\varepsilon_{Yt}\right)+\left(1-\frac{\mathrm{VC}_{t-1}}{\mathrm{TC}_{t-1}}\varepsilon_{Yt-1}\right)\right]\log\frac{Y_t}{Y_{t-1}} - \frac{1}{2}\left\{\left[1+\frac{\mathrm{VC}_t}{\mathrm{TC}_t}(\varepsilon_{Kt}-1)\right]+\left[1+\frac{\mathrm{VC}_{t-1}}{\mathrm{TC}_{t-1}}(\varepsilon_{Kt-1}-1)\right]\right\} \cdot \log\frac{K_t}{K_{t-1}} - \frac{1}{2}\left[\frac{\mathrm{VC}_t}{\mathrm{TC}_t}\varepsilon_{Tt}+\frac{\mathrm{VC}_t}{\mathrm{TC}_{t-1}}\varepsilon_{Tt-1}\right]\frac{\dot{T}}{T},$$

where TC_t represents total cost. The first term on the right-hand side of equation (7) indicates the contribution from the change in output. The second term represents the contribution from capacity expansion, reflecting the difference in the marginal conditions between the short-run and the long-run equilibrium. That is, in the short-run equilibrium, the shadow price of capital ($-\partial \mathrm{VC}_t/\partial K_t$) is likely to differ from the long-run rental price of capital (P_{Kt}) due to the adjustment cost. If the quasi-fixed input, physical capital, was at the optimal level, then $\partial \mathrm{VC}_t/\partial K_t = -P_{Kt}$ and $\varepsilon_{Kt} = -P_{Kt}K_t/\mathrm{VC}_t$. Using these relationships and the definition of total cost and variable cost, $\mathrm{TC}_t = \mathrm{VC}_t + P_{Kt}K_t$, the second term on the right-hand side of equation (7), is cancelled out when physical capital is at the optimal level. Therefore, the effect represented by the second term can be interpreted as a capital utilization effect. The third term indicates the contribution from technological progress.

By using this decomposition, we can interpret the TFP growth from both supply-side and demand-side aspects. On the supply side, economies of scale arise if average cost falls as output rises, and they may be a char-

21. For details on the decomposition formula, see appendix B.

Table 7.9 Estimation Results

	Variable Cost Function		
Parameter	Estimate	Standard Error	*z*
A0	–16.760	37.023	–0.45
AT	0.420	0.791	0.53
AL	0.450	0.293	1.53
AY	0.717	0.535	1.34
AK	–0.284	0.518	–0.55
ALT	0.005	0.003	1.51
AYT	–0.004	0.006	–0.74
AKT	0.006	0.006	1.11
ALL	0.083	0.010	8.1***
AYL	–0.097	0.005	–18.61***
AKL	0.039	0.005	8.21***
AYY	0.083	0.012	6.69***
AYK	–0.024	0.009	–2.72***
AKK	–0.007	0.009	–0.74
ATT	–0.005	0.008	–0.57
DF (intercept dummy)	–0.054	0.642	–0.08
DFL (Slope dummy with labor)	0.138	0.023	6.02***
DFY (Slope dummy with output)	–0.186	0.043	–4.29***
DFK (Slope dummy with capital stock)	0.144	0.047	3.1***
No. of observations	744		
R^2	0.9449		
R^2 for labor share function	0.333		

Source: Author's calculations.
***Significant at the 1 percent level.

acteristic of the technology. However, at the same time, sufficient demand size is a necessary condition for an increase in output. Therefore, the scale effect (the first term on the right-hand side of equation [7]) captures both supply-side and demand-side factors. On the other hand, the capacity utilization effect (the second term) captures the effect from a change in demand in the short run.

7.4.2 The Data and Estimation Results

Data on output and physical capital stock are expressed in real terms, deflated by the wholesale price index (1993 = 100).[22] The price of labor for each establishment was calculated by dividing the total payroll by the number of workers. The price of materials was calculated for each establishment as a weighted average of the wholesale price index for imported manufacturing raw materials and the wholesale price index for manufac-

22. For details, see appendix A.

Table 7.10 **Variable Cost Elasticities (1990–1996 average)**

	Output (E_{Yt})	Capital (E_{Kt})	Time (E_{Tt})	Scale Effect ($1/E_{Yt}$)
All establishments	0.890	–0.022	0.011	1.124
Foreign establishments	0.813	0.057	0.019	1.229
Local establishments	0.898	–0.030	0.011	1.114

Source: Author's calculation based on estimation results in table 7.9.

Table 7.11 **Decomposition of Average Annual TFP Growth Rate, 1990–1996 (%)**

	Scale Effect	Capital Effect	Technological Change Effect	TFP
All establishments	0.117	–1.511	–0.011	–1.405
Foreign establishments	–0.441	–3.257	–0.018	–3.717
Local establishments	–0.468	–1.506	–0.010	–1.984

Source: Author's calculation based on estimation results in table 7.9.

turing raw materials. The expenditures on imported materials and domestically produced raw materials are used as a weight. Estimates of the coefficients of the variable cost function (3) are presented in table 7.9, and the derived elasticities based on the average value of each variable are presented in table 7.10. The important characteristics of the cost side of the industry are summarized below.

The variable cost elasticities of output (E_{Yt}) are shown in the first column, and the scale effect, which is defined as the inverse of E_{Yt}, is shown in the last column of table 7.10. The results show a relatively high cost elasticity of output for local establishments. On average, a 1 percent increase in output causes an increase of 0.81 percent in the variable cost for foreign establishments and an increase of 0.90 percent in the variable cost for local establishments. The scale effect presented in the last column indicates that both foreign and local establishments experienced increasing returns to scale during the period from 1990 to 1996. The scale effect is relatively higher for foreign establishments.

The elasticity of variable cost with respect to increases in physical capital stock (E_{Kt}) is shown in the second column of table 7.10. The negative values for E_{Kt} indicate that variable costs decline with increases in the levels of the quasi-fixed input. The capital elasticity for all establishments on average is negative over the period from 1990 to 1996. It should be noted that the capital elasticity is positive for foreign establishments, suggesting that capital utilization is extremely inefficient in foreign establishments.

Average TFP growth rates and their decomposition are shown in table 7.11. The TFP growth rate for each year is estimated using equation (7).

The average annual TFP growth rate remained very low and negative for both local and foreign establishments. A substantial negative capital effect is observed particularly for foreign establishments. This might be a reflection of the fact that many establishments invested in machinery and equipment or other fixed capital in the early 1990s based on the expectation of continuing growth in the Indonesian automobile market. In addition, quite a few foreign and local establishments were newly established in the mid-1990s, which also may have contributed to the negative capital effect on TFP growth. On average, compared with local establishments, foreign establishments had a lower TFP growth rate over the 1990–96 period. As a result, the average TFP growth rate over the period is –3.7 percent for foreign establishments and –2.0 percent for local establishments, suggesting that both foreign and local establishments experienced substantial negative TFP growth on average.

It should be noted that the greatest part of the TFP growth rate is explained by the scale and the capital effects, and that the technological change effect is negligible over the sample period for both foreign and local establishments.

7.5 Concluding Remarks

According to economic theory, manufacturing plants owned by multinational corporations are considered to be more productive than local ones because of their advantages in managerial resources. This paper empirically studies the difference in productivity between foreign-owned and local establishments and tries to uncover the sources of productivity growth for both foreign and local establishments. Given drawbacks in establishment-level data of developing countries like Indonesia, this paper calculates various productivity measures in order to make the analyses as thorough as possible and obtain robust and comprehensive results.

Consistent with previous empirical studies, the results of this paper suggest that foreign establishments tend to be larger in size, enjoy higher labor productivity, and pay higher wages than local ones. Moreover, foreign establishments tend to show a higher import ratio than local ones. As for the export share in output, this was negligibly small before the financial crisis, but more recently foreign establishments increased the export share rapidly. The results of the regression analysis of the determinants of productivity measures show that foreign establishments achieved significantly higher labor productivity than local ones (table 7.8). However, a comparison of TFP levels for foreign and local establishments reveals no significant evidence that foreign plants do in fact enjoy higher TFP that could be attributed to their ownership-specific advantages, as economic theory would suggest. Furthermore, the results instead indicate that the

scale effect is an important determinant of productivity levels. The cost function analysis in this paper enables us to calculate the variable cost elasticities and find out the difference in cost structures between foreign and local establishments. Moreover, using the estimated variable cost function, the different sources of TFP growth are investigated. It is found that both foreign and local establishments experienced increasing returns to scale, and that the scale effect is relatively higher for foreign establishments. The results also show the existence of excess capacity. In particular, capital utilization is extremely inefficient in foreign establishments. The results of the decomposition of TFP growth suggest that the average annual TFP growth rate remained very low or negative for both local and foreign establishments even before the financial crisis. In addition, the greatest part of the TFP growth rate is explained by the scale effect and the capital utilization effect, while the technological change effect is negligible for both foreign and local establishments. This suggests that demand-side factors are rather important for productivity growth in Indonesia. According to Rhys (1998), the minimum efficient scale is about 250,000 units per year for automobile assembly and about one million units per year for the casting of engine blocks and pressing of panel parts. In Indonesia, however, even the largest assembler plant only assembles at most about 75,000 automobiles per year, which is much lower than the production scale of a major Japanese assembly plant (approximately 600,000 units per year) or a major Thai assembly plant (approximately 150,000 units per year).[23]

On the other hand, according to economic theory, the inefficiency of capital utilization may be the result of the fragmented small market and noncompetitive reasons that affect market power (Tirole 1988). As argued in section 7.2, although there are more than ten automobile assemblers in Indonesia, a small number of conglomerates own more than one assembly firm and produce more than one brand name. Moreover, one conglomerate, the Astra group, commands a market share of more than 50 percent and controls a large number of affiliated auto parts suppliers. The high average price-cost margins also imply that there is little competition in the Indonesian automobile market. Therefore, an important reason for the poor overall performance of both foreign and local establishments seems to have been the highly concentrated structure of the industry and the lack of competition.

The results of this paper strongly confirm that production scale and capital utilization are extremely important determinants of productivity and that technological change is negligible for both foreign and local establish-

23. The information on units of cars assembled in a year was taken from various yearbooks of the automobile market and interviews by the author.

ments. They therefore clearly demonstrate the importance of sufficient market scale and competition if efficiency is to be improved.

As Okamoto and Sjöholm (2000) argue, the government interventions may have created an environment in which weak competition allows inefficient establishments to stay in the industry. Sufficiently large demand and sufficient technological capabilities are essential to the development of the automobile industry; otherwise, the industry will remain in its infancy stage. Although the Indonesian government has introduced some deregulation packages since the early 1990s, the liberalization policy seemed to lack a rigorous discipline or strategy: The government also launched the national car project in 1996, to which it granted special privileges. However, following the IMF instructions after the 1997 crisis, they scrapped the privileges to the national car project and began to implement various liberalization policies. In 1999, the government abandoned the incentive system, which it had introduced in 1993 to foster the auto parts industry, liberalized the imports of CBU cars, and lowered import tariffs. Moreover, the government sold its shares in PT of Astra International to a Singaporean company in 2000.[24] It is difficult to evaluate the effects of the liberalization policy on plant productivity in the automobile industry, as the analysis in this paper is limited to the short period from 1990 to 1999 and plant productivity was heavily affected by the large demand shock after the crisis. Nevertheless, some indexes seem to provide a positive sign for the future prospects of productivity growth. For example, in the motor vehicle component industry, average variable cost and value added per employee improved from 1995 to 1999, and the export share in output rapidly increased during the period. At the same time, the Herfindahl index decreased substantially, suggesting an intensification of competition in the motor vehicle component industry (table 7.6). In order to judge whether the liberalization packages are successful and whether the intensified competition in both the domestic and the overseas markets contributes to productivity improvements, further studies are required, in which case the introduction of a cross-country comparative perspective should be helpful.

Appendix A

Data Description

The value of plant output is measured as the sum of the total value of production and revenues from manufacturing services. The value of output is

24. PT is an abbreviation of Indonesian words, *perséroan terbatas,* referring to limited companies.

deflated by the wholesale price index of manufactured commodities defined at the three-digit ISIC industry level.

In my analysis, each producer uses three inputs in production: labor, capital, and intermediate materials. Labor input is measured as the number of production and other workers. Total payments to labor are measured as total salaries to both groups and are deflated by the general consumer price index.

Capital input is estimated as the book value of fixed assets, including buildings, machinery and equipment, vehicles, and other fixed capital. To control for price-level changes in new capital goods, using the 1993 book values as the basis, I deflate the changes in each plant's book values between the years by the wholesale price indexes for capital goods. By adjusting these deflated changes to the 1993 book values, I scale the book values of capital goods at each year to the 1993 basis. The change in the book value of buildings is deflated by the wholesale price index of residential and nonresidential buildings. The changes in the book values of machinery and equipment, vehicles, and other fixed capital are deflated by the wholesale price index of capital goods. In addition, it should be noted that some missing values of fixed assets are linearly interpolated or extrapolated by the author, using the number of employees for the establishment as an explanatory variable.

Material input includes raw materials and fuel used by the plant. Expenditures on domestically produced raw materials are deflated by the wholesale price index for manufacturing raw materials, and expenditures on imported raw materials are deflated by the wholesale price index for imported manufacturing raw materials. Fuel expenditures are deflated by the consumer price index for fuel, electricity, and water (unfortunately, the wholesale price index for fuel is not available).

The wholesale price indexes are taken from the BPS, *Monthly Statistical Bulletin: Economic Indicators* (various years-b). The consumer price indexes are taken from the BPS, *Statistical Yearbook of Indonesia* (various years-c).

In order to obtain the total cost for each establishment, the rental rate of physical capital is calculated as $w_{kt} = p_{Kt} \cdot (r_t + \delta_K)$, where r_t is the real rate of return in year t, δ_K is the depreciation rate of capital, and p_{Kt} is the price deflator for capital investment in year t. I used the interest rates for investment at commercial banks, obtained from the Bank Indonesia, *Indonesian Financial Statistics* (various years). The depreciation rate was assumed at an arbitrary 10 percent.

Table 7A.1 Entry and Exit Flows in the Data Set

No. of Establishments (in which foreign-owned establishments)	1990–1995		1995–1997		1997–1999	
Motor Vehicles (38431/34100)[a]						
Continuing	7	(3)	4	(2)	5	(3)
Newly entered	0	(0)	2	(1)	0	(0)
In which newly established	0	(0)	1	(0)	0	(0)
Exit	0	(0)	3	(1)	1	(0)
Motor Vehicle Bodies (38432/34200)[a]						
Continuing	50	(0)	47	(0)	38	(1)
Newly entered	9	(0)	9	(0)	1	(0)
In which newly established	5	(0)	7	(0)	0	(0)
Exit	4	(0)	12	(0)	18	(0)
Motor Vehicle Component and Apparatus (38433/34300)[a]						
Continuing	33	(6)	37	(7)	62	(10)
Newly entered	10	(2)	29	(4)	13	(7)
In which newly established	6	(1)	22	(4)	13	(7)
Exit	1	(0)	6	(2)	4	(1)

Source: Author's calculations based on BPS establishment-level data (various years-a).

Notes: Ownership information for exiting establishments is based on the foreign ownership share in the initial year in the period, while for operating and newly entered establishments it is based on the foreign ownership share in the last year of the period.

[a]Industrial classification code for BPS, *Statistik Industri* (various years-d). The industry code was changed in 1998.

Table 7A.2 Descriptive Statistics of the Sample of Establishments (simple average)

	Motor Vehicles Total (3843/34), Full Sample		
	1990	1995	1999
No. of establishments	95	111	119
No. of employees per establishment	239	303	217
Output per establishment[a]	26,600	43,500	25,500
Value added per establishment[a]	16,500	20,800	16,500
Capital stock per establishment[a]	3,973	8,749	15,000
Years in operation	10.3	14.7	12.6
Productivity measures			
Average variable cost[b]	0.64	0.67	0.62
Output per employee[a]	47.5	55.5	57.8
Value added per employee[a]	24.2	18.4	38.1
Capital-labor ratio[a]	25.4	28.1	69.8
Share of nonproduction workers (%)	17.4	19.6	21.8
Inventory ratios (%)			
Total inventory	n.a.	23.4	32.6
Final goods inventory	n.a.	5.1	6.7
Work-in-process inventory	n.a.	6.0	7.2
Raw materials inventory	n.a.	14.8	22.6

Table 7A.2 (continued)

	Motor Vehicles Total (3843/34), Full Sample		
	1990	1995	1999
Other indicators			
Production worker wages[c]	2,301	2,619	2,745
Nonproduction worker wages[c]	5,416	5,726	12,717
Price-cost margin (%)[d]	35.2	33.8	32.1
Export share in output (%)	0.7	2.0	6.9
Import ratio (%)	22.0	22.5	28.5
	Motor Vehicles Total (3843/34), Large Establishments		
	1990	1995	1999
No. of establishments	48	56	60
No. of employees per establishment	407	539	369
Output per establishment[a]	52,000	85,800	50,200
Value added per establishment[a]	32,300	41,000	32,400
Capital stock per establishment[a]	6,349	15,900	27,800
Years in operation	10.5	14.1	12.7
Productivity measures			
Average variable cost[b]	0.55	0.62	0.54
Output per employee[a]	84.2	101.9	107.7
Value added per employee[a]	43.9	32.8	71.6
Capital-labor ratio[a]	18.6	27.1	111.4
Share of nonproduction workers (%)	20.4	21.6	22.7
Inventory ratios (%)			
Total inventory	n.a.	24.5	28.5
Final goods inventory	n.a.	8.0	4.3
Work-in-process inventory	n.a.	3.8	3.4
Raw materials inventory	n.a.	13.6	24.4
Other indicators			
Production worker wages[c]	3,118	3,769	3,996
Nonproduction worker wages[c]	7,863	8,816	21,732
Price-cost margin (%)[d]	43.0	38.5	37.3
Export share in output (%)	0.0	4.0	13.7
Import ratio (%)	36.7	37.7	46.3

Source: Author's calculations based on BPS establishment-level data (various years-a).

Notes: Some of the observations were not included because of missing values or recording mistakes. n.a. = not available. "Large establishments" are defined as the largest 50 percent of establishments sorted by output each year.

[a]In 1993 millions of rupiahs. For price deflators, see appendix A.

[b]Average variable cost is defined as the sum of labor and intermediate input costs divided by output.

[c]In 1993 1,000 rupiahs. For price deflators, see appendix A.

[d]Price-cost margin is defined as (value added – wages paid)/output.

Table 7A.3 Descriptive Statistics of the Sample of Establishments by Ownership in the Motor Vehicle Industries (simple average)

	Motor Vehicles Total (3843/34), Large Establishments											
	1990–96 pooled		1990		1995		1999		Ratio of Foreign to Domestic			
	DO	FO	DO	FO	DO	FO	DO	FO	1990–96	1990	1995	1999
No. of observations	317	74	40	8	45	11	39	21				
No. of employees	385	809***	341	738	447	916	256	579*	2.1	1.8	1.6	2.1
Output per establishment[a]	25,507	203,725***	13,637	244,026	36,706	286,572	14,836	115,803	8.0	8.1	4.7	6.5
Value added per establishment[a]	9,412	125,021***	7,779	155,106	8,736	173,188	9,660	74,679	13.3	7.0	9.4	6.1
Capital stock per establishment[a]	8,005	34,869***	4,865	13,768	10,085	39,787	19,073	44,024*	4.4	2.1	1.9	2.7
Years in operation	11.7	12.7	10.4	11.0	14.0	14.8	13.7	10.7	1.1	1.0	1.0	0.7
Average variable cost[b]	0.62	0.51***	0.57	0.43	0.65	0.53	0.46	0.69	0.8	0.7	0.8	1.5
Output per employee[a]	75.0	151.5***	63.4	188.4*	85.4	169.3	61.3	193.8*	2.0	2.5	2.5	5.0
Value added per employee[a]	29.3	76.5***	30.6	110.3*	21.6	78.9	39.7	130.9*	2.6	2.8	4.0	5.3
Capital-labor ratio[a]	23.2	50.4**	18.1	21.3	24.3	38.8	87.7	155.5	2.2	1.0	1.1	2.8
Share of nonproduction workers (%)	22.2	24.8	20.0	22.7	20.9	24.7	21.2	25.5	1.1	1.2	1.2	1.3
Total inventory (%)[c]	22.1	27.8	n.a.	n.a.	18.5	16.7	14.8	11.6	1.3	n.a.	0.9	0.8
Final goods inventory (%)[c]	3.7	4.8	n.a.	n.a.	4.0	3.8	2.6	2.4	1.3	n.a.	1.0	0.9
Work-in-process inventory (%)[c]	4.0	4.1	n.a.	n.a.	2.4	0.8**	2.7	1.0**	1.0	n.a.	0.3	0.4
Raw materials inventory (%)[c]	15.2	18.7	n.a.	n.a.	10.1	7.8	17.0	6.9	1.2	n.a.	0.8	0.4
Production worker wages[d]	3,212	5,126***	2,739	5,015**	3,252	5,885*	2,300	7,146**	1.6	2.2	2.2	4.1
Nonproduction worker wages[d]	7,669	10,658***	6,761	13,369**	8,515	10,047	11,033	41,600	1.4	2.3	1.0	6.1
Export share in output (%)	3.3	3.2	0.0	0.1	5.0	0.0**	7.4	25.2*	n.a.	n.a.	n.a.	5.1
Import ratio (%)	32.1	62.4***	31.7	61.3*	32.6	58.5*	37.7	61.7**	1.9	1.7	1.5	2.0

Source: Author's calculations based on BPS establishment-level data (various years-a).

Notes: Some of the observations were not included because of missing values or recording mistakes. The *t*-tests are performed based on the assumption of unequal variances. n.a. = not available; DO = domestic-owned; FO = foreign-owned. "Large establishments" are defined as the largest 50 percent of establishments sorted by output each year.

[a]In 1993 millions of rupiahs. For price deflators, see appendix A.

[b]Average variable cost is defined as the sum of labor and intermediate input costs divided by output.

[c]Inventory data are not available for 1990 and 1991.

[d]In 1993 1,000 rupiahs. For price deflators, see appendix A.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Appendix B

Total Factor Productivity Decomposition Formula

The TFP decomposition formula is derived as follows. When physical capital stock (K_t) is considered as a quasi-fixed input in the short run, the variable cost (VC_t) function is given by

$$\mathrm{VC}_t = h(P_{Lt}, P_{Mt}, K_t, Y_t, t), \tag{B1}$$

where P_{Lt} and P_{Kt} are the factor prices of labor and of intermediate inputs, and Y_t denotes output.

Taking the total derivative with respect to time t, we get

$$\frac{d\mathrm{VC}_t}{dt} = \sum_{f=L,M} \frac{\partial h}{\partial P_{ft}} \frac{dP_{ft}}{dt} + \frac{\partial h}{\partial K_t} \frac{dK_t}{dt} + \frac{\partial h}{\partial Y_t} \frac{dY_t}{dt} + \frac{1}{\mathrm{VC}_t} \frac{\partial h}{\partial t} \tag{B2}$$

Using $\varepsilon_{Kt} = \partial \ln \mathrm{VC}_t / \partial \ln K_t$, $\varepsilon_{Yt} = \partial \ln \mathrm{VC}_t / \partial \ln Y_t$ and applying Shephard's lemma, equation (B2) becomes

$$\frac{d \ln \mathrm{VC}_t}{dt} = \frac{\mathrm{TC}_t}{\mathrm{VC}_t} \sum_{f=L,M} s_{ft} \frac{d \ln P_{ft}}{dt} + \varepsilon_{Kt} \frac{d \ln K_t}{dt} + \varepsilon_{Yt} \frac{d \ln Y_t}{dt} + \frac{1}{\mathrm{VC}_t} \frac{\partial h}{\partial t}, \tag{B3}$$

where $s_{ft} = P_{ft} X_{ft} / \mathrm{TC}_t$.

On the other hand, since the variable cost is defined as $\mathrm{VC}_t = \Sigma_{f=L,M} P_{ft} X_{ft}$, taking the total derivative of this definition equation yields

$$\frac{d \ln \mathrm{VC}_t}{dt} = \frac{\mathrm{TC}_t}{\mathrm{VC}_t} \sum_{f=L,M} s_{ft} \frac{d \ln X_{ft}}{dt} + \frac{\mathrm{TC}_t}{\mathrm{VC}_t} \sum_{f=L,M} s_{ft} \frac{d \ln P_{ft}}{dt} \tag{B4}$$

Subtracting the common terms from equations (B3) and (B4), and applying the Törnqvist index–type approximation, we obtain

$$\begin{aligned} &\frac{1}{2}\left(\frac{\mathrm{VC}_t}{\mathrm{TC}_t}\varepsilon_{Kt} + \frac{\mathrm{VC}_{t-1}}{\mathrm{TC}_{t-1}}\varepsilon_{Kt-1}\right)\ln \frac{K_t}{K_{t-1}} + \frac{1}{2}\left(\frac{\mathrm{VC}_t}{\mathrm{TC}_t}\varepsilon_{Yt} + \frac{\mathrm{VC}_{t-1}}{\mathrm{TC}_{t-1}}\varepsilon_{Yt-1}\right) \\ &\quad \cdot \ln \frac{Y_t}{Y_{t-1}} + \frac{1}{2}\left(\frac{1}{\mathrm{TC}_t}\frac{\partial \mathrm{VC}_t}{\partial t} + \frac{1}{\mathrm{TC}_{t-1}}\frac{\partial \mathrm{VC}_{t-1}}{\partial t}\right) \\ &\quad = \frac{1}{2}\sum_{i=L,M}(s_{it} + s_{it-1}) \ln \frac{X_{it}}{X_{it-1}} \end{aligned} \tag{B5}$$

On the other hand, the definition of TFP growth rate is given by

$$\ln \frac{\mathrm{TFP}_t}{\mathrm{TFP}_{t-1}} = \ln \frac{Y_t}{Y_{t-1}} - \frac{1}{2} \sum_{f=L,K,M} (s_{ft} + s_{ft-1}) \ln \frac{X_{ft}}{X_{ft-1}} \tag{B6}$$

From the definition of the TFP growth rate (B6) and equation (B5), the TFP growth decomposition formula is derived as equation (7) in section 7.4.

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Comment Muhammad Chatib Basri

This is an excellent paper and valuable reading. It addresses the issues of the relationship between foreign ownership and productivity. In particular, this paper addresses two questions: First, are foreign plants more productive than local plants, as the MNC theory predicts? Second, if so, what are the determinants of the plants' productivity? This paper also focuses on the establishment data during 1990–99. Consistent with the previous study, this paper shows that foreign establishments tend to be larger in size, enjoy high labor productivity, and pay higher wages than the local ones. In addition, this paper suggests that foreign establishments have a significantly higher productivity than local ones (as presented in table 7.5). In terms of total factor productivity, this paper shows that scale effect and capital utilization are important determinants of productivity level, whereas technological change is negligible. One of the important contributions made by this paper is a comprehensive and in-depth study of the productivity of the Indonesian automotive industry. The results produced by Ito should be regarded as the best indicative given the short time period from 1990 to 1999.

The result on productivity is consistent with previous studies by Okamoto and Sjöholm (2000), among others (Aswicahyono, Basri, and Hill 2000), that argue that protective policy during the period before the economic crisis led to weak competition and allowed inefficient establishments to survive. This is particularly true as suggested by a comparative indicator, the Asian automotive industry in 1995. In terms of sales, production, and exports, Indonesia lagged behind other Asian countries, with the exception of the Philippines. In terms of makers, Indonesia, as well as China and the Philippines, experienced problems in market segmentation.

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This can be seen from the comparison between production and number of makers. With 388,000 production units in Indonesia, there were thirteen makers. The average maker produced around 30,000 units, which was very low, particularly compared with South Korea's 525,000 units (Aswicahyono, Basri, and Hill 2000).

As pointed out by Basri (2001), from the 1970s until the end of the 1980s, the structure of local ownership in the automotive industry was dominated by a patrimonialist patronage. The ambitious nationalist policy to develop Indonesia's domestic automotive industry resulted in a high level of trade protection through nontariff barriers, tariffs, and local content schemes. Furthermore, this policy created rents that attracted rent seekers into the industry. The Indonesian automotive industry is a classic example of an infant industry that failed to grow. In Indonesia the automotive industry is something coined an old baby or a permanent infant industry.

On the ownership issue there are several important characteristics to observe. First, major groups produce more than one brand name, often with little apparent synergy in the production activities of these groups. For example, one group produces Mercedes Benz and Hyundai. Second, until recently, foreign partners were rarely able to obtain majority ownership (Aswicahyono, Basri, and Hill 2000). It is therefore not surprising that some joint-venture partners are reluctant to make a major commitment with the local firms, such as upgrading technological capabilities. These characteristics help to explain why there was little spillover from the foreign to the local firms.

Now I will go into specific comments.

Ownership is a tricky empirical concept in Indonesia, and it is hard to distinguish various ownerships in Indonesia. In addition, foreign presence is apparent in various ways, some of which unrelated to equity investment—for example, licensing (Aswicahyono and Hill 2002). Unfortunately Ito says little about the definition of foreign ownership in her paper, and how to treat joint ventures, which play an important role in the pattern of ownerships in Indonesia.

With regard to the ownership concept, it is important to observe whether the productivity differences are due to the productivity aspects (efficiency, technological change, etc.) or to differences in treatment for foreign and local establishments. This is particularly important for the case of Indonesia, as pointed out by Aswicahyono, Basri, and Hill (2000), as the modalities of MNC entry have varied depending on the regulatory environment and foreign partners' preference.

On the descriptive analysis it is interesting to compare the results in table 7.6 with table 7A.1. Some figures—including output per employee, value added per employee, and average variable cost—in table 7.6 are inconsistent with table 7A.1. I believe these inconsistencies appear due to aggregation and price deflator problems. As I understand that the Indonesian

wholesale price index is not available for five-digit ISIC, there is a possibility of underestimating or overestimating the value while aggregating some variables in real terms.

The other interesting figures are export share in output. Ito shows that export share increased significantly and accounted for 20 percent of the output in the motor vehicles industry (table 7A.1). Although this figure is consistent with the export figures (the value of export in 1999 had almost doubled compared to 1995 for vehicles [SITC 781-3] and had more than doubled for components [SITC 784]), we should interpret these figures carefully. In 1998–99 producers shifted toward the export market due to the collapse of domestic demand, whereas at the same time the total output dropped due to the economic crisis. As a result, the ratio of export share to output significantly increased, but it had less to do with increasing productivity in export.

Ito employs three productivity proxies: average cost, output per employee in real terms, and value added per employee. There is a little problem in calculating with these proxies, particularly the average cost. Average cost is very sensitive with price deflators. Unfortunately the wholesale price index is available only up to four-digit ISIC; thus, we cannot distinguish the price deflator for motor vehicles assembly and components, which obviously have different prices. Aswicahyono, Basri, and Hill (2000) assert that share of foreign ownership (in terms of value added or employment) is higher in motor vehicle assembly than in components or body manufacture. Thus, if we employ the single wholesale price index for the overall auto industry, there is a possibility that the average cost is understated for foreign establishments and overstated for local establishments.

In obtaining the total cost of each establishment, the rental rate of physical capital is estimated as $w_{kt} = p_{Kt} \cdot (r_t + \delta_K)$. Ito uses the interest rate for investment at commercial banks. This is particularly true for perfect competition markets (theoretically in a perfect competition we expect that $\mathrm{MP}_k = r$). However, if the market is not perfect, which is the case of the Indonesian capital market, we cannot assume that MP_k is equal to r. Perhaps it is more useful to calculate r_t as follows:

$$\mathrm{VA} = wL + rK,$$

$$r = \frac{(\mathrm{VZ} - wL)}{K},$$

then from this obtain the real rate of return.

On the determinants of productivity, Ito shows that scale effect (proxy by size) is strongly significant in all equations. Although this is consistent with the hypothesis, nevertheless I wonder whether the author has checked the possibility of endogeneity problem. In these equations, size is proxied by labor, whereas all the productivity measures are also determined by la-

bor. Thus there is a possibility of nonrandom selection problems, and that is why sizes are strongly significant for all equations.

Ito's findings show that the greatest part of TFP growth is explained by the scale effect and capital effect, whereas the role of technological change is negligible. These are very important results and support previous studies that indicate that the performance of the Indonesian automotive industry is poor. The change of TFP mainly took place due to the demand-side or policy variable rather than the supply-side or productivity variable of the automotive industry. The significant drop in scale effect in 1991–92 has more to do with the liquidity squeeze implemented by the Indonesian government in 1991 than with the productivity factors. The similar explanation applies for the case of 1997–98. The significant drop of TFP was mainly driven by the economic crisis. As a response to the rupiah's plunge in August 1997, the government raised interest rates drastically. Bank Indonesia Certificate (SBI) rates, which were only 11.2 percent in August 1997, rose significantly to 43 percent in March 1998. Before the crisis, most vehicles were purchased not in cash but on credit, from banks as well as automotive producers' multifinance operation. Thus to interpret these findings it is very important to understand the economic policy underlying the change of scale effects, which in many cases have less to do with the supply side or change in economies of scale or productivity.

The formula in equation (7) should be treated carefully for the short-run case where capital is fixed in the short run. The decline in output will have a larger impact on the decline in scale effect in the short run rather than in the long run. Thus, we need a careful interpretation for TFP growth for the short run, since the decline in the scale effect is likely to be caused by rigidity rather than by an economies of scale problem.

This paper offers a lot of potential to draw out policy implications, for instance, the importance of sufficient market scale and competition for the purpose of efficiency improvement. What is missing in the conclusion is the question of what the brief picture of the way ahead is, considering that there is a significant reduction in trade protection and large exchange rate protection due to the deep rupiah depreciation. Ito argues that weak competition led to economic efficiency. With regard to the economic liberalization that has taken place in Indonesia, the appropriate question to raise is whether or not the productivity of the auto industry will improve in the future.

These comments and suggestions do not detract from the overall summary judgment that this paper is worth reading and offers an important contribution for the study of the automotive industry in Indonesia.

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Comment Francis T. Lui

Keiko Ito has a carefully written paper that is both solid and stimulating. Its empirical findings have important policy implications. Using data from the Indonesian automobile industry from 1990 to 1999, the paper sheds light on the following questions.

First, do multinational corporations (MNCs) possess an "ownership advantage" (i.e., do the superior management resources they have enable them to attain higher productivity). Second, has the productivity of local automobile plants in Indonesia been helped by any possible spillover effects of the MNCs? Third, what are the effects of protectionist policies on the productivity growth rates of both local and foreign establishments in the Indonesian auto industry?

A key finding of the paper is that there is no real ownership advantage in the Indonesian automobile industry. If one uses partial productivity measures, foreign establishments may appear to be superior. However, once the more appropriate measure, total factor productivity (TFP), is used, and if other variables such as the size of establishments are controlled for, then there is no evidence showing that foreign plants outperform local ones. Given this result, it is not surprising that local plants have not enjoyed any productivity spillovers from foreign establishments. Indeed, estimated TFP growth is negative during the sample period of 1990–99 for both foreign and local establishments.

Why does ownership advantage fail to operate in Indonesia? Ito's paper tries to decompose TFP growth into the scale effect, capital effect, and technological change. It is found that there has been very little technological change in both local and foreign establishments, but the scale of the plants plays an important role. This reminds us that technological change, or the Solow residual, may just be a measure of ignorance. After properly controlling for most of the appropriate factors, this residual should remain constant.

One can of course attribute the negative results in the paper to Indonesia's protectionist policies. To a large extent, this may be well justified.

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However, one can also turn the empirical evidence around and argue for the need for "proper" protection. Since size is important, and foreign enterprises do not exert positive externalities, the Indonesian policies of imposing a bar on completely built-up cars from 1971 to 1993 and an import tariff of up to 275 percent in 1993 may be viewed as attempts to increase the size of domestic automobile production and therefore appropriate. One can argue that the protectionist policies have not been stringent enough. Perhaps foreign automobile makers should not be allowed to operate at all, even in the production of auto parts. Had this been done, local establishments might have been able to exploit the scale effect further. I would like to see how Ito could rule out this possibility.

Another possibility is that the auto industry in Indonesia remains an infant industry. It can be argued that the productive capabilities of the local plants are so low that they cannot benefit from any superior management skills or technology that foreign enterprises may have.

Given more time to develop in the future, local plants may be able to learn more effectively.

These hypotheses presuppose that any of the positive spillover effects possibly coming from the MNCs cannot offset the loss in productivity of the local plants due to the reduction in scale economy. But are MNCs really doing that badly in their productivity? The empirical results may also be interpreted in the following way. First, there has been negative TFP growth in these foreign enterprises. Second, the negative growth is due mainly to the fact that their sizes are not big enough. Third, the scale effect has motivated them to invest in making themselves larger. Fourth, this may lead to underutilization of capacity in the short run.

If we believe in this interpretation, we can argue that the real problem is not on the supply side, but rather on the demand side. Because of the low level of economic development, motorization is not significant in Indonesia. The very size of the market must have limited the capability of the automobile industry to exploit the scale effect. Foreign enterprises might have anticipated that the situation would improve in the future, and therefore they were willing to invest heavily. The apparent inefficiencies in the beginning could be considered as part of the costs of long-term investments. However, the unanticipated Asian Financial Crisis has dramatically reduced the size of the market, at least temporarily. As a result, scale economy cannot be exploited. Moreover, foreign enterprises also find that they have overinvested in their capacities. The evidence based on the 1990–99 sample period probably cannot tell the complete story. In the future, if the Indonesian economy keeps on growing, perhaps foreign enterprises will be able to reap their harvests. However, if scale and capital effects dominate the changes in TFP, it is doubtful whether local companies will be able to benefit a lot, even in the long run.

The foregoing discussion does not imply that the current protectionist

policy in Indonesia has not done too much damage. One example showing the dramatic negative effect of protectionism is the automobile industry in China. Before the 1980s, it was difficult to see foreign-made cars running in China. As late as the mid-1980s, some of the auto plants in China were still struggling with producing backward and obsolete Soviet models. In more recent years, protectionism has not disappeared, but it has been diminished significantly. The import tariff is still substantial, but at least imported cars can be seen anywhere in the country. There are also joint ventures that appear to be doing well. For example, Volkswagen has a joint venture with the government of Shanghai. The latter imposes another form of protectionist policy of requiring all the taxis there to use Volkswagen cars only. This may create deadweight loss, but TFP growth of the joint venture may be positive.

Finally, the paper would be easier to follow if the appendix also contained some details on how certain technical equations can be derived.