Do South Korean Exports Compete with Chinese Exports in Third Markets?

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March 2017

JEL classification: F14, F13

Keywords: Exchange rates; Exports; South Korea; China

Abstract: China has emerged as a formidable competitor with developing countries in the export of lower technology goods. It also competes with Korea in the export of machinery goods. This paper investigates whether Korea and China compete in exporting lower-technology goods such as ships and steel. Results from panel dynamic ordinary least squares estimation indicate that a 10 percent depreciation of the Chinese renminbi will cause Korean lower-technology exports to decrease by 4 or 5 percent and that a depreciation of the Korean won will not cause Chinese exports to decrease. Since competing with China based on price may prove difficult, Korean firms should pursue innovation and strong brands.

1. Introduction

Mattoo, Mishra and Subramanian (2017) investigated how China's exchange rate affects the exports of developing countries to third markets. They noted that very little research has investigated this question. They focused on developing countries because they found that their products compete much more with Chinese products in third market than industrial countries' products do. They included product and destination-specific indices of competition between China and developing country competitors over the 2000-2014 period and reported that a country's exports of products that compete with China increase when the renminbi appreciates.

Baak (2014) examined whether Chinese and Korean machinery exports compete in the Japanese market. Employing a structural model and panel data of 16 machinery products from 2000Q1 to 2012Q2, he reported that a decrease in the unit prices of Chinese exports leads to a decrease in the demand for Korean exports but a decrease in the unit prices of Korean exports does not lead to a decrease in the demand for Chinese exports. In addition, simulation experiments revealed that a depreciation of the Chinese yuan against the Japanese yen increases the Chinese export volume and decreases the Korean export volume substantially. On the other hand, a depreciation of the won against the yen increases the Korean export volume and does not decrease but rather increases the Chinese export volume. These results imply that China competes with Korea in the Japanese machinery market.

Baak's (2014) findings indicate that China and Korea compete in exporting higher technology goods. Mattoo *et al.*'s (2017) findings indicate that China competes with developing countries in exporting lower technology goods. There is a gap in the literature concerning whether China and Korea compete in exporting lower technology goods. Over the 2011-2015 period, 33 percent of Korea's manufacturing exports are categorized as lower technology (LT) or medium low technology (MLT) according to the approach of the OECD (see Hatzichronoglou, 1997).[1] The OECD determines technology levels based on the ratio of R&D spending to value-added.

Table 1 lists Korea's exports in these categories. The four leading LT and MLT exports are shipbuilding, refined petroleum, iron and steel, and rubber and plastic products. Together these four categories accounted for USD 100 billion in exports in 2015.

Figure 1 shows the value of Korea's and China's exports of these four leading categories. The figure indicates that China is also an important exporter in each of these categories. The Korea Institute for Industrial Economics and Trade found that Chinese steel and petrochemical exports are equal in quality to Korean steel and petrochemical exports, but that Chinese exports are significantly cheaper (see Kyu-won, 2016). There may thus be significant price competition between Korea and China in lower technology goods.[2]

This paper investigates this issue. The results indicate that a depreciation of the renminbi leads to a large decrease in Korean LT and MLT exports. The evidence also indicates that a depreciation of the won does not reduce Chinese lower technology exports.

The next section presents the data and methodology. Section 3 contains the results. Section 4 concludes.

2. Data and Methodology

To estimate trade elasticities, standard export functions are used:

$$ex_t = \alpha_0 + \alpha_1 rer_t + \alpha_2 y_t^* \qquad (1)$$

[1] These data come from the CEPII-CHELEM database.
[2] Jung-a (2016) discussed the fierce competition that Korean shipbuilders face from Chinese competitors.

where ex_t represents Korean exports, rer_t represents the real exchange rate between Korea and the importing country, and y_t^* represents real gross domestic product in the importing country. To test for competition with China in third markets, the Chinese real exchange rate relative to the importing country is also included. In addition, trade elasticities are estimated for Chinese exports and the Korean real exchange rate relative to the importing country is included.

Korean low and medium low technology exports to 21 major importers over the 1991-2015 period are employed. Countries that were minor importers over part of the sample period are excluded because these countries can have large percentage changes due to idiosyncratic factors rather than due to changes in real exchange rates and real GDP and these large changes can cloud inference. The major importing countries are Australia, Canada, Denmark, France, Germany, Hong Kong, Indonesia, Italy, Japan, Malaysia, Mexico, the Netherlands, the Philippines, Saudi Arabia, Singapore, Spain, Sweden, Taiwan, Thailand, the United Kingdom, and the United States.

Similarly, China's LT and MLT exports to major importers over the 1991-2015 period are used to estimate trade elasticities for China. For China the major importing countries are Australia, Canada, France, Germany, Hong Kong, Italy, Japan, Malaysia, the Netherlands, the Russian Federation, Saudi Arabia, Singapore, Spain, Taiwan, Thailand, the United Kingdom, and the United States.

Data on total LT and MLT exports are measured in U.S. dollars and are obtained from the CEPII-CHELEM database. Korea's exports are deflated using price deflator data for exports from the Asian Newly Industrialized Economies obtained from the Bureau of Labor Statistics

(BLS). China's exports are deflated using deflator data for Chinese exports also obtained from the BLS.[3]

Annual data on real GDP in the importing countries and the bilateral real exchange rates between Korea or China and the importing countries are also obtained from the CEPII-CHELEM database. An increase in the real exchange rate represents an appreciation of either the Korean won or the Chinese renminbi relative to the importing country's currency.

A battery of panel unit root tests and Kao (1999) and Pedroni (2004) cointegration tests point to cointegrating relations among the variables. The Mark-Sul (1999) weighted DOLS estimator is thus employed. The estimated model for Korean exports takes the form:

$$ex_{j,t} = \beta_0 + \beta_1 rer_{j,t} + \beta_2 y_{j,t}^{*} + \beta_3 rmb_{j,t} + \sum_{k=-p}^{p} \alpha_{1,j,k} \Delta rer_{j,t-k} + \sum_{k=-p}^{p} \alpha_{2,j,k} \Delta y_{j,t-k}^{*} \qquad (2)$$
$$+ \sum_{k=-p}^{p} \alpha_{3,j,k} \Delta rmb_{j,t-k} + u_{j,t},$$
$$t = 1, \cdots, T; \qquad j = 1, \cdots, N.$$

Here $ex_{j,t}$ represents real exports from the South Korea to country *j*, $rer_{j,t}$ represents the bilateral real exchange rate between Korea and country *j*, $y_{j,t}^{*}$ represents real GDP in country *j*, and $rmb_{j,t}$ represents the bilateral real exchange rate between China and country *j*. Cross-section specific lags and leads of the first differenced regressors are included to asymptotically remove endogeneity and serial correlation.[4] A sandwich estimator is employed to allow for heterogeneity in the long-run residual variances. Individual specific

[3] BLS deflator data for China are available starting in 2003. Following Chinn (2006), BLS deflator data for manufactured exports from non-industrialized countries is spliced to the Chinese deflator data and used to deflate Chinese exports before 2003.
[4]The number of lags and leads is determined by the Schwarz Information Criterion.

fixed effects are always included. A model analogous to equation (2) is estimated for Chinese exports.

Figure 2 plots Korean exports to the major importing countries and Figure 3 plots Chinese exports to major importers. As one might expect, Figure 3 shows that Chinese export growth has followed a smooth upward. Chinese exports have increased steadily over the sample period. Figure 2 indicates that, while Korean exports have also tended to increase, the growth around the upward trend has been much more erratic. Thus, the equations for China's exports include time trends. The equations for Korea's exports are estimated both including and excluding time trends.

3. Results

Table 2 presents the results for Korean exports. Columns (2) and (4) include a trend term, and columns (1) and (3) do not. All of the coefficients are of the expected signs and statistically significant at the one percent level. The magnitude of the effects are also plausible. The overall fit, as measured by the standard error of the regression, is slightly better when a trend term is included.

Columns (1) and (2) report results with the won exchange rate and GDP in importing countries. The results indicate that a 10 percent increase in rest of the world GDP would increase exports by about 20 percent and a 10 percent depreciation of the won would increase Korean exports by 8 percent.

Columns (3) and (4) include the renminbi exchange rate in the model. The findings indicate that a 10 percent increase in GDP in importing countries will increase Korean exports by between 15 and 18 percent. In addition, the results indicate that a 10 percent depreciation of the won will increase Korean exports by 9 percent and that a 10 percent depreciation of the renminbi will reduce Korean exports by between 3.5 and 5.7 percent. Baak (2014) reported that a 10 percent won depreciation would increase Korean exports by 9 percent and that a 10 percent renminbi depreciation would decrease Korean exports by 2 percent. The effect of a renminbi depreciation reported in Table 2 is larger, perhaps reflecting stronger price competition in lower technology goods as opposed to the machinery exports that Baak examined.

Table 3 reports the results for Chinese exports. The results indicate that the Chinese exchange rate has a large effect on Chinese exports. A 10 percent renminbi depreciation will reduce Chinese exports by between 11 and 12 percent. The high price elasticities may reflect Ito's (2008) observation that profit margins for Chinese labor-intensive goods are razor thin.

There is no evidence in the table, however, that a depreciation of the Korean won would reduce Chinese exports. Baak (2014) found that a depreciation of the won would not decrease but would actually increase Chinese exports.

The important implication of these findings is that Korean firms exporting lower technology goods face significant price competition from Chinese firms. Chinese firms, on the other hand, do not appear to face the same competition from Korean rivals.

4. Conclusion

Exports play an important role for the Korean economy. Its export/GDP ratio exceeds 50 percent. One-third of Korea's manufactured exports in recent years have been lower technology goods such as ships and steel. Since China is a key producer in these industries, one might expect that there would be significant price competition between China and Korea in these goods.

To test for this, this paper estimates export functions for Korea and China's exports of low technology and medium low technology goods to major importing countries. Evidence from panel DOLS estimations points to exchange rate elasticities of 0.8 or 0.9 for Korean exports and of 1.1 or 1.2 for Chinese exports. In addition, the results indicate that a ten percent depreciation of the renminbi would reduce Korean LT and MLT exports by between 4 and 6 percent and that a depreciation of the Korean won would not decrease Chinese exports.

These findings indicate that Korean firms face substantial competition from Chinese firms in lower technology goods. Since Chinese wages are lower than Korean wages, it may be difficult for Korea producers to compete with Chinese producers based on price.

To remain competitive, Korea should foster innovation and technological advancement. New ideas, creativity, and valuable brands can help Korean companies to confront the challenges from a rising China. Education can help in this process, especially education that provides useful skills that employers need.

The findings also have implications for exchange rate policy in the region. With Korean firms facing such intense competition with China in third markets, Korean officials may be reluctant to see the won appreciate. Officials in other Asian countries may also be reluctant to see their currencies appreciate against the RMB. However, East Asia runs surpluses with the rest of the world year after year that exceed half a trillion dollars. These surpluses are largely driven by goods such as electronics that are produced within regional production networks. The value-added for these products come from Korea, Taiwan, Japan, China, and other regional economies. As protectionist pressure in the West intensifies, it may be necessary for Asia to reduce these surpluses and redirect final goods to East Asia. In order to accomplish this, a joint appreciation of East Asian currencies is necessary (see Thorbecke, 2016). However, with Asian countries competing ferociously in third markets, each may resist letting their currencies appreciate against their neighbors' currencies. There may thus be a need for regionally concerted actions to allow Asian currencies to appreciate together against Western currencies such as the U.S. dollar.

Table 1. Korea's Low and Medium Low Technology Exports to the World in 2015

Export Category (International Standard Industrial Classification Category)	Value of Exports in 2015 (billions of U.S. dollars)	Percent of Korea's Total Low and Medium Low Technology Exports in 2015
Building and Repairing of Ships and Boats (ISIC 351)	$31.61	20.09%
Refined Petroleum Products and Coke (ISIC 23)	$31.53	20.04%
Manufactured Basic Iron and Steel (ISIC 271)	$23.16	14.72%
Rubber and Plastic Products (ISIC 25)	$13.34	8.48%
Fabricated Metal Products excluding Machinery (ISIC 28)	$12.97	8.25%
Manufactured Basic Non-ferrous Metals (ISIC 272)	$10.87	6.91%
Textiles (ISIC 17)	$9.84	6.26%
Food Products and Beverages (ISIC 15)	$4.68	2.97%
Furniture Manufacturing (ISIC 36)	$2.93	1.86%
Non-metallic Minerals (ISIC 26)	$2.88	1.83%
Paper and Paper Products (ISIC 21)	$2.80	1.80%
Leather Products (ISIC 19)	$1.67	1.06%
Wearing Apparel and Fur (ISIC 18)	$1.48	0.94%
Tobacco Products (ISIC 16)	$1.05	0.67%
Publishing and Printing (ISIC 22)	$0.25	0.17%
Wood Products excluding Furniture (ISIC 20)	$0.08	0.05%

Source: CEPII-CHELEM Database and calculations by the author.

Table 2. Panel Dynamic OLS estimates for Korean Low and Medium Low Technology Exports to 21 Trading Partners over the 1991-2015 Period

	(1)	(2)	(1)	(2)
Korean Bilateral Real Exchange Rate Relative to Importing Countries	-0.77*** (0.11)	-0.78*** (0.11)	-0.94*** (0.13)	-0.86*** (0.11)
Chinese Bilateral Real Exchange Rate Relative to Importing Countries			0.57*** (0.11)	0.35*** (0.12)
GDP in Importing Countries	2.11*** (0.07)	1.46*** (0.26)	1.78*** (0.11)	1.45*** (0.30)
Fixed Effects Included	Yes	Yes	Yes	Yes
Time Trend Included	No	Yes	No	Yes
Number of Observations	523	522	518	518
Adjusted *R*-squared	0.914	0.937	0.937	0.949
S.E. of Regression	0.352	0.302	0.321	0.290

Note: The dependent variable is the volume of total low and medium low technology exports from South Korea to 21 countries. Exports are categorized as low and medium low technology goods using the OECD methodology (see Hatzichronoglou, 1997). Data on exports, exchange rates, and GDP are obtained from the CEPII-CHELEM database and data on U.S. export prices are obtained from Federal Reserve Bank of St. Louis FRED database. An increase in the exchange rate represents an appreciation. The predicted sign is negative for the Korean exchange rate and positive for the Chinese exchange rate. The lag length for each cross section is selected based on the Schwarz Criterion. Standard errors are calculated using the Bartlett Kernel and the Newey-West fixed bandwidth method.
*** denotes significance at the 1% level.

Table 3. Panel Dynamic OLS estimates for Chinese Low and Medium Low Technology Exports to 17 Trading Partners over the 1991-2015 Period

	(1)	(2)
Chinese Bilateral Real Exchange Rate Relative to Importing Countries	-1.12*** (0.06)	-1.19*** (0.07)
Korean Bilateral Real Exchange Rate Relative to Importing Countries		0.07 (0.09)
GDP in Importing Countries	2.38*** (0.15)	2.29*** (0.17)
Fixed Effects Included	Yes	Yes
Time Trend Included	Yes	Yes
Number of Observations	414	414
Adjusted *R*-squared	0.981	0.982
S.E. of Regression	0.190	0.184

Note: The dependent variable is the volume of total low and medium low technology exports from South Korea to 21 countries. Exports are categorized as low and medium low technology goods using the OECD methodology (see Hatzichronoglou, 1997). Data on exports, exchange rates, and GDP are obtained from the CEPII-CHELEM database and data on U.S. export prices are obtained from Federal Reserve Bank of St. Louis FRED database. An increase in the exchange rate represents an appreciation. The predicted sign is negative for the Korean exchange rate and positive for the Chinese exchange rate. The lag length for each cross section is selected based on the Schwarz Criterion. Standard errors are calculated using the Bartlett Kernel and the Newey-West fixed bandwidth method.

*** denotes significance at the 1% level.

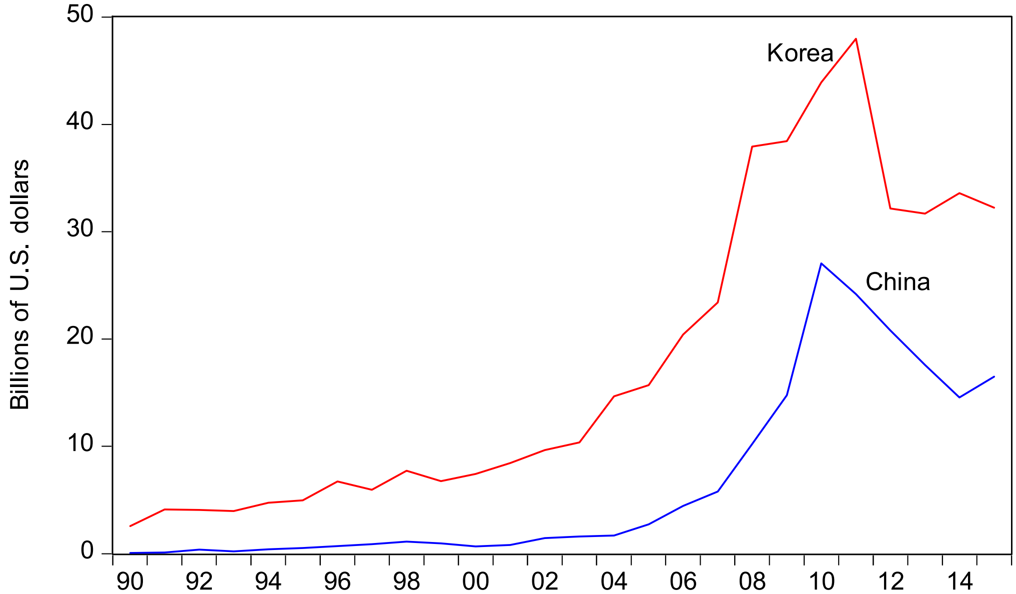

Figure 1a. The Value of Korean and Chinese Exports of Ships to the World.
Note: The exports come from International Standard Industrial Classification (ISIC) category 351.
Source: CEPII-CHELEM database.

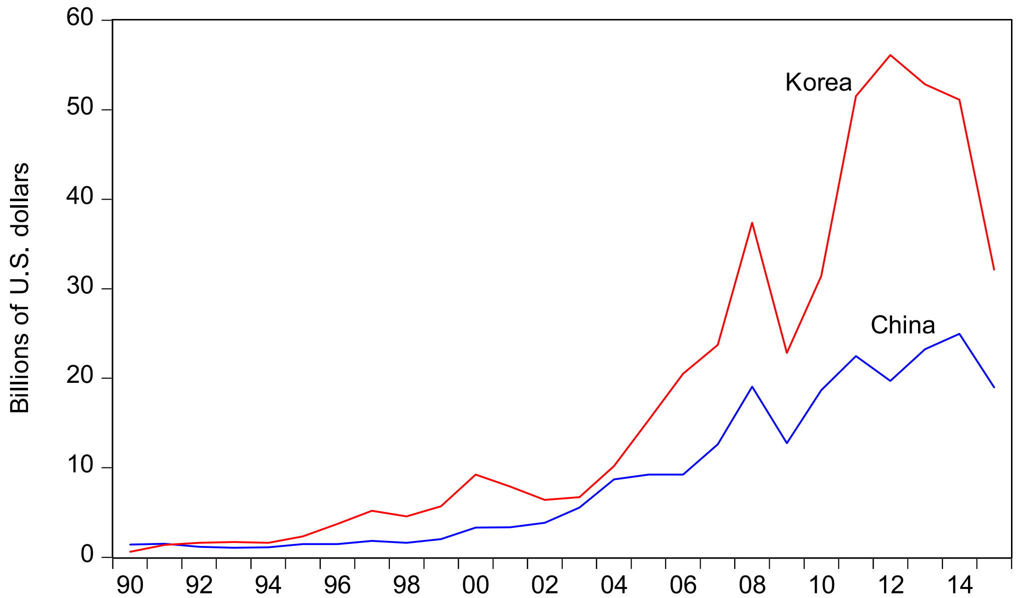

Figure 1b. The Value of Korean and Chinese Exports of Refined Petroleum Products and Coke to the World.
Note: The exports come from International Standard Industrial Classification (ISIC) category 23.
Source: CEPII-CHELEM database.

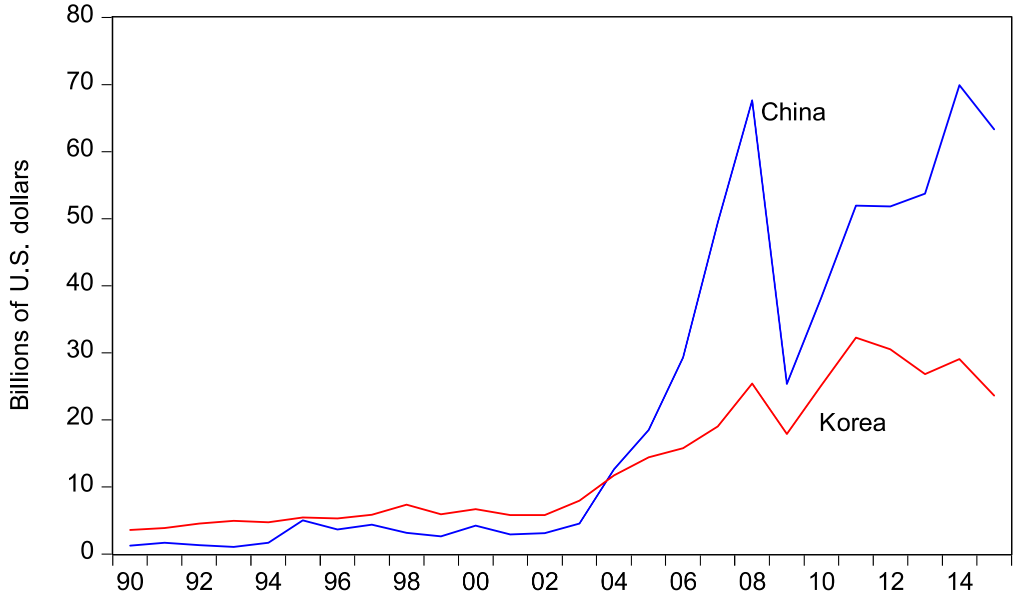

Figure 1c. The Value of Korean and Chinese Exports of Manufactured Iron and Steel to the World.
Note: The exports come from International Standard Industrial Classification (ISIC) category 271.
Source: CEPII-CHELEM database.

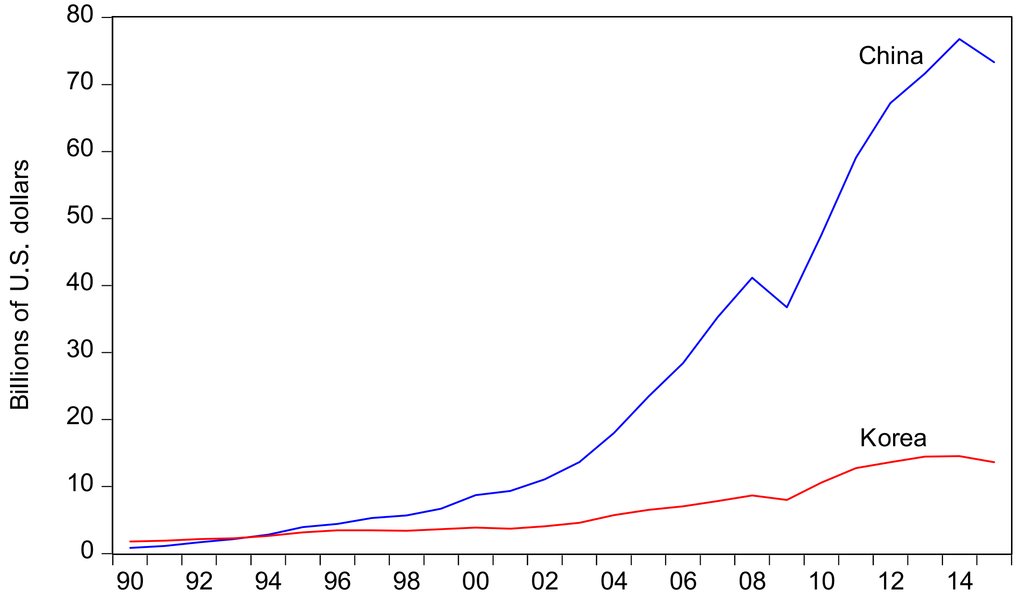

Figure 1d. The Value of Korean and Chinese Exports of Rubber and Plastic Products to the World.
Note: The exports come from International Standard Industrial Classification (ISIC) category 25.
Source: CEPII-CHELEM database.

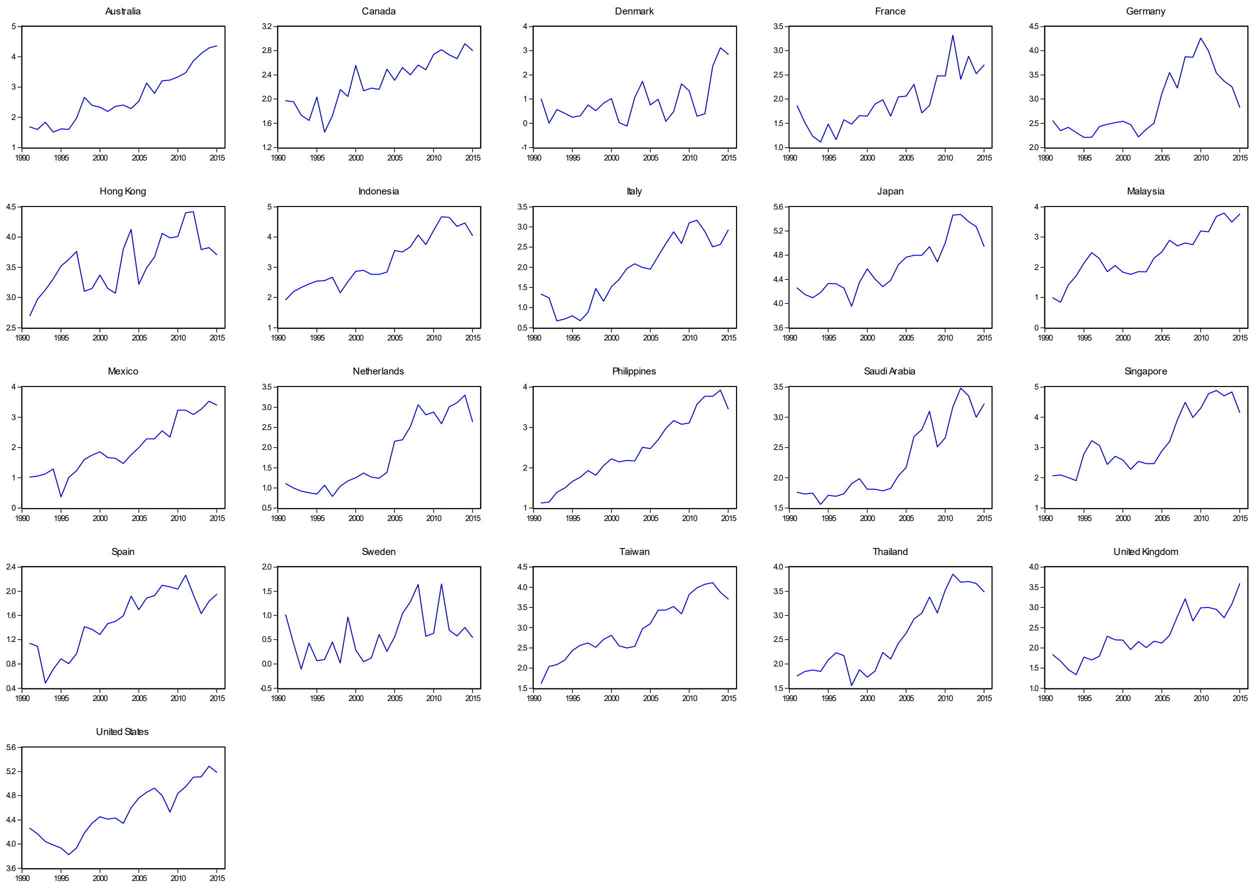

Figure 2. Log of Korean Low and Medium Low Technology Exports to Major Importing Countries over the 1990-2015 Period.
Source: CEPII-CHELEM database.

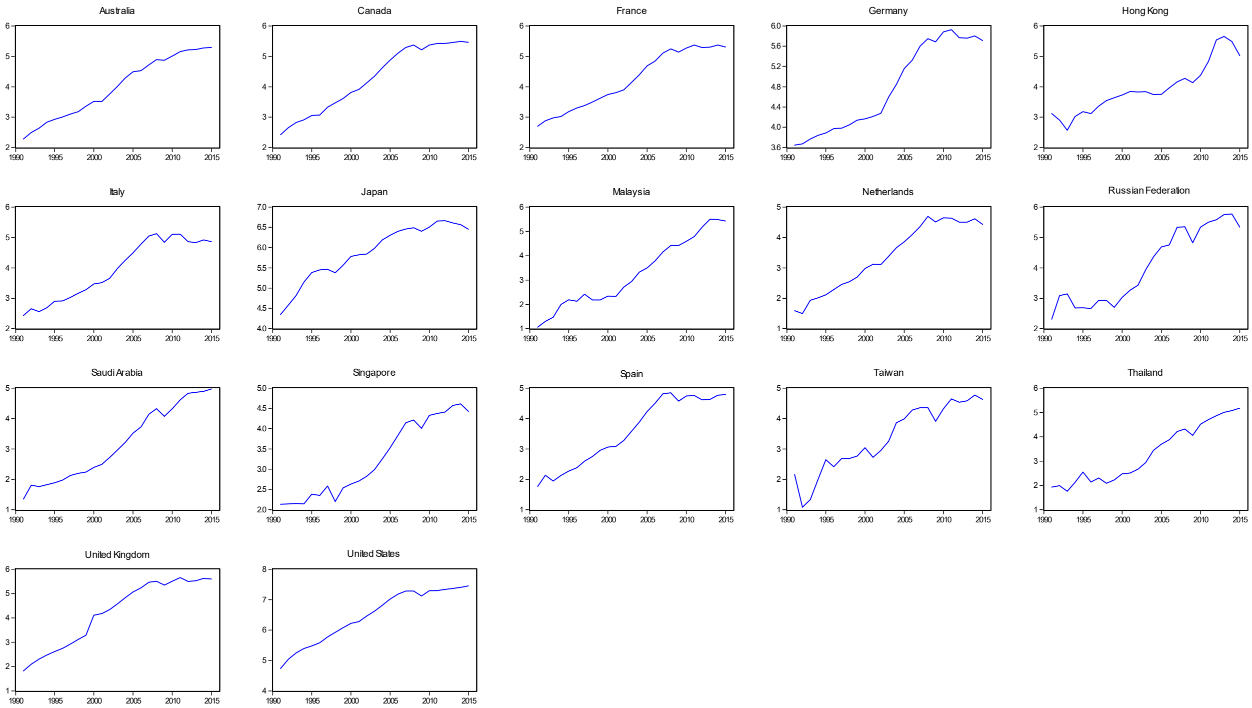

Figure 3. Log of Chinese Low and Medium Low Technology Exports to Major Importing Countries over the 1990-2015 Period.
Source: CEPII-CHELEM database.

References

Baak, S.J. (2014) Do Chinese and Korean products compete in the Japanese market? An investigation of machinery exports. *Journal of the Japanese and International Economies*, 34: 256-271.

Chinn, M., (2006). Estimating U.S.-China trade elasticities: some very preliminary results. Econbrowser weblog, Nov. 2. Available at www.econbrowser.com.

Hatzichronoglou, T., (1997). Revision of the high-technology sector and product classification. Science, Technology and Industry Working Paper No. 1997-02. Paris, France, OECD.

Ito, T., (2008). Influence of the renminbi on exchange rate policies of other Asian currencies. In M. Goldstein and N. R. Lardy, eds., *Debating China's Exchange Rate Policy*, Washington: Institute for International Economics.

Jung-a, S. 2016. South Korean shipbuilders engulfed in crisis. *Financial Times*, 23 June.

Kao, C., (1999), Spurious regression and residual-based tests for cointegration in panel Data. *Journal of Econometrics* 90:1–44.

Kyu-won, K., (2016). South Korea's Leading Industries Feeling the Heat of Competition from China. *Hankyoreh*, July 1.

Mark, N. and D. Sul (1999). A computationally simple cointegration vector estimator for panel data, Ohio State University Manuscript.

Mattoo, A., P. Mishra, and A. Subramanian (2017). Spillover effects of exchange rates: A study of the renminbi. *American Economic Journal: Economic Policy*, forthcoming, available at: http://econ.columbia.edu/files/econ/content/mms_china_don_conference.pdf

Pedroni, P., (2004). Asymptotic and finite sample properties of pooled time series with an application to the PPP hypothesis. *Econometric Theory*,20: 597–625

Thorbecke, W., (2016). China's electronics exports, the renminbi, and exchange rates in supply chain countries. RIETI Discussion Paper Series 16-E-088. Tokyo, RIETI.