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Industry-specific real effective exchange rates of Japan, Korea, and China*

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Abstract

This paper constructs a new data set of the industry-specific real effective exchange rate (REER), based on the producer price indices, of the Japanese yen, Korean won, and Chinese renminbi on a daily basis from 2005 to the present in order to provide a better indicator for the international price competitiveness of the three countries. We show a large difference in the level of REER not only between the countries but also across industries. By conducting factor decomposition analysis of industry-specific REER, it is revealed that a substantial fall in domestic producer prices during the won appreciation period has enhanced Korean firms' export competitiveness compared to Japanese firms, especially in the electrical machinery industry. In contrast, Japanese automobile firms do not lose export competitiveness with respect to their Korean counterparts, due to the relative decline of domestic production costs.

Keywords: Real effective exchange rate (REER), Industry-specific exchange rate, Export competitiveness
JEL classification: F31, F33, F15

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1. Introduction

It has been repeatedly pointed out that the nominal appreciation of the Japanese yen vis-à-vis the US dollar deteriorates export price competitiveness of Japanese firms. After the collapse of Lehman Brothers in September 2008, for instance, the yen appreciated sharply in nominal terms vis-à-vis all currencies, which resulted in a large decline of Japanese exports. The yen kept appreciating since then and stayed around 80 yen vis-à-vis the US dollar from July 2011, while the yen started to depreciate from the end of 2012. Exchange rates of the yen vis-à-vis Asian currencies are important as well in considering Japanese exporter's price competitiveness. For example, the yen and the Korean won moved in opposite directions vis-à-vis the US dollar for the last ten years. As the yen appreciated sharply in nominal terms vis-à-vis the won, Japanese firms were exposed to increasingly severe competition with Korean counterparts.

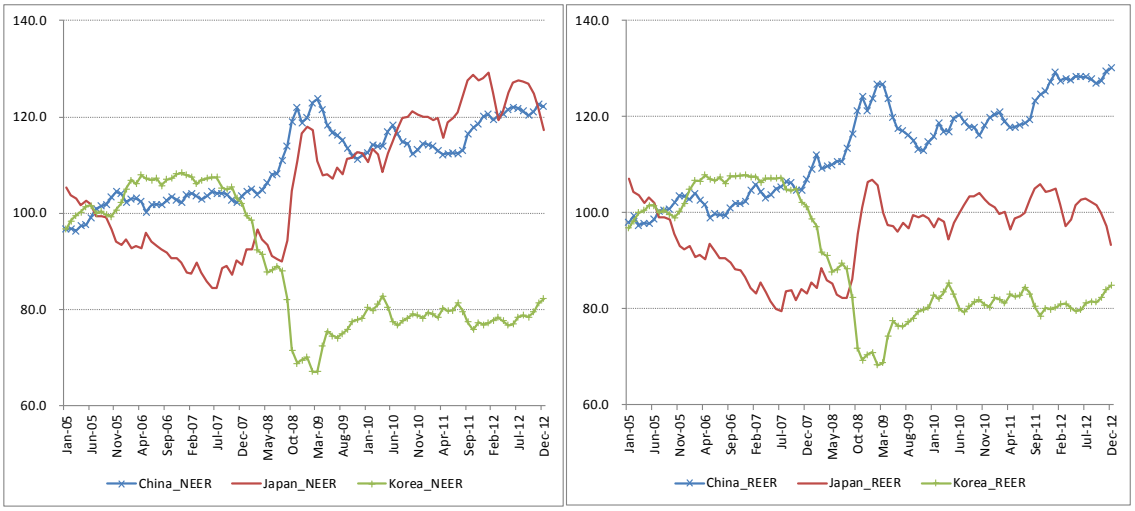
To consider the impact of exchange rate changes on export performance, however, it is not the bilateral nominal exchange rate but the real effective exchange rate (REER) that provides a better measurement of exporting firms' price competitiveness in the global market. The Bank for International Settlements (BIS) publishes both nominal and real effective exchange rates of Japan, Korea and China (Figure 1). It is shown that while the nominal effective exchange rate (NEER) of the yen exhibits a clear upward trend, the REER of the yen stays at around 100 which is equivalent to the 2005-year level. The difference between the yen and the won becomes much smaller if measured by REERs. As will be discussed below, however, the impact of exchange rate changes in fact differs markedly across industries. The REERs published by BIS do not provide any information on such industry-level differences.

There have been a few studies that analyze REERs at an industry level. Goldberg (2004), for example, demonstrates the effectiveness of industry-specific indices by showing that the use of aggregate indices misses the empirical importance of the exchange rate on producer profits in specific industries. By constructing three industry-specific REERs for the United States, industry-specific data is found to be appropriate for understanding the effects of exchange rate fluctuations on respective US industries. By making both aggregate and sector-specific exchange rate indexes for the Portuguese economy, Alexandre, Bação, Cerejeira and Portela (2009) find that the sector-specific exchange rates are more informative than aggregate exchange rates in explaining changes in domestic employment. But, these studies fail to utilize the industry-specific price data for all trading partner countries, which results in an inaccurate calculation of industry specific REERs.

The main contribution of this paper is to construct the new dataset of industry-specific REERs of the yen, the won and the Chinese renminbi as a useful measure to consider the empirical importance of the exchange rate on the exporting firms' competitiveness and performance across industries. A daily series of REER for 13 industries is presented with the sample period ranging from 3rd January 2005 to the present, which shows a large difference in a level of REER not only between three countries but also across industries.[1]

Figure 1. Nominal and Real Effective Exchange Rates of Japanese Yen, Korean Won and Chinese Renminbi:

1a. Nominal Effective Exchange Rates *1b. Real Effective Exchange Rates*



Note: January 2005 through December 2012 (2005 = 100). An increase indicates exchange rate appreciation.

Source: Bank for International Settlements (BIS) effective exchange rate indices (broad indices) comprising 61 economies (http://www.bis.org/statistics/eer/index.htm).

Second, we focus particularly on REER of the two major machinery industries: electric machinery and transport equipment. As discussed in Sato, Shimizu, Shrestha and Zhang (2012a), there is a large difference in the level of REER across Japanese industries and the electrical machinery REER exhibits a largest depreciation among them, which implies that Japanese electrical machinery firms can enjoy export price competitiveness compared to other Japanese industries. However, it is well known that Japanese electrical machinery firms are suffering from worsening business performance

[1] Sato, Shimizu, Shrestha and Zhang (2012a) present the industry-specific REER of the yen for 12 industries. We develop our database and construct REER for 13 industries.

and severe export competition in the world market. It is not sufficient to look at the Japanese REER alone, and the competitors' REERs need to be considered. By comparing the industry-specific REERs between Japan and Korea, we show that Korean electric machinery firms enjoy much larger depreciation of the REER and, hence, stronger export price competitiveness.

Third, by conducting factor decomposition analysis of industry-specific REER, it is revealed that a substantial fall of domestic producer prices during the won appreciation period has enhanced Korean firms' export competitiveness compared to the Japanese one especially in the electric machinery industry. In contrast, Japanese automobile firms do not lose export competitiveness with respect to the Korean counterparts, due to the relative decline of domestic production costs.

The remainder of this paper is organized as follows. Section 2 discusses the effect of exchange rate changes on stock prices as well as domestic prices in Japan and Korea. Section 3 describes the method of constructing the industry-specific REER. Section 4 shows the REER of three Asian currencies for each industry and presents the results of simulation analysis to reveal why Japanese electric machinery firms lose the export competitiveness against the competitor firms in Korea. Finally, Section 5 concludes.

2. Exchange Rate Impact on Japanese and Korean Economies

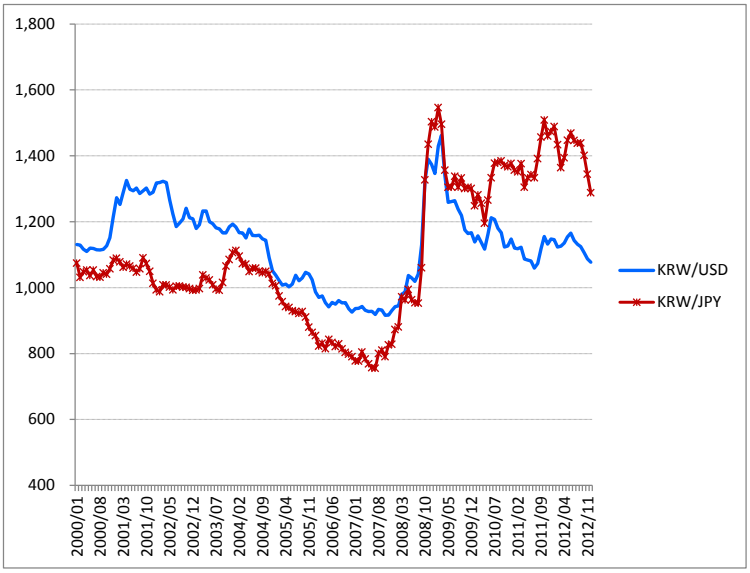
2.1 Exchange Rate and Stock Prices

It is widely known that Japanese machinery firms face a severe competition with Korean counterparts in some industries such as electrical machinery and transport equipment (automobiles). The yen/won exchange rate fluctuation is likely to be one of the most important factors. The won fell precipitously against other currencies in nominal terms after the collapse of Lehman Brothers, keeping price competitiveness of Korean exports, while the sharp appreciation of the yen dampened Japanese exports. Since the end of 2012, however, investor's sentiment in foreign exchange markets has dramatically changed. The yen has started to depreciate, while the won has appreciated (Figure 2). Such a yen's sudden slide has revived a talk of global currency war that leads to competitive devaluation of currencies to gain export price competitiveness.

Figures 3-A and 3-B show the relationship between the yen/won nominal exchange rate and stock price movements of Japanese and Korean representative

companies in the automobile industry and the electrical machinery industry, respectively. In the won appreciation period between 2006 and 2007, stock prices of most Japanese companies are higher than those of Korean companies. When all stock prices are standardized at 100 in January 2005, Toyota's stock price was almost 80 points higher than Hyundai's price in the first half of 2007. Similarly, the stock price of SONY was almost 75 points higher than that of Samsung in the mid-2007. After September 2008, however, the won started to depreciate sharply while the yen began to appreciate against the US dollar, the euro and other currencies. The prolonged appreciation of the yen forced Japanese companies into severe price competition in the global market, while Korean export companies such as Hyundai and Samsung increased their market share at the expense of Japanese rivals. The stock price of Hyundai and Samsung has continued to surge since then. In April 2012, Hyundai's stock price reached the record-high of 461, while the stock price of three Japanese automobile companies stayed around 100. In the same period, the stock price of Samsung rose to 280, while three Japanese electrical machinery companies experienced a substantial decline of stock prices to 40 or less. Surprisingly, the Samsung's stock price soared more than 7 times higher than the Japanese electric companies' price.

Figure 2. Bilateral Nominal Exchange Rate of Korean Won

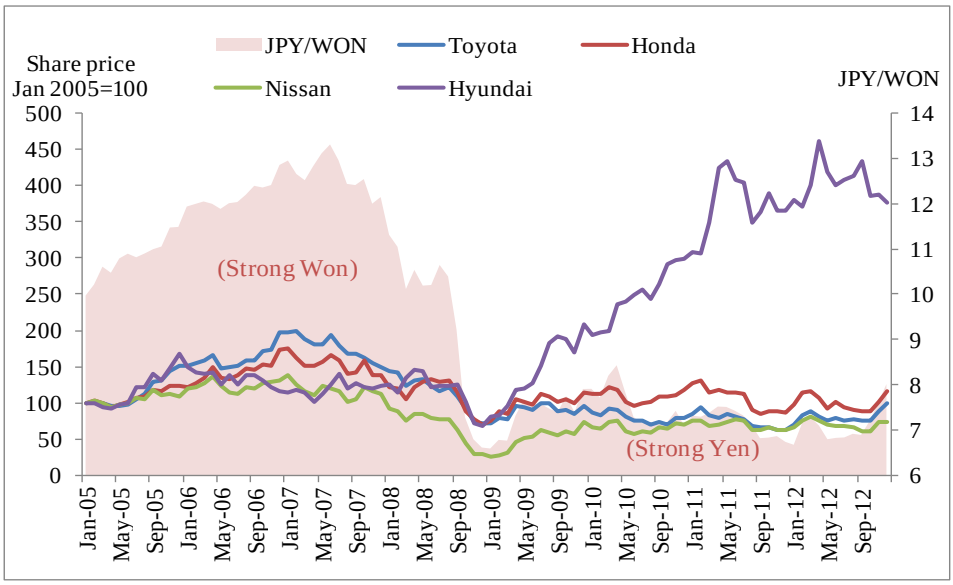


Note: January 2000 through December 2012. "KRW/USD" denotes the bilateral nominal exchange rate (NER) of the won vis-à-vis the US dollar. "KRW/JPY" stands for the NER of the won vis-à-vis the yen (100 yen). Increase indicates depreciation of NER.

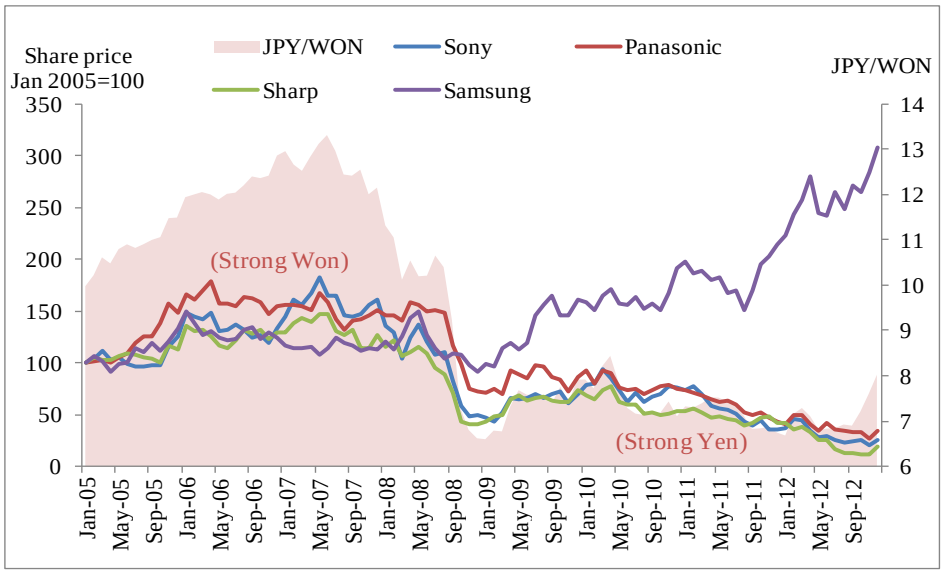
Source: Bank of Korea (http://ecos.bok.or.kr/EIndex_en.jsp).

Figure 3. Exchange Rates and Stock Prices of Japanese and Korean Firms

3-A: Stock Prices of Automobile Companies



3-B: Stock Prices of Electrical Machinery Companies



Note: Stock prices are standardized to 100 as of January 2005=100. JPY/WON denotes the exchange rate of Japanese yen vis-à-vis 100 Korean won.

Source: Stock price data is obtained from Bloomberg and exchange rate data from Datastream.

In the end of 2012, the yen started to depreciate, turning the tables on its Asian exporting rivals, especially Korea. Figure 3-A shows that Hyundai experienced a slowdown in stock prices in 2011 and a subsequent decline in the latter half of 2012,

while the stock price of three Japanese automobile companies took an upturn in the same period. It must be noted that the stock price movements in the electrical machinery industry differ markedly from those in the automobile industry. The stock price of Samsung still keeps climbing up to the highest level, while three Japanese electrical machinery companies has not got out of the prolonged slump of stock prices. The above observation indicates that the effect of nominal yen/won exchange rate differs between two major machinery industries.

2.2 Exchange Rate and Domestic Prices

Let us turn to an analysis of the exchange rate impact on domestic price changes. Three price indices are presented in Figure 4 for Korea and in Figure 5 for Japan. Both Bank of Japan and Bank of Korea publish two types of export and import price indices: one is on domestic currency base and the other is on the contract currency (invoice currency) base.[2] There is one difference between two figures. While Figure 5 presents the price data of Japanese electrical machinery exports, Figure 4 divides the electrical machinery category into two parts: one is the electrical machinery and apparatus and the other is the communication equipment.

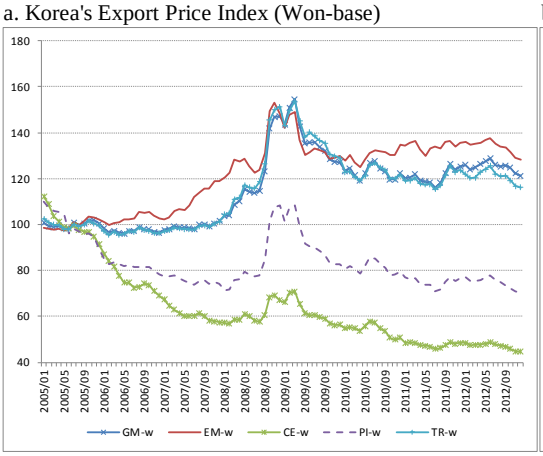
Figures 4b and 5b show that export prices are relatively stable in contract currency terms. It is widely known that Korean trade is generally invoiced in US dollars. In Figure 4b, Korean export prices of both communication equipment and precision instruments exhibit a steady downward trend even in contract currency terms, which differs from Japanese corresponding export prices (Figure 5b). According to both Figures 4a and 4b, the won-base export price increased substantially in response to the large depreciation of the nominal won/US dollar exchange rate, which clearly shows that nominal exchange rate depreciation results in considerable exchange gains of Korean exporting companies (Figure 4f).[3] In response to the yen appreciation for about 4 years, Japanese exporters took exchange losses (Figure 5f), because Japanese exporters pursue the pricing-to-market (PTM) strategy. Such PTM behavior can be confirmed by the decline of yen-base export prices of Japanese machinery exports (Figure 5a), while the contract currency-base export price has been stable at around the level of the base year (Figure 5b).

[2] METI (2012) also makes a comparison of export price changes between the domestic currency-base index and the contract currency-base one.

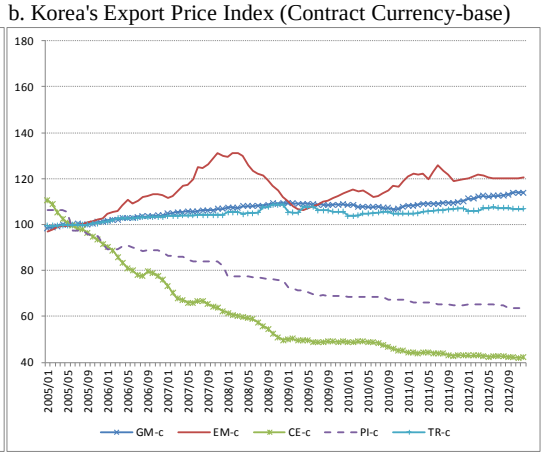
[3] Exchange gain/loss in Figures 4f and 5f is obtained by dividing the domestic currency-base export price by the contract currency-base export price.

Figure 4. Price Index in Korea (January 2005 through December 2012)

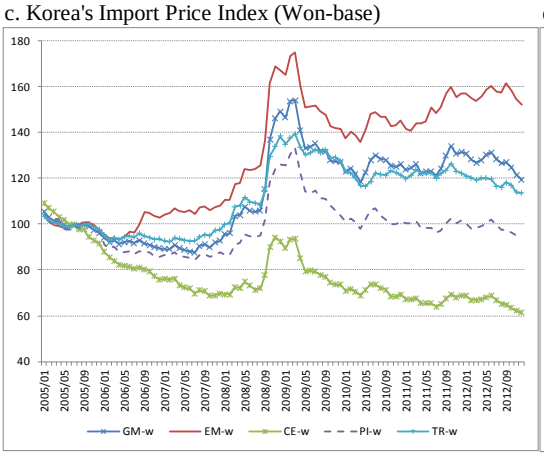
a. Korea's Export Price Index (Won-base)



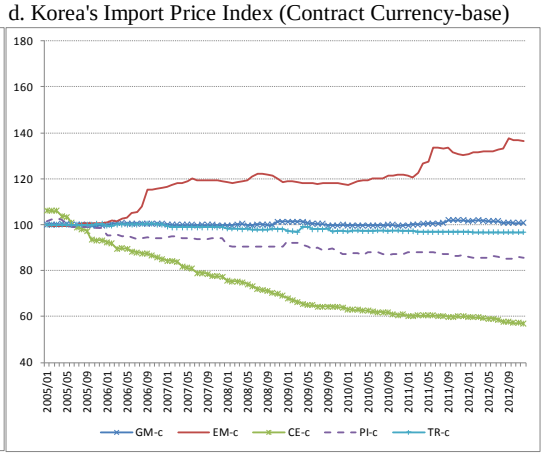
b. Korea's Export Price Index (Contract Currency-base)



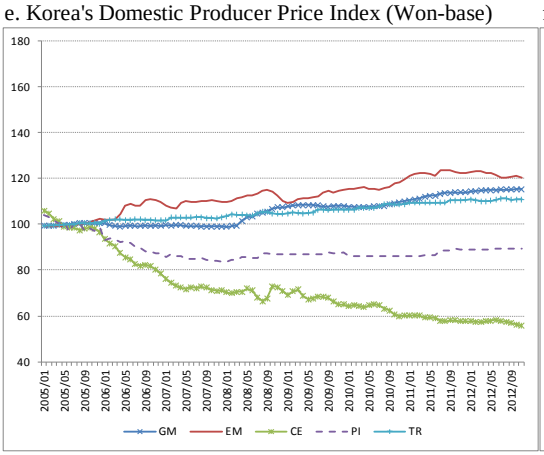
c. Korea's Import Price Index (Won-base)



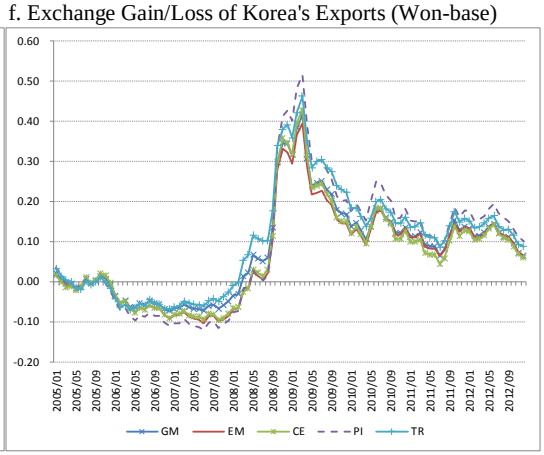
d. Korea's Import Price Index (Contract Currency-base)



e. Korea's Domestic Producer Price Index (Won-base)



f. Exchange Gain/Loss of Korea's Exports (Won-base)

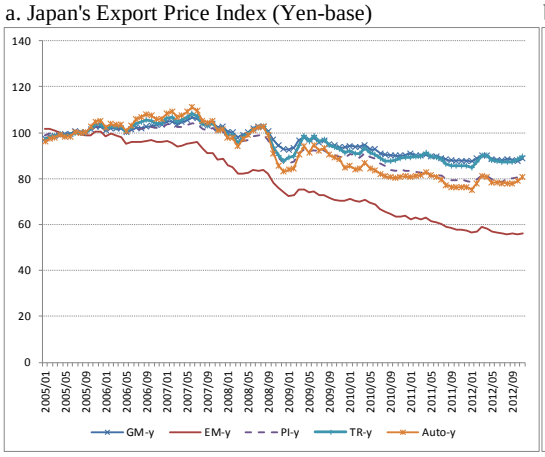


Note: “GM” denotes the general machinery, “EM” the electrical machinery and apparatus, “CE” the communication equipment, “PI” the precision instruments, and “TR” the transport equipment. Figure 4f is obtained by dividing the domestic currency-base export price by the contract currency-base export price.

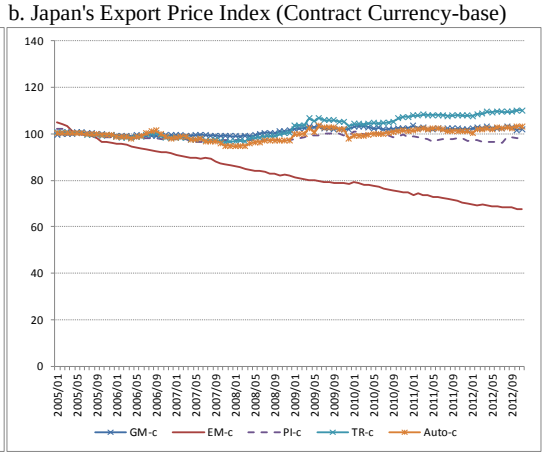
Source: Bank of Korea.

Figure 5. Price Index in Japan (January 2005 through December 2012)

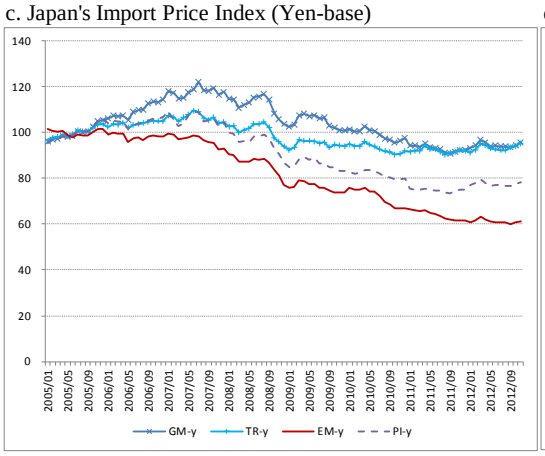
a. Japan's Export Price Index (Yen-base)



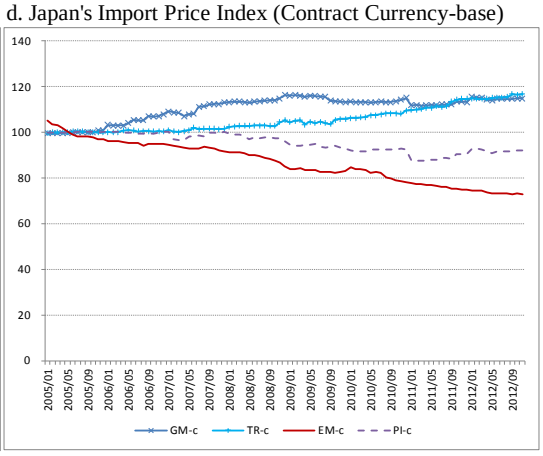
b. Japan's Export Price Index (Contract Currency-base)



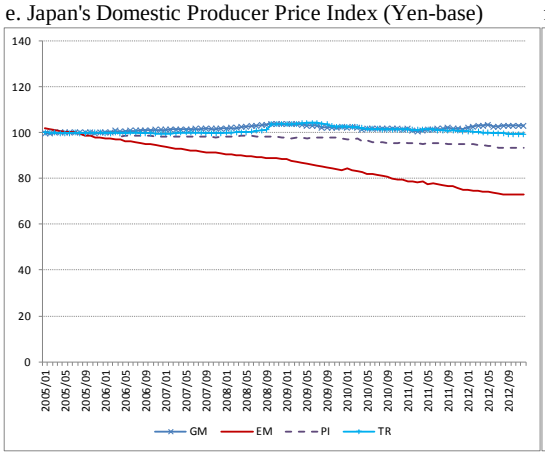
c. Japan's Import Price Index (Yen-base)



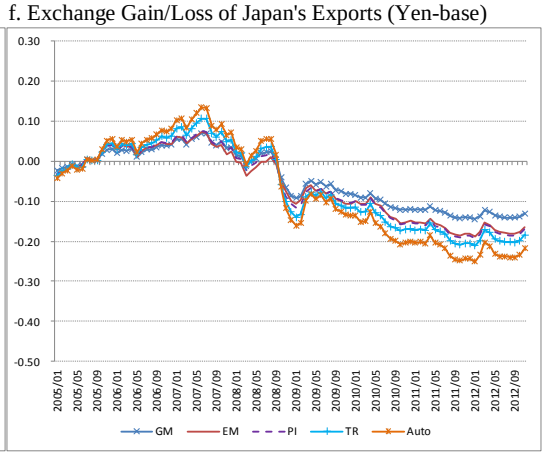
d. Japan's Import Price Index (Contract Currency-base)



e. Japan's Domestic Producer Price Index (Yen-base)



f. Exchange Gain/Loss of Japan's Exports (Yen-base)



Note “GM” denotes the general machinery, “EM” the electrical machinery, “PI” the precision instruments, “TR” the transport equipment, and “Auto” the automobile. Figure 5f is obtained by dividing the domestic currency-base export price by the contract currency-base export price..

Source: Bank of Japan.

For further analysis of the domestic price changes, let us investigate the relationship between import prices and producer price index (PPI). Figures 4-c and 4-d show the fluctuations of Korean import price index. While the contract currency-basis import prices are quite stable and do not exhibit large volatility in Korea (Figure 4-d), the won-base import prices increased to a large extent reflecting the nominal won-US dollar exchange rate, owing to the dominant share of US dollar invoicing in Korean trade. The next question is whether such sharp increase in the won-base import prices results in domestic price increases such as PPI and consumer price index (CPI). Interestingly, the domestic PPI appears less responsive to the increase in import prices and, hence, the nominal depreciation of the won, although the PPI of communication equipment, a largest category in the Korean electrical machinery industry, exhibits a declining trend. In Japan, the domestic PPI is not responsive to the yen appreciation at all except for the electrical machinery PPI. However, the Korean PPI of communication equipment declined to a greater extent than the Japanese electrical machinery PPI.

3. Data Construction of Industry-Specific Effective Exchange Rates

3.1 Effective Exchange Rate Formula

We use the following formula to construct the effective exchange rates:

$$EER_{it} = \prod_{j=1}^{n} \left(ER_{it}^{j} \right)^{\alpha_i^j}, \qquad (1)$$

where *EER* denotes the effective exchange rate; *ER* the bilateral nominal or real exchange rate of country *j*'s currency vis-à-vis the home currency (say, Japanese yen); α_i^j the share of home country's (Japanese) exports of industry *i* to country *j* in the home country's (Japanese) total exports. If *ER* is the bilateral real (nominal) exchange rate, we construct the industry-specific real (nominal) effective exchange rates.

3.2 Partner Country and Industry Classification

In calculating the effective exchange rates, we use one home country and 26 trading partner (export destination) countries: Japan and 9 Asian countries (China, Korea, Indonesia, India, Malaysia, the Philippines, Singapore, Thailand and Taiwan), 11

European countries (Belgium, Ireland, Italy, France, Germany, Greece, Netherlands, Norway, Spain, Sweden and UK), Australia, Canada, Russia, South Africa, Turkey and the United States. For the industry classification, we use the 2-digit International Standard Industrial Classification (ISIC) Rev.3. We aggregate 22 ISIC manufacturing industries into 13 industries. The details are presented in Table 1.

Table 1. Industry Classification

Code	ISIC.rev3	Industry Name	Description
1	15-16	Food	Food, Beverage, Tobacco
2	17-19	Textile	Textiles, Textile Products, Leather and Footwear
3	20	Wood	Wood Products(excl. furniture)
4	21-22	Paper	Paper, Paper Products, Printing and Publishing
5	23	Petroleum	Coke, Refined Petroleum Products, Nuclear Fuel
6	24	Chemical	Chemicals and Chemical Products
7	25	Rubber	Rubber and Plastics Products
8	26	Non-Metal	Non-metallic Mineral Products
9	27-28	Metal	Basic Metals and Fabricated Metal Products
10	29	General	Machinery and Equipment n.e.c.
11	30-32	Electrical	Electrical Machinery
12	33	Optical	Optical Instruments
13	34-35	Transport	Transport Equipment

Note: 23 categories of 2-digit ISIC are converted into 13 classifications. ISIC 36 and 37 are not used in our analysis.

To construct the REER series, it is better to use PPI, since CPI includes the non-tradable prices. While the aggregate REER series published by IMF and BIS is constructed basically using CPI as a domestic price index, we use the industry-breakdown PPI data to calculate the industry-specific REER for Japan, China and Korea.

The availability and source of the industry-specific price data are listed in Appendix Tables A1 and A2. While the price data of each ISIC category is not available in all countries, we collect the industry-specific price data from each country as much as we can. Since such price data is not standardized across countries but based on their own classification, we carefully classify the disaggregated price data of each country according to the ISIC categories. If the price data of a sample country is more disaggregated than the ISIC categories, we calculate the weighted average of disaggregated price data. If the weight data is not available, we use the

industry-breakdown real output data taken from United Nation Industrial Development Organization Industry Statistic Database (UNIDO INDSTAT) at 4-digit ISIC Rev.3 level in order to compute the weighted average of disaggregated price data. We use the monthly series of PPI for all countries except for Australia that publishes only the quarterly series.[4] The price data is normalized to 100 as of 2005 and the seasonality is adjusted by Census X-12.[5]

3.3 Trade Weight

To calculate a trade weight for constructing industry-specific REER for Japan, China or Korea, we follow the two-step procedure. First, we compute the total amounts of exports to 26 countries, which is regarded as the "26-total" exports.[6] We compute the trade weight of each country for each industry by dividing the export amounts to each destination by the 26-total. Second, when calculating the REER series, we use a 3-year average of the trade share for each year to smooth out the annual change in trade share.[7] The export data is obtained from the UN Comtrade Database. Since, as of January 2013, the latest data is the 2011 data, we use the 2009-2011 average data even for 2012 and 2013. Once the 2012 data becomes available, we use the updated data for 2013.

Table 2 shows the industry-breakdown share of Japanese exports by the destination country. It indicates that there are considerable differences of country weight by industry. For example, the weight of the United States is 41.3 percent in Transport Equipment, while 21.3 percent in Electrical Machinery. By contrast, the weight of China is 59.7 percent in Textile, while 8.5 percent in Transport Equipment. Thus, more than 40 percent of Transport Equipment products are exported to the United States, but exports of General Machinery and Electrical Machinery are destined for a wider range of countries.

Compared to the Japanese exports, China's export destination by industry has two distinct features (Table 3). First, the United States is the largest export market for China in most industries. More than 30 percent of exports are directed toward the

[4] Since only quarterly series of PPI is available in Australia, we assume that the monthly PPI is constant for respective quarters in calculating the industry-specific exchange rates.
[5] We use EViews 7 for seasonal adjustment.
[6] In this analysis, we use simple export weight of direct bilateral trade to calculate the effective exchange rate. For the weighting scheme, there are several ways, such as export, import, total of export and import, and BIS's "double weighting" which includes third market competition. See Klau and Fung (2006).
[7] For instance, we use the 3 year average (2007-2009) trade share for calculating the REER series of 2010.

United States in the four industries (Wood, Paper, Rubber and Electrical Machinery), and around 25 percent in three industries (Textile, General Machinery and Optical Instruments). Second, Japan is the second largest export market for China in most industries.

Table 2. Japanese Trade Share by Industry and by Destination Country in 2010

	AUS	BEL	CAN	CHN	GER	SPN	FRA	GRC	IDN	IND	IRE	ITA	KOR	MAL	NED	NOR	PHL	RUS	SGP	SWE	THA	TUR	TWN	UK	USA	SAF	WOR
Food	2.0	0.5	1.7	15.6	0.9	0.4	1.1	0.0	1.4	0.1	0.1	0.3	11.6	1.3	1.1	0.1	1.5	1.8	4.4	0.1	7.9	0.1	18.8	1.2	25.4	0.4	69.8
Textile	0.5	0.6	0.5	59.7	1.9	0.4	1.5	0.1	1.5	0.6	0.1	2.2	6.8	1.6	0.3	0.0	1.1	0.2	1.5	0.1	3.9	0.3	4.7	1.0	8.9	0.1	73.7
Wood	0.3	1.1	0.5	27.4	2.1	0.1	1.1	0.0	2.9	0.1	0.0	0.2	15.5	1.5	1.1	0.0	16.8	0.7	0.6	0.1	3.1	0.0	5.2	1.8	17.8	0.0	91.2
Paper	3.1	0.4	0.8	28.4	2.5	0.4	1.0	0.0	2.7	1.1	0.0	0.6	10.0	4.3	2.2	0.0	1.9	1.1	3.0	0.1	6.9	0.2	9.6	1.4	17.9	0.3	85.2
Petroleum	0.5	0.0	0.0	13.1	0.4	2.2	1.9	-	1.1	11.9	-	1.2	25.2	0.5	4.1	-	0.7	0.0	0.1	4.9	1.9	0.0	3.3	0.6	26.0	0.4	91.1
Chemical	1.0	1.8	0.3	25.8	3.1	0.6	1.5	0.0	2.0	1.5	0.8	1.4	16.5	2.0	2.3	0.1	1.4	0.2	2.4	0.2	5.0	0.4	13.4	1.4	14.6	0.2	89.7
Rubber	3.3	2.8	1.8	18.9	3.4	0.6	1.4	0.2	2.5	0.9	0.1	1.1	18.8	1.5	1.7	0.1	1.9	1.7	2.1	0.3	4.0	0.6	11.5	2.0	16.2	0.8	79.5
Non-Metal	1.3	1.2	0.5	17.5	4.1	0.2	1.0	0.0	1.2	0.8	0.0	0.6	24.1	2.6	2.8	0.1	2.9	0.3	2.3	0.1	4.0	0.1	18.4	1.0	11.4	1.6	89.2
Metal	1.7	0.6	1.1	24.9	1.4	0.2	0.4	0.1	3.5	2.1	0.0	0.4	17.0	5.5	0.8	0.6	2.4	0.5	5.0	0.2	8.5	0.3	10.5	3.6	8.6	0.2	84.3
General	2.1	1.9	1.3	21.3	3.6	0.8	1.8	0.2	2.7	2.4	0.2	1.5	10.4	2.2	3.2	0.1	1.2	1.4	3.4	0.3	5.3	0.8	9.7	2.1	19.6	0.6	83.6
Electrical	1.2	0.9	1.2	26.4	6.1	0.8	1.4	0.0	1.3	1.0	0.1	0.8	7.7	4.4	3.5	0.0	3.0	0.4	3.6	0.5	4.5	0.3	6.0	2.9	21.3	0.3	79.3
Optical	0.9	1.6	1.1	22.9	9.4	0.6	1.2	0.1	0.8	1.2	0.1	1.0	10.3	1.8	3.6	0.1	1.8	0.4	2.2	0.4	3.3	0.4	8.5	2.5	23.4	0.3	84.5
Transport	6.0	1.4	4.5	8.5	3.1	1.5	2.0	0.6	1.7	0.5	0.3	1.8	1.7	1.9	2.1	0.5	0.8	5.6	2.3	0.4	3.2	0.6	1.5	4.3	41.3	1.9	70.0

Note: See Table 1 for the industry code. “WOR” represents the share of the 26-total exports in the Japanese overall exports including all partner countries for each industry.

Source: Authors’ calculation from the UN Comtrade Database.

Table 3. Chinese Trade Share by Industry and by Destination Country in 2010

	AUS	BEL	CAN	GER	SPN	FRA	GRC	IDN	IND	IRE	ITA	JPN	KOR	MAL	NED	NOR	PHL	RUS	SGP	SWE	THA	TUR	TWN	UK	USA	SAF	WOR
Food	2.4	1.2	2.6	4.9	2.2	1.5	0.1	1.3	0.3	0.0	1.4	30.9	9.9	3.1	2.9	0.2	1.8	4.0	1.3	0.5	2.0	0.2	2.1	2.4	20.2	0.6	76.1
Textile	2.6	1.7	3.3	6.2	2.9	3.3	0.4	1.2	1.5	0.3	4.1	17.4	4.2	1.7	2.6	0.5	0.8	6.5	1.9	0.7	0.8	1.2	0.6	4.9	27.2	1.6	64.8
Wood	1.8	2.4	4.1	5.2	2.3	2.7	0.6	0.8	0.7	0.9	2.5	19.2	4.3	2.1	3.3	0.2	0.3	1.7	2.9	0.7	1.2	0.5	1.8	6.6	30.7	0.5	80.8
Paper	5.5	1.2	2.1	3.1	1.4	2.3	0.6	1.5	4.0	0.2	2.0	12.1	4.3	2.7	2.1	0.2	1.5	2.1	1.9	0.5	2.1	1.7	4.1	7.1	32.8	0.9	65.3
Petroleum	3.3	6.4	1.9	1.1	0.4	3.2	0.0	1.3	11.4	0.0	1.4	19.9	4.8	1.0	4.8	0.0	3.4	2.2	4.9	0.0	1.5	2.4	3.0	1.1	17.0	3.4	62.9
Chemical	2.5	2.5	1.3	5.6	2.1	1.6	0.2	3.3	10.6	0.3	2.7	13.0	9.3	2.4	4.2	0.2	1.4	2.4	2.1	0.2	3.7	2.3	6.2	2.2	16.6	1.2	70.7
Rubber	4.0	1.8	3.3	4.4	2.0	2.5	0.5	1.3	2.4	0.3	2.4	11.3	2.7	1.7	2.8	0.3	1.6	3.2	1.6	0.6	1.2	0.8	1.8	5.2	39.1	1.2	69.3
Non-Metal	3.2	2.2	2.7	5.3	3.6	1.9	0.8	1.8	4.1	0.4	3.8	11.2	10.7	2.7	2.9	0.3	1.4	5.4	2.4	0.6	1.9	1.7	2.4	3.9	21.1	1.5	64.8
Metal	2.9	2.8	2.6	3.8	2.4	1.4	0.6	2.7	5.4	0.1	3.7	8.6	15.6	2.0	3.8	0.3	1.2	3.3	3.2	0.5	2.5	1.4	3.6	3.3	21.0	0.9	68.0
General	3.0	1.5	2.7	6.1	2.4	2.9	0.7	2.9	5.8	0.2	4.2	12.0	4.2	2.1	2.6	0.3	0.8	4.0	2.4	0.7	2.3	2.1	2.0	4.1	26.7	1.4	67.4
Electrical	2.1	0.7	1.8	7.9	1.9	3.0	0.2	1.1	3.2	0.8	1.7	9.8	5.7	2.2	7.8	0.1	0.6	1.6	3.9	0.5	1.4	0.9	2.7	3.8	33.9	0.6	64.6
Optical	1.1	0.8	1.0	7.3	1.4	1.6	0.2	1.8	2.0	0.9	2.2	15.0	7.7	6.4	4.4	0.1	0.8	1.8	2.2	0.3	2.6	2.5	6.9	2.3	26.3	0.4	51.9
Transport	2.5	1.0	2.6	10.3	0.8	3.6	1.7	2.0	1.8	0.2	3.2	10.6	5.4	2.0	3.2	1.2	0.8	4.0	11.2	0.5	1.1	0.9	1.9	4.2	22.2	1.1	59.9

Note: See Table 1 for the industry code. “WOR” represents the share of the 26-total exports in the China’s overall exports including all partner countries for each industry.

Source: Authors’ calculation from the UN Comtrade Database.

Table 4. Korean Trade Share by Industry and by Destination Country in 2010

	AUS	BEL	CAN	CHN	GER	SPN	FRA	GRC	IDN	IND	IRE	ITA	JPN	MAL	NED	NOR	PHL	RUS	SGP	SWE	THA	TUR	TWN	UK	USA	SAF	WOR
Food	2.8	0.1	1.2	16.2	0.4	1.9	0.5	0.0	2.4	0.2	0.0	1.0	37.8	1.1	0.4	0.1	2.4	9.4	1.0	0.1	4.6	0.2	2.3	0.4	13.2	0.2	76.5
Textile	1.0	0.6	1.2	38.1	2.2	1.1	1.8	0.2	12.1	1.2	0.0	1.4	8.9	0.5	0.6	0.2	2.9	1.7	0.9	0.2	1.7	2.1	1.3	1.2	16.5	0.4	61.3
Wood	2.1	1.0	0.7	21.6	1.3	0.8	0.4	0.1	3.8	2.9	0.0	2.3	32.6	0.2	0.2	0.1	4.7	9.3	1.1	0.6	0.4	0.3	0.6	0.5	12.3	0.0	71.8
Paper	7.4	0.1	1.6	18.0	0.4	0.2	0.3	0.3	2.2	7.6	0.2	1.1	10.7	3.3	0.2	0.0	1.5	3.1	2.4	0.0	4.1	1.8	5.1	1.4	24.7	2.2	73.0
Petroleum	0.4	0.1	0.3	78.5	0.1	0.0	0.1	0.0	0.2	0.4	-	0.0	13.0	0.5	0.2	0.1	1.0	0.8	0.5	0.0	0.2	0.3	1.7	0.2	1.6	0.1	96.0
Chemical	1.3	1.2	0.5	52.7	1.2	0.6	0.4	0.1	3.1	3.4	0.1	1.1	7.8	1.7	0.7	0.0	1.5	2.1	1.5	0.1	2.7	1.6	7.3	0.6	6.1	0.6	79.3
Rubber	3.2	0.9	2.4	22.3	3.7	1.9	1.3	0.4	1.6	1.5	0.2	2.1	13.5	1.2	2.7	0.3	1.2	2.8	1.4	0.8	1.3	1.9	3.0	3.3	24.3	0.6	75.9
Non-Metal	1.9	0.6	1.1	17.6	2.7	0.7	0.7	0.3	2.5	1.5	0.0	2.0	22.7	1.9	0.5	0.3	1.2	1.3	2.1	0.2	1.3	0.8	18.7	1.0	15.9	0.6	81.1
Metal	2.7	1.8	1.3	26.0	1.0	0.9	0.4	0.3	3.2	6.8	0.1	2.2	15.4	3.3	1.0	0.1	2.6	0.7	3.5	0.3	5.8	1.4	5.9	1.6	11.1	0.3	71.4
General	1.7	1.8	1.9	28.8	3.3	1.0	1.0	0.3	1.8	4.8	0.1	1.7	9.2	1.3	2.4	0.1	1.4	2.9	1.8	0.3	2.6	2.3	2.9	1.7	22.0	0.9	72.8
Electrical	1.9	0.1	1.3	33.0	4.8	1.2	2.9	0.3	1.4	1.8	0.5	1.4	6.1	2.9	1.4	0.2	1.1	2.0	2.2	0.4	1.4	0.9	2.2	4.1	24.3	0.5	75.6
Optical	0.1	0.2	0.2	63.2	2.9	3.3	0.7	0.0	0.7	0.5	0.0	0.3	8.5	2.6	0.3	0.0	0.2	0.7	0.6	0.0	1.3	1.0	3.2	1.0	8.3	0.1	70.2
Transport	3.0	2.5	3.8	8.2	10.2	1.7	2.3	4.1	0.8	3.5	0.8	2.5	1.6	0.9	1.2	2.8	0.5	8.5	8.6	0.6	0.5	2.6	0.3	3.9	23.5	1.0	52.4

Note: See Table 1 for the industry code. “WOR” represents the share of the 26-total exports in the Korea’s overall exports including all partner countries for each industry.

Source: Authors’ calculation from the UN Comtrade Database.

Table 4 shows that Korean exports are mainly toward China, the United States and Japan for most industries. In particular, China is the most important export market for Korea. 78.5 percent of Petroleum product exports, 52.7 percent of Chemical exports and 63.2 percent of Optical Instruments exports are destined for China.

4. Industry-Specific REER in Japan, China and Korea

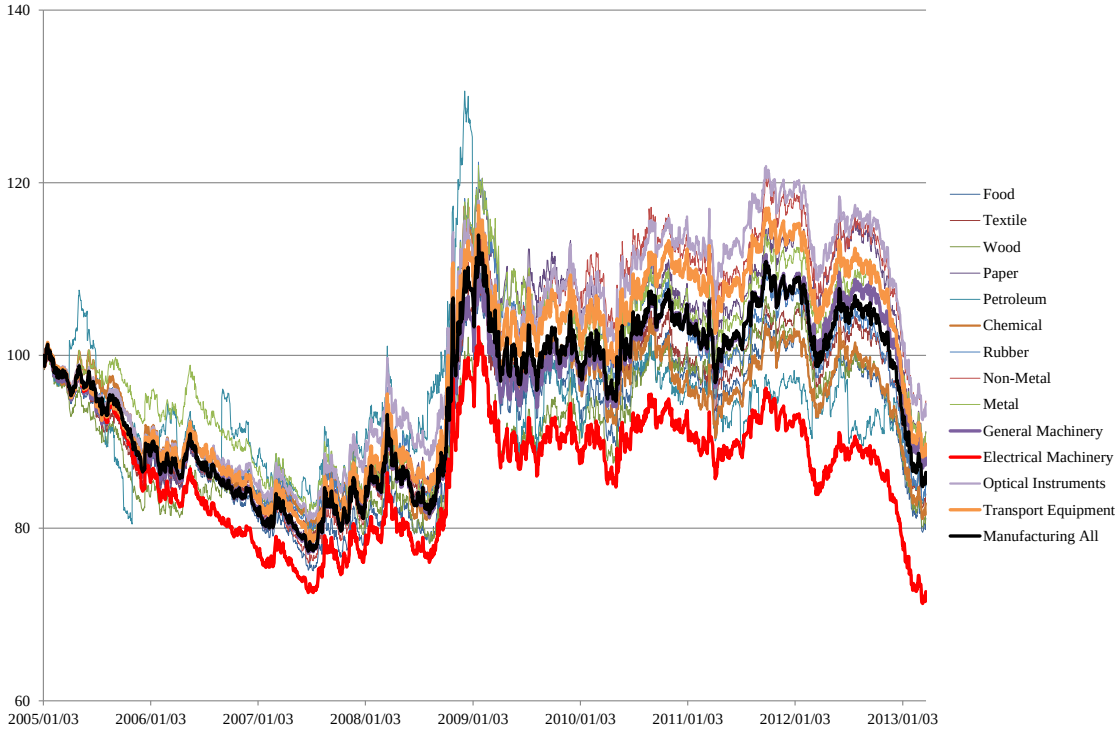
Our new dataset of the industry-specific REER provides clear evidence that the REER movements differ across industries in all three countries. We first show the industry-specific REERs for each country, and then conduct a simple simulation analysis to investigate driving factors of REER movements for each industry.

4.1 Overview of Industry-Specific REER in Japan, China and Korea

Figure 6 shows the Japanese industry-specific REER we calculated. “Manufacturing All” stands for the weighted average of REERs of all industries (henceforth, the aggregate REER). First and the most notable feature is a large difference in the level of REERs across industries. Specifically, as discussed in Sato, Shimizu, Shrestha and Zhang (2012a), the extent of difference in the level of REERs started to widen after the collapse of Lehman Brothers. Second, the Electrical

Machinery REER fluctuates at the lowest level, while the REERs of Non-metallic Mineral products and Paper products are at the highest level. Let us focus on the General Machinery, Electrical Machinery and Transport Equipment that are Japan's main industry in terms of export amounts (Table 5). The Transport Equipment fluctuates above the aggregate REER over the sample period, and the General Machinery moves very closely to the aggregate REER. Third, from around November 2012, the REERs of all industries started to fall sharply, which may reflect the nominal depreciation of the yen. As of 22 March 2013, the Electrical Machinery REER reaches to 73.1, almost the same level as in 2007. Thus, the nominal exchange rate changes are likely to have large influences on the REER movements.

Figure 6. Japanese Industry-Specific REER (3 January 2005 through 22 March 2013)



Note: Authors' calculation (2005=100). Increase indicates the REER appreciation.

In Figure 7, the Chinese industry-specific REER exhibits a clear upward trend, which is a marked difference from the Japanese industry-specific REER. It is because the Chinese government has started to adopt managed floating system since July 2005 and the RMB has been in a gradual appreciation trend against the US dollar. In addition, the Electrical Machinery REER in China fluctuates above the aggregate REER, which differs from the corresponding REER in Japan. On the other hand, the Transport

Equipment REER in China moves at a level lower than the aggregate REER.

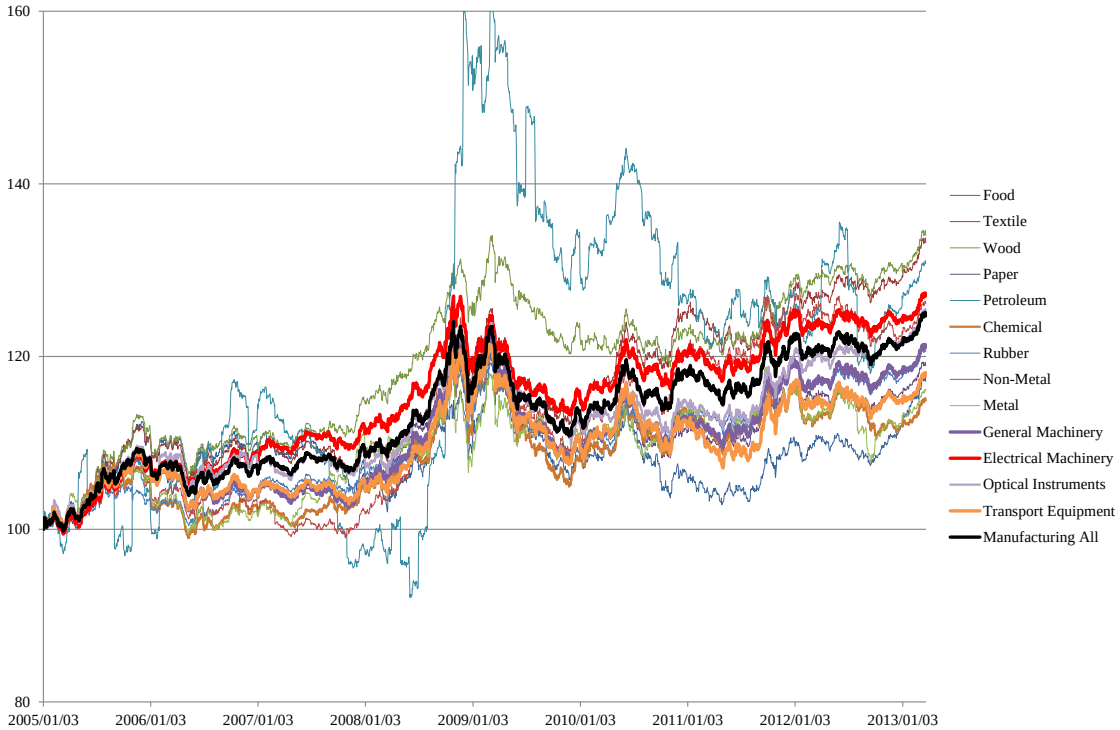
Table 5. Industry Weights of Each Country by Exports in 2010 (percent)

Industry:	Japan	China	Korea
Food	0.6	2.4	1.1
Textile	1.2	20.3	3.8
Wood	0.0	0.8	0.0
Paper	0.6	0.9	0.9
Petroleum	0.1	0.4	0.3
Chemical	11.3	6.2	13.1
Rubber	3.7	3.0	2.6
Non-Metal	1.5	2.1	0.5
Metal	10.2	10.3	11.2
General	17.5	10.0	10.0
Electrical	16.0	33.4	20.5
Optical	6.0	4.1	8.9
Transport	31.2	6.0	27.0

Note: The share of each industry's exports in total exports is presented for respective countries.

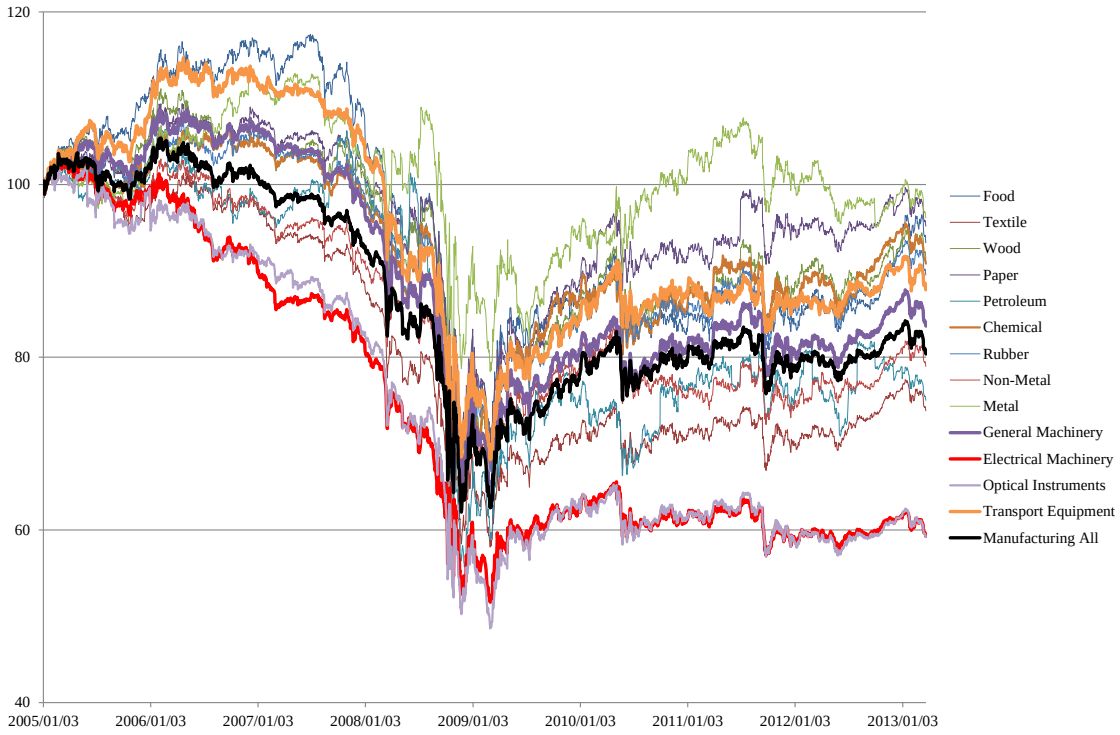
Source: Authors' calculation from the UN Comtrade Database.

Figure 7. Chinese Industry-Specific REER (3 January 2005 through 22 March 2013)



Note: Authors' calculation (2005=100). Increase indicates the REER appreciation.

Figure 8. Korean Industry-Specific REER (3 January 2005 through 22 March 2013)



Note: Authors' calculation (2005=100). Increase indicates the REER appreciation.

The Korean industry-specific REERs in Figure 8 show strikingly large swings over the sample period. In response to a substantial nominal depreciation of the Korean won from the late 2007, the REERs of Korean respective industries started to depreciate sharply. The degree of depreciation in Korean REERs is far larger than that in Japanese REERs. Like Japanese REERs, the Electrical Machinery REER exhibits the largest depreciation in Korea, while the Transport Equipment REER fluctuates far above the aggregate REER. Interestingly, the Electrical machinery REER in Korea started to depreciate much earlier, i.e., from the mid-2006, than the REER of other industries. Even after the sharp depreciation, the Electrical Machinery REER stays around at 60 or below from October 2008, while other Korean industries experience steady appreciation of the REER from 2009 in response to the gradual nominal appreciation of the Korean won vis-à-vis the US dollar.[8] Furthermore, as the yen started to depreciate from the late 2012, all Korean industries accelerated the REER appreciation, but REERs of both Electrical Machinery and Optical Instruments stay close to 60 even as of 22 March 2013. Such remarkable difference of REER movements between the Electrical Machinery and other industries is likely to show the strong price competitiveness of the Electrical

[8] See Figure 2 for the gradual appreciation of the won vis-à-vis the US dollar from 2009.

Machinery industry in Korea.

4.2. Simulation Analysis: Factor Decomposition of REER

While we have observed different movements of REER across industries, our major interest is what causes such large and different swings of REERs across industries. It is conjectured that different movements of domestic and foreign prices across industries affect the REER movements. We conduct a simple simulation analysis by assuming that one of the components of the industry-specific REER is constant at the initial observation in the series and generating the hypothetical REER series (henceforth, simulated REER). If the component is an important factor, the simulated REER will show different movements from the actual REER. If the component is not important, the simulated REER will fluctuate very closely to the actual REER. For this simulation analysis, we use the following two components: Japanese domestic producer price and a weighted average of trading partner's producer prices. As we are discussing REER, equation (1) is reformulated as:

$$REER_{it} = \prod_{j=1}^{n} \left(RER_{it}^{j} \right)^{\alpha_{it}^{j}} . \qquad (2)$$

The bilateral real exchange rate of the domestic currency vis-à-vis the partner country *j*'s currency is defined as the bilateral nominal exchange rate multiplied by the relative price between domestic and foreign (*j*) country:

$$RER_{it}^{j} = NER_{t}^{j} \cdot \left(\frac{P_{it}}{P_{it}^{j}} \right), \qquad (3)$$

where *i* denotes industry, *j* a partner country, and *t* the time period.

This approach is employed by Sato, Shimizu, Shrestha and Zhang (2012a), and the simulation results of industry-specific REERs of the yen are presented. This paper applies the same approach to the industry-specific REERs of the Korean won and the Chinese RMB as well, and makes comparison analysis between three REERs. We focus on two industries, i.e., Electrical Machinery and Transport Equipment, because these two are particularly important industries for Japan and Korea. We also report the results

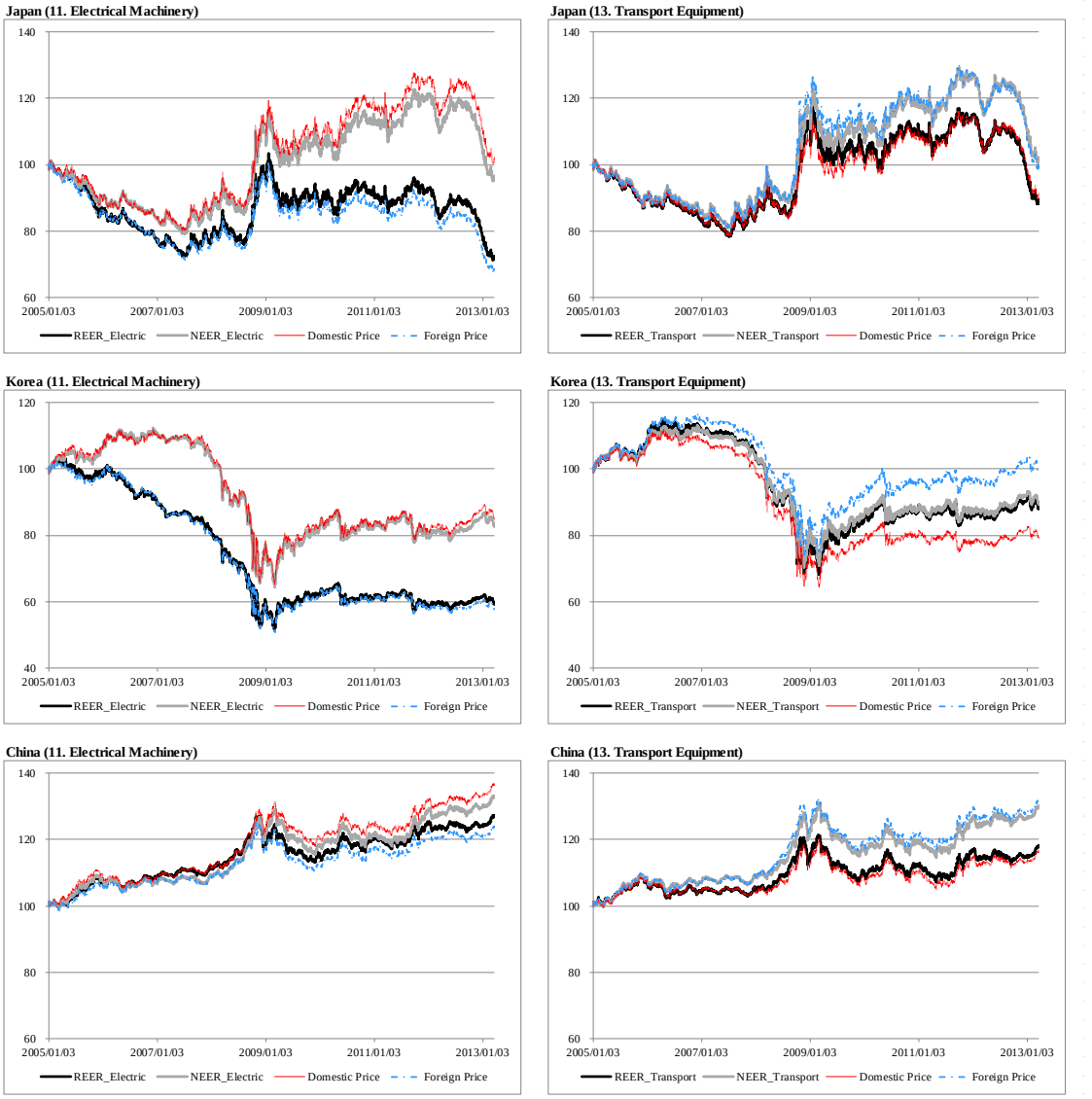
of other 11 industries as well as All Manufacturing Industries, the results of which are presented in Appendix Figures A1-A3.

Figure 9 presents the results of both industry-specific NEER and REER, which provides us with useful information on the relative price changes at each industry. For instance, NEER is far above the REER in the Japanese Electrical Machinery industry with a gap widening between the two (Figure 9), which indicates that the relative Japanese price against foreign prices has been declining. It needs to be investigated what factor has driven the relative price decline in Japanese Electrical Machinery industry. Figure 9 shows that the simulated REER assuming the constant domestic price is far above the actual REER, and even higher than the actual NEER, while the simulated REER with the assumption of constant foreign price is somewhat below the actual REER. This evidence indicates that the recent movements of the Electrical Machinery REER are mainly driven by the domestic price decline. While the NEER kept appreciating from the late 2008 to the end of 2012, the REER stayed around 90, likely due to the efforts of cost reduction by Japanese firms.[9] From the end of 2012, both NEER and REER of the Electrical Machinery depreciated sharply, which suggests that Japanese Electrical Machinery firms rapidly improved the export price competitiveness.

Turning to the Korea's industry-specific REER, the Electrical Machinery REER exhibits a remarkable decline (Figure 9). The simulated REER with constant domestic price is substantially higher than the actual REER (blue line), even before the sharp depreciation of Korean won in nominal terms, which implies that Korean electrical machinery firms made considerable efforts to reduce the production costs during the won appreciation period. Once the won started to depreciate, Korean firms enjoyed significant benefit from their cost reduction efforts, with the result that these firms significantly improved their export price competitiveness. Japanese firms started to lower the production costs from the late 2008, but the level of Korean REER was far lower than that of Japanese REER at that period. Due to the sudden depreciation of the yen from the end of 2012, Japanese REER declined sharply. But, the level of Korean REER is much lower, keeping stronger competitiveness of Korean electrical machinery firms than Japanese counterparts.

[9] This discussion relies largely on Sato, Shimizu, Shrestha and Zhang (2012a).

Figure 9. Factor Decomposition of REER Fluctuations: the Case of Japan



Note: Results of two industries are presented. In the graph of "11. Electrical Machinery", for instance, "REER_Electric" denotes the industry-specific REER of the Electrical machinery industry, and "NEER_Electric" stands for the industry-specific NEER that is presented for comparison. Other line graphs are simulated by the following assumption.

1. "Domestic_Price" represents the simulated REER if the Japanese domestic price (producer price) is assumed to be constant at the initial observation (3 January 2005) over the sample period.

2. "Foreign_Price represents the simulated REER if the weighted average of partner country's domestic price (producer price) is assumed to be constant at the initial observation (3 January 2005) over the sample period.

Figure 9 also presents the factor decomposition results for the Transport Equipment

industry. The Korea's actual REER of Transport Equipment exhibits a strong upward trend and the level of REER is higher than 100 in 2013. Another notable feature is that NEER is much lower in level than the actual REER, and the simulated REER with constant domestic price is far lower than the actual REER in Korea. This evidence suggests that the Korean domestic PPI in the Transport Equipment industry is higher than the corresponding foreign PPI and, hence, Korean firms lose the export price competitiveness in the world market. Turning to the Japanese Transport Equipment industry, NEER is higher in level than the actual REER, although the simulated REER with constant domestic price moves very closely to the actual REER. Taking into account the fall of Japanese REER from the end of 2012, Japanese Transport Equipment firms improve their export competitiveness against the Korean counterparts, due to the relative decline of domestic production costs.

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5. Concluding Remarks

The main contribution of this paper is to construct the new dataset of the industry-specific REER for the yen, the Korean won and the Chinese renminbi as a useful measure to consider the empirical importance of the exchange rate on the exporting firms' competitiveness and performance across industries. A daily series of REER for 13 industries is presented with the sample period ranging from 3rd January 2005 to the present, which shows a large difference in a level of REER not only between three countries but also across industries.

We also focus particularly on REER of the electric machinery industry. We have revealed that there is a large difference in the level of REER across Japanese industries and the electric machinery REER exhibits a largest depreciation among them, which implies that Japanese electric machinery firms can enjoy export price competitiveness compared to other Japanese industries. However, it is well known that Japanese electric machinery firms are suffering from worsening business performance and severe export competition in the world market. By comparing the Japanese REER with the competitors' REERs, especially Korean REERs, we show that Korean electric machinery firms enjoy much larger depreciation of the REER and, hence, stronger export price competitiveness. By conducting factor decomposition analysis of industry-specific REERs, it is revealed that a substantial fall of domestic producer prices during the won appreciation period has enhanced the Korean firms' export competitiveness compared to the Japanese one especially in the electric machinery

industry. In contrast, Japanese automobile firms do not lose export competitiveness with respect to the Korean counterparts, due to the relative decline of domestic production costs.

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Appendix Table A1: Data Source for Price Index

Country	Data Source	Link
Australia	Australian Bureau of Statistics	http://www.abs.gov.au/
Belgium	CEIC	
Canada	Statistics Canada	http://www5.statcan.gc.ca
China	1. CEIC 2. *China Monthly Statistic* 3. *China Statistical Yearbook*	
France	National Institute of Statistics and Economic Studies	http://www.bdm.insee.fr
Germany	GENESIS-Online Database	https://www-genesis.destatis.de
Greece	CEIC	
India	Office of Economic Adviser to Government of India	http://eaindustry.nic.in/
Indonesia	1. BPS, *Indikator Ekonomi* (*Economic Indicators*) 2. CEIC	
Ireland	CEIC	
Italy	CEIC	
Japan	Bank of Japan	http://www.boj.or.jp/
Korea	The Bank of Korea	http://eng.bok.or.kr/eng/engMain.action
Malaysia	CEIC	
Netherlands	Statistics Netherlands Statline Database	http://statline.cbs.nl/StatWeb/?LA=en
Norway	Statistics Norway	http://statbank.ssb.no
Philippines	1. Republic of Philippines National Statistics Office 2. *Philippine Yearbook*	http://www.census.gov.ph
Russia	CEIC	
Singapore	CEIC Statistics Singapore	http://www.singstat.gov.sg/
South Africa	CEIC	
Spain	National Statistics Institute	http://www.ine.es
Sweden	CEIC	
Thailand	CEIC	
Taiwan	CEIC(include output data)	
Turkey	CEIC	
United Kingdom	CEIC	
United States	FEDSTATS U.S. Bureau of Labor Statistics (BLS)	http://www.bls.gov/ppi/#data
Trade Data	UN Comtrade	http://comtrade.un.org/

Appendix Table A2: Availability of Industry-Specific Price Data

ISIC. Rev3	**Industry Classification**	AUS	BLX	CAN	CHN	GER	GRC	ESP	FRA	IDN	IND	IRL	ITA	JPN	KOR
15	Food and Beverage	●	▲	●	○	○	▲	●	○	○	●	○	○	○	○
16	Tobacco	○	○		○	○	○	○	○		○			○	○
17	Textiles	○	○	○	▲	○	○	○	○	○	○	○		○	○
18	Wearing Appeal, Fur	○	X	○	○	○	○	○	○	○	X	○	○	●	○
19	Leather, Footwear		○	○	○	○	○	○	○		○	○		●	○
20	Wood products (excl. furniture)	○	○	○	○	○	○	○	○	○	○	○	○	○	○
21	Paper and Paper products	○	○	○	○	○	○	○	○	○	○	○	○	○	○
22	Printing and Publishing	○	X	○	○	X	○	○	○		○	○	○	●	○
23	Coke, Refined Petroleum product	○	○	○	○	○	○	○	○	○	X	X	○	○	○
24	Chemicals and Chemical products	○	○	○	▲	○	○	●	○	○	○	○	○	○	○
25	Rubber and Plastics products	○	○	○	▲	○	○	○	○	○	○	○	○	○	○
26	Non-metallic Mineral products	○	○	○	○	▲	○	○	○	○	○	○	○	●	○
27	Basic Metals	○	○	○	▲	○	○	○	○	○	○	○	○	●	○
28	Fabricated Metal products	○	○	○	○	X	○	○	X	X	X	○	○	X	X
29	Machinery and Equipment n.e.c.	○	○	○	▲	○	○	○	○	○	○	○	○	○	○
30	Office, Accounting and Computing Machinery	●	○	○	○	▲	○	○	▲	X	X	○	◇	○	◇
31	Electrical Machinery and Apparatus n.e.c.	●	○	○		○	○	○	○	○	●	○	○	○	○
32	Communication Equipment and Apparatus	○	○	▲	○	▲	○	●	○		●	X	◇	○	○
33	Optical Instruments	○	○	▲	○	▲		●	▲		●	X	◇	○	○
34	Motor Vehicles, Trailers and Semi-trailers	○	○	○	○	○	○	○	○	○	○	○	○	○	○
35	Other Transport Equipment					○	○	○	○						
Weight		○	X	○	X	X	X	○	X	X	○	X	X	○	○

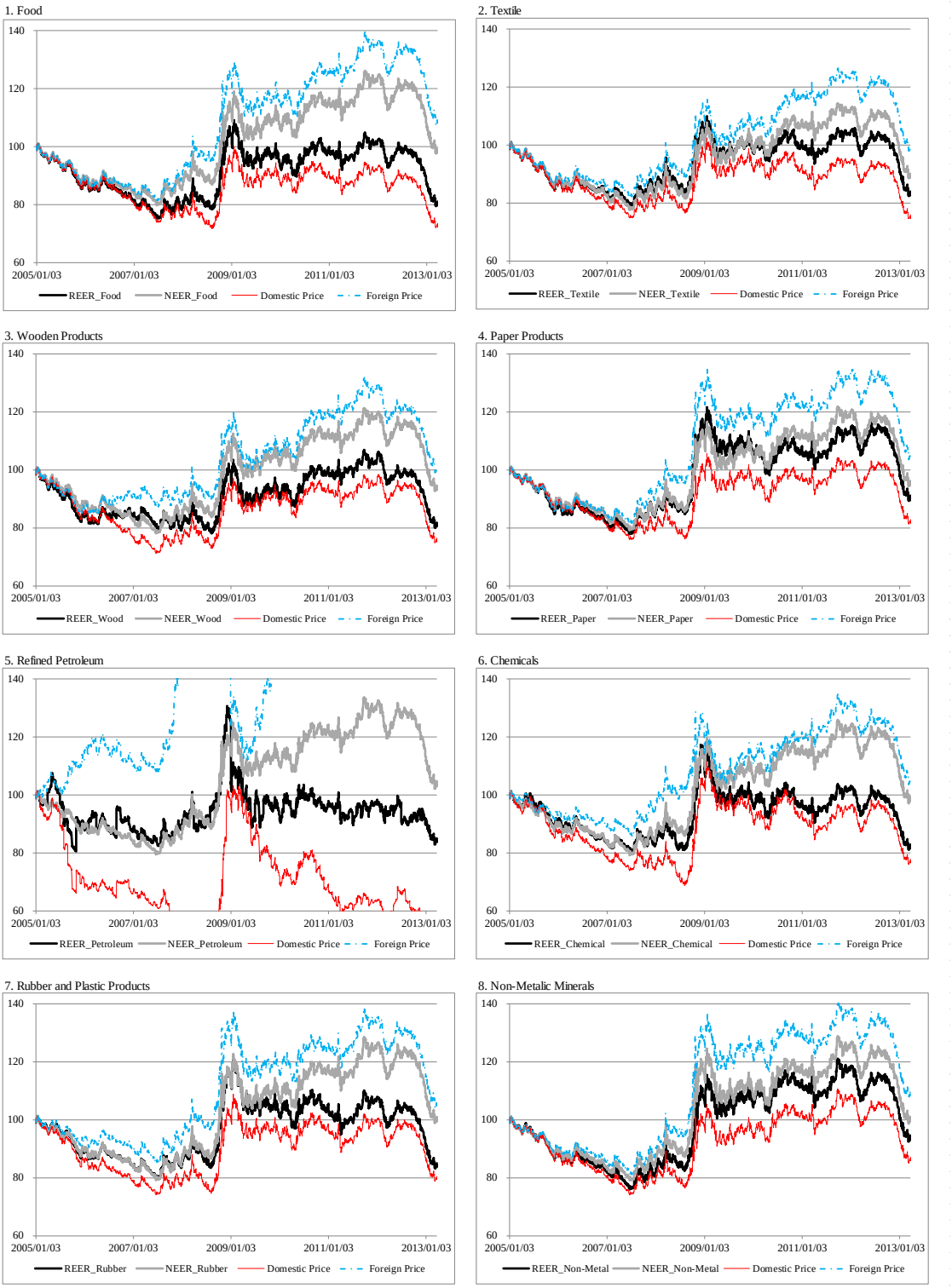
ISIC. Rev3	**Industry Classification**	MYS	NLD	NOR	PHL	RUS	SGP	SWE	THA	TUR	TWN	UK	USA	ZAF
15	Food and Beverage	○	○	○	○	○	○	○	○	○	▲	▲	○	▲
16	Tobacco	○	○		○		○			○	○	○	○	○
17	Textiles	○	○		○	○	○		○	○	○	○	○	○
18	Wearing Appeal, Fur	○	○	○	○	○	●	○	○	○	○	○	○	○
19	Leather, Footwear	○	○		○	○	○		○	○	○	○	○	▲
20	Wood products (excl. furniture)	○	○	○	○	○	○	○	○	○	○	○	○	○
21	Paper and Paper products	○	○	○	○	○	○	○	○	○	○	○	○	○
22	Printing and Publishing	○	○	○	○	○	X		○	○	○	○	○	
23	Coke, Refined Petroleum product	○	○	○	○	○	○	○	○	○	○	○	○	○
24	Chemicals and Chemical products	○	●	●	○	○	○	○	○	○	○	○	○	○
25	Rubber and Plastics products	○	○	○	▲	○	●	○	○	○	○	○	○	○
26	Non-metallic Mineral products	○	○	○	○	○	○	○	○	○	○	○	○	○
27	Basic Metals	○	○	○	○	○	●	○	○	○	○	○	○	○
28	Fabricated Metal products	○	○	○	○		X	○	○	○	○	○	○	○
29	Machinery and Equipment n.e.c.	○	○	○	○	○	●	○	○	○	○	○	○	○
30	Office, Accounting and Computing Machinery	○	○	X	X		○	○	○	○	○	○	○	○
31	Electrical Machinery and Apparatus n.e.c.	○	○	○	○	○	○	○	○	○	○	○		○
32	Communication Equipment and Apparatus	○	X	X	X		○	X	○	○	○	▲	○	○
33	Optical Instruments	○	○	X	X		●	○	○	○		▲		○
34	Motor Vehicles, Trailers and Semi-trailers	○	○	○	○	○	○	○	○	○	○	○	○	○
35	Other Transport Equipment	○	○			○				○	○	○		○
Weight		X	○	○	X	X	○	X	X	X	X	X	X	X

Note: All countries publish the industry specific price data that follows not ISIC but their own classification, except for Malaysia and Thailand the data of which is based on ISIC. ○ means that the data is available but not exactly corresponds to ISIC. ● means that more detailed data is available, and the industry weight data is also available. ▲ means that more detailed data is available, but the industry weight data is not available. x means that the data is not available.

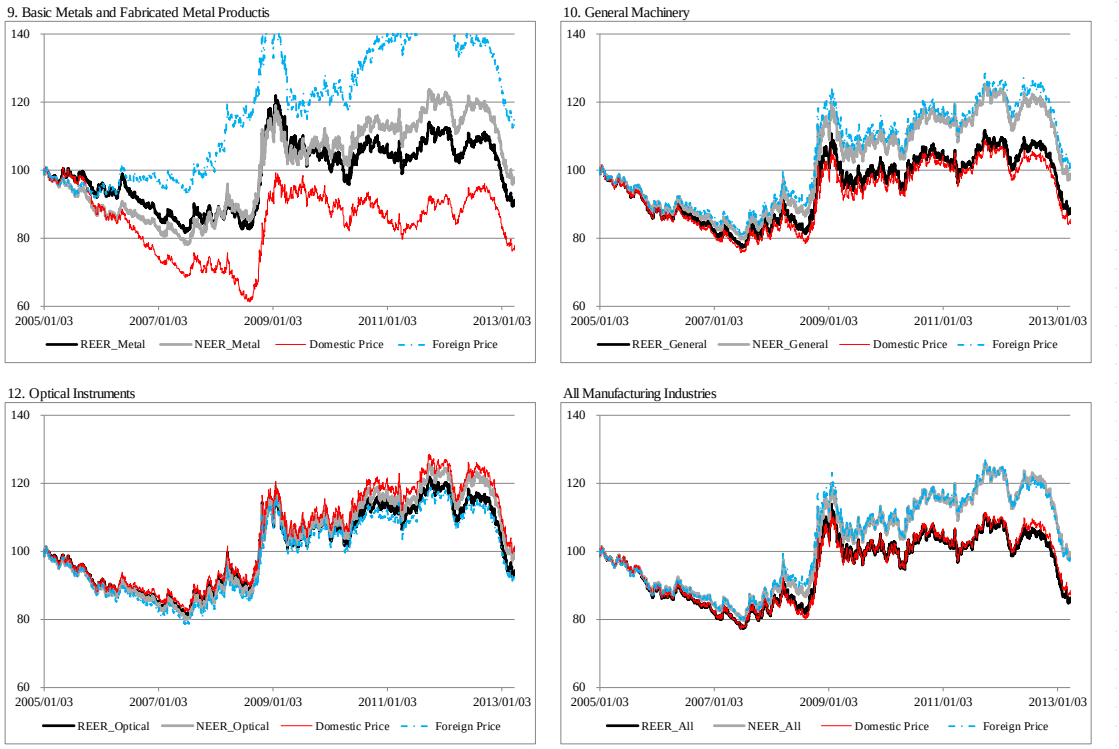
Appendix Table A3: Country Code

Code	Country Description
AUS	Australia
BLX	Belgium
CAN	Canada
CHN	China
DEU	Germany
ESP	Spain
FRA	France
GRC	Greece
IDN	Indonesia
IND	India
IRL	Ireland
ITA	Italy
JPN	Japan
KOR	Korea
MYS	Malaysia
NLD	Netherlands
NOR	Norway
PHL	Philippines
RUS	Russia
SGP	Singapore
SWE	Sweden
THA	Thailand
TUR	Turkey
TWN	Taiwan
UK	UK
USA	USA
ZAF	South Africa

Appendix Figure A1. Factor Decomposition of REER Fluctuations: the Case of Japan

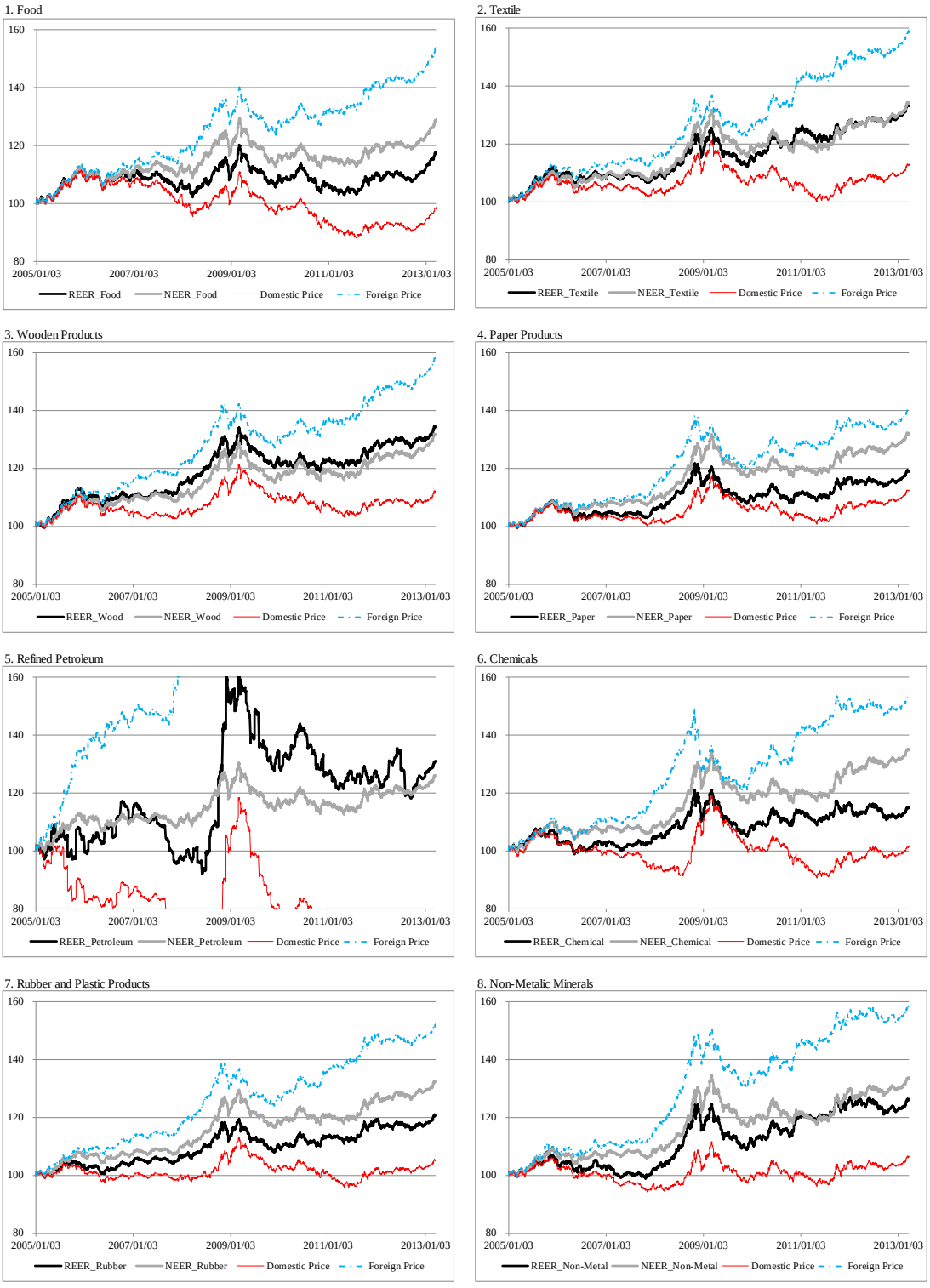


Appendix Figure A1. Factor Decomposition of REER Fluctuations: the Case of Japan (cont'd)

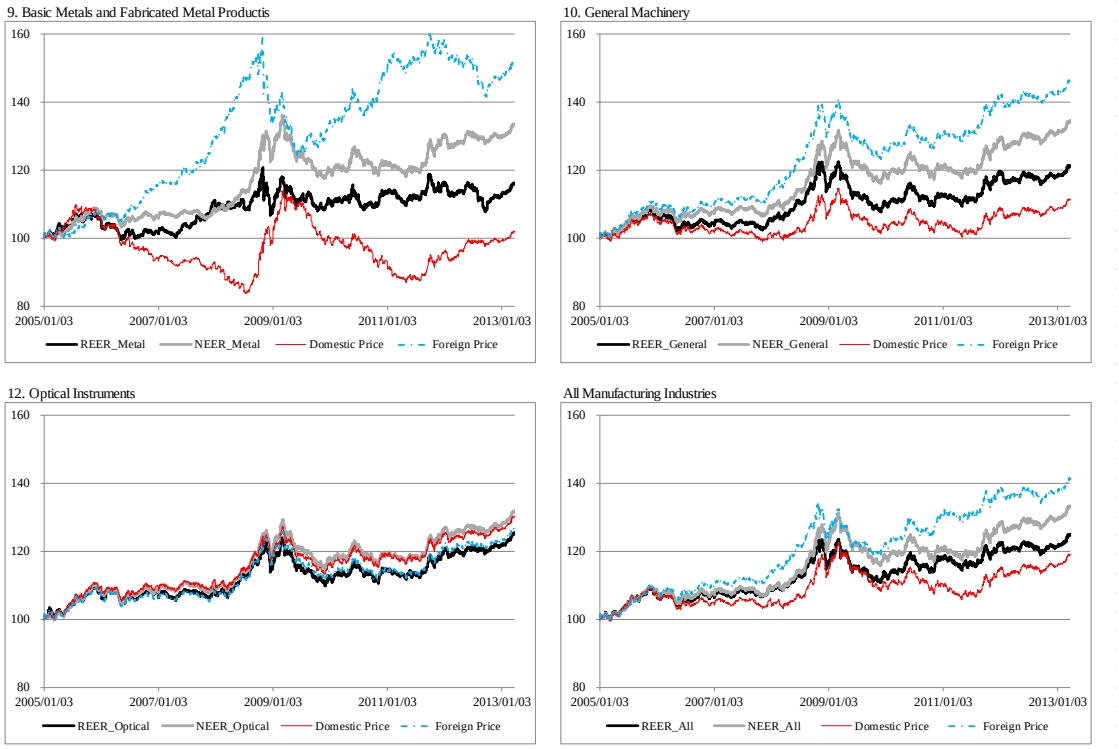


Note: See Figure 9.

Appendix Figure A2. Factor Decomposition of REER Fluctuations: the Case of China

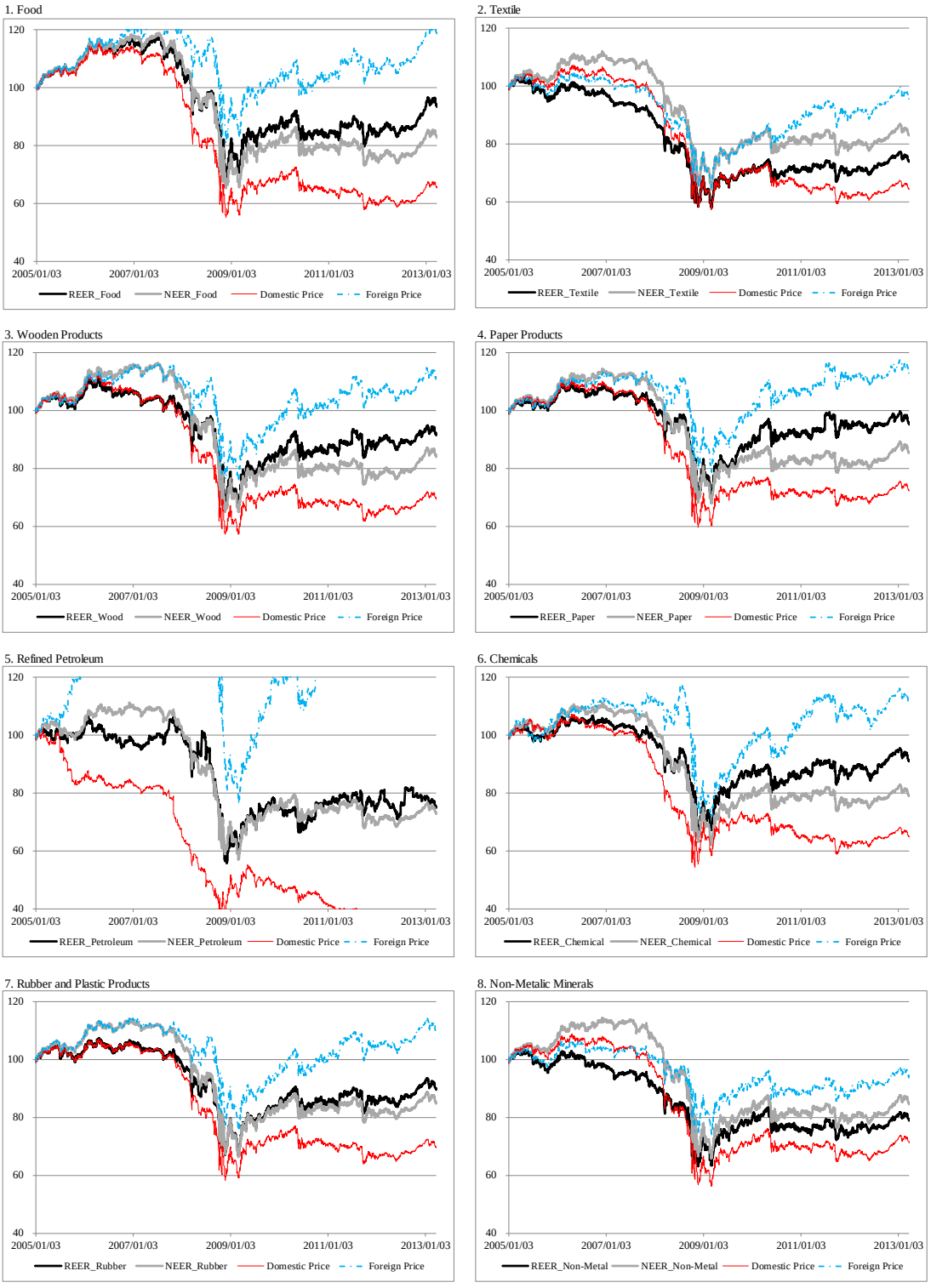


Appendix Figure A2. Factor Decomposition of REER Fluctuations: the Case of China (cont'd)

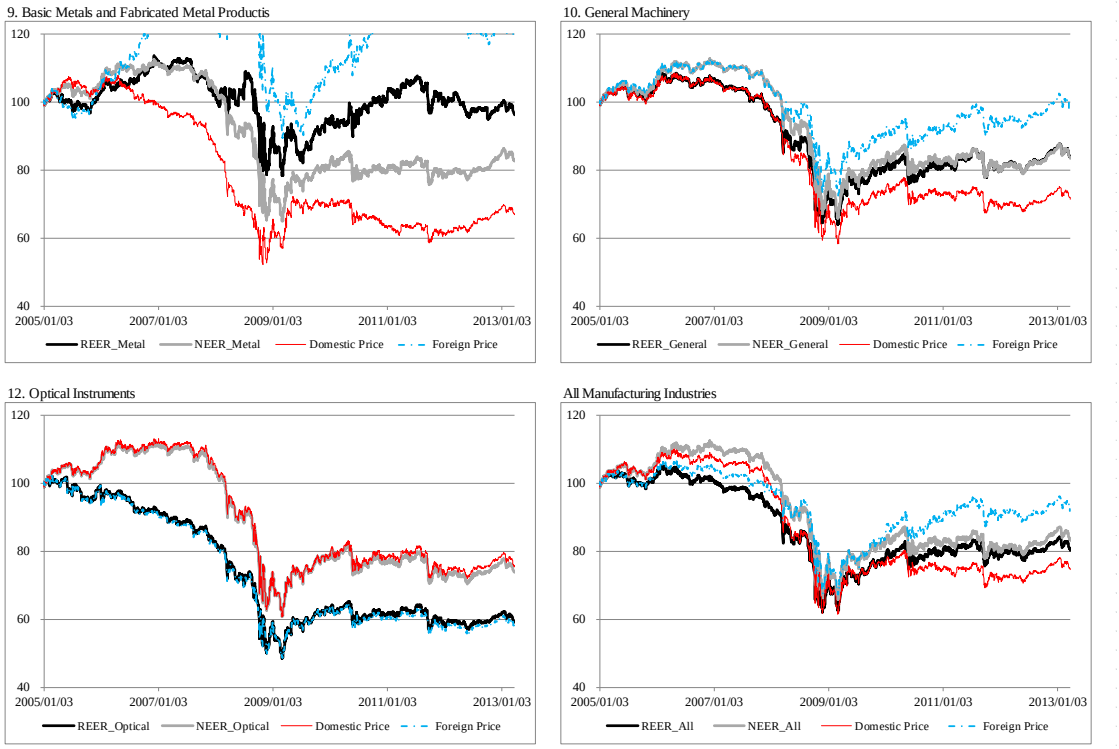


Note: See Figure 9.

Appendix Figure A3. Factor Decomposition of REER Fluctuations: the Case of Korea



Appendix Figure A3. Factor Decomposition of REER Fluctuations: the Case of Korea (cont'd)



Note: See Figure 9.