Why Hasn't the Yen's Depreciation Improved Japan's Trade Deficit?

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Introduction

There was a strong expectation that the rapid depreciation of the yen since the end of 2012 would improve Japan's trade balance. A weaker yen increases import prices and causes the trade deficit to rise in the short run. Over time, however, it was expected that Japan's trade balance would improve in line with the J-curve effect as the weaker yen translates into lower and hence more competitive export prices of Japanese products, which in turn would lead to a rise in the volume of exports. In reality, Japan's trade balance has worsened rather than improved. This indicates that the exchange rate is not the true cause of trade deficits, giving rise to concerns that Japanese products may be losing their competitive appeal in the global market.

In response to such observations, this story makes the following three arguments. First, the sharp appreciation of the yen following the collapse of Lehman Brothers prompted many Japanese companies to enhance cross-border division of labor by expanding their production networks in other Asian countries. The result is a structure where much of the export-boosting effect of a weaker yen is negated because an increase in Japan's exports of industrial products is accompanied inevitably by an increase in imports of parts and components produced by Japanese overseas subsidiaries. Second, we have to check whether Japanese export prices have declined during the yen depreciation period. Due to the export price index data published by the Bank of Japan (BOJ), we confirm that Japanese manufacturing export prices in terms of the contract currency have not changed in response to the large depreciation of the yen. Third, trends in industry-specific real effective exchange rates show that the yen's depreciation since the end of 2012 has improved Japanese manufacturing companies' export price competitiveness significantly. This is also supported by the fact that Japanese transport equipment manufacturers reported strong earnings results in 2014, achieving robust growth in sales.

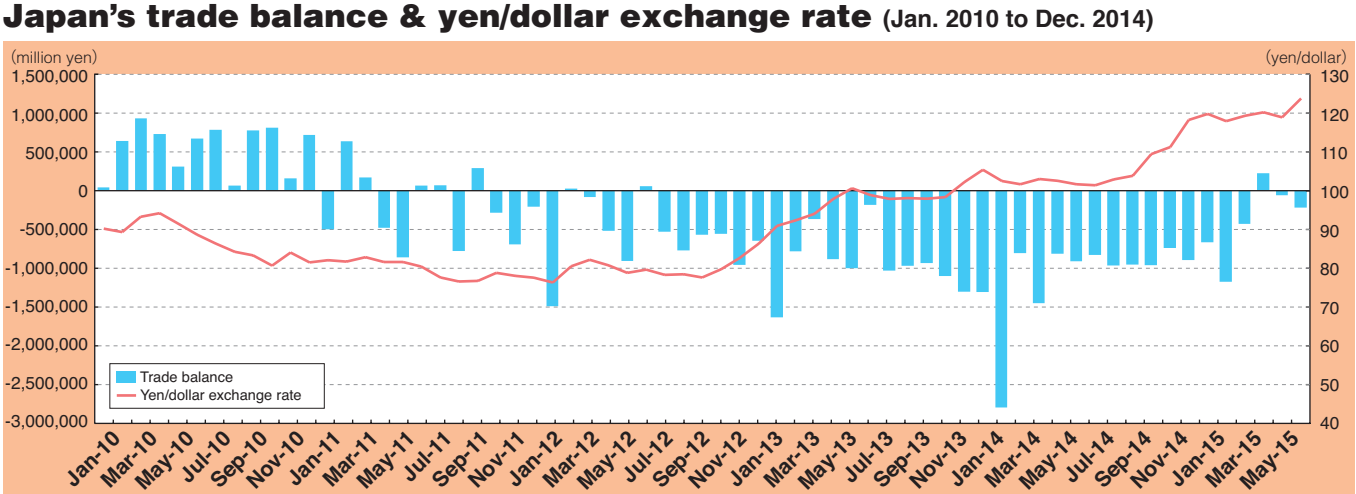
The above findings suggest that the slow recovery of the Japanese trade balance in response to the yen's depreciation can be explained not only by world economic stagnation after the global financial crisis, but also by Japanese firms drastic change in their production and export structure and Japanese firms' pricing behavior.

The Main Factors in Japan's Trade Deficit

A trade deficit has become almost the norm in Japan since the Great East Japan Earthquake of March 2011. *Chart 1* shows the monthly series of Japan's trade balance and the nominal exchange rate of the yen *vis-à-vis* the US dollar from January 2010 to December 2014. The yen kept appreciating in 2010 and stayed at around 80 or less from mid-2011 to the end of 2012. On Oct. 31, 2011, the yen hit a postwar high of 75.32. Such a high value of the yen is likely to have a negative impact on Japanese exports. *Table 1* shows that, in response to the yen's appreciation, the amount of Japanese exports declined from 2010 to 2012 in all industries except

CHART 1

Japan's trade balance & yen/dollar exchange rate (Jan. 2010 to Dec. 2014)



Source: Trade Statistics of Japan (Ministry of Finance) and Bank of Japan

TABLE 1

Annual change in value of imports & exports by industry

(million yen, benchmark year 2010)

	Total	Foodstuffs	Raw materials	Mineral-related fuels	Chemicals	Manufactured goods	General machinery	Electrical machinery	Transport equipment	Others	Yen/dollar exchange rate
Import value											
2010	60,764,957	5,199,420	4,765,880	17,397,958	5,379,439	5,378,596	4,825,708	8,101,043	1,681,355	8,035,557	87.77
	–	–	–	–	–	–	–	–	–	–	–
2011	68,111,187	5,854,222	5,270,347	21,816,150	6,097,638	6,069,200	4,969,742	7,988,833	1,737,577	8,307,478	79.78
	12.1%	12.6%	10.6%	25.4%	13.4%	12.8%	3.0%	▲1.4%	▲3.3%	3.4%	▲9.1%
2012	70,688,632	5,852,259	4,768,020	24,088,214	5,926,316	5,507,608	5,003,891	8,437,814	2,311,815	8,792,696	79.79
	16.3%	12.6%	0.0%	38.5%	10.2%	2.4%	3.7%	▲4.2%	▲7.5%	9.4%	▲9.1%
2013	81,242,545	6,473,095	5,357,616	27,443,830	6,464,172	6,245,453	5,968,882	10,309,320	2,788,248	10,191,929	97.60
	33.7%	24.5%	12.4%	57.7%	20.2%	16.1%	23.7%	27.3%	65.8%	26.8%	▲1.2%
2014	85,889,269	6,727,723	5,600,602	27,688,148	6,863,787	6,990,114	6,752,859	11,529,051	3,052,947	10,684,038	105.84
	41.3%	29.4%	17.5%	59.1%	27.6%	30.0%	39.9%	42.3%	81.6%	33.0%	20.6%
Export value											
2010	67,399,627	406,115	946,147	1,104,977	6,925,266	8,784,805	13,316,635	12,650,452	15,258,136	8,007,092	87.77
	–	–	–	–	–	–	–	–	–	–	–
2011	65,546,475	359,056	971,582	1,247,066	6,798,023	8,786,146	13,803,298	11,600,075	14,033,416	7,947,812	79.78
	▲2.7%	▲11.6%	2.7%	12.9%	▲1.8%	0.0%	3.7%	▲8.3%	▲8.0%	▲0.7%	▲9.1%
2012	63,747,572	355,401	1,059,693	1,025,554	6,364,577	8,442,119	12,842,848	11,405,137	14,994,564	7,257,679	79.79
	▲5.4%	▲12.5%	12.0%	▲7.2%	▲8.1%	▲3.9%	▲3.6%	▲9.8%	▲1.7%	▲9.4%	▲9.1%
2013	69,774,193	435,773	1,206,274	1,532,920	7,507,353	9,176,840	13,359,015	12,051,642	16,332,053	8,172,322	97.60
	3.5%	7.3%	27.5%	38.7%	8.4%	4.5%	0.3%	▲4.7%	7.0%	2.1%	11.2%
2014	73,101,850	481,548	1,194,675	1,521,403	7,820,193	9,464,175	14,218,468	12,649,949	16,907,341	8,844,098	105.84
	8.5%	18.6%	26.3%	37.7%	12.9%	7.7%	6.8%	▲0.0%	10.8%	10.5%	20.6%

Authors' calculation.
Notes: The annual changes from the benchmark year's (2010) value are in parenthesis. The yen/dollar exchange rate is the average of the period.
Source: Trade Statistics (Ministry of Finance). The yen/dollar exchange rates are from the Bank of Japan

raw materials.

Another important factor in the growing trade deficit from 2010 to 2012 is a sharp increase in imports of oil and mineral fuels. According to *Table 1*, Japanese imports of mineral-related fuels grew remarkably. The amount of imports rose by 38.5% from 2010 to 2012, due to a sharp increase in imports of liquefied natural gas (LNG) for generating thermal power prompted by the suspension of nuclear power plants.

From the end of 2012, the yen started to depreciate substantially. In terms of the annual average exchange rate, the yen depreciated from 79.79 in 2012 to 105.84 in 2014. Despite such a large depreciation by 32.6%, Japan's trade deficit increased further in 2013 and stayed at a high level in 2014. According to the J-curve effect, a trade balance tends to deteriorate at the beginning of depreciation of the domestic currency, and will then be improving over time. The question is why such gradual improvement in the trade balance cannot be observed in 2014.

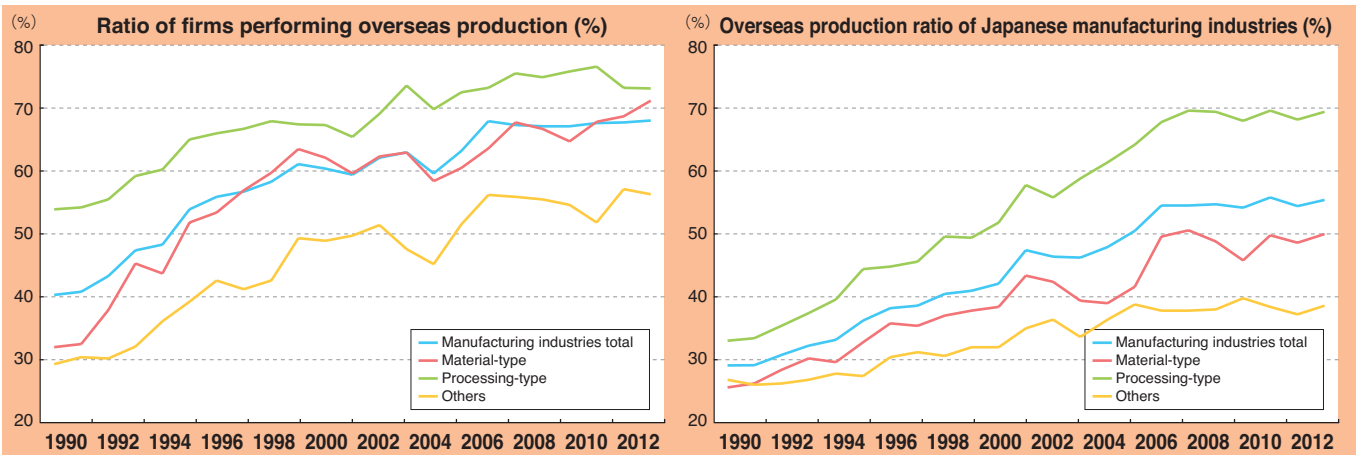
The first possible reason is the effect of the invoice currency. *Table 1* shows that Japanese imports increased in 2013 and further in 2014 in all industries. Since about 79% of imports are invoiced in foreign currencies (mostly in US dollars), the yen's depreciation automatically increases the amount of imports in yen. However, imports of mineral-related fuels increased only slightly in 2014, even though the yen depreciated further from 97.6 in 2013 to 105.84 in 2014. Such a slowdown can be attributed to a sharp and large fall in world oil prices in the latter half of 2014, which may help the trade balance to improve in 2015 and after.

A second possible reason is Japanese firms' strategic change in production locations during the yen-appreciation period. As shown in *Chart 2*, Japanese firms have increased overseas production for the last two decades, which reflects an active division of labor in growing regional production networks, especially in Asia. The historically high level of the yen in 2011-2012 drove Japanese firms to take the division of labor one step further by moving domestic production of low-end goods to overseas subsidiaries to the limit. Instead, Japanese firms concentrated their domestic production on high-end products. Given severe competition in global markets, it is hard to keep exporting domestically produced goods during a period of unprecedented yen appreciation unless the goods are highly differentiated.

Even after the yen started to depreciate at the end of 2012, the quantity of Japanese exports has not shown any clear increase. *Table 2* presents export and import quantities of selected products. Electronics parts and components including integrated circuits (ICs)

CHART 2

Overseas production of Japanese manufacturing firms



Source: FY2012 Annual Survey of Corporate Behavior (Cabinet Office)

TABLE 2

Change in quantity of Japanese exports & imports: selected products (benchmark year = 2010)

Export volume	Power generation machinery	Computer parts	Visual apparatus	Video Recording/ Reproducing apparatus	Parts of audio apparatus	Cars	Motorcycles, autocycles
2011	-0.9%	-5.7%	-16.1%	-18.4%	-16.4%	-7.2%	1.7%
2012	-3.2%	-13.1%	-34.3%	-37.0%	-53.1%	0.6%	-1.0%
2013	-7.7%	-13.9%	-51.8%	-60.5%	-58.7%	-0.6%	-2.8%
2014	-8.1%	-16.1%	-62.3%	-72.8%	-75.9%	-2.9%	4.7%
Import volume	**Crude oil**	**LNG**	**Power generation machinery**	**Computer parts**	**Semiconductors ETC (IC)**	**Motorvehicles**	**Parts of motorvehicles**
2011	-2.7%	12.2%	15.6%	-9.7%	-2.9%	18.5%	5.3%
2012	-0.7%	24.7%	23.3%	-11.2%	1.4%	43.2%	28.0%
2013	-1.3%	25.0%	12.1%	-14.3%	-1.8%	48.0%	34.9%
2014	-6.7%	26.4%	28.9%	-14.1%	12.3%	45.0%	51.0%

Notes: Figures in the first row are the share of the product in total amount of imports. Table shows the percentage change from the benchmark year (2010).
Source: Trade Statistics of Japan (Ministry of Finance)

exhibit a large decline in export quantity. The quantity of audiovisual products exported also fell sharply. In contrast, the export quantity of motor vehicles and parts has not declined much compared to electronic products. This evidence supports the above argument that Japanese firms export high-end products and produce low-end products in other countries. On the other hand, the quantity of Japanese imports of manufacturing products such as automobile parts and ICs increased after the yen's depreciation, which is further supportive evidence that Japanese firms enhanced the division of labor much further with their overseas subsidiaries by importing parts and components as well as low-end products from them.

The above findings suggest that Japanese firms drastically changed their production and export structure to overcome the negative effects of the yen's appreciation in 2010-2012. In the face of recent yen depreciation, Japanese exporters do not have to lower their export prices, because their export products are differentiated and, hence, have strong competitiveness. Given the large share of foreign currency invoicing, Japanese exporters now enjoy exchange gains from yen depreciation. The low-end products are less differentiated and tend to be highly price elastic, but these products are produced by overseas subsidiaries and not exported from Japan. These factors are likely to impede the improvement of Japan's trade balance despite the weak yen.

Empirical Analysis of J-Curve Effect

There are numerous empirical studies on the J-curve effect. As a representative study on the trade between the United States and its trading partner countries including Japan, Andrew Rose and Janet Yellen ("Is There a J-curve?", *Journal of Monetary Economics*, 24, 1989) used the quarterly data for the period from 1960 to 1985, but they could not find either a short-term or long-term relationship between bilateral real exchange rates and trade flows. Mohsen Bahmani-Oskooee and Taggert Brooks ("Bilateral J-Curve Between U.S. and Her Trading Partners" *Weltwirtschaftliches Archiv*, 135, 1999), on the other hand, employed the auto-regressive distributed lag (ARDL) model that incorporates both a co-integration relationship and error-correction model (ECM) between the US and its trading partners. They found that the long-term effect of the real depreciation of the US dollar improved the US trade balance, while the short-term effect did not follow the J-curve pattern.

We conducted an empirical analysis to confirm the effect of the real effective exchange rate (REER) on the Japanese trade balance by using ECM over the sample period from January 1985 to June 2014, including the recent yen-depreciation period due to "Abenomics". We divided the whole sample into two sub-samples: the former includes the period from January 1985 to December 1998 when the J-curve effects were empirically confirmed, and the latter ranges from January 1999 to June 2014. As shown in *Chart 2*, the overseas

production ratio of Japanese manufacturing companies exceeded 10% at the end of 1998. In addition, the revised Foreign Exchange Law was enforced in April 1998 to totally liberalize cross-border transactions, which results in a drastic change in Japanese firms' exchange rate risk management. As we have to have a sufficient number of observations in each sub-sample, it is reasonable to assume that the latter sub-sample starts from January 1999.

Following Rose and Yellen and other previous studies, we employed the following log-linear equation model to consider a long-term relationship between trade balance and REER:

$$\ln TBJapan,t = a + b\cdot\ln YJapan,t + c\cdot\ln YWorld,t + d\cdot\ln REERJapan,t + \varepsilon t \quad (1)$$

where $TB_{Japan,t}$ is a measure of Japan's trade balance, $Y_{Japan,t}$ is a measure of Japan's real income, $Y_{World,t}$ is a measure of the other countries' real income, and $REER_{Japan,t}$ is the real effective exchange rate of the yen. As a measure of the trade balance, we adopted the ratio of Japan's real exports to the world over its real imports from the world, as did Rose and Yellen.

Since we used the monthly series of data for empirical analysis, we employed the industrial production index (IPI) as a proxy for Japan's real income. Japan's IPI series is taken from the website of the Ministry of Economy, Trade and Industry (METI). As for a measure of the world real output fluctuations, we calculated the World IPI, i.e., the weighted average of IPI of Japan's 20 main trading partner countries. Based on the definition of the above variables, we expected the sign of estimated coefficients as b<0, c>0 and d<0. In addition, we included two dummy variables in the latter period. One is the dummy variable (Lehman dummy) for the period of the Lehman Brothers collapse when Japanese exports declined drastically. The other is the dummy variable of the Great East Japan Earthquake (*Shinsai* dummy) that reflects the prolonged negative effect of the earthquake in March 2011 on Japan's trade deficit.

By adopting the above long-term relationship in ECM, we confirm the following long-term equilibrium relationship between trade balance and other variables (figures in parentheses are standard errors).

January 1985 to December 1998:

$$\ln TBJapan,t = \underset{(0.269)}{4.600} - \underset{(0.067)}{0.989}\cdot\ln YJapan,t + \underset{(0.064)}{0.178}\cdot\ln YWorld,t - \underset{(0.034)}{0.242}\cdot\ln REERJapan,t + \varepsilon t$$

January 1999 to June 2014:

$$\ln TBJapan,t = \underset{(0.502)}{-6.154} + \underset{(0.062)}{-0.299}\cdot\ln YJapan,t + \underset{(0.056)}{1.083}\cdot\ln YWorld,t - \underset{(0.040)}{0.047}\cdot\ln REERJapan,t$$
$$\underset{(0.017)}{-6.154}\cdot Dshinsai - \underset{(0.023)}{0.005}\cdot DLehman + \varepsilon t$$

All coefficients in the latter period except for that of Japan's IPI show the correct sign, but the coefficient of REER is not statistically significant. In addition, the results of ECM estimation indicate that the coefficients of the contemporaneous and 11th lagged REER in first-differences are positive and significant in the former period. It is clear that there is evidence of the J-curve phenomenon only in the former period. On the other hand, the estimated coefficient of World IPI is 1.083 and statistically significant in the latter period, which is larger than the corresponding coefficient (0.178) in the former period. This result indicates that Japan's trade balance has been largely affected by world business cycles in recent years. Thus, our empirical examination revealed that Japan's trade balance has become more affected by world business cycles in recent years and far less influenced by changes in REER than before.

Do Japanese Export Prices Decline in Response to Yen Depreciation?

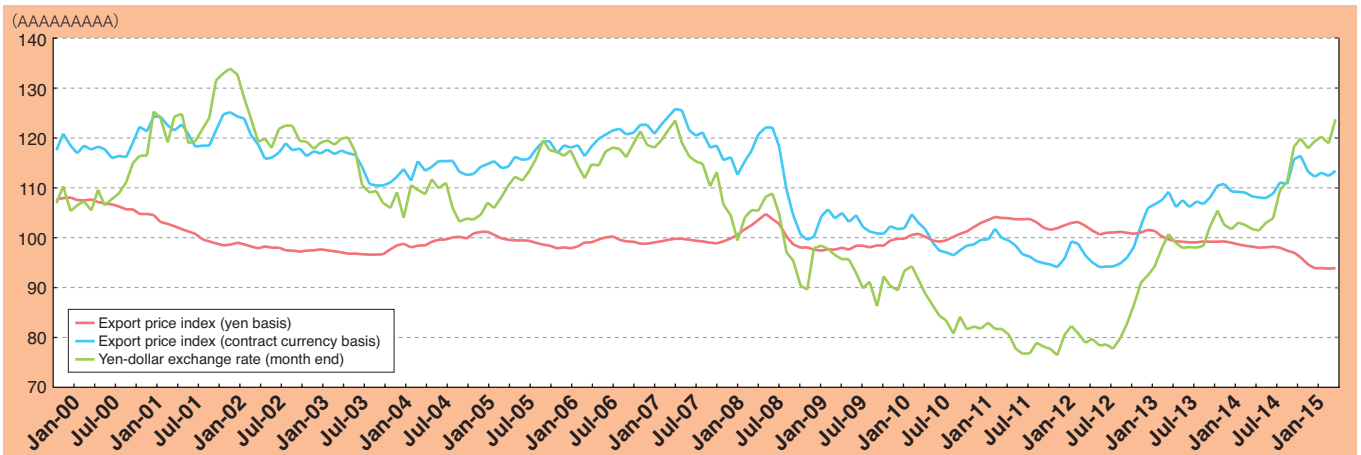
According to the J-curve effect, Japanese export prices in terms of the destination currency are expected to decline in response to the yen's depreciation, which gradually increases the export volume and finally results in the improvement of the Japanese trade balance. The following export demand function is typically assumed: $X = X(P^*, Y^*) = X(P/S, Y^*)$, where X denotes export quantity, P denotes export price, S denotes the nominal exchange rate, Y denotes real output, and an asterisk denotes foreign variables. Suppose that the Japanese export price in yen (P) does not change. As long as the export is invoiced in yen, the export price in foreign currencies (P^*) will decline in response to the yen's depreciation (i.e., an increase in S). The question is whether Japanese export prices have declined during the yen-depreciation period.

The BOJ publishes a monthly series of industry/commodity breakdown data on export price indices both on a *yen* basis and on a *contract currency* basis. As long as traded in foreign currencies, the sample prices are recorded on the original contract currency basis, and finally compiled as the "export price index on a contract currency basis". To compile the "export price index on a yen basis", the sample prices in the contract currency are converted into yen equivalents using the monthly average exchange rate of the yen *vis-à-vis* the contract currency.

Chart 3 shows the movement of the nominal exchange rate of the yen *vis-à-vis* the US dollar and the Japanese export price index (all industries). First, while the level of the exchange rate has fluctuated to a large extent since 2000, export prices on the contract currency basis appeared to be relatively stable at the level of 100 until the middle of 2014, which suggests that Japanese exporters tend to stabilize export prices in terms of the destination currency and, hence, to conduct a pricing-to-market (PTM) strategy. Second, during the yen-depreciation period starting from the end of 2012, the export price index on the contract currency basis stayed around 100 until the middle of 2014, and then started to decline to 93.7 in April 2015. Thus, the magnitude of export price changes on the contract currency basis is still far smaller than that of the yen's depreciation. It indicates that Japanese exporting firms did not respond to the yen's depreciation in 2013 and the first half of 2014. To make a further investigation of such price movements, let us observe the possible differences in export price movements across industries.

CHART 3

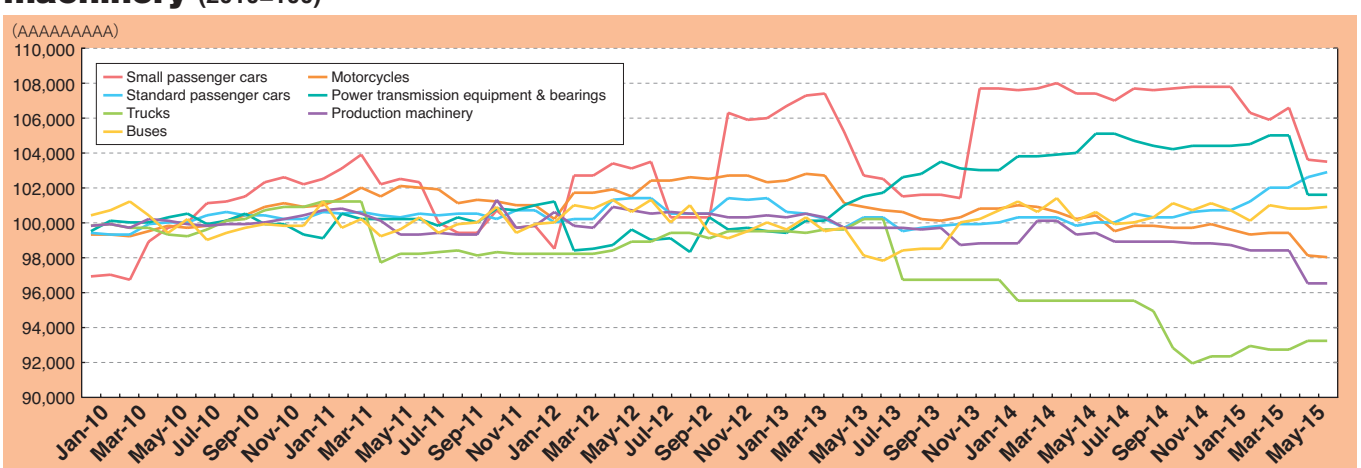
Yen/dollar exchange rate & export price index of Japan



Notes: Export price index is calculated as 2010=100.
Source: Bank of Japan

CHART 4

Export price index (contract currency basis) of transport equipment & general machinery (2010=100)



Source: Bank of Japan

Chart 4 presents the export price indices of Japanese competitive major machinery industries: transport equipment and general machinery (data are available from January 2010). Among five types of transport equipment, the export price movements are different. Small passenger cars were most volatile and showed large upward movements even in the yen's depreciation period, while motorcycles showed a clear downtrend. Standard passenger cars were stable at around 99 in 2014 and then declined to 98 in April 2015. Other types of transport equipment, except for trucks and motorcycles, showed export price declines in April 2015, too. Compared with transport equipment, the export price movements of general machinery were very stable. Power transmission equipment & bearings showed price declines in April 2015, while production machinery have not shown any downtrend in their export prices yet.

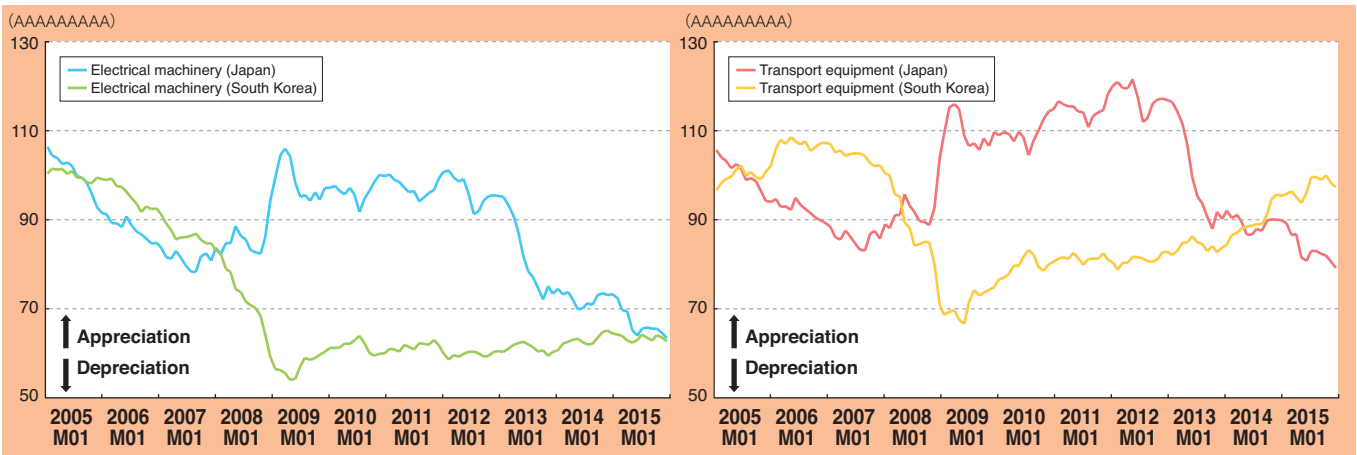
Japanese Export Competitiveness & Industry-Specific REER

How do we describe the change of a country's export competitiveness? It is well known that the REER, not bilateral nominal exchange rates, is a better measurement in considering export firms' competitiveness in the global market. In considering the empirical importance of the exchange rate on an exporter's price competitiveness and producer profits in specific industries, the Research Institute of Economy, Trade, and Industry (RIETI) publishes a new data set of the industry-specific REER for Japan, China and South Korea.

Chart 5 is a comparison of the trends in the REER of the Japanese yen and the South Korean won for the electric machinery and transport equipment industries. Each industry-specific REER is the index based on 2005 equal to 100 and an increase (decline) means appreciation

CHART 5

Industrial-specific REER of Japan & South Korea (electrical machinery & transport equipment)



Notes: Monthly series (2005=100) from January 2001 to December 2013. By definition, an increase (decline) means appreciation (depreciation) of the I-REER.
Source: RIETI website(http://www.rieti.go.jp/users/eeri/index.html)

(depreciation) of the REER, in other words the loss or gain of export competitiveness. Both the electrical machinery and transport equipment REER in Japan rose sharply after the collapse of Lehman Brothers in 2008 due to the sudden appreciation of the yen, while those in South Korea fell due to the depreciation of the won. During the strong-yen period at around 80 yen per dollar which continued until the end of 2012, the electrical machinery and transport equipment REER in Japan stayed around the same level, which means that these industries struggled to bring their costs down in order to compete in the overseas market. In the same period, on the other hand, South Korean electrical machinery and transport equipment companies enjoyed strong export competitiveness.

As the yen started to depreciate from late 2012, the graphs indicate that both Japanese electrical machinery and transport equipment industries have rapidly recovered their export price competitiveness compared with their South Korean counterparts. Thus, we can confirm that the rapid depreciation of the yen since the onset of Abenomics has enabled Japanese companies to narrow the gap with their South Korean rivals significantly in terms of export price competitiveness. This is also supported by the fact that Japanese transport equipment manufacturers reported strong earnings results in 2013 and 2014, achieving robust growth in sales.

Conclusion

Against the backdrop of the recent increase in the Japanese trade deficit under the depreciation of the yen since the end of 2012, we confirmed that the export-boosting effect of yen depreciation is structurally mitigated. We can expect a gradual export price decline in 2015 and so it will take some more time to see an increase in Japanese export quantity.

What are the policy implications of the above observations? First, an increase in imports of mineral fuels due to the shutdown of nuclear power plants following 3.11 was a major factor contributing to Japan's trade deficit. The oil price started to fall substantially from mid-2014, which has significantly improved Japan's trade balance. However, given that crude oil and mineral fuels tend to be invoiced in US dollars, yen depreciation will automatically increase the amount of imports in terms of yen. To avoid the negative impact of possible oil price rebounds, it is imperative for Japan to reconsider its long-term energy policy.

Second, in order to offset a decrease in exports resulting from offshoring manufacturing by increasing the income surplus, it is necessary to maintain the flows of overseas earnings repatriated to Japan. A rise in the share of overseas sales has been prompting the offshoring of research and development (R&D) activities that have been typically conducted at the headquarters in Japan. In order to prevent a decline in the income surplus, the government needs to implement necessary measures to encourage companies to undertake R&D activities in Japan and to remove tax impediments to the repatriation of overseas earnings, namely, by expanding the scope of application of tax exemption for foreign income.

Finally, the yen-depreciation policy has been effective in the sense that Japanese exporting firms have enjoyed large foreign exchange gains, but Japanese importers cannot have such benefits from the yen's depreciation. The Japanese government should utilize this opportunity to implement its growth strategy, the third arrow of Abenomics, as quickly as possible so as to foster export competitiveness across a broader spectrum of industrial sectors. **JS**

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