TECHNOLOGY TRANSFER AND SPILLOVERS:
DOES LOCAL PARTICIPATION WITH
MULTINATIONALS MATTER?

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ABSTRACT

This paper examines the effects on technology transfer and spillovers deriving from ownership sharing of foreign multinational affiliates. More specifically, we try to answer two questions, using unpublished Indonesian micro data. Firstly, do establishments with minority and majority ownership differ in terms of productivity levels? Secondly, does the degree of spillover differ with the degree of ownership in the FDI? Our results show that foreign establishments have comparable high levels of labor productivity and that domestic establishments benefit from spillovers. However, the degree of foreign ownership does neither affect the level of labor productivity in foreign establishments, nor the degree of spillovers.

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I.   Introduction[*]

When firms establish affiliates abroad and become multinational, they are distinguished from the already established firms in the host country for two reasons. One is that they bring with them some amount of proprietary technology that constitutes their firm-specific advantage and allows them to compete successfully with local firms who have the superior knowledge of local markets, consumer preferences, and business practices. Another reason is that the entry of the multinational corporation (MNC) affiliate disturbs the existing equilibrium in the market and forces local firms to take action to protect their market shares and profits. Both these changes are likely to cause various types of externalities or "spillovers" that lead to productivity increases in local firms. Spillovers from foreign direct investment (FDI) may occur from increased competition and labor turnover, or through demonstration, and may take place either in the foreign affiliate's own industry or among the affiliate's suppliers and customers in other industries.

Recent studies of spillovers from foreign direct investment suggest that such effects may be significant, but that they are neither guaranteed, automatic, or free.[1] The effects depend to a large extent on host country and host industry characteristics and the policy environment in which the multinationals operate. For instance, spillovers may not materialize if the technology gap between foreign and local firms is too large, because then there may be little scope for learning.

Another factor that is supposed to influence technology diffusion in host economies is the ownership sharing of foreign affiliates. It is generally believed that local participation with

multinationals reveals the MNCs' proprietary knowledge and in that way facilitates spillovers. With this as an argument, many governments have introduced restrictions on foreign ownership and forced multinationals into joint venture agreements.

Forcing multinationals into equity sharing, however, is not unproblematic. For instance, if there is a risk for foreign firms to loose their intangible assets to a local partner, they may either refuse to invest or bring less advanced (older) technologies to the affiliates. Moreover, majority ownership results in greater control over profits, which in turn provides a greater incentive to transfer technology and management skills to subsidiaries. We would, hence, expect that the greater the foreign control over an affiliate, the more sophisticated technologies would be transferred from the parent firm.[2]

The more technologies brought in to the affiliate, the larger is the scope for spillovers. But there are also other factors that affect spillovers and which are working in the opposite direction. Since local partners in minority owned firms probably get closer contact with the foreign technology, that might enhance technology diffusion in the host economy. Moreover, there are several reasons why MNCs may seek out joint ventures even without formal requirements. For instance, local partners are likely to have better knowledge of local conditions regarding factor endowments and skill of employees.[3] Such factors clearly affect the choice of technology brought in by the MNCs and thereby the degree of spillovers, since technologies suitable for local conditions will have the largest effect on host country firms.

We contribute to the literature on multinationals by examining if the type of foreign ownership has any effect on productivity and the degree of spillovers. As a first step, we analyze

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[2] See Ramachandran (1993).
[3] See Beamish (1988). Blomström and Zejan (1991) find that Swedish firms with relatively brief experience of foreign production are likely to choose minority ventures when they go abroad.

labor productivity differences between local (domestically owned) establishments and establishments with different degree of foreign ownership. We then investigate if the degree of spillovers differ with the degree of foreign ownership.

The paper is organized as follows. Section 2 describes the data and our statistical model. Section 3 includes estimates on productivity differences between firms of different ownership and Section 4 examines the spillover question. There is also a concluding section.

II.   Data and statistical model

The empirical analysis is based on establishment data for 1991 supplied by the Indonesian Central Bureau of Statistics (Biro Pusat Statistik). An industrial survey is conducted yearly and covers all Indonesian establishments with more than 20 employees. In the 1991 industrial survey, the response rate was 85 per cent. The sample consists of 16,494 establishments, which are divided into 329 industries at a 5-digit level of ISIC. However, around 17 per cent of the establishments did not report figures on capital stocks, which leaves us with 13,663 establishments to be used in our estimations.

The data reveal that firms with foreign ownership (majority or minority) produce approximately 20 per cent of the total Indonesian manufacturing gross output in 1991. The largest foreign presence is in such different (3-digit) industries as Chemicals, Beverages, Footwear, and Fabricated Metal Products.[4] There is a difference in the sector wise distribution between joint ventures with different degree of foreign ownership, but there are majority and minority owned firms in every industry at the 3-digit level. This enables us to control for industry specific factors that influence productivity in our comparisons of firms.

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[4] For a description of FDI in Indonesia, see Sjöholm (1999).

In examining the issues at hand, we assume that labor productivity is a function of capital-labor ratio, the skill level of the labor force, capacity utilization, economies of scale, ownership, and various industry specific factors. Labor productivity in establishment i in industry j can thus be expressed as:

$$\frac{Y_{ij}}{L_{ij}} = f\left(\frac{K_{ij}}{L_{ij}}, Skill_{ij}, Capacity\ utilization_{ij}, Scale_{ij}, Foregn\ Ownership_{ij}, Industry_j\right) \qquad (1)$$

where Y, K and L are value added, capital stock (book value), and labor, respectively. The skill level of the labor force is measured as the ratio of white and blue collar workers. Capacity utilization is measured as the share of actual output to potential output as reported by establishments in the questionnaire and *Scale* is an establishment's production over the average production in its 5-digit industry. Ownership is measured by three dummy variables: *For* is a dummy variable with the value 1 for establishments with any foreign ownership (majority or minority). *Min* is a dummy variable with the value 1 for establishments with foreign ownership equal to or less than 50 per cent. *Maj* is a dummy variable with the value 1 for establishments with foreign ownership higher than 50 per cent. Finally, we include 29 industry dummies at the 3-digit level of ISIC to control for industry specific effects not captured by the other explanatory variables. Equation (1) will be estimated in log-linear form.

III. Productivity differences

We start by examining labor productivity differences between establishments of different ownership. Various estimations of equation (1) are shown in Table 1. Regression 1 examines the determinants of labor productivity levels without including industry specific effects or controlling for ownership. All variables register statistically significant coefficients with the expected signs and provide some support for our prior hypotheses. Thus, labor productivity is positively related to capital intensity, labor skill, capacity utilization, and scale of operation.

In Regression 2 we include the industry specific dummy variables. This does not change the overall results. The explanatory variables are still statistically significant with the expected signs. In the third regression, we include the dummy variable *For* to control for foreign ownership. The variable carries a rather large, statistically significant coefficient, suggesting that foreign establishments have comparable high levels of labor productivity. Finally, in Regression 4, we divide the foreign firms into majority and minority owned by including the dummy variables *Maj* and *Min*. The variables have positive and significant coefficients, suggesting that both minority and majority owned foreign affiliates are more productive than domestic establishments. More interesting, however, is that the coefficients are rather similar in size and a chi-square test can not reject the hypothesis of equal coefficients.

Although we try to capture industry specific productivity effects by including 29 (3-digit) industry dummies, the level of aggregation could still have affected our results. We therefore ran separate equations for 9 (2-digit) industries and included 5-digit industry specific dummy variables. The estimations confirmed the results above, with relatively higher labor productivity levels in establishments with foreign ownership, but with no significant difference between minority and majority foreign ownership.

Table 1

Ownership and productivity.

Dependent variable - value added per worker in all establishments

Variables	Regression 1	Regression 2	Regression 3	Regression 4
Constant	4.25	4.65	4.66	4.66
	(30.76)***	(37.64)***	(37.37)***	(38.38)***
K/L	0.33	0.27	0.26	0.26
	(43.45)***	(37.81)***	(36.78)***	(36.78)***
Skill	0.07	0.05	0.05	0.05
	(32.88)***	(23.77)***	(23.81)***	(23.81)***
Cap. Utiliz.	0.28	0.22	0.23	0.23
	(10.18)***	(8.88)***	(9.49)***	(9.49)***
Scale	0.08	0.09	0.09	0.09
	(24.47)***	(29.71)***	(28.50)***	(28.50)***
For	--	--	0.59	--
			(11.07)***	
Min	--	--	--	0.61
				(7.89)***
Maj	--	--	--	0.59
				(8.50)***
Industry dummies	--	estimated	estimated	estimated
Adj. R-sq.	0.38	0.47	0.48	0.48
No. Obs.	13,663	13,663	13,663	13,663
Chi-square test for equal coefficients	--	--	--	0.06

Note: Chi-square test for equal coefficients refer to Min compared to Maj. t-statistics within brackets are based on White's (1980) adjustment for heteroscedasticity.
* Significant at the 10 percent level,
** Significant at the 5 percent level,
*** Significant at the 1 percent level.

Thus, foreign ownership seems to be an important determinant of labor productivity in Indonesian manufacturing, but the degree of foreign ownership in an establishment seems to have no effect on productivity. This suggest that multinationals have a wide range of technologies to choose between when they invest abroad, and that they will adapt their technology transfer to the competitive situation and other conditions in the host economy.

IV. Spillovers

It is generally believed that local participation with multinationals reveals the MNCs proprietary knowledge and in that way facilitates technology spillovers to the domestic sector. Given our finding of no labor productivity differences between minority and majority owned foreign affiliates, we therefore expect spillovers, if they exist, to be larger from minority owned affiliates than from majority owned firms. In order to examine if there are spillovers from foreign investment in Indonesia and if such spillovers differ with the degree of ownership in the FDI, we test whether labor productivity in local firms vary with the degree of foreign production in an industry.

We use three different variables to measures the degree of foreign participation in production. *FDI* is the share of a 5-digit industry's total gross output produced in establishments with foreign ownership (majority or minority). *FDImin* is the share of a industry's gross output produced in establishments with foreign minority ownership and *FDImaj* is the share of a industry's gross output produced in establishments with majority foreign ownership.

The first regression in Table 2 shows that *FDI* has a positive and statistically significant coefficient, which suggests that domestic establishments benefit from the presence of foreign establishments in the same 5-digit industry. The coefficient is stable to the inclusion of sector

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Table 2

Ownership and spillovers

Dependent variable - value added per worker in domestic establishments

Variables	Regression 1	Regression 2	Regression 3
Constant	4.32	4.74	4.74
	(31.36)***	(38.11)***	(38.16)***
K/L	0.30	0.26	0.26
	(40.49)***	(36.12)***	(36.14)***
Skill	0.07	0.05	0.05
	(31.62)***	(24.00)***	(24.01)***
Cap. Utiliz.	0.28	0.22	0.22
	(10.09)***	(8.75)***	(8.75)***
Scale	0.08	0.09	0.09
	(24.33)	(28.35)***	(28.36)***
FDI	1.00	0.34	--
	(15.62)***	(4.40)***	
FDImin	--	--	0.27
			(1.90)*
FDImaj	--	--	0.39
			(4.42)***
Industry dummies	--	estimated	estimated
Adj. R-sq.	0.38	0.45	0.45
No. Obs.	13,037	13,037	13,037
Chi-square test for equal coefficients	--	--	0.52

Note: Chi-square test for equal coefficients refer to FDImin compared to FDImaj.
t-statistics within brackets are based on White's (1980) adjustment for heteroscedasticity.
* Significant at the 10 percent level,
** Significant at the 5 percent level,
***Significant at the 1 percent level.

specific dummy variables, although the size of the coefficient decreases (see Regression 2). Thus, there seems to be positive intra-industry spillovers from FDI in Indonesia.[5]

We compare spillovers from foreign minority and majority owned establishments in Regression 3. Contrary to our expectations, the coefficient for *FDImaj* is slightly larger than the coefficient for *FDImin*, but the difference is not statistically significant. Hence, the degree of foreign ownership of an establishment does not seem to affect the amount of intra-industry spillovers in Indonesian manufacturing.

Again, the high level of aggregation may affect our results. We therefore repeated the estimations at the industry level. Spillovers from FDI were found in some, but not all of the 9 (2-digit) industries.[6] And again, there was no statistically significant difference between spillovers from minority and majority owned foreign establishments.

In sum, our findings suggest that intra-industry spillovers from foreign direct investment exist in Indonesian manufacturing. Labor productivity in domestically owned establishments varies with the degree of foreign presence. However, the spillovers do not seem to be affected by the type of ownership of the foreign establishments. There is no statistically significant difference in the degree of spillovers from minority and majority owned foreign establishments. This suggests that local participation with MNCs does not facilitate technology diffusion in the host economy and that spillovers are determined by something else.

As we mentioned in the introduction, the competitive pressure from FDI is one potentially important determinant of spillovers. Foreign entry into a market may increase competition and force domestic firms to become more efficient. If this is the case, we would expect to find more

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[5] Our cross sectional data does not allow us to test the causality between productivity in local firms and FDI. However, a previous study of the determinants of economic growth suggests that the causality runs from FDI to growth rather than the other way around (see Blomström et al, 1994).

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significant spillovers in non-exporting than in exporting local firms, since export oriented firms already face competition from the world market. This hypothesis is tested in Table 3, where the domestic establishments have been divided into exporters and non-exporters. The results suggest that spillovers are restricted to the non-exporters, which gives support to the hypothesis that FDI increases labor productivity in domestic establishments through competitive pressure. It is worth stressing, however, that this is not an argument for protection. The negative effects of the economy-wide distortions resulting from import substituting policies are likely to overweigh any positive spillover benefits from FDI in the protected sector.

IV. Concluding remarks

Many countries try to frame the environment in which multinational firms operate. Local partner requirement, a frequent condition for FDI, is seen both as a way to restrict foreign influences and to increase the degree of technology diffusion in the host economy. It is generally believed that local participation with multinationals reveals the MNCs' proprietary knowledge and in that way facilitates technology spillovers to the domestic sector. The results of our investigation, however, do not support this hypothesis.

Using detailed Indonesian data, we find that labor productivity is higher in establishments with foreign equity than in purely domestically owned firms and that the latter benefit from spillovers from FDI. However, the degree of local ownership in the FDI does neither seem to effect the productivity in the foreign establishment, nor the degree of spillovers to the domestic

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[6] Spillovers was found in the following industries: *Food, Textiles, Wood, Chemicals,* and *Non-metal products.*

Table 3

Competition and spillovers

Dependent variable - value added per worker in domestic establishments.

	Exporting domestic establishments	Non-Exporting domestic establishments
Variables	Regression 1	Regression 3
Constant	5.28	4.72
	(16.00)***	(35.41)***
K/L	0.23	0.26
	(11.43)***	(33.76)***
Skill	0.04	0.04
	(4.27)***	(23.03)***
Cap. Utiliz.	0.22	0.22
	(3.81)***	(7.96)***
Scale	0.18	0.08
	(10.05)***	(24.29)***
FDI	0.36	0.36
	(1.49)	(4.72)***
Industry dummies	estimated	estimated
Adj. R-sq.	0.35	0.46
No. Obs.	1,921	11,116

Note: Chi-square test for equal coefficients refer to Min compared to Maj.

t-statistics within brackets are based on White's (1980) adjustment for heteroscedasticity.

* Significant at the 10 percent level,

** Significant at the 5 percent level,

*** Significant at the 1 percent level.

sector. We also found that spillovers were restricted to non-exporting local firms, probably because export oriented firms already face competitive pressure from the world market. This suggests that technology spillovers are more a result of the increased competition that follows FDI than ownership sharing of the multinational affiliates.

Appendix

Table A1

Descriptive statistics. All establishments.

Variable	Mean	Standard Deviation	Minimum	Maximum
VA/L	5669	33284	0	3498596
K/L	42133	3111253	0	363031616
Skill	0.3	0.8	0	43.8
Scale	1	4	0	265
Capacity-Utilization (%)	75	19	1	100

Note: Value added – thousand of Rhupias.

Table A2

Correlation Matrix. All establishments.

	VA/L	K/L	Skill	Cap. Util.	Scale	For	Min	Maj
VA/L	1							
K/L	0.53	1						
Skill	0.40	0.35	1					
Cap. Util.	0.04	-0.07	-0.05	1				
Scale	0.30	0.18	0.12	0.01	1			
For	0.24	0.18	0.09	-0.04	0.14	1		
Min	0.15	0.11	0.06	-0.02	0.08	0.58	1	
Maj	0.18	0.11	0.07	-0.03	0.11	0.80	0.0	1

Table A3

Descriptive statistics. Domestic establishments

Variable	Mean	Standard Deviation	Minimum	Maximum
VA/L	4842	32601	0	3498596
K/L	42645	3184997	0	363031616
Skill	0.3	0.7	0	35.8
Scale	1	4	0	265
Capacity-Utilization (%)	75	19	1	100
FDI (%)	12	17	0	100
FDImin (%)	4	9	0	100
FDImaj (%)	8	13	0	98

Note: Value added – thousand of Rhupias.

Table A4

Correlation Matrix. Domestic establishments.

	VA/L	K/L	Skill	Cap. Util.	Scale	FDI	FDImin	FDImaj
VA/L	1							
K/L	0.52	1						
Skill	0.39	0.33	1					
Cap. Util.	0.05	-0.06	-0.04	1				
Scale	0.28	0.17	0.11	0.01	1			
FDI	0.18	0.13	0.12	-0.00	-0.12	1		
FDImin	0.13	0.11	0.09	-0.04	-0.06	0.62	1	
ˉmaj	0.13	0.08	0.08	0.02	-0.11	0.83	0.09	1

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