Exports and Job Creation in South Korea

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1. Introduction

The manufacturing labor market in Korea has been experiencing a continuous slump since 2000. Of particular concern is on the high youth unemployment rate recently. According to Statistics Korea, in 2017 the nation's youth unemployment rate was close to 10 percent, the highest since 2000.[1] Contrary to people's expectations, there is no sign of recovery in the labor market, despite the recent upswing in exports. During the 1970s, 80s and 90s, Korea's export strategy mainly focused on labor-intensive industries to drive successful industrialization and economic growth. However, these industries cannot keep creating the required number of new jobs. Since 1990, Korea's exports have grown at an annual average rate of 7.8 percent, while at the same time employment has declined at an average rate of 0.2 percent per annum.[2]

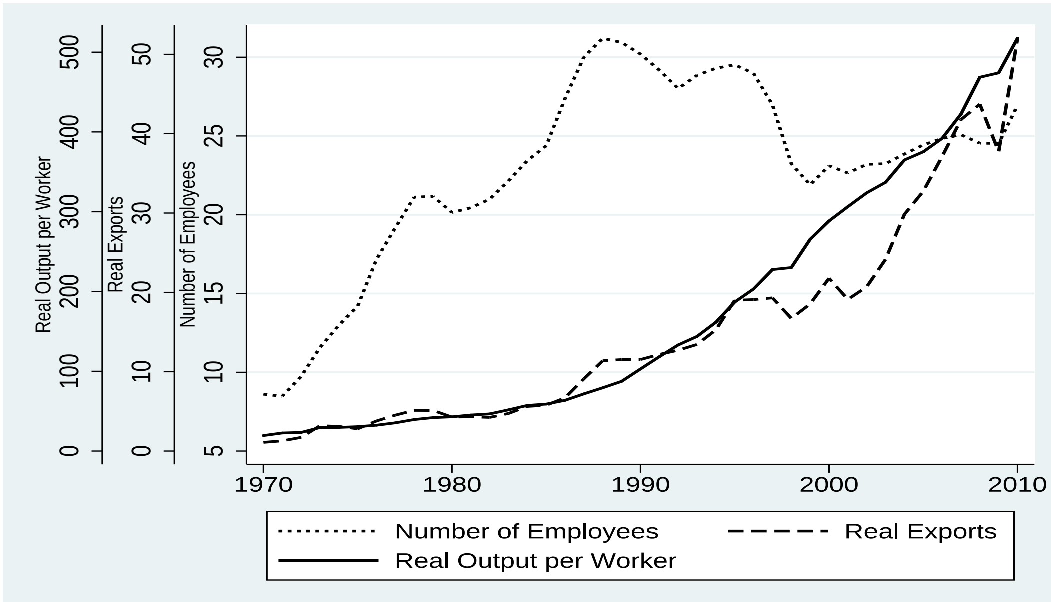
Since the early 1990s, there has been a growing need for Korea to foster new industries and innovations in technology development in its major export industries. This is mainly due to the fact that industrialized economies have been strengthening policies that protect their own advanced technologies. This is also related to developing countries where industrial competitiveness has grown rapidly. It has served as an important momentum to develop new high-tech industries, for example, information technology and communications. The transition from labor- to capital-intensive industries has led to improvements in labor productivity, which, in turn, has resulted in the rapid replacement of labor by capital (technology). Furthermore, although Korea's exports have dramatically increased since the 2000s, due to the expansion of free trade agreements (FTAs), export growth has not led to sufficient job creation, as it has in the past. This weakening of the export-employment linkage means that the virtuous cycle of exports → jobs → income, consumption, and investment is no longer working as it should. Figure 1 shows that the pattern of the trend in exports and employment began to change significantly after 1990.

The fact that exports do not create sufficient jobs is a grave issue for a manufacturing-based

[1] In fact, the 9.8 percent youth unemployment rate is the highest since 1990, except for during the 1998 and 1999 Asian Financial Crisis.

[2] Over the 20 years since 1970, manufacturing exports and employment have grown at annual average rates of 12.4 and 7.4 percent, respectively. These figures were calculated using the Mining and Manufacturing Survey provided by Statistics Korea and the Korea International Trade Association.

Figure 1. Export, output and employment (1970∼2010)



Notes: Employment means the number of workers in the manufacturing sector. All variables except for employment were converted to real variables by using the producer price index (PPI).

export-driven economy, such as Korea. Therefore, it is an important policy question to identify the main reasons why the virtuous circle between exports and employment has considerably weakened. As the Korean labor market continues to struggle, devising good employment policies for effective job creation has become a top priority for many economists and policy makers.

In light of the importance of exports in the Korean labor market, this study attempts to find the primary reasons why export growth does not lead to sufficient job creation. We investigate the effect of exports on employment, using industry-level data on the Korean manufacturing sector, in order to show how changes in the composition of export products have led to changes in the export effect on employment. The main purpose of this study is to provide useful information that can shed light on why this effect has weakened, and then to suggest some policy implications which could possibly strengthen the virtuous cycle between these two variables.

We begin by addressing the main reason why export growth does not lead to sufficient job creation, and we examine the relationship between exports and employment from various perspectives. First, the growth accounting method is used to decompose the export-induced changes in employment into scale and composition effects. Here, we focus on how changes in the composition of export products explain why the employment effect of exports has weakened. From this analysis, we confirm that this has occurred because the composition of export products has shifted to those of less labor-intensive industries. Although the growth accounting method is useful for understanding how the relationship between exports and employment differs by industry and time period, it is not appropriate when accounting for the causal relationship between these two variables. For this reason, we use the generalized method of moments (GMM) for empirically estimating the effect of exports on employment, where capital intensity plays an important role in shaping the export effect on employment.

This paper is related to the strand of literature that empirically investigates the effect of exports on employment using data on the manufacturing sector (e.g., Nam 2008; Cin 2009; Choi et al. 2012; Oh and Kim 2016). While a number of attempts have been made to empirically evaluate the relationship between these two variables, the results are mixed. On the one hand, Cin (2009) estimated a dynamic labor demand equation, using the Tobit GMM estimator to quantify the impact of exports on employment; this study shows that the estimated coefficients of exports are negative but not statistically significant. The author points out that this result is due to the increased reliance on imported intermediate inputs to produce outputs for export. Similarly, Nam (2008) explored the input-output structure to show that the annual growth rate of export-induced employment is significantly lower than it had been in the past. Through these analyses, the authors emphasize the role of structural changes, such as technological development and labor productivity, as the main reasons for the decline in the positive effect of exports on employment.

On the other hand, Choi et al. (2012) find a positive association between exports and employment for North Jeolla province, in Korea, as does Oh and Kim (2016) for Incheon districts. Choi et al. (2012) also point out that an expansion in domestic demand contributes to more job creation than exports do. Similarly, Oh and Kim (2016) show that exports has positive and significant effects on employment, and that this varies with industry characteristics, such as basic materials, processing and assembly, and life-related industries.

Despite the many literatures on the link between exports and employment, there is no consensus on this topic. However, it is generally agreed that the employment effect of exports has been considerably weakened, compared to that of the past, at least in Korea. Nevertheless, few studies attempt to address why this trend has occurred. Most of the above-mentioned studies analyze the net effect of exports on employment, without taking into account the labor substitution effect of capital that is closely related to the capital intensity (or labor productivity) of an industry.[3] In this paper, we focus on the structural factors that are the major cause of the weakening of the virtuous cycle between exports and employment. This allows us to provide valuable information to policy makers who are concerned with developing export policies that are related to effective job creation.

The remainder of this paper is organized as follows: Section 2 uses the growth accounting method to decompose the changes in export-induced employment into scale and composition effects. Section 3 describes the model specifications, the data and the empirical results. The last section provides concluding remarks and some policy implications.

2. Decomposition of Employment Changes

The growth-accounting approach allows us to decompose changes in employment into the effects of changes in domestic demand, exports and labor productivity. The impact of exports on employment can be further decomposed to scale and composition effects so that it captures the important role changes in the composition of export products play in shaping the overall export effect on employment. However, this approach has its limitations in that it cannot be interpreted as a causality between exports and employment. Further, and if exports have significant effects on labor productivity, then the export effect on employment can be overestimated. Nevertheless, the growth accounting approach gives useful information we can use to figure out how the relationship between exports and employment differs by labor intensity of export industry.

[3] Only a few studies have emphasized the importance of labor productivity in accounting for the export effect on employment. Leichenko (2000) shows a negative relationship between export growth and employment, arguing that the positive association between exports and labor productivity explains the export growth-employment decline conundrum. Similarly, Greenaway et al. (1999) empirically evaluate the effects of trade on employment throughout the productivity channel, using a sample of 167 manufacturing industries in the UK. The authors point out that growth in trade, both in terms of exports and imports, led to intensified competition in both import-substitution and export industries, thereby improving labor productivity and, consequently, reducing in the level of derived labor demand.

2.1. Methodology and Data

We apply Chenery's decomposition technique (e.g., Chenery 1979) as follows. Given the national income identity, $Q_{it} = D_{it} + X_{it} - M_{it}$, employment can be rearranged as

$$L_{it} = l_{it}(D_{it} + X_{it} - M_{it}), \tag{1}$$

where Q_{it} is the domestic output of industry i at time t. D, X and M represent domestic demand, exports, and imports, respectively. l_{it} is the number of workers required for one unit of production, so $l_{it} = L_{it}/Q_{it}$. In other words, l can be interpreted as the labor input coefficient, which is the reciprocal of labor productivity. Now, a change in employment in industry i between two periods of time ($t = 0$ and $t = 1$) is shown as

$$\Delta L_i = l_{i1}(1 - m_{i0})\Delta D_i + l_{i1}\Delta X_i + l_{i1}(m_{i0} - m_{i1})D_{i1} + \Delta l_i Q_{i0}, \tag{2}$$

where $m = M/D$ is the import share of domestic demand, or the import penetration.

The aggregate change in employment over all industries can be obtained from Equation (2), which is given by

$$\sum_i \Delta L_i = \sum_i l_{i1}(1 - m_{i0})\Delta D_i + \sum_i l_{i1}\Delta X_i + \sum_i l_{i1}(m_{i0} - m_{i1})D_{i1} + \sum_i \Delta l_i Q_{i0}, \tag{3}$$

where we focus on the effect of changes in exports on overall employment, which is shown in the second term on the right-hand side of Equation (3). Finally, the impact of exports on employment can be further decomposed to separate out the scale and composition effects, which is shown as follows.

$$\sum_i l_{i1}\Delta X_i = l_{m1}\Delta X_m + (\sum_i l_{i1}\Delta X_i - l_{m1}\Delta X_m), \tag{4}$$

where the subscript m stands for the industry average, so $l_m = \sum L_i / \sum Q_i$ indicates the industry average of the input coefficient. $\Delta X_m = \sum \Delta X_i$ represents the aggregate changes in exports. The first term on the right-hand side of Equation (4) is the scale effect of exports on employment that is accounted for by the industry average labor productivity. The second term in the brackets represents the composition effect of exports, which is explained by the changes in the composition of the export products, so that it captures the extent to which a shift toward less labor-intensive products affects the export effect on employment.

In order to calculate Equation (4), we construct the data for the period 1980 to 2010, using input-output and employment tables provided by the Bank of Korea. The variables used in this analysis are total output, the number of employees, and exports, which are classified according to 13 broad manufacturing industries.[4] The number of employees by industries means the number of paid workers, excluding self-employed and unpaid family workers. Since we use output per worker as a proxy for labor productivity, there is a limit to directly comparing the export effect on employment with the domestic demand effect on employment. Nevertheless, it is worthwhile to emphasize the role of the export-composition effect, which is closely related to the increase in the share of exports of labor-saving industries in explaining why the export effect on employment has weakened.

2.2. Decomposition Results

Table 1 shows the export-induced change in employment, which is estimated from Equation (4). While exports have sharply increased over the past 30 years, the export effect on employment is not significant compared to export growth.[5] To be more specific, the effect of exports on employment has significantly weakened since 1990. Two factors explain this phenomenon: the first is the labor-saving production process related to mechanization or automation; this increases average labor productivity across industries, thereby offsetting the positive effects exports can have on employment. The second factor is the process of reorganizing the composition of export products

[4] Due to inconsistencies in the timing of the industry classifications, 13 industries, excluding the printing and reproduction sector, were used for the final analysis.

[5] As previously noted, the results cannot be interpreted as causalities between exports and employment in that the decomposition of the employment changes can be derived from the national income identity. It should be noted that export-induced employment growth is expressed as an employment effect of exports for convenience' sake.

into labor-saving industries. As shown in the last column of Table 1, since 1990 the negative signs of the composition effect confirm that the employment effect of exports is not significant, despite the rapid growth in exports.

Table 1. Employment effect of exports: scale and composition effects

Period	*ΔExport (A)*	*ΔTotal Effect (B)*	*Δ(A/B)*	*Scale Effect*	*Composition Effect*
1980-1985	11,000,000	365,370	3.32	301,185	64,184(17.5)
1985-1990	31,000,000	580,400	1.87	451,611	128,789(22.1)
1990-1995	45,300,000	364,103	0.8	368,657	-4,554(-1.2)
1995-2000	91,800,000	353,937	0.39	397,874	-43,937(-12.4)
2000-2005	97,100,000	232,517	0.24	292,598	-60,081(-25.8)
2005-2010	239,000,000	459,581	0.19	486,525	-26,944(-5.9)

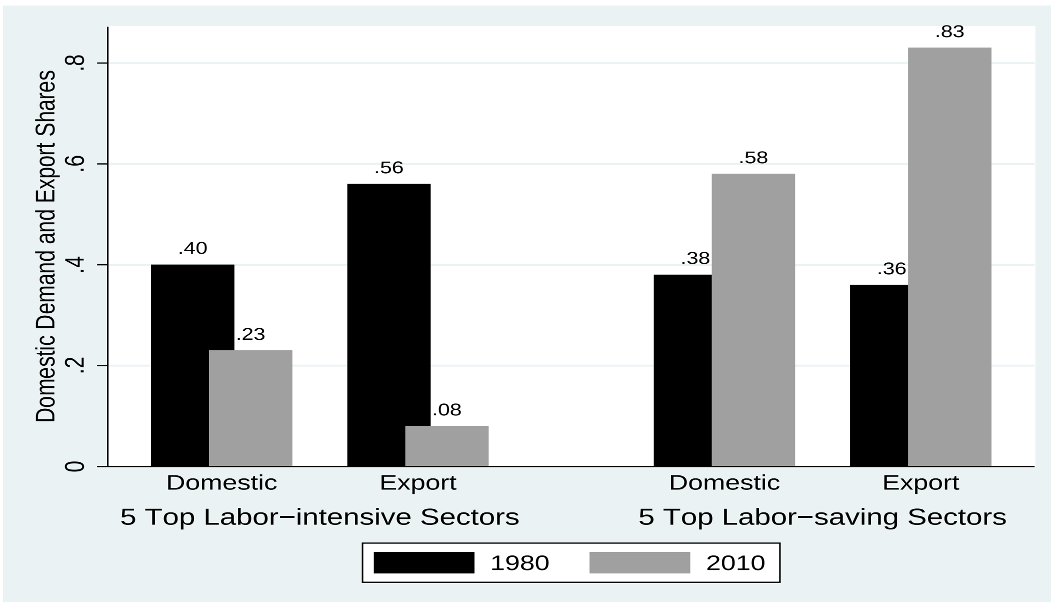
Notes: ΔExport represents the increase in total exports over a period of 5 years. ΔTotal Effect indicates the employment growth that is supported by an increase in exports. Δ(A/B) is the employment that is induced by a 100 million Korean Won worth of exports. The unit of exports is a million Korean Won and the employment unit is one person. The parentheses indicate the proportions of the composition effect out of the total changes in employment.

Figure 2 presents more concrete evidence that supports the fact that major export products in Korea have shifted to those produced by labor-saving industries. In 2010, five major labor-saving industries (that is, petroleum, primary metals, transportation equipment, chemicals, electricity/electronics) accounted for 84 percent of total exports, which is significantly higher than the 36 percent in 1980. In contrast, the proportion of exports attributed to the five major labor-intensive industries has decreased by nearly 48 percent since 1980. These facts imply that Korean exports have rapidly shifted from labor-intensive to labor-saving industries.

Figure 2 also captures an important fact that exports may be less effective than domestic demand is in creating employment. In 2010, the share of products of the five major labor-saving industries in the total domestic demand was 58 percent, which is very low compared to the 84 percent share of total exports in total domestic demand. Note that, in 1980, the share of these industries' products in total domestic demand was similar to that of the share of total exports. This means that the composition of the export industry was relatively more labor-saving than domestic industry.

As a result of exploring the employment effect of exports by major industries (that is, the top and bottom three industries in order of labor-intensity) we found that the less labor-intensive the industry, the lower the employment effect of exports, and as the labor-intensity rate decreases, the rate of decrease in employment is more significant.

Figure 2. Export share of five top labor-intensive industries (1980∼2010)



Notes: The five top labor-intensive industries include textile/leather, wood/paper, other manufacturing, metal products, while the five top labor-saving industries include petroleum, primary metals, transportation equipment, electricity and electronics, and chemical products.

3. The Empirical Analysis

As discussed above, the impact of exports on employment is closely related to the labor- or capital-intensity of industries. That is, the process of the rapid substitution of labor with capital can possibly explain the weakening of the virtuous circle between exports and employment. Based on this understanding, we now empirically analyze the effect of exports on employment, using industry-level data. In this analysis, we emphasize the importance of capital intensity in shaping the export effect on employment. Prior to the empirical analysis, we draw a scatter plot to look into the relationship between export-induced employment and capital intensity.

The correlation between growth in exports and in employment is plotted against the capital-intensity of industries. Figure 3 confirms that there is a negative relationship between the two variables of exports and employment.[6] In the case of labor-intensive industries, such as clothing, leather·footwear, medical·precision·optical equipment industries, the correlation between the two variables is positive and relatively high. From this, it can be interpreted that an increase in these industries' exports positively affects employment expansion.

In contrast, a negative correlation between the two variables is shown in oil refining, chemicals, and primary metals industries, which are highly capital intensive. A negative correlation between exports and employment in these industries can be interpreted as meaning that when there is an increase in exports, one cannot expect to see employment growth because these industries tend to rapidly substitute labor with capital. Rather, if labor productivity increases more, relative to export growth, then employment may decline. This is consistent with Slaper (2015), who looks into the correlation between the two variables of exports and employment by using data on the State of Indiana's exports and employment for the period 2002-2013. Slaper (2015) found negative correlations in most industries, except for some highly labor-intensive ones(that is, textiles, leather, processed food, and other manufacturing industries). In particular, he shows a high negative correlation among highly capital-intensive industries, such as chemicals, primary metals, and electrical and electronics industries.

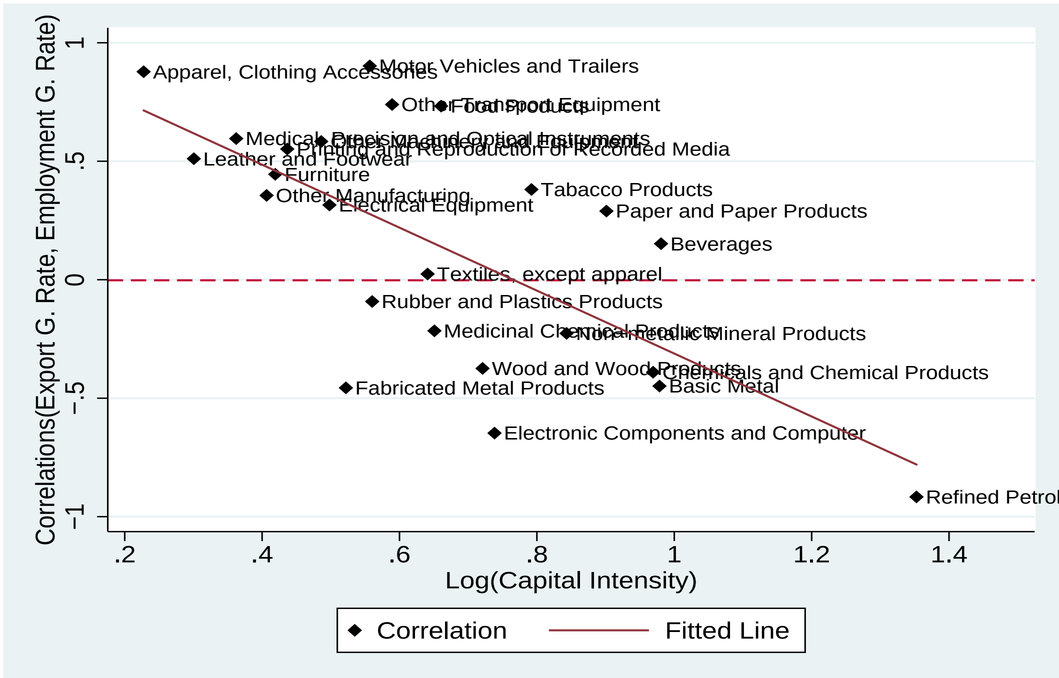
3.1. Model Specification

Following most of the literature, we begin with a Cobb-Douglas production function of a representative firm in an industry, i, at time t, as follows:

$$Q_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta}, \tag{5}$$

[6]The year-end value of tangible assets, divided by the total earning of employees, as a proxy for capital intensity, is calculated by the KSIC 2-digit industry, using the data of the Mining and Manufacturing Survey reported by Statistics Korea. The value used for the scatter plot is the common logarithm of capital intensity.

Figure 3. Capital intensity and a correlation between exports and employment



Notes: The year-end value of tangible assets divided by employees' total earning is used as a proxy for capital intensity. 24 manufacturing industries (2-digit Korean Standard Industrial Classification) are used to draw the scatter plot.

where Q denotes output, and K and L represent the quantity of capital and labor used in production, respectively. A is total factor productivity.[7] Rearranging Equation (5) for L after substituting $K = (\alpha/\beta)(w/c)L$, which is derived from the firm's profit maximization, into Equation (5) gives

$$lnL_{it} = \theta_0 + \theta_1 ln(w/c)_{it} + \theta_2 lnQ_{it}, \quad (6)$$

where w and c denote the real wage and rental rate of capital, respectively. Note that $\theta_0 = (\alpha ln\beta - \alpha ln\alpha - lnA)/(\alpha+\beta)$, $\theta_1 = -\alpha/(\alpha+\beta)$, and $\theta_2 = 1/(\alpha+\beta)$.

Production efficiency grows over time, which is closely related to the X-efficiency of exports and the rate of new technology adoption. Considering these production efficiencies, total factor productivity can be written as $A_{it} = e^{\delta_1 T_i} X_{it}^{\delta_2}$, where X denotes exports, and T and δ are the time variable and a positive constant, respectively. Substituting total factor productivity and $\theta_2 lnQ_{it} =$

[7] α and β represent capital and labor's shares of income, respectively. In practice, the input shares of income, α and β, vary across industries and they also differ by time period, due to the development of production technology.

$\phi_1 lnD_{it} + \phi_2 lnX_{it}$ into Equation (6) gives the following:

$$lnL_{it} = \mu + \theta_1 ln(w/c)_{it} + \phi_1 lnD_{it} + \gamma lnX_{it}, \tag{7}$$

where D and X represent domestic demand and exports, respectively. Note that μ is a constant, that is $(\alpha ln\beta - \alpha ln\alpha)/(\alpha + \beta)$, and $\phi_1 = (1-\sigma)/(\alpha+\beta)$, where $\sigma = X/Q$ is the ratio of exports to total output, which is the export penetration. An interesting variable, $\gamma = (\sigma - \delta_2)/(\alpha+\beta)$, measures the extent to which exports lead to an increase in employment. The effect of exports on employment can be determined by two opposite forces: the positive effect on employment as part of additional production (σ) and the negative effect on employment through the productivity channel (δ_2). An increase in the wage of labor relative to the value of capital reduces firms' labor demand, which is consistent with a negative sign of θ_1. The positive association between domestic demand and employment can be easily captured by θ_1, which is a positive constant.

The short-term deviation of employment due to adjustment costs in the labor market cannot be reflected in the long-term labor demand function derived from Equation (7). However, referring to Hamermesh (1989), we can write the dynamic path that considers the adjustment costs of the labor market as follows:

$$ln\hat{L}_{it} - ln\hat{L}_{it-1} = \rho(lnL_{it} - ln\hat{L}_{it-1}) + \varepsilon_{it}, \tag{8}$$

where $\hat{L}$ and L are the actual and long-run equilibrium labor demand, respectively. ρ is a parameter that indicates the speed of employment adjustment. The closer ρ is to one, the closer labor demand is to the steady state. By substituting Equation (7), which is long-run labor demand, into the dynamic path above, the following dynamic panel equation can be obtained.

$$ln\hat{L}_{it} = \eta + \sum_{\tau} \lambda_\tau ln\hat{L}_{it-\tau} + \sum_{k} \theta_k ln(w/c)_{it-k} + \sum_{k} \phi_k lnD_{it-k} + \sum_{k} \gamma_k lnX_{it-k} + \nu_i + \psi_t + \varepsilon_{it}, \tag{9}$$

where ν_i and ψ_t represent the unobserved industry-specific and time-specific effects, respectively.

ε_{it} is an idiosyncratic error term. Note that $\tau \in \{1, 2, \ldots\}$ and $k \in \{0, 1, \ldots\}$, so that the lagged dependent variables are included in the right hand side of Equation (9). Assuming perfect competition in the capital market, the real rental rate of capital (c) can be captured by an unobserved time-specific effect (ψ_t). Since the real rent of capital under perfect competition can be determined, regardless of the industry, it is not included in the estimation model. Hereafter, the relative factor prices (i.e., the ratio of the wage to the rental rate of capital, w/c) is considered to be equal to w.

The unobserved industry heterogeneity could lead to bias in the OLS estimators. Moreover, in dynamic panel models with lagged dependent variables, the OLS estimates of coefficients of the lagged variables are likely to be severely biased due to the correlation between the lagged dependent variables ($\hat{L}_{it-k}$) and an error term (ε_{it}). This correlation occurs because the lagged dependent variables are closely related to the unobserved, industry-specific heterogeneity, ν_i (e.g., Nickell 1981).

Nickell (1981) also shows that the first-difference estimators in the fixed-effects models generate inconsistent estimates, due to the correlation between the lagged dependent variables and the error terms. In order to obtain unbiased and consistent estimates in the dynamic panel models, we adopt Arellano and Bond (1991) generalised method of moments technique. The Arellano and Bond method eliminates the time-invariant industry-specific fixed effects by taking first differences, and then exploiting the deeper lags of the dependent variables as instruments to deal with endogeneity. The differenced labor demand equation for the dynamic panel of industries is of the following form:

$$\Delta ln\hat{L}_{it} = \eta + \sum_{\tau} \lambda_\tau \Delta ln\hat{L}_{it-\tau} + \sum_{k} \theta_k \Delta ln(w/c)_{it-k} + \sum_{k} \phi_k \Delta lnD_{it-k} + \sum_{k} \gamma_k \Delta lnX_{it-k} + \Delta\psi_t + \Delta\varepsilon_{it}. \tag{10}$$

The first-differenced GMM estimator of Arellano and Bond (1991) may suffer from efficiency losses when the residuals are correlated. The test statistics are needed to test whether the residuals are free from second-order serial correlation. The validity of the instruments is checked using test statistics for over-identification restrictions, for example, the Sargan or Hansen test[8] The test statistics (e.g., AR(1), AR(2) and Hansen) for the validity of the instrument variables used in the Arellano-Bond difference GMM estimator will be addressed in detail later.

As mentioned earlier, capital intensity by industry is an important factor that accounts for the export effect on employment. Therefore, the additional variable for capital intensity across industries is added to the regression equation in the form of an interaction term.[9] In addition, we use the information on the export proportion of Small and Medium-sized Enterprises (SMEs) and the proportion of exports of intermediate goods to quantify the export effect on employment by firm size and end-use group. As the capital intensity of SMEs is generally lower than that of large firms, it is expected that the higher the proportion of SMEs in the industry, the more job creation there will be from exports. These analyses consider firm size and end-use groups and, thus, are able to provide useful information about job-related trade policies.

3.2. Data Description

We construct industry panel data for Korean manufacturing sectors for the period 2000 to 2010. The main data set is drawn from Statistics Korea and the Korea Trade Statistics Promotion Institute (KTSPI). Statistics Korea's Mining and Manufacturing Survey (MMS) surveys businesses with 10 or more employees (about 75,000 businesses), and includes the number of employees, annual wages, value of shipments, value added, major production costs, and year-end values of tangible fixed assets. Export data is extracted from KTSPI.

The number of employees gives a broad sense of the overall employment, including regular, temporary, self-employed and unpaid family workers. Of the total number of manufacturing employees, regular and temporary workers accounts for 97% of all workers. However, this number does not include other types of workers including the self-employed. The value of shipments is

[8]When 'Xtabond2' and robust option are simultaneously used in STATA, the Hansen test is preferred to Sargan.

[9]In Equation (5), labor and capital shares of income (i.e., α and β) are assumed to be constant, regardless of industry and time. However, these assumptions should be relaxed in that these factors' shares of income widely differ across industries. It is also true, even in the same industry, when considering that the relative importance of capital is growing as a result of technology development.

measured as the amount of output actually produced, which is calculated based on sales (shipments), changes in inventory and resales of goods, so the value of shipments is closely related to annual sales. The year-end tangible assets that include land, buildings, machinery, equipment, and transport machinery, such as vehicles and ships, can be used as a proxy for capital assets. All variables included in the MMS comply with the industrial classification prescribed in the 9th revision of the Korea Standard Industrial Classification (KSIC).

HS-CPC-ISIC-KSIC concordance tables are used to match the MMS (KSIC industry classification) with the export data (HS products classification). The MMS provides data on 486 KSIC 5-digit industries; however, 126 industries that can be linked with the export data are used for the empirical analysis.[10] Exports are also sub-grouped by income and geographic region, using the Country & Lending Groups Database (World Bank).[11] The proportion of SMEs' and intermediates' exports by industry are calculated using export information by firm size and end-use.[12] It should be noted that SMEs are defined as those with 300 employees or less.

Since the units in the MMS data are reported in Korean won, dollar-denominated exports are converted into the Korean won, using the annual average won-dollar exchange rates obtained from the Bank of Korea. Since all variables, except for the number of employees, are reported in current prices, they are converted to constant prices by using the producer price index (PPI) by industry. Table 2 shows the descriptive statistics of the main variables used in this study.

[10] In order to leave as many industries as possible in the linkage between employment and export data, the KSIC 3-5 digit industrial classification was used. For example, KSIC 1511 and KSIC 151 (that is, the KSIC 151 industry that remains after excluding the KSIC 1511 industry) were taken into consideration when a sub-industry (KSIC 1511) out of several sub-industries, including in the KSIC 151 industry was only available.

[11] As of 2015, low-income countries are defined as those with a GNI per capita of $1,025 or less in 2014; lower middle-income countries are those with a GNI per capita between $1,026 and $4,035; upper middle-income countries are included in the range of $4,036 to $12,475; high-income countries are those with a GNI per capita of $12,236 or more. Korean exports are also subdivided into geographic regions: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, North America, South Asia, etc.

[12] Export information by firm size is available on the KTSPI database for 2006 to the present, while export information by products' end-use is available from 2002 onward. Due to the limitation of securing data for the analysis period (2000 to 2014) of this study, we calculate the average values of each proportion for the period 2006 to 2014, which is used as an interaction term in the regression equation.

Table 2. Descriptive statistics

Variables	*Obs.*	*Mean*	*Standard Dev.*	*Min*	*Max*
ln(Employees)	1815	9.005	1.412	3.584	12.606
ln(Total Shipment)	1815	28.448	1.664	22.144	32.768
ln(Domestic Demand)	1815	28.198	1.658	20.176	32.335
ln(Wage per Worker)	1815	17.186	0.372	15.216	18.402
ln(Exports)	1815	26.71	2.231	17.9	31.935
ln(Capital Intensity)	1815	1.366	0.576	-0.699	3.666
Exp. Proportion(SMEs)	1815	0.509	0.284	0.019	0.994
Exp. Proportion(Intermediates)	1815	0.332	0.45	0	1
Exp. Proportion(F. Comsumption)	1815	0.305	0.248	0	1

Notes: *ln*(Domestic Demand) is a natural logarithm of total shipments minus exports. *ln*(Capital Intensity) is a natural logarithm of the year-end value of tangible assets divided by total wage. The natural logarithm of the capital intensity in some industries (i.e., manufactures of leather, luggage and similar products (KSIC 151), leisure and sporting boats building (KSIC 3112), manufactures of imitation and costume jewelry (KSIC 3312)) is less than zero.

3.3. Estimation Results

Table 3 shows the results of estimating the dynamic employment equation using the Arellano-Bond difference GMM.[13] The main focus of this study is to quantify the extent to which an industry's capital intensity is related to its export effect on employment. Together with the fact that the characteristics of the products embodied in exports are changing towards being more labor-saving (or capital-intensive), the estimation results on the export effect on employment, which may differ across capital-intensities, can help shed light on why export growth does not lead to sufficient job creation, compared to the export effect during the 1970s and 1980s. In this context, the main variable of interest is an interaction term that allows us to capture the role of capital intensity in determining the impact of exports on employment.

Most of all, it is necessary to discuss the results of the test statistics (i.e., AR(1), AR(2), Hansen) for the validity of the AB GMM estimator (i.e., the autocorrelation and over-identification). In all model specifications, the AR(1) test for the autocorrelation of the residuals rejects the hypothesis

[13]The difference GMM may produce large finite sample biases when the series are persistent. For this reason, we use the system GMM introduced by Blundell and Bond (1998), where the authors proposed extra moment conditions that can help overcome the weak instrument problems of the AB difference GMM estimator. The estimation results using the system GMM are presented in the Appendix on Table 5.

that the errors are not autocorrelated, while the AR(2) test does not reject the hypothesis, so there is no evidence for significant second-order autocorrelation. For the validity of the over-identification restrictions, Hansen test provides the p-values for the null hypothesis. In all specifications, we do not reject the null hypothesis, which suggests that the instruments used in the test are appropriate.

As shown in Table 3, an increase in domestic demand leads to more jobs, while there is a negative correlation between real wages per worker and employment. These results are consistent with the theory of labor demand. A negative association between capital intensity and employment can be interpreted as indicating that job creation is lower in higher-capital-intensity industries than it is in lower-capital-intensity industries. This implies that the overall employment effect of exports can further decrease if the capital-labor ratio embodied in exports increases.

The estimated coefficients for both domestic demand and exports are statistically significant at the 1% level and have positive signs regardless of the model specifications. As a result of estimating using the AB GMM (3rd column in Table 3), a 10% increase in exports leads to a 0.66% increase in employment, whereas a 10% increase in domestic demand increases employment by 1.96%. An increase in domestic demand is more strongly associated with employment growth than is an increase in exports. These results are consistent with the fact that the average capital intensity of domestic demand is lower than the one embodied in exports.

The export elasticity of employment depends on the capital intensity, which is supported by exports and an interaction term. As shown in the 5th column of Table 3, the estimated coefficient for exports is 0.114, while the interaction term is -0.039. The opposite signs of these coefficients implies that capital intensity weakens the positive impact of exports on employment. As a result of calculating the employment effect of exports by applying maximum and minimum values of capital intensity (see Table 2), the export elasticity of employment that corresponds to the highest level of capital intensity is 0.14. In contrast, the corresponding elasticity for the minimum value of capital intensity is -0.03, which implies that the employment effect of exports may be insignificant or absent in a relatively high capital-intensive industry. In other words, this means that there is a limit to the number of new export-induced jobs created, especially in capital-intensive industries.

Table 3. Main regression results

	Dependent Variable = *ln*(Employees)								
	Total Exports				Exports to High-income Countries				
	FE	Arellano-Bond Difference GMM							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Employees)-L1		0.351†	0.363†	0.361†	0.350†	0.202†	0.185†	0.176†	0.170†
		(-0.07)	(-0.07)	(-0.071)	(-0.065)	(-0.054)	(-0.051)	(-0.051)	(-0.049)
ln(Employees)-L2		0.075	0.089**	0.093**	0.095**	0.082**	0.111†	0.111†	0.110†
		(-0.045)	(-0.043)	(-0.043)	(-0.043)	(-0.036)	(-0.034)	(-0.033)	(-0.034)
ln(Domestic Demand)	0.306†	0.187†	0.196†	0.196†	0.193†	0.438†	0.520†	0.520†	0.516†
	(-0.044)	(-0.04)	(-0.046)	(-0.046)	(-0.046)	(-0.039)	(-0.042)	(-0.04)	(-0.04)
ln(Wages)	-0.364†	-0.219†	-0.269†	-0.279†	-0.288†	-0.371†	-0.522†	-0.541†	-0.550†
	(-0.065)	(-0.048)	(-0.072)	(-0.068)	(-0.066)	(-0.046)	(-0.067)	(-0.067)	(-0.064)
ln(Exports)	0.139†	0.069†	0.066†	0.076†	0.114†	0.041†	0.032**	0.057†	0.080**
	(-0.025)	(-0.018)	(-0.019)	(-0.020)	(-0.038)	(-0.015)	(-0.014)	(-0.016)	(-0.032)
ln(Capital Intensity)	-0.084		-0.197*		0.755		-0.438†		0.414
	(-0.053)		(-0.109)		(-0.577)		(-0.093)		(-0.503)
ln(Exports)·ln(Capital Intensity)				-0.009**	-0.039*			-0.019†	-0.036*
				(-0.004)	(-0.021)			(-0.003)	(-0.02)
Adj. R-Squared	0.517	-	-	-	-	-	-	-	-
AR(1)	-	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
AR(2)		0.137	0.247	0.231	0.166	0.112	0.148	0.153	0.130
Hensen	-	0.195	0.191	0.195	0.169	0.201	0.182	0.158	0.154
Group(KSIC)	124	122	122	122	122	122	122	122	122
Observations	1,770	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388

Notes: The estimators analyzed are the fixed-effects and the Arellano-Bond two-step difference GMM. Year dummies are included in all the specifications to control for the year-specific effects. The robust standard errors are in parentheses. †, **, and * refer to statistical significance at the 1 %, 5 %, and 10 % level, respectively.

The estimation results that consider the only exports to high-income countries are shown in Table 3, columns (6)-(9). The employment effect of exports to high-income countries is significantly smaller than that of total exports. This result is consistent with Verhoogen (2008), where the author argues that in the process of exporting to high-income countries, firms tend to increase their relative demand for skilled labor (or capital inputs) to improve product quality. The effect of replacing unskilled labor with skilled labor can be relatively strong in exports to high-income countries, in that importing countries' high income levels lead to increases in demand for high quality products.

Table 4 columns (4)-(5) shows the results of estimating the export effects on employment, taking into account the proportion of exports of SMEs, by industry. Given the high correlation between capital intensity and firm size, it is expected that the higher the proportion of exports by SMEs, the greater the effect of job creation from exports. In fact, the export elasticity of employment tends to increase with an increase in the share of small firms' exports. The estimated coefficient of exports is not statistically different from zero; however the coefficients of the interaction term that includes the export proportion of SMEs is positive (0.139) and statistically significant.

Table 4 columns (6)-(9) reports the estimated results, taking into account the proportion of intermediate/consumer goods exports. First, the proportion of intermediate goods exports is negatively associated with the export effect on employment, which is shown in columns (6)-(7). The export coefficient is 0.096, which is statistically significant at the 1 % level. However, the estimated coefficient on the interaction term, which is composed of exports and its share of intermediate goods, has a negative value of -0.101. This implies that the effect of exports on employment is likely to be insignificant, especially in industries that heavily rely on exports of intermediate goods. In contrast to intermediate goods, the higher the share of consumer goods exports, the greater the effect of exports on employment. This result can be interpreted as reflecting that consumer goods are closely related to labor-intensive production processes.

Table 4. Employment effects of exports by firm size and end-use

	Dependent Variable = *ln*(Employees)								
	Total Exports			Proportions of SMEs' Exports		Proportions of Intermediate & Consumer Goods Exports			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Employees)-L1	0.363†	0.361†	0.350†	0.345†	0.358†	0.342†	0.356†	0.342†	0.355†
	(-0.070)	(-0.071)	(-0.065)	(-0.072)	(-0.073)	(-0.068)	(-0.067)	(-0.069)	(-0.067)
ln(Employees)-L2	0.089**	0.093**	0.095**	0.065	0.079*	0.061	0.073*	0.065	0.064
	(-0.043)	(-0.043)	(-0.043)	(-0.047)	(-0.045)	(-0.046)	(-0.043)	(-0.047)	(-0.046)
ln(Domestic Demand)	0.196†	0.196†	0.193†	0.191†	0.198†	0.186†	0.194†	0.187†	0.192†
	(-0.046)	(-0.046)	(-0.046)	(-0.038)	(-0.044)	(-0.040)	(-0.046)	(-0.040)	(-0.045)
ln(Wages)	-0.269†	-0.279†	-0.288†	-0.221†	-0.270†	-0.249†	-0.297†	-0.264†	-0.273†
	(-0.072)	(-0.068)	(-0.066)	(-0.047)	(-0.070)	(-0.045)	(-0.066)	(-0.045)	(-0.049)
ln(Exports)	0.066†	0.076†	0.114†	0.024	0.025	0.102†	0.096†	0.004	-0.01
	(-0.019)	(-0.02)	(-0.038)	(-0.019)	(-0.022)	(-0.033)	(-0.031)	(-0.030)	(-0.028)
ln(Capital Intensity)	-0.197*		0.755		-0.189*		-0.194*		-0.160**
	(-0.109)		(-0.577)		(-0.102)		(-0.107)		(-0.067)
ln(Exports)·ln(Capital Intensity)		-0.009**	-0.039*						
		(-0.004)	(-0.021)						
ln(Exports)·ln(SMEs)				0.156*	0.139*				
				(-0.089)	(-0.079)				
ln(Exports)·ln(Intermediate Inputs)						-0.104*	-0.101*		
						(-0.060)	(-0.053)		
ln(Exports)·ln(Consumption Goods)								0.096*	0.107**
								(-0.054)	(-0.053)
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.247	0.231	0.166	0.11	0.22	0.182	0.312	0.167	0.315
Hensen	0.191	0.195	0.169	0.219	0.177	0.182	0.177	0.476	0.443
Group(KSIC)	122	122	122	122	122	122	122	122	122
Observations	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388

Notes: The estimator analyzed is the Arellano-Bond two-step difference GMM. The proportions of SMEs' exports and intermediate/consumer goods exports by industry are used as variables of the interaction term. Year dummies are included in all of the specifications to control for year-specific effects. The robust standard errors are in parentheses. †, **, and * refer to statistical significance at the 1 %, 5 %, and 10 % level, respectively.

4. Concluding Remarks

In light of the importance of exports in the Korean labor market, this paper attempts to find the primary reasons why export growth does not lead to sufficient job creation. The main purpose of this study is to provide useful information that can shed light on why the export effect on employment has weakened since 1990, and then to suggest some policy implications which could possibly strengthen the virtuous cycle between exports and employment.

The main findings of the study can be summarized as follows. First, the reduction in the export effect on exports is highly correlated with changes in the composition of export products. In other words, the export effect on employment has weakened as the composition of exports has shifted toward less labor-intensive and more capital-intensive products. A closer look at the changes in the composition of export products shows that the share of the top five labor-saving industries (petroleum, primary metals, transportation equipment, chemicals, electrical equipment and electronics) of total exports has significantly increased from 36 %, in 1980, to nearly 84 %, in 2010, whereas the share of the top five labor-intensive industries of total exports has decreased by 48 % for the last 30 years. It is worth noting that the export-induced employment effect may be weaker than that of domestic demand.

Second, an increase in exports leads to an increase in manufacturing jobs, and the export elasticity of employment decreases as capital-intensity increases. This implies that the reason why exports do not create sufficient jobs is closely related to the capital intensity of the products export industries produce. Third, the export elasticity of employment tends to be higher when the export proportion of SMEs' products is larger. In other words, the employment effect of exports is relatively low in industries with a high proportion of small firms. The export elasticity of employment also depends on a product's main end-use (i.e., intermediates and final consumption), which differs across industries. To be more specific, the greater the proportion of intermediate inputs in an industry, the lower the export elasticity of employment. In contrast, the export effect on employment is positively associated with the export share of final consumption goods. These empirical findings imply that, other things being equal, exports of final consumption goods produced by SMEs are relatively more effective in creating jobs than are goods produced by other types of industries. This result supports the Korean government's emphasis on policies that aim to encourage and promote SME participation in exporting.

Above all, it is important to understand that the weakening of the export effect on employment is a natural consequence of efficient resource allocation among industries. As the decline in the number of manufacturing jobs that occurs during the process of efficient resource allocation is considered a positive aspect of economic growth, we should be cautious when implementing policies for employment promotion through changes in the industrial structure. The empirical findings of this study also emphasize the importance of government policies that foster SMEs as new growth engines because it is difficult to expect further job creation through increases in the exports of goods produced by large-sized labor-saving firms.

To this end, it is important to implement some policies that promote the continuous growth of SMEs, such as promoting business cooperation between large- and small-to-medium-sized enterprises, and regulatory reform. Second, it is necessary to actively support start-ups and SMEs that can quickly adapt amidst the dramatic changes that stem from the fourth industrial revolution. Third, it is important to provide government supports for securing overseas distribution channels in order to expand the export penetration of SMEs. For example, it could be possible to promote participation and expansion of SMEs utilizing the local distribution networks (e.g., E-Mart, LotteMart, etc.) or global open markets (e.g., Amazon, eBay, Taobao, etc.). Finally, it is recommended that policies should aim to increase the participation of SMEs in GVCs, through government policies that enable foreign multinationals to more actively utilize domestic production facilities.

References

Arellano, Manuel and Stephen Bond, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 1991, *58* (2), 277–297.

Blundell, Richard and Stephen Bond, "Initial conditions and moment restrictions in dynamic panel data models," *Journal of Econometrics*, 1998, *87* (1), 115 – 143.

Chenery, Hollis, "Structural change and development policy," A World Bank Research Publication, The World Bank, Washington DC, 1979.

Choi, Yong-Jae, Jae-Hun Choi, and Hail Park, "A Study on Export Promotion Strategies for Regional Growth - Focused on Jeonbuk Region," *Korea trade review*, 2012, *37* (2), 73 – 104.

Cin, Beom-Cheol, "An Empirical Analysis on the Employment Effect of Korean Exporting using the DPD model," *Internation Area Studies Review*, 2009, *13* (3), 213 – 238.

Greenaway, David, Robert C. Hine, and Peter Wright, "An empirical assessment of the impact of trade on employment in the United Kingdom," *European Journal of Political Economy*, 1999, *15* (3), 485 – 500.

Hamermesh, Daniel S., "Labor Demand and the Structure of Adjustment Costs," *The American Economic Review*, 1989, *79* (4), 674–689.

Leichenko, Robin M., "Exports, Employment, and Production: A Causal Assessment of U.S. States and Regions," *Economic Geography*, 2000, *76* (4), 303–325.

Nam, Chong-Hyun, "Does Trade Expansion Still Promote Employment in Korea?," *The World Economy*, 2008, *31* (6), 720–737.

Nickell, Stephen J, "Biases in Dynamic Models with Fixed Effects," *Econometrica*, November 1981, *49* (6), 1417–1426.

Oh, Junbyoung and Mijin Kim, "Does Export Promote Employment in the Manufacturing Sector? : An Empirical Study on the Incheon Regional Area," *Journal of Economics Studies*, 2016, *34* (2), 61 – 93.

Slaper, Timothy, "Does Export Growth Create Jobs?," *Indiana Business Review*, 2015, *90*, 1–6.

Verhoogen, Eric A., "Trade, Quality Upgrading, and Wage Inequality in the Mexican Manufacturing Sector," *The Quarterly Journal of Economics*, 2008, *123* (2), 489–530.

Appendix

Table 5. Regression results using the Syetem GMM

	Dependent Variable = *ln*(Employees)			
	(1)	(2)	(3)	(4)
ln(Employees)-L1	0.720*** (-0.089)	0.583*** (-0.081)	0.566*** (-0.083)	0.544*** (-0.083)
ln(Employees)-L2	0.048 (-0.062)	0.103* (-0.055)	0.108* (-0.055)	0.106** (-0.052)
ln(Domestic Demand)	0.152*** (-0.027)	0.216*** (-0.031)	0.222*** (-0.033)	0.234*** (-0.037)
ln(Wages)	-0.317*** (-0.059)	-0.324*** (-0.063)	-0.336*** (-0.069)	-0.347*** (-0.078)
ln(Exports)	0.040*** (-0.015)	0.057*** (-0.014)	0.077*** (-0.016)	0.131*** (-0.043)
ln(Capital Intensity)		-0.290*** (-0.056)		0.647 (-0.503)
ln(Exports)·ln(Capital Intensity)			-0.011*** (-0.002)	-0.044** (-0.02)
AR(1)	0.001	0.001	0.000	0.000
AR(2)	0.231	0.246	0.195	0.128
Hensen	0.966	0.989	0.983	0.974
Group(KSIC)	122	122	122	122
Observations	1,525	1,525	1,525	1,525

Notes: The estimator analyzed is the system GMM. Year dummies are included in all the specifications to control for year-specific fixed effects. The robust standard errors are in parentheses. ***, **, and * refer to statistical significance at the 1 %, 5 %, and 10 % level, respectively.