RESEARCH DIGEST

Research Digest is a clear and concise summary of main points and issues with policy implications that have been raised in RIETI discussion papers.

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The Construction and Analysis of the Industry-specific Nominal and Real Effective Exchange Rates in Japan

Ever since the Lehman Brothers collapse in 2008, as the Japanese yen continues at high levels, there has been a growing need not only to observe the bilateral exchange rate of the yen vis-à-vis the U.S. dollar but also to watch the daily exchange-rate fluctuations of the yen on an effective basis that includes the currencies of Asian countries, whose importance as trading partners is increasing. One such effort, the Research on a Currency Basket project of the RIETI International Macroeconomics Program (Program Director: ITO Takatoshi, FF, RIETI) began announcing industry-specific real effective exchange rates in July 2012. This data promises to be of use in research, policy-making, corporate activities, and a wide range of other areas. Moreover, Professor SATO Kiyotaka, Professor SHIMIZU Junko, and the others involved in preparation of the actual data, through their analyses using the vast amount of raw data on which their announced data is based such as industry-specific price indexes and foreign trade shares in major trading partner countries, have made discoveries with important implications for government policy. Among them are the factors explaining why the electrical machinery industry faces a relative depreciation of the yen on a real effective basis than other industries.

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Selected publications include: "Global Imbalances and Currency Misalignments in Asia: An analysis with AMU" (with ITO Takatoshi and OGAWA Eiji), *The Frontiers of Economic Policy Analysis Volume 3: Globalization and International Economic Strategies* (written and edited by FUJITA Masahisa and WAKASUGI Ryuhei), Nippon Hyoronsha, 2011; *Economic Analysis of a Case for Common Basket in East Asia* (with ITO Takatoshi and OGAWA Eiji), Toyo Keizai Inc., 2007, and others.

DP:12-E-043	The Construction and Analysis of Industry-specific Effective Exchange Rates in Japan SATO Kiyotaka, SHIMIZU Junko, Nagendra SHRESTHA, ZHANG Shajuan

http://www.rieti.go.jp/en/publications/dp/12e043.pdf

DP:12-E-044	Industry-specific Real Effective Exchange Rates for Japan SATO Kiyotaka, SHIMIZU Junko, Nagendra SHRESTHA, ZHANG Shajuan

http://www.rieti.go.jp/en/publications/dp/12e044.pdf

Calculating the Nominal and Real Effective Exchange Rates of the Yen on an Industry-specific and Daily Basis

—What motivated you to study industry-specific effective exchange rates?

SHIMIZU: Our previous research on a Currency Basket project (Project Leader: OGAWA Eiji, FF, RIETI) of the RIETI International Macroeconomics Program has conducted several studies about the monetary cooperation and an optimal exchange rate system in East Asia. As part of that research, RIETI has compiled a database of Asian Monetary Units (AMU), which is a common currency basket composed of 13 East Asian currencies, and has published the data on its website (http://www.rieti.go.jp/users/amu/en/index.html) since 2005. Whenever newspapers and television broadcasts report foreign exchange rates, they normally give the exchange rate of the yen vis-à-vis the U.S. dollar. The AMU, on the other hand, is an indicator of how the yen is moving in relation to the currencies of Asian countries. Following this original indicator, we created the industry-specific effective exchange rate, which would be useful to the Japanese economy and industry.

The effective exchange rate of the yen is a value that takes the weighted average of the exchange rates between Japan and trading partners based on the share of Japan's exports to partner countries. It is used as an index for measuring Japan's international price competitiveness. Data on this effective exchange rate are published by the central banks of each country and by the Bank for International Settlements (BIS). The BIS data are the most comprehensive, as they include effective exchange rate data for many different countries. These data are monthly, however, there is a disadvantage that even when wide exchange rate fluctuations exist, the extent of these fluctuations on an effective base cannot be seen until the following month. Besides, the data are calculated using the trade weight for all industries, so they do not show us the competitiveness of individual industries.

The Federal Reserve Board (FRB) in the United States and the Bank of England (BOE), on the other hand, publish effective exchange rates for their own countries on a daily basis. If daily effective exchange rates of the yen by industry were also published, this would be useful information for many people, and that it would be even more valuable if they were industry-specific data.

SATO: After the Lehman Brothers collapse in 2008, only the yen appreciated against all other currencies. The yen has appreciated even further with the deepening of the financial crisis in Europe, reaching as high as 75.32 yen vis-à-vis the U.S. dollar at the end of October 2011, a historical high since World War II. As has been widely reported in the news, the yen's strength has dealt a severe blow to Japan's exporting companies.

There is no doubt that Japanese companies overall have been affected by the yen appreciation. It is possible, however, that the degree of impact differs across industries. Let us look, for example, at the automobile and electronics industries, two of Japan's representative export industries. While advanced countries such as the United States and Europe have long been a major export market, Japanese automobile companies have moved into countries in Asia in recent years, setting up production bases. These bases are mainly for selling vehicles locally, but engines and other core components are exported to them from Japan. With electronics, on the other hand, the increasing tendency to divide up processes within the Asian region means that parts and semi-finished products are subject to active trading within the region, while the final export destinations are in North America and Europe. Because of this difference in production and sales structures, the effective exchange rate confronting Japanese companies differs from one industry to another. Also, if the yen rate suddenly surges, a company that waits for the

monthly data to be released will not be able to keep track in timely fashion of the exchange rates it has to handle. Believing it would be good to have the data available more quickly, the decision was made to release effective exchange rates on a daily basis. Now that both nominal and real effective exchange rates are released, as industry-specific and daily data, this information will be useful for studies in a wide range of fields.

SHIMIZU: RIETI began publishing the industry-specific nominal effective exchange rates already in June 2011, and in July 2012, the industry-specific real effective exchange rates became available.

The Difficult Task of Collecting the Industry-specific Price Data of Each Country

—What did the actual work involve?

SATO: We began first with the task of calculating the nominal effective exchange rates for each industry. In so doing, we adopted eight industries in line with the industry classification widely used in Japan. These are Textiles, Chemicals, Metal and metal products, General machinery, Electrical machinery, Transport equipment, Precision instruments, and Other products. For each industry, we then calculated the weight of each trading partner, found the weighted average of exchange rates for the currencies of each partner country, and calculated the nominal effective exchange rates.

Next, we began calculating industry-specific real effective exchange rates, but here we were first faced with the enormous difficulty of obtaining price data. In order to calculate the industry-specific real effective exchange rates, we needed to obtain price data (to the extent possible, producer price indexes) using industry classifications common to all of the applicable countries.

For yen-dollar rates, it is relatively easy to obtain producer prices for the same industry classifications in Japan and the United States. The biggest trading partner of Japan, however, is not the United States but Asia. Many Asian countries have not yet reached the level of statistics-keeping normal in advanced countries. Initially, we did not know whether we would be able to obtain producer price indexes for common industrial classifications, or where we could find such data. In search of the necessary data, we scoured all of the statistical materials we could think of along with the websites of government and other agencies that might have such information for each of Japan's main trading partners, an undertaking that consumed a huge amount of time. Ultimately, we gathered the data based on a new industry classification common to each of the countries and calculated the trade (export) weights. It took us nearly a year to finish putting together real effective exchange rates for the yen. Perhaps due to the difficulty of this task, no other organization has released industry-specific real effective exchange rates up to now.

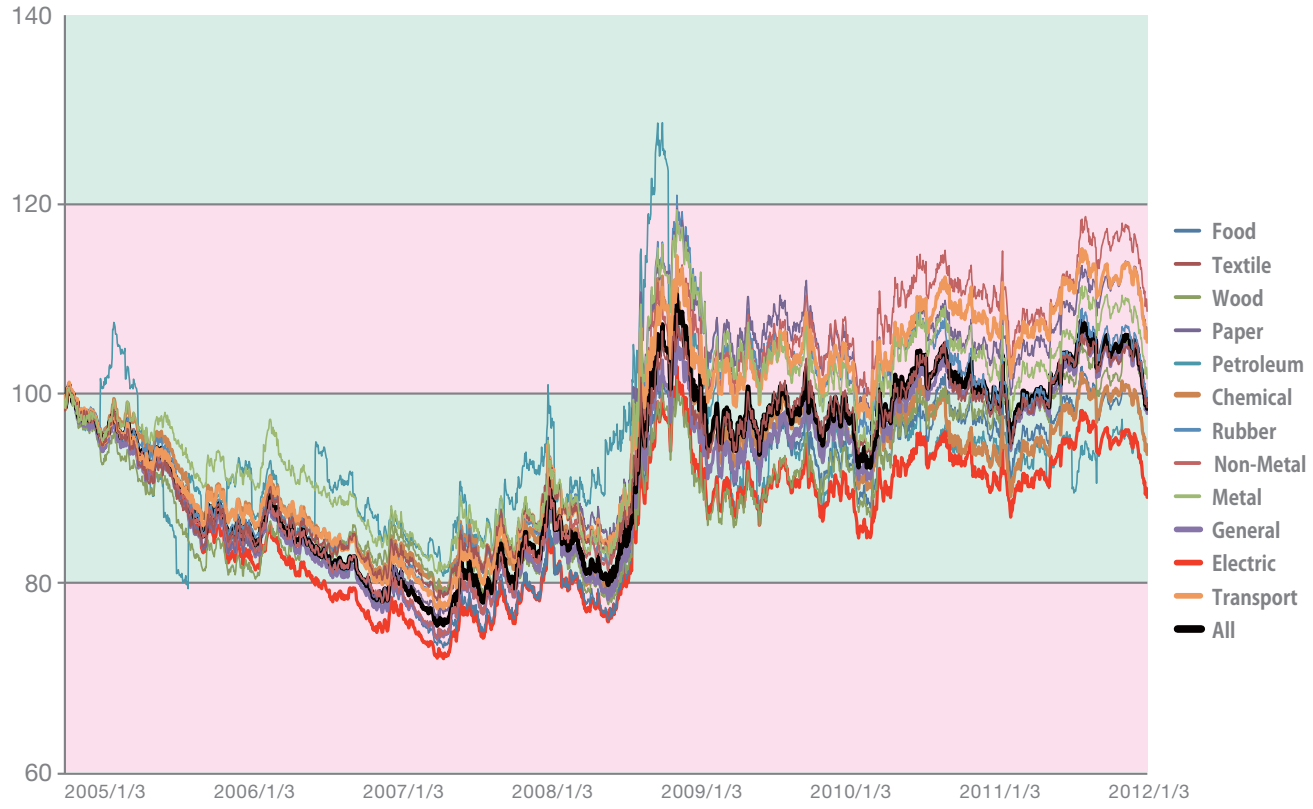
Real Effective Exchange Rates Show the Largest Industry-specific Differences

—What did you learn from your calculations of industry-specific real effective exchange rates?

SATO: As a result of our real effective exchange rate calculations, we were able to observe considerable differences in exchange rate movement in different industries. In the last few years, the nominal yen exchange rate has appreciated substantially against all currencies, but when we looked at this trend for specific industries, we confirmed that there are some industries where the real effective exchange rate has gone way up while in others it has not risen but rather stayed weak. Since the real effective exchange rates released by the BIS and others are not industry-specific rates but are averages for all industries, we could not realize such a difference across industries.

In Figure 1, let us look at the real effective exchange rates for three of Japan's representative export industries—Electrical machinery, Transport equipment, and General machinery, where an increase in the exchange rate means appreciation. We calculated the data daily, with 2005 as the benchmark year, and for the following years. Compared to the average rate for all industries (All: the black solid line), the yen has risen to rather high levels in Transport equipment (Transport), whereas in Electrical machinery (Electric) it has trended much lower than the average. In Gener-

Figure 1: Yen industry-specific real effective exchange rates



Source: Excerpted from Figure 4 in SATO, SHIMIZU, SHRESTHA, and ZHANG (2012)

al machinery (General), the rate has stayed fairly close to the average.

The real effective exchange rate is believed to reflect to a certain extent the price competitiveness of a given industry. If the data in Figure 1 are taken at face value, since the real effective exchange rates in the transport equipment industry (of which the automobile industry is representative) have trended at rather high yen rates, the price competitiveness of that industry would appear to have dropped due to the effects of the strong yen. In the electrical machinery industry, on the other hand, the yen has been at low levels in terms of the real effective exchange rate, so that even while the nominal yen rate has been high, this industry can be seen as maintaining its price competitiveness to a considerable degree compared to other industries. But is it really true that export companies in the electrical machinery industry have benefited from this high cost competitiveness as measured based on real effective exchange rates? Actually, it is possible that the interpretation I noted earlier may not be grasping the situation correctly.

We therefore conducted a simulation analysis to investigate the factors causing fluctuations in real effective exchange rates. Specifically, we analyzed the relationship of real effective exchange rates to the home country's producer prices, the weighted average of the partner country's producer prices, and nominal effective exchange rates, so that we could see which factors could explain the fluctuations in real effective exchange rates. The results of the analysis showed that the changes in the real effective exchange rate in Japan's electrical machinery industry are brought about by declines in producer prices in that industry. This is a feature of the electrical machinery industry that is not evident in other industries. The electrical machinery industry is characterized by severe price competition, not only with U.S. and European companies but also Asian companies in South Korea and Taiwan, for example. Japanese companies in this industry are making stronger efforts than those in trading partner countries to lower their own producer prices, and as a result, this can be seen as driving the real effective exchange rate of the yen lower than in other industries.

SHIMIZU: The results of this analysis are also consistent with the recent realities of Japanese electrical equipment manufacturers posting losses on their balance sheets.

SATO: In the case of the electrical machinery industry, fierce competition is not limited to export markets. Japan's electrical machinery companies are also battling overseas manufacturers for sales in the domestic market. In the automobile industry, although foreign cars have entered the Japanese market, Japanese automakers are not really engaged in fierce price competition with overseas manufacturers. Such price competition in the domestic market is driving down the producer prices in the electrical machinery industry.

SHIMIZU: Our efforts to calculate real effective exchange rates made it possible for us to conduct comparative studies of the differences among industries regarding the extent to which the yen rate has risen. It should be possible to reflect these results in major government policies, such as whether emergency measures to counter the yen strength should be weighted toward particular industries.

—What did you learn about the relationship between nominal effective exchange rates and bilateral nominal exchange rates?

SHIMIZU: Nominal effective exchange rates are weighted averages of bilateral nominal exchange rates of the yen rates for different currencies, weighted based on the share of total Japanese exports. In these calculations, the nominal effective exchange rate is therefore linked to the yen-dollar rate in proportion to the share of the U.S. market in Japanese exports. When we analyzed the actual relationship between nominal effective exchange rates and some major exchange rates, however, we found that the linkage to the yen-dollar rate was larger than the U.S. export share. More than 90% of the movement in the nominal effective exchange rate is in fact linked to the yen-dollar rate.

This is because the majority of Japan's trading partners other than the United States adopt foreign exchange policies linking their own currencies to the U.S. dollar.

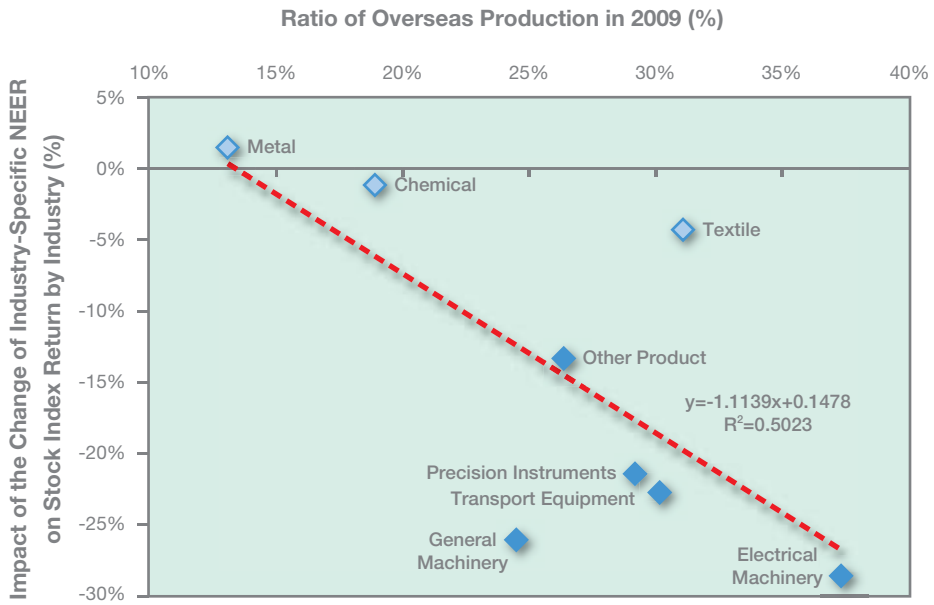
An Empirical Analysis Using Industry-specific Effective Exchange Rates: Relation of share prices to exchange rates

— Is there a difference among industries in the relation of share prices to exchange rates?

SHIMIZU: It is generally said that as the yen rises against the U.S. dollar, the Nikkei stock average drops. To see how this relationship looks in different industries, we conducted a simple regression analysis using the industry-specific stock price indexes of the Tokyo Stock Exchange and the RIETI industry-specific nominal effective exchange rates. The results showed that with the exception of a few industries, there is a negative correlation whereby when the industry-specific effective exchange rates appreciate, the industry-specific stock price indexes react by dropping; moreover, the extent of this reaction is different for each industry. This negative correlation has become greater ever since the Lehman Brothers collapse in 2008.

We then analyzed why the strength of this negative correlation between stock prices and exchange rates would differ across industries. The yen rate is thought to influence stock prices along the following two routes. The first is that in the case of dollar-denominated exports, when the yen rises, the revenue received in terms of the yen declines. The second route is the profit remittance of overseas subsidiaries. The number of companies setting up production overseas in recent years has increased. When these overseas subsidiaries of Japanese companies send back to Japan the profits they earned abroad, these are affected by the exchange rate of the yen. In particular, in recent years, the income surplus has come to make up a larger portion of Japan's current balance than the trade surplus. The greater the extent to which a company has moved its production overseas, the greater should be the negative effects of a strong yen on its profit remittance. If we plot the ratio of overseas production for each industry and the extent of impact of a strong yen on stock prices (exchange rate sensitivity of industry-specific stock price indexes) as in Figure 2, we see that the higher an industry's overseas production ratio, the greater is the negative impact of a

Figure 2: Relation between exchange rate sensitivity of industry-specific stock prices and overseas production ratio



Note 1: As measures of the impact of the change of industry-specific nominal effective exchange rates on stock index return for each industry, we used coefficients obtained by regression analysis of return exceeding the monthly TOPIX industry-specific stock price index from October 2008 to October 2011, with the rate of change of industry-specific nominal effective exchange rates as explanatory variable. The coefficients with blue markers are significant while those with light blue markers are not significant.

Note 2: Overseas production ratios are from a survey on corporate trends (fiscal 2010) by the Cabinet Office of the Japanese government.

strong yen on its stock price.

Ever since the Plaza Accord, Japanese companies have actively proceeded with overseas production as a way of coping with a strong yen. As a result, the ratio of overseas production has grown, but this relationship shows how the earnings of overseas subsidiaries are also subject to foreign exchange risks.

Further Expanding the Industry-specific Real Effective Exchange Rates Data

—What are your research themes for the future?

SATO: In this project, we put together industry-specific real effective exchange rates for Japan. Using the same methodology, we would like to compile industry-specific real effective exchange rates for Asian countries, the United States, and European countries. We have already begun to work on compiling such rates for China and South Korea. As our next task, we want to compare the industry-specific real effective exchange rates for Japan, China, and South Korea and summarize the results of the analysis in an academic paper.

China, for example, has posted large trade surpluses with the United States, causing serious trade friction between the two countries. The exchange rate of the renminbi versus the U.S. dollar is frequently cited as a problem, with the United States strongly urging China to let the renminbi appreciate against the U.S. dollar. By calculating the industry-specific real effective exchange rate of the renminbi and publishing this rate for the electrical machinery industry, which is China's biggest export industry, we will make it possible to verify the international price-competitiveness of China in that industry. This should be valuable data in considering the trade relationship between the United States and China.

In South Korea, meanwhile, the nominal exchange rate of the won has depreciated sharply ever since the Lehman Brothers collapse in September 2008. A large depreciation of the won has given Korean companies a price advantage against which Japanese companies cannot compete. Calculating the industry-specific real effective exchange rates should enable us to investigate the price-competitiveness of Korean companies.

After completing these studies for Japan, China, and South Korea, we plan to go on to calculate the industry-specific real effective exchange rates for other countries in Asia, the United States, and European countries. It is hoped that the data on industry-specific nominal and real effective exchange rates will be utilized as a analytical tool of other researchers, not only in Japan but also overseas, contributing broadly to management strategy and policy making.