The effects of export on wages and employment:
Empirical evidence from the Korean manufacturing industry

By

KIM, Yeong In

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF DEVELOPMENT POLICY

2020

The effects of export on wages and employment: Empirical evidence from the Korean manufacturing industry

By

KIM, Yeong In

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF DEVELOPMENT POLICY

2020

Professor Tabakis, Chrysostomos

The effects of export on wages and employment: Empirical evidence from the Korean manufacturing industry

By

KIM, Yeong In

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF DEVELOPMENT POLICY

Committee in charge:

Professor Tabakis, Chrysostomos, Supervisor ______________

Professor Kim, Taejong ______________

Approval as of December, 2020

ABSTRACT

THE EFFECTS OF EXPORT ON WAGES AND EMPLOYMENT:

EMPIRICAL EVIDENCE FROM THE KOREAN MANUFACTURING INDUSTRY

By

KIM, Yeong-In

This study examines whether a company's export activity increases employment and enhances wages by analyzing plant-level panel data of Korea's manufacturing industry. Previous research has heavily focused on productivity, which was deemed as a factor that boosted companies' performance, but researchers have not reached a solid agreement on whether export promotes productivity. In this paper, the empirical evidence supports that the firms who had started exporting for three years offered higher wages and saw an increased need for hiring new employees than the matched non-exporters did. Moreover, the export-starting effect on wages and employment is evident in 8 out of 22 manufacturing sectors: (1) food products and beverages, (2) rubber and plastics products, (3) other non-metallic mineral products, (4) basic metals, (5) other machinery and equipment, (6) other electrical machinery and electric transformers, (7) electronic components, visual, sounding, and communication equipment, and (8) motor vehicles and trailers. In terms of wages per worker, manufacture of medical, precision, and optical instruments reports the highest amount with a significant mean difference of 11.7%p between the export starters and the non-exporters. The electronic component, visual sounding, and communication equipment manufacture reveal that export starters hired 68 workers more than the non-exporters, which shows the highest mean difference. These research findings suggest that export promotion policies should be designed to support firms in readiness for accessing the export market. Additionally, such policy could be implemented in a structured manner for each manufacturing sector since the magnitude of the impacts varied.

ACKNOWLEDGEMENTS

It has been a long journey to complete this thesis. This work would not have been possible without the assistance of many people.

First of all, I would like to gratefully acknowledge Professor Chrysostomos Tabakis for the persistent guidance to develop ideas and warm encouragements to complete this paper. I also thank Professor Taejong Kim for providing useful comments to the empirical parts of this paper. A special word of gratitude goes to Cheongyeon Won for his helpful feedback and having a thorough look at this thesis in spite of his tight schedule as a Ph.D. I would like to acknowledge my parents, my younger sister, and my beloved Jiho, with gratitude for their love and support. Last but not least, my gratitude is extended to all my friends and colleagues, especially for Hanna, to encourage me not to give up and inspire confidence.

TABLE OF CONTENTS

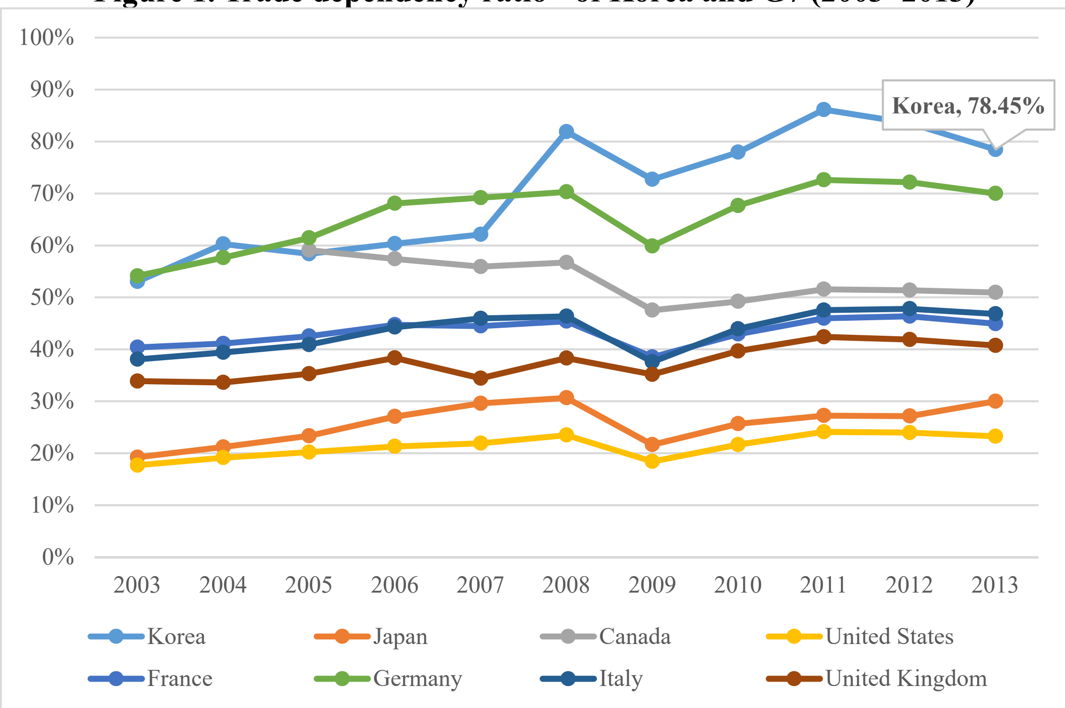
LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

Korea is well-known as a country that has achieved export-led economic growth. At the center of such rapid economic development, international trade has played an important role. As shown in Figure 1, the value of Korea's trade dependency ratio is the highest among the G7 countries. Until today, international trade has a powerful impact on the economic growth of Korea.

<Figure 1. Trade dependency ratio[1] of Korea and G7 (2003~2013)>



Source: KOSIS (Korea Statistical Information Service)

In the 1960s, Korea adopted an export promotion strategy for the manufacturing sector

[1] Trade dependency ratio = (Imports + Exports) / Nominal GDP × 100

based on the belief that export led to economic growth. After the East Asian Miracle became a leading case of an export promotion strategy, many developing countries started to promote export. Accordingly, much work on the interactions between export and economic growth was conducted, and it is now widely accepted that trade is positively related to economic growth[2]. However, national-level characteristics are usually the focus of interest in this field.

In recent years, there has been considerable attention in figuring out the effect of export on firms' productivity. As main discussions have moved from the national level to firms or plants level, a number of micro-econometrics studies have been conducted regarding the exporting activity of firms and their productivity. Such studies[3] maintained that there is a positive relationship between exporting participation and firms' productivity, and this could be a stylized fact. Moreover, it is considered that exporters become more productive and profitable to hire more employees and pay higher wages because not only the national economy but also firms benefit from export. While these studies indicate that export remains promising, they do not show the causal relationship between export and firms' productivity. Another implication is that the performance of exporters was already improved even before they started to export due to other factors rather than export itself.

Although various arguments have surfaced in terms of causality between export and firms' productivity, the direction of the two variables is not clear. There are two possible theoretical explanations to this: the 'learning-by-exporting' hypothesis and the 'self-selection' hypothesis. The 'learning-by-exporting' hypothesis argues that export makes firms more productive. That is, because exporting firms are forced to face a more competitive situation

---

2 More details on this topic, see World Bank (1993), Sachs and Warner (1995), and Frankel and Romer (1999).

3 See Schank, Schnabel and Wagner (2010) and Lee and Choi (2009).

than the domestic market, their cumulative experiences improve their productivity accordingly. The 'self-selection' hypothesis, on the other hand, is that productive and better firms select themselves into exporting. In this hypothesis, only productive firms could endure the additional fixed cost (e.g., entry cost and transportation cost) and keep their exporting activity.

Although interest in the causality of firms' productivity and export has risen, not much research has focused on employment and wages as firms' performance, especially for the Korean manufacturing industry. Instead, most studies chose total factor productivity or its growth as a performance variable and explained that high productivity leads to higher wages and more employment opportunities. However, after controlling the productivity, there still could exist a gap of wages and employment level between exporting firms and domestic firms. Furthermore, understanding the correlation between export and wages/employment is important because it is a well-known fact that workers play an essential role as a labor supplier in the factor market and also as a consumer in the product market.

In this regard, the key question is whether firms hire more and/or offer higher wages after becoming an exporter. This study examines the relationship between export-starting behavior and level of wages or employment using the plant-level data on the Korean manufacturing sector during the period of 2003 to 2013. The data covers all plants with ten or more employees in the manufacturing sector. The reason for choosing the industries in the manufacturing sector is that it plays a vital role in export in Korea. In past decades, manufacturing has had the highest ratio of merchandise export[4] in Korea. According to Korea

[4] Merchandise export shows the free on board value of goods provided to the world in current U.S. dollars. Manufactures contain commodities in SITC sections 5 (chemicals), 6 (basic manufactures), 7 (machinery and transport equipment), and 8 (miscellaneous manufactured goods), excluding division 68 (non-ferrous metals). From Korean Statistical Information Service:
http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_2AQ405&conn_path=I2

Statistical Information Service(KOSIS) data, the manufacture's ratio of merchandise export amounted to 87.6% in 2019.

The aim of this study is to investigate the causal effect of *starting-to-export* on *employment and wages* in the Korean manufacturing sector. To get more clear evidence, firstly, the propensity score matching (PSM) method by Rosenbaum and Rubin (1983) is used in this paper. Wagner (2002) first used this method to analyze the causal effect of export starting on growth of firm size and labor productivity for a German case. Lee and Choi (2009) also used the same method to investigate the association between export and total factor productivity by using Korean data from 1992 to 2003. The PSM approach could adjust a selection bias problem by controlling firms' observable characteristics of export-starting firms as well as non-exporters. In this study, the method is revised to investigate the causality between export and wages/employment. Specifically, labor productivity is additionally used as covariates that control the characteristics rather than using it as a dependent variable, unlike other studies.

Secondly, in terms of defining export firms, an analysis is conducted toward *export-starting* firms rather than exporting firms. Throughout this paper, the term 'export-starting firm' or 'export starter' means the firm that has no experience of exporting prior to year *t*. Previous studies have mostly focused on 'exporter' that did export in year *t*. However, if the analysis is conducted only for the exporting firms, the results could be overestimated because exporting experiences of previous year *t* would already be reflected in the performance of year *t*.

Thirdly, estimating the export-starting effect is conducted for three years, from the first year *t* when a firm starts to export to the third year when the same firm keeps exporting. From the export-starting year, this paper also evaluates whether the export effect lasts for three years and the size of the effect would get smaller or bigger as time goes by.

Lastly, the effect of export starting is also investigated by each industry within the manufacturing sector, according to Korean Standard Industrial Classification (KSIC) at two-digit level. In this context, the analysis is expected to evince which industry creates more employment opportunities and offers higher wages than others, prompted by export-starting.

The remaining part of this paper is organized as follows; section 2 provides literature review, and section 3 discusses the methodology used. In section 4, descriptive statistics and empirical findings are presented. Finally, section 5 concludes the paper.

II. LITERATURE REVIEW

A positive association between firms' export activity and productivity has been widely investigated. Many studies have supported that exporters performed better than non-exporters applying varying measurements. For instance, Bernard et al. (1995) empirically analyzed the relationship between export and firm performance, including productivity, wages, firm size, and other measurements, which showed a positive correlation.

Much work on the correlation between export and productivity has been carried out, yet there are still some critical issues regarding the direction of the effect. There are two possible explanations linking export to productivity. One is the learning-by-exporting hypothesis where export activity improves firms' productivity, and the other is the self-selection hypothesis where good firms, that is, productive firms would initiate export by themselves. However, these two hypotheses are not mutually exclusive, and there is a possibility that the two would appear simultaneously.

Wagner (2007) well organized the accumulated research results on this issue. He reviewed the empirical findings of various studies by using firm-level microdata for analyzing the relationship between export and productivity. According to his paper, many studies indicated that exporters show better results than non-exporters, and productive firms go abroad while export does not improve productivity much. Moreover, it turned out that evidence of the learning-by-exporting hypothesis is more mixed and unclear, and many studies have largely focused on firms' productivity rather than considering other measurements when analyzing the relationship between export and firms' performance.

1. Export effect on firms' productivity

Despite a considerable amount of literature supporting the self-selection hypothesis, evidence of the learning-by-exporting hypothesis has not reached a consensus. Aw et al. (1998) reported the existence of the self-selection hypothesis in a Taiwanese case. However, their paper could not find substantial evidence of self-selection or learning effect in the Korean case. In South Korea, not only the evidence of self-selection was weak, but also the learning-by-exporting was not significant in productivity. Clerides et al. (1998) also found significant evidence of the self-selection hypothesis by using microdata of Colombia, Mexico, and Morocco; however, they found weak evidence for the learning-by-exporting hypothesis. Furthermore, Kim et al. (2009) investigated whether high productivity causes export activity among the eight Korean manufacturing industries[5] from 1997 to 2003. They found out that only three industries (machinery and equipment, computers and office machinery, and electronic components manufacturing) could support the self-selection hypothesis. Nevertheless, they did not find significant evidence of the learning-by-exporting hypothesis except for one industry, the machinery and equipment industry. Another study on the causal relationship of export and productivity was carried out by Kim and Choi (2017). They used a Korean manufacturing data set from 1984 to 2015. According to their paper, productive firms participate the export market, but it is still unclear whether the productivity of exporters increases due to export. They also found out that exporters showed better performance in employment, value added, real wages, and labor productivity than non-exporters.

[5] The eight industries are following: (1) food processing and tobacco, (2) chemicals and chemical products, (3) machinery and equipment, (4) computers and office machinery, (5) electronics and communication equipment, (6) medical, precision and optical instruments, (7) motor vehicles and trailers, and (8) other transport equipment. From "High productivity before or after exports? An empirical analysis of Korean manufacturing firms" by S. I. Kim, M. Gopinath, and H. Kim, 2009, *Journal of Asian Economics, 20*(4), p. 412. Copyright 2009 by Elsevier.

Some papers argue that export and productivity are linked in both directions. That is, both the self-selection and learning-by-exporting effects exist simultaneously. Baldwin and Gu (2003) found evidence of the self-selection and learning-by-exporting effect in the Canadian manufacturing sector. They reported that productive firms participate in the foreign market and that, export activity improves productivity. Unlike previous studies, they found that export is associated with productivity growth in the Canadian case. Mallick and Yang (2013) also reached the same conclusion that both the learning-by-exporting and self-selection hypotheses are present based on their analysis of an Indian case. They affirmed that the productivity of exporters is higher than that of non-exporters after starting export. Another finding in their study was that productive firms tend to enter the export market, and less productive firms are likely to leave the market. A similar finding exists regarding a Korean case. Hahn (2004) concluded that both hypotheses exist in the Korean manufacturing sector and stated that the learning-by-exporting effect is observed in employment. However, it turned out that the learning effect was limited to the short run.

Several studies, for instance, Loecker (2005), Isgut and Fernandes (2007), and Lee and Choi (2009) have been conducted on finding evidence of the learning-by-exporting effect. Loecker (2005) provided evidence of the learning effect in Slovenian manufacturing firms. According to his study, export starters became more productive after exporting, and the productivity gaps get larger over time. Also, he argues that the effect is higher when the destination of export moves towards high-income countries. Isgut and Fernandes (2007) also points out that exposure to exporting improves plant productivity. After controlling for a bias, possibly caused by self-selection, they found that the higher degree of plants' exposure to export contributed to the stronger effect. Lee and Choi (2009) carried out a study on the effects of plants' exporting activity on total factor productivity in the Korean manufacturing sector.

The authors investigated the existence of the learning-by-exporting effect and found that the effect lasted four years from the base exporting year. This result is different from Hahn's (2004), who did not find a long-run effect of learning-by-exporting. More recent evidence (Song, 2015) showed a significant learning effect on export in the Korean manufacturing sector, especially for the second and third years after participating in the export market. Furthermore, the firms exporting to developing countries experienced less increase in their total factor productivity than those exporting to developed countries.

2. Export effect on firms' wages and employment

There has been little research on export activity and wages or employment as firms' performance measurement.

Bernard and Jensen (1997) found little evidence of improving productivity and wage growth after exporting. They concluded that even though good firms self-select into the export market, the results are mixed once they become exporters. Schank et al. (2010) showed that firms that offer high wages self-select into the export market, but this did not result from export. According to their study, exporters' wage premium already existed even in the year before exporting.

Unlike these studies, Wagner (2002) and Mallick and Yang (2010) found evidence of the export effect on wages and employment. Both of the studies estimated the export effect by using the propensity score matching (PSM) method. The first analysis on the causal effects of export on employment and wages using the PSM method was performed by Wagner (2002). He demonstrated that the causal effect of starting-to-export is statistically significant in the growth of employment and wages in German manufacturing industries. After his study, the

PSM method has been widely used in this area. Subsequently, Yang and Mallick (2010) also used PSM and found the existence of export premium in employment with the evidence of self-selection from Chinese firms. They also reported that export entrants' employment growth is higher than that of non-exporters for the first year of starting export.

More recent evidence (Hwang et al., 2017) has revealed that the employment effect of exporting has weakened in Korea from 2000 to 2014. Still, there was a positive correlation between export and the employment of permanent workers. The authors also found a relationship between capital intensity and employment and empirically estimated that when the industry is close to having a capital-intensive structure, the export effect on employment is weakened.

III. METHODOLOGY

This study evaluates the export effect on wages and employment by using the matching approach based on the Korean manufacturing plant-level panel data from 2003 to 2013. Matching approaches have been used to estimate the treatment effect in the evaluation of policy interventions, medical trials, and performance of job-training programs. For instance, treatment could be an economic policy intervention to distribute subsidies when a government needs to know whether the policy has an impact on a certain outcome, such as consumption.

Making a simple mean comparison of outcome variables between the treated and the control groups after the treatment could not be an adequate estimation of the treatment effect. In the example above, subjects of the policy interventions are not randomly assigned, but they are selected based on specific conditions. In other words, the treated are not randomly selected. In this case, the simple mean difference might not be a relevant estimator of the treatment effect because covariates are related to the outcomes and treatment assignment. Simply comparing two sample means of outcome variables might overestimate the treatment effect and cause a selection bias.

To measure the treatment effect properly, comparing the outcome Y when a subject is treated (denote as Y_1) with the outcome Y when the same subject is not treated (denote as Y_0) would be the unbiased estimates. In an ideal experimental case, Y_1 and Y_0 would be observed simultaneously. Treatment and control groups are in identical conditions except for the treatment status. Then, the difference between Y_1 and Y_0 could be averaged in an experimental data set to measure the average impact of the treatment. However, in observational data, it is impossible to observe whether a particular subject has been treated and not treated at the same time. For instance, if a subject is treated, the outcome when the same subject is not treated would be a potential outcome (counterfactual outcome) which is in a counterfactual situation. The potential outcome is unobservable; thus, it concerns a missing-data problem.

<Table 1. Treatment effect in observational data>

Treatment status	$Y_i(1)$	$Y_i(0)$
Treated ($T_i = 1$)	Observable	Counterfactual
Non-treated ($T_i = 0$)	Counterfactual	Observable

Note. T_i means the dummy variable, and Y_i means the potential outcome.

Instead, this paper estimated the average treatment effect on the treated (ATET) to evaluate the impact on those who were assigned in the treatment. In other words, ATET is the mean difference among the treated subjects.

$$\boldsymbol{ATET = E[Y(1) - Y(0)|T_i = 1] = E[Y(1)|T_i = 1] - E[Y(0)|T_i = 1]}$$

As seen in Table 1, $\boldsymbol{E[Y(0)|T_i = 1]}$ is a counterfactual mean that is not observable. Therefore, it is necessary to find a comparison group to estimate the counterfactual outcome. One of the solutions is to use a matching approach. The matching approach compares outcomes by making a sample from non-treated groups that are as similar as possible with the treated groups except the treatment assignment. In this case, the unobservable $\boldsymbol{E[Y(0)|T_i = 1]}$ could be estimated by using the observable $\boldsymbol{E[Y(0)|T_i = 0]}$. If a subject is in the treated ($T_i = 1$), which has characteristics X (covariates), then the matching subject with similar characteristics could be found in the non-treated ($T_i = 0$) to use the outcome $Y_i(0)$. After matching is done between the treated subject and similar untreated subject before the treatment, differences in outcomes of the two groups could be associated with the treatment effect.

Among many matching approaches, this paper employed the propensity score matching (PSM) method. The PSM method, developed by Rosenbaum and Rubin (1983), was used to investigate the causal effects of export on firm size and labor productivity by Wagner (2002) for the first time.

The PSM method calculates the propensity score of the treated and control group based on their observable characteristics and then matches the treated and non-treated subjects by obtaining similar scores. The propensity score is "the conditional probability of assignment to a particular treatment given a vector of observed covariates (Rosenbaum & Rubin, 1983, p.41)." That is, the propensity score is the probability of being assigned treatment, given observed characteristics X.

$$\boldsymbol{Propensity\ Score\ \rho} \equiv \mathbf{Pr}(\boldsymbol{T} = \mathbf{1}|\boldsymbol{X})$$

Through a probit regression of a dummy variable, the propensity score ρ was calculated, which indicates whether or not a subject is treated based on the characteristics with regards to the treatment. When calculating the score, pre-treatment characteristics were used not to be affected by the treatment. To use the propensity score for matching, the following two conditions should be assumed (Rosenbaum & Rubin, 1983);

(1) Conditional independence assumption (unconfoundeness): The potential outcomes given covariates X are independent of assignment of treatment.

$$(\boldsymbol{Y}(\mathbf{0}), \boldsymbol{Y}(\mathbf{1})) \perp \boldsymbol{T}|\boldsymbol{X}$$

(2) Common support condition: Propensity scores are bounded away from zero and one. The distribution of the pre-treatment covariates should be sufficiently overlapped.

$$\mathbf{0} < \mathbf{Pr}(\boldsymbol{T} = \mathbf{1}|\boldsymbol{X}) < \mathbf{1}$$

Given these assumptions, the counterfactual mean could be estimated as observed outcomes.

$$\boldsymbol{E}[\boldsymbol{Y}(\mathbf{0})|\boldsymbol{T_i} = \mathbf{1}, \boldsymbol{X}] = \boldsymbol{E}[\boldsymbol{Y}(\mathbf{0})|\boldsymbol{T_i} = \mathbf{0}, \boldsymbol{X}]$$

After finding the untreated subject with a high probability of being treated for matching, matching data could be used as an estimator of $\boldsymbol{E}[\boldsymbol{Y}(\mathbf{0})|\boldsymbol{T_i} = \mathbf{1}, \boldsymbol{X}]$ to evaluate the average treatment effect on the treated.

IV. RESULTS

1. Data and descriptive statistics

Empirical analyses of this study were based on unbalanced yearly panel data of the Korean manufacturing industry from 2003 to 2013. The panel data set combines the report on mining and manufacturing survey of Statistics Korea with trade statistics from the Korean Customs Service at the plant level. All firms with ten or more employees in manufacturing sectors at Korean Standard Industrial Classification (KSIC) five-digit level are covered in the report on mining and manufacturing surveys. It includes industrial classification (sector), shipments, annual wage, number of workers, value added, assets (e.g., lands, buildings, machinery, and vehicles), production costs (e.g., official and general expenses). The KSIC code was revised in 2007 for the ninth time, and this paper used the KSIC eighth code merged with the ninth code. Overall, there are 23 manufacturing industries in manufacturing section D. However, the manufacture of tobacco products was excluded from the analysis because the number of observations was too small to be used in the propensity score matching. To get more precise information about each plant's exporting status, the trade statistics was also used to conduct an empirical study. All the price variables were adjusted with the base year 2010. Excluding missing data, a total of 659,275 observations were used in the analyses.

In this paper, 'export starter' indicates a firm that had not exported before year *t*, started exporting in year *t*, and continues to export for three years from year *t*. On the other hand, 'exporter' is a firm that exports in year *t*, regardless of whether the firm did export before year *t*. 'Non-exporter' is defined as a firm with no export experience prior to year *t* nor after. Unlike previous studies, this paper did not define exporting status as the proportion of exports to sales.

Furthermore, to reduce the effect that has already been reflected in outcome variables, this paper focused more on the 'export starter' rather than the 'exporter'.

Other characteristics of firms were also considered as covariates in the empirical analysis, such as firm age, sales, value added, total asset, total annual wage, total worker, wages per worker, and labor productivity. These covariates were selected based on the empirical findings of previous studies. 'Firm age' is the number of years in operation of the establishment year to specific year *t*. 'Sales' is the annual turnover, and labor productivity refers to value added per worker.

Table 2 and Table 3 summarize the descriptive statistics. Table 2 shows the mean difference between exporters and non-exporters, and Table 3 presents the mean comparison between export starters and non-exporters. Two tables show that exporters and export starters performed better than non-exporters, on average. Exporters and export starters tended to have more massive sales, hire more employees, offer higher wages, have more assets, and be more productive. Also, the mean differences of each characteristic calculated in the t-test were all statistically significant at the 0.01 level. The distinguishable difference between Table 2 and Table 3 is that the mean of export starter was lower than that of exporter regarding all covariates. As expected, exporter and export starter had statistically different characteristics on average; this also indicates that taking into account the export entrance would be accurate for calculating the export effect.

<Table 2. Descriptive statistics: exporters and non-exporters, all plants>

Characteristics	Treated Group (Exporter)	Control Group (Non-exporter)	Mean difference
Firm age	13.17	9.46	3.71*** (0.024)
Sales	48,702.67	7,012.04	41,690.63*** (897.875)
Total worker	77.73	27.12	50.61*** (0.685)
Total wage	2,988.95	674.94	2,314.01*** (42.196)
Wages per worker	27.75	21.99	5.76*** (0.028)
Value added	15,853.78	2,584.93	13,268.85*** (310.366)
Total asset	13,674.4	2,080.44	11,593.96*** (275.935)
Labor productivity	111.06	71.09	39.97*** (0.717)
Observations	193,488	465,787	-

Note. Exporter refers to the firms that export in year *t*. All monetary values are adjusted to the base year 2010, and they are in Korean million Won. Mean difference refers to t-test results. Standard error of the mean difference is in parentheses. *** denotes that the mean difference is statistically significant at the 0.01 level.

<Table 3. Descriptive statistics: export starters and non-exporters, all plants>

Characteristics	Treated Group (Export starter)	Control Group (Non-exporter)	Mean difference
Firm age	11.30	8.94	2.36*** (0.051)
Sales	23,363.41	4,255.71	19,107.70*** (629.159)
Total worker	46.49	23.64	22.85*** (0.473)
Total wage	1,529.26	538.11	991.15*** (26.097)
Wages per worker	26.22	21.14	5.08*** (0.062)
Value added	8,355.28	1,646.45	6,708.83*** (257.411)
Total asset	5,406.08	1,252.36	4,153.72*** (150.680)
Labor productivity	99.32	65.44	33.88*** (0.652)
Observations	26,389	360,097	-

Note. Export starter refers to the firms that start exporting in year *t* and have not exported before year *t*. All monetary values are adjusted to the base year 2010, and they are in Korean million Won. Mean difference refers to t-test results. Standard error of the mean difference is in parentheses. *** denotes that the mean difference is statistically significant at the 0.01 level.

2. Empirical strategy

This paper examined the causal effect of the export market entrance on employment and wages using the propensity score matching method. The first question was whether Korean manufacturing firms hire more or offer better wages after entering the export market. Also, the analysis investigated the existence of export starting effect for three years after the entrance. The subsequent question was to figure out whether the effect also exists for each manufacturing sector. The empirical analyses were conducted by each sector to find the existence of export starting effect on wages and employment.

The logarithm of wages per worker and the number of total workers were used as dependent variables in terms of firm performance measurements. Firm age, firm age squared term, the logarithm of sales, logarithm of labor productivity, and total asset were considered in the analysis as firm characteristics. Year dummy was also included in the model. The treatment variable is ‘export starter’ in which firms start exporting in year *t*.

As mentioned in Section 3, a simple mean comparison of outcome variables between the treated and the controls after the treatment could not be an adequate estimator of the treatment effect. To measure the effect of export starting, wages and employment when a firm starts to export should be compared with the wages and employment when the same firm chooses not to export. However, this is a counterfactual situation in observational studies.

Accordingly, instead of using a counterfactual mean, the propensity score matching method creates a sample from the non-exporter as similar as possible to the export starter excluding the exporting status to compare outcomes.

$$\boldsymbol{Propensity\ Score\ \rho \equiv \mathrm{Pr}\left(START_{it} = 1 \middle| X_{i,t-1}\right)}$$

In the above equation, Pr means probability. A dummy variable $START_{it}$ equals 1 for an export starter, and it takes zero for a non-exporter. $X_{i,t-1}$ refers to characteristics of firm i, where t is an export market entry year, and t-1 denotes the year before entry. The propensity score refers to the conditional probability of being an export starter given observed covariates. The score was calculated by a probit regression of a dummy variable $START_{it}$, signifying whether the firm starts exporting after controlling the plants' characteristics, $X_{i,t-1}$. In this paper, Stata 15.0 was used to analyze the data, and matching was carried out using the 'psmatch2' command. As a matching method, nearest-neighbor matching[6] was used. Every export starter was matched to its non-exporter, having the closest propensity score.

After finding the non-export firms with a high probability of being an export starter for matching, the matching data could be used to compare the export starting effect on wages and employment between export starter and non-exporter directly.

3. Empirical findings

(1) Export effect on wages and employment[7]

The first set of analyses investigated the impact of the export entrance on wages per worker. The results are exhibited in Table 4. It shows that wages per worker paid by export starters, on average, was 6.3%p higher than in comparable non-exporters in the first year of the

---

[6] There are several matching methods, such as nearest-neighbor matching, caliper matching, kernel matching, and others. In this paper, nearest-neighbor matching is used as an appropriate method. According to Austin (2011), one-to-one or pair matching is the most common propensity score implementation. More details on this topic can be found in Austin (2011).

[7] From this part, the empirical analyses were conducted focusing on the export starter. Exporters were excluded from the sample for the analyses. See Appendix A for the results of the exporter.

export entry. Not only for the first year, but the effect of starting export on wages also existed in the second and third years where the firm keeps exporting. For three years after the export market entrance, differences in wages per worker between the export-starting firms and non-exporters were statistically significant at any conventional level. Although the differences became smaller (5.6%p higher in the second year and 5.4%p higher in the third year), the export starting effect on wages remained until the third year of the entry.

Furthermore, there were significant differences in the number of total workers between export starter and non-exporter.[8] In Table 5, the average number of total workers of export-starting firms was 6 persons more than the average number of total workers that they would have hired if they had not participated the export market. The effect of the employment on export participation was significant from the first year to the third year. By comparing the differences, it was specified that export starters tended to hire more workers in the second year than the first year, and the mean difference became about three times larger (18.850 compared to 6.528). Also, the average difference in employment between export starter and non-exporter were more extensive in the third year following the entry.

Overall, the empirical results showed a causal effect of export-starting on wages per worker and total workers for three years after entering the export market. There were significant mean differences between export starters and non-exporters in terms of wages and employment on average. Both measurements revealed notable differences; specifically, the export effect towards employment increased over time.

---

[8] This result is compatible with the previous findings of Hwang et al. (2017). The authors found a positive association between export activity and the employment of *permanent* workers. The effect remained for two years after the participation, while the effect towards *temporary* workers exists only in the third year after the participation.

<Table 4. Export effect on wages: matched plants>

Dependent variable: logarithm of annual wages per worker					
Export entrance	Observations		Logarithm of wages per worker		Mean difference
	Treated	Controls	Treated	Controls	
First year	25,258	243,185	3.194	3.131	0.063*** (0.004)
Second year	13,419	221,091	3.239	3.183	0.056*** (0.005)
Third year	8,800	199,220	3.270	3.216	0.054*** (0.007)

Note. Mean difference refers to the average treatment effect on the treated (ATET). Standard error of the mean difference is in parentheses. *** denotes significance at the level of 1%.

<Table 5. Export effect on employment: matched plants>

Dependent variable: total worker (employment)					
Export entrance	Observations		Logarithm of wages per worker		Mean difference
	Treated	Controls	Treated	Controls	
First year	25,258	243,409	47.442	40.914	6.528*** (1.729)
Second year	13,419	221,313	58.769	39.919	18.850*** (2.972)
Third year	8,800	199,440	66.896	44.478	22.418*** (3.745)

Note. See the note of Table 4.

After using the propensity score matching method, the balancing test was conducted. Applying Rubin (2001)'s methodology, the mean difference of the propensity score between the treated and matched untreated groups should be small. Also, the variance ratio of the score in the two groups should be close to one. It means that the difference between the treated and matched control groups should be small after the matching. Rubin's B and Rubin's R, respectively, measure the propensity score's standardized mean difference and the score's variance ratio. Consequently, Rubin also recommends that B's value to be under 25 and that R to be between 0.5 and 2 for sufficient balancing. In table 6, B and R of all tests are within the range suggested by Rubin.

<Table 6. Balancing test after matching>

Export entrance Dependent variable		First year Wages per worker	 Total worker	Second year Wages per worker	 Total worker	Third year Wages per worker	 Total worker
Measures	Rubin's B	2.5	2.6	7.1	5.7	5.2	4.5
	Rubin's R	1.07	1.00	1.14	1.10	1.06	1.05

Note. According to Rubin (2001), B indicates the standardized mean difference of the propensity score's linear index in the treated and matched untreated. R refers to the variance ratio of treated to matched untreated of the propensity score index. For detailed explanations on this topic, see Rubin (2001).

(2) Export effect on wages and employment by manufacturing sector

Another purpose of this paper was to figure out whether the export starting effect exists on wages and employment by each manufacturing sector. The empirical tests were conducted using the same previous methodology. The sectoral analyses were performed based on the KSIC eighth code with a two-digit level for 22 industries except for tobacco manufacturing.

Table 7 reports the results of which sector offers higher wages and more jobs after entering the export market. The results showed that the firms in 9 industries were affected by starting export in terms of wages per worker and employment: food products and beverages, textiles, rubber and plastics products, other non-metallic mineral products, basic metals, other machinery and equipment, other electrical machinery and electric transformers, electronic components, visual, sounding, and communication equipment, and motor vehicles and trailers. 9 out of 22 export-starting industries showed significant changes in wages and employment. An important point here is that while the mean difference of both employment and wages followed a positive effect in eight industries, there showed opposite effects in the textile industry; positive export-starting effect on wages and negative export-starting effect on employment at the significant level of 10%.

<Table 7. Export starting effect by each manufacturing sector: matched plants>

Export starting effect on wages and employment: matched plants		
Manufacturing sector	Logarithm of wages per worker	Total worker
Food products and beverages	0.051** (0.022)	12.752*** (3.044)
Textiles(except apparel)	0.029* (0.015)	-2.926* (1.640)
Sewn wearing apparel and fur articles	0.046 (0.033)	3.934 (3.924)
Leather, luggage, and footwear	0.081* (0.048)	0.339 (3.967)
Wood and products of wood(except furniture)	0.080* (0.042)	5.850 (4.498)
Pulp, paper and paper products	0.041* (0.024)	4.158 (3.241)
Printing and reproduction of recorded media	0.008 (0.024)	-4.509 (9.733)
Coke, briquettes, and refined petroleum products	-0.083 (0.152)	102.710 (90.244)
Chemicals and chemical products	0.027 (0.019)	7.326*** (2.419)
Rubber and plastics products	0.035*** (0.012)	8.554*** (2.150)
Other non-metallic mineral products	0.090*** (0.029)	16.316*** (3.306)
Basic metals	0.042** (0.018)	15.435*** (3.331)
Fabricated metal products(except machinery and furniture)	0.012 (0.011)	1.275 (1.069)
Other machinery and equipment	0.078*** (0.008)	4.481*** (0.856)
Computers and office appliances	0.129*** (0.050)	7.732 (12.532)
Other electrical machinery and electric transformers	0.062*** (0.015)	12.665*** (3.220)
Electronic components, visual, sounding, and communication equipment	0.093*** (0.019)	68.071*** (24.907)
Medical, precision, and optical instruments, watches and clocks	0.117*** (0.021)	1.868 (1.484)
Motor vehicles and trailers	0.040** (0.017)	16.405** (7.342)
Other transport equipment	-0.086*** (0.033)	9.560 (12.020)
Furniture and other manufacturing	0.012 (0.022)	2.040 (1.884)
Materials recovery	-0.143 (0.118)	-7.357 (11.906)

Note. The manufacturing sector is classified in accordance with the Korean Standard Industrial Classification (KSIC) eighth code. *, **, and *** denote significance at 10%, 5%, and 1%, respectively. The mean difference refers to the average treatment effect on the treated (ATET). The standard error of the mean difference is in parentheses. For the detailed statistics, see Appendix B and C.

Of the 22 manufacturing sectors, wages per worker of export starters in 14 industries were significantly higher than that of non-exporters. On the other hand, in the manufacture of other transportation equipment, it was revealed that wages per worker paid by export starters is 8.6%p lower than non-exporters after starting export. Regarding the number of total workers, under half the manufacturing sectors reported the existence of the export effect. There are 9 out of 22 sectors with a positive and statistically significant difference in the number of total workers between export starting firms and non-exporters.

Table 8 shows the top 3 industries that had the magnitude effect of an increase in wages and employment. Unexpectedly, no significant difference in favor of employment was found between export starter and non-exporter in the medical, precision, and optical instruments manufacturing sector even though it showed the most considerable wage increase effect due to export activity. With a few exceptions, the results demonstrated that the export starting effect on wages and employment was more positively significant in the machinery, equipment, and vehicle sectors than in the traditional manufacturing sectors, such as textiles, apparel, and furniture.

<Table 8. Sectoral analysis: matched plants>

Logarithm of wages per worker			Total worker		
Rank	Sector	Mean difference	Rank	Sector	Mean difference
1	Medical, precision, and optical instruments, watches and clocks	**11.7%p**	1	Electronic components, visual, sounding, and communication equipment	**68.071**
2	Electronic components, visual, sounding, and communication equipment	**9.3%p**	2	Motor vehicles and trailers	**16.405**
3	Other non-metallic mineral products	**9.0%p**	3	Other non-metallic mineral products	**16.316**

Note. In each industry, export starters tend to hire more workers or offer higher wages than non-exporters on average after the export market entrance.

V. CONCLUSION

The primary purpose of this paper is to investigate the effect of export starting on wages and employment using the yearly panel data of Korean manufacturing during the period of 2003 to 2013. The evidence of this study suggests that export starting firms increase the wages per worker as well as the number of total workers after entering the export market. Furthermore, this effect remained not only for the first year of the entry but for the whole three years. This implies that the export starting effect on the total workers is more substantial than wages per worker.

This study also examined whether the effect also exists within each manufacturing sector. It was found that export entrant firms have offered higher wages than non-exporters among 14 out of 22 sectors. In terms of employment, the results showed a positive impact on the number of total workers due to the export starting in 9 sectors. In the manufacturing of *medical, precision, and optical instruments, watches and clocks*, it reported the highest and the most significant mean difference of wages per worker (11.7%p) between export starter and non-exporters. The manufacturing sector of *electronic components, visual, sounding, and communication equipment* showed that export starters, on average, tended to employ 68 more workers than non-exporters. Moreover, it was also revealed the most significant effect regarding employment among 22 sectors. Overall, this study found a causal effect of the export entrance on wages and employment for the whole industry and each manufacturing sector in Korea.

However, there were several potential limitations to be considered. First, the model could not control the characteristics of workers and employers. Wages and employment were determined by other covariates, such as education level, skill level, gender, and other observed and unobserved characteristics, besides export activity. Therefore, the results might be distorted due to the covariates. Second, employment was measured by the number of total workers. In this study, total workers included all types of workers, and the results were not analyzed by dividing the effect into permanent workers and temporary workers. As Hwang et al. (2017) raised, the export starting effect on wages and employment of both types of workers could be different. Lastly, this study did not figure out through which channels affect wages and employment. It only investigated the existence of the export starting effect. Further work needs to be carried out to explain the specific channels in which export activity increases wages and employment. It is also necessary to conduct relevant research considering the characteristics of both employers and employees.

Nevertheless, this study remains promising as it conducted an analysis on the export starting effects in the Korean manufacturing industries. Subsequently, key contributions of this study are as follows: first, this paper used wages and employment as firms' performance measurements for export activity while previous studies mainly focused on the firms' productivity. Second, the empirical analyses were performed using the propensity score matching (PSM) method to adjust the selection bias problem. Also, to get more precise results, the analyses were conducted for export starters to reduce the effect that had already been reflected on wages and employment. Third, the study also investigated the remaining effect of entering the export market for three years. Lastly, the tests were also conducted on the sectoral level of Korea's manufacturing industry to see the export starting effect on wages and employment.

These observations might have important implications for the export promotion policy in the future. Considering the export starting effect, the export promotion policy should be designed to support firms to lower the barrier in order to participate in the global market. Moreover, since the effect remains more significant in specific manufacturing sectors, the policy could be implemented appropriately for each sector.

REFERENCES

Austin, P. C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research*, *46*(3), 399-424.

Aw, B. Y., Chung, S., & Roberts, M. J. (1998). Productivity and the decision to export: Micro evidence from Taiwan and South Korea. (Working paper 6558). National Bureau of Economic Research, Cambridge.

Baldwin, J. R., & Gu, W. (2003). Export-market participation and productivity performance in Canadian manufacturing. *The Canadian Journal of Economics / Revue canadienne d'Economique*, *36*(3), 634-657.

Bernard, A. B., & Jensen, J. B. (1997). Exporters, skill upgrading, and the wage gap. *Journal of International Economics*, *42*, 3-31.

Bernard, A. B., & Jensen, J. B. (1999). Exceptional exporter performance: Cause, effect, or both? *Journal of International Economics*, *47*, 1-25.

Bernard, A. B., Jensen, J. B., & Lawrence, R. Z. (1995). Exporters, jobs, and wages in U.S. manufacturing: 1976-1987. *Brookings Papers on Economic Activity. Microeconomics*, *1995*, 67-119.

Clerides, S. K., Lach, S., & Tybout, J. R. (1998). Is learning-by-exporting important? Micro dynamic evidence from Colombia, Mexico and Morocco. *The Quarterly Journal of Economics*, *113*(3), 903-947.

Fernandes, A. M., & Isgut, A. E. (2007). Learning-by-exporting effects: Are they for real? (MPRA Paper 3121). University Library of Munich, Germany.

Frankel, J., & Romer, D. (1999). Does trade cause growth? *The American Economic Review, 89*(3), 379-399.

Hahn, C. H. (2004). Exporting and performance of plants: Evidence from Korean manufacturing. (Working paper 10208). National Bureau of Economic Research, Cambridge.

Hwang, U., Lee, S., Kim, H. H., & Kang, Y. (2017). The employment effect of exports. *Policy Analyses* 17-18, Korea Institute for International Economic Policy.

Kim, S. I., Gopinath, M., & Kim, H. (2009). High productivity before or after exports? An empirical analysis of Korean manufacturing firms. *Journal of Asian Economics*, *20*(4), 410-418.

Korea Statistical Information Service. (2020). Trade dependency ratio. Retrieved from http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_2KAA806_OECD&conn_path=I2

Korea Statistical Information Service. (2020). Manufacture's ratio of merchandise exports. Retrieved from http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_2AQ405&conn_path=I2

Kim, T., & Choi, J. (2017). Exporting and firm performance in Korean manufacturing. *Journal of Industrial Economics and Business*, *30*(5), 1779-1795.

Lee, S., & Choi, Y. S. (2009). The effects of plants' export activity on total factor productivity in Korea. *Panel for Korean Economic Analysis*, *15*(1), 77-125.

Loecker, J. D. (2007). Do exports generate higher productivity? Evidence form Slovenia. *Journal of International Economics*, *73*, 69-98.

Mallick, S., & Yang, Y. (2013). Productivity performance of export market entry and exit: Evidence from Indian firms. *Review of International Economics*, *21*(4), 809-824.

Marin, D. (1992). Is the export-led growth hypothesis valid for industrialized countries? *The Review of Economics and Statistics*, *74*(4), 678-688.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effect. *Biometrika*, *70*(1), 41-55.

Rubin, D. B. (2001). Using propensity scores to help design observational studies: Application to the tobacco litigation. *Health Services and Outcomes Research Methodology*, *2*, 169-188.

Sachs, J., & Warner, A. (1995). Economic convergence and economic policies. (Working Paper 5039). National Bureau of Economic Research, Cambridge.

Schank, T., Schnabel. C., & Wagner, J. (2010). Higher wages in exporting firms: self-selection, export effect, or both? First evidence from linked employer-employee data. *Review of World Economics*, *146*(2), 303-322.

Song, Y. (2015). The impacts of exports on the structure and productivity of Korean manufacturing. *KDI Policy Studies*, 10, Korea Development Institute.

Wagner, J. (2002). The causal effects of exports on firm size and labor productivity: First evidence from a matching approach. *Economics Letters*, *77*, 287-292.

Wagner, J. (2007). Exports and productivity: A survey of the evidence from firm-level data. *The World Economy*, *30*(1), 60-82.

World Bank. (1993). *The East Asian miracle: Economic growth and public policy*. Oxford University Press.

Yang, L., & Oh, K. (2018). Wage premium of exporting firms in Korean manufacturing. *Journal of Korean Economics Studies*, *26*(3), 65-90.

Yang, Y., & Mallick, S. (2010). Export premium, self-selection and learning-by-exporting: Evidence from Chinese matched firms. *The World Economy*, *33*(10), 1218-1240.

APPENDICES

APPENDIX A

<Export effect on wages and employment: Comparing exporter and export starter>

Dependent variable: logarithm of wages per worker					
Treatment	Observations		Logarithm of wages per worker		Mean difference (s.e.)
	Treated	Controls	Treated	Controls	
EXPORT	157,491	327,995	3.272	3.221	0.051*** (0.002)
START	25,258	243,185	3.194	3.131	0.063*** (0.004)

Dependent variable: total worker (employment)					
Treatment	Observations		Total worker		Mean difference (s.e.)
	Treated	Controls	Treated	Controls	
EXPORT	157,491	328,228	83.057	66.513	16.544*** (1.319)
START	25,258	243,409	47.442	40.914	6.528*** (1.729)

Note. Mean difference refers to the average treatment effect on the treated (ATET). Standard error of the mean difference is in parentheses. *EXPORT* is a dummy variable for exporters and *START* is a dummy variable for export starters. *** denotes significance at the level of 1%.

APPENDIX B

<Export starting effect on logarithm of wages per worker: sectoral matched plants>

Dependent variable: logarithm of wages per worker						
Manufacturing Sector	Observations		Logarithm of wages per worker		Mean difference (s.e.)	Pseudo R^2
	Treated	Controls	Treated	Controls		
Food products and beverages	1,443	20,942	3.004	2.954	0.051** (0.022)	0.042
Textiles(except apparel)	1,396	16,166	3.057	3.029	0.029* (0.015)	0.085
Sewn wearing apparel and fur articles	694	12,890	2.999	2.953	0.046 (0.033)	0.231
Leather, luggage, and footwear	304	2,530	2.957	2.876	0.081* (0.048)	0.141
Wood and products of wood (except furniture)	213	4,606	3.210	3.130	0.080* (0.042)	0.118
Pulp, paper and paper products	620	7,268	3.213	3.172	0.041* (0.024)	0.099
Printing and reproduction of recorded media	513	8,800	3.241	3.233	0.008 (0.024)	0.057
Coke, briquettes, and refined petroleum products	31	378	3.583	3.666	-0.083 (0.152)	0.294
Chemicals and chemical products	1,559	5,744	3.303	3.275	0.027 (0.019)	0.077
Rubber and plastics products	2,288	20,434	3.139	3.104	0.035*** (0.012)	0.069
Other non-metallic mineral products	500	14,646	3.261	3.171	0.090*** (0.029)	0.049
Basic metals	1,015	9,315	3.370	3.328	0.042** (0.018)	0.104
Fabricated metal products (except machinery and furniture)	2,659	39,878	3.202	3.190	0.012 (0.011)	0.062
Other machinery and equipment	5,180	23,606	3.272	3.194	0.078*** (0.008)	0.065
Computers and office appliances	217	888	3.213	3.084	0.129*** (0.050)	0.102
Other electrical machinery and electric transformers	1,720	11,422	3.180	3.117	0.062*** (0.015)	0.056
Electronic components, visual, sounding, and communication equipment	1,614	10,193	3.175	3.081	0.093*** (0.019)	0.105
Medical, precision, and optical instruments, watches and clocks	937	3,659	3.192	3.075	0.117*** (0.021)	0.101
Motor vehicles and trailers	1,202	13,550	3.248	3.210	0.040** (0.017)	0.142
Other transport equipment	284	6,812	3.320	3.406	-0.086*** (0.033)	0.140
Furniture and other manufacturing	841	9,111	3.071	3.059	0.012 (0.022)	0.049
Materials recovery	28	347	3.074	3.217	-0.143 (0.118)	0.065

Note. Industries with bolded are significant at traditional level. The manufacturing sector is classified in accordance with the Korean Standard Industrial Classification (KSIC) eighth code. *, **, *** denotes significance level 10%, 5%, 1%, respectively.

APPENDIX C

<Export starting effect on total worker: sectoral matched plants>

Dependent variable: total worker						
Manufacturing Sector	Observations		Total worker		Mean difference (s.e.)	Pseudo R^2
	Treated	Controls	Treated	Controls		
Food products and beverages	1,443	20,997	59.878	47.126	12.752*** (3.044)	0.042
Textiles(except apparel)	1,396	16,177	36.111	39.037	-2.926* (1.640)	0.085
Sewn wearing apparel and fur articles	694	13,015	46.069	42.135	3.934 (3.924)	0.232
Leather, luggage, and footwear	304	2,541	31.352	31.013	0.339 (3.967)	0.141
Wood and products of wood (except furniture)	213	4,606	40.920	35.070	5.850 (4.498)	0.118
Pulp, paper and paper products	620	7,269	45.615	41.456	4.158 (3.241)	0.099
Printing and reproduction of recorded media	513	8,801	49.097	53.606	-4.509 (9.733)	0.057
Coke, briquettes, and refined petroleum products	31	378	128.645	25.935	102.710 (90.244)	0.294
Chemicals and chemical products	1,559	5,744	47.008	39.682	7.326*** (2.419)	0.077
Rubber and plastics products	2,288	20,434	41.533	32.979	8.554*** (2.150)	0.069
Other non-metallic mineral products	500	14,646	50.268	33.952	16.316*** (3.306)	0.049
Basic metals	1,015	9,315	53.740	38.304	15.435*** (3.331)	0.104
Fabricated metal products (except machinery and furniture)	2,695	39,882	33.345	32.070	1.275 (1.069)	0.062
Other machinery and equipment	5,180	23,608	31.757	27.277	4.481*** (0.856)	0.065
Computers and office appliances	217	888	47.862	40.130	7.732 (12.532)	0.102
Other electrical machinery and electric transformers	1,720	11,424	41.765	29.100	12.665*** (3.220)	0.056
Electronic components, visual, sounding, and communication equipment	1,614	10,196	130.164	62.093	68.071*** (24.907)	0.105
Medical, precision, and optical instruments, watches and clocks	937	3,661	28.396	26.528	1.868 (1.484)	0.101
Motor vehicles and trailers	1,202	13,551	72.048	55.643	16.405** (7.342)	0.142
Other transport equipment	284	6,812	71.933	62.373	9.560 (12.020)	0.140
Furniture and other manufacturing	841	9,112	30.914	28.875	2.040 (1.884)	0.049
Materials recovery	28	347	24.393	31.75	-7.357 (11.906)	0.065

Note. See the note of Appendix B.