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Restructuring Energy to Stop Income Outflow

—Decarbonization Significantly Improves Terms of Trade—

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Summary

◆ Japan's terms of trade have deteriorated as import prices have risen sharply due to soaring resource prices. The terms of trade represent the profit margin of trade transactions, and when they deteriorate, income flows out of the country. The deterioration in Japan's terms of trade is also significant on a global scale, as Japan's dependence on imports for energy resources is one of the largest in the world.

◆ About 8 trillion yen of income is forecasted to flow overseas in fiscal 2021 due to deteriorating terms of trade. A large amount of income has already flowed out: about 40% of the income generated by economic growth since 2000 has been lost due to the deterioration. Deterioration in terms of trade not only reduces corporate profits but also lowers household incomes. Since 2000, real wages have fallen by about 10% as a result, almost offsetting any increase in labor productivity.

◆ To prevent the outflow of income overseas, it is essential to transform the energy structure. According to an estimate by the Network of Central Banks and Supervisors for Greening the Financial System (NGFS), which includes the financial authorities of various countries, decarbonization efforts will cause the use of mineral fuels to fall to about 15% of the current level and the terms of trade to improve by 2050, boosting income growth by just under 40%.

◆ At present, radical efforts to decarbonize the world are causing high resource prices and worsening the terms of trade in Japan. However, in the medium to long term,

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decarbonization efforts have the effect of increasing income through improved terms of trade as well as increased productivity and reduced losses due to climate change. In this sense, transformation of the energy structure is important not only for mitigating climate change risks and ensuring economic security, but also from a purely economic perspective in terms of increasing the income of the country as a whole.

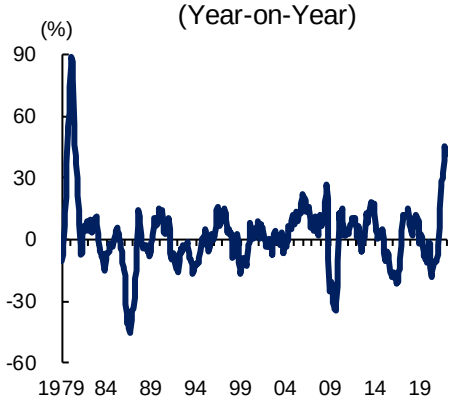
- **This is an English version of "エネルギー構造転換で所得流出に歯止めを ― 脱炭素への取り組みで交易条件は大幅な改善余地 ―" in JRI Research Focus (The original version is available at https://www.jri.co.jp/MediaLibrary/file/report/researchfocus/pdf/13134.pdf)**

1. The Highest Rise in Import Prices in 41 Years

Japan's import prices are soaring. According to the Bank of Japan's Corporate Price Index, import prices rose 45% in November 2021 from the previous year, the highest increase in 41 years since June 1980 (Figure 1).

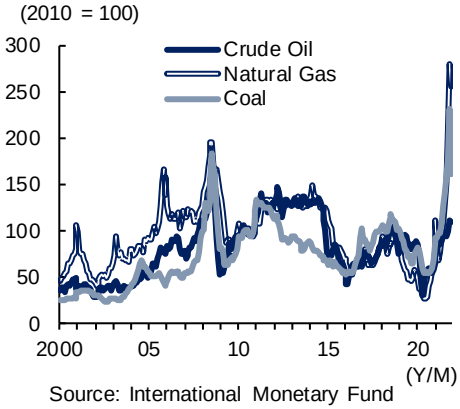
The rise in import prices is due to a sharp rise in resource prices as well as a weaker yen. The prices of natural resources have been rising since the middle of 2020, accelerating this year (Figure 2). The rise in resource prices has been driven by the recovery of economic activity, which had been stagnant due to the coronavirus pandemic, and the recent rise in geopolitical risks related to the situation in the Middle East. In addition, with the focus on climate change intensifying, financial institutions and shareholders around the world have become increasingly concerned about greenhouse gas emissions, and investment in the development of oil fields has slowed. This suppresses the supply of mineral fuels and raises prices.

Figure 1. Import Prices
(Year-on-Year)



Source: Bank of Japan

Figure 2. Resource Prices

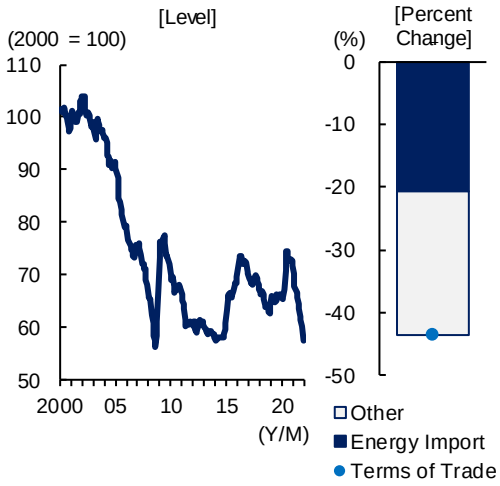


Source: International Monetary Fund
Commodity Price Index

2. Deterioration in Japan's Terms of Trade Is a Major Global Problem

Rising import prices have led to a significant deterioration in terms of trade. Terms of trade are defined as the ratio of export prices to import prices and represent the quantity of imported goods that can be exchanged for a unit of export goods. This can be interpreted as the profit margin of trade transactions (converted by quantity), meaning that the lower the figure, the lower the purchasing power of the economy as a whole. It is also possible to interpret this as an inability to pass on higher prices for imported raw materials to export prices, resulting in an foreign outflow of income. According to the Bank of Japan's Corporate Price Index, the terms of trade in December 2021 deteriorated by 20% from the previous year (Figure 3, left).

Figure 3. Terms of Trade



Source : Bank of Japan
Note : The percentage change was from January 2000 to December 2021. Energy imports are the contribution of oil, coal, and natural gas imports.

The long history of high resource prices has worsened the terms of trade. Over the last 20 years, the terms of trade have deteriorated by about 40%, half of which is attributable to higher prices for energy resources (Figure 3, right). The extent of deterioration in Japan is considerably larger than in other countries. Looking at the changes in terms of trade by country and region, since 2000, the terms of trade have improved significantly for energy-

exporting countries such as Russia and the Middle East, and have slightly improved in the United States, which became one of the world's largest oil producers thanks to the shale revolution. In contrast, the euro area and Asian countries, such as South Korea and Taiwan, showed relatively large deterioration rates, with Japan showing the worst deterioration (Figure 4).

Japan's dependence on imports for energy resources is one of the major reasons for the deterioration in terms of trade. According to United Nations statistics, Japan's energy resource imports account for the seventh largest share of total imports among the 148 countries for which data are available, following Zimbabwe and other small African countries, Pakistan, and Ukraine, and the largest share among major countries (Table 1). Imports of energy resources totaled 11 trillion yen in 2020, including 6 trillion yen for oil and 3 trillion yen for natural gas.

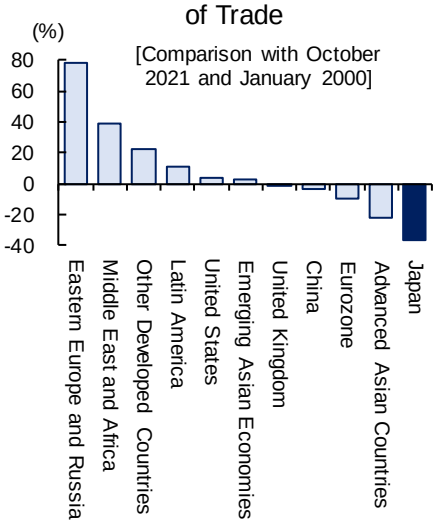
3. Deterioration in Terms of Trade Puts a Heavy Burden on the Economy

The deteriorating terms of trade have put a heavy burden on the economy as a whole. The decrease (increase) in real income caused by the deterioration (improvement) of the terms of trade is called the trade loss (gain). Trade losses in Japan have been increasing since last year, and in fiscal 2021 are expected to increase by about 8 trillion yen from the previous year. This will be the largest increase in losses since fiscal 1980.

Increased trade losses have severely depressed overall economic income. Gross domestic income for fiscal 2021 is expected to decline by 1.5 percentage points from the previous year due to increased trade losses[1]. This decline is large enough to offset half of the increase in gross domestic product (GDP) (up 2.9% from the previous year) and hinders Japan's economic recovery from the coronavirus pandemic.

The increase in trade losses has hampered income formation in the Japanese economy as a whole. Specifically, from fiscal 2000 to fiscal 2021, trade losses depressed the growth rate of gross domestic income by 4.7 percentage points (Figure 5). During this period, GDP pushed up gross domestic income by 11.0

Figure 4. Rate of Change in Terms of Trade



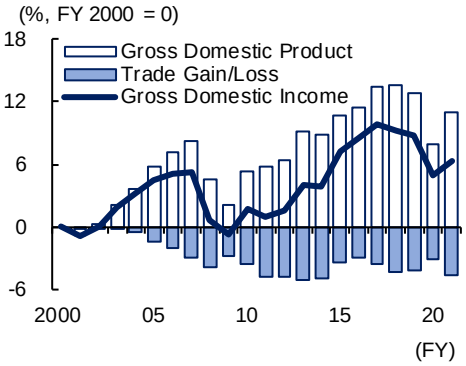
Source: Netherlands Bureau of Economic Analysis
Note: Advanced Asian countries include South Korea, Taiwan, Hong Kong and Singapore. Emerging Asia excludes China.

Table 1. Percentage of Energy Resource Imports

Rank	Country	Percentage (%)
1	Zimbabwe	27.3
2	Pakistan	26.5
3	Burkina Faso	26.4
4	Guyana	22.2
5	Sao Tome and Principe	21.9
6	Ukraine	21.6
7	Japan	21.5
8	Seychelles	20.6
9	Fiji	20.4
10	Tanzania	19.9

Source : United Nations
Note : Energy imports as a percentage of total imports minus energy exports as a percentage of total exports.

Figure 5. Real Gross Domestic Income (Cumulative Percentage Change)

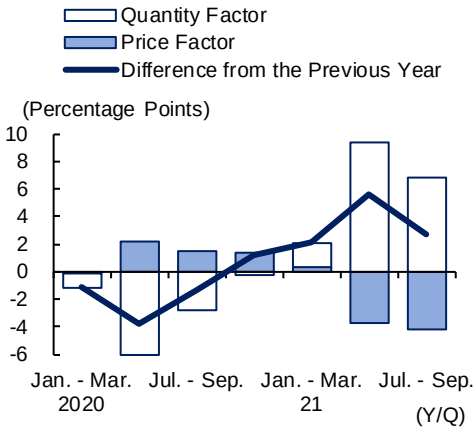


Source: Cabinet Office
Note: Cumulative rate of change since FY 2000. The forecast for FY 2021 is that of the Japan Research Institute.

[1] Real gross domestic income is defined as the sum of real gross domestic product and trade gains (the difference between trade losses).

percentage points, and trade losses offset 40% of the increase in income from economic growth in the form of outflows. This deterioration in terms of trade has not only depressed the economy in recent years, but has also been one of the factors behind the medium- to long-term stagnation of the Japanese economy.

Figure 6. Operating Profit Margin of Manufacturing (YoY Difference)

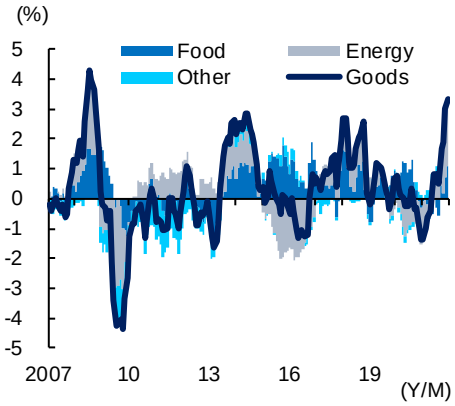


Source: Compiled by the Japan Research Institute from the Ministry of Finance and the Bank of Japan
Note: Operating profit margin is the ratio of operating income to sales. Price factors are calculated by the following formula:
Output prices (year-on-year) - input prices (year-on-year) x intermediate input ratio.
The intermediate input ratio is the ratio of cost of sales to sales.

4. Deterioration in Terms of Trade Affects both Firms and Households

The economic burden of deteriorating terms of trade affects both firms and households. In the case of firms, higher prices for imported raw materials hurt profits. In particular, the manufacturing industry has been severely affected by the rise in raw material prices, slowing the recovery from the pandemic. When dividing the operating profit margin of the manufacturing industry into the price factor and the quantity factor, the purchase price rose more than the selling price for the July-September quarter of 2021, reducing the operating profit margin (relative to sales) by four percentage points from the previous year (Figure 6). Many of the quantitative factors that increased due to the recovery in demand from the pandemic were negated by price factors.

Figure 7. Consumer Prices (YoY)



Source: Ministry of Internal Affairs and Communications
Note: Consumption tax is excluded.

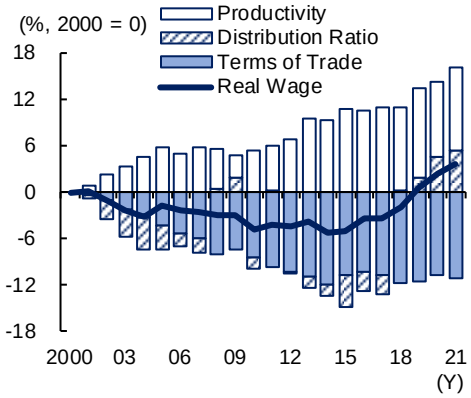
Deterioration in terms of trade not only affects firms but also households. Part of the increase in raw material costs is passed on to consumer prices. Indeed, among consumer prices, prices of goods have started to rise, reaching 3.3% in December 2021 compared to the previous year (Figure 7). Excluding the impact of the consumption tax hike, at more than 3% the figure is the highest since September 2008. The rise in consumer prices has so far centered on gasoline and utility costs, but if prices are passed on to food and other products, consumer prices could rise further. Moreover, the deterioration in corporate profits, which is not reflected in consumer prices, will reduce the income households receive by bonus cuts. The burden on households is increasing due to both rising prices and falling incomes.

Japan's real wages have been depressed for the past 20 years by the deteriorating terms of trade. Real wages are affected not only by labor productivity and labor share but also by terms of trade[2]. Real wages represent the quantity of consumer goods that can be purchased with the income received by the worker. When the terms of trade deteriorate due to an increase in import prices, the quantity of imported consumer goods that can be purchased decreases, and this means a decline in real wages. When looking at real wages in Japan, it hardly

[2] Real wages are equationally expressed as the product of labor productivity, labor share, and terms of trade. Terms of trade are defined here as the ratio of the GDP deflator to consumer prices; this ratio is close to the difference between export prices and import prices.

increased, even though labor productivity increased by about 10% from 2000 to 2021 (Figure 8). The deterioration in terms of trade has contributed to this, reducing real wages by about 10% over the past 20 years and almost offsetting the increase in labor productivity. In other words, it can be interpreted that the increase in wages that should have been paid to the workers through the improvement of labor productivity was used to pay for imported goods, mainly energy.

Figure 8. Real Wages
(Cumulative Percentage Change)

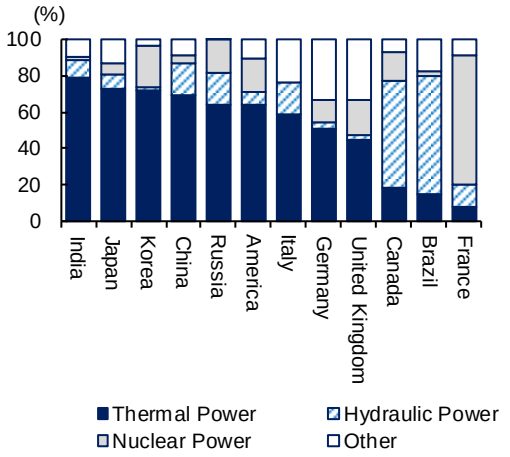


Source: Compiled by the Japan Research Institute from the Cabinet Office, the Ministry of Internal Affairs and Communications, and the Ministry of Health, Labour and Welfare
Note: Real wages are the ratio of nominal wages to consumer prices. Nominal wages are hourly compensation. Total working hours is calculated by multiplying the number of employees by the total actual working hours per person. Terms of trade are the ratio of the GDP deflator to consumer prices. 2021 is the forecast of the Japan Research Institute.

5. Enhancing Wealth through Improving Energy Self-Sufficiency

Efforts to reduce dependence on imports for energy resources are essential to prevent income from flowing out of the country due to deteriorating terms of trade. One of the reasons for Japan's high dependence on imports for energy resources is that Japan's power supply structure is heavily dependent on thermal power generation. Looking at the share of power generation by source, thermal power generation in Japan, similar to India, South Korea, and China, accounts for about 70%, which is higher than that in Europe and other countries (Figure 9). This has led to large imports of mineral fuels. In this regard, the government has declared that it will reduce greenhouse gas emissions to virtually zero by 2050, and has set targets for achieving this goal. The Ministry of Economy, Trade and Industry, for example, has called for a drastic overhaul of its power mix, with the goal of reducing the share of thermal power generation and increasing the share of renewable energy to between 50 and 60%.

Figure 9. Composition of Power Generation by Power Source (2018)



Source: Federation of Electric Power Companies

If such measures are taken, it is expected that, in the long run, the economy will be transformed into an structure in which the terms of trade are unlikely to deteriorate in times of high resource prices. The Network of Central Banks and Supervisors for Greening the Financial System (NGFS), in which financial authorities of each country participate, estimates the economic impact of responses to environmental issues. According to their estimates, if systematic efforts are made to achieve decarbonization by 2050, the use of mineral resources in 2050 will be reduced to the current level of 15%, which would be 70% less than if no measures were taken (Figure 10).

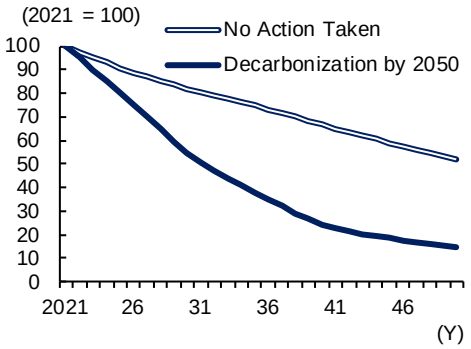
According to the estimates, since the price of mineral fuels increases more than general prices, the deterioration of the terms of trade will be reduced if imports of mineral fuels are reduced. Thus, in the case of

decarbonization, trade losses are small and will only depress gross domestic income growth (cumulative; hereinafter the same applies) by about two percentage points between 2021 and 2050 (Figure 11). On the other hand, if no measures are taken, trade losses will reduce gross domestic income by five percentage points. Therefore, it is estimated that improving the terms of trade through decarbonization will boost gross domestic income growth by three percentage points. On the other hand, decarbonization results in about five percentage points higher GDP compared with the case where no measures are taken. This may be due to increased productivity through the development of new energy sources and reduced physical losses through the mitigation of climate change.

Taken together, decarbonization efforts will boost gross domestic income by about 8%, with more than 60% of this increase attributable to increases in GDP, such as through increases in productivity, and the remaining 40% attributable to improvements in terms of trade.

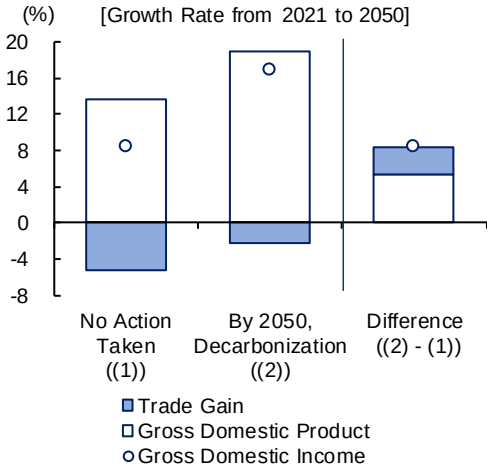
As mentioned above, the world's radical decarbonization efforts have led to high resource prices and worsened terms of trade. However, over the long term of the next 30 years, decarbonization efforts are likely to increase overall economic income through improved terms of trade as well as increased productivity and reduced climate change losses. Efforts to transform the energy structure, including the use of renewable energy, are important not only from an environmental and economic security perspective, but also from a purely economic perspective, raising the income of the country as a whole.

Figure 10. Mineral Fuel Consumption (Forecast)



Source: Developed by JRI from NGFS
Note: Uses NiGEM NGFS v 1.21 model estimates. Consumption of oil, coal, and natural gas. No Action Taken and Decarbonization by 2050 represent "Current Policies" senerio and "Net Zero 2050" senerio, respectively.

Figure 11. Real Gross Domestic Income



Source :Developed by JRI from NGFS
Note: Uses NiGEM NGFS v 1.21 model estimates. The calculation of the trading profit assumes that the new meter is the import price. Energy in import prices is calculated based on energy consumption and price forecasts. Both scenarios use baseline energy prices. Import and export prices other than energy are assumed to remain unchanged. Real gross domestic income is calculated as the sum of gross domestic product and the projected trade gains.