



Exchange Rates and Firm Exports: The Role of Foreign Ownership and Subsidiaries

Hyelin Choi and Hyo Sang Kim



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Executive Summary

Exchange rates have been changed unusually large these days. From 2011 to 2016, the Euro and the Japanese Yen have depreciated against the US Dollar by more than 25 percent. According to a theory, since competitively valued exchange rate helps to boost export growth, we should have observed a substantial increase in export in the EU and Japan. However, the effectiveness of the exchange rates on exports appears to be weak across countries. This anomaly is one of the central puzzles in international macroeconomics: why large movements in the exchange rate have modest effects on the aggregate variables such as import prices, consumer prices, and quantity of exports.

In this paper, we examine the role of global production linkages on exchange rate elasticities by using Korean firm-level data. At firm-level, foreign-owned firms or firms with foreign subsidiaries participated in the Global Value Chains (GVC) play an important role in weakening the effect of exchange rate movements on firm exports. The empirical results show that the exchange rate elasticity of total export is about -0.64, which implies that 10% appreciation of Korean Won would make a drop in total export by 6.4%. However, the exchange rate elasticities of firms are not homogeneous across firms. We find that the exchange rate elasticities of firm exports are significant and negative for domestic-owned firms and firms without foreign subsidiary whereas those are insignificant for foreign-owned firms and firms with foreign subsidiaries.

After controlling exports to foreign affiliates, we still find that the estimated exchange rate elasticities of exports are statistically insignificant, but become negative and relatively larger for firms with global production linkages. Moreover, firms with higher GVC integration measure or more imported intermediate inputs have the significantly lower exchange rate elasticities of firm exports. It suggests that developments of global production linkages via firm ownership, within-industry or within-firm in the last decade play an essential role in alleviating the effect of exchange rate movements on the firm exports.

Keywords: Exchange Rate Elasticity, Firm Export, Production Linkage, Global Value Chains

JEL Classification: F14, F15, F23, F31

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Exchange Rates and Firm Exports: The Role of Foreign Ownership and Subsidiaries

Hyelin Choi[†] and Hyo Sang Kim^{††}

1. Introduction

Exchange rates have been changed unusually large these days. From 2011 to 2016, the Euro and the Japanese Yen have depreciated against the US Dollar by more than 25 percent. According to a theory, since competitively valued exchange rate helps to boost export growth, we should have observed a substantial increase in export in the EU and Japan. However, the effectiveness of the exchange rates on exports appears to be weak across countries. This anomaly is one of the central puzzles in international macroeconomics: why large movements in the exchange rate have modest effects on the aggregate variables such as import prices, consumer prices, and quantity of exports. Understanding the reasons behind the modest response of export to the exchange rate movement is important to conduct proper evaluations on the export policies and monetary policies.

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The lack of association between exchange rates and export values has led many economists to explore its causes. Some papers have focused on the firm's heterogeneity. Berman, Martin, and Mayer (2012) and Dekle, Jeong, and Ryoo (2016), for example, found that exporting firms with high productivity have less sensitive to the exchange rate changes by adjusting their mark-ups instead of export quantities. Amiti, Itskhoki, and Konings (2014) show that more import-intensive exporters are less sensitive to exchange rate changes because they face offsetting exchange rate effects on their marginal cost. In contrast to the previous papers, this paper considers the firm's global production linkages with particular emphasis on the role of foreign ownership and foreign subsidiaries. We investigate what patterns foreign-owned firms or firms which own foreign subsidiaries have in import and export and examine how they affect firm exports with respect to the exchange rate changes. If foreign-owned firms significantly depend on foreign intermediate inputs, exchange rate depreciation rather incurs negative impact on export by considerably raising input cost. Also, if firms that own foreign affiliates export goods to their affiliates with an export-import contract in advance, they are less affected by prices changes stemming from exchange rate changes.

The foreign-owned firms and firms with foreign subsidiaries are partially participating in global value chains (GVC) as multinational firms. In effect, the greater technical complexity of products, lower transport and communication costs and reduced barriers to foreign trade have enabled the cross-border fragmentation of production. The GVC has increasingly developed over the last two decades, and data shows that about a third of the value of world trade consists of GVC-related intermediate products. GVC may play a role in weakening the elasticity of exports. As exchange rate depreciation leads to increases in the local-currency cost of imported intermediate goods and associated local-currency export prices, the foreign consumers will face invariable foreign-currency import prices. That is to say, the exchange rate movements affect both cost of intermediate goods and price of exports in the opposite direction and offset exchange rate effect on the export.

We exploit whether foreign ownership and foreign subsidiaries contribute to loosening the effectiveness of changes in exchange rates on the export growth by using detailed Korean firm-level data. Korea is chosen for the following reasons: Korea is one of the largest outward FDI countries and the third highest countries in terms of GVC participation. Also, since Korea is an export-led economy, the effect of exchange rate elasticity on export is one of the most important issues discussed by international

economists and policymakers. Specifically, we attempt to analyze the reaction of firms to exchange rate movements by categorizing firms into four groups: domestic-owned and foreign-owned firms, and firms without foreign subsidiary and firms which own foreign subsidiaries. Firstly, we examine the exchange rate elasticity of total export in order to investigate the role of the foreign ownership and foreign subsidiaries in explaining export sensitivity to exchange rate changes. Secondly, we estimated the exchange rate elasticity of exports to other than foreign affiliates to examine the role of exports to the foreign parent company or foreign subsidiaries for inelastic exchange rate elasticities. Lastly, we examine whether industry-level GVC measures and imported intermediate inputs play roles in weakening the exchange rate elasticities.

The empirical results show that the exchange rate elasticity of total export is about -0.64, which implies that 10% appreciation of Korean Won would make a drop in total export by 6.4%. However, the exchange rate elasticities of total exports for foreign-owned firms and firms that own foreign subsidiaries are estimated insignificantly. Thus, we can expect that the relationships with foreign parent firm or foreign subsidiaries are important factors in weakening the effect of exchange rate movements on firm exports. Even after controlling the export to foreign affiliates, we find that exchange rate elasticities of firms are not homogenous across firms. The elasticities of domestic-owned firms and firms without foreign subsidiaries are estimated statically significantly negative, while the elasticities of firms with foreign linkages are statistically insignificant. However, the elasticities of foreign-owned firms and firms with foreign subsidiaries become negative and relatively larger, which implies that exports to foreign-related firms partially dilute the effect of exchange rate changes on firm exports. Also, we find that the elasticities get lower as firms are in the higher GVC participation industry and firms depend more on imported intermediate inputs. To summarize, global production linkages via firm ownership, within-industry or within-firm global production linkages alleviate the effect of exchange rate movements on the firm exports.

This paper is related to three strands of literature. Many papers already studied the effect of exchange rate movements on the firm's export. Bernard and Jensen (2004a) and Bugamelli and Infante (2003) examine the effect of exchange rate movements on export market entry, and Bernard and Jensen (2004b) and Forbes (2002) study the effect of a devaluation on export with data on the US manufacturing plants and companies around the world, respectively.

Another strand of literature is related to the papers which study the role of

foreign ownership. Some papers study the impact of foreign ownership on firm's survival and stability (Görg and Strobl (2003), Bernard *et al.* (2007)) and other papers examine the role of foreign ownership in responses to the economic downturn (Alvarez and Gorg (2007), Alfaro and Chen (2012)).

Lastly, some papers explicitly addressed the role of GVC in declining exchange rate elasticity. Fauceglia, Shingal, and Wermelinger (2014), Powers and Riker (2013), and Amiti, Itshhoki, and Konings (2014) show that the decrease in gross exports in response to an appreciation is smaller when the share of imported intermediates is larger. Ahmed, Appendino, and Ruta (2015) observe that the exchange rate elasticity of manufacturing exports has declined during the past two decades, with the growing role of GVC trade accounting for about two-fifths of the decline. Riad *et al.* (2012) find that position in the supply chain also matters, and countries on the downstream in the supply chain are less responsive to the changes in the exchange rate.

To the best of knowledge, this paper is the first to examine the role of global production linkages in weakening exchange rate elasticities using Korean firm-level data. We closely investigate the impact of firm-level ownership and foreign subsidiaries on exchange rate elasticities by controlling a variety of firm characteristics. Also, this paper brings a contribution by figuring out what mechanism works in explaining loosening exchange rate elasticities.

The remainder of the paper is organized as follows. Section 2 introduces data used in the analysis, and some insights can be obtained from the data. In Section 3, we estimate the exchange rate elasticities and present the empirical results. Lastly, we conclude in Section 4.

2. Data Description

We mainly employ the annual firm-level panel dataset, Survey of Business Activities (SBA) provided by Statistics Korea (KOSTAT). The SBA includes all firms in both the manufacturing and service sectors with more than 50 employees and more than 300 million Korean Won¹ in the capital, covering the period of 2006 through 2015. The total revenue of firms in the survey excluding finance industry is 1.91 trillion Dollars, and net income is 96.3 billion Dollar in 2015, corresponding to 138% and 7% of nominal GDP of Korea in 2015, 1.38 trillion Dollars. The total sum of exports of firms included in the SBA is 449 billion Dollar, which accounts for 85% of the aggregate export of Korea, 526 billion Dollars.² Thus, data has good representativeness of Korean export.

The SBA has several distinct features over alternative firm-level data to analyze the exchange rate elasticity of firm exports. First of all, this dataset contains non-listed and relatively small firms. Although the dataset excludes small firms which has less than 50 employees, it is reasonable to assume that the dataset is sufficient to analyze the export performance of firms because global market participation of a firm requires iceberg fixed costs and thus small firms could not enter the export market. Second, central to our analysis, the SBA reports not only balance sheets and financial statements but also management activities and operational information of firms such as domestic and foreign affiliates and business transactions with affiliates. Thus, this dataset provides valuable information on global production linkages of Korean firms.

We impose several requirements in cleaning the data. First, we combine industry classification into 11 categories to have a sufficient number of firms in each category.³ Second, we restrict the data only for the manufacturing sector as the majority of

¹ This is worth about 300,000 US dollar.

² Dollar value is computed based on 2015 average Won/Dollar exchange rate, 1,130.96.

³ 11 industries include (1) food, (2) textile and leather, (3) wood and paper, (4) petroleum, (5) chemical and rubber, (6) non-metal, (7) metal, (8) electronics, (9) optical and precision instruments, (10) machinery and equipment, (11) transportation. This industry classification is based both on the 2-digit Korean Standard Industrial Classification (KSIC) and the International Standard Industrial Classification (ISIC) Revision 3.

exporters are manufacturing firms. Third, we drop firms that do not export as we primarily investigate firm's export performance. As a result, 36,194 observations are left in the final sample, among which 3,206 observations are foreign-owned firms, and 14,784 observations are firms that own foreign subsidiaries.

To estimate the exchange rate elasticity of export, we obtain the industry-level real effective exchange rate (REER) from the Research Institute of Economy, Trade, and Industry (RIETI).⁴ RIETI provides industry-level nominal and real effective exchange rates in 29 countries including Korea. The industry-level REER is computed as follows:

$$REER_{jt} = \prod_{k=1}^n (RER_{jt}^k)^{\alpha_j^k} \quad (1)$$

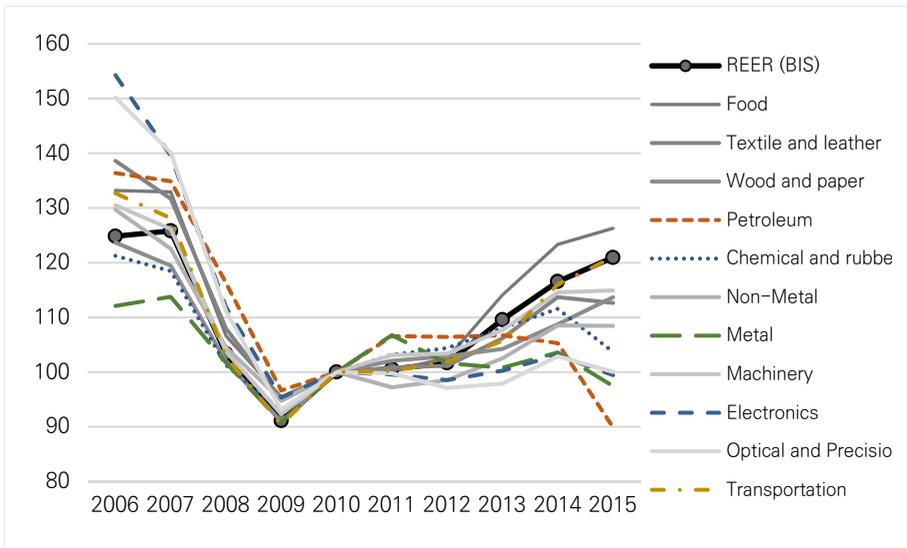
where $REER_{jt}$ is the REER of industry j and at year t , RER_{jt}^k is the bilateral real exchange rate between Korea and country k of industry j and in year t , and α_j^k is the export share of Korea of industry j to country k . The bilateral real exchange rate can be derived from the bilateral nominal exchange rate and price ratio between two countries

$$RER_{jt}^k = NER_{jt}^k \times \frac{P_{jt}^{Korea}}{P_{jt}^k} \quad (2)$$

where NER_{jt}^k is the bilateral nominal exchange rate between Korea and country k of industry j and in year t , and P_{jt}^k is the producer price index of country k of industry j and in year t .

⁴ See Sato *et al.* (2013) and Sato *et al.* (2015) for detail.

Figure 1. Industry-level Real Effective Exchange Rates



Note: The real effective exchange rates are normalized by 100 in 2010.

Source: RIETI and BIS.

While the REER provided by BIS has no variations by industry, the REER from RIETI has variations by industry. It allows us to control for industry-level unobserved heterogeneity. Figure 1 shows that there are some variations in REER across industries, but there are large devaluations in 2008 and 2009 for the global financial crisis and slow recovering afterward in general.

2-1. Production Linkages: Foreign Ownership and Foreign Subsidiaries

To interpret global production linkages, we classify whether a firm has a foreign parent firm and whether a firm owns foreign subsidiaries. Table 1 provides descriptive statistics for the primary variables of the exporting firms, separated by nationality of the ownership and separated by the presence of foreign subsidiaries.

Table 1. Descriptive Statistics: Export Firms

	Full sample	Domestic ownership	Foreign ownership	Firms with no foreign subsidiary	Firm with foreign subsidiaries
Employment	132	128	186	108	190
Total sales (billions Won)	43,064	40,741	85,481	31,957	71,931
Total assets (billions Won)	41,476	39,793	62,573	29,364	71,198
Net profit per total sales (%)	3.51	3.33	6.02	3.39	3.67
Log(TFP)	5.58	5.55	5.89	5.45	5.76
Log(Labor productivity)	4.96	4.94	5.19	4.88	5.07
Material share in cost (%)	0.55	0.55	0.59	0.54	0.57
Payroll share in cost (%)	0.14	0.14	0.14	0.15	0.13
Interest payment share in cost (%)	0.02	0.02	0.01	0.02	0.02
Export share in output (%)	0.29	0.29	0.31	0.26	0.34
Export share to foreign-related firms (%)	0.12	0.10	0.34	0.05	0.22
Import share in materials (%)	0.23	0.21	0.43	0.21	0.25
Import share from foreign-related firms (%)	0.10	0.08	0.34	0.05	0.17
Observations	36,194	32,988	3,206	21,410	14,784
Percent	100.00	91.14	8.86	59.15	40.85

Note: Average values are reported except employment, total sales, and total assets. Medians are reported for employment, total sale and total assets to eliminate the upward bias of few large firms.

Firms show different characteristics depending on whether they are domestic-owned or foreign-owned firms. On average, foreign-owned firms are larger than domestic-owned firms in terms of employment, total sales, and total assets. Also, on average, foreign-owned firms are more productive than domestic-owned firms regarding net profit, total factor productivity, and labor productivity. Interestingly, the imported input share of foreign-owned firms is double that of domestic-owned firms, and the export share is slightly higher than domestic-owned firms. It is due to that foreign-owned firms procure a significant share of intermediate goods from their foreign parent firms or other foreign affiliates and export relatively large share to their foreign-related firms.

The firms also show different characteristics regarding whether they own foreign subsidiaries or not. Firms which own foreign subsidiaries are relatively more substantial and productive than firms without foreign subsidiary. Also, they show different export shares in total output, in particular, the firms with foreign subsidiaries export more than firms without foreign subsidiaries. It is partly due to that a significant proportion of intermediate goods would be exported to foreign affiliates since Korean multinational

firms mainly use foreign affiliates as an assembly plant. Specifically, for the firms which own foreign subsidiaries, exports to foreign-related firms account for 22 percent of total exports.

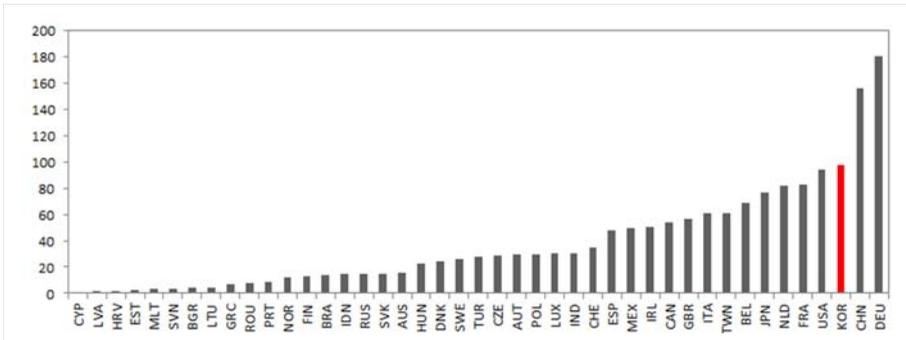
2-2. Global Production Linkages and GVC Integration

If firms are foreign-owned or firms have foreign subsidiaries, they are participating in GVC via global production linkages. To see whether our firm-level analysis is related to GVC measures widely used in the literature, we investigate whether the exchange rate elasticity of firm exports decreases with firms that are involved in the GVC. The GVC participation is measured by applying a disaggregated accounting framework proposed by Wang, Wei, and Zhu (2013) to World Input-Output Tables (WIOT). The WIOT covers 43 countries and the rest of the world and 56 industries for the period of 2000 through 2014. Wang, Wei, and Zhu (2013) allow us to decompose industry-level bilateral export into 16 components of three groups: domestic value added, foreign value added, and pure double counted terms. Based on these 16 terms, we can measure the degree of GVC participation, and it is obtained by calculating the ratio of vertical specialization to total export, where the vertical specialization is the summation of foreign-valued added and double counting from foreign sources. The higher the ratio is, the more the industry is involved in GVC.

According to the GVC measure obtained from WIOT, Korea is the third countries among which mostly participate in GVC, following Germany and China as shown in Figure 2. GVC participation varies across industries and Table 2 lists top 5 industries which show the highest GVC participation in Korea. Especially, Manufacture of coke and refined petroleum products is pronounced in GVC participation, followed by manufacture of basic metals and manufacture of chemicals and chemical products. Over the sample period, Korea's GVC participation has substantially increased as shown in Figure 3. Although there is a slight decline in GVC participation after the great financial crisis, it substantially increases over the mid-2000's.

In addition, to see whether industry-level GVC measure obtained from WIOT is consistent with the firm-level data, we compare the measure of GVC participation from WIOT with the within-industry share of firms which have global production linkages through foreign ownership or foreign subsidiaries. Figure 4 supports that they are very closely related.

Figure 2. GVC Participation (2014)



Note: The Figure reports the degree of GVC participation in 2014.

Source: Author calculation based on WIOT and Wang, Wei, and Zhu (2013).

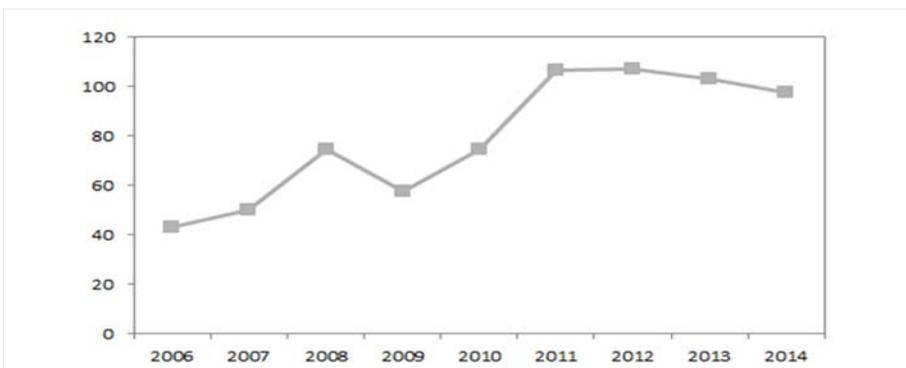
Table 2. GVC Participation by Industry for Korea (2014)

Industry	GVC
Manufacture of coke, briquettes and refined petroleum products	0.724
Manufacture of basic metals	0.438
Manufacture of chemicals and chemical products	0.425
Manufacture of computer, electronic and optical products	0.348
Manufacture of other transport equipment	0.333

Note: The Figure reports the degree of GVC participation in 2014.

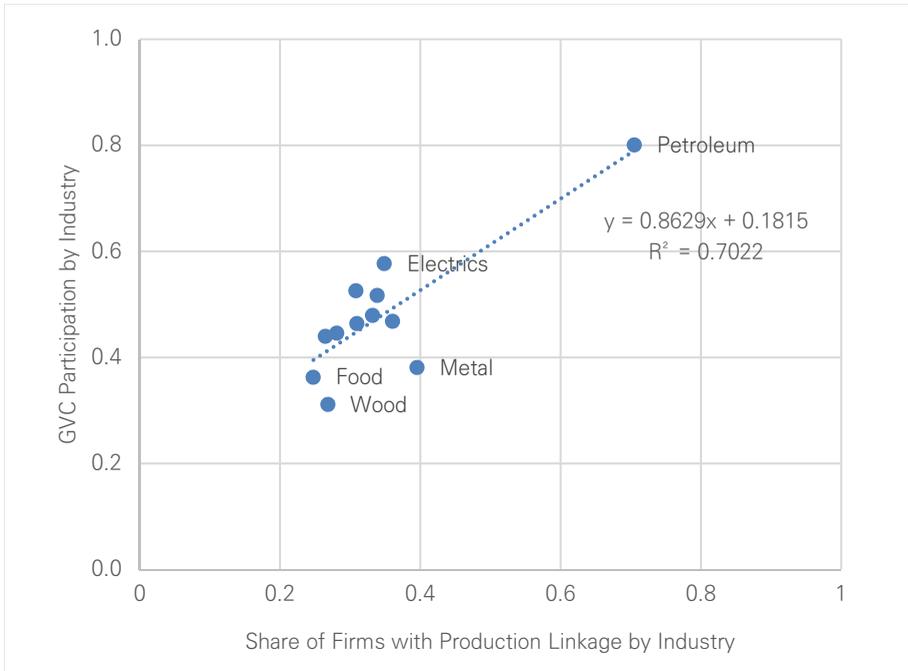
Source: Author calculation based on WIOT and Wang, Wei, and Zhu (2013).

Figure 3. Korea's GVC participation



Source: Author calculation based on WIOT and Wang, Wei, and Zhu (2013).

Figure 4. GVC Participation and Share of Firms with Production Linkages by Industry



Note: The share of firms with production linkages by industry (x-axis) is computed by the number of firms with foreign parent's firms or foreign subsidiaries divided by the total number of firms within the industry.

Source: Author calculation based on SBA and Wang, Wei, and Zhu (2013).

3. Empirical Evidence

This section presents our main empirical results. We start by estimating the exchange rate elasticity of total exports by analyzing subsamples of firms categorized by foreign ownership and foreign subsidiaries to investigate the role of global production linkages through foreign ownership and establishment. Then we estimate the exchange rate elasticities of exports to other than foreign-related firms to indirectly examine the role of foreign-related firms to lower exchange rate elasticities to firm exports. Lastly, we provide empirical evidence that exchange rate elasticities of firm exports decrease with the within-industry and within-firm global production linkage measures such as industry-level GVC integration measure and firm-level imported intermediate input share.

3-1. Exchange Rate Elasticity of Firm Exports

To empirically test the relationship between exchange rates and firm export, we begin with estimating the following equation:

$$\ln exp_{ijt} = \beta \ln REER_{jt} + \gamma X_{ijt} + \delta_j + \delta_t + \varepsilon_{ijt} \quad (3)$$

where exp_{ijt} denotes real exports of firm i in industry j at year t , which is measured by the export value of each firm deflated by industry-level PPI. $REER_{jt}$ is the industry-level real effective exchange rate of Korea in industry j at year t . We also include the total factor productivity (TFP) and the number of employees of firm i in industry j at year t to control for firm's productivity and size effect. Lastly, we control industry and year fixed effects to deal with demand-side effects such as global financial crisis and omitted variable bias. Here, we internally assume that firms in the same industry in a given year face the same world demand.

Table 3. Exchange Rate Elasticities on Total Exports

	(1)	(2)	(3)	(4)	(5)
Dependent Variable: $\ln(\text{Total Exports})$	Full Sample	Domestic Owned	Foreign Owned	No Foreign Subsidiary	Foreign Subsidiaries
$\ln REER$	-0.64*** (0.19)	-0.69*** (0.21)	0.09 (0.63)	-0.76*** (0.26)	-0.11 (0.28)
$\ln TFP$	0.48*** (0.025)	0.48*** (0.026)	0.48*** (0.091)	0.51*** (0.034)	0.43*** (0.033)
$\ln Employment$	0.75*** (0.037)	0.80*** (0.039)	0.61*** (0.14)	0.74*** (0.054)	0.70*** (0.056)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes
R^2 : within	0.069	0.070	0.065	0.065	0.071
between	0.279	0.275	0.219	0.172	0.377
overall	0.321	0.317	0.257	0.188	0.404
Observations	35,825	32,632	3,193	21,365	14,461

Note: Robust standard clustered errors at the firm level are in parenthesis with ***, ** and * denoting the significance level at 1%, 5%, and 10%, respectively.

We regress the exchange rate elasticity of firm exports in Eq. (3) using the fixed effects estimation by allowing for the unobserved error term ε_{ijt} that may be correlated with regressors.⁵ Table 3 reports the estimated exchange rate elasticities of firm exports after controlling the individual firm productivity and size effects. Column (1) in Table 3 shows that the estimated coefficient of the real effective exchange rate is statistically significantly negative in full sample. The estimated exchange rate elasticity is -0.64, which implies that 10% appreciation of real-valued Korean Won would lead a drop in total exports by 6.4% in real term. This result is consistent with the previous studies; Li, Ma, and Xu (2015), Berman, Martin, and Mayer (2012) and Dekle, Jeong, and Ryoo (2016) find that the exchange rate elasticities of Chinese, French and Japanese firm exports are -0.34, -0.70, and -1.34, respectively. The estimated coefficients on the individual firm TFP and employment are positive and

⁵ We also conduct the pooled ordinary least squares and random effect estimation. The results are robust with the estimation methods. As the results of Hausman test are rejected in the most cases, we only report the fixed effect models.

statistically significant. Thus, it supports that more productive and larger firms can export more.

Column (2)-(5) in Table 3 reports the estimated exchange rate elasticities of firm exports within subsamples of firms categorized by foreign ownership and foreign subsidiaries. The coefficients of the real effective exchange rate of domestic-owned firms and firms without foreign subsidiaries in Column (2) and (4) are estimated statistically significantly negative, whereas those of foreign-owned firms and firms that have foreign subsidiaries in Column (3) and (5) are estimated insignificant. Thus, it is substantial empirical evidence that firms, who have global production linkages via foreign ownership and establishment, lower the exchange rate elasticity of firm exports.

3-2. Inelastic Export to Exchange Rates: The Role of Foreign-Related Firms

In this subsection, we indirectly investigate why firms with global production linkages have inelastic export to exchange rate changes. On the one hand, if a firm has a significant share of exports that go to foreign parent firms or foreign subsidiaries, then the exports of the firm can be more inelastic to exchange rate changes. On the other hand, if a firm has global production linkages or networks that helps to manage the exchange rate risk, then exchange rate changes affect less to the firm exports.

To deal with this, we consider exports to other than foreign-related firms as the dependent variable. If exports to foreign parent firms or foreign subsidiaries are the only export share that is inelastic to exchange rate, the exchange rate elasticity on exports to other than foreign subsidiaries must become more substantial. As before, we categorize firms into four groups: domestic-owned and foreign-owned firms, and firms with and without foreign subsidiaries. Notably, we focus on foreign-owned firms and firms that own foreign subsidiaries because domestic-owned firms and firms without foreign subsidiary have the relatively small shares of export to foreign-related firms, so the results are expected to be similar with the previous subsection. If the exchange rate elasticities of exports to other than foreign-related firms on those groups are significant, it is more likely that exports to foreign-related firms make the elasticity insignificant. If not, then it is more likely that foreign-owned firms or firms that own foreign subsidiaries have their abilities to hedge the exchange rate risk.

Table 4. Exchange Rate Elasticities on Exports to Other than Foreign-Related Firms

	(1)	(2)	(3)	(4)	(5)
Dependent Variable: <i>ln(Export to Others)</i>	Full Sample	Domestic Owned	Foreign Owned	No Foreign Subsidiary	Foreign Subsidiaries
<i>ln REER</i>	-0.61*** (0.21)	-0.64*** (0.21)	-0.31 (0.90)	-0.95*** (0.28)	-0.40 (0.31)
<i>ln TFP</i>	0.48*** (0.027)	0.48*** (0.028)	0.43*** (0.11)	0.51*** (0.036)	0.42*** (0.038)
<i>ln Employment</i>	0.74*** (0.041)	0.74*** (0.042)	0.76*** (0.19)	0.75*** (0.057)	0.67*** (0.064)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes
<i>R</i> ² : within	0.058	0.061	0.054	0.059	0.052
between	0.271	0.273	0.249	0.162	0.363
overall	0.297	0.300	0.246	0.168	0.376
Observations	33,917	31,214	2,703	20,787	13,130

Note: Robust standard clustered errors at the firm level are in parenthesis with ***, ** and * denoting the significance level at 1%, 5%, and 10%, respectively.

According to the estimated results, besides direct exports to foreign-related firms, firms with foreign linkage through foreign ownership or foreign subsidiaries have some advantage to deal with exchange rate risks. Each column in Table 4 reports the empirical results on the exchange rate elasticities of firm exports to other than foreign-related firms for the full sample, domestic-owned firms, foreign-owned firms, firms without foreign subsidiary, and firms that own foreign subsidiaries, respectively. While the estimated coefficients of the real effective exchange rate of the full sample, domestic-owned firms, and firms without foreign subsidiary are statistically significantly negative in Column (1), (2) and (4), which are consistent with the previous results in Table 3, the estimated coefficients of the real effective exchange rate of foreign-owned firms and firms who own foreign subsidiaries are insignificant in Column (3) and (5). The estimated coefficients on the individual firm TFP and employment are positive and statistically significant across all categories.

Interestingly, even though the estimated coefficients of real effective exchange rates are insignificant for foreign-owned firms and firms who own foreign subsidiaries, they become negative and relatively larger in Table 4 than those in Table 3. Thus,

we would expect that exports to foreign parent firms or foreign subsidiaries partially reduce the exchange rate elasticities to firm exports, but there can be others than exports to foreign-related firms that lower exchange rate elasticities of firm exports as this effects are still insignificant.

3-3. The Role of Production Linkages

To understand the role of production linkages within industries and firms, we investigate the impacts of GVC integration and imported input shares on the exchange rate elasticities of firm exports. Thus, we consider the estimation equation as follows:

$$\ln exp_{ijt} = \beta_0 + [\beta_1 + \beta_2 GVC_{jt-1} + \beta_3 S_{it}] \times \ln REER_{jt} + \gamma X_{ijt} + \delta_j + \delta_t + \varepsilon_{ijt} \quad (4)$$

where $GVC_{jt-1} \in (0,1)$ is measured as the share of vertical specialization⁶ to total export in industry j at time $t - 1$, which is an industry-level GVC measure obtained by applying Wang, Wei, and Zhu (2013) to WIOD. $S_{it} \in (0,1)$ denotes the imported input share of firm i at time t , which is defined as the ratio of foreign intermediates to total intermediates (as material costs). From Eq. (3), we consider cross-product terms of firm-level imported input share and industry-level GVC integration measure with the real effective exchange rate. Those coefficients can be interpreted as a marginal effect of industry-level GVC integration and firm-level imported input share to exchange rate elasticity of firm exports.

⁶ Vertical specialization is calculated by adding foreign value added and pure double counting from foreign sources and the ratio of vertical specialization to total export is a measure of GVC participation.

Table 5. The Role of Production Linkages

	(1)	(2)	(3)	(4)	(5)
Dependent Variable: $\ln(\text{Total Exports})$	Full Sample	Domestic Owned	Foreign Owned	No Foreign Subsidiary	Foreign Subsidiaries
$\ln REER$	-0.74*** (0.20)	-0.77*** (0.21)	-0.25 (0.65)	-0.91*** (0.28)	-0.18 (0.28)
$GVC_j \times \ln REER$	0.16*** (0.043)	0.15*** (0.046)	0.23* (0.116)	0.21*** (0.056)	0.047 (0.067)
$S_i \times \ln REER$	0.051*** (0.008)	0.056*** (0.008)	0.019 (0.022)	0.035*** (0.011)	0.057*** (0.011)
$\ln TFP$	0.47*** (0.025)	0.47*** (0.026)	0.48*** (0.091)	0.51*** (0.035)	0.42*** (0.033)
$\ln Employment$	0.75*** (0.038)	0.77*** (0.040)	0.63*** (0.142)	0.74*** (0.056)	0.71*** (0.055)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes
R^2 : within	0.072	0.073	0.068	0.067	0.075
between	0.295	0.290	0.240	0.186	0.394
overall	0.336	0.333	0.271	0.199	0.420
Observations	34,559	31,416	3,143	20,490	14,069

Note: Robust standard clustered errors at the firm level are in parenthesis with ***, ** and * denoting the significance level at 1%, 5%, and 10%, respectively.

Table 5 reports the estimation results of the fixed effect panel regression. Each column in Table 5 presents the results of the full sample, domestic-owned firms, foreign-owned firms, firms without foreign subsidiary, and firms that own foreign subsidiaries, respectively. The estimated coefficients of the real effective exchange rate are negative and somewhat more substantial than the results in Table 3, as we control the global production linkage variables. In general, however, the estimated coefficients of the real effective exchange rate, TFP, and employment are consistent with the results in Table 3.

The estimated coefficients of the cross-product term of the industry-level GVC integration measure and the real effective exchange rate are positive and statistically significant for all models except the case of firms that owns foreign subsidiaries. Thus, firms in the industry with high GVC integration have inelastic export to exchange

rate changes. According to the estimated coefficients on Column (1) in Table 5, if the firms are in the industry that is fully involved in GVC ($GVC_j = 1$), 10% appreciation of real-valued Korean Won would lead to a drop of total exports by 5.8% (7.4% - 1.6%) in the real term. On the other hand, if the industry has nothing to do with GVC at all ($GVC_j = 0$), the firms in that industry would experience a drop in total export by 7.4%. Therefore, firms in the industry that involved in GVC have less sensitive on firm exports to exchange rate changes.

The estimated coefficients of the cross-product term of the imported input share and the real effective exchange rate are positive and statistically significant for all models except the case of foreign-owned firms. It can be intuitively understood because exchange movements affect both cost of intermediate goods and price of exports in the opposite direction and thus, attenuate the effectiveness of exchange rates on firm exports. Interestingly, even though foreign-owned firms have the most significant share of imported inputs, there are no significant effects on exchange rate elasticity of firms export. Foreign-owned firms may make a global production schedule in advance, so their exchange rate elasticities do not depend on the share of imported inputs.

4. Conclusion

This paper questions on the role of the global production linkages through foreign ownership and foreign subsidiaries to explain lowering exchange rate elasticities of firm exports. We find that the exchange rate elasticities of firm exports are heterogeneous across firms. The estimated exchange rate elasticities on firm exports are statistically significantly negative for domestic-owned firms and firms that have no foreign subsidiary, whereas those are insignificant for foreign-owned and firms that have foreign subsidiaries. Thus, we expect that global production linkages via foreign ownership and foreign subsidiaries can significantly lower the effect of exchange rate on firm exports. Also, we examine that the exports to foreign-related firms play essential roles to lower the exchange rate elasticities by analyzing exports to other than foreign-related firms. We find that exports to foreign-related firms can dilute the effect of exchange rate changes on firm exports, but the effects are not statistically significant. Lastly, we find that exchange rate elasticities of firm exports decrease with within-industry and within-firm global production linkage measures such as industry-level GVC participation measure and firm-level imported intermediate input share. All in all, global production linkages alleviate the effect of exchange rates on firm exports. It may be important to understand the low exchange rate elasticity of aggregate export.

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국문요약

2011~16년 사이 유로화 및 일본 엔화가 미국 달러화 대비 25% 이상 절하되었음에도 불구하고, 유럽과 일본의 수출은 증가하지 않았다. 이와 같이 환율 변동에도 불구하고 수입가격, 수출량 등의 거시변수가 왜 민감하게 반응하지 않는지는 국제경제학 분야의 오랜 질문이었다. 본 연구는 수출에 대한 환율탄력성이 낮은 이유를 기업의 국제적 생산연계를 통해 살펴보고자 하였다. 통계청의 기업활동조사를 바탕으로 기업의 수출이 환율에 어떻게 반응하는지를 국내소유기업과 해외소유기업, 그리고 해외지사를 보유하지 않은 기업과 보유한 기업으로 구분하여 살펴보았다. 분석 결과, 기업의 총수출은 환율에 유의하게 반응하는 반면, 해외소유기업 및 해외지사를 보유한 기업의 수출은 환율에 반응하지 않는 것으로 추정되었다. 해외 관련 기업에 대한 수출을 제외한 수출의 영향을 살펴보기 위하여, 총수출에서 해외 관련 기업에 대한 수출을 제외한 수출이 환율에 어떻게 반응하는지 기업 특성별로 살펴본 결과, 여전히 국내소유기업과 해외지사를 보유하지 않은 기업의 수출은 환율 변화에 통계적으로 유의하게 반응한 반면, 해외소유기업과 해외지사를 보유한 기업의 수출은 환율 변화에 유의하게 반응하지 않는 것으로 나타났지만, 총수출에 대한 탄력성에 비하여 더 크게 추정되었다. 한편 수입 중간재 비중 및 글로벌 가치사슬 참여 정도 등 기업의 국제적 생산연계 정도를 고려한 결과, 국제적 생산연계가 높은 기업의 환율탄력성이 유의하게 작은 것으로 나타났다.

핵심용어: 환율탄력성, 수출, 생산연계, 글로벌 가치사슬

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Exchange Rates and Firm Exports: The Role of Foreign Ownership and Subsidiaries

Hyelin Choi and Hyo Sang Kim

This paper examines the role of global production linkages on exchange rate elasticities by using Korean firm-level data. At firm-level, foreign-owned firms or firms with foreign subsidiaries participated in the Global Value Chains (GVC) play an important role in weakening the effect of exchange rate movements on firm exports. We find that the exchange rate elasticities of firm exports are significant and negative for domestic-owned firms and firms without foreign subsidiary whereas those are insignificant for foreign-owned firms and firms with foreign subsidiaries. After controlling exports to foreign affiliates, we still find that the estimated exchange rate elasticities of exports are statistically insignificant, but become negative and relatively larger for firms with global production linkages. Moreover, firms with higher GVC integration measure or more imported intermediate inputs have the significantly lower exchange rate elasticities of firm exports. It suggests that developments of global production linkages in the last decade play an essential role in explaining low exchange rate elasticity on exports.

