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Impact of Chinese Renminbi
on Korean Exports:
Does Quality Matter?

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Impact of Chinese Renminbi on Korean Exports: Does Quality Matter?

This paper examines the impact of changes in the Chinese exchange rate on Korean exports taking into consideration the characteristics of the exported products. In this paper, we consider the degree of vertical product differentiation to be one of the causes that ease the negative spillover effects from the depreciation of the Chinese renminbi on Korea's export performance. Using import data from OECD member countries from 2002 to 2014, we find that Korea's exports to OECD countries of the products that have a greater degree of competition fall more as the renminbi depreciates. In addition, once quality differences between Korea and China are considered in the estimation, the negative impact from the depreciation of the Chinese renminbi turn out to be negligible. Due to a small response to the depreciation of the Chinese renminbi for a high quality good, the negative impact diminishes in the markets and the products where Korean goods show a relatively higher quality than those of China.

Keywords: Export competition, Exchange rate pass-through, Quality, Product differentiation

JEL Classification: F10, F11, F13, F14, F31

I . Introduction

This paper examines the effects of the Chinese exchange rate on Korean exports in terms of export competition based on product characteristics. Recently, China has expanded its role in international trade. The structure of China's exports has evolved. Leading export industries used to be light manufacturing and assembly or processing in the manufacturing sectors, but now China's leading export industries have become sophisticated products in technology-intensive sectors, and are higher-technology products (Rodrik, 2006; Hausmann et al., 2007; Schott, 2008). As China's trade structure evolves into more mature stages, the main export products of China overlap with those from Korea.

Figure 1 shows the composition of export products from Korea and China. Panel A and B indicate the export value classified by industry (1-digit SITC code) from both Korea and China to the world, respectively. Both countries depend highly on the export of machinery and transport equipment. The major industries for export from Korean are manufactured goods and machinery, whereas from China it is machinery and manufactured articles. Exports of both machinery and manufactured articles from China have increased by nine and six times over 15 years, thanks to a boom in processing trade and the practice of assembling imported intermediate inputs.

Based on the significant similarity of the structure of each country's exports, it is clear that China becomes one of the major export competitors of Korea. As the trade structure of both countries become more similar, the export competition between the two countries towards the third market is more intensive. (Kim et al., 2006; Greenaway et al., 2008)¹.

1) Kim, Kim and Lee (2006) argue that the structure of China's exports has become similar to that of Korea, and that structural changes lead to export competition between Korea and China. Greenaway et al. (2008) argue that the transition of the structure of Chinese exports, from labor-intensive products to high-tech products, leads to Chinese exporters competing not with less developed countries, but with developed Asian countries.

Figure 1. Composition of Korean and Chinese Exports, Classified by 1-Digit SITC Code

In the face of severe export competition, export prices are one of key factors in capturing the export market share. The depreciation of the Chinese renminbi (henceforth RMB) makes the export price of Chinese goods relatively cheaper than that of Korean goods, improving China's price competitiveness. Thus, Korea is more likely to lose market share in common export markets while China expands its share in those export markets. Previous studies have attributed the effect of the depreciation of the RMB on Korean export focusing on the price competitiveness between Korea and China in terms of export value. Baak (2011) found the

depreciated Chinese RMB had negative impact on Korea's export to the U.S. import market from 1986 to 2008 whereas he also found the positive effect during the recent period (1995-2008). This implies that the degree of export competition in terms of export value is not enough to explain the competitiveness of export prices. Recently, due to vertical or horizontal product differentiation, the degree of substitution between products from Korea and China also influence on the level of export competition. If two products are highly replaceable, the impact of price competitiveness on Korea's exports would be significant. On the other hand, the effect would be small if the two products are highly differentiated. Therefore, we consider the degree of product differentiation, especially vertical differentiation, as one of the factors influencing relative export prices.

The contributions of this paper are to show the theoretical expectations and also to provide empirical evidence by taking into consideration the degree of export product substitutability as well as product differentiation. This paper links the model of Chen and Juvenal (2016) and that of Mattoo et al. (2017) to show the effects of the RMB exchange rate on Korean exports, reflecting the vertical differentiation of products which is quality. From the model of Chen and Juvenal (2016), we introduce a theoretical framework that allows the pricing strategies of firms to be in line with a firm's export product quality. According to these findings, under the assumption that local distribution costs denoted in the currency of the importers are higher for a high quality good, the exchange rate pass-through is incomplete and heterogeneous based on product quality. Therefore, the effects of the depreciated RMB on the aggregate export value of Korea would vary according to product quality.

Additionally, empirical evidence is provided by using the import data of OECD countries from 2002 to 2014. To measure the substitutability of goods from Korea and China, we use three indices showing the degree of substitutability and complementarity between products from Korea and China. The indices measure the Chinese share of imports (import ratio

from China over total imports) adjusted by the degree of importance as key products for Korea, for China and also for the importers themselves. In addition, we introduce a methodology to measure the degree of vertical product differentiation using export product quality data as provided by the World Bank and the IMF.²⁾ We use the relative quality index to show how the export products of Korea have relatively higher quality than those from China. Another quality index we use in this paper is that we measure how Chinese export quality satisfies the level of quality that importers demand. Therefore, we estimate the effects of the depreciation of the RMB on Korean exports that are different in line with the heterogeneous export product quality.

Our estimation results show that the depreciation of the RMB causes a more significant reduction to Korea's export in the markets and products that show a greater degree of competition, i.e., a 10 percent depreciation of RMB is associated with a reduction in Korea's export by 0.1 percent. However, for products that are key for China, exports from Korea increase more at a given depreciation of the RMB: a 10 percent depreciation of RMB is associated with an increase in Korea's export by 0.07 percent. This implies that China's major export products are complementary to Korean export products, based on the fact that Korean export increases at a given depreciation of RMB.

In terms of quality differences among export products, we also find that the negative spillover effects from the depreciation of the RMB are larger when Chinese export product quality sufficiently meets the needs of the importers. However, for export products from Korea that shows relatively higher quality, the magnitude of the negative effects become smaller.

2) The World Bank and the IMP provide the export and import quality estimates across 835 products, 162 countries from 1964 to 2014. Quality estimates are derived from unit values with two adjustments, production costs and pricing strategies. In detail, trade price equation including unobservable quality, production costs, and distance between importer and exporter (a proxy for pricing strategies) is applied to the quality-augmented gravity equation, and so quality estimates are obtained at each importer-exporter-product-year level. See Henn et al. (2017) for details.

The remainder of the paper is structured as follows. In Section 2, a review of the literature is discussed. The theoretical model is derived in Section 3. The empirical estimations are reported in Section 4. The data and the estimation results are presented in Sections 5 and 6, respectively. Finally, in Section 7, the paper is summarized, and conclusions are drawn.

II. Literature Review

A common strand in the literature analyzes the relationship between the exchange rate, exports, and quality. Previous studies find that the effects of changes in the exchange rate on prices, such as imports, exports and consumer prices. The effects are found to be limited due to the behavior of firms. This limited effect is the called “incomplete exchange rate pass-through,” indicating the magnitude of the response in prices, which does not fully reflect the unit change in exchange rate. Many studies find that the exchange rate pass-through is incomplete on import prices (Campa and Goldberg, 2005; Gopinath and Rigobon, 2008), on consumer prices (Goldberg and Campa, 2010), and on export prices (Amiti et al., 2014; Berman et al., 2012; Chatterjee et al., 2013). Krugman (1987) finds that changes in the exchange rate do not fully reflect the price, because exporters adjust their mark-up in response to the exchange rate shock in a monopolistic competition market. Market share acts as an important role in determining the pass-through, according to Froot and Kemperer (1989) and Feenstra et al. (1996). Froot and Kemperer (1989) argue that the exchange rate pass-through is incomplete due to firms’ price adjustment once their future demand is determined by current market share. Feenstra et al. (1996) provide a theoretical framework to show the relationship between the exchange rate pass-through and the market share, and provide empirical evidence with trade data from France, Germany, Sweden and the U.S. showing that the rates of pass-through are heterogeneous depending on the source country’s market share. Other factors influencing price elasticity besides

market share, i.e., the degree of product differentiation and quality, come up as sources of causing an incomplete exchange rate pass-through.

Starting in mid 2010, economists began to consider the relationship between the exchange rate and product quality. Auer et al. (2018) show theoretically and empirically how a firm's markup pricing strategies are determined by the interaction of quality and the consumer's valuation of quality, based on the idea that product quality is one of the core determinants of a firm's pricing-to-market decision. They confirm two predictions derived from the theoretical model by using European car market data from 1970 to 1999: (1) relative prices in rich markets compared to poor markets are higher as the quality of goods gets higher; (2) the pass-through rate of the exchange rate into the consumer price is likely to decrease in quality once the income of the importer is sufficiently high. In line with their study, the differences in product quality make exporting firms behave heterogeneously in response to any exchange rate movement (Chen and Juvenel, 2016). According to their theoretical model predictions, exporters change the export price more and export volumes less for high-quality goods in response to a change in the real exchange rate. In addition, they confirm the predictions that the exchange rate pass-through decreases with product quality by using Argentinean wine producing firm data. Although their paper firstly introduces firms that produce multiple-products with different levels of quality in the presence of local distribution costs, it does not consider market-specific preferences for quality.

After China's join in WTO in early 2000, many papers shed light on export competition between China and other Asian countries. Holst and Weiss (2004) argue that ASEAN countries would compete in terms of export performance in third markets with China based on their empirical estimation with ASEAN exports to the U.S. and Japan during the 1995-2000. According to Athukorala (2009), the early studies overlooked the vertical specialization across countries in Asia which forms a regional production network. He argues that a rising China in the international

trade market does not necessarily crowd out other exporters based on empirical evidence using Asian countries trade data from 1992 to 2005 with China. The studies focused on export competition in Korea are also in line with the purpose of this paper. Won and Lee (2017) examine export competition among Korea, Japan and China toward the ASEAN import market and find that Chinese market share has increased and substituted that of the Japanese. They also find that the effects on exports of changes in the real exchange rate are limited. In other words, there are little substitution effects in terms of market share caused by relative prices.

Several studies previously examine the effects of the Chinese RMB on the exports of China itself and other Asian countries. Benassy-Quere et al. (2003) find that volatility in the Chinese exchange rate affects the volume of other Asian countries' exports by analyzing China and 11 other Asian countries' exports from 1984 to 2001. Thorbecke and Smith (2008) find that appreciation of the RMB has a smaller impact than appreciation of generalized Asian currencies on China's exports. Baak (2014) estimates the effects of the Chinese RMB exchange rate on Korea's exports to Japan from 1986 Q1 to 2003 Q4, and find that a 1% depreciation of the Korean won raises China's exports to Japan by 2%, while a 1% appreciation of the RMB increases Korea's export by less than 1 %. Another study of Baak (2011) focuses on the US import market and finds that depreciation of the RMB has negatively impacted over 1986-2008 but positively impacted during 1995-2008. The effect of Chinese RMB depreciation on Korea's export has changed dramatically over the observation period. This implies that the effects of the Chinese RMB depreciation on Korean exports could not only be explained by price competitiveness. Rather than, the complementarity of exports of Korea and China draw the results of Baak (2011).

The depreciated currency could raise the exports of the other once exports of Korea and China complement each other through the global supply chain, for example. Mattoo et al. (2017) discuss the effects of

China's exchange rate changes on developing countries exports to third markets. They estimate the competitor country effect for 121 developing countries from 2000 to 2014 and show that exporters competing more with China tend to get hurt more in the market from the depreciation of the RMB. They find that export competitors increase exports by 1.5 to 2.5 percent, on average, as the Chinese RMB appreciates by 10 percent. However, their paper does not consider the different levels of quality of the exported products. Therefore, in this paper, we explore the effects of changes in the value of the RMB on Korean exports to third markets by taking heterogeneous product quality into consideration.

III. Theoretical Framework

1. Pricing-to-market Strategy of Chinese Exporting Firms

Following the theoretical framework of Berman et al. (2012) and Chen and Juvenal (2016), we keep the model simple. We limit our focus to Chinese exporting firms at the firm-level analysis. Our model allows the Chinese exporting firms' pricing-to-market strategy according to the export product quality under the assumption of an incomplete exchange rate pass-through (henceforth ERPT). Let assume J countries (Home) import a fixed number of G different goods. Suppose that Home country j imports from various source countries $i = 1, \dots, J$ ($i \neq j$). Let then assume the case of China as a source country. China produces a continuum of differentiated varieties, φ , of each good $g \in \{1, \dots, G\}$. We also assume that the market is monopolistic competition, and that each exporting firm in China produces each differentiated variety, φ . Accordingly, φ indicates a variety, firm, as well as firm-specific productivity.

A representative agent has the utility of importer j toward good g imported from China, $U(c_g^{CNj})$. The utility function of importer j to

good g imported from China is $U(c_g^{CNj}) = [\int_{N_g^{CNj}} (x_g^{CNj} q_g^{CN}(\varphi))^{(\sigma_g-1)/\sigma_g} d\varphi]^{\sigma_g/(1-\sigma_g)}$

where $x_g^{CNj}(\varphi)$ is the consumption of variety imported to j from China, and $q_g^{CN}(\varphi)$ is the level of quality of goods exported from China. According to Feenstra et al. (2018) and Chen and Juvenal (2016), the relationship between quality ($q_g^{CN}(\varphi)$) and productivity is defined as follows. We denote global good-specific productivity shock as A_g , country-specific productivity shock as A^{CN} , wage of China (ω_g^{CN}), and firm-specific productivity as φ . Products with higher quality have higher marginal costs. Thus, quality is denoted as a function of productivity in the form of $q_g^{CN}(\varphi) = (\frac{\omega_g^{CN}}{A_g A^{CN} \varphi})^\lambda$ (where $\lambda > 1$).³⁾ Thus, higher quality

goods have a lower productivity and higher marginal costs. We denote $p_g^{CNj}(\varphi)$ as the profit maximizing export price expressed in RMB, the price of a variety of good g in the exporting country, China, for firm φ . Following Berman et al. (2012) and Chen and Juvenal (2016), we also assume that additional distribution costs beside the “iceberg transportation costs” (τ_g^{CNj}) are needed to be paid in the currency of the importer. The additional distribution cost is expressed as $\eta_g^j \omega_g^j q_g^{CN}(\varphi)$, composed of units of labor per good g produced (η_g^j), the wage rate for producing good g in country j (ω_g^j), and the quality of variety that the firm produced ($q_g^{CN}(\varphi)$). Therefore, the distribution costs increase with quality, but are not affected by the movement of the exchange rate. The import price ($p_g^{CNj*}(\varphi)$), as expressed in units of local currency of importer j , is shown in Equation (1)

$$p_g^{CNj*}(\varphi) = \frac{\tau_g^{CNj} p_g^{CNj}(\varphi)}{E^{CNj}} + \eta_g^j \omega_g^j q_g^{CN}(\varphi) \quad (1)$$

3) Markups increase with quality (Chen and Juvenal, 2016).

where τ_g^{CNj} is the iceberg transportation costs; E^{CNj} is the nominal exchange rate between China and the importer, measured in RMB per importer j 's local currency unit; and, the wage rate in importer j is w^j .

On the other hand, the profit maximizing export price expressed in Chinese RMB is shown in Equation (2)

$$p_g^{CNj}(\varphi) = \left(\frac{\sigma_g}{\sigma_g - 1}\right) \left(1 + \frac{\eta_g^j r^{CNj} \varphi q_g^{CN}(\varphi)}{\sigma_g \tau_g^{CNj}}\right) \left(\frac{\omega_g^{CN}(\varphi)}{\varphi}\right) \quad (2)$$

where $r^{CNj} = E^{CNj} \frac{\bar{\omega}^j}{\bar{\omega}^{CN}}$ is the real exchange rate between China and the importer; and, the average wage rate in importer j and in China are $\bar{\omega}^j$ and $\bar{\omega}^{CN}$, respectively. By plugging Equation (2) into Equation (1), the import price of Chinese goods is expressed as Equation (3).

$$p_g^{CNj*}(\varphi) = \left(\frac{\sigma_g}{\sigma_g - 1}\right) \left(\frac{\tau^{CNj} \omega_g^{CN}}{r^{CNj} \varphi} + \eta_g^j w_g^j q_g^{CN}(\varphi)\right) \quad (3)$$

As shown in Equation (3), Chinese firms' pricing-to-market strategy generates an additive term reflecting local distribution costs. The import price p_g^{CNj*} , denoted in importer's currency unit, increase with quality. In addition, the effects of the real exchange rate on import price vary with quality of the exported goods, as indicated in Equation (4). The exchange rate pass-through is written as a function of quality. As the real exchange rate depreciates (r^{CNj} increases), the import price expressed in units of local currency for importer decreases ($p_g^{CNj*}(\varphi)$ reduces). In addition, the exchange rate pass-through ($\mu_{p_g^{CNj*}}(\varphi)$) decrease with quality of the exported products ($q_g^{CN}(\varphi)$).

$$\mu_{p_g^{CNj*}}(\varphi) = \left| \frac{\partial p_g^{CNj*}(\varphi)}{\partial r^{CNj}} \frac{r^{CNj}}{p_g^{CNj*}(\varphi)} \right| = \frac{\tau^{CNj} \omega_g^{CN}}{\tau^{CNj} \omega_g^{CN} + \eta_g^j w_g^j q_g^{CN} \varphi r^{CNj}} \quad (4)$$

2. Impact of Changes in the Exchange Rate on Aggregate Imports

Now, we focus on the aggregate-level, good g . Let assume that Korea is one of source countries. Following the model of Mattoo et al. (2017), we could express Home country j 's spending on imports of good g from Korea at time t (V_{gt}^{KRj}) as in Equation (5).

$$V_{gt}^{KRj} = [K_{gt}^{KRj} (\frac{P_{gt}^{KRj}}{P_{gt}^{Fj}})^{1-\sigma_g}] [(1-\beta_{gt}^j) (\frac{P_{gt}^{Fj}}{P_{gt}^j})^{1-w_g}] [\alpha_{gt}^j (\frac{P_{gt}^j}{P_t^j})^{1-\eta}] P_t^j C_t^j \quad (5)$$

where K_{gt}^{KRj} ($0 \leq K_{gt}^{KRj} \leq 1$) is the random preference weight that importer j attaches to Korea; $1-\beta_{gt}^j$ ($0 \leq \beta_{gt}^j \leq 1$) shows the random preference weight that consumers in j attach to foreign produced goods; α_{gt}^j indicates the random preference weight on good g with $\sum_g \alpha_{gt}^j = 1$; σ_g , w_g and η are the elasticity of substitution between good g 's variety φ originating in different exporters, that between the home produced and foreign produced variety φ , and that between differentiated good g , respectively.

As noted in Mattoo (2017), the import demand depends on three parts besides the total consumption of importer j , $P_t^j C_t^j$. The first term on the right-hand side consists of the price index of good g that is imported from Korea relative to the price index of imported good g from all trading partners, the consumer's preference weight for good g from Korea (κ_{gt}^{KRj}), and the elasticity of substitution between the imported varieties, φ (σ_g). The second term depends on the price index of good g that is imported from all source countries relative to the price index of good g , the consumer's preference weight for foreign-produced good g ($1-\beta_{gt}^j$), and the elasticity of substitution between the home and foreign varieties of φ (w_g). The third term consists of the price index of good g relative to the price index of all goods, the consumer's preference weight for

good g (α_{gt}^j), and the elasticity of substitution between different goods (η).

The effects of a change in the real exchange rate between the RMB and the importer's local currency, which is denoted as R_t^j on the import value of good g imported from Korea (V_{gt}^{KRj}) can be seen as the results of the partial derivatives. The effects of a change in the real exchange rate of the RMB is composed of three parts: (1) the effects of the aggregated import varieties price index (P_{gt}^{Fj})⁴ on the spending share on Korean goods, (2) the effects of the import price index for goods from China (P_{gt}^{CNj}) on the world price index, and (3) the effects of change in the exchange rate on the import price index of goods from China.

$$\frac{\partial \ln V_{gt}^{KRj}}{\partial \ln R_t^j} = \frac{\partial \ln V_{gt}^{KRj}}{\partial \ln P_{gt}^{Fj}} \frac{\partial \ln P_{gt}^{Fj}}{\partial \ln P_{gt}^{CNj}} \frac{\partial \ln P_{gt}^{CNj}}{\partial \ln R_t^j} \quad (6)$$

The first term on the right-hand side of Equation (6) can be expressed as the elasticity of substitution between imported goods minus one, as denoted in Equation (7).

$$\frac{\partial \ln V_{gt}^{KRj}}{\partial \ln P_{gt}^{Fj}} = \sigma_g - 1 \quad \text{where } \sigma_g > 1 \quad (7)$$

The second term, the price elasticity of the foreign price index with respect to the price index of the Chinese good g , is equal to the share of expenditure on Chinese good g to the total imports of good g at time t , S_{gt}^{CNj} .

$$\frac{\partial \ln P_{gt}^{Fj}}{\partial \ln P_{gt}^{CNj}} = \frac{K_{gt}^{CNj} (P_{gt}^{CNj})^{1-\sigma_g}}{\sum_{i \neq j} K_{gt}^{ij} (P_{gt}^{ij})^{1-\sigma_g}} = \frac{K_{gt}^{CNj} (P_{gt}^{CNj})^{1-\sigma_g}}{\sum_{i \neq j} (P_{gt}^{ij})^{1-\sigma_g}} = K_{gt}^{CNj} \left(\frac{P_{gt}^{CNj}}{P_{gt}^{Fj}} \right)^{1-\sigma_g} = S_{gt}^{CNj} \quad (8)$$

4) $P_{gt}^{Fj} = \left[\sum_{i, i \neq j} K_g^{ij} (P_{gt}^{ij})^{1-\sigma_g} \right]^{1/(1-\sigma_g)}$

The last term $\frac{\partial \ln P_{gt}^{CNj}}{\partial \ln R_t^j}$ indicates the extent of changes in local-currency import price with respect to the bilateral exchange rate, so-called exchange rate pass-through. As indicated in Equation (9), local-currency import price of importer j (P_{gt}^{CNj})⁵⁾ is the product of export price of Chinese good denoted in Chinese RMB (P_{gt}^{CN}) and the bilateral exchange rate ($1/R_t^j$ where R_t^j indicates exchange rate of importer with respect to China, measured as RMB/importer currency) raised to the power of bilateral exchange rate elasticity (μ_g^{CNj}).

$$P_{gt}^{CNj} = P_{gt}^{CN} (1/R_t^j)^{\mu_g^{CNj}} \quad (9)$$

Thus, the partial derivatives of export prices denoted in the importer's currency with respect to the exchange rate is the negative exchange rate elasticity, $-\mu_g^{CNj}$. According to the previous studies that estimate the pass-through rate of the RMB, the estimates are not equal to one, indicating an incomplete exchange rate pass-through (ERPT) (Kim et al., 2013; Auer, 2015; Li et al., 2015).⁶⁾ Therefore, we use incomplete ERPT estimates from the previous studies. Later, we use complete ERPT by setting the value to one to show the robustness of the estimation results.

$$\frac{\partial \ln P_{gt}^{CNj}}{\partial \ln R_t^j} = -\mu_g^{CNj} \quad (10)$$

5) The local-currency price index ($P_g^{CNj} = [\int_{N_g^{CNj}} (P_g^{CNj*}(\varphi))^{1-\sigma_g} d\varphi]^{1/(1-\sigma_g)}$) is the sum of the import price of Chinese goods (P_g^{CNj*}) from Equation (3).

6) Kim et al. (2013) use micro data, goods-level price data, and measure the degree of change in the exchange rate on the import price index from 2005 to 2008. They suggest that the ERPT is up to 0.8. Auer (2015) estimates the effect of the changes in the RMB on the U.S. import price index from 1994 to 2010 and suggests that the estimate is 0.563. Li et al. (2015) find an incomplete ERPT using Chinese firm-level data from 2000 to 2007. They suggest that 10% depreciation in the bilateral real exchange rate increases export prices by less than 0.5%.

Overall, the effects of changes in the exchange rate on exports from Korea can be shown in Equation (6) by combining Equations (7), (8) and (9).

$$\frac{\partial \ln V_{gt}^{KRj}}{\partial \ln R_t^j} = (1 - \sigma_g) S_{gt}^{CNj} \mu_g^{CNj} \quad (11)$$

The effect of the bilateral exchange rate between the Chinese RMB and the importer's local currency (R_t^j) on the import value of good g from Korea (V_{gt}^{KRj}) can be seen in three parts. (1) The effect of the aggregated import price index (P_{gt}^{Fj}) on the import value from Korea (V_{gt}^{KRj}) is equal to the elasticity of substitution between the imported goods, $\sigma_g - 1$. (2) The effects of the import price index for good g from China (P_{gt}^{CNj}) on the aggregate import price index (P_{gt}^{Fj}) is expressed as a share of expenditures on the good g from China at time t , S_{gt}^{CNj} . (3) The effects of change in the exchange rate on the import price index of good g from China is expressed as the exchange rate pass-through, $-\mu_g^{CNj}$. Therefore, the overall effect is expressed as the product of elasticity of substitution between imported goods, the import share of expenditures on Chinese goods, and the exchange rate pass-through. We expect the overall effect would be negative because the elasticity of substitution (σ_g) is less than 1, by definition, and others (S_{gt}^{CNj} , μ_g^{CNj}) would have positive values. This implies that the depreciation of the Chinese RMB, increasing R_t^j , would decrease the export value of Korean goods by increasing the import share of Chinese goods. The other two parameters control the magnitude of the effect during the empirical estimation process.

IV. Empirical Analysis

1. First Step of Estimation

From Equation (11), the competitor country effect caused from the depreciation of the Chinese RMB is estimated by the following equation.

$$\ln V_{gt}^{KRj} = \beta \cdot S_{gt}^{CNj} \times \mu_g^j \times \ln R_t^j + \gamma_{gt} + \zeta_g^j + \varepsilon_{gt}^j \quad (12)$$

The dependent variable is the logged industry g import value of country j from Korea at time t , $\ln V_{gt}^{KRj}$. $\ln R_t^j$ indicates the logged real exchange rate measured in RMB per importer j 's local currency based on the period average value at time t . S_{gt}^{CNj} is the Chinese share of the importer's market at time t . μ_g^j is a proxy for the elasticity of the bilateral exchange rate between the importer's local currency unit and the Chinese RMB, indicating the effect of the exchange rate on Chinese export prices denoted in the importer's currency. Due to a lack of data, we could not estimate the exchange rate pass-through. Instead, we use the estimates of the exchange rate pass-through from the estimates from Campa and Goldberg (2005) and Casas (2019)⁷⁾. Product-year (γ_{gt}) and product-country fixed effects (ζ_g^j) are used.⁸⁾

We use three indices to show the level of substitutability (complementarity) of products between Korea and China based on OECD import market share. All indices include a ratio of imports from China

7) We use the estimates of the exchange rate pass-through into import prices for 23 OECD member countries from Campa and Goldberg (2005). They estimate the ERPT into import prices using quarterly data from 1975 to 2003 and find a partial ERPT in the short run. Asymmetric industry ERPT estimates are obtained from Casas (2019). She uses microdata from Colombia, and estimated the ERPT into import and export prices for each industry. We use the estimates of ERPT into import prices for 18 SIC industries. We transform the ERPT, which varies both across importers as well as industries, by using a weighted average calculation. Please see the Appendix for details.

8) Year-country fixed effects show high collinearity with the explanation variable due to exchange rates that vary by year and country.

over total imports (henceforth, the share for China or the Chinese share) indicating how important China is as a source country for importers. Additionally, the indices also include information that how important the product is as an export from Korea, from China, and as well as for the importers. The first index measures the weighted Chinese share by the degree of the substitutability of the export items from Korea. In other words, the weight measures how much disaggregate product g' (HS 6-digit level) account for the export of the aggregate product g (HS 4-digit level) from Korea in OECD market. The index, following an index of Mattoo (2017), is higher as the degree of competition between Korea and China is greater. As the Chinese share of the products that are core export items for Korea increases, it indicates that the degree of competition between the two countries is higher.

Mathematically, the index is composed of the Chinese share of good g' over total imports of good g' ($S_{g't}^{CNj} = \frac{V_{g't}^{CNj}}{\sum_i V_{g't}^{ij}}$) multiplied by the import

share of good g' over the aggregate level of imported good g from Korea ($I_{g't}^{KRj} = \frac{V_{g't}^{KRj}}{\sum_{g'} V_{g't}^{KRj}}$). In order to have the index at the level of HS 4-digit,

we sum the products over all g' goods, denoted as $LKR_{gt}^j (= \sum_{g'} S_{g't}^{CNj} I_{g't}^{KRj})$.

The second index is the sum of the Chinese share multiplied by the import share of good g' over the aggregate level of good g from all exporters. This is denoted as $LWD_{gt}^j (= \sum_{g'} S_{g't}^{CNj} I_{g't}^{WDj})$ and indicates the

adjusted Chinese share by the importance of the goods for the importers. The higher value of the weight indicates that items are crucial for the total imports from all trading partners. Thus, the degree of dependence on imports from China is larger as the value of the indicator is high. The third index is the sum of the Chinese share multiplied by the import share of good g' over the aggregate level of imported good g from China, denoted as $LCN_{gt}^j (= \sum_{g'} S_{g't}^{CNj} I_{g't}^{CNj})$. This shows the weighted

Chinese share by the degree of to which the imported items are crucial for China's exports. The higher value of the index indicates that Chinese export share increase for items that are crucial for China itself. Therefore, this indicator shows the level of export intensity of products from China.

The exchange rate pass-through (μ_g^j) is incomplete in our model, so the exchange rate pass-through varies across import markets and also across industries. The interaction between the exchange rate and the index of the share of China ($S_{gt}^{CNj} \times \mu_g^j \times \ln R_t^j$) is the variable of interest. The coefficient of the interaction term, β , measures the extent of changes in Korean exports to OECD markets due to a greater (lesser) degree of competition between Korea and China at a given depreciation of the RMB. The expected sign of β would be negative, which implies that exports from Korea would be hurt more ceteris paribus as the Chinese share increases in a given market when the Chinese RMB depreciates.

The other omitted variables are controlled by various forms of fixed effects, product-country and product-year fixed effects.⁹⁾ Product-country fixed effects control specific industries in specific country shocks, such as industry specific supply shock in a certain country. Product-year fixed effects control any industry specific time varying characteristics. For example, a reduction in oil prices would affect specific manufacturing

Table 1. Adjusted Import Share From China Over Total Imports

(1)	Level of substitutability	$LKR_{gt}^j = \sum_g S_{gt}^{CNj} I_{gt}^{KRj} = \sum_g \left(\frac{V_{gt}^{CNj}}{\sum_i V_{gt}^{ij}} \frac{V_{gt}^{KRj}}{\sum_g V_{gt}^{KRj}} \right)$	Weighted by degree of key products for Korea's export
(2)	Level of dependency	$LWD_{gt}^j = \sum_g S_{gt}^{CNj} I_{gt}^{WDj} = \sum_g \left(\frac{V_{gt}^{CNj}}{\sum_i V_{gt}^{ij}} \frac{V_{gt}^{WDj}}{\sum_g V_{gt}^{WDj}} \right)$	Weighted by degree of key products for importers
(3)	Level of intensity	$LCN_{gt}^j = \sum_g S_{gt}^{CNj} I_{gt}^{CNj} = \sum_g \left(\frac{V_{gt}^{CNj}}{\sum_i V_{gt}^{ij}} \frac{V_{gt}^{CNj}}{\sum_g V_{gt}^{CNj}} \right)$	Weighted by degree of key products for China's export

9) We exclude country-year fixed effects. Since bilateral exchange rate has country-year dimension, inclusion of country-year fixed effects suffer from multicollinearity problems.

industries. Later, we also apply year fixed effects with country-product fixed effects simultaneously in order to test the robustness of the estimates.

2. Second Step of Estimation

The second step of the estimation is to evaluate the spillover effects along with product quality. Since the quality of imported products affects the market shares as well as the exchange rate pass-through, as indicated in Section 3, the product quality should be considered, too, in order to evaluate the spillover effects. We add the interaction term with the quality index into Equation (12) to examine the additional spillover effects rising from quality differences.

$$\ln V_{gt}^{KRj} = \beta_1 \cdot S_{gt}^{CNj} \times \mu_g^j \times \ln R_t^j + \beta_2 \cdot Q_{gt}^j \times S_{gt}^{CNj} \times \mu_g^j \times \ln R_t^j + \gamma_{gt} + \zeta_g^j + \varepsilon_{gt}^j \quad (13)$$

Two types of quality index Q_{gt}^j are used. The first quality index indicates how Chinese imported goods satisfy the expected quality level of importers. It is the ratio of Chinese export product quality over the quality that importers demand. Later we change the ratio to a binary value: to 0 if the ratio is less than 1 and to 1 if the ratio is greater than 1. Therefore, if the value is 1, it implies that Chinese export products meet the quality demands of importers. The second quality index indicates the relative export product quality between Korea and China, a ratio of Korean export product quality over the Chinese export product quality. As with the first index, we make the ratio binary: to 0 if the ratio is less than 1 and to 1 if the ratio is greater than 1. Therefore, if the value is 1, the export product quality of Korea is relatively higher than that of China.

$$Q_{gt}^{CNj} \begin{cases} = 1, & \text{if } Q_{gt}^{EX_{CN}} / Q_{gt}^{IM_j} \geq 1 \\ = 0, & \text{otherwise} \end{cases}$$

$$Q_{gt}^{Rj} \begin{cases} = 1, & \text{if } Q_{gt}^{EX_{KR}} / Q_{gt}^{EX_{CN}} \geq 1 \\ = 0, & \text{otherwise} \end{cases}$$

The coefficient of β_1 measures the extent of changes in Korean exports to the products that are not differentiated in terms of quality under a given depreciation of the RMB. The coefficient of β_2 measures the extent of changes in Korean exports to the products that are differentiated in terms of quality under a given depreciation of the RMB. The expected sign of β_1 would be negative, which implies that the Korean exports would be hurt more as the Chinese share increase in the given market when the Chinese RMB depreciates. On the other hand, the expected sign of β_2 would be positive, which implies that the Korean export of Korea would be hurt less *ceteris paribus* as the Chinese share increase at the given market when the Chinese RMB depreciates for products that are differentiated in terms of quality.

V. Data

We use import data from OECD member countries from the U.N. Comtrade Database at the six-digit level of the Harmonized System (HS). The exchange rate of importers' local currency and the Chinese yuan (period average), the Consumer Price Index of importers including China¹⁰⁾ are obtained from the International Monetary Fund's (IMF) International Financial Statistics (IFS) database.

Quality data is obtained from the IMF's and World Bank's Export Quality database. The database provides export and import quality estimates across 835 products and 162 countries from 1964 to 2014. Quality estimates are derived from unit values with two adjustments, production costs and pricing strategies. In detail, the trade price equation including the unobservable quality, production costs, and distance between importer and exporter (a proxy for pricing strategies) is applied to the quality-augmented gravity equation. Based on the estimated coefficients of

10) Real exchange rate is measured by multiply by CPI of importer and deflated by CPI of China

the augmented gravity equation, the quality estimates are obtained at each importer-exporter-product-year level.¹¹⁾ Import quality estimates, importer j 's average quality of imports of a given product, are simultaneously obtained by aggregation over all exporting countries' export product qualities toward importer j . All estimates are normalized by their 90th percentile in the relevant product-year combination for comparisons. Then, the estimates are aggregated using export values as weights across importers to obtain export quality index at each exporter-product-year level. Similarly, import quality at each importer-product-year level is obtained by summing import-weighted average of estimates across exporters. Since the quality data is classified into four-digit SITC codes, whereas the trade data is classified into the HS code, the classification is linked into the HS four-digit level by using the correspondence table from the U.N. Trade Statistics.¹²⁾ Table 2 shows the summary statistics.

Table 2. Summary Statistics

	# of obs	mean	sd	min	max
$I_CN_{gt}^j$	223,695	0.214	0.214	0	1
$I_KR_{gt}^j$	223,695	0.171	0.196	0	1
$I_WD_{gt}^j$	223,695	0.170	0.198	0	1
V_{gt}^{KRj}	223,695	8536.23	122575.2	0.001	1.50E+07
ERPT	223,695	0.743	2.77	-1.26E+09	2,364
rCNYperLCU	223,695	5.982	3.981	0.010789	15,388
Q_{gt}^{CNj}	223,695	0.916	0.089	0.101668	1.928
Q_{gt}^{Rj}	223,695	1.102	0.111	0.411	9.382

Notes: rCNYperLCU indicates the real bilateral exchange rate between the Chinese RMB and the importer's local currency.

11) For further detailed explanation, see Henn (2017).

12) The values of quality index by SITC 1 digit are provided in Appendix.

VI. Estimation Results

We report the estimation results of Equation (12) in Table 3. Columns (1) to (4) are the results with the first competition index (LKR_{gt}^j), the Chinese import share weighted by core export products for Korea. Columns (5) to (8) show the results using the second index (LWD_{gt}^j), the Chinese import share weighted by importer's core import products. Columns (9) to (12) report the results with the third index ($L CN_{gt}^j$), the adjusted Chinese import share with the degree of importance of the products for China. The odd columns are results using country-product and year fixed effects and the even columns are results with two-way fixed effects, country-product and product-year fixed effects. The results of the estimation of Equation (10) are columns (4), (8) and (12). The other estimates are provided to justify the specification of the estimation equation, in addition to the theoretical framework.

The signs of the estimated coefficients of the adjusted Chinese share are heterogeneous. For both cases using two-way fixed effects as well as one-way fixed effects, the adjusted Chinese import share by core export products for Korea (LKR_{gt}^j) has statistically significant negative signs of the estimated coefficients in columns (1) and (2). The negative sign of the adjusted Chinese import share indicates that Korea's exports decrease once China's share of the products that are substantially important for Korea increases. As shown in columns (3) and (4), the interaction term of the adjusted Chinese share, the exchange rate pass-through, and the log of the real Chinese exchange rate with respect to the local currency units of the importers ($LKR_{gt}^j \times \mu_g^j \times \ln R_t^j$) show negative estimated coefficients. In the case of using year and country-product fixed effects, the interaction term gains statistical significance. This implies that Korean exports with a greater degree of competition fall more as the Chinese RMB depreciates. In other words, the larger the degree that Korean exports compete with China at a given product and market, a depreciation of the renminbi makes exports from Korea fall more.

Table 3. Korean Exports with Changes in the Chinese RMB

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\ln R_t^j$	1.167*** (0.0670)	1.237*** (0.0595)			1.176*** (0.0671)	1.245*** (0.0596)			1.169*** (0.0674)	1.243*** (0.0596)		
$I_KR_{gt}^j$	-0.832*** (0.0676)	-0.454*** (0.0663)										
$I_WD_{gt}^j$					-0.823*** (0.0708)	-0.351*** (0.0693)						
$I_CN_{gt}^j$									0.0236 (0.0605)	0.294*** (0.0583)		
$I_KR_{gt}^j \times \mu_g^j \times \ln R_t^j$	-0.0331 (0.0525)	-0.0542 (0.0495)	-0.136*** (0.0506)	-0.0587 (0.0472)								
$I_WD_{gt}^j \times \mu_g^j \times \ln R_t^j$					-0.0953* (0.0537)	-0.105** (0.0506)	-0.166*** (0.0522)	-0.0700 (0.0488)				
$I_CN_{gt}^j \times \mu_g^j \times \ln R_t^j$									-0.00544 (0.0476)	-0.0430 (0.0442)	0.0797* (0.0459)	0.103** (0.0429)
Observations	224541	223695	224541	223695	224541	223695	224541	223695	224541	223695	224541	223695
R-squared	0.817	0.848	0.816	0.848	0.817	0.848	0.816	0.848	0.817	0.848	0.816	0.848
country-product FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
product-year FE	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
year FE	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N

Notes: Dependent variable is the logged industry g import value of country j from Korea at time t . The result of the simple regression analysis with exchange rate variable as the independent variable only to observe the effect of the changes in the RMB on Korean exports is not presented in Table 3 due to the lack of statistical significance.

Columns (5) to (8) provide the results with adjusted shares by core products for importers (LWD_{gt}^j). The adjusted shares have statistically significant negative signs of the estimated coefficients in columns (5) and (6). The negative signs of the adjusted share by core products for importers show that exports from Korea decline once the import share from China increases for products that are significantly crucial to the importers. As shown in columns (7) and (8), the interaction term of adjusted Chinese share, the exchange rate pass-through, and the log of the real Chinese exchange rate with respect to the local currency units of the importers ($LWD_{gt}^j \times \mu_g^j \times \ln R_t^j$) show negative estimated coefficients. In the case of using year and country-product fixed effects, the interaction term gains statistical significance. This implies that Korea's exports decline more once the Chinese share of products with a greater degree of importance for importers increases at a given depreciation of the RMB.

Columns (9) to (12) provide the results with adjusted shares by core products for China (LCN_{gt}^j). The adjusted-shares have statistically significant positive signs of the estimated coefficients in columns (9) and (10). The positive signs of the adjusted shares by core products for China show that exports from Korea rise once the import share from China increases for products that are substantially important to China. This implies that Korea's exports and China's exports have complementarity in the product and import markets that are important to China. As shown in columns (11) and (12), the interaction term of the adjusted Chinese share, the exchange rate pass-through, and the log of the real Chinese exchange rate with respect to local currency units of the importers ($LCN_{gt}^j \times \mu_g^j \times \ln R_t^j$) show statistically significant positive estimated coefficients. This shows that Korea's exports rise more as China's share in products that are important for China increases at a given depreciated RMB. It implies that Korean exports are not in a situation where they compete with China in terms of export price. Instead, exports from Korea take advantage of a depreciated Chinese RMB. This implies that the

exports of Korea and China are actually complementary based on the findings that the depreciated RMB not only increase the exports of China but also those of Korea.

Table 4 reports the estimation results of Equation (13). Columns (1) to (4) are the results with the first competition index (IKR_{gt}^j), the Chinese import share weighted by Korean core export products. Columns (5) to (8) show the results using the second index (IWD_{gt}^j), the Chinese import share weighted by the importer's core import products. Columns (9) to (12) show the results with the third index (ICN_{gt}^j), as in Table 3. Columns (1)-(2), (5)-(6), and (9)-(10) are the results with the Chinese product quality (Q_{gt}^{CNj}), while columns (3)-(4), (7)-(8), and (11)-(12) are the results with the relative quality index between Korea and China (Q_{gt}^{Rj}).

In the case of using the import share from China weighted by the core Korean export products, none of the specifications, except column (4), are statistically significant. In column (4), the estimated coefficient of the adjusted share interacted with the log changes in the exchange rate (I_krg_rept) has a statistically significant negative sign, while the coefficient of a variable that is interacted with the quality index ($I_krg_rept * Q_{gt}^{Rj}$) has a positive sign. This implies that exports from Korea decline more as the degree of the Chinese export share adjusted by the core Korean export product is greater when the RMB depreciates. However, once Korea's exports of a product have a relatively higher quality than the Chinese (positive coefficient of $I_krg_rept * Q_{gt}^{Rj}$), Korean exports decline by less than Korea's exports of a product that does not have relatively higher quality.

In the case of using the importer's core product adjusted for the Chinese export share (I_wg_rept), as shown in columns (5) to (8), the estimated coefficients of the variable itself show negative signs, while the estimated coefficient of the interaction terms with Chinese export product quality ($I_wg_rept * Q_{gt}^{CNj}$) also have negative signs, as shown in columns (5) and (6). This means that exports from Korea decline more as the adjusted

Chinese export share gets higher when the RMB rate decreases. Additionally, Korea's exports decline even more when Chinese export product quality sufficiently meets the importer's demanded quality.

On the other hand, the results with relative Korean export quality to Chinese export quality are shown in columns (7) and (8). The coefficients of the importer's core product adjusted for the Chinese export share (I_wg_rept) have statistically significant negative signs, and the coefficients of the interaction term with quality index ($I_wg_rept * Q_{gt}^{Rj}$) have statistically significant positive signs. This implies that exports from Korea declines less for products with relatively higher quality, even if exports from Korea fall as the degree of adjusted Chinese export share increases due to the depreciation of the RMB.

Column (9) shows the case of using a core product adjusted Chinese export share (I_cng_rept). The estimated coefficients of the variable itself show positive signs, while the estimated coefficient of the interaction terms with Chinese export product quality ($I_cng_rept * Q_{gt}^{CNj}$) have negative signs. This means that exports from Korea go up more as the degree of adjusted Chinese export share is greater when the RMB rate decreases, indicating a complementary relationship between Korean and Chinese exports. However, if export products have a relatively high quality in respect to the level of quality demanded by the importers, exports from Korea decline. On the other hand, the results using the relative quality index, which are shown in columns (11) and (12), have different outcomes. The estimated coefficients of the adjusted Chinese export share (I_cng_rept) have a negative sign, while that of a variable interacted with relative quality index ($I_cng_rept * Q_{gt}^{Rj}$) have a positive sign, as shown in column (11). Korea's exports decline by less for the products that have a relatively higher quality compared to the Chinese export product quality, even though Korean exports go down as the degree of adjusted Chinese export share increases caused by a depreciation of the RMB.

Table 4. Korean Exports with Changes in the Chines RMB: Interaction Term with Quality

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)		(9)	(10)	(11)	(12)
I_krg_rept	-0.0159 (0.0517)	-0.0791 (0.0486)	-0.0952 (0.0827)	-0.202** (0.0857)	I_wg_rept	-0.168*** (0.0540)	-0.0877* (0.0499)	-0.509*** (0.0985)	-0.207** (0.0872)	I_cng_rept	0.0879* (0.0475)	0.0946** (0.0440)	-0.271*** (0.0907)	-0.0474 (0.0820)
Q_{gt}^{CNj}	-0.0129 (0.0277)	-0.0221 (0.0285)			Q_{gt}^{CNj}	-0.267*** (0.0293)	-0.0239 (0.0284)			Q_{gt}^{CNj}	-0.267*** (0.0294)	-0.0254 (0.0285)		
$I_krg_rept^* Q_{gt}^{CNj}$	-0.0896 (0.0605)	-0.0480 (0.0605)			$I_wg_rept^* Q_{gt}^{CNj}$	-0.285*** (0.0650)	-0.0317 (0.0585)			$I_cng_rept^* Q_{gt}^{CNj}$	-0.269*** (0.0609)	-0.0279 (0.0549)		
Q_{gt}^{Rj}			-0.0893 (0.107)	-0.0977 (0.105)	Q_{gt}^{Rj}			0.0969*** (0.0329)	-0.0978 (0.105)	Q_{gt}^{Rj}			0.0923*** (0.0328)	-0.0998 (0.105)
$I_krg_rept^* Q_{gt}^{Rj}$			0.0922 (0.0698)	0.145* (0.0778)	$I_wg_rept^* Q_{gt}^{Rj}$			0.359*** (0.0892)	0.145* (0.0794)	$I_cng_rept^* Q_{gt}^{Rj}$			0.364*** (0.0830)	0.155** (0.0753)
Obs	216137	216137	218039	218039	Obs	216971	216137	218815	218039	Obs	216971	216137	218815	218039
R-squared	0.852	0.848	0.852	0.848	R-squared	0.817	0.848	0.817	0.848	R-squared	0.817	0.848	0.817	0.848
country-product FE	Y	Y	Y	Y	country-product FE	Y	Y	Y	Y	country-product FE	Y	Y	Y	Y
product-year FE	N	Y	N	Y	product-year FE	N	Y	N	Y	product-year FE	N	Y	N	Y
year FE	Y	N	Y	N	year FE	Y	N	Y	N	year FE	Y	N	Y	N

Note: I_krg_rept , I_wg_rept , and I_cng_rept are the abbreviations of $I_K R_{gt}^j \times \mu_g^j \times \ln R_t^j$, $I_W D_{gt}^j \times \mu_g^j \times \ln R_t^j$, and $I_C N_{gt}^j \times \mu_g^j \times \ln R_t^j$, respectively.

From Equation (11), we derive the way to calculate the effects of changes in the Chinese RMB rate on the growth of Korean exports as written in Equation (14).

$$\frac{\partial \ln V_{gt}^{KRj}}{\partial \ln R_t^j} = \hat{\beta} \times S_{gt}^{CNj} \times \mu_g^{CNj} \quad (14)$$

The estimates from columns (3), (7) and (11) of Table 3¹³⁾ are the estimated $\hat{\beta}$. Based on the value of the products of the adjusted share and the ERPT, we can obtain the average effects of any exchange rate changes in Korea's export growth. Table 5 shows the average effects for the 10th, 50th and 90th percentile of adjusted share. These values indicate that a 10 percent depreciation of the RMB is associated with a reduction in Korean exports of 0.1 percent for products that have a high degree of competition with China. For products that are core export product for China, a 10 percent depreciation of the RMB is associated with an increase in Korean exports of 0.07 percent. This implies Korean and Chinese export products have complementarity.

Table 5. Range of Estimated Effects of a 10 percent Depreciation in the RMB

Percentile of the index	$I_{-KR_{gt}^j}$	$I_{-WD_{gt}^j}$	$I_{-CN_{gt}^j}$
10	-0.003	-0.004	0.002
50	-0.093	-0.112	0.074
90	-0.626	-0.765	0.408

13) The estimated coefficients of the product of adjusted share, log of exchange rate, and ERPT (-0.136, -0.166, 0.797) are used for $\hat{\beta}_{i_kr,g}$, $\hat{\beta}_{i_wg}$, and $\hat{\beta}_{i_cn,g}$, respectively.

The cases considering product quality are shown in Table 6. Based on the value of relative Chinese export quality in terms of quality demanded by importers, we calculate the magnitude of the spillover effects as reported in Panel A of Table 6. Similarly, we measure the range of estimated spillover effect in line with a relatively Korean quality in terms of Chinese quality as reported in Panel B of Table 6.¹⁴⁾

The magnitudes for the Chinese export products with relatively higher quality than the expected quality in the destination markets are reported in columns indicating $Q^{CN}=1$. Those for the export products from Korea having relatively higher quality than those from China are reported in columns denoting $Q^R=1$. Otherwise, the magnitudes are reported in columns showing $Q^{CN}=0$ and $Q^R=0$. The values are calculated based on three different adjusted Chinese share indices and their values for the 10th-, 50th-, and 90th- percentile.

Table 6. Range of Estimated Effects of a 10 percent Depreciation in the RMB: with Quality Indices

A. Relative Chinese Export Quality to OECD's Import Quality						
Percentile of the index	$L_KR_{gt}^j$ $Q^{CN}=0$	$L_KR_{gt}^j$ $Q^{CN}=1$	$L_WD_{gt}^j$ $Q^{CN}=0$	$L_WD_{gt}^j$ $Q^{CN}=1$	$L_CN_{gt}^j$ $Q^{CN}=0$	$L_CN_{gt}^j$ $Q^{CN}=1$
10	-0.0010	-0.0031	-0.0040	-0.0107	0.0027	-0.0055
50	-0.0313	-0.0925	-0.1129	-0.3045	0.0820	-0.1689
90	-0.2113	-0.6237	-0.7745	-2.0884	0.4505	-0.9281

B. Relative Korean Export Quality to Chines Export Quality						
Percentile of the index	$L_KR_{gt}^j$ $Q^R=0$	$L_KR_{gt}^j$ $Q^R=1$	$L_WD_{gt}^j$ $Q^R=0$	$L_WD_{gt}^j$ $Q^R=1$	$L_CN_{gt}^j$ $Q^R=0$	$L_CN_{gt}^j$ $Q^R=1$
10	-0.0046	-0.0013	-0.0120	-0.0035	-0.0082	0.0028
50	-0.1380	-0.0389	-0.3421	-0.1008	-0.2528	0.0867
90	-0.9298	-0.2624	-2.3466	-0.6915	-1.3888	0.4766

14) The estimated coefficients of the product of adjusted share, log of exchange rate, and ERPT used for $\hat{\beta}_{1,i_krg}$, $\hat{\beta}_{1,i_wg}$, and $\hat{\beta}_{1,i_cng}$ are -0.0459, -0.168, 0.0879, respectively. The estimated coefficients for $\hat{\beta}_{2,i_krg}$, $\hat{\beta}_{2,i_wg}$, and $\hat{\beta}_{2,i_cng}$ are -0.0896, -0.285, and -0.269, respectively.

For products that are core items for importers (LWD_{gt}^j), a 10 percent depreciation of the RMB is associated with a reduction in Korean exports by 0.11% once those products qualities are not satisfied with the level of expected quality of importers. Moreover, a 10 percent depreciation reduces Korean export by 0.30% once products are satisfied with the level of expectation of the destination markets in terms of quality. For products that have complementarity with those from China, a core export items for China (LCN_{gt}^j), Korean export increase by 0.08% if the qualities of them are not satisfies with the level of quality demanding of importers. On the other hand, export of Korea decrease by 0.17% once Chinese export product qualities are met the level of quality that importers demanded.

Based on the information about relative quality differences between Korea and China, we divide the range of estimated spillover effects into the products that have a relatively higher quality to that of Chinese ($Q^R=1$) and the products that do not ($Q^R=0$). Thus, we can compare the heterogeneous effects according to the relative quality. For products that core export products for Korea (LKR_{gt}^j) or for importers (LWD_{gt}^j), a 10 percent depreciation of the RMB is associated with a reduction in Korean exports of 0.1% to 0.3% once those products are not “prior” in terms of relative quality. However, the magnitude of the effect decreases when we consider quality. A 10 percent depreciation of the RMB is associated with a reduction in Korean export of 0.03% to 0.1%, once products have a relative higher quality. Moreover, a 10 percent depreciation of the RMB is associated with an increase in Korean exports of 0.08 percent when the import share from China increases for the products that are core export items from China (LCN_{gt}^j) once the export products of Korea have relatively higher quality than those of China. In contrast, for products that have relative lower quality, a 10 percent depreciation of the RMB reduces the export of Korea by 0.25%. As a robustness check, we estimate the same specification of estimation equation under the assumption of a perfect exchange rate pass through

by setting the μ_g^j as one. The results remain the same as what we previously studied in Tables 3 and 4. For details, refer Table A4-A7 of the appendix.

VII. Conclusion

We explore the effects of changes in the RMB exchange rate on Korean exports by taking export product characteristic into consideration. As China transforms its trade structure from labor-intensive manufacturing to capital-intensive, its expanding role in import markets might lower the exports of its competitors, especially Korea. Previous studies tend to analyze the effects of depreciation in the RMB on trading partners' exports by using the competitive relationship between countries. Many studies find that a depreciation of the RMB lowers export prices for products from China, improving the price of competitiveness, and eventually lowers the share of other exporters in the import market.

However, the export competition based on export value itself is not enough to explain the effects of the exchange rate on other exporters, since the degree of price competitiveness might be heterogeneous depending on the degree of substitution between goods from Korea and China. The impact of depreciation in the exchange rate on price elasticity is different depending on the degree of product differentiation. This study reflects the degree of vertical differentiation of the export product in analyzing the spillover effects of the Chinese exchange rate on Korean exports. Based on the empirical estimation results, our main findings are that a depreciation of the Chinese RMB reduces Korean exports to OECD member countries as the export products show the greater degree in competition. On the other hand, if Chinese export share adjusted by core products for China increases, the export of Korea increases at a given the depreciated Chinese RMB. This implies that core export products for China have complementarity with those from Korea. Additionally, we find

that the negative spillover effects from a depreciation of the RMB are larger when we consider how well Chinese export product quality meets the need of importers. However, for products exported from Korea that have a relatively higher product quality, the magnitude of the negative effects is smaller than the opposite.

The results of our paper imply that influence from the movement of the Chinese RMB exchange rate on Korean exports has been limited. The views that the depreciated RMB would increase the level of price competition between Korea and China overestimate the negative spillover effects on Korean exports. The findings that the vertically differentiated product characteristics make a room to reduce the negative spillover effects caused by a depreciated RMB suggest a forward direction for trade policy. To reduce the volatility caused by the depreciated currency of trading partners, the quality of the products exported needs to be improved. In addition, it is also important to use the global supply chain as a way to reduce uncertainty, given that the complementarity between export products from Korea and China is one of the causes that could help increase Korea's exports even if the Chinese RMB depreciates.

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Appendix

A. Exchange Rate Pass-Through

We use the estimates of the exchange rate pass-through on import prices for 23 OECD member countries from Campa and Goldberg (2005). They estimate the ERPT into import prices using quarterly data from 1975 to 2003 and find a partial ERPT in the short run. Asymmetric industry ERPT estimates are obtained from Casacas (2019). She uses microdata from Colombia, and estimated the ERPT into import and export prices for each industry. We use the estimates of ERPT into import prices for 18 SIC industries. We transform the ERPT so that it varies both across importers and also industries by using weighted average calculations.

$$ERPT_c^*(ERPT_j / \overline{ERPT_j}) \text{ where } \overline{ERPT_j} \text{ is average}$$

Since the industry code from Casacas (2019) is classified by the ISIC while the main data for our paper is classified by the HS code, we merge our datasets by using a concordance table of HS-ISIC provided by Reference and Management Of Nomenclatures (RAMON) of Eurostat. For any observations that are not matched with an ISIC codes, we use the average value.

Cross-country ERPT*		Cross-industry ERPT**		
Country	ERPT _c	ISIC	ERPT _{i,\$} ¹⁵⁾	ERPT _{i,NS} ¹⁶⁾
Australia	0.56	15	0.919	0.615
Austria	0.21	17	1.072	0.651
Belgium	0.21	18	2.211	0.684
Canada	0.75	19	0.76	0.381
Czech Republic	0.39	20	1.293	0.545
Denmark	0.43	21	1.525	0.487
Finland	0.55	22	1.525	0.487
France	0.53	24	1.078	0.663
Germany	0.55	25	1.107	0.498
Hungary	0.51	26	1.014	0.435
Ireland	0.16	28	1.035	0.72
Italy	0.35	29	1.036	0.55
Japan	0.43	31	1.018	0.316
Netherlands	0.79	32	0.986	0.59
New Zealand	0.22	33	0.911	0.282
Norway	0.4	34	0.858	0.529
Poland	0.56	35	0.858	0.529
Portugal	0.63	36	1.021	0.634
Spain	0.68	Ave	1.049	0.51
Sweden	0.48			
Switzerland	0.67			
United Kingdom	0.36			
United States	0.23			
Average	0.46			

Notes: * Campa and Goldberg (2005), ** Casas (2019)

15) Estimates for dollarized economy

16) Estimates for non-dollarized economy

B. Quality Index

We use the quality index based on the quality data is obtained from IMF's and World Bank's Export Quality Database. The database provides the export and import quality estimates across 835 products, 162 countries from 1964 to 2014.

Q_{gt}^{KRj} measures the extent to how Korean good satisfy the expected quality level of importers. The quality index of Korean export product for product g at time t over import quality index for importer j , for product g at time t . Q_{gt}^{CNj} measures the extent to how Chinese good satisfy the expected quality level of importers. The quality index of Chinese export product for product g at time t over import quality index for importer j , for product g at time t . Q_{gt}^{Rj} measures the relative quality difference between Korea and China, a ratio of quality index of Korean export product for product g at time t over quality index of Chinese export product for product g at time t .

$$Q_{gt}^{KRj} = Q_{gt}^{EX_{KR}} / Q_{gt}^{IM_j}$$

$$Q_{gt}^{CNj} = Q_{gt}^{EX_{CN}} / Q_{gt}^{IM_j}$$

$$Q_{gt}^{Rj} = Q_{gt}^{EX_{KR}} / Q_{gt}^{EX_{CN}}$$

SITC 1 digit	Description	Q_g^{KR}	Q_g^{CN}	Q_g^R
8	Miscellaneous manufactured articles	1.009158	0.93838	1.082521
7	Machinery and transport equipment	1.008692	0.922332	1.101699
5	Chemicals	0.996752	0.903918	1.106161
6	Manufactured goods classified chiefly by material	0.976365	0.870146	1.141105
1	Beverages and tobacco	0.973158	0.852252	1.145471
3	Mineral fuels, lubricants and related materials	0.972378	0.894863	1.093935
2	Crude materials, inedible, except fuels	0.963281	0.893709	1.088122
0	Food and live animals	0.930778	0.748477	1.261238
4	Animal and vegetable oils and fats	0.926696	0.658342	1.494928
9	Commod. & transacts. Not class. Accord. To kind	0.850274	0.753752	1.126152

Note: All values indicate the average value for OECD importers from 2002 to 2014. Q_g^{KR} is the extent to how Korean good satisfy the expected quality level of importers. It is the ratio of Korean export product quality over the quality importers demanded. Q_g^{CN} is the extent to how Chinese import good satisfy the expected quality level of importers. It is the ratio of Chinese export product quality over the quality importers demanded. Q_g^R indicates the relative quality difference between Korea and China.

C. Competition Index

We measured the competition index based on the value of adjusted import share from China over total imports. The import share is adjusted by level of substitutability, dependency and the complementarity. Those indices have a year-product-importer dimension. For satisfying readers' curiosity, we provide the value of the aggregate index at the level of one digit SITC code. The industries showing relative high competition are overlapped with the industries having high complementarity (i.e. crude materials, animal and vegetable oils and chemical products). This is due to the structure of export between Korea and China is similar at the aggregate level. However, the industry of mineral fuels shows relative high level of complementarity but relative low level of competition. Also, the industry of chemicals shows relative high level of competition rather than high level of complementarity.

SITC 1 digit	Description	$I_KR_{gt}^j$	Rank	$I_CN_{gt}^j$	Rank	$I_WD_{gt}^j$	Rank
0	Food and live animals	0.740	6	0.721	7	0.758	7
1	Beverages and tobacco	0.761	5	0.787	5	0.809	5
2	Crude materials, inedible, except fuels	0.914	2	0.924	1	0.914	2
3	Mineral fuels, lubricants and related materials	0.740	7	0.862	4	0.818	4
4	Animal and vegetable oils and fats	0.892	3	0.911	3	0.889	3
5	Chemicals	0.763	4	0.759	6	0.761	6
6	Manufactured goods classified chiefly by material	0.714	8	0.690	8	0.709	8
7	Machinery and transport equipment	0.567	10	0.575	10	0.556	10
8	Miscellaneous manufactured articles	0.629	9	0.621	9	0.634	9
9	Commod. & transacts. Not class. Accord. To kind	0.963	1	0.916	2	0.934	1

Table A1. Korean Exports With Changes in the RMB Rate: Core Items for Korea's Exports, Adjusted Index

[illegible]

Table A3. Korean Exports with Changes in the RMB Rate: Core Items for China's Exports, Adjusted Index

[illegible]

Table A4. Korean Exports with Changes in the RMB Rate under Perfect ERPT Conditions: Core Items for Korean Exports, Adjusted Index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$I_KR_{gt}^j$	-0.889*** (0.0686)	-0.505*** (0.0671)			-0.850*** (0.0682)	-0.458*** (0.0668)		
$\ln R_t^j$			1.194*** (0.0673)	1.253*** (0.0594)	1.160*** (0.0670)	1.234*** (0.0594)		
$I_KR_{gt}^j \times \mu_g^j \times \ln R_t^j$	0.0556* (0.0298)	0.0297 (0.0283)	-0.109*** (0.0285)	-0.0811*** (0.0268)	0.00808 (0.0297)	-0.0226 (0.0282)	-0.0661** (0.0284)	-0.0341 (0.0267)
Observations	224541	223695	224541	223695	224541	223695	224541	223695
R-squared	0.817	0.848	0.817	0.848	0.817	0.848	0.816	0.848
country-product FE	Y	Y	Y	Y	Y	Y	Y	Y
product-year FE	N	Y	N	Y	N	Y	N	Y
year FE	Y	N	Y	N	Y	N	Y	N

Table A5. Korean Exports with Changes in the RMB Rate under Perfect ERPT Conditions: Core Items for Importer, Adjusted Index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$I_{-}WD_{gt}^j$	-0.873*** (0.0718)	-0.396*** (0.0701)			-0.832*** (0.0714)	-0.346*** (0.0698)		
$\ln R_t^j$			1.202*** (0.0674)	1.257*** (0.0595)	1.171*** (0.0671)	1.244*** (0.0595)		
$I_{-}WD_{gt}^j \times \mu_g^j \times \ln R_t^j$	0.0161 (0.0306)	-0.00355 (0.0290)	-0.138*** (0.0296)	-0.0991*** (0.0277)	-0.0356 (0.0304)	-0.0604** (0.0289)	-0.0897*** (0.0294)	-0.0472* (0.0277)
Observations	224541	223695	224541	223695	224541	223695	224541	223695
R-squared	0.817	0.848	0.817	0.848	0.817	0.848	0.816	0.848
country-product FE	Y	Y	Y	Y	Y	Y	Y	Y
product-year FE	N	Y	N	Y	N	Y	N	Y
year FE	Y	N	Y	N	Y	N	Y	N

Table A6. Korean Exports with Changes in the RMB Rate under Perfect ERPT Conditions: Core Items for China's Exports, Adjusted Index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$I_CN_{gt}^j$	-0.0301 (0.0616)	0.248*** (0.0592)			0.0117 (0.0612)	0.297*** (0.0589)		
$\ln R_t^j$			1.163*** (0.0674)	1.230*** (0.0596)	1.164*** (0.0674)	1.243*** (0.0596)		
$I_CN_{gt}^j \times \mu_g^j \times \ln R_t^j$	0.0629** (0.0266)	0.0275 (0.0249)	0.0152 (0.0253)	0.0125 (0.0237)	0.0136 (0.0265)	-0.0268 (0.0248)	0.0587** (0.0253)	0.0599** (0.0238)
Observations	224541	223695	224541	223695	224541	223695	224541	223695
R-squared	0.816	0.848	0.817	0.848	0.817	0.848	0.816	0.848
country-product FE	Y	Y	Y	Y	Y	Y	Y	Y
product-year FE	N	Y	N	Y	N	Y	N	Y
year FE	Y	N	Y	N	Y	N	Y	N

Table A7. Korean Exports with Changes in the RMB Rate: Interaction Term with Quality, Under Perfect ERPT Conditions

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)		(9)	(10)	(11)	(12)
I_krg_rept	0.00728 (0.0293)	−0.0441 (0.0274)	−0.0165 (0.0469)	−0.0969** (0.0488)	I_wg_rept	−0.0905*** (0.0303)	−0.0561** (0.0282)	−0.247*** (0.0539)	−0.109** (0.0489)	I_cng_rept	0.0635** (0.0260)	0.0558** (0.0243)	−0.0909* (0.0482)	−0.00311 (0.0450)
Q_{gt}^{CNj}	−0.0114 (0.0278)	−0.0189 (0.0286)			Q_{gt}^{CNj}	−0.267*** (0.0294)	−0.0206 (0.0285)			Q_{gt}^{CNj}	−0.267*** (0.0295)	−0.0222 (0.0286)		
I_krg_rept* Q_{gt}^{CNj}	−0.0546 (0.0357)	−0.0413 (0.0358)			I_wg_rept* Q_{gt}^{CNj}	−0.154*** (0.0375)	−0.0326 (0.0347)			I_cng_rept* Q_{gt}^{CNj}	−0.142*** (0.0346)	−0.0274 (0.0320)		
Q_{gt}^{Rj}			−0.0894 (0.107)	−0.100 (0.105)	Q_{gt}^{Rj}			0.0989*** (0.0326)	−0.101 (0.105)	Q_{gt}^{Rj}			0.0958*** (0.0325)	−0.101 (0.105)
I_krg_rept* Q_{gt}^{Rj}			0.0297 (0.0390)	0.0626 (0.0438)	I_wg_rept* Q_{gt}^{Rj}			0.164*** (0.0478)	0.0650 (0.0438)	I_cng_rept* Q_{gt}^{Rj}			0.156*** (0.0434)	0.0647 (0.0408)
Obs	216137	216137	218039	218039	Obs	216971	216137	218815	218039	Obs	216971	216137	218815	218039
R-squared	0.852	0.848	0.852	0.848	R-squared	0.817	0.848	0.817	0.848	R-squared	0.817	0.848	0.817	0.848
country-product FE	Y	Y	Y	Y	country-product FE	Y	Y	Y	Y	country-product FE	Y	Y	Y	Y
product-year FE	N	Y	N	Y	product-year FE	N	Y	N	Y	product-year FE	N	Y	N	Y
year FE	Y	N	Y	N	year FE	Y	N	Y	N	year FE	Y	N	Y	N

<Abstract in Korean>

중국 위안화 환율 변동이 한국 수출에 미치는 영향: 수출품 품질을 중심으로

음지현*

본 연구에서는 중국의 위안화 변동이 한국 수출에 미치는 영향을 제품의 특성과 품질을 반영하여 분석하였다. 본고에서는 중국 위안화 평가절하가 우리나라 수출에 미치는 부정적인 파급효과를 완화하는 원인으로 수직적 제품 차별화에 집중하였다. 2002~2014년 기간 중 OECD 회원국의 수입자료를 활용하여 패널회귀 분석을 수행한 결과 위안화 평가절하로 인한 부정적인 영향은 우리나라와 중국이 경쟁하고 있는 품목에서 더 크게 나타났다. 중국의 주요 수출품목을 중심으로 수입국에서 중국의 비중이 높아지는 경우 우리나라의 수출은 오히려 증가하는 것으로 나타났다. 또한 중국 수출품 품질 대비 우리나라 수출품의 품질이 높은 경우 위안화 평가절하로 인한 부정적인 파급효과가 완화되는 것으로 나타났다.

핵심 주제어: 수출경쟁, 환율 변동의 가격전가도, 품질, 제품차별화

JEL Classification: F10, F11, F13, F14, F31

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이 연구내용은 집필자의 개인의견이며 한국은행의 공식견해와는 무관합니다. 따라서 본 논문의 내용을 보도하거나 인용할 경우에는 집필자명을 반드시 명시하여주시기 바랍니다.

BOK 경제연구 발간목록

한국은행 경제연구원에서는 Working Paper인 『BOK 경제연구』를 수시로 발간하고 있습니다. 『BOK 경제연구』는 주요 경제 현상 및 정책 효과에 대한 직관적 설명 뿐 아니라 깊이 있는 이론 또는 실증 분석을 제공함으로써 엄밀한 논증에 초점을 두는 학술논문 형태의 연구이며 한국은행 직원 및 한국은행 연구용역사업의 연구 결과물이 수록되고 있습니다. 『BOK 경제연구』는 한국은행 경제연구원 홈페이지(<http://imer.bok.or.kr>)에서 다운로드하여 보실 수 있습니다.

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5	정책금리 변동이 성별·세대별 고용률에 미치는 영향	정성엽
6	From Firm-level Imports to Aggregate Productivity: Evidence from Korean Manufacturing Firms Data	JaeBin Ahn · Moon Jung Choi
7	자유무역협정(FTA)이 한국 기업의 기업내 무역에 미친 효과	전봉걸 · 김은숙 · 이주용
8	The Relation Between Monetary and Macroprudential Policy	Jong Ku Kang
9	조세피난처 투자자가 투자 기업 및 주식시장에 미치는 영향	정호성 · 김순호
10	주택실거래 자료를 이용한 주택부문 거시건전성 정책 효과 분석	정호성 · 이지은
11	Does Intra-Regional Trade Matter in Regional Stock Markets?: New Evidence from Asia-Pacific Region	Sei-Wan Kim · Moon Jung Choi
12	Liability, Information, and Anti-fraud Investment in a Layered Retail Payment Structure	Kyoung-Soo Yoon · Jooyong Jun
13	Testing the Labor Market Dualism in Korea	Sungyup Chung · Sunyoung Jung
14	북한 이중경제 사회계정행렬 추정을 통한 비공식부문 분석	최지영

제2016 -15	Divergent EME Responses to Global and Domestic Monetary Policy Shocks	Woon Gyu Choi · Byongju Lee · Taesu Kang · Geun-Young Kim
16	Loan Rate Differences across Financial Sectors: A Mechanism Design Approach	Byoung-Ki Kim · Jun Gyu Min
17	근로자의 고용형태가 임금 및 소득 분포에 미치는 영향	최충 · 정성엽
18	Endogeneity of Inflation Target	Soyoung Kim · Geunhyung Yim
19	Who Are the First Users of a Newly-Emerging International Currency? A Demand-Side Study of Chinese Renminbi Internationalization	Hyoung-kyu Chey · Geun-Young Kim · Dong Hyun Lee
20	기업 취약성 지수 개발 및 기업 부실화에 대한 영향 분석	최영준
21	US Interest Rate Policy Spillover and International Capital Flow: Evidence from Korea	Jieun Lee · Jung-Min Kim · Jong Kook Shin
제2017 -1	가계부채가 소비와 경제성장에 미치는 영향 - 유량효과와 저장효과 분석 -	강종구
2	Which Monetary Shocks Matter in Small Open Economies? Evidence from SVARs	Jongrim Ha · Inhwan So
3	FTA의 물가 안정화 효과 분석	곽노선 · 임호성
4	The Effect of Labor Market Polarization on the College Students' Employment	Sungyup Chung
5	국내 자영업의 폐업을 결정요인 분석	남윤미
6	차주별 패널자료를 이용한 주택담보대출의 연체요인에 대한 연구	정호성
7	국면전환 확산과정모형을 이용한 콜금리행태 분석	최승문 · 김병국

제2017-8	Behavioral Aspects of Household Portfolio Choice: Effects of Loss Aversion on Life Insurance Uptake and Savings	In Do Hwang
9	신용공급 충격이 재화별 소비에 미치는 영향	김광환 · 최석기
10	유가가 손익분기인플레이션에 미치는 영향	김진용 · 김준철 · 임형준
11	인구구조변화가 인플레이션의 장기 추세에 미치는 영향	강환구
12	종합적 상환여건을 반영한 과다부채 가계의 리스크 요인 분석	이동진 · 한진현
13	Crowding out in a Dual Currency Regime? Digital versus Fiat Currency	KiHoon Hong · Kyounghoon Park · Jongmin Yu
14	Improving Forecast Accuracy of Financial Vulnerability: Partial Least Squares Factor Model Approach	Hyeongwoo Kim · Kyunghwan Ko
15	Which Type of Trust Matters?: Interpersonal vs. Institutional vs. Political Trust	In Do Hwang
16	기업특성에 따른 연령별 고용행태 분석	이상욱 · 권철우 · 남윤미
17	Equity Market Globalization and Portfolio Rebalancing	Kyungkeun Kim · Dongwon Lee
18	The Effect of Market Volatility on Liquidity and Stock Returns in the Korean Stock Market	Jieun Lee · KeeH.Chung
19	Using Cheap Talk to Polarize or Unify a Group of Decision Makers	Daeyoung Jeong
20	패스트트랙 기업회생절차가 법정관리 기업의 이자보상비율에 미친 영향	최영준
21	인구고령화가 경제성장에 미치는 영향	안병권 · 김기호 · 육승환
22	고령화에 대응한 인구대책: OECD사례를 중심으로	김진일 · 박경훈

제2017 -23	인구구조변화와 경상수지	김경근 · 김소영
24	통일과 고령화	최지영
25	인구고령화가 주택시장에 미치는 영향	오강현 · 김솔 · 윤재준 · 안상기 · 권동휘
26	고령화가 대외투자에 미치는 영향	임진수 · 김영래
27	인구고령화가 가계의 자산 및 부채에 미치는 영향	조세형 · 이용민 · 김정훈
28	인구고령화에 따른 우리나라 산업구조 변화	강종구
29	인구구조 변화와 재정	송호신 · 허준영
30	인구고령화가 노동수급에 미치는 영향	이철희 · 이지은
31	인구 고령화가 금융산업에 미치는 영향	윤경수 · 차재훈 · 박소희 · 강선영
32	금리와 은행 수익성 간의 관계 분석	한재준 · 소인환
33	Bank Globalization and Monetary Policy Transmission in Small Open Economies	Inhwan So
34	기존 경영자 관리인(DIP) 제도의 회생기업 경영성과에 대한 영향	최영준
35	Transmission of Monetary Policy in Times of High Household Debt	Youngju Kim · Hyunjoon Lim
제2018 -1	4차 산업혁명과 한국의 혁신역량: 특허자료를 이용한 국가기술별 비교 분석, 1976-2015	이지홍 · 임현경 · 정대영
2	What Drives the Stock Market Comovements between Korea and China, Japan and the US?	Jinsoo Lee · Bok-Keun Yu
3	Who Improves or Worsens Liquidity in the Korean Treasury Bond Market?	Jieun Lee

제2018-4	Establishment Size and Wage Inequality: The Roles of Performance Pay and Rent Sharing	Sang-yoon Song
5	가계대출 부도요인 및 금융업권별 금융취약성: 자영업 차주를 중심으로	정호성
6	직업훈련이 청년취업률 제고에 미치는 영향	최충 · 김남주 · 최광성
7	재고투자와 경기변동에 대한 동학적 분석	서병선 · 장근호
8	Rare Disasters and Exchange Rates: An Empirical Investigation of Korean Exchange Rates under Tension between the Two Koreas	Cheolbeom Park · Suyeon Park
9	통화정책과 기업 설비투자 - 자산가격경로와 대차대조표경로 분석 -	박상준 · 육승환
10	Upgrading Product Quality: The Impact of Tariffs and Standards	Jihyun Eum
11	북한이탈주민의 신용행태에 관한 연구	정승호 · 민병기 · 김주원
12	Uncertainty Shocks and Asymmetric Dynamics in Korea: A Nonlinear Approach	Kevin Larcher · Jaebeom Kim · Youngju Kim
13	북한경제의 대외개방에 따른 경제적 후생 변화 분석	정혁 · 최창용 · 최지영
14	Central Bank Reputation and Inflation-Unemployment Performance: Empirical Evidence from an Executive Survey of 62 Countries	In Do Hwang
15	Reserve Accumulation and Bank Lending: Evidence from Korea	Youngjin Yun
16	The Banks' Swansong: Banking and the Financial Markets under Asymmetric Information	Jungu Yang

제2018-17	E-money: Legal Restrictions Theory and Monetary Policy	Ohik Kwon · Jaevin Park
18	글로벌 금융위기 전·후 외국인의 채권투자 결정요인 변화 분석: 한국의 사례	유복근
19	설비자본재 기술진보가 근로유형별 임금 및 고용에 미치는 영향	김남주
20	Fixed-Rate Loans and the Effectiveness of Monetary Policy	Sung Ho Park
21	Leverage, Hand-to-Mouth Households, and MPC Heterogeneity: Evidence from Korea	Sang-yoon Song
22	선진국 수입수요가 우리나라 수출에 미치는 영향	최문정 · 김경근
23	Cross-Border Bank Flows through Foreign Branches: Evidence from Korea	Youngjin Yun
24	Accounting for the Sources of the Recent Decline in Korea's Exports to China	Moon Jung Choi · Kei-Mu Yi
25	The Effects of Export Diversification on Macroeconomic Stabilization: Evidence from Korea	Jinsoo Lee · Bok-Keun Yu
26	Identifying Uncertainty Shocks due to Geopolitical Swings in Korea	Seohyun Lee · Inhwan So · Jongrim Ha
27	Monetary Policy and Income Inequality in Korea	Jongwook Park
28	How the Financial Market Can Dampen the Effects of Commodity Price Shocks	Myunghyun Kim
29	Which External Shock Matters in Small Open Economies? US Economic Policy Uncertainty vs. Global Risk Aversion	Youngju Kim · Hyunjoon Lim
30	Do Korean Exports Have Different Patterns over Different Regimes?: New Evidence from STAR-VECM	Sei-Wan Kim · Moon Jung Choi
31	기술진보와 청년고용	심명규 · 양희승 · 이서현

제2018-32	북한지역 장기주택수요 및 연관 주택건설투자 추정	이주영
33	기업규모간 임금격차 원인 분석	송상윤
34	우리나라 고용구조의 특징과 과제	장근호
35	창업의 장기 고용효과: 시군구 자료 분석	조성철 · 김기호
36	수출입과 기업의 노동수요	음지현 · 박진호 · 최문정
37	청년실업의 이력현상 분석	김남주
38	노동시장 이중구조와 노동생산성: OECD 국가를 중심으로	최충 · 최광성 · 이지은
39	한국과 일본의 청년실업 비교분석 및 시사점	박상준 · 김남주 · 장근호
40	노동시장의 이중구조와 정책대응: 해외사례 및 시사점	전병유 · 황인도 · 박광용
41	최저임금이 고용구조에 미치는 영향	송헌재 · 임현준 · 신우리
42	최저임금과 생산성: 우리나라 제조업의 사례	김규일 · 육승환
43	Transmission of U.S. Monetary Policy to Commodity Exporters and Importers	Myunghyun Kim
44	Determinants of Capital Flows in the Korean Bond Market	Soohyon Kim
45	Central Bank Credibility and Monetary Policy	Kwangyong Park
46	통화정책이 자본유출입에 미치는 영향: 행태방정식 분석	이명수 · 송승주

제2018 –47	Commodities and International Business Cycles	Myunghyun Kim
제2019 –1	Deciphering Monetary Policy Board Minutes through Text Mining Approach: The Case of Korea	Ki Young Park • Youngjoon Lee • Soohyon Kim
2	The Impacts of Macroeconomic News Announcements on Intraday Implied Volatility	Jieun Lee • Doojin Ryu
3	Taking a Bigger Slice of the Global Value Chain Pie: An Industry-level Analysis	Chong-Sup Kim • Seungho Lee • Jihyun Eum
4	Trend Growth Shocks and Asset Prices	Nam Gang Lee
5	Uncertainty, Attention Allocation and Monetary Policy Asymmetry	Kwangyong Park
6	Central Bank Digital Currency and Financial Stability	Young Sik Kim • Ohik Kwon
7	은행의 수익 및 자산구조를 반영한 통화정책 위험선호경로	김익진 • 정호성
8	혁신기업에 대한 산업금융 지원: 이론모형 분석	강경훈 • 양준구
9	가계부채 제약하의 통화정책: 2주체 거시모형(TANK)에서의 정량적 분석	정용승 • 송승주
10	Alchemy of Financial Innovation: Securitization, Liquidity and Optimal Monetary Policy	Jungu Yang
11	Measuring Monetary Policy Surprises Using Text Mining: The Case of Korea	Youngjoon Lee • Soohyon Kim • Ki Young Park
12	Tracking Uncertainty through the Relative Sentiment Shift Series	Seohyun Lee • Rickard Nyman
13	Intra-firm and Arm's Length Trade during the Global Financial Crisis: Evidence from Korean Manufacturing Firms	Moon Jung Choi • Ji Hyun Eum

제2019-14	특허자료를 이용한 우리나라 지식전파의 지역화 분석	이지홍 · 남윤미
15	Overhead Labour and Skill-Biased Technological Change: The Role of Product Diversification	Choong Hyun Nam
16	Does the Number of Countries in an International Business Cycle Model Matter?	Myunghyun Kim
17	High-Frequency Credit Spread Information and Macroeconomic Forecast Revision	Bruno Deschamps · Christos Ioannidis · Kook Ka
18	경제 분석을 위한 텍스트 마이닝	김수현 · 이영준 · 신진영 · 박기영
19	Takeover, Distress, and Equity Issuance: Evidence from Korea	Euna Cho
20	The Cash-Flow Channel of Monetary Policy: Evidence from Mortgage Borrowers	Sang-yoon Song
21	부의 효과의 분위 추정: 분위 정준 공적분회귀를 중심으로	김기호
22	Identifying Government Spending Shocks and Multipliers in Korea	Kwangyong Park · Eun Kyung Lee
23	Systemic Risk of the Consumer Credit Network across Financial Institutions	Hyun Hak Kim · Hosung Jung
24	Impact of Chinese Renminbi on Korean Exports: Does Quality Matter?	Jihyun Eum