

(Box 1) Impact of Exchange Rate Movements on Japan's Real Economy

This box presents an empirical analysis of the impact of movements in foreign exchange rates on Japan's economy based on objective data, taking recent changes in economic structure into account.

There are a wide range of channels through which movements in foreign exchange rates can affect the economy. The following considers a depreciation of the yen; the impact would be the opposite in the case of the yen's appreciation. Specifically, a depreciation would (1) increase the volume of goods exports through improved price competitiveness of Japanese exporting firms, (2) increase domestic corporate profits through a rise in the goods export value in yen terms, (3) increase services exports (inbound tourism consumption by foreign visitors to Japan), (4) increase net income receipts from abroad converted into yen (improving the income balance within the balance of payments), and (5) decrease domestic corporate profits or consumer purchasing power due to a rise in import costs. Among these channels, there is a trade-off between (1) and (2) in the short run, depending on whether firms change the price in yen terms or the volume of their exports. Moreover, from a long-term perspective, if firms proceed with shifting their production sites to overseas, the impact through channels (1) and (2) will shrink, while the impact through channel (4) will increase. Thus, the channels through which exchange rate movements affect the real economy can change as a result of changes in corporate strategy and

economic structure.

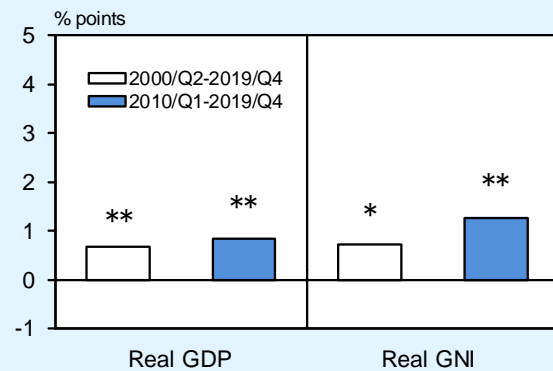
Given these considerations, changes in macroeconomic variables in response to a 10 percent yen depreciation shock on real effective exchange rates are examined using a vector auto-regression (VAR) model.²¹ In order to take into account that the economic structure may have changed in recent years, the estimation results for (1) the two decades before the COVID-19 pandemic (2000-2019) and (2) the decade before the pandemic (2010-2019) are compared.

Starting with the most fundamental result, the estimates show that the impact of the yen's depreciation on real GDP is statistically significantly positive, including in recent years (Chart B1-1[1]).

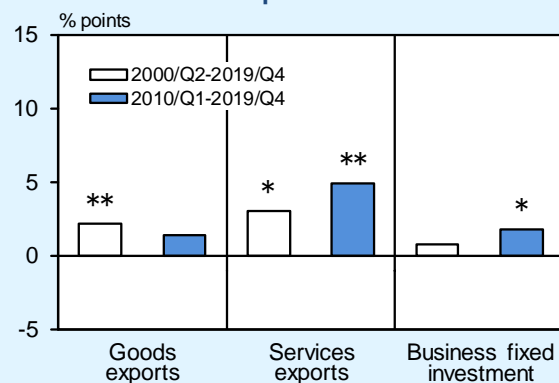
Next, the main channels through which the yen's depreciation affects Japan's economic activity and prices have changed in recent years. First, the positive impact of the yen's depreciation on the volume of goods exports has been smaller in recent years (Chart B1-1[2]).²² This is attributed to the fact that the link between export prices in

Chart B1-1: Response to a 10% Yen Depreciation Shock

1. Real GDP and Real GNI



2. Real GDP Components



Sources: BIS; Cabinet Office; CPB Netherlands Bureau for Economic Policy Analysis; IMF, etc.

- Notes: 1. The VAR models (three-period lag) are estimated using the real effective exchange rate (quarterly log difference) and each of the macroeconomic variables shown on the horizontal axis (quarterly log difference) as endogenous variables. Shocks are identified by Cholesky decomposition, where variables are ordered as above. World real GDP (q/q % change) is used as an exogenous variable. The bars represent the cumulative responses after four quarters following a 10% yen depreciation shock.
2. For the estimation of the impact on real goods exports and real business fixed investment, the world trade volume (quarterly log difference) instead of world real GDP is used as an exogenous variable in the models.
3. For the estimation of the impact on real goods exports, dummy variables for the Great East Japan Earthquake are included for 2011/Q2-Q3 in the model. For the estimation of the impact on real services exports, a Great East Japan Earthquake dummy variable for 2011/Q2 as well as a dummy variable for the rebasing of the Balance of Payments Related Statistics for 2014/Q1 are included in the model.
4. ** and * in the figures denote statistical significance at the 5 and 10 percent levels, respectively (obtained using the bootstrap method).

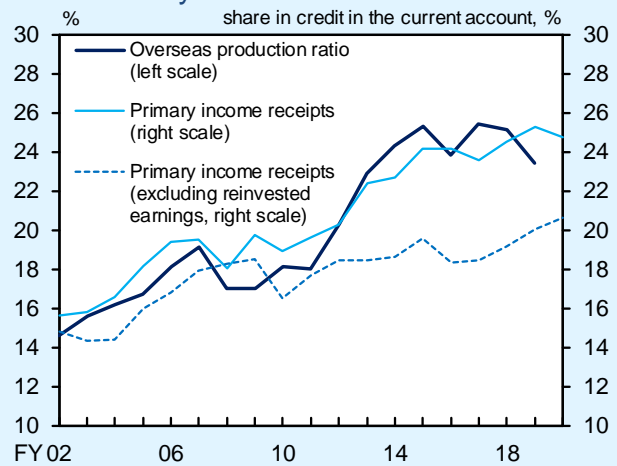
²¹ The VAR model is used to estimate cumulative responses after 4 quarters following a 10 percent yen depreciation shock on the quarter-on-quarter rate of change in foreign exchange rates. Note that the results are almost the same when estimating cumulative responses after 8 or 12 quarters following the shock.

²² The decline in the positive impact of the yen's depreciation on the goods export volume also is pointed out in the following: "Changes in the Environment Surrounding Japan's Exports: An Approach Focusing on Global Trade Volume and Export Share," *Bank of Japan Review Series*, no. 15-E-7, April 2015, and Box 2 in the April 2018 Outlook Report.

foreign currency terms, such as the U.S. dollar, and exchange rates has weakened, mainly because, (1) until the mid-2010s, major exporting firms shifted their production sites to overseas, and (2) during this process, domestic production of Japanese firms shifted to higher value-added goods (Charts B1-2 and B1-3).²³ An analysis of detailed data by item shows that, while the exchange rate elasticity of export volumes remains statistically significantly positive for many items in recent years (1,947 out of the 2,710 items analyzed), the distribution has shifted to the left -- which indicates a lower exchange rate elasticity -- compared with a decade earlier (Chart B1-4). In industries where the overseas production ratio is high and domestic production has shifted to higher value-added goods, more items are seeing a decline in the exchange rate elasticity.

Second, on the other hand, the positive impact that the yen's depreciation has on Japan's economy through improvement in the income balance within the balance of payments has been larger in recent years. Globalization of firms has led to steady increases in the amount of profits that Japanese firms earn from their overseas businesses and the amount of profits repatriated to Japan through dividends and other means (Chart B1-2). As a result, when the VAR analysis is conducted using real gross national income (real GNI, which is defined as real GDP plus trading gains and losses as well as net income from the rest of the world) rather than real GDP, it

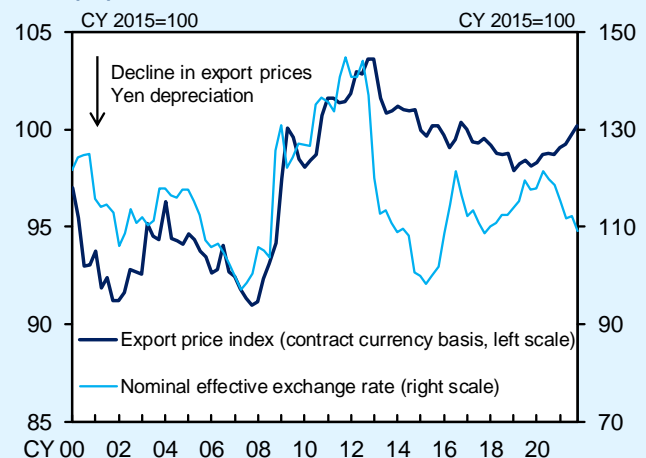
Chart B1-2: Overseas Production Ratio and Primary Income



Sources: Ministry of Economy, Trade and Industry; Ministry of Finance and Bank of Japan.

Note: The overseas production ratio is based on "all domestic companies (manufacturing industries)" from the *Basic Survey on Overseas Business Activities* and calculated as follows: Sales of overseas affiliates / (Sales of overseas affiliates + Sales of domestic companies).

Chart B1-3: Export Prices of Transportation Equipment



Sources: Bank of Japan; BIS.

Note: The figure for the nominal effective exchange rate for 2021/Q4 is the October-November average.

²³ In a case where export prices in foreign currency terms do not move together with foreign exchange rates, the yen's depreciation does not raise export volumes but instead increases export prices in yen terms. Therefore, even in this case, the yen's depreciation has a positive impact on the export value and corporate profits through improvement in export profitability.

is confirmed that the positive impact of the yen's depreciation has been larger in recent years (Chart B1-1[1]). The increase in profits, including income transfers from overseas, also seems to have pushed up domestic business fixed investment (Chart B1-1[2]).

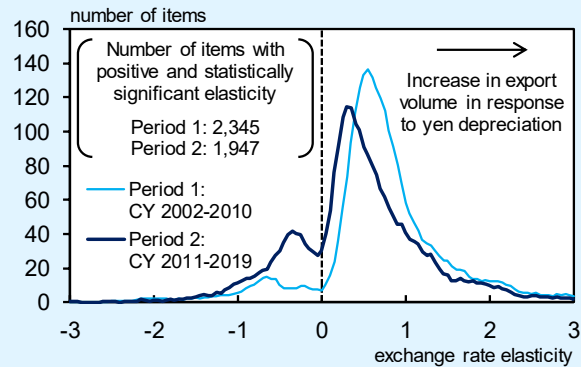
Third, in terms of changes in the impact on prices, the pass-through of the yen's depreciation to the CPI seems to have been larger in recent years, reflecting a rise in the import penetration ratio of household appliances and other products through the early 2010s (Chart B1-5).

Thus, even when taking into account economic structural changes in recent years, the yen's depreciation is likely to continue to have a positive impact on Japan's economy on the whole.²⁴ However, the following three points need to be borne in mind.

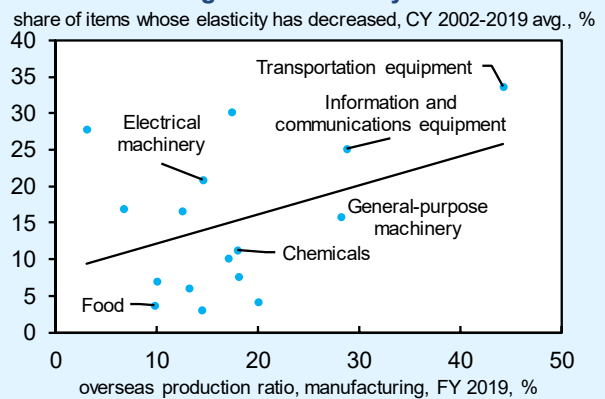
First, the majority of firms, including exporters, tend to favor exchange rate stability in order to avoid uncertainties in formulating and executing their business plans. This can be confirmed quite often in anecdotal information from a wide range of firms. Regardless of whether the yen depreciates or appreciates, if the exchange rates change rapidly at a pace that economic entities cannot keep up with, this may have an adverse impact on the economy. Therefore, not only the

Chart B1-4: Impact of Yen Depreciation on Export Volume

1. Distribution of Exchange Rate Elasticities



2. Overseas Production Ratio and Change in Exchange Rate Elasticity



Sources: Ministry of Economy, Trade and Industry; Ministry of Finance; Ministry of Internal Affairs and Communications; BIS; CPB Netherlands Bureau for Economic Policy Analysis.

Notes: 1. Exchange rate elasticity β is estimated based on the following regression for each item i :

$$\begin{aligned} \text{Export volume of item } i \text{ (s.a., m/m \% chg. of 6-month backward moving average)} \\ = \text{Constant} \\ - \beta \times \text{Real effective exchange rate (n-month lag, m/m \% chg.)} \\ + \gamma \times \text{World trade volume (s.a., m/m \% chg.)} \end{aligned}$$

Lag length n is set between 0 and 24 and chosen such that β is maximized and statistically significant at least at the 10 percent level. If no significant β is obtained, n is set to 0.

2. β is estimated for 2,710 items (classified at the 9-digit level and excluding re-exported goods) for which there are neither missing values nor changes in units during the period from 2002 through 2019.

3. The share of items whose elasticity has decreased is the share of items in each industry for which β is positive and statistically significant for Period 1 but either has decreased by one or more with the sign remaining positive or is no longer significant for Period 2.

4. The definition of the overseas production ratio is the same as in Chart B1-2.

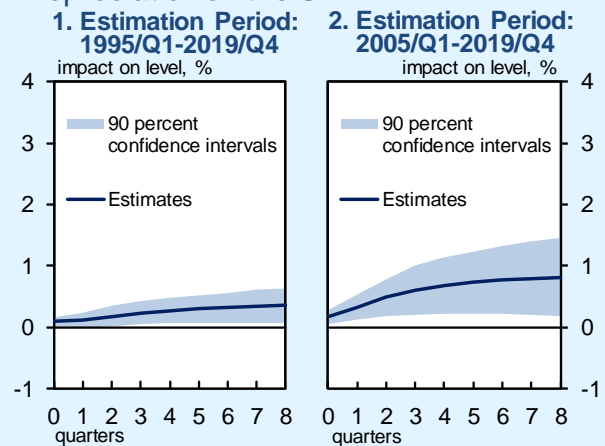
²⁴ The yen's depreciation can also push up services exports (inbound tourism consumption). While this channel currently is not operating due to entry and travel restrictions under the COVID-19 pandemic, it is expected to start operating again when these restrictions are eased as the impact of COVID-19 wanes.

level of the exchange rates but also the pace and duration of their movements should be taken into account.

Second, the direction and magnitude of the impact of exchange rate movements seem to vary depending on the industry and firm size. For example, while the yen's depreciation has a positive impact on profits of export-oriented industries, it has a negative impact on profits of domestic demand-oriented industries through increased import costs. The yen's depreciation also pushes down households' real income through rises in prices of imported goods and other items. Attention should also be paid to the increased impact on the CPI through the aforementioned rise in the import penetration ratio.

Third, and related to the second point, exchange rate movements have a different impact on sentiment, depending on how the economy, including stock prices and general prices, is affected by exchange rates. Looking at household activity-related comments in the Cabinet Office's *Economy Watchers Survey*, there are currently few comments referring to the yen's depreciation and it is not confirmed that exchange rate movements are having a major impact on sentiment (Chart B1-6). It should be noted, however, that (1) in the period from the end of 2012 through 2013, the yen's depreciation together with a rise in stock prices tended to be mentioned in comments that suggested an economic improvement, whereas (2) in the period from autumn 2014 through 2015, the yen's depreciation and a rise in general prices tended to

Chart B1-5: Impact of a 10% Yen Depreciation on the CPI



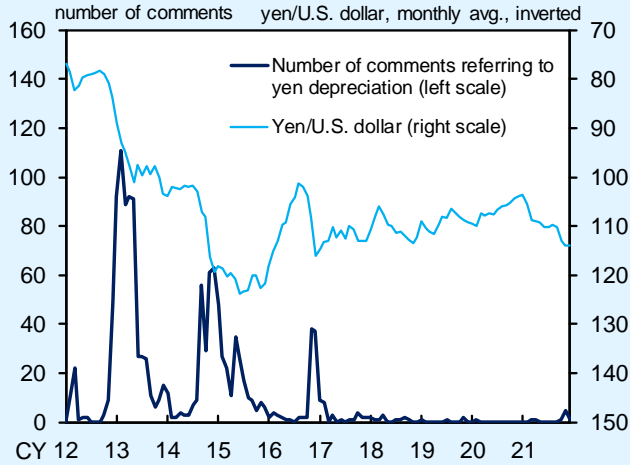
Sources: Ministry of Internal Affairs and Communications; Bank of Japan; BLS; Bloomberg.

Note: The impact of a 10% yen depreciation on the CPI (less fresh food) is estimated for each period employing a VAR model (two-period lag) and using the yen/U.S. dollar exchange rate, the output gap, and the CPI as endogenous variables. Shocks are identified by Cholesky decomposition, where variables are ordered as above. Real commodity prices (the CRB Index deflated by the U.S. CPI) are used as an exogenous variable.

be mentioned in comments that suggested an economic downturn.

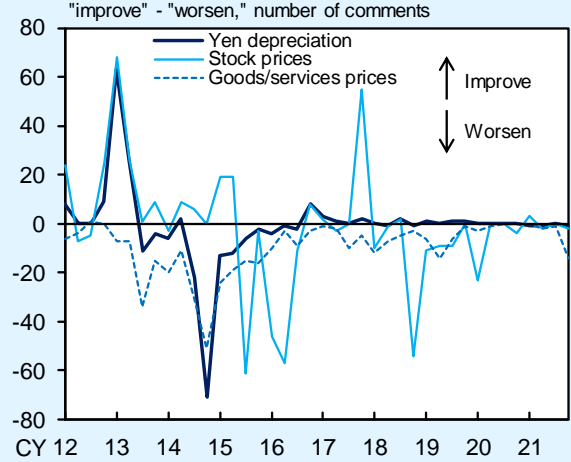
Chart B1-6: Yen Depreciation and Private Consumption-Related Business Sentiment

1. Comments about Yen Depreciation in the Economy Watchers Survey



Sources: Cabinet Office; Bloomberg.
Note: Figures for the number of comments referring to yen depreciation are based on the Economy Watchers Survey (household activity-related). In the comments, respondents provide reasons for their assessment of the economic outlook.

2. Sentiment toward Yen Depreciation



Source: Cabinet Office.
Note: Figures are based on comments in the Economy Watchers Survey (household activity-related). In the comments, respondents provide reasons for their assessment of the economic outlook. Focusing on comments referring to "yen depreciation," "stock prices," or "goods/services prices," the chart shows the difference between the number of comments indicating that respondents expect the economy to get "better" or "slightly better" in the next 2-3 months and those expecting the economy to get "worse" or "slightly worse."