Foreign Networks and Exports: Results from Indonesian Panel Data

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Abstract

Participation in exports differs substantially between plants even within industries. One plausible hypothesis is that foreign networks decrease export-costs and that plants with large amounts of such networks will be relatively likely to start export. We focus on two types of foreign networks: foreign ownership and import of intermediate products. Our results suggest that plants in Indonesian manufacturing with any foreign ownership are substantially more likely to start export than wholly domestically-owned plants. The results remain robust to alternative model specifications and after controlling for other plant characteristics. There is no effect on export from import of intermediate products.

Keywords: Export; Sunk Costs; Foreign Ownership; Import

JEL classification: F10; F23; L10

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I. Introduction

The heterogeneity of firms has been a core aspect in recent years empirical literature on international trade. Firms within sectors and countries differ substantially in various characteristics such as size, capital intensities, and productivity levels. The heterogeneity includes firms' participation in international trade; most firms typically produce for the domestic market and there are often few entries into export. The obvious question is what are the determinants of firms' participation in export?

Micro-econometric studies on panel data find size, productivity, and skills of the labour force, to be important determinants.[1] It is likely, however, that more than large size and high productivity is required to export, considering the large difficulties involved. For instance, to be able to export requires knowledge about foreign consumer preferences, distribution system, legal framework and a host of other aspects of the foreign market. Such information is costly to collect and are normally referred to as sunk entry costs: expenses incurred from entering a foreign market must be written off whether the firm decides to export or not.[2] On the other hand, once the firm has invested in collecting the information, it can utilize it without much further costs. The export entry costs can be expected to vary between firms and Roberts and Tybout (1997, p.561) suggest that foreign networks will decrease a firm's cost for collecting information on new markets, but the issue has not been fully empirically examined. There are different channels where foreign networks can develop. This paper contributes to the literature by examining two possible channels: foreign ownership and imports of goods from abroad.

Cross-section studies typically find exporting firms to have more foreign contacts in comparison to non-exporting firms. In particular, a relatively high proportion of exporters

[1] See, e.g., Bernard and Jensen (1999, 2001), Bernard and Wagner (2001), Clerides et al. (1998), and Roberts and Tybout (1997).

[2] See e.g. Baldwin (1988, 1989), Baldwin and Krugman (1989), Dixit (1989a, 1989b), and Krugman (1989).

tend to have foreign ownership.[3] Such findings suggest a link between foreign networks and the ability to become an exporter but the causality is unclear. It is, for instance, possible that foreign owners tend to acquire exporters rather than non-exporters, and that imports follows from exports rather than causing it. To control for these possibilities requires a panel data set where the plants can be followed over time.

This paper studies the export-decision within the Indonesian manufacturing sector on a panel of plants between 1990-2000. This enables us to control for firm specific effects and for possible causality problems. We use a general method of moments (GMM) model, which unlike other commonly used methods produce unbiased and efficient estimates of the export determinants. Plants with some foreign ownership are relatively likely to start export even after controlling for other plant characteristics. There is no evidence of an effect from import of intermediate goods on the choice to export.

II. Exports in the Indonesian Manufacturing Sector

The structure of the Indonesian manufacturing sector is seen in Table 1. The number of plants increased with about 34 percent from 16,536 in 1990 to 22,174 in 2000. The relative size of different sectors has changed over time, where the share of Food products has declined and the shares of Textiles and Fabricated metal products have increased. Textiles is the largest employer in year 2000, accounting for almost one third of the manufacturing labour force, and Fabricated Metals is the largest sector in terms of value added with a share of about 27 percent. Moreover, these two sectors are together accounting for almost 47 percent of total manufacturing exports. Other sectors with large export include Food, Wood and Furniture, and Chemicals. The share of manufacturing output that is exported has increased from about 17 percent in 1990 to about 26 percent in 2000. Every industry within manufacturing has

[3] See e.g. Ramstetter (1999) and Sjöholm (2003) in the case of Indonesia.

become more export-oriented. Despite this increase in export, an overwhelming share of output is supplying the domestic market and only in Wood and Furniture is more than 50 percent of output exported. The importance of production for the domestic market compared to export is even more striking from the share of plants that export; the share has increased over time, but is still only about 17 percent. Even in the most export-intensive industry, Wood and Furniture, less than 38 percent of the plants are engaged in export.

Table 2 compares characteristics of exporters and non-exporters. Exporters have a labour productivity about twice as high as non-exporters and the difference seems to have increased over time. Exporters' relatively high labour productivity is found in every sector in both years. Moreover, exporters are considerably larger in terms of employment than non-exporters, about four times as large in 1990 and six times as large in 2000. Again, exporters are relatively large in all sectors in both years. Finally, exporters seem to include a higher share of white-collar workers, but the difference is relatively small and not consistent over sectors.

Our main hypothesis is that foreign contacts may increase the likelihood of exports. The figures on imports and foreign ownership in table 3 confirm that foreign plants are more common among exporters than among non-exporters and that exporters have a higher share of imports of intermediate goods. The share of foreign plants among exporters was 13 percent in 1990 and 27 percent in 2000. The share among non-exporters was 3 and 7 percent respectively, and foreign plants are more common among exporters than among non-exporters in all sectors. The same pattern is seen for import where the share of imports among exporters increased from 19 to 24 percent between 1990 and 2000, and the share among non-exporters has been stable at 9 percent.

As previously said, the causality between plant characteristics and export in tables 2 and 3 is not clear. We will try to control for this by looking at plants' entry to, and exit from,

export. Table 4 shows the pattern of entry and exit. The share of non-exporters that start to export in the following year has been rather stable at around five percent over the years. However, there are differences between sectors where, for instance, plants in Wood and Furniture and Other manufacturing are relatively likely to become exporters, and plants in Food products and Paper and Pulp are relatively unlikely to become exporters. The exit rate from export is very large; about one third of exporters in 1990 exit from exports the following year. The exit rate declines over time to about 20 percent in 1999. Part of these high figures seems to be caused by plants that exit and re-entry into export. For instance, the exit rate declines to about 20 percent in 1990 if only those plants that do not export in any of the next three years are included (not shown). Hence, about one third of the plants that exit export in 1991, re-entered export in the following two years. The implication is that it seems important to control for previous export in our econometric analysis.[4]

III. Model, Variables, Data and Econometric Method

Model

A profit-maximizing firm will export if the difference between the current value of expected total profits from export and no export ($\hat{\pi}_{it}$) is greater than a fixed cost to change its export status (F_{it}).[5] The fixed cost is assumed to depend on the firm's previous export experience. There is no cost for a firm to export in the current year if it exported in the previous year, but it will face a cost to exit from the foreign markets (X_i).

The export decision can be expressed as follows:

$$Y_{it} = \begin{cases} 1 & \text{if } \hat{\pi}_{it} - F_{it} \geq 0, \text{where } F_{it} = F_i^{\infty} + (F_i^{\infty} + X_i)Y_{i,t-1} + \sum_{j=2}^{J} (F_i^{\infty} - F_i^{j})\tilde{Y}_{i,t-j}, \\ 0 & \text{otherwise,} \end{cases} \quad (1)$$

[4] In addition, there is a group of plants that export only a minor share of their output. The exit rate declined to slightly less than 30 percent in 1990 if exporters are defined as plants with more than ten percent of their output exported.

[5] See, e.g., Bernard and Jensen (1999, 2001), Bernard and Wagner (2001), Clerides et al. (1998), and Roberts and Tybout (1997).

where Y_{it} is a dummy variable with the value 1 if the *i* th firm chose to export during year *t*. Moreover, F_i^{∞} is a fixed cost to enter foreign markets for the first time, $F_i^j (j \geq 2)$ is a fixed cost to re-enter foreign markets after *j*-1 years of non-exporting. $\tilde{Y}_{i,t-j} \equiv Y_{i,t-j} \prod_{k=1}^{j-1} (1 - Y_{i,t-k})$ shows the most recent export experience and J_i is the firm's age. For example, for a firm that exports at year *t*-2 but do not export at year *t*-1, $Y_{i,t-1} = 0$, $\tilde{Y}_{i,t-2} = 1$, $\tilde{Y}_{i,t-j} = 0 (j > 2)$, and then $F_{it} = F_i^2$.

Non-structural models can be derived from equation (1) by assuming that $\hat{\pi}_{it} - F_i^{\infty}$ is a function of various factors that affect a firm's profitability ($\mathbf{z}_{it}$), and the error term (ε_{it}). The following dynamic binary choice equation is then obtained:

$$Y_{it} = \begin{cases} 1 & \text{if } \boldsymbol{\beta}' \mathbf{z}_{it} + \gamma^{\infty} Y_{i,t-1} + \sum_{j=2}^{J} \gamma^j \tilde{Y}_{i,t-j} + \varepsilon_{it} \geq 0, \\ 0 & \text{otherwise,} \end{cases} \tag{2}$$

where the fixed costs F_i^{∞}, F_i^j and X_i in equation (1) are assumed to be identical among plants so that $F_i^{\infty} + X_i = \gamma^{\infty}$ and $F_i^{\infty} - F_i^j = \gamma^j$. The error term, ε_{it}, can be decomposed in a time-invariant plant-specific effect, η_i, and a pure error term, u_{it}. The former includes observable effects such as location, and unobservable effects such as managerial skill and plant-specific assets.

Variables

Two types of variables are included in the vector $\mathbf{z}_{it}$. Firstly, there are time-specific factors that have a common effect on all plants' export-decision, such as exchange rates and trade policy conditions. Including time-specific dummy variables will capture such factors. The second type is time-variant plant-specific variables. The amount of foreign contacts will be captured by a dummy variable on foreign ownership and a dummy variable for imports of intermediate goods. In addition, we examine the effect of public ownership since such plants

may have other objectives than purely private plants. We also include additional variables that are likely to affect export: value added per worker, the use of power divided by the number of workers, the share of white-collar workers in total employees, and plant size measured by the number of workers. The first two variables aim at measuring labour productivity and capital intensity and are included since they might affect product quality or plant profitability, and thereby the probability to export. We include the share of white-collar workers to capture the skill level of the plants' workers, which might have an impact on product quality and on export. Size may affect export through, for instance, scale economies. Another plausible mechanism between size and export is that large plants have been successful in the domestic market, which could increase the possibility to succeed also internationally.

Finally, we control for industry specific effects by including industry dummy variables at a 3-digit level of ISIC, and all independent variables are lagged one year in order to avoid causality problems.

Data

We analyze the issues at hand on Indonesian manufacturing data supplied by the Indonesian Statistical Office. The data includes all manufacturing plants with more than 20 employees in any of the years 1975-2000. We will use data between 1990 and 2000 when export figures are included. Plant identification codes enable us to construct a panel and follow the plants over time. After cleaning the data, our dataset contains 197,195 observations for 26,987 plants during 1990-2000.

Econometric Methods

The estimation of a dynamic binary choice model for panel data is econometrically complicated by various possible biases. One such bias is that some of the independent

variables are likely to be highly correlated with the plant-specific effect, η_i. For instance, managerial skill and plant-specific assets, which are included in the plant-specific effect, are presumably correlated with firm size and productivity. The commonly used method of treating the individual effects η_i as random will therefore cause biased estimates of the parameters.[6] Treating the individual effect as fixed may also cause inconsistent estimates in a non-linear model with panel data and a relatively short time period.[7] We therefore choose to estimate equation 2 as a linear probability model. This method follows Bernard and Jensen (1999, 2001) and Bernard and Wagner (2001), who examine sunk costs and export by estimating a dynamic linear probability model with the assumption of a first order autoregressive process, which implies that $\tilde{Y}_{i,t-j}$ in equation 2 is omitted. It is known that the coefficient on $Y_{i,t-1}$ is upward-biased when the model is estimated with ordinary least square (OLS) ignoring plant-specific effects.[8] In addition, the slope coefficients are biased in the fixed effect model because the lagged dependent variable is correlated with the error term.[9] When γ^{∞} is positive, the bias of the coefficient is always negative.[10] Using these characteristics, an upper bound on the importance of sunk costs is estimated by OLS and a lower bound by a fixed effect model controlling for plant-specific effects.

Hence, the OLS and the fixed effect model will provide biased estimates of the included coefficients. However, there are other different approaches that are used to get consistent estimators in dynamic linear probit models. The first, and most common approach is to use an instrumental variable model (IV).[11] In such model, a consistent estimate of γ^{∞} is obtained by applying instrumental-variable methods after differencing out plant-specific effects. The IV estimator is consistent but not necessarily efficient because it uses only some

[6] See e.g. Bernard and Jensen (2001, pp.11-12).
[7] Hsiao (1986, p.159).
[8] See e.g. Hsiao (1986, pp.76-78).
[9] The fixed effect model is in the literature also referred to as dummy variable least square.
[10] See, e.g. Hsiao (1986, pp.73-76).
[11] See e.g. Bernard and Jensen (1999, 2001), Bernard and Wagner (2001), and Holz-Eakin *et al*.(1988).

of the available moment conditions.[12] Furthermore, the error term is auto-correlated in the differenced equation unless it follows a unit root process. We will follow the approach by Arellano and Bond (1991), Arellano and Bover (1995), and Ahn and Schmidt (1995) who have suggested a general method of moments approach (GMM) for linear dynamic panel models. One advantage with this method is that it takes account of first-order serial correlation of the error term and provides unbiased as well as efficient estimates.

IV. Econometric Results

As previously discussed, the coefficients in OLS and fixed effect models are biased, but estimating these models enables us to compare the results with previous studies, and it will also provide a sense for how robust the results are. We therefore start with the OLS and the fixed effect models, followed by the GMM estimations.

Table 5 shows the results for the OLS and the fixed effect models. All estimations in the table confirm our hypothesis that foreign ownership is important for export. Foreign-owned firms are between 6.2 and 8.4 percent more likely than domestic plants to start export (columns 1 and 2). The fixed effect model examines changes within plants over time and the coefficient for foreign ownership is in this model estimating the likelihood of export in plants that change ownership. It is seen that such firms are between 8.4 and 9.4 percent (columns 3 and 4) more likely to become an exporter when they are foreign owned compared to when they were domestically owned. We also used OLS to examine if the effect of foreign ownership differed between greenfield investments and foreign takeovers of domestic plants (not shown). The hypothesis of equal coefficients for the two types of foreign plants could not be rejected and we conclude that the form of foreign entrance makes little difference for the likelihood to become an exporter.

[12] See Ahn and Schmidt (1995), and Baltagi (1995, p.126). In addition, IV estimators do not take in to account the differenced structure of the residuals in differenced equations (Baltagi, 1995).

The result for import is more uncertain with a positive and statistically significant coefficient in two out of four estimations. Moreover, the size of the import coefficient is very small, which suggest that import is of little importance in explaining export.

Columns 2 and 4 includes $\tilde{Y}_{i,t-2}$, which is a dummy variable for plants that did not export in the previous year but did export two years ago. Sunk costs seem important for export: the one-year lagged export variable is positive and statistically significant in all estimations. However, the two-year lag is positive in the OLS estimation but negative in the fixed effect model. The coefficient and the significance levels differ between the models also for a few other variables. All estimations find capital intensities (as captured by energy consumption) and size to positively affect export, whereas the result for white-collar workers and labor productivity is more uncertain. Public ownership is never statistically significant. The OLS examines differences between plants and the fixed effect model estimates the intertemporal relationship between the export decision and possible determinants within a plant. Hence, the results implies, for instance, that plants with high productivity levels tend to export but that productivity-changes within a plant has no effect on export.

As previously said, we can compare our OLS and fixed effect results with previous studies. It seems that our findings are broadly consistent with the results in Bernard and Jensen (1999, 2001) and Bernard and Wagner (2001); sunk costs are important in explaining exports and so is size. Previous studies have also found that high productivity levels positively affect the decision to export but that the effect of growth in productivity (fixed effect model) is more uncertain. The size of the sunk cost effect seems to be higher in other studies, often close to 1.0, suggesting that the entry and exit from export is more pronounced in Indonesia. Finally, measures on foreign networks have not been included in previous studies, which prevent a comparison of these effects.

Table 6 shows the estimation results of the GMM model.[13] This model is similar to the fixed effect model in the respect that it examines changes within plants. Estimation 1 does not include plant characteristics other than ownership and previous export. It is seen that foreign plants are about 19 percent more likely than domestically-owned plants to start export. The rest of the estimations include various plant characteristics that are likely to affect export. Te results are very robust to inclusion of additional variables and the effect of foreign ownership actually increases slightly. Estimations 2-5 suggest that the probability to export is 19-21 percent higher when a plant is foreign-owned compared to when the same plant is domestically-owned. The effect is substantially higher than in the OLS or the fixed effect models.

The coefficient for import is not statistically significant. Moreover, the results suggest that publicly owned plants have a lower probability to start export than other plants. However, public ownership is statistically insignificant when we control for industry specific effects. Hence, public plants' low export probability is partly caused by their location in domestically oriented industries. The results for the other variables are similar to the estimations in table 5. There is clear evidence of export rigidities; firms that have started to export continues to export as seen from the statistically significant coefficient on $Y_{i,t-1}$ and the coefficients are, as we would expect, between the upper bound of OLS and the lower bound of the fixed effect model. Accordingly, the coefficient of $\tilde{Y}_{i,t-2}$ is also positive and statistically significant. Moreover, plants are relatively likely to start export as they grow in size, capital intensity, or labor productivity, but that the change in white-collar ratio has no effect on the probability to export.

In order to examine the effect of ownership changes and import intensity in more detail, we continue with the GMM estimations shown in columns 3 and 4. Firstly, we include

[13] These equations were estimated using Arellano and Bond's (1998) DPD program downloaded from http://www.cemfi.es/~arellano/#dpd.

a dummy variable for majority-foreign ownership. The variable is not statistically significant and the results suggest that foreign ownership is an important determinant to export but that it does not seem to be important that the plant has a majority foreign ownership. Secondly, we include a variable on the import intensity constructed as import of intermediate goods as a share of total intermediate goods. The import intensity variable is positive and statistically significant. Hence, an increase in imported inputs increases the probability to export. However, the size of the coefficient is very small, implying that one percentage point increase in imported inputs increases the probability to export by only about 0.05 percent.[14]

Summarizing the results for the different models and specifications, it seems that foreign ownership is important for export, as are size, capital intensity and labor productivity. The result for import, and for a few other variables, is mixed and differs between models. An important question is therefore which model that provides the most reliable result. As previously discussed, we tend to believe that the GMM estimations are preferred to the OLS and the fixed effect model. Arrelano and Bond (1991) suggest two specification tests that are applicable with GMM estimations. These tests are captured by the variables m1 and m2. The first variable, m1, is a test for first-order serial correlation in the differenced residuals. The statistical significant coefficients suggest that such correlation exist and that a GMM model, rather than OLS and IV estimations, is appropriate. The second test, m2, is on the second-order correlation of the differenced residuals. The statistically insignificant coefficient for m2 suggests that there is no such correlation and that the GMM models are well specified.

IV. Concluding Remarks

Inflows of foreign direct investment (FDI) are widely recognized as one potentially important factor for developing countries' industrialization and growth. FDI may benefit the

[14] We also estimated the models in table 6 with data for 1993-1997 to examine if the turmoil at the time of the Asian crisis affects the results. The results remained largely unchanged.

host country by inflows of capital, new technology, and improved management. In addition, foreign-owned firms have often comparably good access to foreign markets. Our study confirms the relatively high export orientation of foreign-owned plants. In addition, our results suggest that inflows of FDI may bring about a higher degree of flexibility in the economy; even foreign-owned plants that began their operation in Indonesia by producing only for the domestic market are more likely than domestically-owned plants to start export. In our preferred estimations, the GMM model, foreign-owned plants are about 19 percent more likely to start export than purely domestically-owned plants. Foreign and domestic plants differ also in many other characteristics that are likely to affect export behavior, such as size, capital intensity, and labor productivity. However, the effect of foreign ownership on export remains robust to inclusion of such plant characteristics.

Our second variable on foreign networks, import of intermediate products, does not seem to affect the likelihood of export. The coefficient for import is statistically significant in some model specifications, but the coefficient is very small and of no practical significance.

References

Ahn, Seung C. and Peter Schmidt (1995). "Efficient Estimation of Models for Dynamic Panel Data", *Journal of Econometrics*, Vol. 68, pp.5-27.

Arellano, Manuel, and Stephen Bond (1991). "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies*, Vol. 58, pp. 277-297.

Arellano, Manuel, and Stephen Bond (1998). "Dynamic Panel Data Estimation Using DPD98 for GAUSS: A Guide for Users", downloaded from http://www.cemfi.es/~arellano/#dpd.

Arellano, Manuel, and Olympia Bover (1995) "Another Look at the Instrumental Variable Estimation of Error-Components Models", *Journal of Econometrics*, Vol. 68, pp.29-51.

Baldwin R. Edward (1988) "Hysteresis in Import prices: the Beachhead Effect", *American Economic Review*, Vol. 78, pp. 773-85.

Baldwin R. Edward (1989) "Sunk-Cost Hysteresis", *NBER Working Paper Series* No. 2911.

Baldwin R. Edward, Krugman P (1989) "Persistent Trade Effects of Large Exchange Rate Shocks", *Quarterly Journal of Economics*, Vol. 104, pp. 635-54.

Baltagi, Badi H. (1995) *Econometric Analysis of Panel Data*, Chichester: John Wiley & Sons.

Bernard, Andrew B. and J. Bradford Jensen (1999). "Exceptional Exporter Performance: Cause, Effect, or Both?", *Journal of International Economics*, Vol. 47, pp. 1-25.

Bernard, Andrew B., and J. Bradford Jensen (2001). "Why Some Firms Export", *NBER Working Paper Series* No. 8349.

Bernard, Andrew B., and Joachim Wagner (2001). "Export Entry and Exit by German Firms", *Weltwirtschaftliches Archiv*, Vol.137(1), pp. 105-123.

Clerides, Sofrans K., Saul Lach, and James R. Tybout (1998). “Is Learning by Exporting Important?: Micro-Dynamic Evidence from Colombia, Mexico, and Morocco”, *Quartely Journal of Economics,* Vol. 113 (3), pp. 903-947.

Dixit, Avinash (1989a) “Entry and Exit Decisions under Uncertainty”, *Journal of Political Economy* Vol. 97, pp. 620-38.

Dixit, Avinash (1989b) “Hysteresis, Import Penetration, and Exchange Rate Pass-Through”, *Quarterly Journal of Economics,*Vol. 105, pp. 205-28.

Holtz-Eakin, Douglas, Whitney Newey, and Harvey S. Rosen (1988) “Estimating Vector Autoregressions with Panel Data”, *Econometrica,* Vol. 56, pp. 1371-1395.

Hsiao, Cheng (1986) *Analysis of Panel Data,* Cambridge: Cambridge University Press.

Krugman, Paul (1989) *Exchange rate instability.* MIT Press, Cambridge.

Ramstetter Eric D. (1999) “Trade Propensities and Foreign Ownership Shares in Indonesian Manufacturing”, *Bulletin of Indonesian Economic Studies,*Vol. 35, pp. 43-66.

Roberts, Mark J., and James R. Tybout (1997) “The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs”, *American Economic Review,*Vol. 87 (4), pp. 545-564.

Sjöholm, Fredrik (2003), “Which Indonesian Firms Export? The Importance of Foreign Networks”, *Papers in Regional Science,* Vol. 82, pp. 333-350.

Table 1. Descriptive statistics of the Indonesian manufacturing sector in 1990 and 2000.

ISIC	Sector	Number of plants		Share of total manufacturing (%)						Share of total output that is exported (%)		Share of total plants that export (%)	
				Value added		Employment		Exports[1]					
	Year	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
	Total	16 536	22 174	100.0	100.0	100.0	100.0	100.0	100.0	16.9	26.4	11.7	16.5
31	Food	4 616	5 482	27.5	21.2	23.1	19.3	11.9	12.6	8.5	16.4	6.4	9.6
32	Textile	3 958	4 876	14.6	16.1	27.5	32.7	22.6	24.0	24.0	37.1	13.5	17.1
33	Wood, Furniture	1 946	3 147	11.0	6.6	15.3	13.1	31.5	15.1	47.4	59.8	29.3	37.7
34	Paper, Printing	702	967	4.6	6.3	3.3	3.8	2.2	4.6	7.7	15.7	2.8	5.2
35	Chemicals	2 059	2 622	14.3	14.8	14.4	11.5	17.2	14.5	17.2	24.7	14.2	16.0
36	Non-metallic mineral	1 323	1 907	3.8	3.5	4.3	3.9	1.9	2.6	9.1	23.0	4.4	6.2
37	Basic metal industries	95	239	9.0	3.4	1.2	1.2	6.8	3.1	14.4	18.4	18.9	16.3
38	Fabricated metal products	1 595	2 434	14.8	27.3	9.8	12.4	5.4	22.6	5.9	24.1	7.0	13.7
39	Other manufacturing	242	500	0.4	0 .8	1.1	2.0	0 .4	1.0	15.9	34.3	14.9	30.8

[1] see Appendix Table 1 and 2 for more detail export figures.

Table 2. Plant characteristics for exporters and non-exporters in 1990 and 2000.

ISIC	Sector	Labour productivity (value added per worker, 1000 rupiahs)				Size (number of workers)				Share of white-collar workers (%)			
		Exporters		Non-exporters		Exporters		Non-exporters		Exporters		Non-exporters	
		1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
	Total	4 037	18 779	2 154	8 273	197	297	45	47	16	16	14	14
31	Food	2 672	13 561	1 000	4 643	117	170	33	35	18	18	13	12
32	Textile	2 511	12 575	1 386	5 990	258	475	42	47	11	12	9	10
33	Wood, Furniture	3 771	9 814	2 278	6 841	174	146	42	32	14	12	15	12
34	Paper, Printing	9 245	12 860	2 316	10 871	279	258	46	54	26	18	19	19
35	Chemicals	5 347	34 268	4 628	15 813	196	237	54	54	21	24	20	23
36	Non-metallic mineral	2 938	22 640	1 438	6 473	225	263	56	64	15	17	13	12
37	Basic metal industries	27 996	66 959	9 601	22 646	270	312	132	78	27	20	28	23
38	Fabricated metal products	5 988	36 403	2 635	13 284	202	294	58	68	18	19	18	19
39	Other manufacturing	2 142	6 897	1 236	6 084	195	121	32	35	12	12	9	10

Table 3. Imports and ownership for exporters and non-exporters in 1990 and 2000.

ISIC	Sector	Share of foreign plants (%)				Share of imported intermediate goods			
		Exporters		Non-exporters		Exporters		Non-exporters	
		1990	2000	1990	2000	1990	2000	1990	2000
	Total	13	27	3	7	19	24	9	9
31	Food	5	16	1	2	2	6	2	2
32	Textile	11	24	1	4	22	27	9	9
33	Wood, Furniture	6	9	2	2	1	2	1	1
34	Paper, Printing	19	23	2	4	46	22	9	7
35	Chemicals	18	37	8	19	31	34	20	13
36	Non-metallic mineral	7	26	2	5	24	24	10	11
37	Basic metal industries	33	45	17	18	46	51	17	24
38	Fabricated metal products	38	60	7	21	43	58	20	25
39	Other manufacturing	22	23	3	8	34	21	19	12

Table 4. Entry and exit rates for exports in 1990 and 1999.

ISIC	Sector	Entry rate to export (share of non-exporters who start export the following year)		Exit rate from export (share of exporters who stop export the following year)	
		1990	1999	1990	1999
	Total	4.5	5.2	33	20
31	Food	2.5	2.8	47	24
32	Textile	5.2	6.2	34	21
33	Wood, Furniture	9.4	11.6	25	15
34	Paper, Printing	2.8	2.1	50	29
35	Chemicals	6.1	5.7	33	19
36	Non-metallic mineral	2.9	2.0	47	21
37	Basic metal industries	16.9	6.6	33	31
38	Fabricated metal products	3.0	5.0	30	23
39	Other manufacturing	12.1	11.2	19	21

Table 5.Estimation results of linear probability models for export decision

Independent variables	OLS	OLS	Fixed effect	Fixed effect
Constant	-0.1673 ***	-0.1187 ***	-0.0088 ***	0.0112 ***
	(24.8)	(17.5)	(2.9)	(3.6)
Export the previous year	0.5246 ***	0.5537 ***	0.1344 ***	0.0835 ***
	(125.4)	(129)	(27.3)	(14)
Export two years ago	–	0.2378 ***	–	-0.0485 ***
		(39.6)		(8.2)
Electric power (log)	0.0022 ***	0.0020 ***	0.0024 ***	0.0028 ***
	(6.6)	(6.1)	(3.7)	(3.7)
White-collar workers (%)	-0.0004 ***	-0.0004 ***	0.0000	0.0000
	(7.4)	(6.7)	(0.3)	(0.3)
Size (log)	0.0443 ***	0.0356 ***	0.0085 ***	0.0093 ***
	(43.7)	(36.1)	(2.9)	(2.7)
Labor productivity (log)	0.0054 ***	0.0044 ***	-0.0006	-0.0002
	(6.2)	(4.9)	(0.5)	(0.2)
Public ownership	0.0010	-0.0011	0.0010	0.0062
	(0.2)	(0.2)	(0.1)	(0.7)
Foreign ownership	0.0840 ***	0.0625 ***	0.0935 ***	0.0841 ***
	(17.5)	(12.8)	(6.7)	(5.2)
Import	0.0080 ***	0.0036	0.0072 *	0.0060
	(3.4)	(1.5)	(1.7)	(1.3)
Industry dummies (p-value)	0.00 ***	0.00 ***	0.00 ***	0.00 ***
Time dummies (p-value)	0.00 ***	0.00 ***	0.00 ***	0.00 ***
Number of plants	20,694	20,694	20,694	20,694
Number of observations	154,914	134,220	134,220	113,526
Period	1991-2000	1992-2000	1992-2000	1993-2000
Wald-test (p-value)	0.00 ***	0.00 ***	0.00 ***	0.00 ***
m1 (p-value)	0.00 ***	0.00 ***	0.00 ***	0.00 ***
m2 (p-value)	0.00 ***	0.00 ***	0.01 **	0.00 ***

Note: T-statistics within brackets are based on robust standard errors. *) Significant at the 10 percent level, **) Significant at the 5 percent level, ***) Significant at the 1 percent level.

Table 6. Export determinants in Indonesian manufacturing. GMM estimations.

	GMM estimations				
Variables	(1)	(2)	(3)	(4)	(5)
Constant	-0.0065*	-0.0070***	-0.0043**	-0.0072***	-0.0043*
	(-1.6)	(-3.7)	(2.1)	(-3.6)	(1.9)
Export the previous year	0.2506***	0.2508***	0.2480***	0.2484***	0.2452***
	(23.9)	(23.9)	(23.5)	(23.9)	(23.5)
Export two years ago	0.0783***	0.0725***	0.0708***	0.0699***	0.0680***
	(7.4)	(7.2)	(6.7)	(7.1)	(6.7)
Electric power (log)	–	0.0040***	0.0024***	0.0038***	0.0024***
		(3.8)	(2.8)	(3.5)	(2.6)
White-collar workers (%)	–	0.0001	0.0001	0.0001	0.0001
		(-0.43)	(0.1)	(-0.4)	(0.1)
Size (log)	–	0.0406***	0.0440***	0.0404***	0.0442***
		(5.1)	(4.9)	(4.8)	(4.7)
Labor productivity (log)	–	0.0056***	0.0051***	0.0052***	0.0048***
		(3.9)	(3.6)	(3.7)	(3.5)
Public ownership	-0.0018	-0.0090*	-0.0077	-0.0089*	-0.0082
	(-0.9)	(0.6)	(1.2)	(-1.7)	(1.2)
Foreign ownership	0.1875***	0.2008***	0.1937***	0.2050***	0.1939***
	(3.9)	(4.2)	(3.8)	(3.8)	(3.3)
Majority foreign ownership	–	–	–	0.0074	0.0168
				(0.2)	(0.3)
Import	0.0291*	0.0217	0.0136	0.0072	0.0051
	(1.1)	(1.1)	(0.6)	(0.0)	(0.1)
Import ratio	–	–	–	0.0005***	0.0004**
				(3.6)	(2.4)
Industry dummies (p-value)	0.00***	–	0.00***	–	0.00***
Time dummies (p-value)	0.00***	0.00***	0.00***	0.00***	0.00***
Number of plants	20,694	20694	20694	20694	20694
Number of observations	113,526	113526	113526	113526	113526
Period	1993-2000	1993-2000	1993-2000	1993-2000	1993-2000
Wald-test (p-value)	0.00***	0.00***	0.00***	0.00***	0.00***
m1 (p-value)	0.00***	0.00***	0.00***	0.00***	0.00***
m2 (p-value)	0.69	0.68	0.67	0.54	0.53

Note: T-statistics within brackets are based on one-step robust standard errors (see Arellano and Bond, 1991). *) Significant at the 10 percent level, **) Significant at the 5 percent level, ***) Significant at the 1 percent level.

Appendix Table 1 Estimated export value for foreign and local plants (million U.S. dollar)

Industry	Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
31	All	767	1,118	1,774	1,810	2,469	4,401	3,525	2,979	1,179	1,852	2,479
Food	Foreign	37	136	249	204	358	473	685	488	329	546	750
	Local	730	982	1,525	1,606	2,111	3,928	2,840	2,491	850	1,305	1,729
	Unido	1,274	1,621	1,721	1,994	2,970	2,961	3,308	3,408	3,056	3,449	3,285
32	All	1,458	1,966	3,669	4,527	4,970	6,006	8,778	4,994	1,630	3,587	4,716
Textile	Foreign	321	597	1,638	1,627	2,017	2,218	3,100	2,152	642	1,703	1,837
	Local	1,136	1,369	2,031	2,900	2,954	3,789	5,678	2,842	988	1,885	2,879
	Unido	1,530	2,111	4,403	7,212	4,519	4,894	7,934	6,177	6,062	8,251	9,719
33	All	2,036	3,378	3,145	3,837	4,399	4,781	5,815	3,760	1,129	2,561	2,967
Wood, Furniture	Foreign	262	449	370	568	683	690	1,410	705	156	507	400
	Local	1,774	2,928	2,775	3,269	3,715	4,091	4,404	3,056	973	2,054	2,567
	Unido	3,566	3,980	4,585	580	5,682	5,533	5,752	5,180	3,175	4,633	4,845
34	All	142	295	408	32	274	497	717	443	10	101	905
Paper, Printing	Foreign	74	34	99	11	41	76	446	220	2	17	44
	Local	68	262	309	20	233	421	271	223	7	84	861
	Unido	238	331	388	534	710	1,365	1,378	1,423	2,130	2,456	3,020
35	All	1,111	1,283	1,754	1,442	2,240	3,294	4,246	2,923	1,302	1,842	2,851
Chemicals	Foreign	296	310	349	343	607	950	1,175	923	477	672	1,172
	Local	815	973	1,405	1,099	1,632	2,344	3,071	2,000	825	1,170	1,679
	Unido	2,076	2,259	2,610	2,474	1,822	2,593	3,032	4,203	3,820	4,524	6,352
36	All	125	147	206	222	85	242	461	319	117	366	511
Non-metallic	Foreign	20	17	25	34	17	77	187	71	77	151	229
mineral	Local	106	131	181	188	68	165	274	247	40	215	282
	Unido	241	230	349	333	325	355	423	311	326	702	831
37	All	440	260	741	478	1,473	916	761	513	44	221	609
Basic metal	Foreign	229	196	454	204	357	630	372	196	17	145	166
industries	Local	211	64	287	274	1,116	287	390	317	27	76	443
	Unido	239	290	836	758	943	1,376	1,224	1,167	1,357	1,412	1,782
38	All	349	551	1,417	1,421	2,438	3,400	5,408	3,215	602	2,789	4,447
Fabricated metal	Foreign	247	287	1,059	1,047	1,899	2,777	3,806	2,631	359	2,487	4,205
products	Local	101	264	358	374	539	623	1,602	583	244	302	243
	Unido	557	883	1,650	2,431	3,154	3,806	5,009	4,031	5,295	6,283	12,030
39	All	29	125	230	316	291	288	351	250	106	133	188
Other	Foreign	10	61	156	232	197	201	230	152	69	82	102
manufacturing	Local	19	64	73	84	94	87	121	98	37	51	86
	Unido	76	134	195	236	289	101	45	250	1,950	683	785
Total	All	6,455	9,123	13,342	14,085	18,638	23,826	30,063	19,397	6,118	13,451	19,681
	Foreign	1,496	2,087	4,399	4,270	6,176	8,092	11,411	7,539	2,128	6,309	8,908
	Local	4,959	7,037	8,943	9,815	12,462	15,734	18,652	11,858	3,991	7,143	10,773
	Unido	9,798	11,840	16,737	16,552	20,415	22,986	28,105	26,149	27,172	32,392	42,649

Note) Unido: calculated from *Industrial Demand-Supply Balance Database* (UNIDO).

Appendix Table 2 Average export propensity for foreign and local plants (%)

Industry	Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
31	All	4.32	4.85	6.92	7.31	7.51	6.20	7.45	6.68	4.32	6.09	7.14
Food	Foreign	12.37	19.09	25.70	26.26	29.52	27.54	37.35	23.09	15.73	28.55	34.87
	Local	4.19	4.57	6.50	6.82	6.83	5.57	6.55	6.18	3.89	5.25	6.10
32	All	9.32	12.90	15.22	15.10	14.46	13.05	15.04	10.68	5.16	9.92	13.12
Textile	Foreign	41.43	48.23	53.61	52.00	54.63	57.42	59.27	40.01	19.85	36.38	48.74
	Local	8.46	11.40	13.08	12.80	12.02	10.56	12.31	8.85	4.11	7.89	10.48
33	All	22.39	29.42	31.49	33.53	32.97	29.88	33.34	22.36	16.27	27.34	33.16
Wood, Furniture	Foreign	50.53	63.18	59.59	70.48	71.06	70.90	80.52	62.34	28.60	60.95	69.74
	Local	21.52	28.04	30.40	32.17	31.68	28.59	31.63	20.73	15.79	25.81	31.36
34	All	0.99	2.29	4.25	1.14	4.26	3.78	3.55	3.71	0.27	2.70	2.98
Paper, Printing	Foreign	13.50	22.17	23.16	6.04	20.85	25.37	34.44	26.33	2.69	13.30	18.28
	Local	0.74	1.76	3.61	0.98	3.72	3.04	2.44	2.87	0.16	2.25	2.32
35	All	8.78	9.14	10.42	10.02	11.09	10.59	10.61	8.91	6.17	8.41	10.14
Chemicals	Foreign	17.38	21.31	20.42	21.66	25.39	26.49	26.83	24.66	15.98	19.92	25.33
	Local	7.97	7.98	9.40	8.81	9.55	8.77	8.67	6.92	4.66	6.72	7.68
36	All	2.18	3.30	3.21	3.78	1.29	2.40	2.20	2.88	1.31	3.00	3.26
Non-metallic	Foreign	9.06	17.95	21.91	21.83	10.19	23.88	28.12	16.30	12.43	23.32	22.21
	Local	2.09	3.07	2.79	3.42	1.08	1.97	1.67	2.58	1.01	2.37	2.66
37	All	5.49	8.58	12.12	9.94	10.47	10.22	11.42	13.88	5.69	9.95	10.32
Basic metal	Foreign	10.37	12.48	20.91	26.67	26.08	33.89	27.72	33.28	10.28	21.65	23.42
	Local	4.28	7.61	10.17	6.45	7.37	5.52	7.40	8.08	3.95	5.81	6.46
38	All	2.90	4.96	7.50	7.66	9.23	8.75	9.46	8.94	2.84	7.83	8.79
Fabricated metal	Foreign	12.85	21.54	31.52	34.08	38.04	38.43	38.92	30.30	8.70	23.51	28.22
	Local	1.96	3.21	4.35	3.85	4.38	4.03	4.73	4.56	1.32	3.58	3.74
39	All	9.30	22.28	25.80	27.41	27.68	25.21	23.55	13.89	11.64	16.75	24.70
Other	Foreign	37.93	59.93	61.37	71.65	63.31	62.54	58.75	34.62	32.05	39.77	51.47
	Local	7.41	16.23	20.78	20.06	21.21	19.68	18.99	11.07	9.10	13.37	20.95
Total	All	7.83	10.29	12.32	12.60	12.83	11.71	12.99	9.95	5.97	10.27	12.65
	Foreign	22.89	32.73	36.76	38.55	40.32	41.32	44.15	32.64	15.31	29.10	36.13
	Local	7.25	9.21	10.96	11.05	11.07	9.92	11.00	8.35	5.20	8.65	10.62

Note) Calculated as the average of export ratio