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Abstract

In considering the empirical importance of the exchange rate on exporters' price competitiveness and producer profits in specific industries, the industry-specific real effective exchange rate (REER) is far more useful than the aggregate REER published by the International Monetary Fund (IMF) and the Bank for International Settlements (BIS). The novelty of this study is to construct a new dataset of the industry-specific REER of the yen on a daily basis from 2005 to the present to provide a better indicator for the international price competitiveness of Japanese exporters. By conducting simulation analysis, we show whether recent fluctuations of the REER have been driven by various factors such as domestic and foreign price changes. By running a near-vector autoregression (VAR) estimation with block exogeneity, we demonstrate that Japanese exports of major machinery industries are affected not by the nominal exchange rate shock but by the world output fluctuations and the domestic price changes in Japan.

Keywords: Industry-specific real effective exchange rate (REER), Japanese yen, Competitiveness, Vector autoregression

JEL classification: F31, F33, F15

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1. Introduction

It has been argued that nominal appreciation of the yen vis-à-vis the U.S. dollar deteriorates the export price competitiveness of Japanese exporters. After the Lehman Brothers collapse in September 2008, for instance, the bilateral nominal exchange rate of the yen appreciated sharply vis-à-vis the all currencies, then Japanese exports decreased to a large extent. The yen has kept appreciating to around 76-79 yen vis-à-vis the US dollar in 2011 and staying around 80 yen vis-à-vis the US dollar even in the mid-2012. A natural question is whether such an appreciation of the yen in bilateral nominal terms has deteriorated the export competitiveness of Japanese export firms and whether the impacts of the nominal yen appreciation differ across industries in Japan.

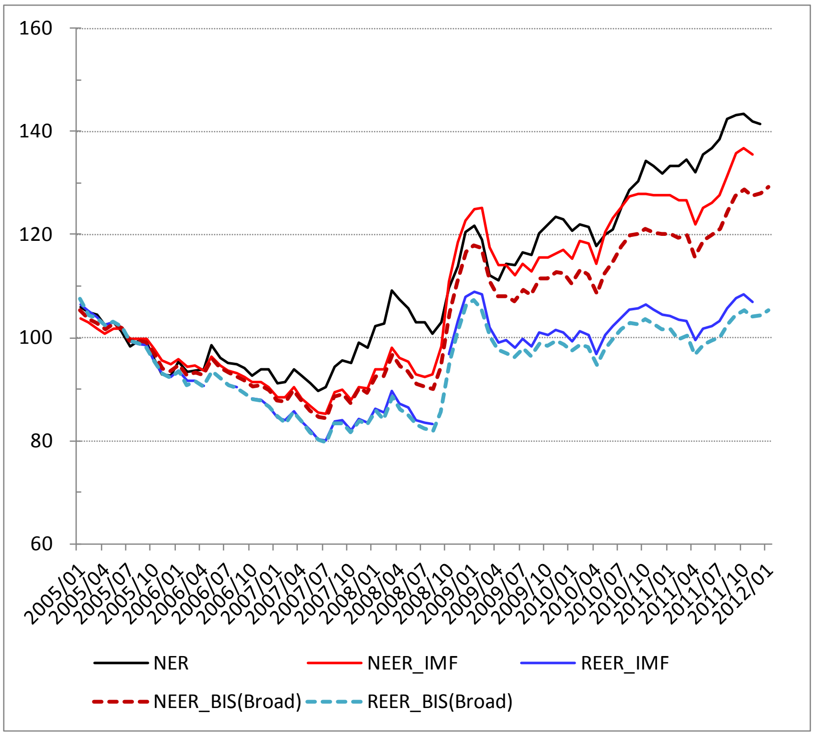
It is well known that a real effective exchange rate (REER), not bilateral nominal exchange rates, is a better measurement to consider the export firms' competitiveness in the global market. As shown in Figure 1, both the nominal effective exchange rate (NEER) and the REER are currently published by International Monetary Fund (IMF), Bank for International Settlements (BIS) and central banks. However, these effective exchange rates are constructed by aggregate based trade weights. While industry-specific REER is far more useful to consider, for example, the empirical importance of the exchange rate on export price competitiveness and producer profits in specific industries, such industry-specific REER is seldom available.

The novelty of this study is to construct a new data set of the industry-specific REER of the yen at a daily basis from 2005 to the present to provide a better indicator for international price competitiveness of Japanese exporters. By conducting a simulation analysis, we examine whether recent fluctuations of the REER of the yen have been driven by the domestic or foreign price changes. We also conduct a near-VAR estimation with block exogeneity to investigate which shock most affect the Japanese exports at an industry level.

We reveal that the level of REER is the lowest in the electric machinery industry, which suggests that the electric machinery industry still has export price competitiveness compared to the other industries despite the sharp appreciation of the yen in nominal terms. However, our simulation analysis reveals that such stronger price competitiveness is mainly ascribed to the effort of lowering its own product price by the electric machinery industry. By conducting near-VAR estimation with block exogeneity, we demonstrate that not the NEER shock but the other types of shock such as world output shock and the domestic price shock better explain the Japanese export volume changes. Thus, the industry-specific REER we constructed is useful for conducting rigorous empirical analysis and also for drawing policy implications both for exporting companies and policy makers.

The remainder of this paper is organized as follows. Section 2 describes the method of constructing the industry-specific REER. Section 3 shows the REER for each industry and presents the simulation result. Section 4 conducts the VAR analysis and reports the results of impulse response function analysis and the variance decomposition test. Finally, Section 5 concludes.

Figure 1. Japanese Effective Exchange Rates (2005=100)



Note: Monthly series from January 2005. The IMF data ends in November 2011 and the BIS data ends in January 2012. NEER denotes the nominal effective exchange rate and REER the real effective exchange rate. REER is calculated based on consumer price index. An increase in graph means appreciation of the yen.

Source: CEIC Database.

2. Data Construction of Industry-Specific Effective Exchange Rates

2.1 Effective Exchange Rate Formula

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

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

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

2.2 Partner Country and Industry Classification

In our effective exchange rate calculation, we include 15 countries as a trading partner (i.e., export destination) country: 8 Asian countries (China, Korea, Indonesia, India, Malaysia, the Philippines, Singapore and Thailand), 4 European countries (Italy, France, Germany and UK), Australia, Russia, and the United States. Table 1 presents the share of 15 countries in Japanese total exports from 2002 to 2009, which shows that these 15 countries account for 66-70 percent during that period.

Table 1. Percent Share of Destination Country in Japanese Total Exports

Destination country	2002	2003	2004	2005	2006	2007	2008	2009
AUS	2.1	2.2	2.2	2.2	2.0	2.1	2.2	2.2
CHN	9.4	12.0	12.7	13.0	14.0	14.2	14.8	18.3
GER	3.3	3.5	3.4	3.2	3.2	3.2	3.1	2.9
FRA	1.5	1.5	1.5	1.3	1.2	1.3	1.3	1.1
IDN	1.5	1.5	1.6	1.5	1.1	1.3	1.7	1.7
IND	0.4	0.5	0.5	0.6	0.7	0.9	1.0	1.2
ITA	1.1	1.2	1.2	1.0	1.1	1.1	1.0	1.0
KOR	6.5	7.0	7.3	7.4	7.3	7.2	7.4	8.2
MYS	2.7	2.4	2.2	2.1	2.1	2.1	2.1	2.3
PHL	2.0	1.8	1.7	1.6	1.4	1.3	1.2	1.3
RUS	0.2	0.4	0.6	0.8	1.2	1.8	2.5	0.7
SGP	3.2	2.9	3.0	2.9	2.8	2.2	2.4	2.4
THA	3.1	3.3	3.5	3.7	3.5	3.5	3.7	3.8
UK	2.9	2.8	2.7	2.6	2.4	2.5	2.3	2.1
USA	29.2	25.2	23.1	23.4	23.4	21.3	18.6	17.1
TOTAL	**69.1**	**68.3**	**67.2**	**67.1**	**67.1**	**66.1**	**65.5**	**66.5**

Note: TOTAL denotes the share of 15 countries in Japanese total exports.

Source: Authors' calculation from the UN Comtrade Database.

We use the 2-digit International Standard Industrial Classification (ISIC) Rev.3 for our industrial classification. We aggregate 22 ISIC manufacturing industries into 12 industries. The details are presented in Table 2.

Table 2. Industry Classification

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

Note: 23 categories of 2-digit ISIC are converted into 12 classifications. ISIC 36 and 37 are not used in our analysis.

2.3 Industry-Specific Price Data

To construct the REER series, it is better to use the export (import) price index or producer price index, since consumer price index (CPI) includes the non-tradable prices. However, the aggregate REER series published by IMF and BIS is calculated basically using CPI as a domestic price index. In contrast, we use the industry-breakdown data on the producer price index (PPI) to calculate the industry-specific REER for Japan.

Table 3 shows the availability of the industry-specific price data. While 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 match disaggregated price data of each country to respective ISIC categories. If the price data of a sample country is more disaggregated than 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. The price data is normalized to 100 as of 2005 and the seasonality is adjusted by Census X-12.[1]

[1] We use EViews 7 for seasonal adjustment.

Table 3. Availability of Industry-Specific Price Data

<table>
<tr><th>ISIC</th><th>Industry Classification</th><th>AUS</th><th>CHN</th><th>GER</th><th>FRA</th><th>IDN</th><th>IND</th><th>ITA</th><th>JPN</th></tr>
<tr><td>15</td><td>Food and Beverage</td><td rowspan="2">▲</td><td>○</td><td>○</td><td>○</td><td rowspan="2">○</td><td>●</td><td>○</td><td>○</td></tr>
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<tr><td>17</td><td>Textiles</td><td rowspan="3">○</td><td>▲</td><td>○</td><td>○</td><td>○</td><td>○</td><td rowspan="3">○</td><td>○</td></tr>
<tr><td>18</td><td>Wearing Appeal, Fur</td><td>○</td><td>○</td><td>○</td><td rowspan="2">○</td><td>X</td><td>●</td></tr>
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<tr><td>22</td><td>Printing and Publishing</td><td>○</td><td>○</td><td>X</td><td>○</td><td>○</td><td>○</td><td>●</td></tr>
<tr><td>23</td><td>Coke, Refined Petroleum Products</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>X</td><td>○</td><td>○</td></tr>
<tr><td>24</td><td>Chemicals and Chemical Products</td><td>○</td><td>▲</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
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<tr><td>26</td><td>Non-metallic Mineral Products</td><td>○</td><td>○</td><td>▲</td><td>○</td><td>○</td><td>○</td><td>○</td><td>●</td></tr>
<tr><td>27</td><td>Basic Metals</td><td>○</td><td>▲</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>●</td></tr>
<tr><td>28</td><td>Fabricated Metal Products</td><td>○</td><td>○</td><td>X</td><td>X</td><td>X</td><td>X</td><td>○</td><td>X</td></tr>
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<tr><td>32</td><td>Communication Equipment and Apparatus</td><td>○</td><td>○</td><td>X</td><td>○</td><td>X</td><td rowspan="2">○</td><td>○</td></tr>
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</table>

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.

Source: See Appendix Table.

2.4 Trade Weight

To calculate a trade weight for constructing industry-specific REER, we follow the two-step procedure. First, we compute the total amounts of exports to 15 countries, which is regarded as the "15-total" exports. We compute the trade weight of each country for each industry by dividing the export amounts to each destination by the 15-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.[2] The export data is obtained from the UN Comtrade Database. Since, as of March 2012, the latest data is the 2010 data, we use the 2008-2010 average data even for 2011 and 2012. Once the most recent year data (e.g., the 2011 data) becomes available, we use the updated data for 2011 and after. Table 4 shows the industry-breakdown share of Japanese exports by the destination country.

Table 4. Japanese Trade Share by Industry and by Destination Country in 2009 (Percent)

Code	AUS	CHN	GER	FRA	IDN	IND	ITA	KOR	MYS	PHL	RUS	SGP	THA	UK	USA	**WOR**
1	1.5	10.9	0.7	0.9	0.8	0.1	0.2	7.7	0.9	0.7	1.4	3.3	4.4	0.9	18.0	**52.5**
2	0.4	44.7	1.3	1.1	1.2	0.5	1.4	4.7	1.3	0.8	0.2	1.0	2.8	0.7	5.7	**67.8**
3	0.2	21.2	3.0	1.2	1.8	0.1	0.3	23.1	0.8	16.6	0.9	0.3	2.2	1.1	13.5	**86.4**
4	2.9	27.0	1.8	0.8	2.3	1.0	0.5	9.1	3.3	1.6	1.3	2.2	5.1	1.0	13.2	**73.2**
5	0.4	13.6	0.2	2.1	2.3	17.9	1.8	27.2	0.6	0.5	0.0	0.1	3.9	0.0	9.4	**80.1**
6	0.9	24.7	2.5	1.3	1.9	1.5	1.3	14.9	1.7	1.2	0.2	2.0	4.1	1.1	13.3	**72.5**
7	2.6	16.2	2.1	0.9	2.1	0.8	0.7	17.3	1.2	1.4	1.3	1.6	3.0	1.2	11.4	**63.6**
8	1.2	17.1	3.3	0.8	1.0	1.0	0.4	22.5	2.6	2.2	0.2	2.4	3.4	0.7	8.9	**67.6**
9	1.0	22.5	1.1	0.2	3.0	2.1	0.3	14.5	4.3	2.0	0.2	4.0	6.6	4.0	6.6	**72.6**
10	1.8	20.8	2.6	1.3	2.5	2.1	1.0	9.2	1.8	1.2	0.8	3.0	4.8	1.2	14.9	**69.0**
11	0.9	22.6	5.6	1.1	1.0	1.0	0.7	7.0	3.0	2.0	0.3	2.3	3.6	1.9	16.6	**69.8**
12	4.5	8.5	2.2	1.4	1.4	0.5	1.3	1.2	1.7	0.7	1.2	2.0	2.6	2.9	26.2	**58.2**

Note: See Table 2 for the industry code. "WOR" represents the share of the 15-total exports in the Japanese overall exports including all partner countries for each industry.

Source: Authors' calculation from the UN Comtrade Database.

3. Japanese Industry-Specific REER

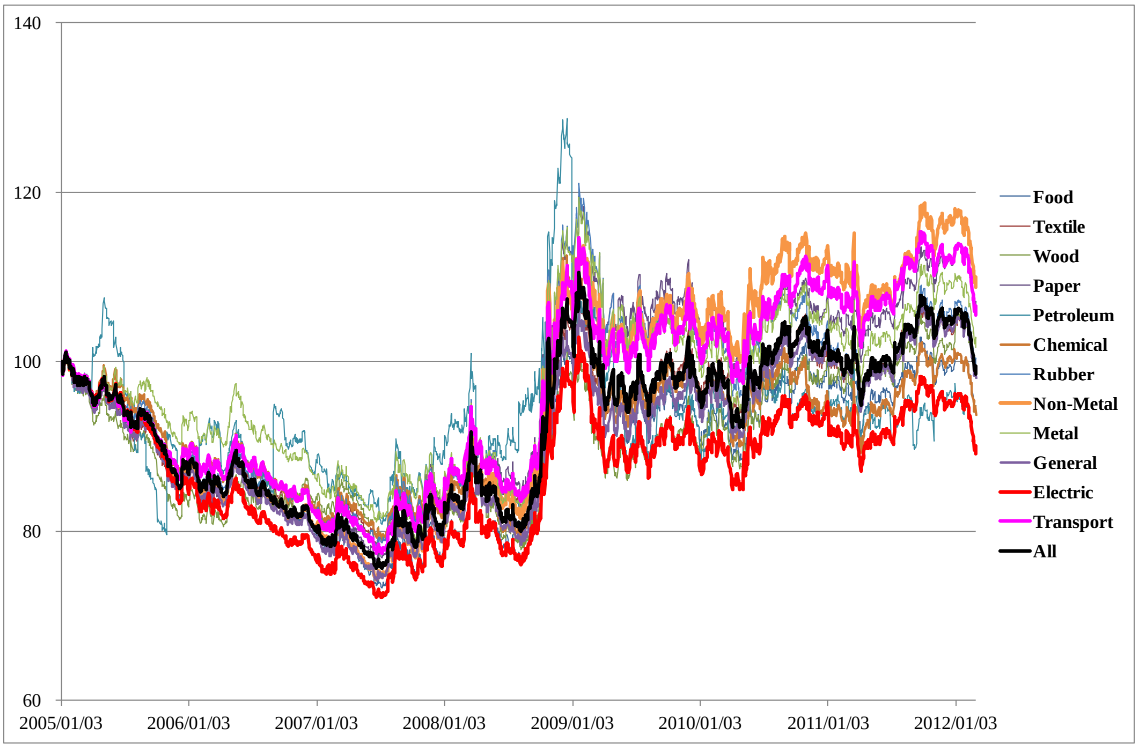
3.1 Overview of Industry-Specific REER

Figure 2 shows the Japanese industry-specific REER we calculated. The black bold line represents the REER of all industries that exhibits similar movements to the REER published by IMF and BIS (see Figure 1). The most striking feature is a large difference in the

[2] For instance, we use the 3 year average (2007-2009) trade share for calculating the REER series of 2010.

level of REER across industries especially after the sharp appreciation in the Lehman Brothers collapse in September 2008. The REER of the non-metallic mineral products is at the highest level and the REER of the electric machinery is at the lowest. Interestingly, the REER of the refined petroleum products fluctuated very widely, which is likely to reflect the sharp fluctuation of crude oil prices in recent years.

Figure 2. Japanese Industry-Specific REER (Jan.3, 2005 through March 2, 2012)



Source: Authors' calculation.

3.2. Simulation Analysis

While we have observed different movements of REER across industries, a natural question is what causes such a difference. It is conjectured that different price movements 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 REER series. If the component is an important factor, the simulated REER shows different movements from the actual REER. If the component is not important, the simulated REER fluctuates very closely to the actual REER. For this simulation analysis, we use the following three components: Japanese domestic producer price, a weighted average of trading partner's producer prices, and the trade share of respective partner countries.

Figure 3. Factor Decomposition of REER Fluctuations

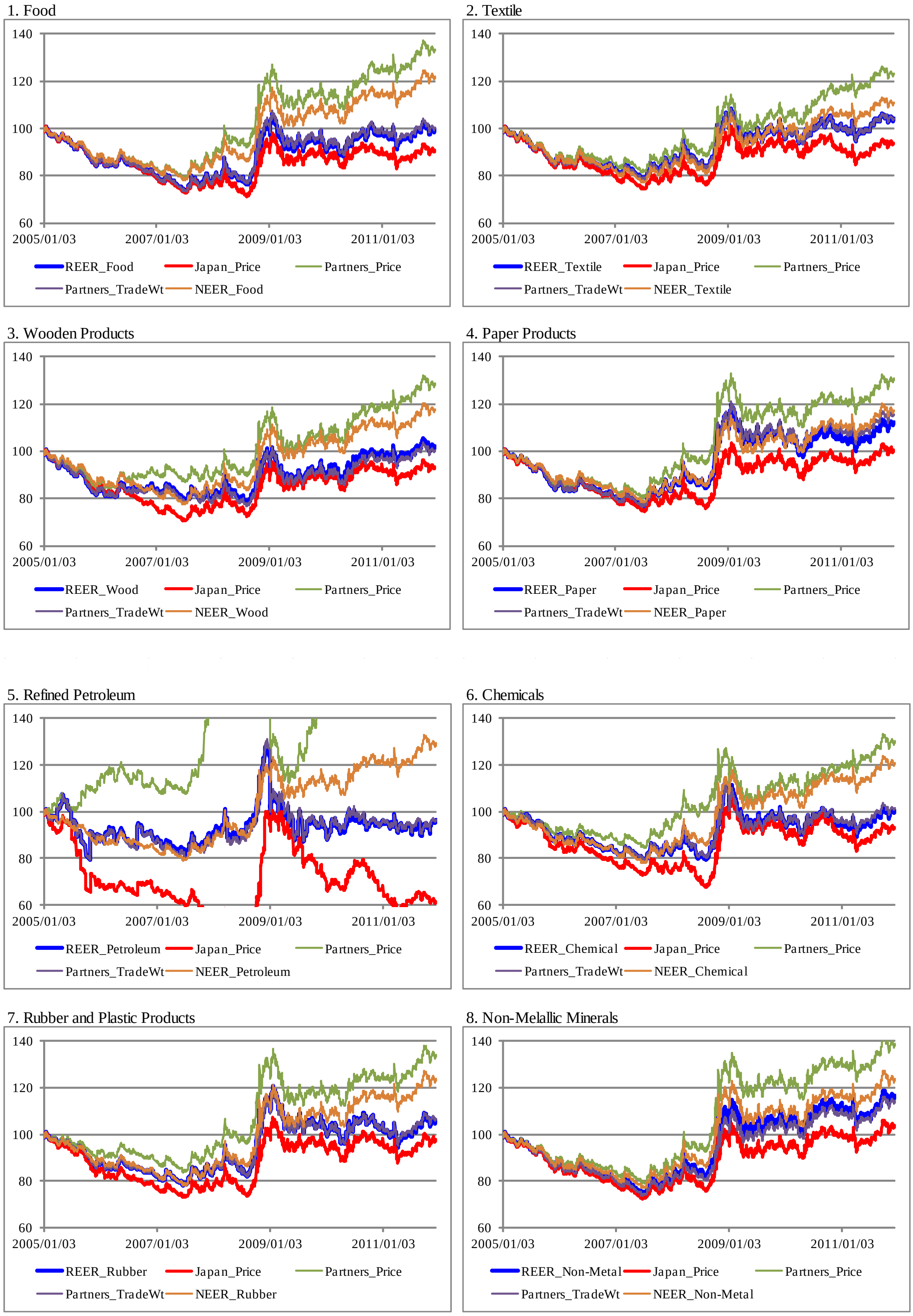
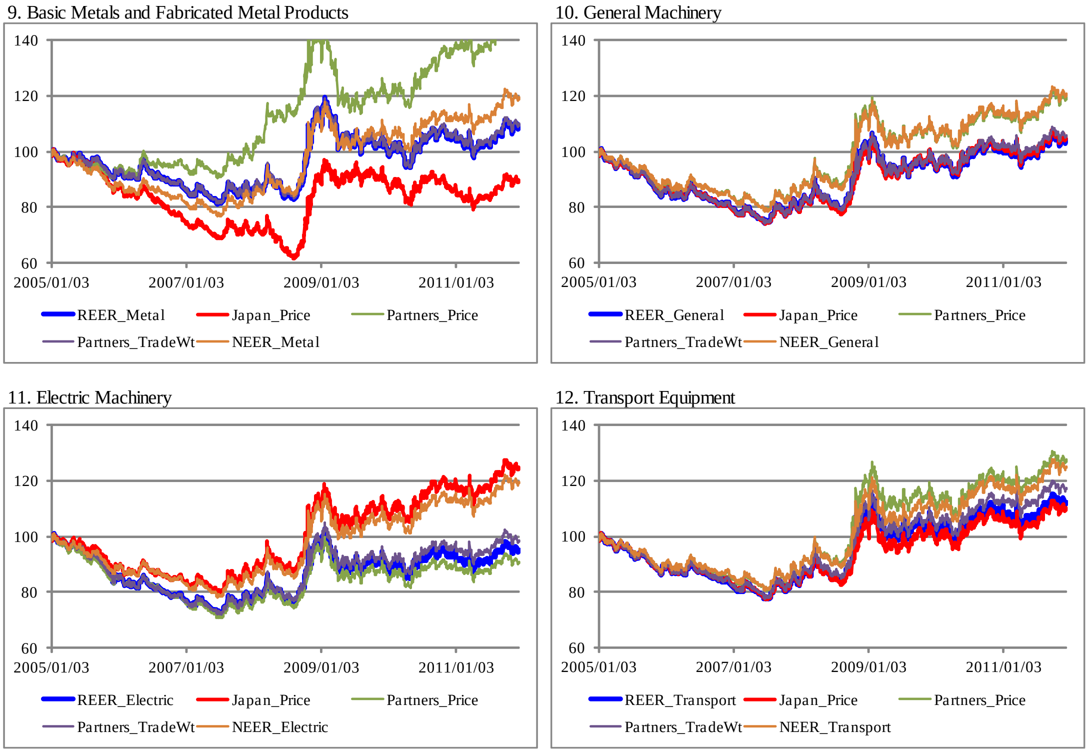


Figure 3. Factor Decomposition of REER Fluctuations (cont'd)



Note: In the graph of "11. Electric Machinery", for instance, "REER_Electronics" denotes the industry-specific REER of the electric machinery industry, and "NEER_Electronics" stands for the industry-specific NEER that is presented for comparison. Other line graphs are simulated by the following assumption.

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

2. "Partner_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 (January 2005) over the sample period.

3. "Partner_TradeWt" represents the simulated REER if the weighted average of partner country's trade share is assumed to be constant at the initial observation (year 2005) over the sample period.

Figure 3 shows the results of simulation for all twelve industries. For comparison purpose, we also present both the REER and the NEER for each industry. First, the NEER is far above the REER in level in most industries. However, it is interesting to note that the REER and the NEER exhibit very similar movements in the case of paper products.

Second, it is generally observed that a line graph in green (i.e., the simulated REER with constant partner country’s price) is above the actual REER, which indicates that Japanese REER would appreciate more if the foreign price level did not increase. We also observe that a line graph in red (i.e., the simulated REER with constant Japanese price) is below the actual REER, though to a smaller extent, which implies that an increase in Japanese domestic price tends to cause an appreciation of the Japanese REER.

Third, and more importantly, there is a striking difference between the electric machinery industry and the other industries. Specifically, in the electric machinery industry, a line graph in red (i.e., the simulated REER with constant Japanese price) is far above the actual REER, while a line graph in green (i.e., the simulated REER with constant partner country’s price) is slightly below the actual REER. This observation indicates that without a decline of Japanese producer price index in the electric machinery industry, the REER would appreciate to a large extent. Bearing in mind that the actual REER of the electric machinery industry is the second lowest in level among the REERs of all industries, we may state that it is the effort of the Japanese electric machinery industry to reduce its own price level that maintain the price competitiveness of their exports in highly competitive global markets, even though the NEER appreciates substantially.

Finally, in the refined petroleum industry, the simulated REER shows very large fluctuations, which is likely due to the sharp up and down of the crude oil price during the sample period.

4. Structural VAR Analysis

4.1 Empirical Strategy

By using the industry-specific REER, this section empirically investigates the effect of REER fluctuations on Japanese exports. To allow for possible lagged effects of REER on exports, we use a VAR model by including the following variables. First, we use the industry-breakdown data of Japanese export volume (quantity) index to examine the impact of the industry-specific REER. Second, we include the weighted average of trading partner country’s industrial production index (IPI) as a proxy for world outputs. We collect the industry breakdown of IPI for all trading partner countries and calculate the weighted average of IPI by industry. Third, instead of including the industry-specific REER variable, we decompose the REER into three components: the industry-specific NEER, Japanese industry-specific producer price, and the weighted average of industry-specific producer prices in trading partner countries. These three variables are included in the VAR model to investigate which factor has more influences on the Japanese export volume by industry. All variables are in natural logarithm. In the case of world output, we use the cyclical component of IPI that is obtained by applying the Hodrick-Prescott filter to the IPI series.

In order to allow for the effects of the above variables on the Japanese export volume, we employ the following near-VAR model with block exogeneity:[3]

$$\sum_{s=0}^{p}\begin{bmatrix} A_{11}(s) & A_{12}(s) \\ A_{21}(s) & A_{22}(s) \end{bmatrix}\begin{bmatrix} y_{1,t-s} \\ y_{2,t-s} \end{bmatrix}=\begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \end{bmatrix},$$

where $A_{12}(s)=0$ for each s = 0, 1,…, p , $y_{1,t}$ is a vector of variables external to the domestic country, and $y_{2,t}$ is a vector of variables in the domestic country. A vector of structural shocks, $\varepsilon_t=[\varepsilon_{1,t} \quad \varepsilon_{2,t}]'$, is uncorrelated with past y_{t-s} for $s>0$, and satisfies $E[\varepsilon_t\varepsilon_t' \mid y_{t-s}, s>0]=I$ and $E[\varepsilon_t \mid y_{t-s}, s>0]=0$, where $\varepsilon_{1,t}$ is a vector of structural shocks of external origin and $\varepsilon_{2,t}$ is a vector of structural shocks of domestic origin. The model is formulated separately for each industry. We impose the block exogeneity restriction, $A_{12}(s)=0$ for each s = 0, 1…p, which indicates that domestic shocks, $\varepsilon_{2,t}$, have neither contemporaneous nor lagged effects on the external variables, $y_{1,t}$.

A foreign block, $y_{1,t}$, includes two variables, namely the world real output (the weighted average of trading partner’s industrial production index) and the world producer prices (the weighted average of trading partner’s producer prices). In the foreign block, we impose the long-run zero restrictions, as in Blanchard and Quah (1989), where (i) only a shock to the first variable (world real output shock), that is, the world real output shock, affects the second variable (world producer prices) in the long run; and (ii) both the world real output shock and a shock to the world producer prices, that is, the world producer price shock, affect domestic inflation in the long run.

[3] See Cushaman and Zha (1997), Zha (1999), and Maćkowiak (2007) for an analysis using the near-VAR model with block exogeneity.

A country-specific block, $y_{2,t}$, includes three variables, namely the domestic producer prices, Japanese exports, and the NEER. In the country-specific block, we impose the contemporaneous zero restrictions. The domestic producer prices are contemporaneously affected only by a shock to the domestic producer prices, that is, the domestic producer price shock. Both the domestic producer price shock and a shock to Japanese exports, that is, the export shock affect Japanese exports contemporaneously, but a shock to the NEER, that is, the NEER shock does not affect Japanese exports contemporaneously. The NEER is contemporaneously affected by the all three shocks.

Thus, SUR estimation is used with the above block exogeneity assumption to identify structural shocks by imposing both contemporaneous and long-run restrictions. Our near-VAR structure is just-identified by combining both short- and long-run restrictions as well as the block exogenous restrictions.[4] In this near-VAR estimation, the monthly series of data is used. Three lag is chosen for the near-VAR system due to the small sample size.

It is necessary to check the time-series properties of each endogenous variable for the near-VAR estimation. The result of unit-root tests shows that the endogenous variables are not stationary in level, but stationary in first-differences, even in the case of the cyclical component of the IPI series. This result may be due to the small sample size of our analysis: it may not be appropriate to conduct any types of unit root tests due to the small sample size. Thus, we took the first-difference of each log transformed variable for the SUR estimation of the near-VAR model to ensure the stationarity of variables.

4.2 Data Description

As a proxy for the world real output, we calculate the weighted average of industrial production index (IPI) of fifteen trading partner countries for each industry. The monthly series of the industry-specific IPI is taken from CEIC Database and IMF, *International Financial Statistics*, CD-ROM. Since only the quarterly series of data is available for Australia, we assume that IPI is the same in three months of respective quarters. Since China's industry-specific IPI is not available, we use the total IPI data for all manufacturing industries in China. For Japanese exports, we use the monthly series of the Japanese export volume (quantity) index, which is obtained from the website of the Japan Customs. All data are monthly, expressed in natural logarithms. Seasonality is adjusted using the Census X12 method.

4.3 Empirical Results

The results of impulse response function analysis are presented in Figure 4. Our main

[4] The RATS 7.0 econometric software program is used for estimation

interest is in the impulse responses of Japanese exports to identified shocks. Due to space limitation, we also focus on the results of Japanese major three machinery industries: general machinery, electric machinery and transport equipment. The blue line indicates the impulse response, while the red dotted line shows percentile bands of the 16 per cent and 84 per cent fractiles.[5]

First, in the electric machinery industry, Japanese exports exhibit very small response to the NEER shock and the response is not statistically significant over the twenty-four month time horizons. The response to domestic price shock is also very small and statistically insignificant. Interestingly, the response to foreign price shock is negative and significant for the first several periods, which is not consistent with our expectation. However, the response to foreign price shock is relatively small. More importantly, we can observe the large and significant response of Japanese exports to world output shock, which suggests that Japanese electric machinery exports are largely driven by the world electronics cycles.

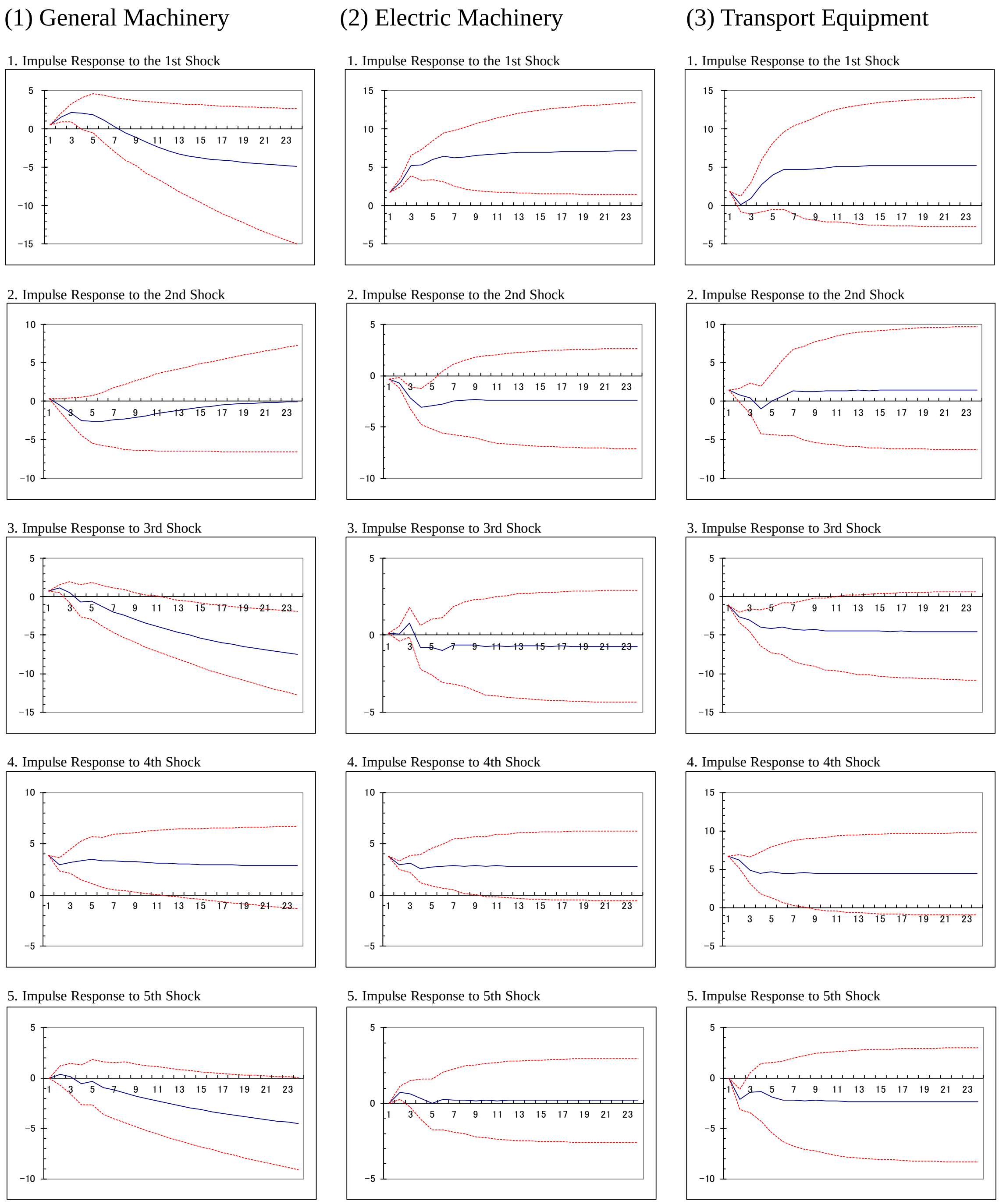
Second, in the transport equipment industry, the response to the NEER shock is small and significantly negative, but only for a few horizons. The response to the world output shock and the world price shock is both significantly positive only for the initial period with a small degree of responses. Japanese exports show the largest response to the domestic price shock, which indicates that a relative increase in Japanese domestic price deteriorates Japanese exports.

Finally, in the general machinery industry, the response to the NEER shock is again statistically insignificant. The response to the world output shock is significantly positive, but short-lived. Interestingly, the response to the domestic price shock is significantly positive, but only for the first two periods. However, from the twelve periods, the response to the domestic price shock becomes significantly negative. Although further investigation is necessary, this result may suggest the strong export competitiveness of the general machinery industry.

To identify the relative contribution of each shock to the endogenous variables, a variance decomposition (VD) analysis is conducted to decompose the variation in the percentage change of the forecast error variance of changes in the five endogenous variables at the 1 through 24 month horizons. Let us present the results of VD of Japanese export volume only for the three major machinery industries, which is presented in Table 5.

[5] This follows Sims and Zha (1999) and conducts the Monte Carlo integration of 2,500 replications.

Figure 4. Impulse Responses of Japanese Exports to Structural Shocks



Note: The results of impulse responses of Japanese exports to each structural shock are reported. The 1st shock (the world output shock), the 2nd shock (the world price shock), the 3rd shock (the domestic price shock), the 4th shock (the export volume shock), and the 5th shock (the NEER shock). The blue line indicates the impulse response. The red dotted line shows the percentile bands of the 16 per cent and 84 per cent fractiles.

Table 5. Variance Decomposition of Japanese Export Volume

a) General Machinery Industry

Step	Std Error	1st Shock	2nd Shock	3rd Shock	4th Shock	5th Shock
1	0.0401	1.97	0.70	3.72	93.60	0.00
2	0.0434	6.31	4.72	4.01	84.14	0.82
4	0.0483	6.79	11.35	10.10	68.20	3.56
6	0.0521	7.19	10.01	14.64	59.68	8.47
12	0.0576	14.75	9.53	16.97	50.73	8.01
18	0.0602	16.57	9.53	18.73	47.01	8.16
24	0.0610	17.14	9.61	19.18	45.96	8.11

b) Electric Machinery Industry

Step	Std Error	1st Shock	2nd Shock	3rd Shock	4th Shock	5th Shock
1	0.0417	16.83	0.67	0.09	82.40	0.00
2	0.0452	22.99	1.16	0.09	73.32	2.44
4	0.0556	29.40	9.91	9.49	48.95	2.25
6	0.0571	30.12	10.07	9.21	46.76	3.85
12	0.0578	29.76	10.47	9.77	45.90	4.09
18	0.0578	29.78	10.48	9.77	45.87	4.10
24	0.0578	29.78	10.48	9.77	45.86	4.10

c) Transport Equipment Industry

Step	Std Error	1st Shock	2nd Shock	3rd Shock	4th Shock	5th Shock
1	0.0725	6.86	4.08	2.08	86.98	0.00
2	0.0795	10.68	3.85	6.26	72.86	6.34
4	0.0869	12.54	5.14	10.39	66.56	5.37
6	0.0911	14.79	8.39	9.78	61.39	5.66
12	0.0927	14.41	10.17	10.13	59.71	5.58
18	0.0927	14.42	10.17	10.15	59.69	5.58
24	0.0927	14.42	10.17	10.15	59.69	5.58

The results of VD analysis are consistent with those of the impulse response function analysis. As it can be seen in Table 5, the fluctuations in Japanese export volume were mainly caused by the export volume shocks at all horizons. In the electric machinery industry, however, the world output shock accounts for a large percentage of the variation in the Japanese export volume. In the transport equipment industry, the domestic price shock accounts for more than 10 percent of the variation in the Japanese export volume. In the general machinery industry, the domestic price shock explains a bigger percentage of the variation in the Japanese export volume than in the transport equipment industry. Finally, the NEER shock accounts for the smallest percentage of the variation in the Japanese export volume, which also conforms to our early observation that the impulse response of Japanese export volume to the NEER shock is not statistically significant reported in Figure 4.

5. Concluding Remarks

The main contribution of this paper is to present the industry-specific REER of the yen from the beginning of 2005 to the present to reveal the industry-level difference in the impact of the nominal yen appreciation vis-à-vis the US dollar. We have demonstrated that even though bilateral nominal exchange rate of the yen vis-à-vis the US dollar appreciated sharply from the Lehman Brothers collapse in September 2008, the level of the REER and the degree of its fluctuations differ markedly across industries. The level of REER is the lowest in the electric machinery industry, which suggests that the electric machinery industry still has export price competitiveness compared to the other industries. Our simulation analysis, however, reveals that such strong price competitiveness is mainly ascribed to the effort of lowering its own product price by the electric machinery industry. Our near-VAR estimation with block exogeneity demonstrates that the NEER shock least explains the Japanese export volume changes. The electric machinery exports are mainly explained by the world electronic cycles and the change in transport equipment exports is likely due to the domestic price changes. Thus, the industry-specific REER we constructed is useful for conducting rigorous empirical analysis and also for drawing policy implications both for exporting companies and policy makers.

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Data Appendix: Data Source for Price Index

Country	Data Source
Ausuralia	Australian Bureau of Statistics
China	CEIC
France	National Institute of Statistics and Economic Studies
Germany	GENESIS-Online Database
India	Office of Economic Adviser to Government of India
Indonesia	Economic Indicators-Monthly Statistical Bulletin
Italy	CEIC
Japan	Bank of Japan
Korea	Bank of Korea
Malaysia	CEIC
Philippines	Republic of Philippines National Statistics Office
Russia	CEIC
Singapore	CEIC
Thailand	CEIC
United Kingdom	CEIC
United States	U.S. Bureau of Labor Statistics (BLS)

Note:

U.S. Bureau of Labor Statistics (BLS): http://www.bls.gov/ppi/#data

Australian Bureau of Statistics: http://www.abs.gov.au/

National Institute of Statistics and Economic Studies: http://www.bdm.insee.fr

GENESIS-Online database: https://www-genesis.destatis.de

Republic of Philippines National Statistics Office: http://www.census.gov.ph

Office of Economic Adviser to Government of India: http://eaindustry.nic.in/

Bank of Japan: http://www.boj.or.jp/

Bank of Korea: http://eng.bok.or.kr/eng/engMain.action

Republic of Philippines National Statistics Office: http://www.census.gov.ph