RIETI Discussion Paper Series 11-E-054

# Export and Productivity Under Different Market Condition: Evidence from Japan

**YASHIRO Naomitsu**
RIETI

**HIRANO Daisuke**
Institute of Economic Research, Kyoto University

Research Institute of Economy, Trade & Industry, IAA
The Research Institute of Economy, Trade and Industry
http://www.rieti.go.jp/en/

RIETI Discussion Paper Series 11-E-054
May 2011

# Export and Productivity Under Different Export Market Conditions: Evidence from Japan

YASHIRO Naomitsu*
The Research Center for Advanced Policy Studies,
Institute of Economic Research, Kyoto University, and
Research Institute of Economy, Trade and Industry

HIRANO Daisuke
The Research Center for Advanced Policy Studies,
Institute of Economic Research, Kyoto University

Abstract

We use a large dataset of Japanese manufacturing firms to compare the effects of export entry on productivity under different export market conditions. Using the established econometric procedures of Propensity Score Matching and Difference-in-Differences, we explicitly estimate the effects of export entry during two periods with fairly different export market conditions: from 2002 to 2005, corresponding to the earlier period of global economic expansion that ended in 2007, and from 1998 to 2001, the period which witnessed the aftermath of the Asian financial crisis. We find that export entry is associated with significantly higher ex-post productivity growth vis-à-vis non-entrants only during the period with favourable export market conditions. We also find that such advantage in productivity growth is long lasting and is found only for entrants exporting to high-income markets. Furthermore, export entry is associated with higher growth in R&D expenditure only during this period. These findings suggest that the effect of export entry in enhancing productivity growth, sometimes referred to as "learning-by-exporting," depends on good market conditions.

*Keywords*: exports, productivity, and market conditions.
*JEL Classification*: F1; F2



* Corresponding Author: Yoshida-Honmachi, Sakyo-ku, Kyoto, JAPAN 602-8501
Tel: 81-75-753-7171 Fax: 81-75-753-7178 E-mail: yashiro-naomitsu@kier.kyoto-u.ac.jp

## 1. Introduction

It is now a stylized fact that exporting firms have, on average, higher productivity than of non-exporting firms.[1] How such an advantage comes about remains an open question. Studies such as Melitz (2003) and Helpman et al. (2004) emphasized the mechanism whereby the relatively productive firms self-select into undertaking exports and foreign investment in the presence of large entry costs. On the other hand, since the documentation of export-oriented growth in East Asian countries, export has been often thought to provide opportunities for a firm's development (for example, World Bank, 1993). Motivated by the claim made by Grossman and Helpman (1991) that export can be a channel through which firms acquire advanced technology and knowledge from foreign trading partners, numerous studies have explored the effects of export entry on productivity changes, effects which are often referred as 'learning-by-exporting'. Aw et al. (2000), Van Biesebroeck (2005) and De Loecker (2007) are among studies that found significantly higher productivity growth relative to non-exporter following export entry. On the other hand, works like Bernard and Jensen (1999) and Silvente (2005) reported that although firms experience a boost in productivity immediately after entering export, such growth fades rather quickly. Rather than

[1] See for example, Bernard et al. (2007), Mayer and Ottaviano (2008) and Wakasugi et al. (2008) for statistical description of such 'export premia'.

learning, researchers often interpret such short life of post-entry advantage as a consequence of increased capacity utilization following the acquisition of export demand (Damijian and Kostevc, 2006).

Several works have tried to mitigate conflicting evidence on the effects of export entry on productivity growth by incorporating various factors that may shape learning-by- exporting. Blalock and Gertler (2004) suggested that learning-by-exporting is mostly for firms in developing countries with much room for technology catch-up. This view, however, is not entirely consistent with the positive evidence reported for firms in advanced countries such as the U.K or Japan. (Girma et al., 2004 and Kimura and Kiyota, 2006). Studies such as De Loecker (2007) or Park et al. (2010) pointed out export destination as an important factor: only exports to high-income markets where exporters are exposed to sophisticated technology and high-quality requirements may be associated with learning. Greenaway and Kneller (2007) observed differences in ex-post productivity growth of exporters and several industry characteristics and reported that effects of export entry are smaller in industries with high shares of output produced by foreign firms, hinting that the size of foreign presence in domestic market can shape the extent of learning-by-exporting. More recently, Fryges and Wagner (2008) and Anderson and Loof (2009) stressed the differences in export intensity and export persistence in generating learning effects. This paper contributes to these recent developments by adding another dimension: differences in export market conditions.

Our idea that export market conditions can shape ex-post productivity growth of export entrants is motivated by the observation that a favourable export environment is likely to allow sustained contact with foreign markets, which increases the chance of learning-by-exporting in line of what Anderson and Loof (2009) suggested. Furthermore, good prospects of foreign demand are likely to encourage a firm's forward-looking investments on innovation activities. Recent studies such as Lileeva and Trefler (2010), Aw et al. (forthcoming) and Bustos (forthcoming) stressed that export entry increases the return on investments that enhance productivity because exporters having access to foreign markets capture larger demand than domestic firms as consequence of such investments. While none of these studies modelled how the expectation on future foreign demand is formed, it is reasonable to think that expected foreign sales are larger in the time of export boom.[2]

To examine the validity of our conjecture, we compare the effects of export entry on productivity growth of Japanese manufacturing firms during two periods when export market

[2] Note that the relationship between export entry and productivity growth channeled by innovation investments differs in nature from learning-by-exporting, because the source of productivity growth is not the absorption of international knowledge spillover but investments motivated by foreign demand. Aw et al. (2007), however, found that exports and R&D of Taiwanese firms are complementary in their contribution to future productivity. Yashiro and Hirano (2010) reported from a custom-made survey of Japan's small and medium exporters that the chance of realizing innovation as a result of export entry depends crucially on whether the exporter has engaged in R&D and information gathering activity ex-post. The realization of learning-by-exporting is thus closely related to innovation investments.

conditions differed substantially. The first period, from 2002 to 2005, can be viewed as the early half of global economic expansion that ended in 2007. The second period, from 1998 to 2001, marked the aftermath of the Asian financial crisis. Figure 1 depicts the transition of Japan's real export during these two periods. The difference in overall export trends is apparent: while export expanded steadily during the former period, it stagnated in the late 1990s, seeing only a short-lived recovery in 2000. Market conditions and perceptions of Japanese exporters on future foreign demand are thus expected to have been substantially different during these two periods.

(Figure 1 about here)

Using a large dataset of Japanese manufacturing firms, we compute, for each period, effects of export entry in the first year of each sample (2002 and 1998) on productivity growth in subsequent years. Following previous literature, the effects of export entry are computed as Difference-in-Differences (DID) estimator between export entrants and non-entrants. Inferring these effects by unconditional comparison, however, is likely to lead to overestimation due to the unobservable differences between export entrants and non-entrants. Therefore, we adopt the Propensity Score Matching (PSM) procedure, which is widely employed in previous literature, to form the control group sharing similar probability of export entry with the actual entrants.

We find that export entrants enjoy significantly higher growth in productivity ex-post than non-entrants. This effect, however, is observed only in the period of favourable export market conditions and is absent in the aftermath of the Asian financial crisis. The differences in export entry effects between the two periods are statistically significant, implying that positive market conditions play a significant role in determining the effects of export entry. Results are robust to different specification of productivity.

The dependence of the export-productivity nexus on market conditions may suggest the possibility that productivity growth mostly reflects capacity utilization. However, unlike the effects of increased capacity utilization, which are considered short-lived, we find the effects of export entry long lasting. On breaking down the sample of export entrants according to whether they export to high-income markets, significant effects on productivity are observed only among those exporting to high-income markets. This is in line with previous studies which stressed learning from sophisticated markets. Furthermore, it is also found that in positive export environment, export entrants' R&D expenditure increases significantly faster than that of non-entrants, suggesting the existence of R&D-channelled innovation, but only under sufficiently favourable market condition.

Our results provide useful insight into the formation of an export-productivity nexus, particularly to understand why it is observed in some cases but not in others, sometimes even within the same country. The results also point to the importance of incorporating expectation formation within a model of dynamic decision making for export entry and innovation investments, as suggested in Aw et al. (forthcoming). Finally, the main policy implication drawn from our results is that if the government is to promote development of small enterprises through export promotion, such policy is more likely to succeed in a favourable export environment.

The following section introduces the data used in our analysis and our empirical framework. Section 3 reports the results, and Section 4 concludes the paper.

## 2. Data and Empirical Framework

### (1) Data on Japanese Manufacturing Firms

The data which we use throughout our analysis is *The Basic Survey of Japanese Business Structure and Activities (Kigyo Katsudo Kihon Chosa),* conducted annually by the Ministry of Economy, Trade and Industry (METI). Covering enterprises with more than 50 employees or capital greater than 10 million yen, this dataset provides wide-ranging firm information related to sales, profit, employment, export activity and various types of investments including R&D. The dataset has been used in numerous studies on internationalization and productivity of Japanese firms. Our dataset spans 1997–2005, from the outbreak of the Asian financial crisis to the midst of the global economic boom. This constitutes a large, unbalanced panel data with 20,000 firms per year on an average.[3] We retrieve two smaller datasets from this dataset: one covering 1997–2001 and another covering 2001–2005. We focus on the export entrants in the years 2002 and 1998. We define export entrant as a firm which did not export in the previous year but exports in the current year. Entrants in the year 2002 are, therefore, firms which switched from being domestic firms in 2001 to exporters in

[3] The dataset also contains firms in non-manufacturing sectors such as retail or service. We drop these samples to prevent serious differences in industrial characteristics from affecting our results. This reduces the size of our sample to around 13,000 per year.

2002. There are 306 and 295 export entrants in 2002 and 1998 respectively, corresponding to about 8% of total exporters in those years. While our definition of export entrants could be a crude one in that it does not prove that these 'entrants' are first-time entrants, our exercise which requires two non-overlapping time periods leaves us small room to track past export status.

As our measure of productivity, we estimate the Total Factor Productivity (TFP) for each firm using an estimation method proposed by Olley and Pakes (1996). This method corrects the bias on estimates of input coefficients arising in response to a firm's unobserved productivity as well as the selection-bias occurring from the least productive firm's exit. The method has often been widely employed by empirical works treating heterogeneity in productivity and internationalization, such as Keller and Yeaple (2009). Value added is computed by subtracting the intermediate and administration inputs from sales. Both are deflated using the industry-level output deflator and input deflator from the JIP 2006 database developed by the Research Institute of Economy, Trade and Industry (RIETI). Capital stock is also deflated using the capital deflator of JIP database.[4]

(2) Empirical Framework

[4] For detailed explanations regarding JIP 2006 Database, see: http://www.rieti.go.jp/en/database/d05.html.

Following numerous studies that evaluate the consequence of export on firm performance, we estimate the effects of export entry on productivity as DID estimator, which removes the common shock between export entrants and non-entrants as well as the time-invariant part of unobserved firm level heterogeneity. DID is computed as the difference of mean productivity changes between the case in which firms entered export on time 1 (the first term in the equation below) and that in which they did not (the second term). This estimator can be interpreted as the Average Treatment Effect of Export Entry on Treated (ATT).

$$ATT = E(TFP_{i1+s} - TFP_{i0} \left| Export^{1}_{i1} = 1\right.) - E(TFP_{i1+s} - TFP_{i0} \left| Export^{1}_{i1} = 0\right.) \quad (1)$$

$Export^{1}_{it}$ is a binary variable that takes 1 if a firm *i* which is an export entrant (expressed by number 1 in its shoulder) engaged in exports in time t, and 0 otherwise. Because by definition, all entrants engaged in export on time 1, the second term on the RHS is an unobservable counterfactual. Therefore, it is replaced by $E(Y_{i1+s} - Y_{i0} \left| Export^{0}_{i1} = 0\right.)$, the ex-post productivity change of non-entrants in time 1 (non-entrants status expressed by number 0 on its shoulder).

Commonly raised issues in comparative analysis between export entrants and non-entrants include the issue of self-selection of the most productive firms into export entry and the potentially unobservable firm heterogeneity governing both productivity and export entry. Such self-selection and endogeneity cause bias in estimating the effects of export entry on productivity. The most common approach to counter this issue is the PSM method, which compares export entrants to a control group of non-entrants with similar probability of export entry.[5] Such probability, often mentioned as score, is estimated as a function of selected firm characteristics. We specifically estimate the score of export entry as the following function of firm characteristics in the previous period:

$$P(Export_{i1} = 1 | Export_{i0} = 0) = F(TFP_{i0}, Emp_{i0}, R\&D_{i0}, Wage_{i0}, Capital_{i0}, Ind, Time) \quad (2)$$

To make our estimation results as general as possible, we have selected the explanatory variables which are widely used in previous literature. These variables include logarithm of TFP, employment size, R&D expenditure, average wage and capital–labour ratio (per capita real capital stock). We also include two-digit industry dummies which control time-invariant industry characteristics and time dummies which control macroeconomic trend and cycle. Based on this estimated probability of export entry for each firm, we carry out nearest neighbour matching to form the control group of

[5] See for example the series of work by David Greenaway and his colleagues (Girma et al., 2004, Greenaway and Kneller, 2007 and more) for actual application of PSM. PSM is also used in studies of various topics concerning the internationalization of firms, including the effect of foreign acquisition (Arnold and Javorcik, 2009) or off-shoring (Hijzen et al., 2010) on productivity.

non-entrants sharing close enough score with the entrants. While our focus is on export entrants in 2002 and 1998, we estimate a general probability of export entry across the entire period between 1997 and 2005, instead of carrying out PSM separately for 2002 and 1998. This most likely reduce the possibility of the observed difference in effect of export entry between the two periods being generated by the systematic differences in each control group during these two points of time.

Finally, we set the base productivity level as time 0, the year before export entry, and observe the productivity growth from this level for the first three years of export entry. This approach reflects the observation by De Loecker (2007) that export entrants do not necessarily out-perform non-entrants in year-to-year productivity growth.

## 3. Estimation Results

We start by estimating the probability of export entry for the entire sample period. Table 1 displays the results of logit estimation of equation (1). We notice that productivity does not have any significant coefficient. While this is at odds with the prediction by the theoretical model of self-selection, it is consistent with the finding of Todo (2009) who reported using a mixed logit model where the role of ex-ante productivity level is decimal in determining whether Japanese firms become exporters. According to his estimation, even a 50% higher TFP level at present would result only in a 0.05% higher probability of becoming an exporter in the next period. On the other hand, firm size, measured by the number of employees and R&D expenditure, contributes significantly to raising the probability of export entry. The positive association between firm size and export entry is well documented for firms in various countries. Effects of R&D in inducing export entry are also documented by Aw et al. (2007) for Taiwanese firms and Girma et al. (2009) for Irish firms. Average wage and capital-labour ratio have negative coefficients but are not significant.

(Table 1 about here)

Next, we form the control group of non-entrants for export entrants in 2002 and 1998 by the standard nearest neighbour matching based on the estimated score.[6] This yields control groups with probabilities of export entry similar to those for the actual entrants. We observe the quality of match by comparing the mean values of firm characteristics incorporated in the estimation of score between the treated (export entrants) and the controlled (matched non-entrants) in the years 2002 and 1998. From Table 2, we see that the null hypothesis that mean values are identical between two groups cannot be rejected for any of the variables.

[6] We carried out the psmatch2 command on STATA with default kaliper.

(Table 2 about here)

We are now ready to observe the effects of export entry on the productivity growth of Japanese manufacturing firms by estimating the ATT described in equation 1. From Table 3, we see that export entry in the year 2002 is immediately associated with productivity growth higher than that of non-entrants. The estimated coefficients in the first row indicate that export entrants experienced 6.4% point higher growth in TFP in the year of entry. The advantage of export entrants in ex-post productivity growth increases with time, peaking in the second year after the entry. All the coefficients are significant at 5% level, which confirms the existence of positive contribution by export entry to productivity during this period of favourable market conditions. In contrast, when we look at the effects of entry in 1998, all the coefficients indicating entrants' advantage in productivity growth are not significant. The coefficients are also all negative, implying the possibility that entrants even underperformed in comparison to non-entrants during this period.

In addition to observing a stark asymmetry between ATTs of export entry in the two periods, we also test whether such difference between ATTs is statistically significant. For this we use Individual Treatment Effect (ITT) which we define as the subtraction from the productivity growth of an export entrant $i$ of that of the non-entrant matched to export entrant $i$ by PSM:

$$ITT_i = (TFP_{i1+s} - TFP_{i0} \left| Export_{i1}^{1} = 1) - (TFP_{i1+s} - TFP_{i0} \right| Export_{i1}^{01} = 0) \quad (3)$$

where $Export_{it}^{01} = 0$ describes the matched non-entrant. By regressing ITTs on a time dummy indicating the year 2002 and observing its coefficients, we infer the statistical difference in ATTs between the two periods. The coefficients and their significance are reported on last row of Table 3. Difference in ATTs between two periods are significant and positive for all the points of time, supporting our conjecture that good market conditions have an important role in realizing positive effects of export entry.

(Table 3 about here)

We also carry out the same exercise with other measures of productivity: one is TFP estimated by the method of Levingson & Petrin (2003) which uses the information on intermediate input to correct the potential bias on input coefficients; another is labour productivity, which is the real value added divided by the number of employee for our robustness analysis. Results are listed in the appendix. We obtain very similar results for these cases, but the effects of export entry on labour productivity under better market conditions seem less lasting than on TFP. This could be because labour productivity responds to the change in utilized capital stock per labour and, therefore, is affected more directly by the change in capital utilization intensity than is TFP.

How should the nature of the observed export-productivity nexus be interpreted? One may see the significant role of market conditions as evidence to ex-post productivity growth being mostly attributable to increased capacity utilization. We, however, argue from three perspectives that this export–productivity nexus of Japanese exporters is closer to 'learning-by-exporting' or the result of innovation investments rather than being a mere consequence of increased capacity utilization. First, effects of export entry on TFP are long lasting; although previous studies stressing the role of capacity utilization such as Damijan and Kostevc (2006) based their arguments on the observation of very short lived boost in productivity observed only on the year of export entry.

Second, previous literature such as De Loecker (2007) or Park et al. (2010) stressed the existence of 'learning-by-exporting' by reporting that export to high-income markets is associated with greater if not the only significant effect of entry. We conduct the same line of analysis by separating the sample of export entrants with exports to high-income markets (which we define as North America and Europe) from those without. In the sample used for analysis in Table 3, entrants exporting to high-income markets comprise about 36% of 294 entrants in 2004 and 38% of 286 entrants in 1998. The effects of entry and differences in such effects between the two time periods are then estimated for both groups of entrants. Table 4 shows that significantly higher and lasting ex-post productivity growth under favourable market conditions is present only for entrants that export to higher-income markets. The extent of export entry effects is also larger compared to the estimate of the entire sample of entrants and follows the same pattern across time, implying that those entrants are mainly driving the results in Table 3.[7]

(Table 4 about here)

Lastly, we observe the behaviour innovation activities on the part of export entrants in the two periods. Salomon and Shaver (2005) claimed that observing innovation activities is a more suitable way to infer learning-by-exporting than TFP which is subject to various fluctuations. Table 5 summarizes the average treatment effects of export entry on R&D expenditure estimated in a similar way as TFP. We find that entrants increase their R&D spending significantly more than do non-entrants only in a sufficiently favourable market environment. While the difference between the treatment effects in the two periods is significant in the first year of entry, we believe that this finding lends support to the hypothesis that good export market conditions encourage investment in innovation.

[7] Although the significance of export entry effects on productivity in the year of entry starting in 2002 is weaker in comparison to that of the whole sample case, it is still significant at 10% level.

(Table 5 about here)

These three findings together support the view that the higher productivity growth experienced by export entrants during the recent export boom has been channelled by learning and innovation activity.

## 4. Conclusion

We have explored possible heterogeneity in the effects of export entry on productivity under different export market conditions. A favourable export environment is not only likely to allow 'learning-by-exporting' through sustained contact with foreign markets but is also more likely to motivate exporters to engage in innovation investments which enhance productivity in the mid to long run. Following the standard econometric framework established by previous literature on the export-productivity nexus, we evaluate the effects of export entry on Japanese manufacturing firms' productivity for two periods of substantially different market conditions. We find that export entry is associated with significantly higher ex-post productivity growth vis-à-vis non-entrants only during the period of favourable export market conditions. Similar to the results reported by previous literature which claimed the existence of 'learning-by-exporting,' these effects of export entry are long-lasting and detected only among entrants which export to high-income countries, unlike the effects of increased capacity utilization, which dissipate soon after export entry. Furthermore, export entry is also found to have promoted R&D expenditure only under good market condition. All these observations lend support to our conjecture.

Previous studies such as De Loecker (2007) rescaled different time periods within the dataset into a single timeline following export entry. While such treatment is likely to be based on an intent to prevent different market conditions from altering the estimated treatment effect, it misses the potential effects of market conditions on exporter's learning and innovation investments. It is also difficult to interpret the mechanism behind the ATT of export entry when we only observe the relation between export entry and productivity that is 'averaged-out' across market conditions. Exploring the differences across market conditions allows us a richer understanding of the export-productivity nexus.

An important caveat is that our analysis did not clarify exactly how good export market conditions promote 'learning-by-exporting' or innovation activities. In particular, the relation between market prospects and innovation investment decisions should be tested more formally within a structural model. A promising line of research may be to incorporate expectations on future foreign demands within the dynamic model of investment decision proposed by Aw et al. (forthcoming). Finally, our study suggests that if governments are to provide policy support for the internationalization of small enterprises facing difficulty in entering the export market on their own,[8] such policy support is more likely to result in development of those firms in a favourable export environment than in an unfavourable environment.

---

[8] This is likely when there is an up-front entry cost of exports and firms are facing financial constraints (see Chaney, 2005) or when the cost of gathering information about foreign buyer is too large.

References

Andersen, M., Loof, H., 2009. Learning-by-Exporting Revisited: The Role of Intensity and Persistence. The Scandinavian Journal of Economics. 111(4), 893–916.

Arnold, J.N., Javorcik, B.S., 2009. Gifted Kids or Pushy Parents? Foreign Direct Investment and Plant Productivity in Indonesia. Journal of International Economics 79, 42–53.

Aw, B.Y., Chung, S., Roberts, M.J., 2000. Productivity and Turnover in the Export market: Micro-level Evidence from the Republic of Korea and Taiwan. The World Bank Economic Review 14(1), 65–90.

Aw, B.Y., Roberts, M.J., Winston, T., 2007. Export Market Participation, Investments in R&D and Worker Training, and the Evolution of Firm Productivity. The World Economy 130(1), 83–104.

Aw, B.Y., Roberts M.J., Xu, D.Y., forthcoming. R&D Investment, Exporting and Productivity Dynamic. American Economic Review.

Bernard, A.B., Jensen, J.B., 1999. Exceptional Exporter Performance: Cause, Effect, or Both? Journal of International Economics 47(1), 1–25.

Bernard, A.B., Jensen, J.B., Redding, S.J., Schott, P. K., 2007. Firms in International Trade. Journal of Economic Perspective 21(3), 105–130.

Blalock, G., Gertler, P.J., 2004. Learning from Exporting Revisited in a Less Developed Setting Journal of Development Economics 75, 397–416.

Bustos, P., forthcoming. Trade Liberalization, Exports and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinean Firms. American Economic Review.

Chaney, T., 2005. Liquidity Constrained Exporters. University of Chicago, mimeo.

Damijan, P.J., Kostevc, C., 2006. Learning-by-Exporting: Continuous Productivity Improvements or Capacity Utilization Effects? Evidence from Slovenian Firms. Review of World Economics 142(3), 599–614.

De Loecker, J., 2007. Do Exports Generate Higher Productivity? Evidence from Slovenia. Journal of International Economics 73, 69–98.

Fryges, H., Wagner, J., 2008. Exports and Productivity Growth: First Evidence from a Continuous Treatment Approach. Review of World Economics 144(4), 695–722.

Girma, S., Greenaway, D., Kneller, R., 2004. Does Exporting Lead to Better Performance? A Microeconometric Analysis of Matched Firms. Review of International Economics 12, 855–866.

Girma, S., Görg, H., Hanley, A., 2009. R&D and Exporting: A Comparison of British and Irish Firms. Review of World Economics 144(4), 750–773.

Greenaway, D., Kneller, R., 2007. Industry Difference in the Effect of Export Market Entry: Learning by Exporting? Review of World Economics 143(3), 416–432.

Grossman, G., Helpman, E., 1991. Trade, Knowledge Spillovers and Growth. European Economic

Review 35, 517–526.

Helpman, E., Melitz, M.J., Yeaple S.R., 2004. Export Versus FDI with Heterogeneous Firms. American Economic Review, 94(1), 300-316.

Hijzen, A., Inui, T., Todo, Y., 2010. Does Offshoring Pay? Firm-Level Evidence from Japan. Economic Inquiry, 48(4), 880-895

Keller, W., Yeaple, S.R., 2009. Multinational Enterprises, International Trade, and Technology Diffusion: A Firm-level Analysis of the Productivity Effects of Foreign Competition in the United States. Review of Economics and Statistics, 91(4), 821–831.

Kimura, F., Kiyota, K., 2006. Exports, FDI and productivity: Dynamic evidence from Japanese Firms. Review of World Economics 142(4), 695–719.

Levinsohn, J., Petrin, A., 2003. Estimating Production Function Using Inputs to Control for Unobservable. Review of Economic Studies 70, 317–341.

Lileeva, A., Trefler, D., 2010. Improved Access to Foreign Markets Raises Plant-level Productivity … For Some Plants. Quarterly Journal of Economics 125(3),1051–1099.

Mayer, T., Ottaviano, G.I.P., 2008. The Happy Few: The Internationalization of European Firms. Bruegel Blueprint Series.

Melitz, M., 2003. The Impact of Trade on Intra-Industry Reallocations and Aggregate Productivity. Econometrica 71(6), 1695–1725.

Olley, G.S., Pakes, A., 1996. The Dynamic of Productivity in the Telecommunication Industry. Econometrica 64(6), 1263–97.

Park, A., Yang, D., Shi, X., Jiang, Y., 2010. Exporting and Firm Performance: Chinese exporters and the Asian Financial Crisis. The Review of Economics and Statistics, 92(4), 822–842

Salomon, R.M., Shaver, J.M., 2005. Learning by Exporting: New Insights from Examining Firm Innovation. Journal of Economics and Management Strategy 14(2), 431–460.

Silvente, F.R., 2005. Changing Export Status and Firm Performance: Evidence from UK Small Firms. Applied Economics Letters 12, 567–571.

Todo, Y., 2009. Quantitative Evaluation of Determinants of Export and FDI: Firm-level Evidence from Japan. Research Institute of Economy, Trade and Industry (RIETI) Discussion Paper Series 09-E-019.

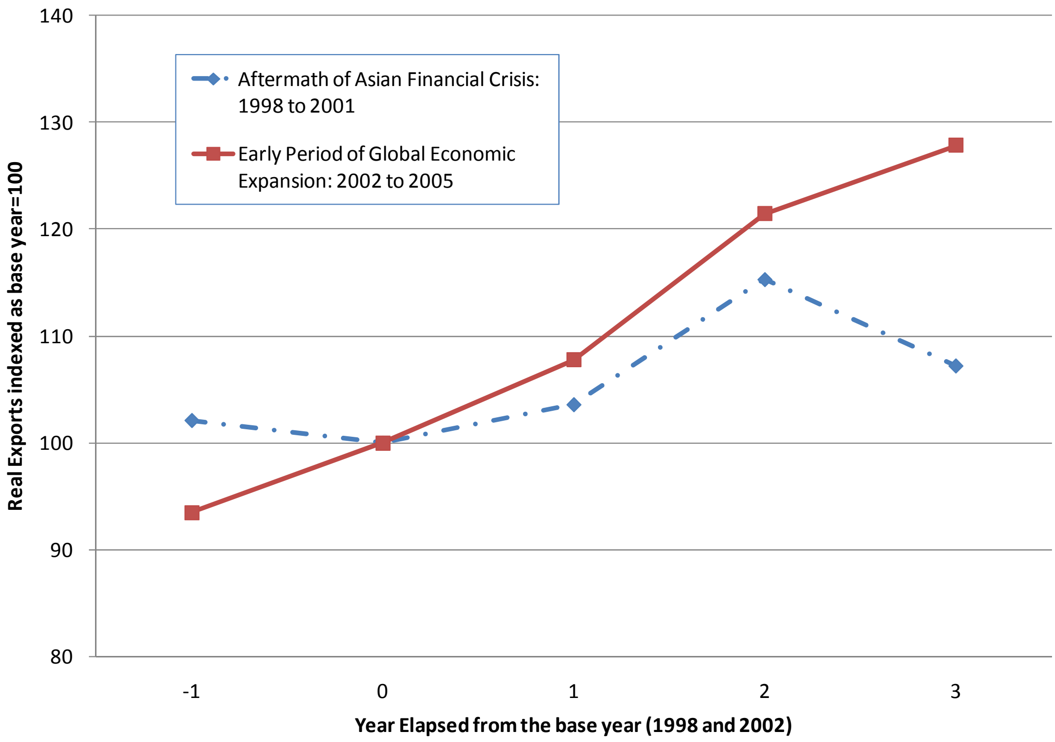
Van Biesebroeck, J., 2005. Exporting Raises Productivity in Sub-Saharan African Manufacturing Plants. Journal of International Economics 67, 373–391.

Wakasugi, R., Todo, Y., Sato, H., Nishioka, S., Matsuura, T., Ito, B., Tanaka, A., 2008. The Internationalization of Japanese Firms: New Findings Based on Firm-Level Data. Research Institute of Economy, Trade and Industry (RIETI) Discussion Paper Series 08-E-036.

World Bank, 1993. The East Asian Miracle: Economic Growth and Public Policy. Oxford: Oxford University Press.

Yashiro, N., Hirano, D., 2010. Anatomy of Learning-from-Exporting: Role of Foreign Knowledge Acquisition. Research Institute of Economy, Trade and Industry (RIETI), Discussion Paper Series 01-E-053.

Figure 1 Transition of Japan's Real Exports during 2001- 2005 and 1997-2001




Note: Real Export is indexed as the base year = 100, where the base years are 2002 and 1998.

Source: Authors' calculation from Real Export Index (Bank of Japan)

Table1. Estimated Coefficients of Export Entry Probability Function (Logit Estimation)

| | | |
|---|---|---|
| TFP | 0.068 | |
| | (0.058) | |
| Employment Size | 0.184 | ** |
| | (0.028) | |
| R&D Investment | 0.156 | ** |
| | (0.011) | |
| Per capita Wage | -0.035 | |
| | (0.085) | |
| Per capita Capital Stock | -0.019 | |
| | (0.017) | |
| Industry Dummy | Yes | |
| Year Dummy | Yes | |
| Intercept | -4.065 | ** |
| | (0.213) | |
| Log likelihood | -9403.4 | |
| Pseudo $R^2$ | 0.068 | |
| N | 66197 | |

Note:

All variables are in log value except for Industry and Year Dummies.

Numbers in the parentheses are standard errors.

**, * indicate statistical significance at the level of 1% and 5%, respectively.

Source: Authors' calculation

Table2. Mean Comparison of Matched Samples

| | Variable | Mean | | t-statistic | p-value |
|---|---|---|---|---|---|
| | | Treated | Control | | |
| 2002 | TFP | 1.896 | 1.882 | 0.39 | 0.697 |
| | Employment Size | 5.248 | 5.160 | 1.08 | 0.281 |
| | R&D Investment | 2.326 | 2.207 | 0.58 | 0.56 |
| | Per capita Wage | 1.624 | 1.575 | 1.67 | 0.095 |
| | Per capita Capital Stock | 1.702 | 1.584 | 0.96 | 0.339 |
| 1998 | TFP | 1.747 | 1.743 | 0.09 | 0.926 |
| | Employment Size | 5.420 | 5.323 | 1.16 | 0.245 |
| | R&D Investment | 2.908 | 2.658 | 1.14 | 0.254 |
| | Per capita Wage | 1.602 | 1.581 | 0.74 | 0.46 |
| | Per capita Capital Stock | 2.288 | 2.207 | 0.88 | 0.377 |

Note:

All variables are in log value.

t-statistics and p-values correspond to the null hypothesis that mean vales between two groups are identical.

Source: Author's calculation

Table 3. Average Treatment Effect (ATT) of Export Entry on Total Factor Productivity

| | Years after Entry | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| ATT of Entry in 2002 | 0.064 * | 0.094 * | 0.122 * | 0.105 * |
| | (0.027) | (0.037) | (0.049) | (0.048) |
| *N* of Treated | 294 | 255 | 252 | 239 |
| *N* of Untreated | 7798 | 6874 | 6648 | 6318 |
| ATT of Entry in 1998 | -0.027 | -0.034 | -0.030 | -0.033 |
| | (0.028) | (0.038) | (0.041) | (0.047) |
| *N* of Treated | 283 | 263 | 248 | 239 |
| *N* of Untreated | 8914 | 8041 | 7310 | 6871 |
| Difference in ATTs | 0.091 * | 0.128 * | 0.152 * | 0.137 * |
| | (0.038) | (0.051) | (0.062) | (0.067) |

Note:

Table reports ATT of export entry on logarithm of Total Factor Productivity estimated using the method by Olley and Pakes (1996).

Difference in ATTs is computed by regressing export entrants' treatment effects on Year dummy indicating Year 2002.

Numbers in the parentheses are standard errors.

**, * indicate statistical significance at the level of 1% and 5%, respectively.

Source: Authors' calculation

Table 4. Average Treatment Effect (ATT) of Export Entry by Export Destination

| | Years after Entry | | | |
|---|---|---|---|---|
| Firms Exporting to High Income Markets | | | | |
| | 0 | 1 | 2 | 3 |
| ATT of Entry in 2002 | 0.097 | 0.145 * | 0.296 ** | 0.217 ** |
| | (0.050) | (0.064) | (0.086) | (0.084) |
| ATT of Entry in 1998 | -0.032 | -0.050 | -0.094 | -0.066 |
| | (0.046) | (0.055) | (0.059) | (0.064) |
| Difference in ATTs | 0.129 | 0.195 * | 0.390 ** | 0.284 ** |
| | (0.067) | (0.083) | (0.107) | (0.106) |
| Firms Not Exporting to High Income Markets | | | | |
| | 0 | 1 | 2 | 3 |
| ATT of Entry in 2002 | 0.045 | 0.064 | 0.014 | 0.038 |
| | (0.030) | (0.045) | (0.056) | (0.056) |
| ATT of Entry in 1998 | -0.024 | -0.025 | 0.007 | -0.013 |
| | (0.036) | (0.051) | (0.054) | (0.064) |
| Difference in ATTs | 0.069 | 0.088 | 0.007 | 0.051 |
| | (0.046) | (0.064) | (0.075) | (0.086) |

Note:

Table reports ATT of export entry on logarithm of Total Factor Productivity estimated using the method by Olley and Pakes (1996).

Difference in ATTs is computed by regressing export entrants' treatment effects (ITTs) on Year dummy indicating Year 2002.

Numbers in the parentheses are standard errors.

**, * indicate statistical significance at the level of 1% and 5%, respectively.

Source: Authors' calculation

Table 5. Average Treatment Effect (ATT) of Export Entry on R&D Expenditure

| | Years after Entry | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| ATT of Entry in 2002 | 0.400 ** | 0.281 * | 0.353 * | 0.326 * |
| | (0.113) | (0.130) | (0.151) | (0.154) |
| *N* of Treated | 294 | 255 | 252 | 239 |
| *N* of Untreated | 7798 | 6874 | 6648 | 6318 |
| ATT of Entry in 1998 | 0.001 | 0.112 | 0.175 | 0.177 |
| | (0.001) | (0.101) | (0.141) | (0.132) |
| *N* of Treated | 283 | 263 | 248 | 239 |
| *N* of Untreated | 8914 | 8041 | 7310 | 6871 |
| Difference in ATTs | 0.399 ** | 0.169 | 0.178 | 0.148 |
| | (0.112) | (0.159) | (0.197) | (0.192) |

Note:

Table reports ATT of export entry on logarithm of R&D expenditure.

Difference in ATTs is computed by regressing export entrants' treatment effects (ITTs) on Year dummy indicating Year 2002.

Numbers in the parentheses are standard errors.

**, * indicate statistical significance at the level of 1% and 5%, respectively.

Source: Authors' calculation

Appendix: Average Treatment Effect (ATT) of Export Entry on Alternative Measures of Productivity

(1) Total Factor Productivity estimated by method of Levinson & Petrin (2003)

| | Years after Entry | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| ATT of Entry in 2002 | 0.089 ** | 0.103 ** | 0.115 * | 0.118 * |
| | (0.028) | (0.038) | (0.050) | (0.050) |
| *N* of Treated | 294 | 255 | 252 | 239 |
| *N* of Untreated | 7798 | 6874 | 6648 | 6318 |
| ATT of Entry in 1998 | -0.029 | -0.017 | -0.020 | -0.016 |
| | (0.029) | (0.037) | (0.041) | (0.047) |
| *N* of Treated | 283 | 263 | 248 | 239 |
| *N* of Untreated | 8914 | 8041 | 7310 | 6871 |
| Difference in ATTs | 0.118 ** | 0.120 * | 0.134 * | 0.134 * |
| | (0.039) | (0.050) | (0.061) | (0.067) |

Note:

Table reports ATT of export entry on logarithm of Total Factor Productivity estimated using the method by Levinson & Petrin (2003).

Difference in ATTs is computed by regressing export entrants' treatment effects (ITTs) on Year dummy indicating Year 2002.

Numbers in the parentheses are standard errors.

**, * indicate statistical significance at the level of 1% and 5%, respectively.

Source: Authors' calculation

(2) Labor Productivity

| | Years after Entry | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| ATT of Entry in 2002 | 0.059 * | 0.090 ** | 0.054 | 0.064 |
| | (0.026) | (0.033) | (0.040) | (0.042) |
| *N* of Treated | 294 | 255 | 256 | 241 |
| *N* of Untreated | 7798 | 6874 | 6710 | 6392 |
| ATT of Entry in 1998 | -0.016 | -0.016 | -0.001 | 0.030 |
| | (0.023) | (0.031) | (0.034) | (0.037) |
| *N* of Treated | 283 | 263 | 248 | 241 |
| *N* of Untreated | 8914 | 8041 | 7343 | 6951 |
| Difference in ATTs | 0.075 * | 0.106 * | 0.054 | 0.034 |
| | (0.033) | (0.044) | (0.051) | (0.055) |

Note:

Table reports ATT of export entry on logarithm of Labour Productivity calculated as real value added divided by number of employee.

Difference in ATTs is computed by regressing export entrants' treatment effects (ITTs) on Year dummy indicating Year 2002.

Numbers in the parentheses are standard errors.

**, * indicate statistical significance at the level of 1% and 5%, respectively.

Source: Authors' calculation