Do non-exporting plants benefit from parent firms' export experience?

Hyunbae Chun[*] Jung Hur[§] Nyeongseon Son[†] Haeyeon Yoon[‡]

Abstract

This study examines the spillover of knowledge from export activity within firm, indirect effects from export activity, by analyzing the performance of non-exporting plants in exporting firms. We exploit 1, 3, and 5 years growth of plants' performances (employment, sales, labor productivity, and total factor productivity), using Korean plant level data from 2008 to 2013. Our results show that there are no significant differences in the performance growth between non-exporting plants and exporting plants in exporting firms, while significant differences exist among non-exporting plants according to their firms' activity. The non-exporting plants which belong to exporting firms grow faster than the other non-exporting plants whose firms do not export. The results indicate that the exporting plant within same firm acts as transmission channels of the learning effects to the non-exporting plant. So if a plant belongs to an exporting firm, irrespective of whether the plant exports or not, the plant gets considerable positive effects of export activity through its firm. To control a self-selection bias, propensity score matching method is used and in that estimation we also found that the non-exporting plant benefits from its firm's export activity.

Key words: Export, Learning by Exporting, Firms

JEL classification: F14, L23

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[*]Department of Economics, Sogang University. Email: hchun@sogang.ac.kr
[§]Department of Economics, Sogang University. Email: ecsjhur@sogang.ac.kr
[†]Department of Economics, Sogang University. Email: starsys7@nvaer.com
[‡]Department of Economics, Sogang University, Email: hyyoon@sogang.ac.kr

1. Introduction

It is a stylized fact that exporting firms are more productive than non-exporting firms (Bernard and Jensen, 1999; Wagner, 2007). Firms get knowledge and technology from export activity and they grow faster than non-export firms (Arrow, 1962; Blalock and Gertler, 2004). Learning by exporting hypothesis is supported by studies with micro data (De Loecker, 2007; Fernandes and Isgut, 2015), even if debates about causality still remain (Aw et al., 2000; Bernard and Wagner, 2001).

With globalization and growth of multi-unit firms, the role of firm in managing and arranging production stages becomes more important (Bernard and Jensen, 2007). A firm organizes and arranges a series of production stages. As a firm owns more than two plants and also engages in the global market, the firm distributes the production stages among its plants and acts as liaison between plants boosting interaction within firm. So if one of its plants gets better knowledge from export activity, the knowledge would be shared with other plants within firm. Therefore the learning effects from an exporting plants (direct effect) are not limited to that plant, but peer plants belonging to the same firm also get the positive effects (indirect effect or spillover effect). Even though a plant does not export, it may get the learning effect as same as an exporting plant does. But the previous studies have exploited only the existence of direct effect and they do not pay attention to indirect or spillover effect of export activity within firm.

In this paper, we examine the indirect effect of export activity through peers within firm, using Korean manufacturing establishment data from 2008 to 2013. First, we check the existence of the learning by exporting effect by exploiting the performances of plants with difference in difference (DID) model with propensity score matching (PSM). Second, to check whether the indirect effect exists or not, we compare the performance growth of exporting plants with that of non-exporting plants which belong to the same firm. To see how much the indirect effect is, we compare the growth of non-exporting plants in exporting firms and that in non-exporting firms. Finally, to control for the self-selection process, the DID model with PSM is used, following Heckman et al. (1997). Our results show that there exists the indirect effect of export activity in non-exporting plants from peer exporting plants within the same firm, and the indirect effect is large enough to widen the gap of plants' performances between non-exporting plants of exporting firms and those of non-exporting firms.

2. Data

This paper uses establishment-level data from the Mining and Manufacturing Survey from 2008 to 2013, conducted by Statistics Korea. Establishments with at least 10 employees in Korea mining and manufacturing sectors are surveyed annually by Statistics Korea. This survey data contains general information about establishments (sales, employment, capital, etc.) and also it includes ID of firm where plants belong to. With the firm ID of establishment, we define a multi-plant firm which owns more than two plants and a peer plant which has the same firm ID. Since from 2008 the survey does not contain plant's export information, we use trade information of plants conducted by Korea Customs Service. This trade information includes ID of plant which has any positive amount of export and the rank of countries information that the plant exports. Using the plant's ID, we match the export information with plant's information from the Mining and Manufacturing Survey data. We define an exporting firm if at least one plant included in that firm does export activity.

[Table 1]

Table 1 describes the mean value of plants' performances in 2008. In an upper panel A, we divide the plants by their own export activity; an exporting plant group and a non-exporting

plant group. About 24% of Korean manufacturing plants export in 2008. On average, the exporting plants are larger in both employment and sales and they are more productive than the non-exporting plants. In a lower panel B, according to the parent firm's export activity, we additionally divide the non-exporting plant group into non-exporting plants in exporting firms and non-exporting plants in non-exporting firms. Even though the number of non-exporting plants in exporting firm is small, 2% of the non-exporting plant group, their sales take more than 10% share in total plants' sales which indicates their economic importance. We find that there exists a substantial heterogeneity in the plants' performances among non-exporting plants. The non-exporting plants which belong to the exporting firms outperform than those in non-exporting firms and also their performances are more similar to, or even better than, those of the exporting plants. With summary statistics in Table 1, we found the difference in plants' performances among non-exporting plants, and from the finding we could infer that the parent firms' export experience influences the performances of plants within firm, irrespective of whether the plants export or not.

3. Estimation Model & Results

Before the analysis of the indirect effect, we check if there are the learning effects from export activity. We compare exporting plants in 2008 which do not export in 2007(treat group) and non-exporting plants in both periods (control group), using the DID model with PSM. The DID model estimates effects of specific shock on a treatment group's outcome by comparing the average change over time in the outcome between the treatment group which was exposed to the shock and the control group which was not. In the model, the control group is assumed as a counterfactual. But if the control group does not appropriately represent the counterfactual of treat group or the characteristics of the two group are totally different before the shock, a selection bias may occur. To mitigate the potential selection bias, this paper utilizes the propensity score matching method from Rosenbaum and Rubin (1983). First, we regress a probit model with an export dummy as a dependent variable which takes 1 if a plant starts export in 2008 and otherwise it takes 0. In the probit model, the plant's characteristics (age, employment, sales, labor productivity, and TFP)[1] in 2007 are controlled. After the regression of the probit model, the value of predicted export probability of a plant, a propensity score, is measured. Plants are selected to the control group if the plants have the closest propensity score with that of an export starting plant (the method of the nearest neighbor)[2]. By matching within 3-digit level sector (83), the matched control group is created within disaggregated manufacturing sectors. With the control group, we utilize the DID model to estimate the direct learning effect from export activity, by comparing the growth of plant's performances (employment, sales, labor productivity, and TFP) in the two groups after 1, 3, and 5 years from 2008. This estimation result is described in Table 2 which shows the exporting plants grow faster than the non-exporting plants in all sides of performances. The outperformance of the exporting plants remains 1, 3, and 5 years after they start exporting, indicating the existence of the direct effect from export activity.

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[1] Employment is the number of employees excluding temporary and dispatched workers. Labor productivity is defined as the real value-added per worker. Nominal value-added is defined as sales revenue minus the sum of cost of goods sold and selling, general, and administrative expenses plus the sum of labor expense and capital depreciation. TFP is based on real value-added from Cobb-Douglas production function with one-thirds real capital stock share. Capital stock is defined as the value of tangible fixed assets. We use 2010 deflators for the real value-added and real capital stock at two-digit level from the Bank of Korea.

[2] For a plant in the treat group, 5 plants are matched according to the propensity score.

[Table 2]

[Figure 1]

Based on the existence of the direct effect from export activity, we check whether there is the indirect effect of export activity in non-exporting plants within the same firm and how large the effect is. Figure 1 describes a sample of the first estimation which checks the existence of the indirect effects of export activity through the peer exporting plants on non-exporting plants. We examine the difference of the growth between the non-exporting plants (A1) and the exporting plants (A2) belonging to the exporting firms (A). The first estimation model is specified as:

$$Perform_{i(j)kt} = \alpha_0 + \alpha_1 P\_EX_{i(j)k} + X'_{i(j)k0}\beta + \delta_k + e_{i(j)kt} \quad (1)$$

$$where\ X'_{i(j)k0}\beta = \beta_1 Age_{i(j)k0} + \beta_2 Labor_{i(j)k0} + \beta_3 Sales_{i(j)k0} + \beta_4 LP_{i(j)k0} + \beta_5 TFP_{i(j)k0}$$

In the equation (1), $Perform_{i(j)kt}$ is performance's growth of plant i in industry j owned by firm k at t. We examine the 1, 3, and 5 years' growth after 2008. As the performance of plants, employment, sales, labor productivity, and TFP are used. $P\_EX_{i(j)k}$ is a dummy variable which takes the value of 1 if a plant does export activity in 2008, otherwise it takes 0. We add a control vector of plant characteristics $X_{i(j)k0}$ which includes age, employment, sales, labor productivity, and TFP of plant i in industry j owned by firm k at year 2008. Since we compare plants in same firm, firm dummy variable δ_k is included. $\alpha_1, \beta_1, \beta_2, \beta_3, \beta_4, \ and\ \beta_5$ are unknown parameters and $e_{i(j)kt}$is the standard error term clustered by 3-digit level industry.

[Table 3]

As shown in Table 3, the growth of plants' performances between exporting and non-exporting plants in exporting firms does not statistically differ. The exporting plants have a higher growth of labor in one year than the non-exporting plants, but after 3 years it seems that there is not any difference in labor growth between them. The other growth of performances, such as sales, labor productivity, and TFP, does not show any differences between the two groups. The results from Table 3 indicate that if the plants belong to exporting firms then whether the plants export or not does not matter for the plants' growth. It means that the learning effects from export activity are broadly shared within firm, supporting the existence of the indirect effect.

[Figure 2]

Figure 2 shows a sample of the second estimation which examines whether the indirect effect is negligible or not. The growth of plants' performances between two groups of non-exporting plants is exploited; the first group includes non-exporting plants (A1) which belong to exporting firms (A), and the other group contains non-exporting plants (B1) which belong to non-exporting firms (B).

$$Perform_{i(j)kt} = \alpha_0 + \alpha_1 F\_EX_{i(j)k} + X'_{i(j)k0}\beta + \lambda_j + e_{i(j)kt} \quad (2)$$

The second estimation model is almost same with the first one, except two variables. Instead of $P\_EX_{i(j)k}$, we use $F\_EX_{i(j)k}$ variable which takes the value of 1 if a firm k of plant i in industry j owns any exporting plants, otherwise it is 0. So the dummy variable shows whether the plant i belongs to an exporting firm or not. In place of firm dummy variable δ_k, industry dummy variable λ_j is included to control unobservable industry characteristics in the equation

(2). The control vector of plant characteristics $X_{i(j)k0}$ is included and the standard error clustered by industry is used.

[Table 4]

Table 4 describes the difference of plants' performances growth between non-exporting plants of exporting and non-exporting firms. All of the coefficients in first row of Table 4, except that of the employment, are positive and statistically significant in 1% level. The higher growth of non-exporting plants in exporting firms remains after 3 and 5 years from the base year, 2008. The results show that among non-exporting plants, there are significant differences in the plants' performances growth depending on the characteristics of firms. Our results from Table 3 and 4 demonstrate positive experiences and effects from the peer's export activity are transferred to non-exporting plants through parent firms and these effects are substantial.

Since there might be the self-selection bias in the two previous estimations, lastly, we examine the indirect effect of export activity through peer exporting plants, using the DID model with PSM. As same as the estimation of direct effects, we create control group using propensity score matching techniques with the characteristics of plants in 2007. Both of the control and the treat group include plants which do not export activity in 2007 and 2008. The difference between two groups is that the treat group includes firms which switch from non-exporting in 2007 to exporting firms in 2008, while firms in the control group do not export in both periods. If there exists the indirect effect, the performance growth in the treat group might be higher than that in the control group.

[Table 5]

Table 5 shows the results of the last estimation. The results show that the plants whose firms become exporters in 2008 grow faster than the other plants whose firms do not export in 2008. The higher growth of non-exporting plants in export starting firms remains after 3 and 5 years from the base year, 2008. Using the propensity score matching method, we found the non-exporting plants get positive effects from their firms' export activity.

4. Conclusion

Because of the prevalence of multi-plant and multinational firms, the role of firm becomes important in organizing and managing their production processes. But the previous studies did not consider the role of firm and the firm's activity. The studies have exploited only the direct effect from a plant's export activity on that plant. This paper examines the spillover of knowledge from export activity within firm, by exploiting the indirect effect from the firms' export activity on the non-exporting plants.

Before examining the indirect effect, we check the existence of the direct effect from export activity. In Korean plant-level data, we found that export starting plants grow faster than non-export plants. This result supports the learning by exporting hypothesis. To see whether the non-exporting plants benefit from their firm's export activity, we compare the performance growth between exporting and non-exporting plants in exporting firms and the growth between non-exporting plants in exporting and non-exporting firms. Our results show that there is no difference in the growth of plants between exporting and non-exporting plants which belong to the exporting firms, while there is a large difference in the growth of plants' performance according to the firms' activity. The results mean that the peer exporting plants act as transmission channels to the non-exporting plants within the same firms. So if a plant belongs to exporting firm, regardless of export activity of that plant, the plant has the learning effect of export activity through its exporting peers. To minimize the self-selection bias, lastly, the DID

model with PSM is used. The results from the DID model also show that the non-exporting plants in the export starting firms grow faster than those in non-exporting firms, indicating the existence of the spillover effect of export activity within firm.

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Figure 1: Sample structure for Table 3

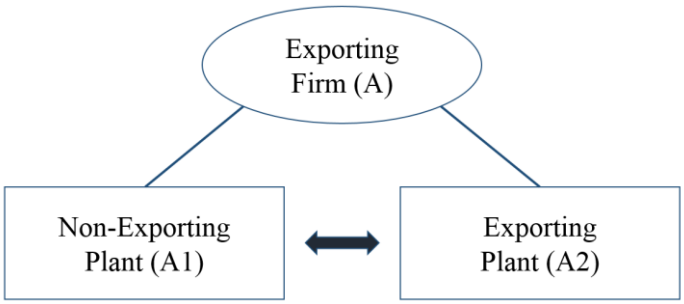

Figure 2: Sample structure for Table 4

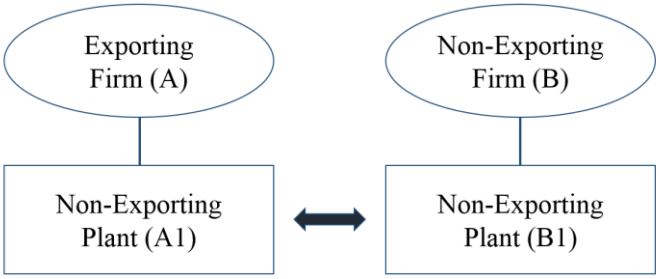

Table 1: Summary statistics of plant's performances

A. Plant's activity	Exporting Plant (14,128)	Non-exporting Plant (43,790)	
Employment	3.441	2.816	
Sales	8.759	7.756	
Labor productivity	4.346	4.105	
TFP	3.090	3.023	
B. Firm's activity	Exporting Plant (14,128)	Non-exporting Plant in Exporting firm (1,000)	Non-exporting Plant in Non-exporting Firm(42,790)
Employment	3.441	3.930	2.790
Sales	8.759	9.738	7.710
Labor productivity	4.346	4.786	4.089
TFP	3.090	3.263	3.018

Notes: All the values are based on plant's characteristics in 2008. If a plant exports in 2008, the plant is classified to the Exporting plant group. If a firm owns at least one exporting plant, the firms is defined as an exporting firm. The number of plants in that group is described in parentheses.

Table 2: Direct effects of Export activity, DID with PSM

	2009(t+1)	2011(t+3)	2013(t+5)
∆ln(Employment)	0.026***	0.031***	0.046***
∆ln(Sales)	0.076***	0.098***	0.100***
∆ln(Labor productivity)	0.034***	0.056***	0.040***
∆ln(TFP)	0.034***	0.039***	0.017
Observation (Treat/Total)	5,574 / 32,662	4,784 / 21,146	4,096 / 21,595

Notes: Sample includes plants which do not export in 2007. Treat group includes plants which do not export in 2007 but start export activity in 2008. Control group is matched sample using the treat group. Control group includes plants which do not export in both periods of 2007 and 2008. Performances of plants in 2008 are used as a basis to measure the growth of plants' performances. Numbers in parentheses are standard errors clustered by industry. ***, **, and * indicate statistical significances at 1%, 5%, and 10% levels, respectively.

Table 3: Exporting Firm sample

Year	Observation	∆ln(Employment)	∆ ln(Sales)	∆ ln(Labor Productivity)	∆ln(TFP)
2009(t+1)	2,219	0.058**	0.010	-0.051	-0.042
		(0.027)	(0.034)	(0.047)	(0.042)
2011(t+3)	1,854	0.026	0.029	0.046	0.032
		(0.047)	(0.046)	(0.045)	(0.048)
2013(t+5)	1,636	-0.008	0.003	0.024	-0.003
		(0.049)	(0.072)	(0.082)	(0.060)

Notes: Performances of plants in 2008 are used as a basis to measure the growth of plants' performances. Firm fixed effect is employed. Numbers in parentheses are robust standard errors. ***, **, and * indicate statistical significances at 1%, 5%, and 10% levels, respectively.

Table 4: Non-exporting Plant sample

Year	Observation	∆ln(Employment)	∆ln(Sales)	∆ln(Labor Productivity)	∆ln(TFP)
2009(t+1)	34,558	0.002	0.104***	0.114***	0.105***
		(0.018)	(0.025)	(0.030)	(0.029)
2011(t+3)	25,271	0.045*	0.135***	0.072**	0.065**
		(0.026)	(0.036)	(0.030)	(0.031)
2013(t+5)	20,200	0.061**	0.152***	0.164***	0.149***
		(0.030)	(0.054)	(0.037)	(0.037)

Notes: Performances of plants in 2008 are used as a basis to measure the growth of plants' performances. 3-digit level industry fixed effect is employed. Numbers in parentheses are robust standard errors. ***, **, and * indicate statistical significances at 1%, 5%, and 10% levels, respectively.

Table 5: Indirect effects, DID with PSM

	2009(t+1)	2011(t+3)	2013(t+5)
∆ln(Employment)	0.045	0.134***	0.163**
∆ln(Sales)	0.178***	0.205***	0.240***
∆ln(Labor productivity)	0.194**	0.125*	0.135*
∆ln(TFP)	0.165***	0.140**	0.147**
Observation (Treat/Total)	159 / 26,860	137 / 20,950	121 / 17,323

Notes: Sample includes plants which do not export in both 2007 and 2008. Treat group includes plants whose parent firms do not export in 2007 but start export activity in 2008. Control group is matched sample using the treat group. Control group includes plants whose parent firms do not export in both periods of 2007 and 2008. Performances of plants in 2008 are used as a basis to measure the growth of plants' performances. Numbers in parentheses are standard errors clustered by industry. ***, **, and * indicate statistical significances at 1%, 5%, and 10% levels, respectively.