The Impact of Trade Costs on Firm Entry, Exporting, and Survival in Korea

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Abstract: This study uses a unique firm-level dataset to examine how falling trade costs from 1993-2001 affected entry, exit, productivity, and exporting in the Korean manufacturing sector. We verify many of the predictions of recent heterogeneous-firm models of international trade. For example, falling trade costs reduced entry by new Korean firms, increased their probability of exit, and reduced the market share of surviving firms. We also find that small firms had a particularly high level of dynamism over the sample period. Small firms were more likely to enter and exit, and marginally more likely to gain market share, enter export markets for the first time, and improve their productivity.

Keywords: Employment, Exit, Exports, Firm deaths, Survival, Trade costs

JEL classification: F10; D24

1. Introduction

Declining trade costs are a signature feature of globalization and carry important consequences for the structure and performance of firms in an industry. Firms in most industries vary greatly in size, productivity, and capital intensity (Bernard and Jensen, 1999). Falling trade costs therefore have different effects on firms. New models of international trade with heterogeneous firms such as Melitz (2003) and Bernard et al. (2003) formalize these processes and generate a number of testable implications. For example, falling trade costs may drive down goods prices and force firms with low productivity to exit the domestic market. On the other hand, firms with high productivity may increase their domestic market share and be able to start exporting.

The purpose of this study is to evaluate the key predictions of these models in the context of Korean manufacturing firms over the period 1993-2001. This was an interesting period in Korea because government intervention in the economy was greatly reduced and policies on imports and foreign investment were liberalized to promote competition (Moskovitch and Kim, 2008). Our approach lets us examine how the resulting changes in trade costs affected the productivity of industries and individual firms. We examine how trade costs and other factors affect the probability of firm entry and exit, and the probability that firms newly begin to export to foreign markets. In addition, we examine changes in domestic market share and the amount that firms were able to export as trade costs fell.

The data are from Korea's credit rating agency (the Korea Information Service) and describe the activities of an average 5,021 firms over the sample period. Our data series is for 1993-2001 and is somewhat longer than what is typically used in the literature that investigates heterogeneous firms. Our data are for the firm level as opposed to the plant level, which is in line with the set up of the theoretical models that generate the hypotheses.

Our study contributes to the literature that documents the characteristics of individual firms or plants that produce for foreign markets (e.g., Clerides, Lach, and Tybout, 1998; Bernard and Jensen, 1999; Aw, Chung, and Roberts, 2000; Tybout, 2003; Bernard, Jensen, and Schott, 2006). Korea has been little studied within this literature and is an excellent example of the export-led growth idea. Our study also complements the industrial organization literature, which has long been interested in firms' entry and exit patterns (e.g., Tirole, 2003). This literature suggests that a firm may enter because it has high productivity, is filling a niche market, or is optimal size for the market. Our approach allows for many of these factors but focuses on how changes in trade costs may have affected the competitive environment of an industry, and thus patterns of firm entry and exit.

We verify several key predictions of recent heterogeneous-firm models of international trade. For example, falling trade costs reduced entry by new Korean firms, increased their probability of exit, and reduced the market share of surviving firms. Exporting is rare among firms while entry and exit are high. The size of a firm plays a particularly big role in our investigation. Small firms are more likely to enter and exit, and are somewhat more likely to have higher productivity, to gain market share, and to enter export markets.

2. Testable hypotheses

The development of trade models with heterogeneous firms has opened up many new research questions. One class of models is based on Bernard et al. (2003), who introduce stochastic firm productivity into the multi-country Ricardian model. Firms use different technologies to produce the same good. Consumers in any given country buy each good from the lowest-cost producer across all countries, based on a stochastic productivity draw. Due to trade costs, several firms producing the same good can survive if they are located in different countries, although each firm is the sole supplier to any given destination.

Another class of models is based on Melitz (2003), who starts with a monopolistic competition framework. Unlike Bernard et al. (2003), firms do not directly compete to be the exclusive supplier of a homogeneous good, as each firm produces its own distinct version. Firms make an irreversible investment to enter the domestic market while being uncertain about their future productivity. Upon entry, each firm learns about its productivity level, as drawn from a known distribution. The least productive firms face negative profits and have to exit. Among those surviving, only relatively productive firms choose to export since exporting is costly. Trade costs include a fixed cost of entry into the export market, plus a per unit (variable) trade cost. Remaining firms serve the domestic market.

Although the models in this literature have different structures, they make a number of overlapping predictions regarding the role of trade costs. The specific hypotheses that we test below concern falls in variable (per unit) trade costs, as opposed to any fixed costs of entry or exporting.

One effect of lower trade costs may be to inhibit successful entry of new firms into the domestic market (hypothesis 1). Entering firms must leap a higher hurdle in terms of productivity due to the presence of foreign competition. The productivity cut-off or break-even point to enter domestic markets is larger in the case of an open economy relative to a closed one (Melitz, 2003).

Falling trade costs may also reduce the domestic market share of surviving firms because of the entry of high-productivity foreign firms into the domestic marketplace (hypothesis 2). In turn, the productivity of individual firms is expected to increase with declining trade costs (hypothesis 3). This may be because a firm changes its product mix, or because increased competition induces plants to improve their productive efficiency, i.e., it gives them a 'kick in the pants' (Bernard, Jensen, and Schott, 2006). This may also contribute to an increase in industry productivity when trade costs decline (hypothesis 4). This could also happen if low-productivity, non-exporting firms have to exit, or if high-productivity firms expand through exporting.

As the costs of accessing foreign markets fall, the number of new exporting firms may increase (hypothesis 5), in particular, higher productive firms that weren't able to export previously. In turn, existing high-productivity exporters may be able to export more (hypothesis 6), as falling per unit trade costs give them cheaper access to external markets. Falling trade costs also raise the probability of firm exit (hypothesis 7). This is because the productivity threshold for survival in an increasingly competitive marketplace will be higher. In summary, the hypotheses from heterogeneous firm models of trade that we test are:

Hypothesis 1. Falling trade costs decrease the probability of entry by new firms.

Hypothesis 2. Falling trade costs reduce the domestic market share of surviving firms.

Hypothesis 3. Falling trade costs raise the productivity of individual firms.

Hypothesis 4. Falling trade costs raise overall industry productivity.

Hypothesis 5. Falling trade costs increase the number of new exporting firms.

Hypothesis 6. Falling trade costs increase export sales at existing exporters.

Hypothesis 7. Falling trade costs raises the probability of firm exit.

We also examine the importance of the size and capital-intensity of firms, as these are also likely to affect firm entry and exit. For example, larger firms may benefit from scale economies and greater experience. Additionally, large firms may have better access to capital than newer, smaller startups, especially in Korea, where connections can be important (Doh and Ryu, 2004; Moskovitch and Kim, 2008).

3. Data

Firm-level data on Korean manufacturing are obtained from the Korea Information Service (KIS), the major credit-rating agency in Korea. A firm is designated as "in the market" if it reports to KIS in three consecutive years. A firm "enters" in year *t* if the firm did not report in year $t-1$ or any previous year, and if it *did* report in year *t*, $t+1$, and $t+2$. A firm "exits" in year *t* if it reports to KIS in years $t-2$, $t-1$, and *t*, but not in year $t+1$ or any following year.

Tables 1 and 2 report selected descriptive statistics. For example, in a given year, 23% of firms were newly entering, 10% of firms were exiting, and 3% of firms began exporting (table 1, bottom row). Entering firms, exiting firms, and new exporters tended to be smaller than other firms (table 2).

Trade costs: Trade costs are calculated following the framework of Novy (2007) and Jacks, Meissner, and Novy (2006). The approach is based on the gravity model and makes use of observable trade and output data. It corresponds fairly well to the notion of variable trade costs in the theoretical models described above. Let τ_{ij} be the trade cost between country *i* and *j*, x_{ii} be *i*'s consumption of domestic goods, x_{ij} be exports from i to j, and σ >1 be the elasticity of substitution among varieties. Trade costs are calculated as:

$$\tau_{ij} = \left(\frac{x_{ii} x_{jj}}{x_{ij} x_{ji}} \right)^{\frac{1}{2(\sigma-1)}} - 1 .$$

This approach is consistent with the models described above because both outbound and inbound costs change in the same way. τ_{ij} is calculated using GDP data and trade data from the Bank of Korea (2007) for Korea and seven major trading partner countries. Table 3 reports the results for 1993 and 2003. The largest reductions in tariff-equivalent trade costs were with China and Taiwan. They declined from 0.70 to 0.49, and 0.79 to 0.61, respectively. The average change in trade cost, weighted by countries' respective trade volumes with Korea, declined approximately 10.6% over the sample period. The same GDP-level trade costs are used for all industries.

Total factor productivity: To measure total factor productivity (TFP) we employ the mathematical programming technique called Data Envelopment Analysis. Calculation of the index is described fully in Chambers et al. (1996). The approach identifies a "best practice" benchmark for efficient use of resources, then evaluates each firm relative to this benchmark. The index takes values closer to zero as firms have higher total factor productivity. Industry level TFP is median of firm-level TFP values.

4. Results

Entry: Hypothesis 1 is that falling trade costs lead to greater foreign competition and thus less entry by new domestic firms. The probability that a firm (*f*) newly enters the domestic market between year *t* and year *t*+2 is denoted $\Pr(ENT_{ft+2}=1)$. The change in overall trade costs between period *t* and $t-2$ between Korea and its major trading partners is denoted $\Delta Cost_{t-2}$. We employ a gap in time between changes in trade costs and changes in entry to help mitigate problems of endogeneity and omitted variables. The models are specified as logistic regressions:

(1) (base) $\Pr(ENT_{ft+2}=1)=\Phi(\beta\Delta Cost_{t-2})$,

(variant) $\Pr(ENT_{ft+2}=1)=\Phi(\beta\Delta Cost_{t-2}+\gamma X_{ft})$.

X_{ft} in the variant specification is a vector of firm characteristics, including the size of the labor force and the capital-labor ratio. The expected sign of β is positive since positive changes in trade costs lower the threshold by which new firms are able to survive in the market.

Table 4 reports two logit regressions for each of eight industries. The left (base) regression for each industry explains firm entry solely by trade costs. In six of eight industries, firm entry and trade costs have the predicted positive association: as trade costs fall, entry by new domestic firms is less likely, since there is more foreign competition (food products and chemicals are the exceptions). The coefficients are statistically nonzero at the 1% level for the six industries. These results are consistent with expectations.

In the variant regressions, the corresponding coefficients in the right (variant) regressions are qualitatively the same. Here, changes in firm exits are additionally explained by employment and a firm's capital-labor ratio. The coefficient on the employment variable is negative and statistically nonzero in each industry. This means that entering firms are typically smaller than incumbents. This is consistent with our descriptive statistics. For example, table 2 shows that new firms have 36.6 employees on average, while incumbent firms had 161.9 employees on average. The coefficient on the capital-labor variable is negative in each industry, and is statistically significant in seven of the eight industries (table 4). In each of the eight industries, new firms tend to use more labor relative to capital than do incumbent firms. Again, these findings are consistent with expectations.

Market share: Hypothesis 2 states that falling trade costs reduce the market share of domestic firms as foreign firms increase their share. As above, we employ a gap in time between changes in trade costs and changes in market shares to help mitigate problems of endogeneity and omitted variables. The change in market share of a surviving firm between year *t* and year *t*+2 is denoted $\Delta Share_{ft+2} = Share_{ft+2} - Share_{ft}$. The regressions are then:

(2) (base) $$\Delta Share_{ft+2} = \beta \Delta Cost_{t-2} + \varepsilon_{ft},$$

(variant) $$\Delta Share_{ft+2} = \beta \Delta Cost_{t-2} + \gamma X_{ft} + \varepsilon_{ft},$$

The expected sign of β is positive since positive changes in trade costs are associated with positive changes in market shares by Korean firms.

Table 5 reports two OLS regressions for each of eight industries. We look first at the left (base) regression for each industry. Except for the food products and electronics sectors, the sign of the coefficient on trade costs is positive, which is consistent with expectations. There is statistical significance for three of the six industries.

In the variant specifications, the coefficient on trade costs is qualitatively the same as in the base specification. The coefficient on employment, in turn, is negative and statistically significant in five of the eight industries. This suggests that larger firms are somewhat more likely to lose market share. This is somewhat surprising given that larger firms may have more experience and connections, not to mention scale (Moskovitch and Kim, 2008). When we look at the coefficient on the capital-labor ratio, it is positive in six of the eight industries. This suggests that firms with a higher capital intensity tend to increase their market share. These results, however, are not statistically significant.

Productivity of individual firms: Hypothesis 3 is that falling trade costs will force existing firms to improve their productivity, perhaps by changing their scale or their product mix. To test this idea, we denote the change in a firm's total factor productivity from period *t* to period *t*+2 as ΔTFP_{ft+2}. The regressions are:

(3) (base) $$\Delta TFP_{ft+2} = \beta \Delta Cost_{t-2} + \varepsilon_{ft},$$

(variant) $$\Delta TFP_{ft+2} = \beta \Delta Cost_{t-2} + \gamma X_{ft} + \varepsilon_{ft}.$$

TFP is measured by an index whose values closer to zero imply higher productivity. Therefore, $\Delta TFP_{ft+2} > 0$ means productivity has *worsened*. Therefore, the expected sign of β is positive – productivity worsens when domestic firms are more sheltered from foreign competition.

Table 6 reports two OLS regressions for each of eight industries. The sign on trade costs is the same in both the base and variant specifications, for each industry. For five of the industries, the sign on trade costs is positive, which is consistent with the theory. An unexpected negative sign is found for three of the industries (chemical products, electronics, and other transport). The coefficient is statistically non-zero in half of the 16 total specifications. The results are therefore mixed – we find a small amount of support for the theory. The corresponding coefficients on the variant specifications are qualitatively the same.

As above, the variant specifications include firms' size of labor force and capital-labor ratio as explanatory variables. The coefficient on employment is negative for all sectors except medical and precision instruments. There is statistical significance in half of these cases. This implies that small firms are more likely to improve their productive efficiency. In four of the eight industries, firms with a higher capital intensity had a positive change in their total factor productivity. Few of these results are statistically significant, however, and so the results concerning capital intensity are inconclusive.

Productivity of industries: Hypothesis 4 is that falling trade costs leads to higher overall productivity in an industry. This differs from (although is potentially caused by) hypothesis 3, which concerned trade costs and *firm-level* productivity. Let ΔTFP_{it+2} denote the average annual percent change in total factor productivity for industry (*i*) between year *t* and year *t+2*. The regression is specified as:

(4) $$\Delta TFP_{it+2} = c_t + \beta \Delta Cost_{it-2} + \delta_i + \varepsilon_{it},$$

where δ_i is an industry fixed-effect dummy variable. The expected sign of β is positive – productivity worsens when domestic firms are more sheltered from foreign competition.

Table 7 reports four OLS regressions differing according to whether *median* or *mean* productivity is used, and whether industry fixed effects are included. Regardless of the specification, the coefficient on trade costs is positive. When the dependent variable is median productivity, the coefficient is 0.391, irrespective of the inclusion of industry fixed effects. When mean productivity is the dependent variable, the coefficient is 0.447, irrespective of the inclusion of industry fixed effects. While the coefficients are not statistically different than zero, the results make sense since downward changes in trade costs imply increases in productivity.

New exporters: Hypothesis 5 is that falling trade costs increase the number of firms who are newly able to export. Let $\Pr(EXP_{ft+2}=1)$ denote the probability that non-exporting firms become exporters. The logit model specifications are:

(5) (base) $\Pr(EXP_{ft+2}=1)=\Phi(\beta\Delta Cost_{t-2})$,

(variant) $\Pr(EXP_{ft+2}=1)=\Phi(\beta\Delta Cost_{t-2}+\gamma X_{ft})$

The expected sign of β is negative since positive changes in trade costs are associated with fewer exporting firms.

Table 8 reports two logit regressions for each of eight industries. The coefficient on trade costs has the expected negative sign for six of the eight industries. This is consistent with heterogeneous-firm models of international trade. However, none of the coefficients are statistically different from zero. An unexpected sign occurs only for food products, and for machinery and equipment. In these industries there may be barriers to exports, such as technology licensed from foreign countries that precludes their ability to participate in foreign markets.

Corresponding results for the variant regression are similar. The coefficient on the employment variable is negative in six of the eight industries. This implies that larger firms are less likely to be a new exporter. The two exceptions are machinery and equipment and medical and precision instruments. In general, the coefficient on size is not statistically different than zero. The capital-labor coefficient is negative in all industries except computers and office machinery. In none of the cases is there statistical significance.

Although the lack of statistical significance prevents strong conclusions from being made in this case, it appears that smaller and less capital-intensive firms are the ones most likely to enter the export market. Table 2 shows that new exporters had 117.0 employees versus 134.2 employees for all other firms. Interestingly, this is different than the result of Bernard, Jensen, and Schott (2006). Looking at U.S. manufacturers, they find that larger and more capital-intensive firms are more likely to become exporters.

This difference in outcomes between Korea and the U.S. may relate to the particular circumstances of Korea in the 1990s. During this period many new businesses formed with the goal of exporting beyond the small domestic market. Looking at the data (not reported in the tables), 46% of new exporters in Korea started exporting in the same year that they started their business; 17% started exporting during the second year of their business. Of those firms that started exporting within three years of starting their business, the average number of employees was 69.

Export growth: Hypothesis 6 is that a decrease in trade costs raises export sales at existing, high-productivity exporters. The log difference in exports from *t* and *t*+2 is denoted $\Delta \ln Exports_{ft+2}$. The regressions are then:

(6) (base) $$\Delta \ln Exports_{ft+2} = \beta \Delta Cost_{t-2} + \varepsilon_{ft},$$

(variant) $$\Delta \ln Exports_{ft+2} = \beta \Delta Cost_{t-2} + \gamma X_{ft} + \varepsilon_{ft}.$$

The expected sign of β is negative since positive changes in trade costs are associated with lower export sales by existing exporters.

Table 9 reports two OLS regression results for each of eight industries. In the case of machinery and equipment, the coefficient on trade costs is negative, as expected. For the other seven industries, however, the coefficient is positive, meaning that Korean exporters were unable to expand. The results for these seven industries are therefore not consistent with the predictions of the heterogeneous-firm models. The reasons for this result are not clear. One possible explanation is that the financial crisis of the late 1990s prevented firms from expanding export operations, even with decreases in trade costs and in the value of the Won.

In the variant regressions, the coefficients on firm size and capital-labor ratio are generally insignificant. Therefore we can make no strong conclusion about how firm size or capital intensity might play a role in increasing the level of exports.

Firm exit: Hypothesis 7 is that declining trade costs will cause less productive firms to exit the domestic market. In other words, a decrease in trade costs raises the probability of firm exit. To see the effect of changing trade costs on firm exits, we estimate logistic regressions. The probability of a firm's exit in industry *f* between year *t* and year *t*+2 is denoted $\Pr(D_{ft+2}=1)$. The regressions are:

(7) (base) $$\Pr(D_{ft+2}=1)=\Phi(\beta\Delta Cost_{t-2}),$$

(variant) $$\Pr(D_{ft+2}=1)=\Phi(\beta\Delta Cost_{t-2}+\gamma X_{ft}).$$

The expected sign of β is negative since positive changes in trade costs are associated with lower rates of firm exit.

Table 10 reports the results of two logit regressions for each of eight industries. The coefficient on trade costs is negative in nearly every industry, for both base and variant specifications. This is the expected sign and is consistent with heterogeneous-firm models of international trade. The only exceptions are for computers and office machinery and the alternative specification for electronics. The implication is that falling trade costs increase the probability of exit. However, coefficients are statistically nonzero for chemical products only.

In the variant regressions, the coefficient on the capital-labor ratio is statistically nonzero for two of the eight industries. However, the coefficient on employment is negative and statistically significant for seven of the eight industries. The implication is that large firms are less likely to exit. This is consistent with the results of Table 2, which shows that exiting firms have an average of 100.4 employees, while continuing firms have an average of 158.9 employees. The reason for this effect may have to do with access to credit, for example. Large firms with an established reputation, or part of a *Chaebol* conglomerate, may have better credit terms or are better able to survive difficult periods (Doh and Ryu, 2004).

Sensitivity checks: One measure of the robustness of our results is provided by the fact we do not restrict the coefficients of the eight industries to be the same. In addition, the coefficient on trade costs is typically very similar between the base and variant specifications.

Additional variants that we consider but do not report allow for a right-hand-side interaction term between trade costs and plant productivity, and a right-hand-side interaction term between trade costs and export status. This allows us to consider additional aspects of the theory, such as that as trade costs fall, firms with *higher* relative productive are more likely to enter the export market (Bernard, Jensen, and Schott, 2006). The signs and significance of these coefficients are typically not consistent with expectations. This may be due to endogeneity problems. For example, productivity and export status may be correlated with the error terms due to factors such as learning-by-exporting.

Additional specifications consider the Asian financial crisis. In the fall of 1997 the Korean Won had a large fall in value. To the extent that firms had foreign-denominated debt they may have been hurt, yet, on the other hand, they may have been able to export more. The crisis also affected credit markets. To account for these two principal effects, we included trade-weighted exchange rates and interest rates as additional explanatory variables. Allowance for these factors did not generally improve goodness of fit or change the qualitative nature of the results. Indeed, analysis of descriptive statistics suggests that the financial crisis had only limited effect on the variables we study. One might think that the crisis would have caused many firms to exit. However, in the years after the crisis (1998-2000), the total number of entering firms was 50% higher than the number of exiting firms. In particular, 6,688 firms entered and only 4,461 firms exited (table 1). This is consistent with findings by Moskovitch and Kim (2008), who suggest that the Asian financial crisis may have contributed to the upsurge of start-ups and related changes.

5. Conclusions

This study shows that falling trade costs have had important consequences for the structure of manufacturing activity in Korea. Some of these effects were “negative” in that many firms went out of business. On the other hand, Korea’s manufacturing sector appears to have had a great deal of entrepreneurial activity and to have made marginal gains in productivity over the 1993-2001 time period that we study.

Our results support several key predictions from the new literature on heterogeneous-firm models of international trade. We find that falling trade costs lead to less entry by new domestic firms, and to lower market shares among existing domestic firms, due to greater foreign competition in domestic markets. On the other hand, the productivity of individual firms increased over this period. These results hold for several manufacturing industries and are robust to variations in our specifications.

Tests of other hypotheses, such as the prediction that falling overall trade costs will increase export sales at existing exporters, were inconclusive. Our results do not necessarily nullify the export-intensity hypothesis, but there is no clear pattern in the signs and significance of the estimated coefficients.

Small firms were at the heart of many of the changes in the Korean manufacturing sector in the 1993-2001 period. Firms that increased their market share amidst falling trade costs tended to be smaller than the average firm. Firms that newly started to export were smaller and less capital-intensive than the average firm. Forty-six percent of new exporters in Korea started exporting in the same year that they started their business.

These findings may be related to the fact that during this period the Korean government reduced its intervention in the economy and its traditional favoritism for larger conglomerates. The 1997 financial crisis may have also disrupted the strength of many traditional firms and alliances. As a result there appears to have been a surge of entrepreneurial activity, with firm entry rates remaining high even after the financial crisis.

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Table 1. Number of firms to enter, exit, and export, all industries together

Year	No. of entering firms (share of total)	No. of exiting firms (share of total)	No. of new exporters (share of total)	Total no. of firms
1992	226 (0.127)	121 (0.068)	96 (0.053)	1,778
1993	137 (0.081)	123 (0.073)	53 (0.031)	1,679
1994	264 (0.148)	135 (0.075)	63 (0.035)	1,782
1995	463 (0.225)	132 (0.064)	83 (0.040)	2,055
1996	1,712 (0.474)	271 (0.075)	140 (0.038)	3,611
1997	1,844 (0.367)	266 (0.052)	181 (0.036)	5,021
1998	1,611 (0.253)	623 (0.098)	210 (0.033)	6,351
1999	1,986 (0.265)	910 (0.121)	268 (0.035)	7,489
2000	1,655 (0.205)	1,376 (0.170)	223 (0.027)	8,062
2001	1,436 (0.174)	1,552 (0.189)	182 (0.022)	8,210
2002	2,049 (0.222)	N/A	215 (0.023)	9,195
Average	1,217 (0.23)	551 (0.10)	156 (0.03)	5,021

Notes: All values refer to the eight industries combined. We are unable to observe exit data for 2002 since we would need information for subsequent years.

Table 2. Average size and capital intensity of firms to enter

	No. of employees (proxy for firm size)	*K/L* Ratio (Capital/Labor)
Entering firms	36.6	40,341.4
All firms except entering firms	161.9	62,201.6
Exiting firms	100.4	65,544.0
All firms except exiting firms	158.9	56,023.3
New exporters	117.0	62,251.5
All firms except new exporters	134.2	57,425.3
All firms together	133.7	57,564.2

Table 3. Korea's bilateral trade costs, selected years

	Tariff equivalent τ (%)		
Partner Country	1993	2003	Change
Taiwan	0.79	0.61	-22.7%
Germany	0.87	0.83	-3.5%
USA	0.66	0.67	0.9%
Singapore	0.61	0.57	-6.2%
U.K	1.00	0.94	-5.1%
Japan	0.65	0.60	-7.1%
China	0.70	0.49	-29.0%
Weighted average	0.66	0.59	-10.6%

Table 4. Hypothesis 1, Dependent variable: Probability of entering the domestic market

	Food products		Chemical products		Machinery and equipment		Computers and office machinery	
Intercept	-1.18***	5.14***	-1.45***	1.76***	-0.76***	2.95***	-0.66***	4.41***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Change in trade costs	-0.75	11.75***	-7.37**	12.13***	29.55***	33.30***	22.68***	22.56***
	(0.834)	(0.003)	(0.015)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log(employment)		-1.58***		-2.01***		-0.95***		-1.26***
		(0.000)		(0.000)		(0.000)		(0.000)
Log(*K/L*)		-0.82***		-0.002		-0.59***		-0.77***
		(0.000)		(0.400)		(0.000)		(0.000)
Observations	4190	4190	6487	6487	22671	22671	1304	1304
Log Likelihood	-2289.6	-1954.6	-3263.3	-2738.1	-12532	-11810	-772.7	-691.5
	Electronics		Medical and precision instruments		Motor vehicles		Other transport equipment	
Intercept	-0.79***	4.55***	-0.72***	2.63***	-1.22***	5.38***	-0.90***	3.44***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Change in trade costs	19.53***	23.12***	24.58***	29.48***	18.14***	26.29***	21.25***	22.97***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log(employment)		-1.35***		-1.14***		-1.62***		-0.90***
		(0.000)		(0.000)		(0.000)		(0.000)
Log(*K/L*)		-0.74***		-0.46***		-0.82***		-0.68***
		(0.000)		(0.000)		(0.000)		(0.000)
Observations	8698	8698	4458	4458	6277	6277	1857	1857
Log Likelihood	-4968.5	-4374.5	-2544.9	-2386.9	-3060.5	-2651.3	-1013.9	-947.1

Notes: *p*-value is in parenthesis. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 5. Hypothesis 2, Dependent variable: Change in domestic market share

	Food products		Chemical products		Machinery and equipment		Computers and office machinery	
Intercept	0.751*	-0.0005	-0.0001***	0.0007***	-0.222***	0.0001**	-0.001***	0.002
	(0.078)	(0.224)	(0.000)	(0.001)	(0.000)	(0.031)	(0.000)	(0.285)
Change in trade costs	-0.002	-0.002	0.001	0.001	0.0003	0.0004	0.062**	0.058**
	(0.487)	(0.499)	(0.261)	(0.211)	(0.501)	(0.367)	(0.033)	(0.021)
Log(employment)		0.634		-0.0003***		-0.0001***		-0.004***
		(0.293)		(0.000)		(0.000)		(0.000)
Log(*K/L*)		0.0001		-0.00002		0.786		0.0008
		(0.264)		(0.561)		(0.496)		(0.150)
Observations	1330	1330	2323	2323	4634	4634	248	248
R^2	0.000	0.002	0.000	0.033	0.000	0.020	0.018	0.270

	Electronics		Medical and precision instruments		Motor vehicles		Other transport equipment	
Intercept	0.00005	0.0005**	0.0002	-0.004	0.00002	0.0004	0.0004	-0.006***
	(0.776)	(0.013)	(0.545)	(0.218)	(0.196)	(0.167)	(0.031)	(0.001)
Change in trade costs	-0.013***	-0.013***	0.2418***	0.243***	0.003*	0.003**	0.032	0.027
	(0.000)	(0.000)	(0.000)	(0.000)	(0.054)	(0.044)	(0.113)	(0.155)
Log(employment)		-0.0001***		0.0008		-0.0002***		0.001***
		(0.000)		(0.299)		(0.000)		(0.000)
Log(*K/L*)		-0.000005		0.0007		0.000001		0.0006
		(0.266)		(0.355)		(0.792)		(0.122)
Observations	1920	1920	869	869	1807	1807	445	445
R^2	0.024	0.033	0.036	0.039	0.002	0.023	0.005	0.093

Notes: *p*-value is in parenthesis. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 6. Hypothesis 3, Dependent variable: Growth in firm-level total factor productivity

	Food products		Chemical products		Machinery and equipment		Computers and office machinery	
Intercept	0.006	0.259	-0.075***	0.023	0.036***	0.116**	0.026	0.42**
	(0.602)	(0.101)	(0.000)	(0.752)	(0.000)	(0.038)	(0.146)	(0.024)
Change in trade costs	0.647	0.765	-3.571***	-3.357***	1.447***	1.653***	2.245**	2.254**
	(0.387)	(0.307)	(0.000)	(0.000)	(0.000)	(0.000)	(0.036)	(0.034)
Log(employment)		-0.03*		-0.078***		-0.04***		-0.008
		(0.065)		(0.000)		(0.000)		(0.764)
Log(*K/L*)		-0.036		0.015		-0.001		-0.083**
		(0.252)		(0.302)		(0.912)		(0.042)
Observations	196	196	634	634	806	806	61	61
R^2	0.003	0.027	0.107	0.158	0.024	0.045	0.071	0.143
	Electronics		Medical and precision instruments		Motor vehicles		Other transport equipment	
Intercept	0.003	0.158**	-0.02*	-0.205	0.016***	0.284***	0.003	0.018
	(0.565)	(0.013)	(0.059)	(0.178)	(0.004)	(0.003)	(0.748)	(0.884)
Change in trade costs	-1.814***	-1.85***	0.75	0.746	0.074	0.241	-1.135	-0.985
	(0.000)	(0.000)	(0.388)	(0.393)	(0.825)	(0.469)	(0.123)	(0.194)
Log(employment)		-0.006		0.026		-0.07***		-0.023
		(0.510)		(0.335)		(0.000)		(0.259)
Log(*K/L*)		0.03**		0.029		-0.02		0.007
		(0.024)		(0.403)		(0.298)		(0.793)
Observations	694	694	118	118	583	583	117	117
R^2	0.048	0.056	0.006	0.024	0.000	0.053	0.020	0.031

Notes: *p*-value is in parenthesis. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 7. Hypothesis 4, Dependent variable: Industry productivity growth

	Change in median total factor productivity		Change in mean total factor productivity	
Change in trade costs	0.391	0.391	0.447	0.447
	(0.302)	(0.302)	(0.174)	(0.168)
Intercept	0.024***	0.307**	0.022***	0.026**
	(0.000)	(0.048)	(0.000)	(0.048)
Industry fixed effects	No	Yes	No	Yes
Observations	80	80	80	80
R^2	0.014	0.105	0.024	0.138

Notes: *p*-value is in parenthesis. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 8. Hypothesis 5, Dependent variable: Probability of entering the export market

	Food products		Chemical products		Machinery and equipment		Computers and office machinery	
Intercept	-4.23***	-1.916	-4.347***	-3.538**	-3.714***	-4.064***	-3.744***	-6.511**
	(0.000)	(0.345)	(0.000)	(0.030)	(0.000)	(0.000)	(0.000)	(0.036)
Change in trade costs	8.64	10.288	-2.987	-2.014	8.013	6.424	-15.121	-10.539
	(0.482)	(0.415)	(0.757)	(0.836)	(0.116)	(0.207)	(0.440)	(0.596)
Log(employment)		-0.307		-0.214		0.314**		-0.634
		(0.316)		(0.439)		(0.050)		(0.302)
Log(*K/L*)		-0.36		-0.078		-0.026		0.884
		(0.399)		(0.824)		(0.868)		(0.217)
Observations	1712	1712	3020	3020	7612	7612	384	384
Log Likelihood	-125.9	-125	-208.3	-207.9	-824.4	-822.4	-46	-45
	Electronics		Medical and precision instruments		Motor vehicles		Other transport equipment	
Intercept	-4.212***	-2.977**	-3.849***	-3.335**	-4.095***	-0.694	-3.369***	-0.577
	(0.000)	(0.029)	(0.000)	(0.022)	(0.000)	(0.686)	(0.000)	(0.729)
Change in trade costs	-3.565	-3.169	-2.609	-3.257	-8.432	-7.547	-2.489	-2.171
	(0.699)	(0.737)	(0.824)	(0.783)	(0.335)	(0.393)	(0.854)	(0.875)
Log(employment)		-0.18		0.1		-0.261		-0.179
		(0.503)		(0.777)		(0.361)		(0.659)
Log(*K/L*)		-0.201		-0.158		-0.617		-0.558
		(0.533)		(0.665)		(0.103)		(0.151)
Observations	3015	3015	1414	1414	2772	2772	681	681
Log Likelihood	-233.7	-233.2	-145.2	-145.1	-241.8	-239.8	-100.5	-99.1

Notes: *p*-value is in parenthesis. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 9. Hypothesis 6, Dependent variable: Change in log exports

	Food products		Chemical products		Machinery and equipment		Computers and office machinery	
Intercept	-0.02	0.52	0.02*	0.14	0.1***	0.32	0.13	0.53
	(0.626)	(0.326)	(0.080)	(0.408)	(0.000)	(0.280)	(0.129)	(0.582)
Change in trade costs	0.77	0.08	0.57	0.55	-0.19	-0.27	1.19	4.04
	(0.761)	(0.975)	(0.553)	(0.567)	(0.898)	(0.860)	(0.818)	(0.436)
Log(employment)		0.06		-0.0004		0.002		-0.35**
		(0.264)		(0.988)		(0.958)		(0.024)
Log(*K/L*)		-0.15		-0.02		-0.04		0.09
		(0.165)		(0.523)		(0.454)		(0.66)
Observations	135	135	508	508	545	545	49	49
R^2	0.000	0.023	0.000	0.001	0.000	0.001	0.001	0.048
	Electronics		**Medical and precision instruments**		**Motor vehicles**		**Other transport equipment**	
Intercept	0.002	0.48*	0.03	1.58***	0.04**	0.15	0.09*	0.19
	(0.912)	(0.051)	(0.497)	(0.008)	(0.022)	(0.672)	(0.087)	(0.758)
Change in trade costs	2.23**	2.30**	1.00	1.37	2.06*	2.20**	0.19	-0.03
	(0.039)	(0.033)	(0.743)	(0.646)	(0.062)	(0.049)	(0.955)	(0.991)
Log(employment)		-0.07**		-0.09		-0.05		0.01
		(0.042)		(0.290)		(0.195)		(0.849)
Log(*K/L*)		-0.06		-0.31**		0.006		-0.02
		(0.189)		(0.018)		(0.932)		(0.827)
Observations	541	541	82	82	468	468	83	83
R^2	0.007	0.018	0.001	0.018	0.007	0.011	0.000	0.001

Notes: *p*-value is in parenthesis. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 10. Hypothesis 7, Dependent variable: Probability of exit

	Food products		Chemical products		Machinery and equipment		Computers and office machinery	
Intercept	-1.56***	2.33***	-2.00***	1.08	-1.83***	-1.07***	-1.51***	-0.18
	(0.000)	(0.003)	(0.000)	(0.108)	(0.000)	(0.003)	(0.000)	(0.892)
Change in trade costs	-5.04	-5.69	-13.43***	-14.88***	-6.18	-6.38	6.10	6.11
	(0.326)	(0.320)	(0.003)	(0.002)	(0.146)	(0.163)	(0.667)	(0.693)
Log(employment)		-1.04***		-0.95***		-0.56***		-0.56**
		(0.000)		(0.000)		(0.000)		(0.050)
Log(*K/L*)		-0.38**		-0.25*		0.01		-0.07
		(0.018)		(0.074)		(0.905)		(0.823)
Observations	1330	1330	2323	2323	4634	4634	248	248
Log Likelihood	-610.4	-563.8	-842.4	-802.4	-1852.2	-1831.4	-117.3	-114.9
	Electronics		**Medical and precision instruments**		**Motor vehicles**		**Other transport equipment**	
Intercept	-2.11***	0.07	-1.74***	-1.22	-2.30***	1.11	-2.20***	-0.64
	(0.000)	(0.913)	(0.000)	(0.103)	(0.000)	(0.291)	(0.000)	(0.646)
Change in trade costs	-0.07	0.74	-6.86	-6.59	-6.20	-7.45	-8.06	-8.68
	(0.989)	(0.909)	(0.455)	(0.520)	(0.317)	(0.287)	(0.594)	(0.583)
Log(employment)		-0.82***		-0.84***		-1.18***		-0.24
		(0.000)		(0.000)		(0.000)		(0.406)
Log(*K/L*)		-0.14		0.17		-0.22		-0.25
		(0.354)		(0.331)		(0.315)		(0.424)
Observations	1920	1920	869	869	1807	1807	445	445
Log Likelihood	-656.4	-633.3	-364.7	-354.3	-547	-518.6	-143.4	-142.5

Notes: *p*-value is in parenthesis. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.