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Domestic Competition and the Propensity to Export: An Inverted-U Shaped Relationship*

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The purpose of this paper is to determine the relationship between domestic competition and the propensity to export. Using Korean census data on manufacturing industries for the period from 1988-1999, we find that there is an inverted-U shaped relationship between domestic competition as measured by the Herfindahl-Hirschman Index and the propensity to export. This paper presents new insight into the propensity to export, while controlling for other related determinants. We also identify the role of sunk cost, firm characteristics, and the spillover effect from neighboring exporters as those related determinants of the propensity to export. Research results demonstrate a level of consistency in the competition variable as it relates to alternative model specification.

JEL Classification: L6, F1, D2
Keywords: domestic competition, the propensity to export, inverted-U shape, Korean economy

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1. INTRODUCTION

The fundamental question addressed in this study examines why some firms choose to export products while others do not. There is a body of research that estimates and identifies determinants that affects the decision to export. However, few studies have focused on domestic competition as the key determinant and driving force in the propensity to export. This study is unique in that it includes competition as a variable in the formula used to determine why firms choose to export.

There are two facts generally accepted regarding export markets. One is the existence of sunk-costs, and the other is that exporters are more productive than non-exporters. The essential question is how firms can enhance their ability to compete in the export market. 'Innovation' is being recognized widely as an important factor in productivity success. There are multiple sources a firm can use to become 'innovative'. However, that is not the main subject of this paper even if we consider various determinants for the decision to export. We examine the relationship between domestic competition and the propensity to export using the connection between competition and innovation.

This paper answers these following two questions: 'Is domestic competition a significant factor in the propensity to export? If so, what is the relationship between domestic competition and the propensity to export?'. Both questions will be answered when we identify the relationship between domestic competition and the propensity to export.

There are two approaches in the literature which examine the variables involved in the decision to export. One focuses on the link between domestic competition and the propensity to export. The other concentrates on the relationship between innovation and the productivity-export link.

Das (1982) asserts that in the presence of imperfect competition and increasing returns to scale, a higher concentration of industry leads to greater comparative advantage. A country will export products from relatively more concentrated sectors. The less competitive the industry, the higher would be

the probability to export. But there is the limitation of not having considered firm dynamics in the research of Das (1982). The empirical literature on the relationship between domestic competition and the decision to export at the firm level has produced mixed evidence. E. W. Chirwa (1998) and J. Azam *et al*. (2001) found that competition had a negative relationship with the propensity to export in Malawi and Cote d'Ivoire. Conversely, Zhao, Hongxin, and Shaoming Zou (2002) and T. Poddar (2004) examined the positive relationship between competition and the propensity to export in India and China. These studies demonstrate that there is no universal conclusion to be drawn regarding competition.

The other approach argues that firms which have implemented innovative activity experience an increase in productivity and subsequently have a higher propensity to export. Caldera (2009) found that innovation has a positive effect on the probability of participation in the export market based on an examination of Spanish manufacturing firms. Parisi *et al*. (2006) showed that R&D spending was strongly positively associated with the introduction of innovation, which in turn enhanced the productivity at the firm level in Italy. Therefore, the positive effect of innovation on the probability to export[1)] is widely accepted.

In contrast with competition, other determinants in deciding to export, such as sunk costs, firm heterogeneity, and spillover effects offer some reconciliation between theory and empirical work. Robert and Tybout (1997) at first separated the roles of profit heterogeneity and sunk entry costs in explaining the exporting status of manufacturing plants in Colombian from 1981-1989. They identified the existence and influence of sunk costs as a determinant in the decision to export using the dynamic discrete model. Bernard and Wagner (2001) and Bernard and Jensen (2004) also identified the role of various plant characteristics as well as sunk costs in the market entry decision of German firms between 1978-1992 and U.S. manufacturing plants between 1984-1992 as Robert and Tybout (1997). Conversely, some

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[1)] See Bernard and Jensen(1997), Aw, Roberts, and Winston (2007), Aw, Roberts, and Xu (2009), Damijan, Kostevc, and Polanec (2008), Caldera (2009).

Figure 1 Competition, Innovation, Productivity, and the Propensity to Export

studies examined the spillover effects as a factor in the exporting activity. Although Bernard and Jensen (2004) didn't find any evidence of spillover effects on the probability to export from U.S. manufacturing plants, Aitken *et al*. (1997) and Clerides *et al*. (1998) found some evidence of spillover effects in Colombia, Mexico, and Morocco.

From the previous literature, we know that innovation, productivity, and the decision to export have a positive link (see figure 1). As a result, the relationship between competition and innovation becomes the critical link in explaining the relationship between competition and the propensity to export. To investigate the relationship between competition and the propensity to export, we first examine previous research which discusses the relationship between competition and innovation in the industrial organization field.

With the relationship between competition and innovation confirmed theoretically, we predict the relationship between competition and the propensity to export, and verify this relationship empirically using Korean manufacturing industries from 1988-1999 as our case study.

Jung and Lee (2014) found that there are region-spillover effects on the propensity to export using data from Korean manufacturing plants (1988-1999), the same dataset used in this research, after controlling the various determinants such as sunk costs and firm heterogeneity. However, there is no analysis for the relationship between domestic competition and the propensity to export. Therefore, the main contribution of this research is identifying the relationship between domestic competition and the propensity to export, controlling various factors affecting the decision to export which are considered in Jung and Lee (2014).

In summary, empirical results show there is an inverted-U shaped relationship between competition and the propensity to export, comparable to the link between competition and innovation.

This paper is organized as follows: In the next section, we introduce the theoretical background and empirical strategy used to identify the relationship between competition and the propensity to export. In section 3, in addition to describing the panel dataset and the variables used in this study, empirical results are interpreted. Finally, section 4 concludes with policy implications.

2. THEORETICAL BACKGROUND AND EMPIRICAL STRATEGY

2.1. Theoretical Background

Economists have long been interested in the relationship between competition and innovation. However, the theory seems contradicted by empirical work. In other words, industrial organization theories predict that innovation should decline with competition due to the reduction of monopoly rent. However, empirical works[2] find a positive link between competition and innovation. There is no reconciliation between theory and empirical work until Aghion *et al*. (2005).[3]

Aghion *et al*. (2005) provide new insights into competition and innovation to reconcile the contradiction in the theories above and empirical works. They found strong evidence of an inverted-U shaped relationship between competition and innovation using British panel data. Based on their theoretical and empirical research, we hypothesize that the relationship

[2] See Geroski (1995), Nickell (1996), No and Seo (2014), and Blundell, Griffith, and Van Reenen (1999).

[3] A detailed description of the theory is omitted because it is beyond the scope of this study. See Aghion *et al*. (2005) for a detailed explanation of the relationship between competition and innovation.

between competition and the propensity to export has an inverted-U shape, controlling for various determinants of the propensity to export such as sunk cost, firm heterogeneity, and the spillover effects.

The simplified explanation for an inverted-U shape between competition and innovation is as follows: Innovations occur step-by-step by both technological leaders and followers in the industry. Innovation incentives are based not on post-innovation rents but on the difference between post-innovation and pre-innovation rents. Moreover, two conditions are needed to explain an inverted-U shaped relationship between competition and innovation. First, we divide the competition level into either low or high. Second, there are two states such as leveled[4] and unleveled[5] that define the technology gap among firms in a sector. An equilibrium fraction of industries would be different according to the level of competition.

For sectors with low levels of competition, a positive relationship between competition and innovation would be explained by the following: There is little incentive for firms with similar technology to innovate, because firms with low competition enjoy high monopoly rent so the difference between pre-innovation rent and post-innovation rent would be small. There is the high innovation incentive for followers when the industry is unleveled in technology. So, the industry will be quick to leave the unleveled state as soon as the follower with high innovation incentive innovates. The leveled state would remain until one of the firms with similar technology and low innovation incentive innovates. As a result, the industry will mostly experience the leveled state. The escape-competition effects, that competition induces innovation, are likely to dominate in low levels of competition, due to the overall effect depends on the proportion of level sectors. When the degree of competition begins at a low level, an increase in competition should result in an increased average innovation rate. With high levels of competition, there is relatively little incentive for the laggard in an unleveled state to innovate because the difference between pre- and post-

[4] Where incumbent firms are operating at similar technological levels.
[5] Where one firm (the leader) lies one step ahead of its competitor (the laggard or follower).

innovation rent is small. So, the industry will be relatively slow to leave the unleveled state. In the leveled state, high competition creates a relatively large innovation incentive caused by the low pre-innovation rent. The industry will then be quick to leave the leveled state. As a result, the industry will spend most of its time in the unleveled state, which is contrary to industries with low levels of competition. The Schumpeterian effect that competition restricts innovation dominates because there is no innovation incentive for the leader and the follower. When the degree of competition begins on a high level, an increase in competition should result in a decreased average innovation rate.

Therefore, we hypothesize that the competition and the propensity to export also have an inverted-U shaped relationship based on an inverted-U shaped relationship between competition and innovation.

2.2. Empirical Strategy

Consistent with Jung and Lee (2014), we follow the basic theory and econometric model of Robert and Tybout (1997) for identifying the empirical relationship between competition and the propensity to export. The difference between this study and Jung and Lee (2014) is that this study considers the competition variable as an addition factor for explaining the decision to export in the empirical model.

We define the variable Y_{it} as the status of export in time t for exporting $(Y_{it}=1)$ and non-exporting $(Y_{it}=0)$, $-X_i$ if a plant exits, and the variable $\tilde{Y}_{i,\,t-j}$ represents the plant's most recent exporting experience. From the future viewpoint, the value function is as follows:

$$V_{it}\left(\Omega_{it}\right)=\max_{Y_{it}}\left(R_{it}\left(Y_{it}^{(-)}\right)+\delta E_t\{V_{i,\,t+1}\left(\Omega_{i,\,t+1}\right)\mid Y_{it}^{(-)}\}\right), \qquad (1)$$

where δ is the one-period discount rate, Ω_{it} is the plant specific information, and $R_{it}\left(Y_{it}^{(-)}\right)$ is the expected gross profit generated by the exporting activity of each rational and profit-maximizing firm.

Considering the above value function, we can obtain the empirical model below with the participation condition that export profit is bigger than zero, reflecting that a firm's decision to export during period t considers both the current profit $(\pi_i(p_t, s_{it}))$ and the expected profit from exporting. The state variables in the market and plant level p_t and s_{it} affect $\pi_i(p_t, s_{it})$ and the expected future value generated from the exporting activity.

$$Y_{it} = \begin{cases} 1 & if \ \ \pi_{it}^{*} - F_i^0 + \left(F_i^0 + X_i\right)Y_{i,\,t-1} - \sum_{j=2}^{J}(F_i^0 - F_i^j)\tilde{Y}_{i,\,t-j} \geq 0 \\ 0 & otherwise \end{cases}, \qquad (2)$$

where $\pi_{it}^{*} = \pi_i(p_t, s_{it}) + \delta\left[E_t\left(V_{it}\left(\Omega_{i,\,t+1}\right)|\ Y_{it}=1\right) - E_t\left(V_{it}\left(\Omega_{i,\,t+1}\right)|\ Y_{it}=0\right)\right]$.

This empirical model assumes that variation in $\pi_{it}^{*} - F_i^0$ derives from various different sources: time-specific effect (μ_t), observable differences in plant characteristics including region-industry spillover effects (Z_{it}), the sunk costs of past exporting $\left(Y_{i,\,t-j}\right)$ and noise (ε_{it}). [6)]

As the contribution of this study to existing literature, we add the domestic competition variable (1–HHI[7)]) in quadratic form on the empirical model to investigate the relationship between competition and the propensity to export. In addition, we utilize for testing our hypothesis. We use the probit-regression model to estimate the reduce-form as follows:

$$Y_{it} = \begin{cases} & 0 \leq \mu_t + \beta_0 Z_{it} + \beta_1(Comp) + \beta_2(Comp)^2 \\ 1 \quad if & \quad + \gamma^0 Y_{i,\,t\text{-}1} + \sum_{j=2}^{J}\gamma^j \tilde{Y}_{i,\,t\text{-}j} + \varepsilon_{it} \\ 0 & otherwise \end{cases}. \qquad (3)$$

[6)] Jung and Lee (2014) has already examined various determinants for the propensity to export for Korean manufacturing plants using the same dataset. However, they didn't consider domestic competition as a significant factor of the decision to export. Therefore, the contribution of this study is to identify the relationship between domestic competition and the propensity to export within the same empirical model.

[7)] Herfindahl-Hirschman Index is defined as the sum of the squared market shares of firms in the industry.

Various determinants to be considered in the above reduced form are sunk costs, firm heterogeneity, spillover effects and domestic competition (*Comp*), consistent with Jung and Lee (2014). To identify the non-linear relationship between domestic competition and the propensity to export, the reduced form includes the quadratic form of domestic competition $\left((Comp)^2\right)$.

3. EMPIRICAL ANALYSIS

3.1. Data Description and Key Variables[8)]

We used Korean manufacturing census data[9)] regarding plants operating in Korea from 1988-1999. The panel dataset includes all plants with over 5 workers and information such as output, value-added, export status, cost variables, workers, wage, capital, inventory, and plant identification number. From the census dataset, we have selected a sample of continuously

Table 1 Yearly Distribution of Continuously Operating Plants: 1994-1999

Year		1994	1995	1996	1997	1998	1999
Single-unit plant	Frequency	9,394	9,445	9,312	9,284	10,195	9,331
	Percent	91.1	91.6	90.3	90	98.8	90.5
Multi-unit plant	Frequency	914	869	1,002	1,030	119	982
	Percent	8.9	8.4	9.7	10	1.2	9.5
Total	Frequency	10,308	10,314	10,314	10,314	10,314	10,313
	Percent	100.0	100.0	100.0	100.0	100.0	100.0

Note: The number of observations varies slightly across time due to missing observations of some variables.
Source: Jung and Lee (2014).

8) Most of explanation is very similar to Jung and Lee (2014) because dataset used in this study is same to that of Jung and Lee (2014).

9) Production, total shipment, value-added, and wage are deflated by the producer price indices at 2 digits KSIC (Korea Standard Industry Code) disaggregated level to change from nominal term to real term. The year-begin and end tangible fixed asset as the capital stock is deflated by the capital good deflator computed in national account, and the variables relating to cost (direct or Indirect) is deflated by the intermediate input price index.

operating plants from 1988-1999 for this research because very few firms begin production and enter export markets concurrently and we can simplify the research without any distortion in the patterns of export market transitions. Table 1 shows that over 90% of the plants in our sample are single-unit plants. Based on these facts, we can make sure that there is no problem even if a plant is considered as a firm.

In addition, we have scrutinized the composition of 2-digit industries between all plants and our sample to check whether our sample that is composed of continuously operating plants can bias the general conclusions. As displayed in figure 2, the composition of 2-digits industries for both the continuing plant group and all plants is very similar. Table 2 shows that the general patterns of exporting transition are a high exporting persistence and a low change rate in the exporting status for non-exporters as the results of existing literature.

Table 3 shows the comparison between the average performance of exporting and non-exporting plants, indicating that on average, exporting plant are more productive than non-exporting plants. More specifically, 'Total Worker' and 'Capital' as the proxy variable of size are 6 times and 12 times larger for exporting plants than non-exporting plants respectively. Labor productivity and wage per worker, which are used as a measure of efficiency and quality of human capital, are higher for exporters than for non-exporters.

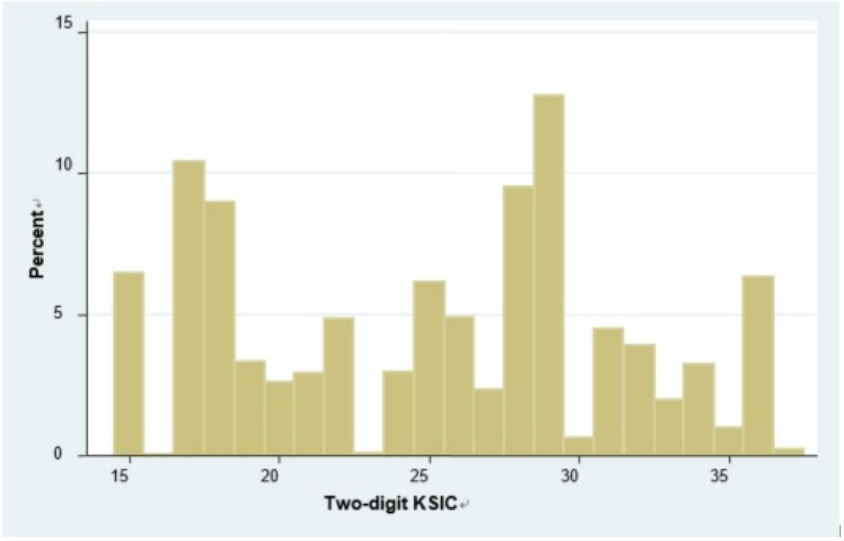
Four key categories,[10] including competition, sunk cost, firm heterogeneity, and spillover, are considered as the determinants of the propensity to export in this paper. Three determinants, excluding competition, have already been examined in Jung and Lee (2014) and the contribution of this paper is to confirm the hypothesis that there is an inverted-U shaped relationship between competition and the propensity to export through adding competition and controlling for the other determinants.

First, the key factor in the decision to export in this paper is market

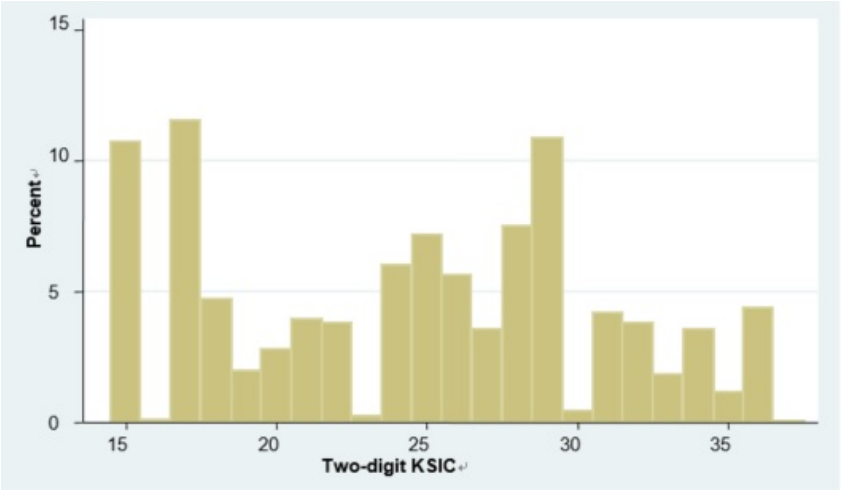
[10] See Jung and Lee (2014) for the detailed explanation of other determinants except the competition.

Figure 2 The Distribution of Exporting Plants by the Two-Digit KSIC: 1990-1999

[All Plants]



[Continuously Operating Plants]



Source: Jung and Lee (2014).

Table 2 Dynamic Transition Ratio of Exporting Plants during 1988-1999

Year	Number of				Ratio of		
	Total	Export	Entry	Exit	Export/Total	Entry/Total	Exit/Total
1988	10,314	2,816		589	0.27		0.06
1989	10,314	2,770	543	589	0.27	0.05	0.06
1990	10,314	2,717	536	490	0.26	0.05	0.05
1991	10,314	2,807	580	430	0.27	0.06	0.04
1992	10,314	2,930	553	656	0.28	0.05	0.06
1993	10,314	2,782	508	534	0.27	0.05	0.05
1994	10,314	2,842	594	493	0.28	0.06	0.05
1995	10,314	2,914	565	571	0.28	0.05	0.06
1996	10,314	2,820	477	485	0.27	0.05	0.05
1997	10,314	2,886	551	517	0.28	0.05	0.05
1998	10,314	3,036	667	628	0.29	0.06	0.06
1999	10,314	3,014	606		0.29	0.06	

Source: Jung and Lee (2014).

Table 3 Summary Statistics for Continuously Operating Plants: Mean

Variable	Frequency	Total Worker	Capital	Labor Productivity	Wage per worker	Capital Intensity
Total	123,768	106.88	7,844.28	32.85	9.43	37.49
Exporters	34,334	269.20	23,307.49	44.33	10.95	48.27
Non-Exporters	89,434	44.57	1,907.91	28.45	8.85	33.35

Source: Jung and Lee (2014).

concentration used as the proxy variable of competition, though there are several ways to measure competition in the market. The most commonly used function for market concentration is the Herfindahl Hirschman Index (HHI),[11] which equals the sum of the squared market shares of firms in the industry. We measure HHI[12] in the 5-digits industry and the quadratic form of competition measured by (1–HHI) and the square of (1–HHI) is used to identify the inverted-U shaped relationship between competition and the

[11] The value of HHI always is between 0 and 1.

[12] HHI can overstate concentration because they ignore imports, which have grown in importance, while HHI also can understate concentration in this research because this research considers the plant as the firm.

propensity to export predicted in the regression model.

Second, sunk cost is the irreversible cost paid when a firm enters a foreign market. To identify the existence and magnitude of sunk costs apart from other determinants, this study considers three variables relating to the past exporting activity status, consistent with previous research. The third factor is firm heterogeneity, which is based on the 'Self-Selection'[13] hypothesis. The proxy variables of heterogeneity we consider include size, labor productivity, labor quality, capital intensity, and age. In addition to firm heterogeneity of various types, we consider the type of organization as an additional factor. There are two types of organizations we considered. One is owned by an individual, and the other is governed by a corporate group or company. Fourth, we focus on the spillovers effects resulting from the exporting activity of other firms affects the export decision in individual firms. In this paper, spillover effects will be examined using Korean manufacturing industry panel dataset utilizing a dynamic specification consistent with Bernard and Jensen (2004) and Jung and Lee (2014).

3.2. Empirical Results

Regression results displayed in table 4 clearly show an inverted-U shaped relationship between competition and the probability to export, controlling for other determinants relating to the export decision. The coefficient of the linear term of (1–HHI) used as the proxy variable of competition is significantly positive around 0.85 - 1.18 and the coefficient of the quadratic term is significantly negative around –0.7 - –0.98, implying the inverted-U shaped relationship between domestic competition and the propensity to export. Therefore, our hypothesis is not rejected.

Based on the regression results, the critical point at which the value of (1–HHI) levels off and changes direction is around 0.5 - 0.6. It is reasonable to assert an inverted-U shaped relationship between competition and the

13) Firm with high productivity has more probability for being exporter than one with low productivity.

probability to export, because the point is within the range of (1–HHI), allowing between 0 and 1. The outcome of regression implies that when the value of (1–HHI) is below 0.5, specifically with low competition levels, as competition increases, the probability to export increases. However when the value of (1–HHI) is above 0.6, the probability of exporting decreases as competition increases.

The results support our hypothesis that the propensity to export and competition has an inverted-U shaped relationship between competition and innovation that Aghion *et al*. (2005) asserts. Moreover, this inverted-U shape between competition and the probability to export is meaningful due to the effect of competition on the probability to export remains after controlling for other determinants of the exporting decision. This is the unique contribution of this paper.

The empirical results of the other determinants of the exporting decision are consistent with Jung and Lee (2014). The brief explanation of other factors such as the sunk cost, firm heterogeneity, and spillover effects is as follows: All coefficients of previous exporting experiences, are consistently positive and significant, identifying the existence of sunk cost and the persistence of exporting activity of Korean firms. Results show that the effect of the firm's previous experience in exporting decreases at a decreasing rate over time. That is to say, the effects of previous experience depreciate quickly. This result demonstrates that the sunk cost exists in the export market and its effect depreciates over time with the absence of exporting activity increases.

This research used various variables as the proxy of firm heterogeneity. In table 4 wage per worker considered as labor quality has a negative but insignificant coefficient contrary to our expectation that exporters would have a higher probability for high labor quality and the ratio of export price to domestic price is insignificant although the sign of the coefficient is positive as expected. However, when we used the relative wage per worker in the 5-digits industry category as labor quality considering the difference in wage per worker between industries, the coefficient of relative wage per

Table 4 Various Factors, Domestic Competition, and the Decision to Export

	Probit estimation					
	(1)	(2)	(3)	(4)	(5)	(6)
Exported last year	2.341***	2.338***	2.337***	2.334***	2.301***	2.295***
	(0.0140)	(0.0140)	(0.0140)	(0.0140)	(0.0141)	(0.0141)
Exported two years ago	1.271***	1.269***	1.269***	1.267***	1.253***	1.249***
	(0.0212)	(0.0212)	(0.0212)	(0.0212)	(0.0213)	(0.0213)
Exported three years ago	0.823***	0.821***	0.821***	0.819***	0.805***	0.801***
	(0.0278)	(0.0278)	(0.0278)	(0.0278)	(0.0279)	(0.0279)
Ln (export price/ppi)	0.0737	0.0495	0.0679	0.0419	0.0591	0.0541
	(0.0620)	(0.0621)	(0.0620)	(0.0621)	(0.0624)	(0.0624)
Age	0.00441**	0.00432**	0.00402**	0.00390*	0.00376*	0.00331*
	(0.00153)	(0.00153)	(0.00153)	(0.00153)	(0.00153)	(0.00153)
Age^2	–0.0000789**	–0.0000806**	–0.0000735*	–0.0000750*	–0.0000907**	–0.0000855**
	(0.0000296)	(0.0000296)	(0.0000296)	(0.0000297)	(0.0000297)	(0.0000298)
Type of corporation	0.251***	0.248***	0.231***	0.228***	0.144***	0.129***
	(0.0156)	(0.0156)	(0.0153)	(0.0153)	(0.0165)	(0.0161)
Region_exporter (outside industry)	–4.274***	–4.558***	–4.307***	–4.609***	–5.493***	–5.451***
	(1.101)	(1.103)	(1.101)	(1.104)	(1.110)	(1.111)
Industry_exporter (outside region)	0.194	0.0744	0.217	0.0913	0.147	0.190
	(0.156)	(0.157)	(0.155)	(0.157)	(0.158)	(0.157)
Region_Industry (Local)	0.680***	0.678***	0.689***	0.688***	0.760***	0.775***
	(0.137)	(0.137)	(0.137)	(0.137)	(0.138)	(0.138)

Ln (Capital)	0.117***	0.115***	0.111***	0.109***		
	(0.00478)	(0.00480)	(0.00464)	(0.00467)		
Ln (Total worker)					0.221***	0.217***
					(0.00710)	(0.00707)
Ln (wage per worker)	–0.0295	–0.0296			0.0200	
	(0.0192)	(0.0192)			(0.0187)	
Relative wage_per_worker			0.0995***	0.108***		0.128***
			(0.0200)	(0.0200)		(0.0199)
Competition		1.128**		1.172**	0.841*	0.877*
(1–HHI)		(0.379)		(0.379)	(0.382)	(0.382)
(Competition)^2		–0.932***		–0.976***	–0.707**	–0.751**
(1–HHI)^2		(0.248)		(0.248)	(0.250)	(0.250)
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Region dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	92,775	92,775	92,777	92,777	92,819	92,821

Notes: Two-digit KSIC, region and year dummy variables are considered in all of regressions and one period lagged independent variables are used to escape simultaneity problem. Domestic competition is measured by 1–HHI. Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

worker is significant and positive saying that the difference of labor quality can explain the probability to export in restricted industry category. The coefficient of capital and the number of worker is positive and significant. As a result, we can say that the more efficient or the larger size of the firm results in the higher probability to export, which is consistent with previous literature regarding the decision to export. Additionally, with respect to age, which is used frequently in the IO field as another proxy of efficiency, the age variable has positive and significant while age square variable has negative and significant coefficient, implying that the longer the firm has been in operation, the greater the probability to export if market forces eliminates inefficient firms, but the change rate of exporting probability for the firm decreases. This relationship between age of firm and the probability to export is very similar to the relationship between age of firm and the survival rate known as “the passive learning by doing”. We also verify that the organization of firm is important like the previous result in Colombia. Corporate ownership increases the probability to export. One interpretation for this result is that corporate ownership has more possibility to spread risk caused by exporting activities compared to individual ownership.

We assume that firms share labor and capital if there is an exporting firm in the same region or industry, and utilize three variables for measuring the externality of exporting activity of other firms, as in Jung and Lee (2014). The results are consistent with Jung and Lee (2014). The coefficient of spillover variable in the same region and different 2-digit industry is negative and significant. This implies that if a firm is located in the same region as a high number of export firm in different industries, there is a negative effect for the propensity of exporting. They have the limitation of sharing specialized labor and capital, although they receive some knowledge for exporting. The coefficient of spillover variable in the different region and the same 2-digits industry is positive but insignificant. This means that even if there are many exporting firms in the same industry but the regions are different, the externality effect for the firms is not significant. According to this result, a firm has a higher probability to share input factors like labor and

capital in the same industry, but the proximity between firms is important. The coefficient of the spillover variable in the same region and 2-digits industry except itself is positive and significant. When we consider both region and industry, there is positive and significant spillover effects that increase the probability to export. This positive and significant coefficient shows that sharing the specific capital and labor in the same industry and the proximity as the agglomeration are important for increased propensity to export in Korea.

As the most important contribution of this paper, new insight for the relationship between competition and the probability to export is confirmed empirically after controlling for all possible determinants of the propensity to export such as the sunk costs, firm heterogeneity, and spillover effects. Competition exhibits non-linear relationship with the probability to export, and the form of non-linearity is an inverted-U shape.

4. CONCLUSION AND POLICY IMPLICATION

Korea has accomplished remarkable export-led-growth since the 1970s'. Therefore, identifying determinants of Korean firm decisions to export successfully is one of most important steps for analyzing Korean economic success.

This paper suggests the foundation of policy that Korea should consider for sustainable growth through analyzing the determinants of the decision to export. Particularly, the relationship between competition and the probability to export has not been considered in the Korean export market, or internationally. This research is the first to demonstrate the relationship between domestic competition and the propensity to export, reconciling the previous theories and empirical works.

This inverted-U shaped relationship has policy implications relating to competition, export strategy and economic growth. Competition in the market structure in industries should be considered carefully. The emergence

of China threatens the position of Korea as a major exporter in international markets. Even if individual firms have to try to enhance their productivity, competition or market structure also needs to be considered carefully to maintain sustainable growth in Korea.

For the future agenda, the relationship between competition and the propensity to export could be different according to industries separated by particular standards, for example, technology, the ratio of capital to labor, and the stage of product life cycle. Additional, research in various industries is needed.

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