Section 2 Challenges for building a resilient trade balance structure

1. Analysis of factors of the record trade deficit in 2022

Against the backdrop of resource price upsurges and the yen depreciation due to differences in the monetary policy direction between Japan and other major countries, Japan registered its largest-ever trade deficit in 2022. This subsection will analyze the factors of the record deficit. Specifically, using the export price index, the import price index, and the real import and export indexes published by the Bank of Japan, we will decompose the change in the trade balance into three factors—the change due to exchange rate fluctuations (exchange factor), the change due to price fluctuations on a contract-currency basis (contract currency-denominated price factor), and the change due to fluctuations in real imports/exports (real import/export factor), which represents nominal imports/exports excluding the effects of inflation—and identify which of them was the main factor of the trade deficit.

Figure II-2-2-1 explains the decomposition of the change in the trade balance into the exchange factor, the contract currency-denominated price factor and the real import/export factor. The relationship between those factors can be expressed by the following formula: The yen-denominated export value (import value) = the exchange rate × the contract currency-denominated export price (import price) × real exports (imports) [Formula (1)]. If both sides of the formula are converted into the logarithm form, the formula can be expressed as follows: the logarithm of the yen-denominated export value (import value) = the logarithm of the exchange rate + the logarithm of the contract currency-denominated export price (import price) + the logarithm of real exports (imports) [Formula (2)]. Furthermore, if the rate of change is expressed as a logarithmic difference, the following equation is obtained: The rate of change in the yen-denominated export value (import value) = the rate of change in the exchange rate + the rate of change in the contract currency-denominated export price (import price) + the rate of change in real exports (imports) [Formula (3)]. Here, in order to help better understand the decomposition of the trade balance, let us define the trade balance as follows: The trade balance = the export value/the import value, and in this case, the relationship between the factors can be expressed as follows: the rate of change in the trade balance = the rate of change in the yen-denominated export value – the rate of change in the yen-denominated import value [Formula (4)]. If Formula (3) is assigned to Formula (4), the following equation is obtained as an expression of the relationship between the factors of the change in the trade balance: The rate of change in the trade balance = the contract currency-denominated price factor (the rate of change in the contract currency-denominated export price – the rate of change in the contract currency-denominated import price) + the change in real import/export quantity factor (the rate of change in real exports – the rate of change in real imports).

Figure II-2-2-1. Explanations of decomposition of change in trade balance into factors

In the case where export value (import value) = export price (import price) × export quantity (import quantity), the following formulae can be derived.

Yen-denominated export value (import value) = yen-denominated export price (import price) × real exports (imports)

Yen-denominated export value (import value) = exchange rate × contract currency-denominated export price (import price) × real exports (imports) ... (1)

Concerning (1), where the logarithm of both sides is taken:

ln yen-denominated export value (import value) = ln exchange rate + ln contract currency-denominated export price (import price) + ln real exports (imports) ... (2)

Concerning (2), when the rate of change is expressed as a logarithmic difference dln, the formula is shown as follows.

dln yen-denominated export value (import value) = dln exchange rate + dln contract currency-denominated export price (import price) + dln real exports (imports) ... (3)

Rate of change in yen-denominated export value (import value) in yen = rate of change in exchange rate + rate of change in contract currency-denominated export prices (import prices) + rate of change in real exports (imports)

Defining trade balance = export value/import value, and taking the logarithm of both sides and expressing it as a logarithmic difference, the formula can be expressed as follows.

Trade balance = yen-denominated export value /yen-denominated import value

dln trade balance = dln yen-denominated export value - dln yen-denominated import value … (4)

Substituting (3) into (4), the formula can be expressed as follows.

dln trade balance = dln exchange rate + dln contract currency-denominated export price + dln real exports – dln exchange rate – dln contract currency-denominated import price – dln real imports

= dln contract currency-denominated export price – dln contract currency-denominated import price + dln real exports – dln real imports

Rate of change in trade balance = rate of change in contract currency-denominated export price – rate of change in contract currency-denominated import price + rate of change in real exports – rate of change in real imports

↑ Contract currency-denominated price factor

↑ Change in real import/export quantity factor

As described above, the change in trade balance can be decomposed into the contract currency-denominated price factor and the change in real import/export quantity factor.

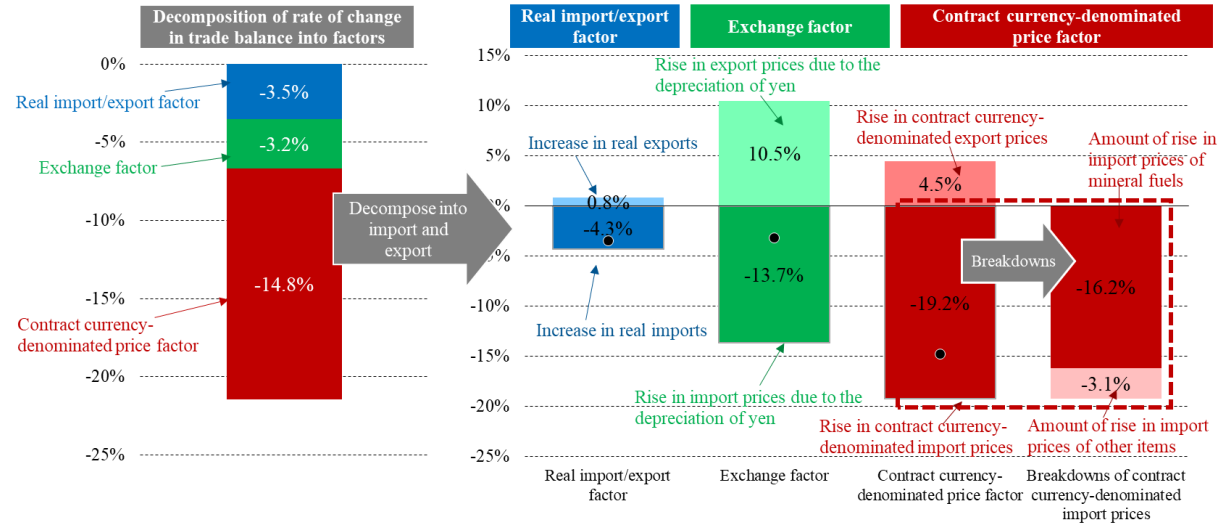
Actually, as the rate of change in the exchange rate is not offset, the exchange factors (rate of change in exchange rate = rate of change in yen-denominated export prices (import prices) – rate of change in contract currency-denominated export prices (import prices)) have an impact on the trade balance as well.

Source: METI.

Figure II-2-2-2 shows the decomposition of the rate of change in the trade balance from 2021 to 2022 under the abovementioned method. First, we can see that the real import/export factor was not the main factor because the contributions of both imports and exports are small. Next, regarding the contract currency-denominated price factor, while the contribution of export price change was limited, import price change made a significant negative contribution, and this means that the contract currency-denominated price factor is the main factor of the trade deficit. As for the exchange factor, the contribution of the exchange factor on the import price side was greater than the contribution of the

currency contract-denominated price factor on the import price side, indicating that the yen depreciation made a negative contribution to the trade balance through an increase in yen-denominated import prices. However, the contribution of the exchange factor on the export price side made a significant positive contribution to the trade balance. Therefore, in terms of the impact on the whole of the trade balance, the contribution of the contract currency-denominated price factor was greater than the contribution of the exchange factor, so it can be concluded that the contract currency-denominated price factor was the main factor of the trade deficit. Furthermore, if the change in the contract currency-denominated import price is decomposed by product item, the change in mineral fuel prices accounted for more than 80% of the overall price change. In other words, given that the contribution of the contract currency-denominated price factor accounted for around 70% of the change in the trade balance, it can be said that most of the change in the trade balance in 2022 is attributable to the rise in the contract currency-denominated import price of mineral fuels.

Figure II-2-2-2. Decomposition of rate of change in trade balance into factors in 2022

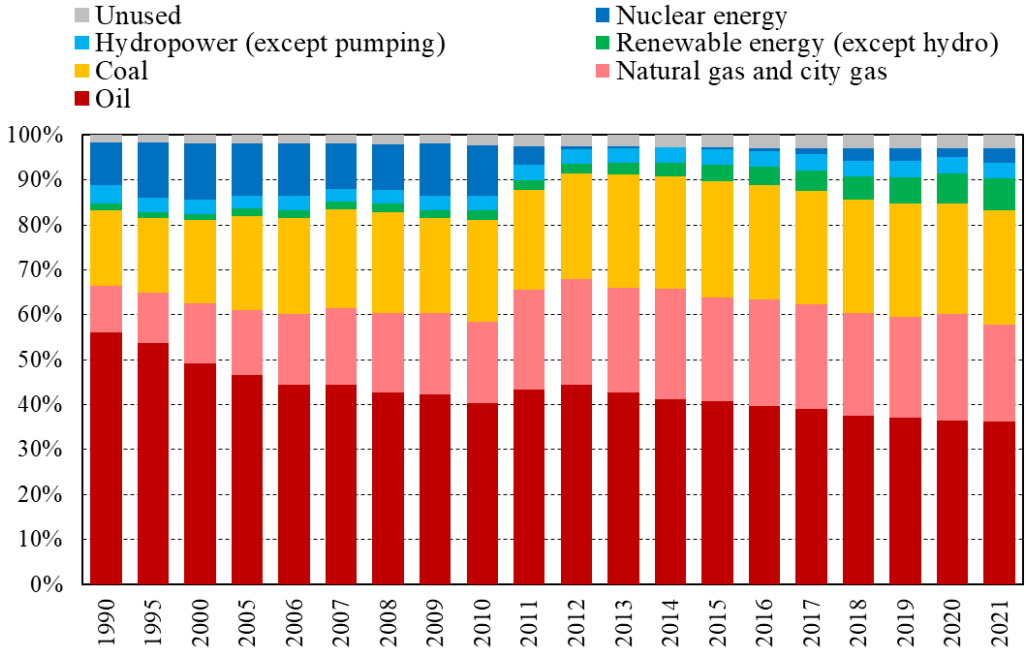


Note: Estimates based on the data as of March 2023.
Source: *Corporate Goods Price Index, Real Exports and Real Imports Index* (Bank of Japan).

The fact that the current trade balance structure is susceptible to the effects of change in import prices of mineral fuels means that the vulnerability of the trade balance structure lies in Japan's heavy dependence on imports of mineral fuels. Figure II-2-2-3 shows the composition of the primary energy supply in Japan. The share of mineral fuels has markedly increased since 2011, when the Great East Japan Earthquake occurred, indicating an increased level of dependence on mineral fuels. However, according to Figure II-2-2-4, which shows changes in the increase in imports of mineral fuels due to an increase of one unit of economic activity (GDP) (elasticity), against the backdrop of a rise in energy efficiency, the level of elasticity has been on a medium- to long-term downtrend, which has become more pronounced since 2012. That is evidence that energy conservation and renewable energy initiatives are expanding amid the limited use of nuclear energy since the Great East Japan Earthquake. However, the record trade deficit registered in 2022 has exposed the fact that the vulnerability of the trade balance structure lies in Japan's heavy dependence on imports of mineral fuels. Therefore, in order to strengthen

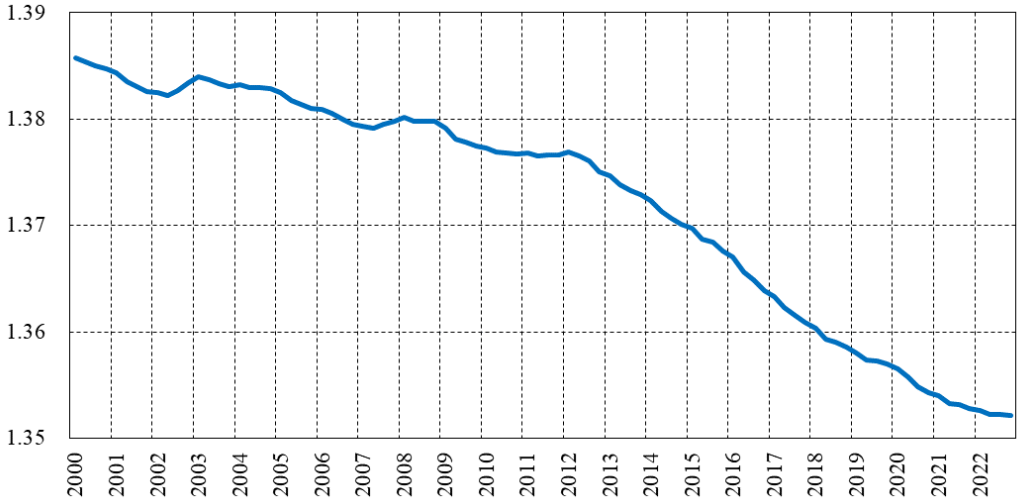
the trade balance structure, the most critical challenge is to reduce the dependence on imports of mineral fuels by promoting the use of diverse power sources, including the use of nuclear power predicated on ensuring safety, while continuing to expand energy conservation and renewable initiatives.

Figure II-2-2-3. Composition of primary energy supply in Japan



Source: *Comprehensive Energy Statistics* (METI).

Figure II-2-2-4. Elasticity of mineral fuel imports to an increase of one unit of real GDP



Note: Concerning the estimation formula with one-period lag + C, wherein log (import value of mineral fuels/yen-denominated import prices of mineral fuels) = α × log (real GDP) + β × log (import value of mineral fuels/yen-denominated import prices of mineral fuels), the value obtained by Kalman filtering with α as a time-varying coefficient is set as the elasticity of mineral fuel imports to an increase of one unit of real GDP.

Source: *National Accounts of Japan* (CAO), *Corporate Goods Price Index* (Bank of Japan), *Trade Statistics of Japan* (MOF).

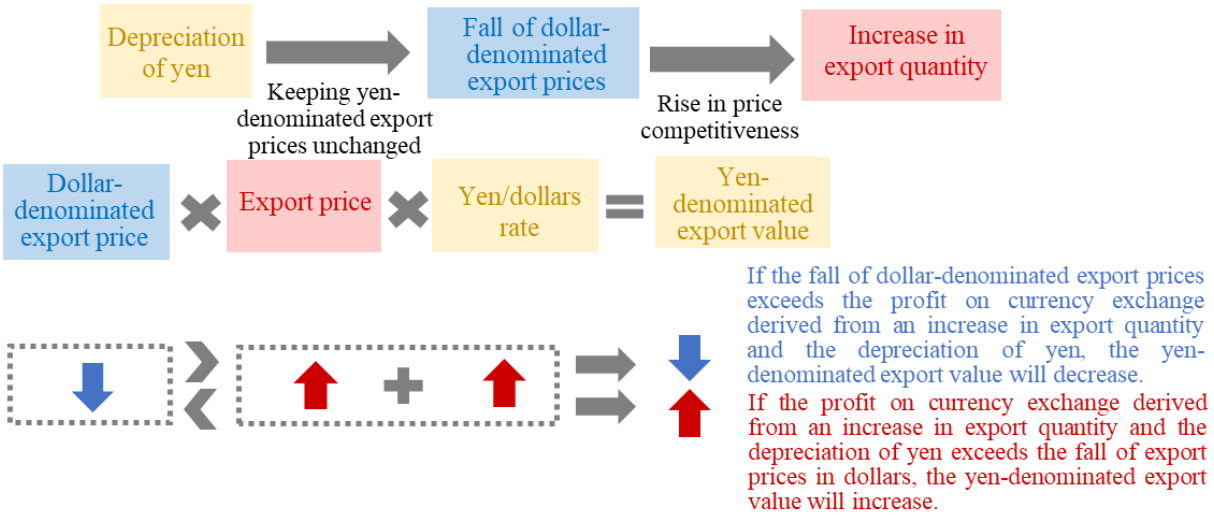
As described above, the decomposition of the record trade deficit registered in 2022 shows that the deficit is attributable in large part to the rise in contract currency-denominated import prices, most of which is accounted for by the rise in import prices of mineral fuels. If we look at the composition of the primary energy supply in Japan, we can see that although Japan has made progress in reducing its dependence on imports of fossil fuels since the Great East Japan Earthquake, the level of dependence still remains high, so reducing the dependence on mineral fuels continues to be a critical challenge from the viewpoint of increasing the resiliency of the trade structure as well. On the other hand, for Japan, a resource-poor country that has to depend on imports for much of the supply of energy and food, maintaining and strengthening the free trade system suits its own interests, and doing so is also a responsibility that Japan should fulfill as a major global trading country. The fact that although the yen depreciation provided a good opportunity to expand exports, the contribution of exports to the trade balance was limited also poses a challenge for maintaining and strengthening Japan's income earning power. In addition, at a time when moves are underway to strengthen domestic manufacturing bases from the viewpoint of economic security and supply chain resiliency, it is important to realize a virtuous cycle between the expansion of domestic investment, the acceleration of innovation, and income increase while taking into consideration this trend.

2. Challenges for increasing export income

As described in the previous subsection, although the yen depreciation provided a good opportunity to expand exports, the contribution of exports to the trade balance was limited. This subsection will identify the challenges for increasing export income by taking a close look at the status of export income during the recent phase of yen depreciation.

First, using Figure II-2-2-5, we will explain the yen depreciation's export-promoting effect. The yen depreciation's export-promoting effect refers to an increase in export quantity resulting from the yen depreciation. For example, let us assume that the dollar is now depreciating against the dollar. In this case, if exporting countries keep yen-denominated export prices unchanged, dollar-denominated export prices fall because of the fall in the value of the yen. The decline in dollar-denominated prices creates price competitiveness, leading to an increase in export quantity. That is the yen depreciation's export-promoting effect. However, it should be kept in mind that export value does not increase unless the impact of the increase in export quantity outweighs the impact of the fall in export prices.

Figure II-2-2-5. Export promoting effect backed by the depreciation of yen (against dollars)



Source: METI.

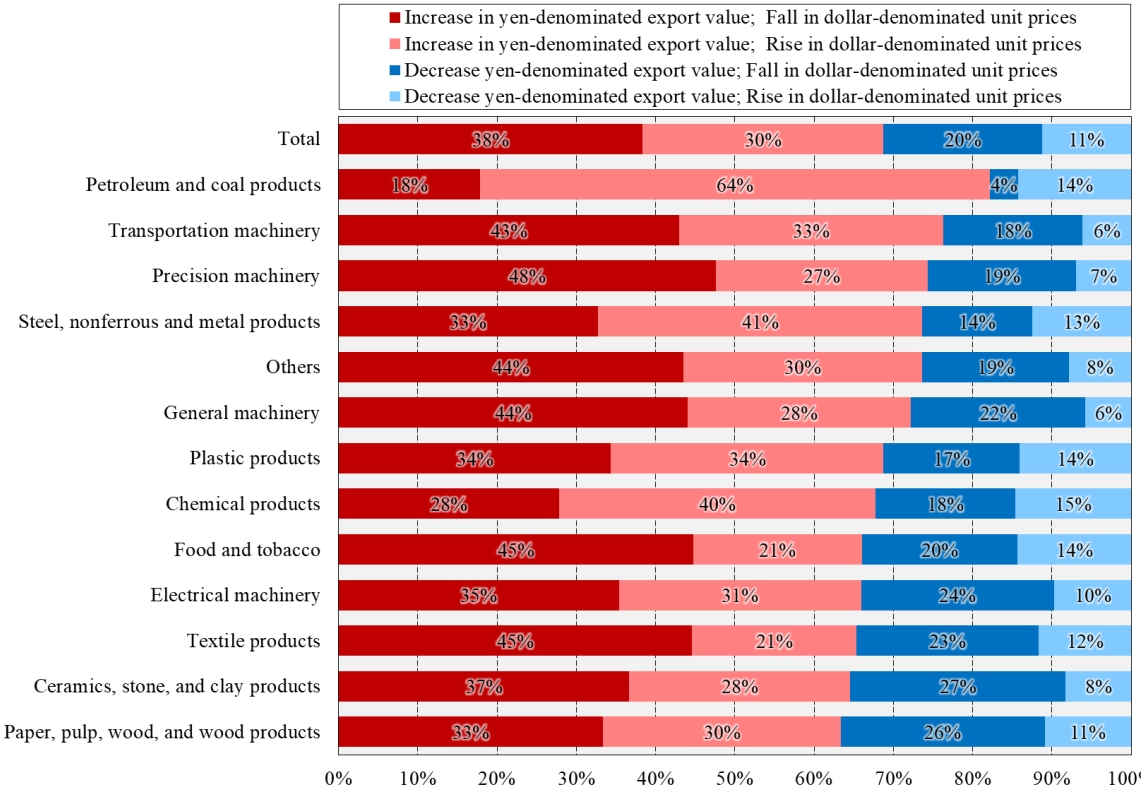
JETRO (2022)[228] analyzed exports classified by product item in the first half of 2022 using data on export quantity and dollar-denominated export value recorded in the Global Trade Atlas, compiled by IHS Markit, and came up with the following findings: export quantity increased on a year-on-year basis for 1,942 product items out of the total of 4,199 items under the six-digit HS Code; the dollar-denominate unit price fell on a year-on-year basis for 1,320 items, or around 70%, out of the 1,942 items; and export value increased on a year-on-year basis for 861 items, more than half of the 1,320 items. The findings suggest the possibility that the yen depreciation's export-promoting effect worked for some product items.

Regarding changes in exports from 2021 to 2022, Figure II-2-2-6, which was compiled in reference to the above analysis, focuses on the change in dollar-denominated unit prices and the status of yen-denominated export income. According to this figure, yen-denominated export income increased for some 70% of all export items under the six-digit HS Code but decreased for around 30%. A closer look shows that for around 40% of all items, income increased despite falls in dollar-denominated unit prices, indicating that the yen depreciation's export-promoting effect increased income. In particular, the percentage of items for which export income increased despite falls in unit prices was high with respect to precision machinery, food, textile products, general machinery, and transportation machinery. On the other hand, for around 20% of all items, falls in dollar-denominated unit prices did not lead to higher export income. In particular, the percentage of items for which export income did not increase despite falls in unit prices was high with respect to ceramic, stone and clay products, paper, pulp and wood products, and electrical machinery. Meanwhile, for around 30% of all items, export income increased due to rises in dollar-denominated unit prices. In particular, the percentage of items for which export

[228] JETRO "TOKUSHUU: SEKAI KEIZAI NO KONRAN DE MOTOMERARERU KAIGAI BIJINESU NO SAI KOUCHIKU—ENYASU KA HANSUU CHIKAKU NO SHOUHIN GA YUSHUTSU SUURYOU WO NABASU (NIPPON) 2022 KAMIHANKI NO BOUEKI WO BUNSEKI" https://www.jetro.go.jp/biz/areareports/special/2022/1002/a9c529af460e7ded.html.

income increased due to higher unit prices was high with respect to petroleum and coal products, steel, nonferrous and metal products, and chemical products. On the other hand, for around 10% of all items, export income declined due to rises in dollar-denominated unit prices.

Figure II-2-2-6. Changes in dollar-denominated unit prices and the status of yen-denominated export income (from 2021 to 2022)

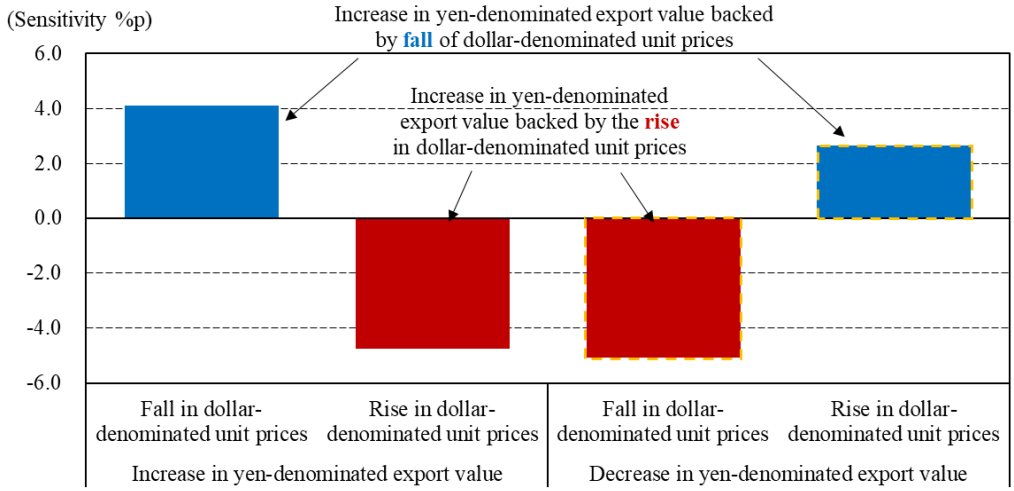


Source: Global Trade Atlas.

Next, in order to deepen understanding of the relationship between the change in dollar-denominated unit prices and the change in export value from 2021 to 2022, let us take a more detailed look at the characteristics of the changes. First, focusing on the relationship between the change in dollar-denominated unit price and the change in export quantity from 2021 to 2022 with respect to each of the product items under the six-digit HS Code, we divide the items into the following four groups: items for which the dollar-denominated unit price fell and yen-denominated export value increased; items for which the dollar-denominated unit price rose and yen-denominated export value increased; items for which the dollar-denominated unit price fell and yen-denominated export value declined; and items for which the dollar-denominated unit price rose and yen-denominated export value declined. We calculate the sensitivity of export quantity to change in the dollar-based unit price, and based thereon, we calculate the sensitivity of the yen-denominated export value. The results of the calculations are shown in Figure II-2-2-7. In the case of items for which the dollar-denominated unit price fell and yen-denominated export value increased and items for which the dollar-denominated unit price rose and yen-denominated export value declined, a fall in dollar-denominated unit price tends to lead to an increase in export income. On the other hand, in the case of items for which the dollar-denominated unit price rose and

yen-denominated export value increased and items for which dollar-denominated unit price fell and yen-denominated export value declined, a rise in dollar-denominated unit price tends to lead to an increase in export income.

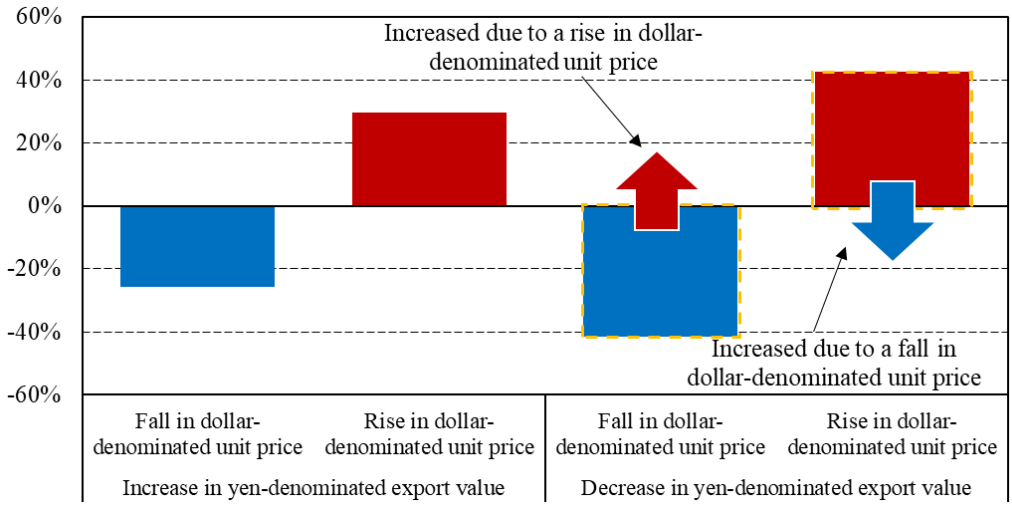
Figure II-2-2-7. Changes in yen-denominated export income backed by 10% fall in dollar-denominated unit prices



Note: A regression analysis is conducted, setting the rate of change in the export quantity as a dependent variable and the rate of change in the dollar-denominated unit prices as an independent variable, and then the coefficient of the rate of change in the dollar-denominated unit prices obtained by this analysis is set as the sensitivity of export quantity backed by a change in the dollar-denominated unit prices. Based on this sensitivity, the estimated rate of change in export quantity backed by a 10% fall in dollar-denominated unit prices is calculated, and based on this estimated value, a change in the yen-denominated export value backed by a 10% fall in dollar-denominated unit prices (dollar-denominated unit prices × export quantity × dollar-yen rate) is calculated.
Source: Global Trade Atlas.

Figure II-2-2-8 shows the actual rate of change in dollar-denominated unit price from 2021 to 2022. Regarding the groups of items for which the yen-denominated export value declined, the actual direction of change in the dollar-denominated unit price is inverse to the direction of change that is estimated to lead to an increase in export income in Figure II-2-2-7. This suggests the possibility that a rise in the dollar-denominated unit price may increase export income in the case of items for which the dollar-denominated unit price declined, while a decline in the dollar-denominated unit price may increase income in the case of items for which the dollar-denominated unit price rose.

Figure II-2-2-8. Rate of change in dollar-denominated unit price (from 2021 to 2022)



Source: Global Trade Atlas.

Above, we looked at changes in the dollar-denominated unit price and in yen-denominated export value amid the yen depreciation, but those changes also reflect the effects of changes in demand in trade counterpart countries, among other factors. As a result, strictly speaking, that is not an analysis of changes in export due to the yen depreciation. Therefore, we will look at Japan's exports of more 4,000 product items under the six-digit HS Code from 1994 to 2022 by export destination country and analyze whether the yen depreciation has led to an increase in export quantity through falls in dollar-denominated unit price while controlling the effects of changes in demand in export destination countries.

First, we will briefly explain the analysis method. The data samples used for the analysis are product items under the abovementioned six-digit HS Code classified by export destination country (hereinafter "market"), and the analysis period is from 1994 to 2022, for which relevant data are available. In addition, following the method used above, the dollar-denominated unit price used for the analysis is calculated by dividing the dollar-denominated export value by export quantity on a market-by-market basis. We estimate the impact that fluctuations of the yen-dollar exchange rate have on export quantity through change in dollar-denominated unit price, using an instrumental variable method. In the estimation, we adopt the rate of change in GDP of export destination countries as an additional independent variable in view of the fact that export quantity is affected not only by the exchange rate but also by demand in export destination countries. In addition, we analyze the impact that exchange rate fluctuations have on export quantity through changes in dollar-denominated unit prices while excluding the effects of other factors to the largest possible extent by controlling export trends specific to particular items and particular countries and the effects of the revision of the HS Code on statistics.

The details of the analysis results are as shown in Note 4. Even after being controlled for demand in export destination countries, the yen depreciation has the significant effect of increasing export quantity through falls in dollar-denominated unit prices. However, on average, the yen depreciation's effect of increasing export quantity is outweighed by the impact of falls in dollar-denominated unit prices, and therefore, from the viewpoint of securing export income, it is necessary to bear in mind the possibility

that even during a yen depreciation phase, an excessive reduction of dollar-denominated unit prices may hurt income.