



**BOJ**  
*Reports & Research Papers*

# Financial System FSR report



BANK OF JAPAN  
OCTOBER 2021

The total of major banks, regional banks, and *shinkin* banks covered in this *Report* is as follows (as at end-September 2021).

Major banks comprise the following 10 banks: Mizuho Bank, MUFG Bank, Sumitomo Mitsui Banking Corporation, Resona Bank, Saitama Resona Bank, Mitsubishi UFJ Trust and Banking Corporation, Mizuho Trust and Banking Company, Sumitomo Mitsui Trust Bank, Shinsei Bank, and Aozora Bank. Regional banks comprise the 62 member banks of the Regional Banks Association of Japan (Regional banks I) and the 37 member banks of the Second Association of Regional Banks (Regional banks II). *Shinkin* banks are the 247 *shinkin* banks that hold current accounts at the Bank of Japan.

This *Report* basically uses data available as at end-September 2021.

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## Objectives of the *Financial System Report*

The Bank of Japan's semiannual *Financial System Report* has two main objectives: to assess the stability of Japan's financial system and to communicate to all related parties the future tasks and challenges in order to ensure the system's stability.

The *Report* first summarizes the current situation of financial markets and financial intermediation activities of Japanese financial institutions, then provides a regular assessment of the financial cycle and the resilience of financial institutions to stress, and lastly analyzes the vulnerabilities of the financial system from a macroprudential perspective. It also outlines issues that deserve attention and challenges to be addressed.

The Bank uses the results of the analysis set out in the *Report* in planning policies to ensure the stability of the financial system and for providing guidance and advice to financial institutions through on-site examinations and off-site monitoring. Moreover, the Bank makes use of the results in international discussions on regulation, supervision, and vulnerability assessment. In relation to the conduct of monetary policy, the macro assessment of financial system stability is also regarded as important input for the Bank in assessing risks in economic and price developments from a medium- to long-term perspective.

## Motivations behind the October 2021 issue of the *Report*

The October 2021 *Report* provides a detailed analysis of the following major risks: domestic credit risk as well as risks associated with securities investment and foreign currency funding, and then uses a stress testing framework to examine the robustness of Japan's financial system. On the domestic credit risk stemming from the spread of COVID-19, this *Report* presents a simulation of financial soundness of small and medium-sized enterprises (SMEs) while taking details of the degree of heterogeneity in corporate profits across firms into account, and considering that the challenges facing firms are gradually shifting from a financing issue to a solvency issue. On the risks associated with securities investment and foreign currency funding, this *Report* examines the transmission effects of an adjustment in global financial markets on securities investment and funding conditions faced by Japanese financial institutions, while taking into account implications brought to light by the degree of overlap between securities portfolios of individual financial institutions and those of non-bank financial intermediaries (NBFIs), and by differences in funding profiles across financial institutions.

In the macro stress testing, the resilience of Japan's financial institutions and the financial system is examined under three downside scenarios that reflect risks revealed from the analysis on the real economy and on the financial markets.

## Contents

<b>Chapter I. Executive summary: Assessment of the stability of Japan's financial system and discussion of future challenges</b>	<b>1</b>
<b>Chapter II. Risks observed in financial and capital markets</b>	<b>3</b>
A. Global financial markets	
B. Japanese financial markets	
<b>Chapter III. Examination of financial intermediation</b>	<b>12</b>
A. Financial intermediation by financial institutions	
B. Financial intermediation by non-bank financial intermediaries	
C. Financial cycle and vulnerability	
<b>Chapter IV. Risks faced by financial institutions</b>	<b>29</b>
A. Domestic credit risk	
B. Overseas credit risk	
C. Market risk associated with securities investment	
D. Foreign currency funding risk	
E. Risks posed by structural changes in the business environment	
<b>Chapter V. Examination of the resilience of the financial system</b>	<b>61</b>
A. Financial institutions' profitability and capital adequacy	
B. Macro stress testing	
Box 1: Funding conditions of firms by probability of default: comparison with the global financial crisis	80
Box 2: Developments in the real estate market: comparison with developments during the global financial crisis	
Box 3: Foreign currency funding risks: The link between changes in global market conditions and funding structure	
Box 4: The methodology of climate-related financial risk scenario analysis	

## Glossary

### *Financial statements of financial institutions*

Net income = operating profits from core business + realized gains/losses on stockholdings + realized gains/losses on bondholdings – credit costs ± others (such as extraordinary gains/losses)

Gross operating profits from core business = core gross operating profits = net interest income + net non-interest income

Operating profits from core business = pre-provision net revenue (PPNR) excluding trading income = net interest income + net non-interest income – general and administrative expenses

Net interest income = interest income – interest expenses

Net non-interest income = net fees and commissions + profits on specified transactions + other operating profits – realized gains/losses on bondholdings

Overall gains/losses on stockholdings = realized gains/losses on stockholdings + changes in unrealized gains/losses on stockholdings

Realized gains/losses on stockholdings = gains on sales of stocks – losses on sales of stocks – losses on devaluation of stocks

Overall gains/losses on bondholdings = realized gains/losses on bondholdings + changes in unrealized gains/losses on bondholdings

Realized gains/losses on bondholdings = gains on sales of bonds + gains on redemption of bonds – losses on sales of bonds – losses on redemption of bonds – losses on devaluation of bonds

Credit costs = loan-loss provisions + write-offs + losses on credit sales – recoveries of write-offs

Credit cost ratio = credit costs / total loans outstanding

### *Capital adequacy ratios of internationally active banks*

Common equity Tier 1 (CET1) capital ratio = CET1 capital / risk-weighted assets

CET1 capital includes common equities and retained earnings.

Tier 1 capital ratio = Tier 1 capital / risk-weighted assets

Tier 1 capital includes CET1 capital and preferred equities that meet certain conditions.

Total capital adequacy ratio = Total capital / risk-weighted assets

Total capital includes Tier 1 capital and subordinated bonds that meet certain conditions.

### *Capital adequacy ratios of domestic banks*

Core capital ratio = core capital / risk-weighted assets

Core capital includes common equities and retained earnings as well as preferred equities that meet certain conditions.

## **I. Executive summary: Assessment of the stability of Japan's financial system and discussion of future challenges**

### *Current assessment of the stability of Japan's financial system*

Japan's financial system has been maintaining stability on the whole, while COVID-19 continues to have a significant impact on economic and financial activity at home and abroad.

The Japanese government and the Bank of Japan, in close cooperation with overseas authorities, swiftly implemented large-scale fiscal and monetary policy measures and took flexible regulatory and supervisory actions to support economic activity and maintain the functioning of financial markets. Firms that are significantly affected by the pandemic experience funding difficulties. However, underpinned by the financial soundness of financial institutions on the whole, the policy responses have been effective and the financial intermediation function is being fulfilled smoothly. In financial markets, with risk sentiment remaining favorable on the whole, there have been continuing inflows of funds to the stock market and emerging market economies.

### *Future risks and caveats*

According to the results of the macro stress testing, Japan's financial system is likely to remain highly robust even in the case of future resurgence of COVID-19 or adjustment in global financial markets and emerging economies due to a rise in U.S. long-term interest rates. However, in the event of a substantial and rapid adjustment in global financial markets, a deterioration in financial institutions' financial soundness and the resultant impairment of the smooth functioning of financial intermediation could pose a risk of further downward pressure on the real economy.

In this regard, the following three risks warrant particular attention. The first risk is an increase in credit costs due to a delay in economic recovery at home and abroad. A simulation of the impact of the pandemic on corporate financing and firms' debt repayment capacity suggests that credit risk of domestic loans will be contained when the economy follows a recovery trend. Underpinned by the fact that firms on the whole have maintained their financial soundness, various measures to support corporate financing seem to be highly effective in restraining that risk. However, as the impact of the pandemic significantly varies across firms and industries, if there is a delay in the recovery, there is a risk of an adverse impact on the creditworthiness of loans to firms that are significantly affected by the pandemic and of loans' embedded vulnerabilities since before the outbreak. In this regard, attention should also be paid to the developments in the real estate industry, which had increased its lending since before the pandemic, and in the profits of borrowers with a large amount of borrowings that significantly increased their leverage.

Credit risk of overseas loans is generally contained as overseas economies recover on the whole. Nevertheless, there are signs of deterioration in some portfolios that seem to be severely affected by the pandemic. Moreover, attention needs to be paid to energy-related exposure where the impact of global efforts toward achieving a low-carbon economy could strengthen, and to exposure related to air transportation where there is significant uncertainty over the industry's future demand.

The second risk is a deterioration in gains/losses on securities investment due to substantial adjustments in financial markets. Under the prolonged low interest rate environment in Japan, Japanese financial institutions have been actively investing, particularly in domestic and overseas credit products and investment trusts, to search for yield. Meanwhile, the importance of non-bank financial intermediaries (NBFIs) such as investment funds in financial intermediation activities has been growing in the global financial system. In recent years, there has been a growing overlap in

the securities portfolios of Japan's financial institutions and investment funds, measured by the correlation of market values of the portfolios, and there seems to be a growing possibility that the market risk that Japanese financial institutions face at times of stress is amplified by not only their investment behavior but also the activities of NBFIs. The analysis in this *Report* shows that financial institutions with a higher degree of overlap with investment funds tend to be affected much more by shocks in global financial markets.

The third risk is a destabilization of foreign currency funding due to the tightening of foreign currency funding markets. With Japan's financial institutions having expanded their foreign currency assets, there were stress events such as the market turmoil in March 2020, where financial institutions were forced to change their funding instruments significantly. According to an analysis of the determinants of foreign currency funding instruments and their funding rates, funding conditions are not only affected significantly by changes in global market conditions such as in interest rates and redemption rates of investment funds but also depend on financial institutions' funding profiles, including the degree to which funding counterparties are diversified. With the future risk of an adjustment in global financial markets in mind, attention should continue to be paid to the foreign currency funding basis and financing management.

Even after the pandemic subsides, it is likely that the low interest rate environment and structural factors will continue to exert downward pressure on financial institutions' profits. Against this backdrop, attention should be paid to the risk of a gradual pullback in financial intermediation, or on the contrary, to the possibility that the vulnerability of the financial system increases, mainly as a result of financial institutions' search for yield behavior.

### *Challenges for financial institutions*

Future developments in the spread of COVID-19 and their impact on the domestic and overseas economies remain uncertain. Against this backdrop, the major challenge for financial institutions is to smoothly fulfill their financial intermediation function by balancing their financial soundness and risk taking. In this regard, (1) strengthened management of the three risks mentioned above, (2) offering support based on the sustainability of borrowers' businesses, and (3) sound capital planning under considerable uncertainty are the keys to maintaining their financial soundness.

In Japan, the environment surrounding its economy and society is undergoing major changes, e.g., digital transformation and climate change, amid the decline in and aging of the population. Against this background, financial institutions are expected to contribute to achieving a sustainable society by improving their services while maintaining their soundness.

The Bank of Japan, in close cooperation with the Japanese government and overseas financial authorities, will make efforts to ensure the stability of the financial system and the smooth functioning of financial intermediation. From a medium- to long-term perspective, the Bank will actively support financial institutions' initiatives by preparing institutional frameworks for the financial system, by taking measures to respond to climate-related financial risks and by facilitating digital transformation.

## II. Risks observed in financial and capital markets

- This chapter summarizes the developments in financial markets within Japan and abroad, mainly during the first half of fiscal 2021, and examines the risks associated with market developments.<sup>1</sup>
- In global financial markets, under aggressive fiscal and monetary policy measures taken in each country and region, inflows of funds to the stock market and emerging market economies have continued, mainly on the back of expectations for economic recovery that reflects progress with COVID-19 vaccinations. U.S. and European stock prices have risen sharply, and the credit spreads of corporate bonds -- particularly high-yield bonds -- have narrowed. Emerging market economies have seen stock prices above pre-pandemic levels, stable currencies, and more or less flat credit spreads of government bonds. Meanwhile, U.S. long-term interest rates have declined amid continued accommodative financial conditions.
- In Japanese financial markets, with the Bank of Japan continuing Quantitative and Qualitative Monetary Easing (QQE) with Yield Curve Control, both short- and long-term interest rates were generally stable during the first half of fiscal 2021. Japanese stock prices had exhibited sluggish movements compared to those in the United States and Europe through late August. However, they have risen thereafter, mainly reflecting corrections to undervaluation of Japanese stock prices compared to their U.S. and European counterparts, with the confirmed new cases of COVID-19 starting to decline.
- Uncertainty about global financial markets remains high. There is a risk that U.S. long-term interest rates will rise suddenly, depending, for example, on developments in U.S. inflation rates if attention is paid to an early reduction in monetary policy accommodation by the Federal Reserve (FRB). Attention should be paid to the possibility that asset prices, including those of stocks and credit products, could correct in the event of, for example, such a sudden rise in U.S. long-term interest rates, as well as depending on developments in the spread of COVID-19 including its variants, and in the Chinese real estate sector.

### A. Global financial markets

#### *U.S. and European long-term interest rates*

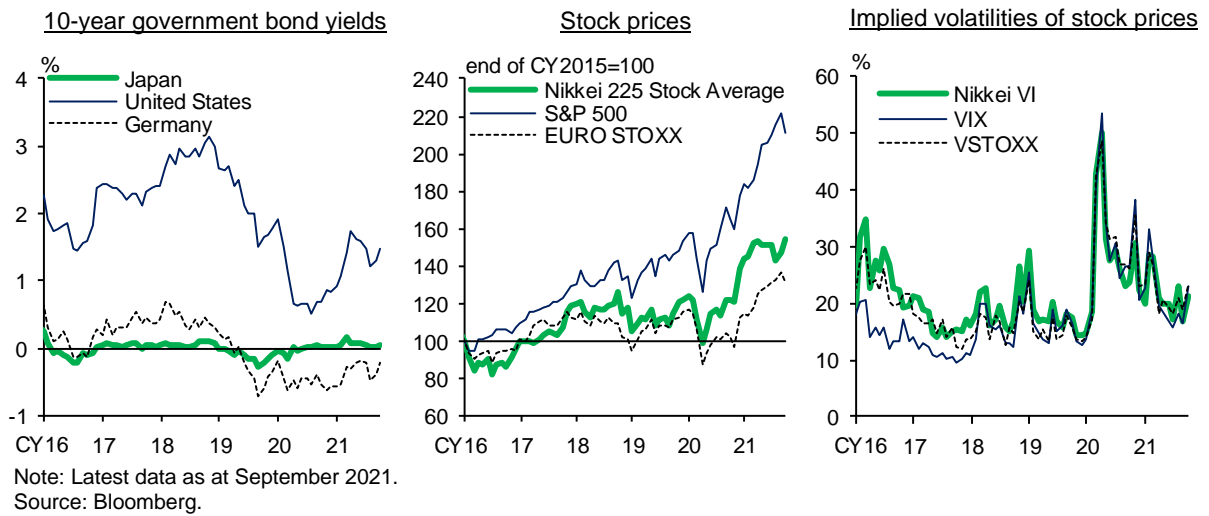
U.S. long-term interest rates have declined amid continued accommodative financial conditions (Chart II-1-1). Federal funds futures curves rose as the outlook for the federal funds rate was revised upward at the Federal Open Market Committee meetings (Chart II-1-2). In this situation, the yield curve for U.S. Treasuries has flattened, due partly to an adjustment of investors' positions (Chart II-1-3). The volatility of U.S. Treasury bond futures, although declining, has remained at a somewhat high level, due mainly to concerns over a rise in inflation rates (Chart II-1-4). European long-term interest rates have been more or less flat, albeit with fluctuations (Chart II-1-5).

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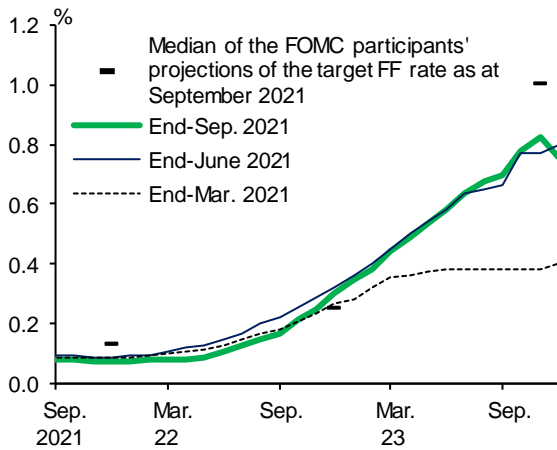
<sup>1</sup> In Japan, the fiscal year starts in April and ends in March of the following year.



**Chart II-1-1: Developments in global financial markets**

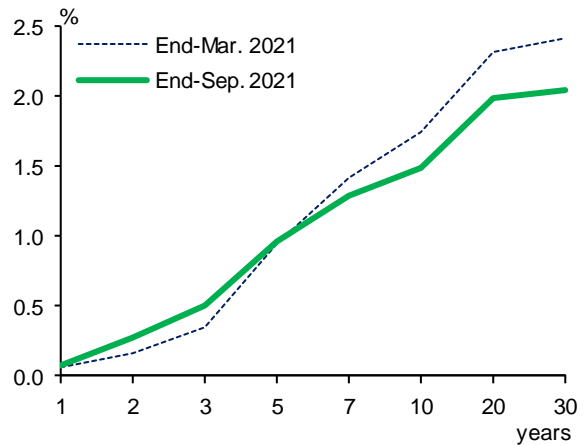


**Chart II-1-2: Federal funds futures curves**



Source: Bloomberg; FRB.

**Chart II-1-3: U.S. Treasury yield curves**



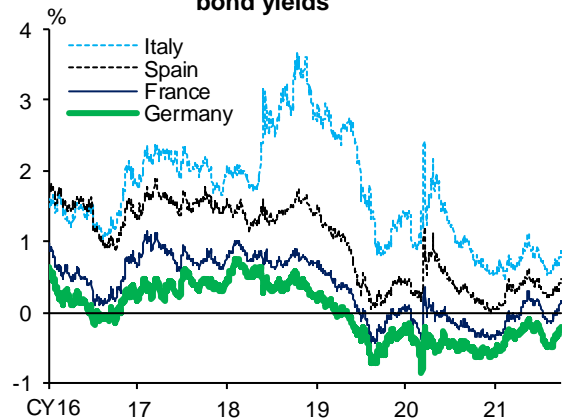
Source: Bloomberg.

**Chart II-1-4: Implied volatility of U.S. Treasury bond futures**



Note: Implied volatility is calculated from put options on U.S. Treasury bond futures. Latest data as at end-September 2021.  
 Source: Bloomberg.

**Chart II-1-5: 10-year European government bond yields**



Note: Latest data as at end-September 2021.  
 Source: Bloomberg.

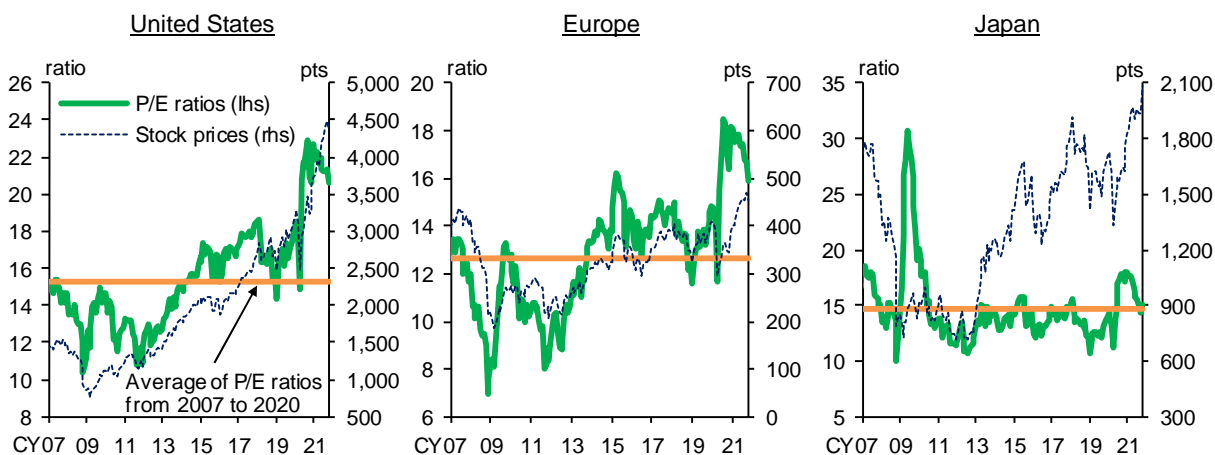
II. Risks observed in financial and capital markets  
A. Global financial markets

*U.S. and European stock prices*

U.S. stock prices have risen significantly and recorded historical highs, mainly on the back of a heightening of expectations for economic recovery in view of the progress with vaccinations and the fact that growth stocks -- which are stocks of growth sectors that tend to benefit from declines in interest rates -- account for a large share in the U.S. stock market (Charts II-1-1, II-1-6, and II-1-7). European stock prices have also risen significantly and recorded historical highs, owing mainly to expectations for economic recovery in view of the progress with vaccinations (Charts II-1-1 and II-1-6). Meanwhile, there were substantial inflows in equity funds (Chart II-1-8).

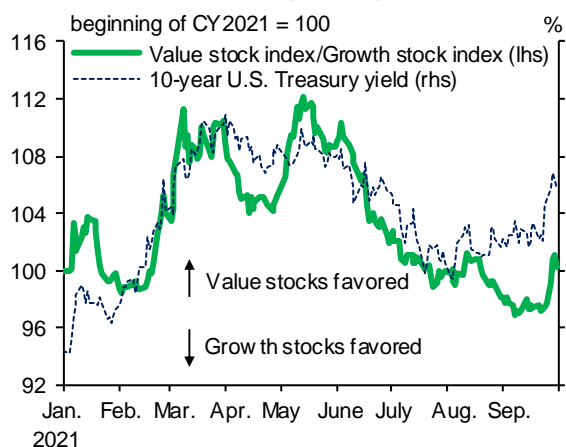
Expected earnings per share (EPS) for U.S. and European firms has been rising (Chart II-1-9). Volatility of stock prices has generally fallen to the pre-pandemic level, reflecting, for example, a heightening of expectations for economic recovery in view of the progress with vaccinations (Chart II-1-1). Meanwhile, price-earnings (P/E) ratios have remained at high levels (Chart II-1-6).

**Chart II-1-6: Stock prices and valuation**



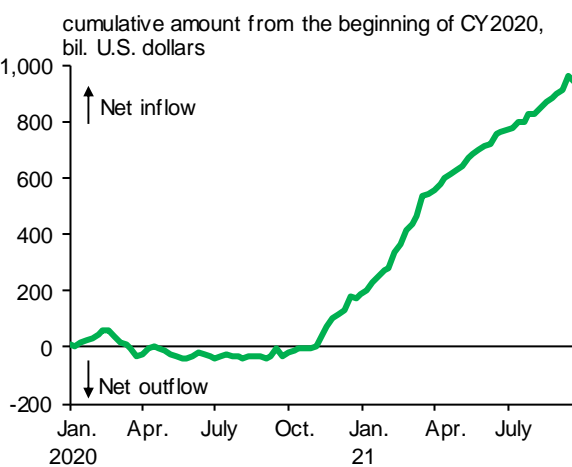
Note: 1. "Stock prices" indicates the S&P 500 for the United States, the EURO STOXX for Europe, and the TOPIX for Japan. "P/E ratios" is calculated using expected EPS for the next 12 months.  
2. Latest data as at September 2021.  
Source: Datastream from Refinitiv.

**Chart II-1-7: Preference between growth and value stocks and 10-year U.S. Treasury bond yield**



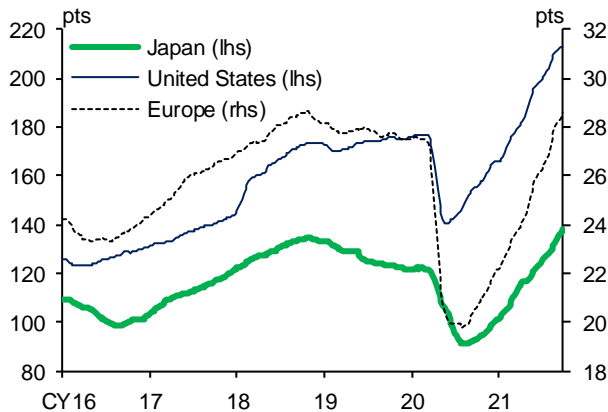
Note: 1. "Value stock index" indicates the MSCI World Value Index. "Growth stock index" indicates the MSCI World Growth index.  
2. Latest data as at end-September 2021.  
Source: Bloomberg.

**Chart II-1-8: Net flows in global equity funds**



Note: Latest data as at September 29, 2021 (weekly data).  
Source: EPFR Global; Haver Analytics.

**Chart II-1-9: Expected EPS**

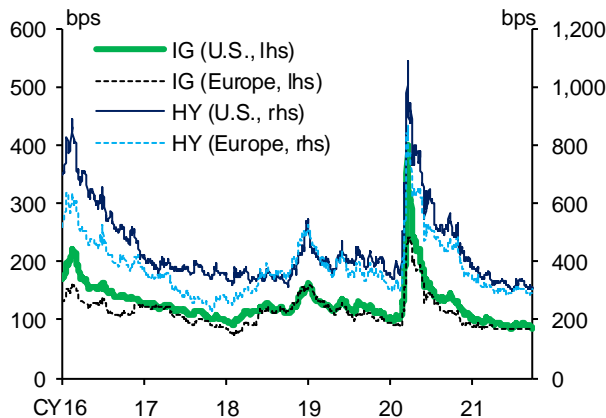


Note: 1. "Japan," "United States," and "Europe" indicate expected EPS for the next 12 months of the TOPIX, the S&P 500, and the EURO STOXX, respectively. 4-week backward moving averages.  
 2. Latest data as at end-September 2021.  
 Source: Datastream from Refinitiv.

*U.S. and European credit markets*

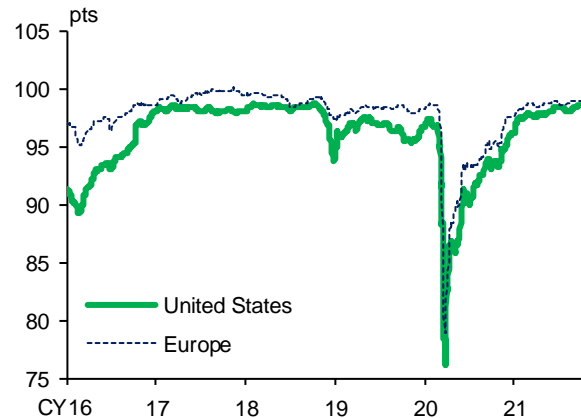
In U.S. and European credit markets, credit spreads have narrowed, particularly among high-yield bonds, partly due to expectations for economic recovery in view of the progress with vaccinations while interest rates have remained low globally and investors have continued to search for yield (Chart II-1-10). The prices of leveraged loans have generally been at around pre-pandemic levels (Chart II-1-11). Meanwhile, it has been pointed out that investors' risk-taking stance has become increasingly aggressive, as seen in, for example, an uptrend in the share of the covenant-light loans in the leveraged loan market.

**Chart II-1-10: Credit spreads on U.S. and European corporate bonds**



Note: 1. Calculated by ICE Data Indices. "IG" and "HY" indicate investment-grade corporate bonds and high-yield bonds, respectively.  
 2. Latest data as at end-September 2021.  
 Source: Bloomberg.

**Chart II-1-11: Leveraged loan prices**

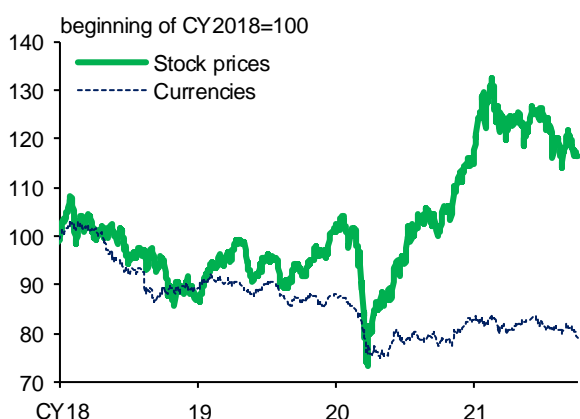


Note: 1. The figures indicate the index of leveraged loan prices in the secondary markets (the S&P/LSTA Leveraged Loan Index for the United States and the S&P European Leveraged Loan Index for Europe).  
 2. Latest data as at end-September 2021.  
 Source: Bloomberg.

### Emerging markets

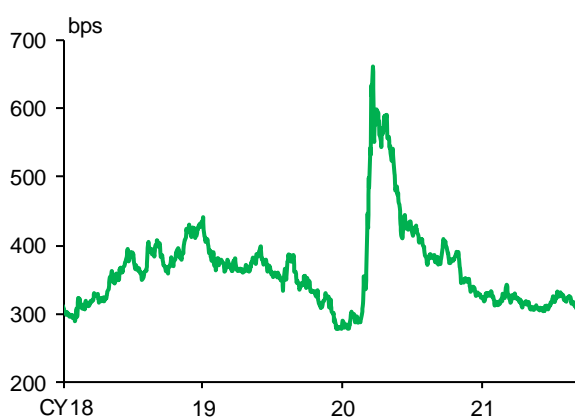
In emerging markets, although stock prices fell temporarily, partly reflecting concerns about developments in the Chinese real estate sector, they have been above pre-pandemic levels amid continuing favorable risk sentiment among investors, reflecting expectations for global economic recovery. Moreover, currencies have been stable (Chart II-1-12). Credit spreads of government bonds have generally been more or less flat (Chart II-1-13). Credit default swap (CDS) spreads have seen some dispersions across countries and regions due to factors including the differences in developments of the pandemic (Chart II-1-14). Meanwhile, bond and equity fund inflows to emerging market economies have continued (Chart II-1-15).

**Chart II-1-12: Stock prices and currencies in emerging market economies**



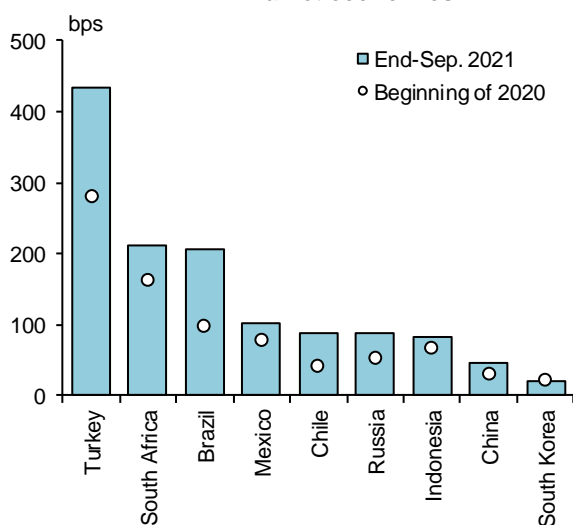
Note: 1. "Stock prices" indicates the MSCI EM Local Index.  
"Currency" indicates the J.P. Morgan EMCI Index.  
2. Latest data as at end-September 2021.  
Source: Bloomberg.

**Chart II-1-13: Credit spreads in emerging market economies**



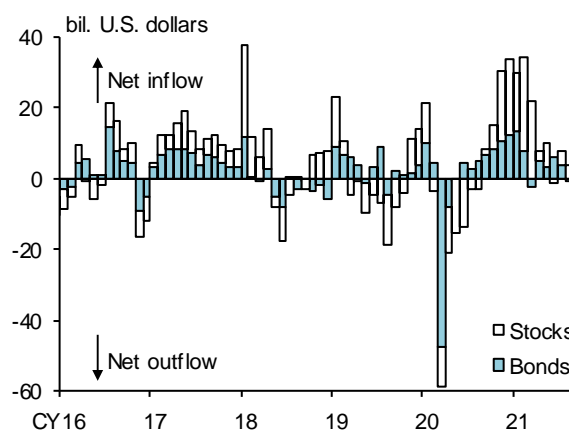
Note: 1. Yield spreads of the EMBI Global over U.S. Treasuries.  
2. Latest data as at end-September 2021.  
Source: Bloomberg.

**Chart II-1-14: CDS spreads in emerging market economies**



Source: Bloomberg.

**Chart II-1-15: Net flows in emerging market funds**



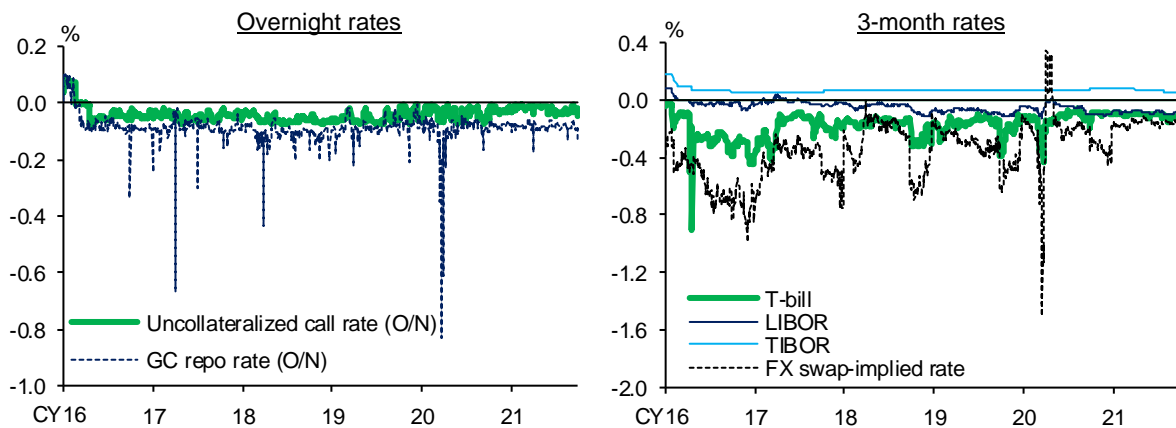
Note: Latest data as at September 2021.  
Source: EPFR Global; Haver Analytics.

## B. Japanese financial markets

### Short- and long-term interest rates

Short-term interest rates on both overnight and term instruments have been in negative territory on the whole (Chart II-2-1). Under QE with Yield Curve Control, the slope of the yield curve for JGBs has been in line with the current guideline for market operations, in which the short-term policy interest rate is set at minus 0.1 percent and the target level of 10-year JGB yields is around 0 percent (Charts II-2-2 and II-2-3).

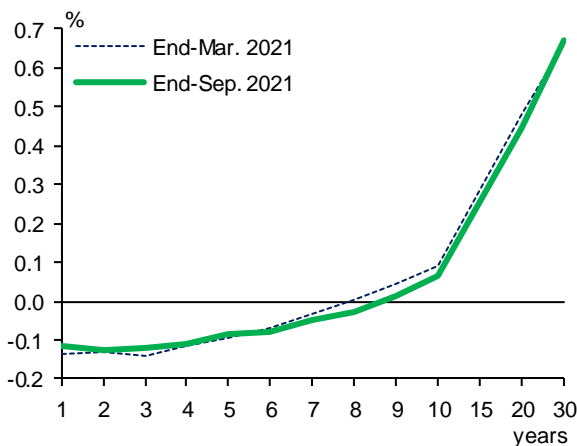
**Chart II-2-1: Short-term rates**



- Note: 1. In the left-hand chart, the horizontal axis indicates the starting date of transaction settlement. Up to April 27, 2018, "GC repo rate (O/N)" indicates the T/N rate.  
 2. In the right-hand chart, "FX swap-implied rate" is estimated based on the U.S. dollar LIBOR and FX swap (forward spread).  
 3. In both charts, the latest data are as at end-September 2021.

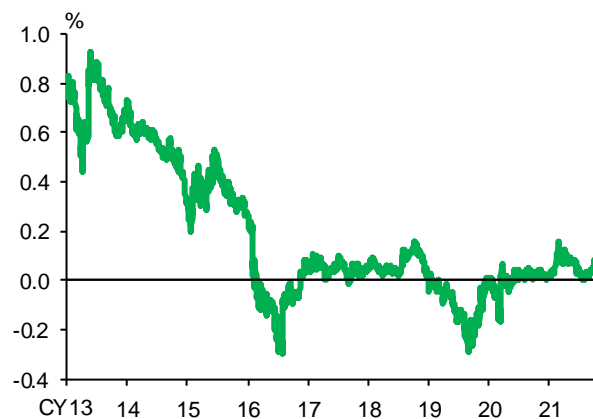
Source: Bloomberg; Japan Bond Trading; JSDA; BOJ.

**Chart II-2-2: JGB yield curves**



Source: Bloomberg.

**Chart II-2-3: 10-year JGB yields**



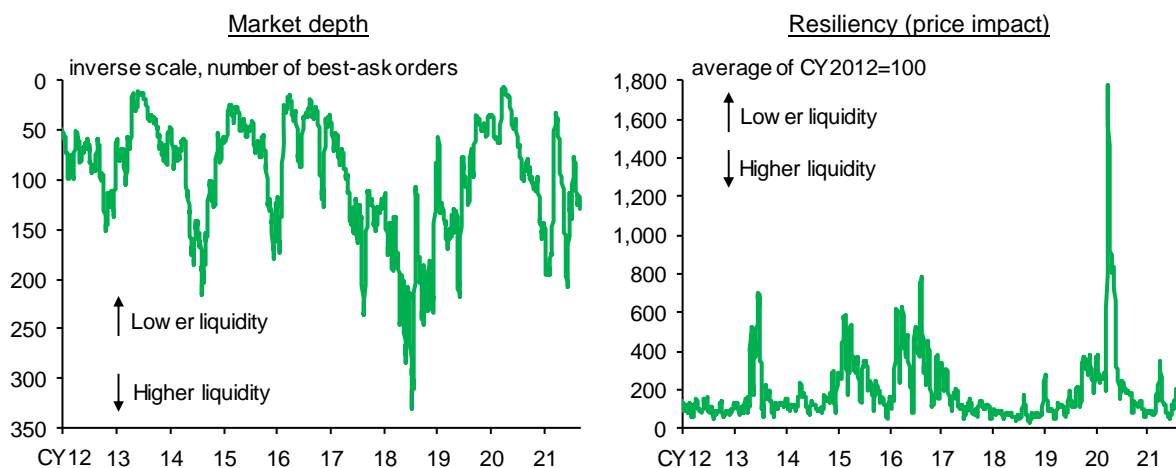
Note: Latest data as at end-September 2021.  
 Source: Bloomberg.

II. Risks observed in financial and capital markets  
 B. Japanese financial markets

*Liquidity and functioning of JGB markets*

The liquidity and functioning of JGB markets have recovered from the state of significant deterioration observed around spring 2020. Liquidity indicators of market depth and resiliency have been improving continuously (Chart II-2-4).<sup>2</sup> Inter-dealer transaction volume for cash JGBs has remained at a low level with some fluctuations (Chart II-2-5). Meanwhile, according to the latest *Bond Market Survey* (August 2021), the diffusion index for the degree of bond market functioning from the surveyed institutions' viewpoint has seen improvement, although it is still in deep negative territory (Chart II-2-6).

**Chart II-2-4: Market depth and resiliency in JGB futures markets**

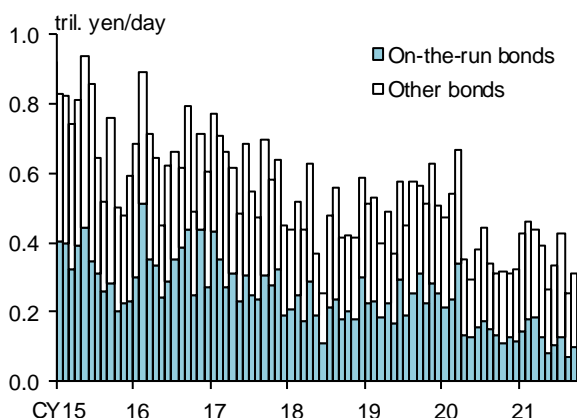


Note: 1. In the left-hand chart, the figures are the number of orders at the best-ask price with 1-minute frequency (median for each business day). In the right-hand chart, the figures indicate the price change per unit volume of transactions for each business day.

2. 10-day backward moving averages. Latest data as at end-August 2021.

Source: Nikkei Inc., "NEEDS."

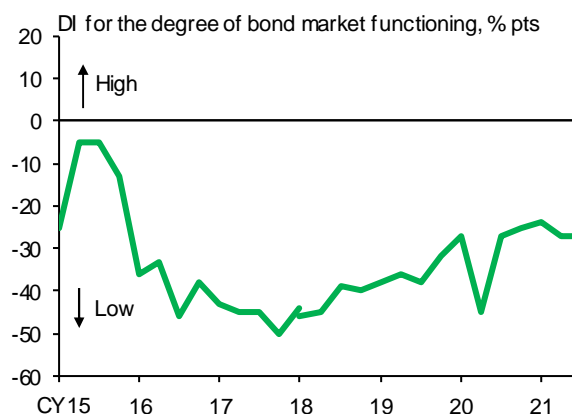
**Chart II-2-5: Transaction volume in JGB markets**



Note: Inter-dealer transaction volume for cash JGBs (2-, 5-, 10-, 20-, 30-, and 40-year JGBs) via Japan Bond Trading. Latest data as at September 2021.

Source: Japan Bond Trading; QUICK.

**Chart II-2-6: Bond market survey**



Note: 1. Based on the proportion of responding institutions selecting a given choice, the DI is calculated as follows: DI for the degree of current bond market functioning = "high" - "low."

2. The data from February 2018 onward cover major institutional investors. Latest data are based on the August 2021 survey.

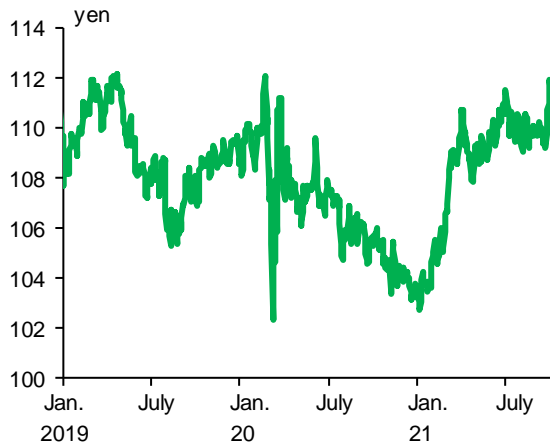
Source: BOJ, "Bond market survey."

<sup>2</sup> For details, see the Bank of Japan's website (<https://www.boj.or.jp/en/paym/bond/index.htm/#p02>). The Financial Markets Department of the Bank generally updates and releases liquidity indicators of the JGB markets on a quarterly basis.

*FX markets and stock and credit markets*

In FX markets, the yen has been in the range of 107-112 yen against the U.S. dollar (Chart II-2-7).

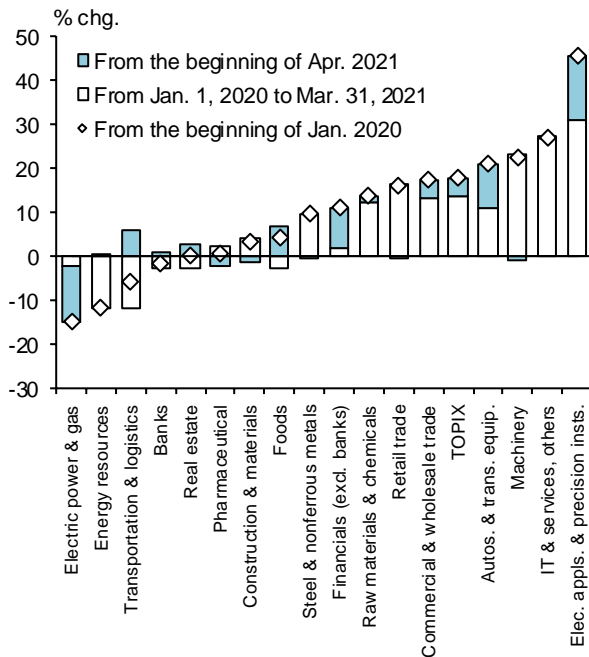
**Chart II-2-7: U.S. dollar/yen rates**



Note: Latest data as at end-September 2021.  
Source: Bloomberg.

Japanese stock prices had exhibited sluggish movements compared to those in the United States and Europe through late August. However, they have risen thereafter, mainly reflecting corrections to undervaluation of Japanese stock prices compared to their U.S. and European counterparts, with the confirmed new cases of COVID-19 starting to decline (Charts II-1-1 and II-1-6). From the beginning of April 2021, stock prices have risen in a wide range of sectors (Chart II-2-8). The expected EPS for Japanese firms has been increasing (Chart II-1-9). Against this background, the P/E ratios for Japanese firms have declined and been at the levels of the long-term average (Chart II-1-6). Meanwhile, credit spreads of corporate bonds and issuance rates for CP have been almost flat (Charts II-2-9 and II-2-10).

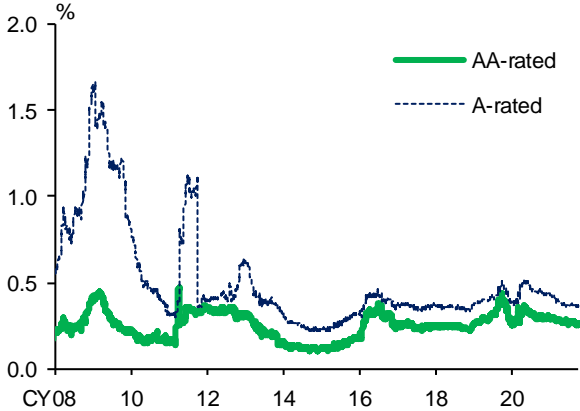
**Chart II-2-8: Japanese stock price performance by sector**



Note: Latest data as at end-September 2021.  
Source: Bloomberg.

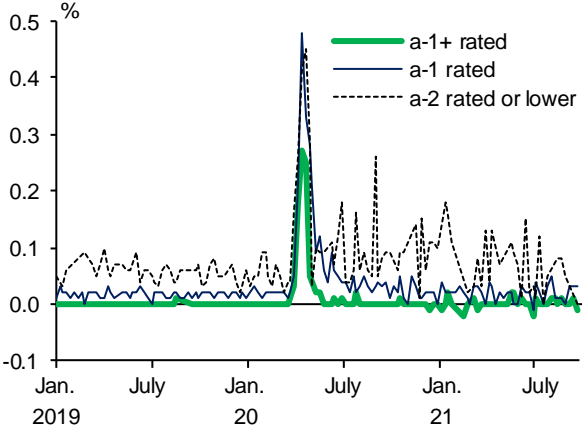
II. Risks observed in financial and capital markets  
 B. Japanese financial markets

**Chart II-2-9: Credit spreads on corporate bonds**



Note: 1. Yield spreads of corporate bonds with remaining maturity of 3 or more years but less than 7 years over government bonds. Rated by R&I.  
 2. Latest data as at end-September 2021.  
 Source: Bloomberg; JSDA; QUICK.

**Chart II-2-10: CP issuance rates**



Note: 1. Average rates of issuance for CP issued by business companies with remaining maturity of 3 months. In principle, rated by R&I.  
 2. Latest data as at September 24, 2021 (weekly data).  
 Source: JASDEC.



### III. Examination of financial intermediation

- This chapter examines developments in financial intermediation in Japan, mostly based on information that was available in the first half of fiscal 2021.

#### Financial intermediation by financial institutions

- Japanese financial institutions have actively fulfilled the functioning of financial intermediation and the outstanding amount of private financial institutions' domestic loans has greatly exceeded pre-pandemic levels. Under these circumstances, firms' increased needs for funds, including precautionary demand due to the pandemic, have started to calm down on the whole, and large firms in particular have been repaying their cash reserves.
- Overseas loans have been declining as firms have continued to raise funds through corporate bonds, etc., under favorable market funding conditions and major banks are increasingly cutting back on less profitable loans.
- As for securities investment, major banks' holdings of both yen-denominated and foreign bonds have been more or less flat. Regional financial institutions have been increasing their holdings of investment trusts, aiming to increase their interest and dividend income. The outstanding amount of overseas credit products held by Japanese financial institutions is unchanged.

#### Financial intermediation by non-bank financial intermediaries

- Life insurance companies have continued to invest in super-long-term JGBs. Pension funds have continued to invest in foreign securities while rebalancing their portfolios in response to rising stock prices. Meanwhile, Japanese investment trusts have continued to see steady inflows.

#### Financial cycle and vulnerability

- In the current heat map, five out of the 14 Financial Activity Indexes (FAIXs) are "red," which signals a large upward deviation from the trend. The red FAIXs do not signal overheating of financial activities but represent vigorous financial intermediation activities to underpin firms' operating liquidity as a result of, for example, measures to support corporate financing.

## A. Financial intermediation by financial institutions

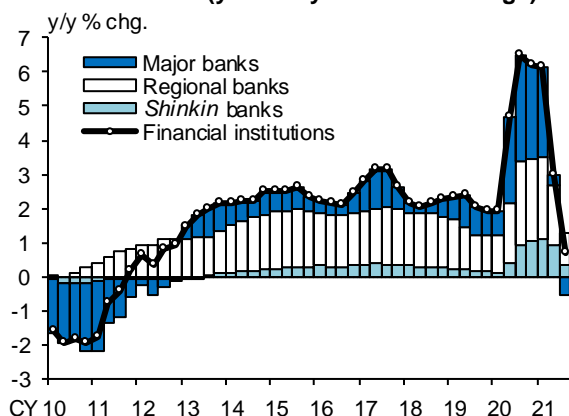
### 1. Domestic loans

Although the outstanding amount of private financial institutions' domestic loans has greatly exceeded pre-pandemic levels, its annual growth rate has fallen since the start of fiscal 2021 (Charts III-1-1 and III-1-2).

Firms' increased needs for funds, including precautionary demand due to the pandemic, have started to calm down on the whole. By type of borrower, the annual growth rate of loans outstanding to large and medium-sized firms has turned negative as large firms in particular have been repaying their cash reserves. While the annual growth rate of loans outstanding to small firms has slowed, it has remained positive, partly reflecting a remaining need for funds on the whole (Charts III-1-3 and III-1-4). Loans to individuals have continued to grow at a slow pace.

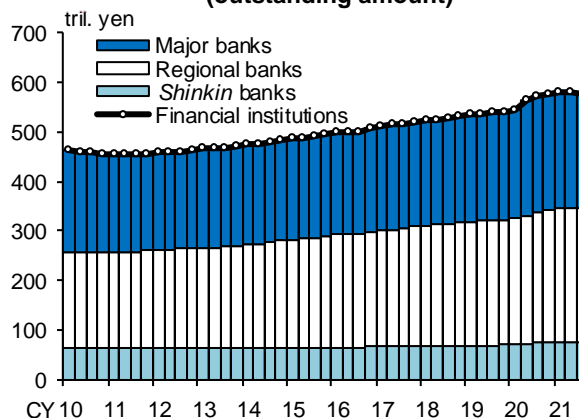
Meanwhile, the lending stance of financial institutions continues to be active (Chart III-1-4).

**Chart III-1-1: Domestic loans outstanding among financial institutions (year-on-year rate of change)**



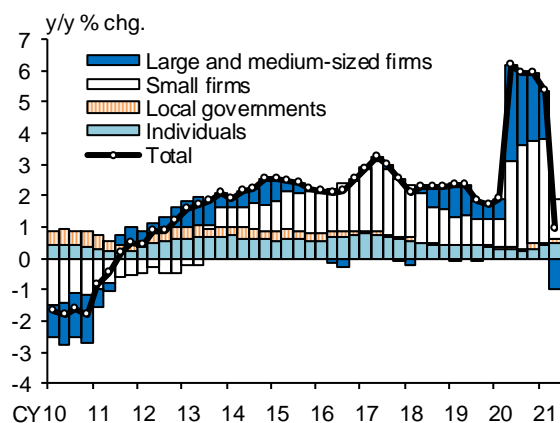
Note: Latest data as at the July-September quarter of 2021.  
 Source: BOJ, "Principal figures of financial institutions."

**Chart III-1-2: Domestic loans outstanding among financial institutions (outstanding amount)**



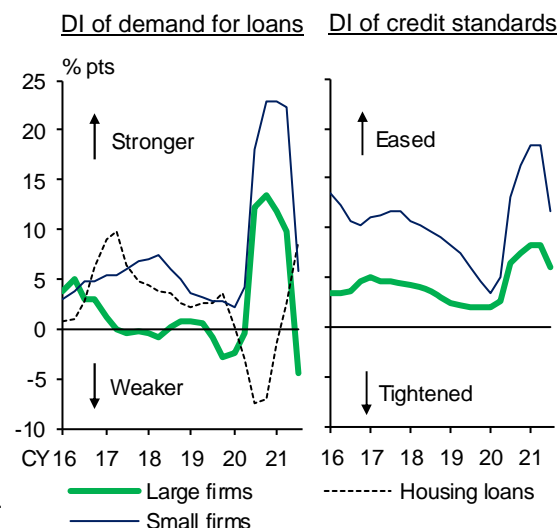
Note: Latest data as at the July-September quarter of 2021.  
 Source: BOJ, "Principal figures of financial institutions."

**Chart III-1-3: Loans outstanding among financial institutions by type of borrower**



Note: Loans to banks and insurance companies are excluded.  
 Latest data as at end-June 2021.  
 Source: BOJ.

**Chart III-1-4: Survey on bank lending practices at large Japanese banks**



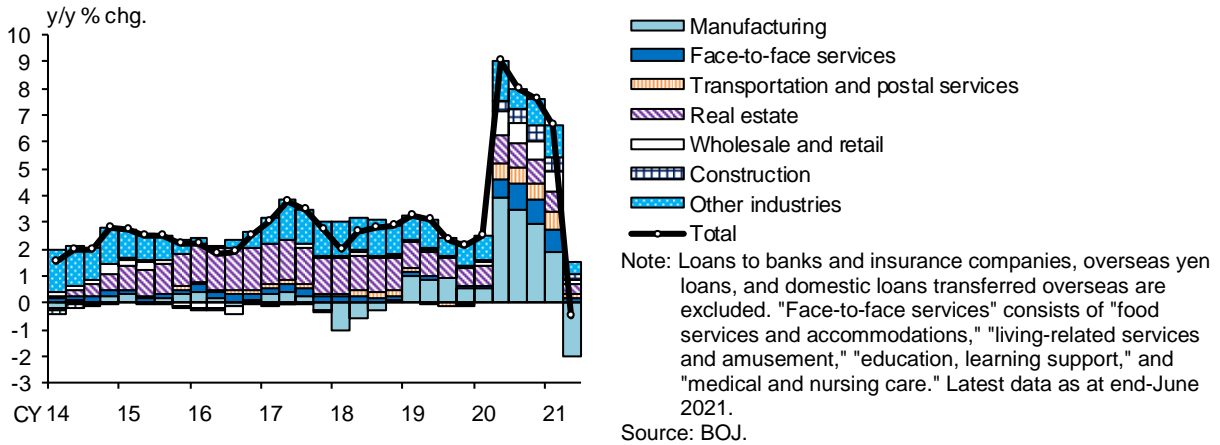
Note: 4-quarter backward moving averages. Latest data as at July 2021.

Source: BOJ, "Senior loan officer opinion survey on bank lending practices at large Japanese banks."

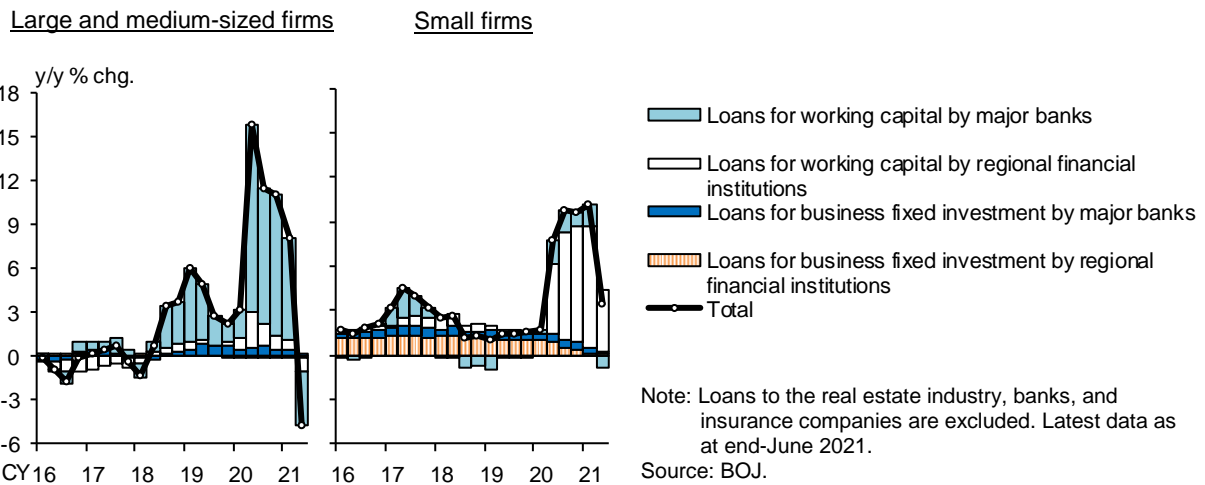
### Developments in loans by type of borrower

While the annual growth rate of loans to manufacturing firms has turned negative, that to non-manufacturing firms has remained positive (Chart III-1-5). By type of loan, the annual growth rate of loans for working capital has turned negative for large and medium-sized firms, while it has remained positive for small firms. The pace of increase in loans for business fixed investment has decelerated (Chart III-1-6).

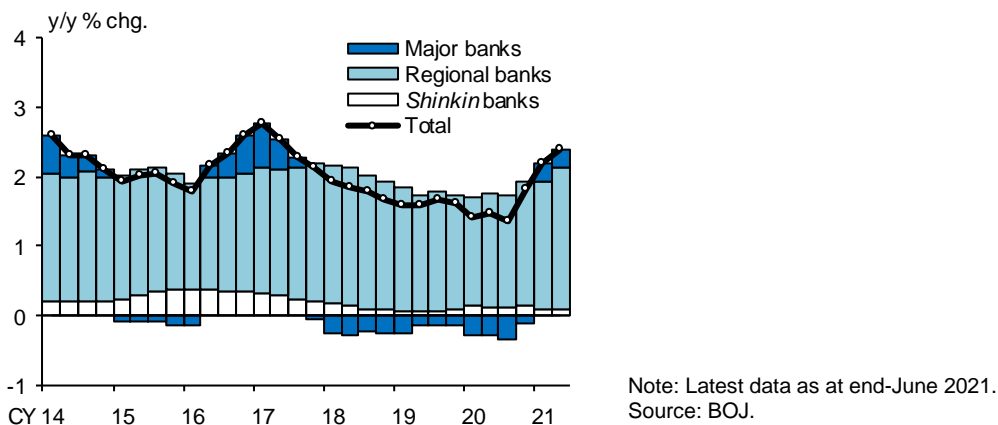
**Chart III-1-5: Banks' corporate loans outstanding by industry**



**Chart III-1-6: Corporate loans outstanding by size of firm and type of loan**



**Chart III-1-7: Outstanding amount of housing loans among financial institutions**



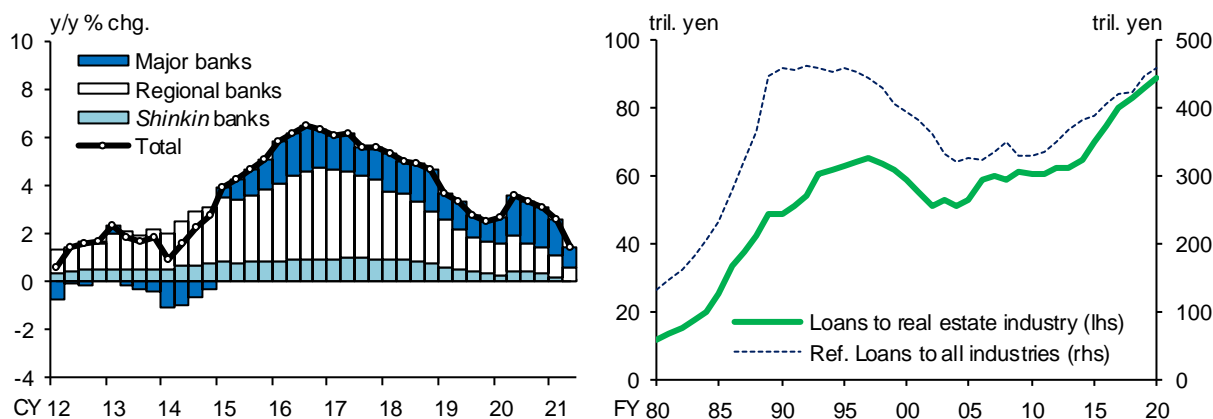
With regard to loans to individuals, the annual growth rate of housing loans -- which account for a large share of loans to individuals -- has increased somewhat, due in part to pent-up demand (Charts III-1-4 and III-1-7).

### Developments in real estate loans

Although the outstanding amount of loans to the real estate industry has continued to grow, the year-on-year rate of increase has become smaller (Chart III-1-8). The outstanding amount of loans to the real estate industry by domestically licensed banks remained at a record high of about 89 trillion yen as of the end of March 2021.

Meanwhile, with the growth of pandemic-related loans leveling off, some regional financial institutions have been focusing on lending to the real estate industry to increase their total outstanding amount of loans.

**Chart III-1-8: Real estate loans among financial institutions**

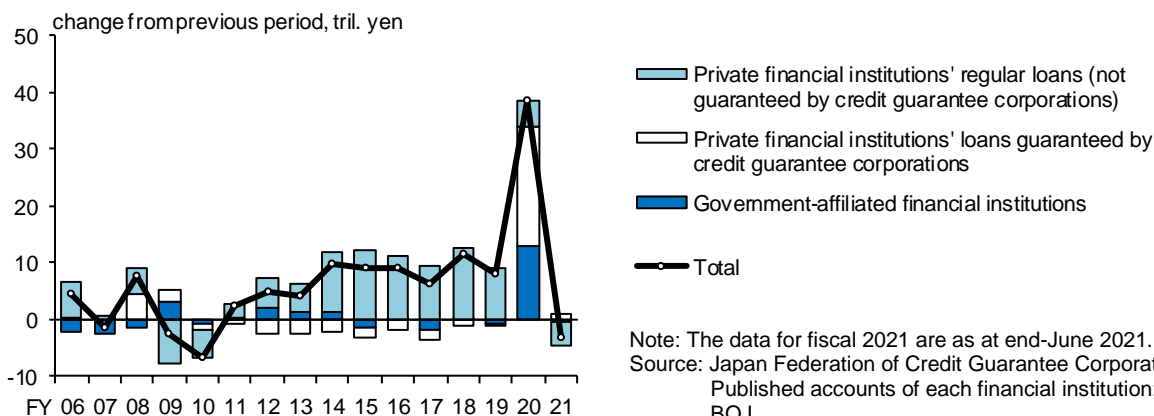


Note: 1. The right-hand chart covers domestically licensed banks only to extend the time scale.  
2. In the left-hand chart, the latest data are as at end-June 2021. In the right-hand chart, the latest data are as at end-March 2021.  
Source: BOJ.

### Developments in public financing support

Public financing support -- defined as the sum of loans by private financial institutions guaranteed by credit guarantee corporations and loans by government-affiliated financial institutions -- expanded substantially in fiscal 2020 and has been more or less flat in fiscal 2021 (Chart III-1-9).

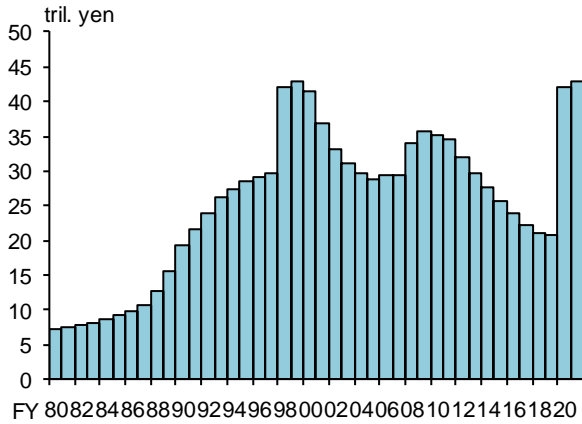
**Chart III-1-9: Corporate loans outstanding by government-affiliated and private financial institutions**



Note: The data for fiscal 2021 are as at end-June 2021.  
Source: Japan Federation of Credit Guarantee Corporations; Published accounts of each financial institution; BOJ.

The outstanding amount of guaranteed liabilities has reached a size comparable to that seen in financial crises in the past (Chart III-1-10).

**Chart III-1-10: Outstanding amount of guaranteed liabilities**

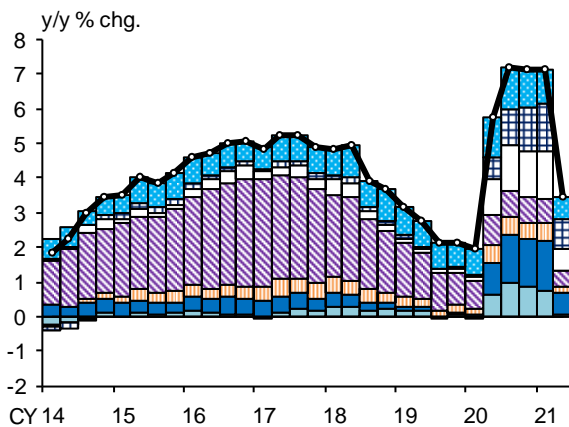


Note: The data for fiscal 2021 are as at end-July 2021.  
Source: Japan Federation of Credit Guarantee Corporations.

*Financing support for small firms by regional financial institutions*

Under the prolonged impact of COVID-19, regional financial institutions have continued to provide financing support to firms. Reflecting these efforts, loans outstanding to small firms well exceed pre-pandemic levels. However, growth in lending has clearly slowed down in a wide range of industries, including face-to-face services industries (such as food services and accommodations), due to (1) the overall low demand for additional funds, (2) the base effects of the large increase in the extension of effectively interest-free loans in the previous year, and (3) repayment of precautionary funds by some firms, particularly in the manufacturing industry (Chart III-1-11).

**Chart III-1-11: Regional banks' loans outstanding to small firms by industry**



Note: Loans to banks and insurance companies are excluded. "Face-to-face services" consists of "food services and accommodations," "living-related services and amusement," "education, learning support," and "medical and nursing care." Latest data as at end-June 2021.  
Source: BOJ.

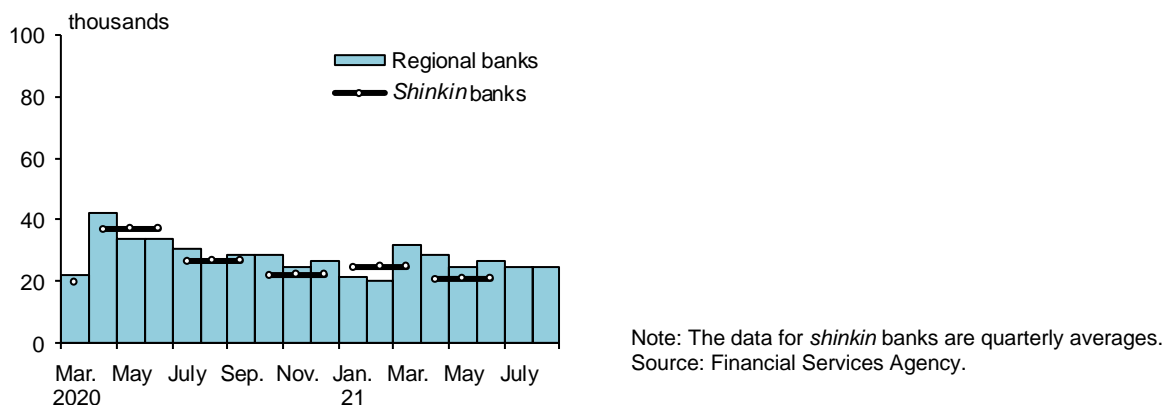
Although some firms strongly affected by the pandemic have been experiencing tight financing, there has been no notable increase in applications for additional loans or changes in the terms and conditions of loans at present (Chart III-1-12). Meanwhile, regional financial institutions have been providing various types of support to firms in their core business, such as support for business restructuring, including responses to structural changes expected for the post-COVID-19 era.

While the number of bankruptcies, default rates, and the subrogation rate have generally remained at low levels, the default rate in the food services and accommodations industry has been rising

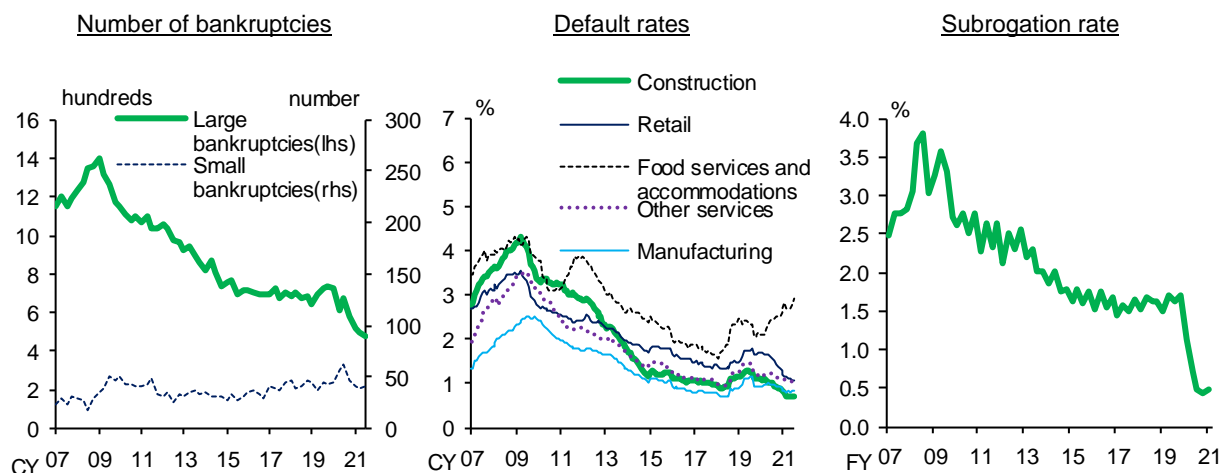
III. Examination of financial intermediation  
A. Financial intermediation by financial institutions

somewhat compared to a while ago (Chart III-1-13).<sup>3</sup> Current levels overall are well below those before the pandemic, partly owing to fiscal and financial support. However, with the repayment of pandemic-related loans, including effectively interest-free loans, starting to gather pace, it is necessary to carefully examine whether borrower firms, including those severely affected by the pandemic, have secured sufficient debt repayment capacity.

**Chart III-1-12: Number of applications for a change in the terms and conditions of SME loans**



**Chart III-1-13: Developments in bankruptcies, default rates, and subrogation rate**



Note: 1. In the left-hand chart, "Large bankruptcies" and "Small bankruptcies" indicate above and below 10 million yen of total debt, respectively.  
2. In the right-hand chart, the subrogation rate is calculated as the annualized amount of subrogation divided by the total amount of credit guarantees.  
3. The latest data in the left-hand chart are as at July-September 2021(quarterly average), those in the middle chart are as at July 2021, and those in the right-hand chart are as at April-June 2021.  
Source: Japan Federation of Credit Guarantee Corporations; The Risk Data Bank of Japan; Tokyo Shoko Research.

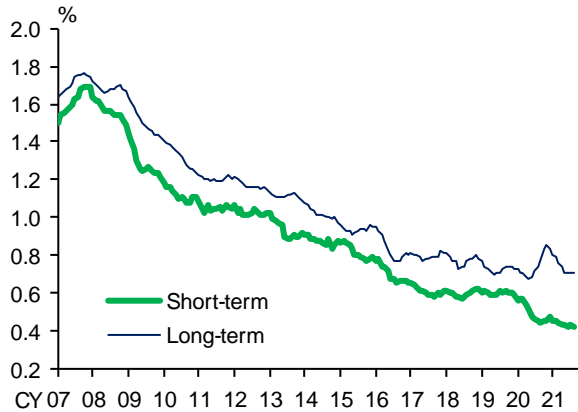
### Developments in loan interest rates

Financial institutions' average contract interest rates on new loans and discounts have been hovering around record low levels. Against this backdrop, the long-term average contract interest rate on new loans has been declining recently, mainly due to the termination at the end of May 2021 of the extension of effectively interest-free loans, which had been pushing up interest rates

<sup>3</sup> The numbers of business closings and liquidations have also generally been low to date. According to the business register statistics of the Ministry of Justice, the number of business closures since the start of fiscal 2021 is down by around 5 percent on a year-on-year basis.

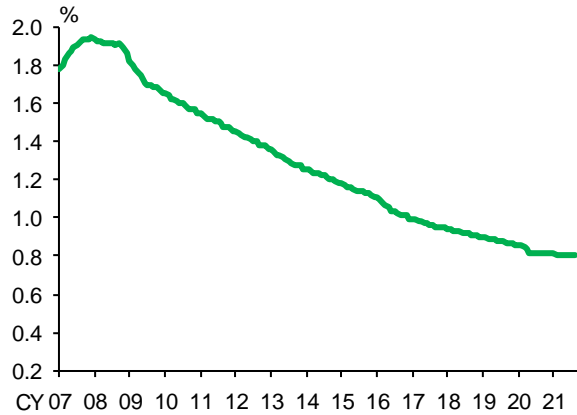
(Chart III-1-14). Meanwhile, the average interest rate on loans outstanding has been more or less flat (Chart III-1-15).

**Chart III-1-14: Average contract interest rates on new loans and discounts among domestically licensed banks**



Note: 6-month backward moving averages. Latest data as at August 2021.  
Source: BOJ, "Average contract interest rates on loans and discounts."

**Chart III-1-15: Average contract interest rates on outstanding loans and bills discounted among domestically licensed banks**

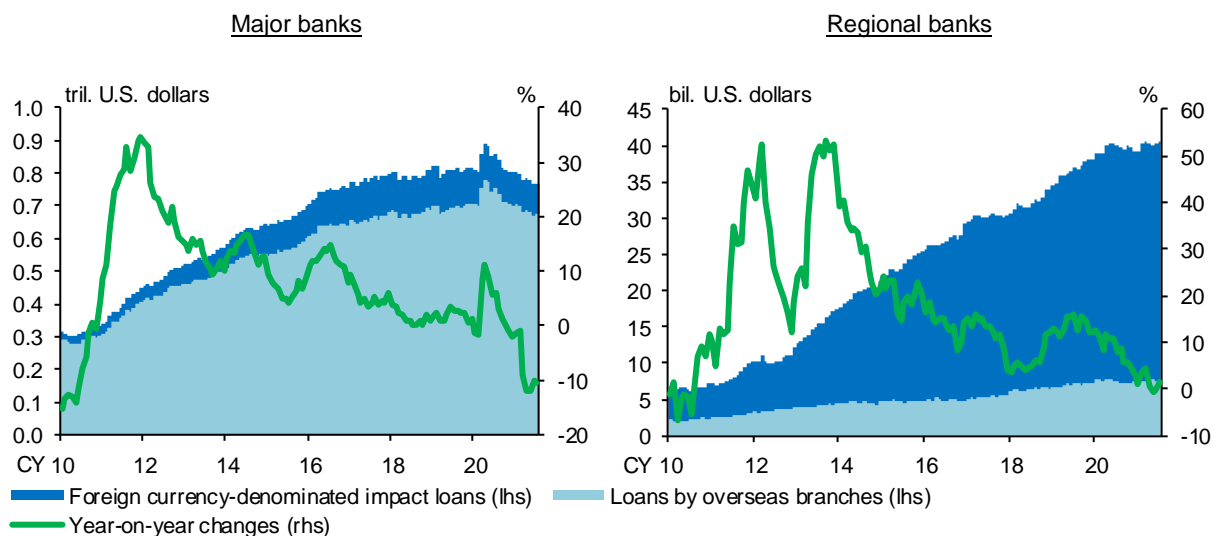


Note: Latest data as at August 2021.  
Source: BOJ, "Average contract interest rates on loans and discounts."

## 2. Overseas loans

Overseas loans, which temporarily increased substantially in spring 2020, mainly due to precautionary borrowing by U.S. firms to secure cash reserves, have been declining and are now below pre-pandemic levels (Chart III-1-16). The current decline in overseas loans by major banks is attributed to the fact that firms are repaying bank loans they borrowed for precautionary purposes, continuing to raise funds through corporate bonds, etc., under favorable market funding conditions, and that major banks are increasingly cutting back on less profitable loans.

**Chart III-1-16: Overseas loans outstanding among banks**

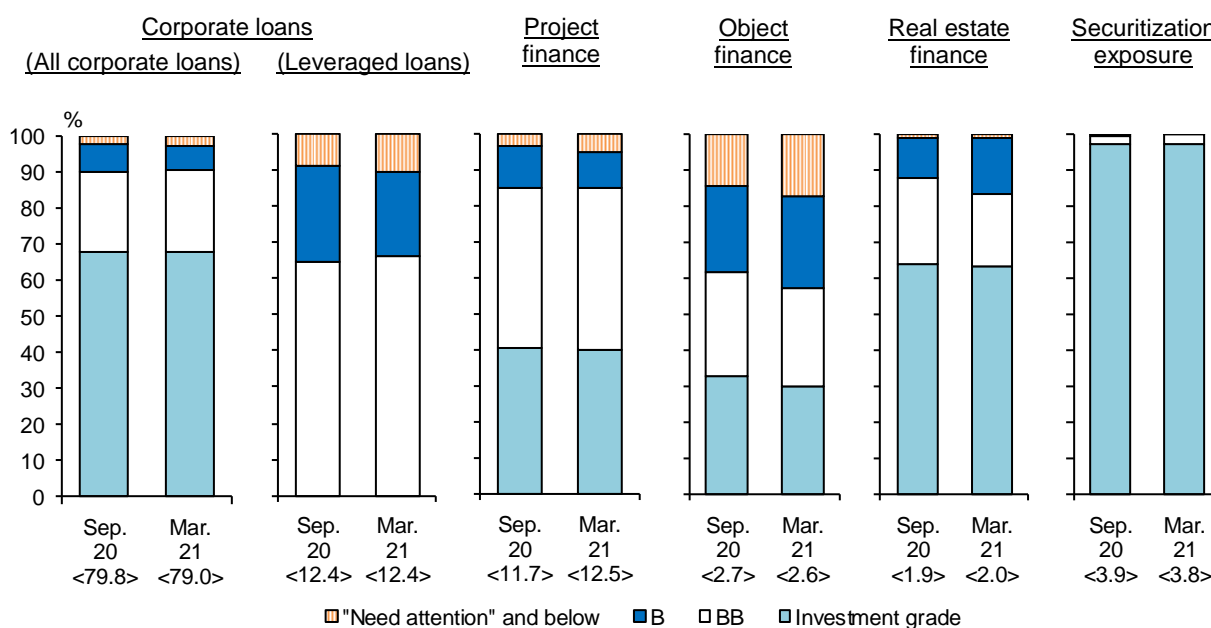


Note: 1. "Loans by overseas branches" includes parts of foreign currency-denominated impact loans in accounts held by overseas branches. "Foreign currency-denominated impact loans" indicates banks' foreign currency-denominated loans to residents. "Year-on-year changes" represents the growth rate of the sum of "Loans by overseas branches" and "Foreign currency-denominated impact loans."  
2. On a non-consolidated basis. Latest data as at end-July 2021.

Source: BOJ.

Looking at the rating composition of overseas loans, there have not been any significant changes for corporate loans, which account for about 80 percent of total overseas loans, compared to the end of September 2020, and the quality of loan portfolios has remained high overall (Chart III-1-17). Moreover, the rating composition of leveraged loans, which carry relatively high risk, is also largely unchanged as downgrades have come to a halt. Turning to products other than corporate loans, the proportion of object finance loans with a low rating has increased somewhat, especially among aircraft finance loans, reflecting the prolonged impact of the pandemic, although the share of object finance loans in the total amount of overseas loans is limited. Continued attention needs to be paid to developments especially in industries and products that are susceptible to the pandemic, and to the impact of these developments on credit costs.

**Chart III-1-17: Composition of overseas loans by type of product and credit rating among large financial institutions**



Note: 1. "Large financial institutions" includes major banks, Japan Post Bank, and a central organization of financial cooperatives. The data are as at month-end.

2. The figures in brackets indicate the share of the respective product types at each point in time.

Source: BOJ.

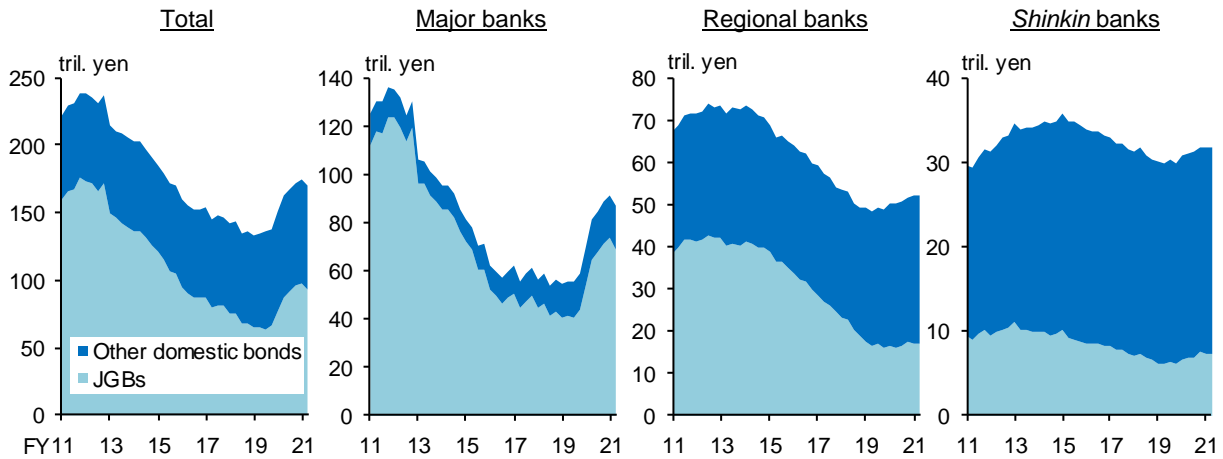
### 3. Securities investment

Financial institutions' holdings of yen-denominated bonds, including JGBs, municipal bonds, and corporate bonds, have been more or less flat, as yen interest rates have been low on the whole (Chart III-1-18). The holdings of major banks are generally unchanged, with increases and decreases observed in their holdings of treasury discount bills (T-Bills) depending, for example, on their current account deposit balances at the Bank of Japan and demand for collateral. While the amount of regional financial institutions' holdings of these securities is more or less unchanged, they have been shifting their portfolios to super-long-term JGBs and yen-denominated bonds other than JGBs by reinvesting their redeemed JGB holdings.

Holdings of foreign bonds (calculated in yen terms) have remained more or less flat (Chart III-1-19). Major banks have been selling and buying foreign bonds in response to developments in overseas interest rates, and their holdings of foreign bonds are essentially unchanged on the whole. Regional financial institutions' holdings are more or less unchanged, partly because some institutions held back on investing due to the decline in U.S. interest rates.



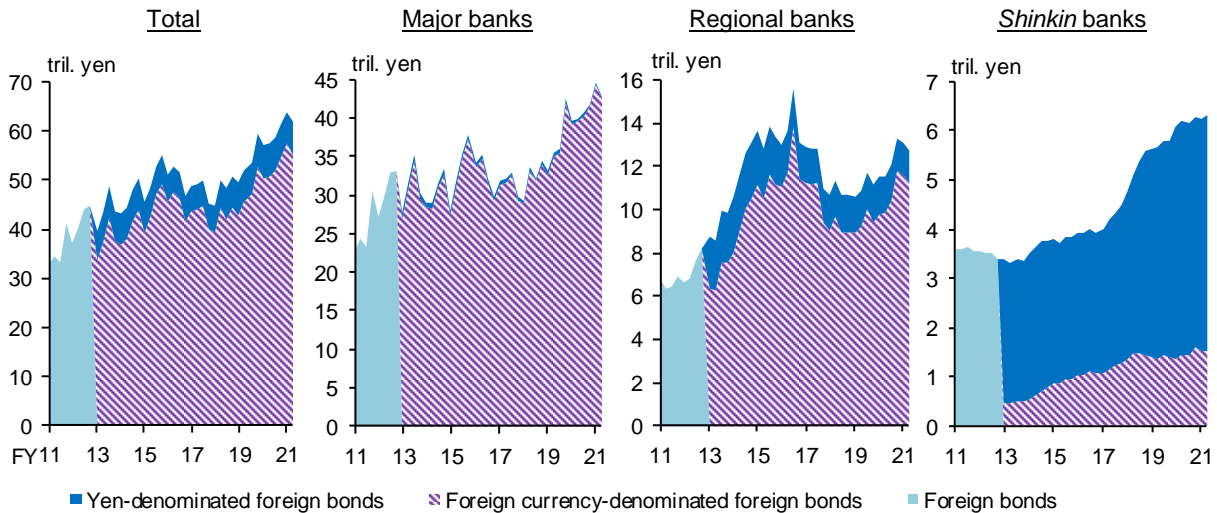
**Chart III-1-18: Outstanding amount of yen-denominated bonds among financial institutions**



Note: The data are the sum of figures for domestic and overseas branches, based on the outstanding amount at month-end. Latest data as at end-August 2021.

Source: BOJ.

**Chart III-1-19: Outstanding amount of foreign bonds among financial institutions**

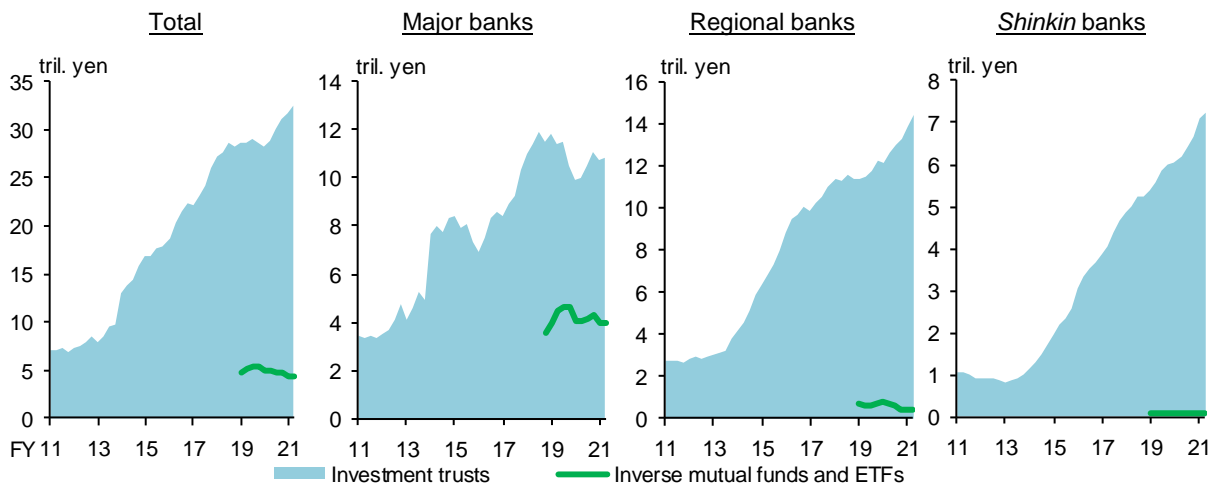


Note: 1. "Foreign bonds" is the sum of figures for "Foreign currency-denominated foreign bonds" and "Yen-denominated foreign bonds".

2. The data are the sum of figures for domestic and overseas branches, based on the outstanding amount at month-end. Latest data as at end-August 2021.

Source: BOJ.

**Chart III-1-20: Outstanding amount of investment trusts among financial institutions**



Note: 1. The data include some securities other than investment trusts.

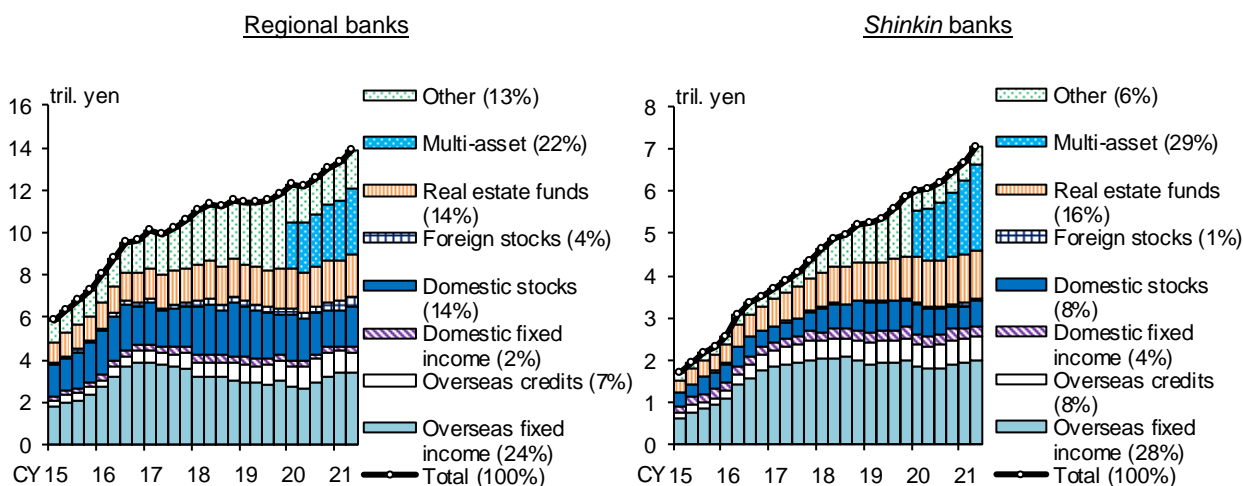
2. The data are the sum of figures for domestic and overseas branches, including domestic and foreign investment trusts, based on the outstanding amount at month-end. Latest data as at end-August 2021.

Source: BOJ.

III. Examination of financial intermediation  
 A. Financial intermediation by financial institutions

Financial institutions' holdings of investment trusts have increased, led by regional financial institutions (Chart III-1-20). While major banks increased their holdings of stock investment trusts through the end of fiscal 2020 amid the global rise in stock prices, their holdings have decreased somewhat since the beginning of fiscal 2021 due to sales to lock in gains. Regional financial institutions, on the other hand, have been increasing their holdings, mainly of multi-asset and overseas fixed income investment trusts, aiming to increase their interest and dividend income (Chart III-1-21).

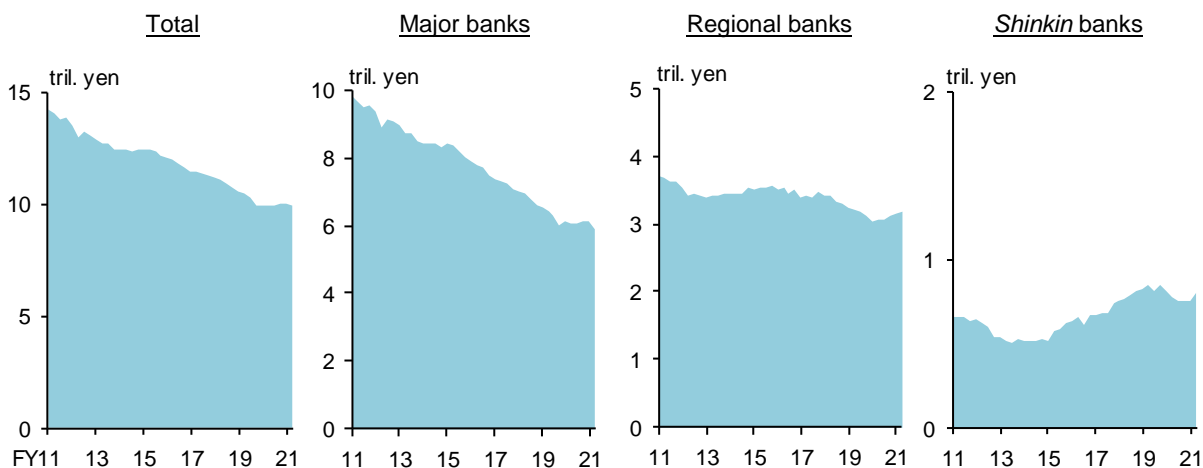
**Chart III-1-21: Breakdown of outstanding amount of investment trusts among regional financial institutions**



Note: 1. Based on book values. The figures in parentheses in the chart indicate the share of the respective product types in the latest period.  
 2. "Other" includes other foreign securities.  
 3. Up to end-December 2019, "Other" includes "Multi-asset."  
 4. Latest data as at end-June 2021.  
 Source: BOJ.

While financial institutions' stockholdings have followed a downward trend, they have been more or less flat recently (Chart III-1-22). Strategic stockholdings, i.e., stockholdings for the purpose of maintaining business ties with firms, have continued to fall, partly as a response to growing social interest in corporate governance. Meanwhile, some regional banks have been increasing their stockholdings for investment purposes.

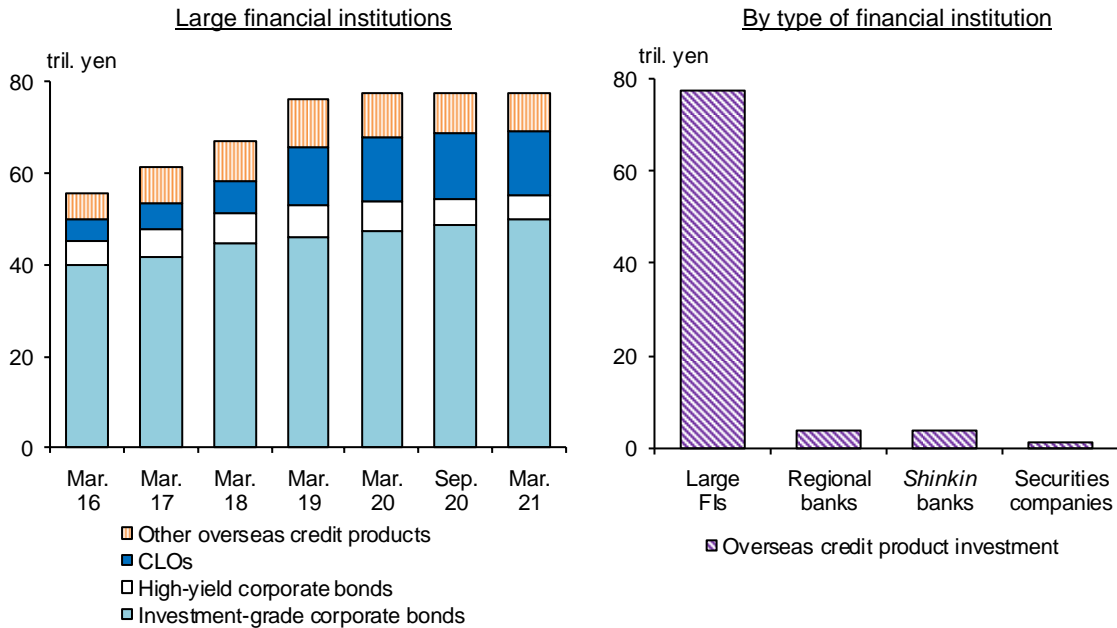
**Chart III-1-22: Outstanding amount of stockholdings among financial institutions**



Note: 1. Based on the outstanding amount on a book value basis at month-end. The data exclude foreign stockholdings.  
 2. The data for major banks are figures for domestic branches and the data for other banks are the sum of figures for domestic and overseas branches. Latest data as at end-August 2021.  
 Source: BOJ.

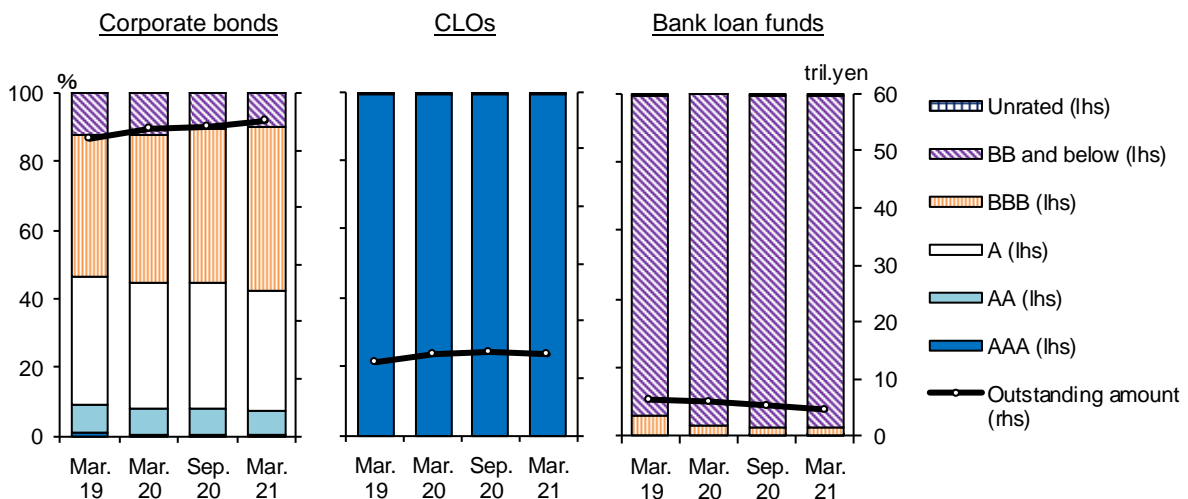
The outstanding amount of overseas credit products held by Japanese financial institutions as a whole, including Japan Post Bank and a central organization of financial cooperatives, is unchanged (Chart III-1-23). With credit spreads tightening further, a large number of financial institutions have remained cautious, partly due to concerns about the future, such as a resurgence of COVID-19. Compared to large financial institutions, regional financial institutions continue to have little exposure to overseas credit products.

**Chart III-1-23: Outstanding amount of overseas credit product investment among financial institutions**



Note: 1. "Large financial institutions" includes major banks, Japan Post Bank, and a central organization of financial cooperatives.  
 2. Data for "By type of financial institution" are as at end-March 2021.  
 Source: BOJ.

**Chart III-1-24: Composition of overseas credit product investment among large financial institutions by credit rating**



Note: Covers major banks, Japan Post Bank, and a central organization of financial cooperatives.  
 Source: BOJ.

The outstanding amount of overseas credit product investment by large financial institutions by credit rating shows no major change in the share of holdings by credit rating. No material

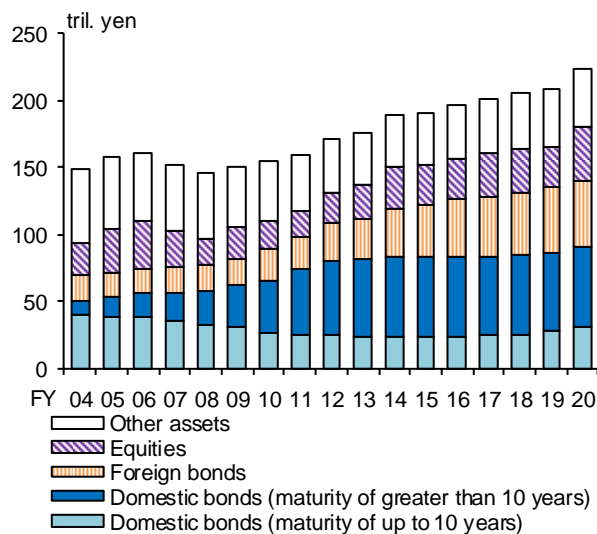
deterioration in the quality of overseas credit portfolios due to the spread of COVID-19 has been observed. The overall credit quality of large financial institutions' portfolios remains high. These institutions' holdings of securitized products, including collateralized loan obligations (CLOs), consist almost entirely of AAA-rated tranches, i.e., tranches with the highest credit rating, and about 90 percent of bond holdings consist of investment-grade bonds (BBB and above) (Chart III-1-24). That said, bonds with a BBB rating, the lowest investment-grade rating, account for just below 50 percent of total bond holdings, and some institutions hold bank loan funds, which are predominantly backed by non-investment grade (BB or below) loans.

## B. Financial intermediation by non-bank financial intermediaries

### 1. Insurance companies and pension funds

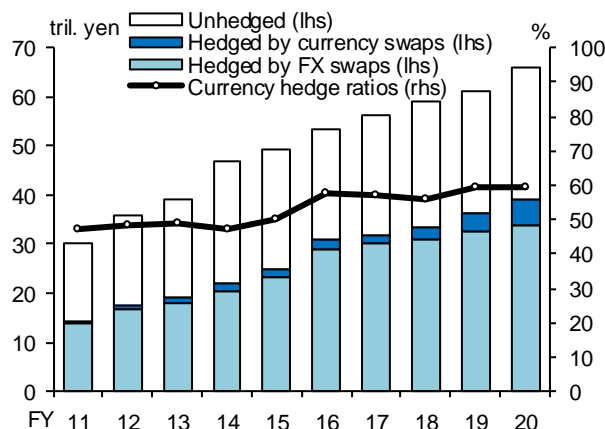
Life insurance companies have continued to invest in super-long-term JGBs in order to reduce the duration mismatch between assets and liabilities (Chart III-2-1). Regarding foreign securities, they have continued to increase their investment in hedged U.S. investment-grade bonds, etc., as hedging costs have remained low (Chart III-2-2).

**Chart III-2-1: Investment assets outstanding among life insurance companies**



Note: 1. "Other assets" includes cash and deposits, loans, investment trusts, and real estate.  
 2. Covers nine major life insurance companies.  
 Based on general accounts.  
 Source: Published accounts of each company.

**Chart III-2-2: Currency hedge ratios for foreign securities investment among life insurance companies**

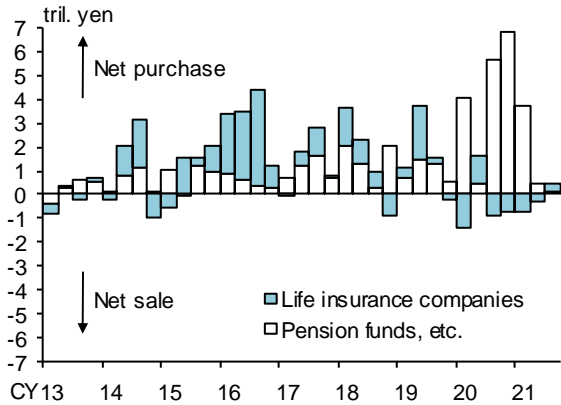


Note: Covers nine major life insurance companies.  
 Estimated based on general accounts.  
 Source: Published accounts of each company.

Pension funds have continued to invest in foreign securities while rebalancing their portfolios in response to rising stock prices (Charts III-2-3 and III-2-4). Specifically, the Government Pension Investment Fund (GPIF), which is in charge of managing the assets of public pension funds such as employees' pension funds and the national pension fund, has been continuously rebalancing its portfolio in response to changes in the market environment within the basic portfolio allocation, which was revised in April 2020 and determines the fund's portfolio share of each asset class from the perspective of safe and efficient asset management over a long-term investment horizon. Against this background, the GPIF increased the investment in foreign bonds, for which the portfolio

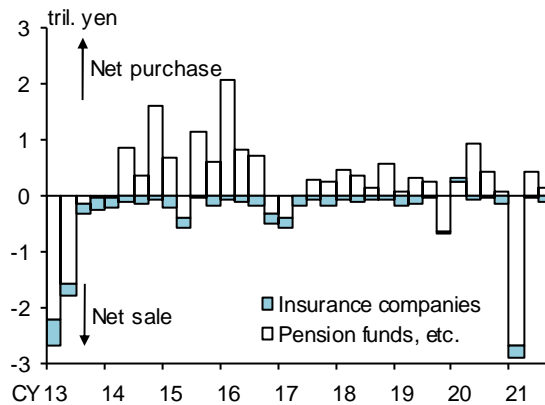
share was raised in the revision, and made some rebalancing in response to a rise in stock prices during fiscal 2020. Meanwhile, corporate pension funds have essentially maintained their existing investment stance, and similar rebalancing was seen in response to rising stock prices.

**Chart III-2-3: Medium- and long-term foreign bond investments by institutional investors**



Note: 1. "Pension funds, etc." indicates trust accounts of banks and trust banks.  
 2. Latest data as at July-August 2021.  
 Source: Ministry of Finance.

**Chart III-2-4: Stock investments by institutional investors**

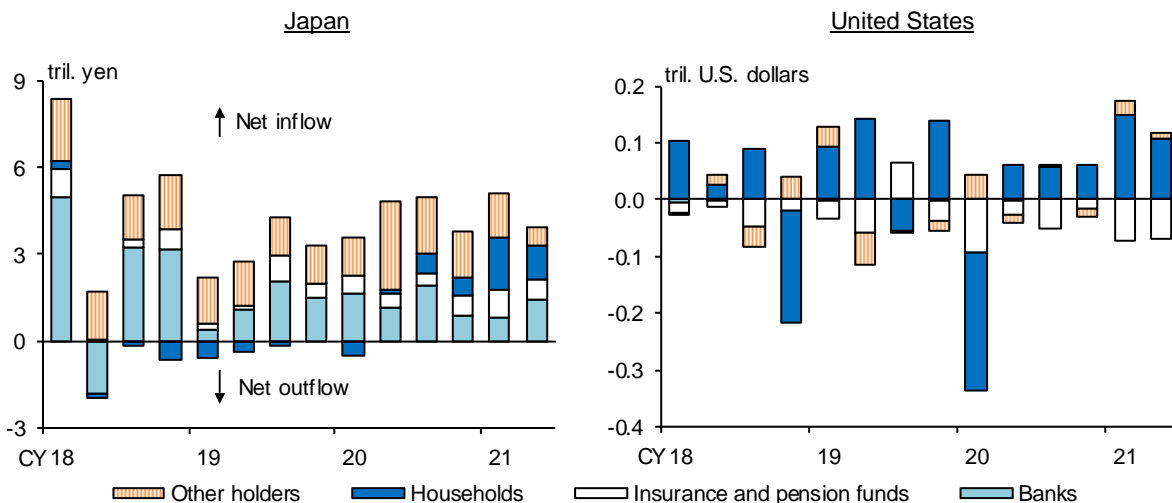


Note: 1. "Pension funds, etc." indicates banking and trust accounts of trust banks.  
 2. Latest data as at July-August 2021.  
 Source: Tokyo Stock Exchange.

## 2. Securities investment trusts

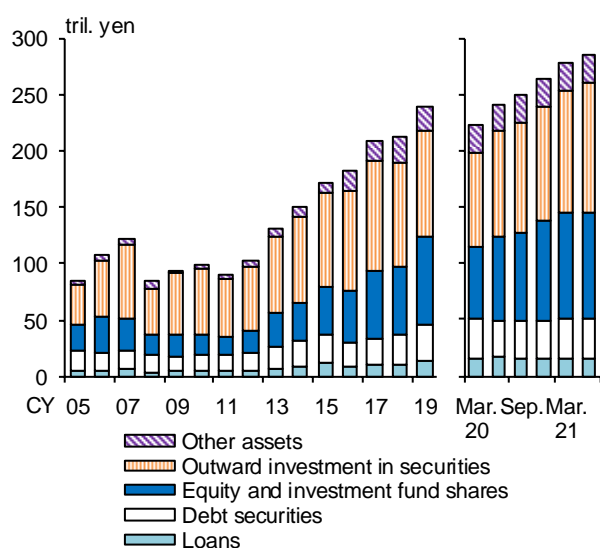
Japanese investment trusts have continued to see steady inflows, including in the first quarter of 2020, when there were large outflows of funds from their U.S. counterparts (Chart III-2-5). Although there was a period when assets under management fell substantially due to the sharp fall in the prices of stocks and other risk assets in February and March 2020, they have continued to increase, reflecting the rise in market value due to the subsequent market recovery (Chart III-2-6). By type of holder, securities investment trust holdings by households, among which stock investment trust holdings make up a large share, have seen a substantial increase (Chart III-2-7).

**Chart III-2-5: Decomposition of flows of investment trusts**



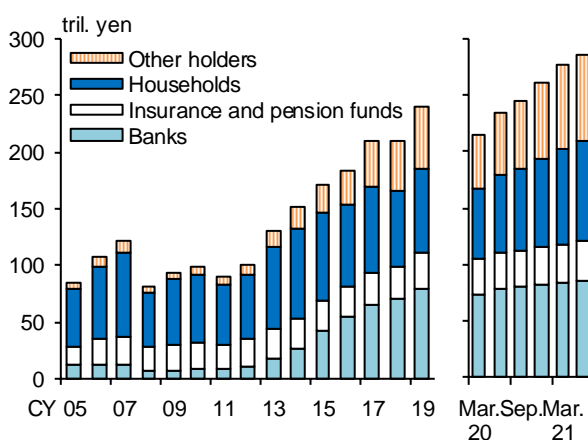
Note: 1. Covers flows of investment trust beneficiary certificates for Japan and mutual fund shares for the United States.  
 2. "Households" of the United States includes nonprofit organizations.  
 3. Latest data as at the April-June quarter of 2021.  
 Source: FRB, "Financial accounts"; BOJ, "Flow of funds accounts."

**Chart III-2-6: Investment assets outstanding among investment trusts**



Note: 1. Breakdown of investment assets held by securities investment trusts.  
 2. Latest data as at end-June 2021.  
 Source: BOJ, "Flow of funds accounts."

**Chart III-2-7: Outstanding amount of investment trusts by type of holder**



Note: 1. Breakdown of investment trust beneficiary certificates by type of holder.  
 2. Latest data as at end-June 2021.  
 Source: BOJ, "Flow of funds accounts."

## C. Financial cycle and vulnerability

### 1. Heat map

This section examines Japan's current financial cycle based on the financial intermediation activities, using the heat map and other tools. The heat map is a tool to regularly monitor and assess developments in FAIXs, comprising indicators that deviated substantially from their trend during the bubble period in the late 1980s, for the early detection of financial imbalances caused by overheating of financial activities. In the current heat map, nine out of the 14 FAIXs are "green," which signals neither overheating (a certain upward deviation from the trend) nor a contraction (a certain downward deviation from the trend), and five FAIXs are "red," which signals a large upward deviation from the trend. Specifically, the four FAIXs that were "red" in the previous issue of the *Report* -- the *growth rate of M2*, the *total credit to GDP ratio*, the *household loans to GDP ratio*, and the *real estate loans to GDP ratio* -- are still "red," and the *corporate credit to GDP ratio* newly turned "red" (Charts III-3-1, III-3-2, and III-3-3).<sup>4</sup>

Of the five FAIXs that are "red," the four FAIXs other than the *growth rate of M2* all have nominal GDP in the denominator, meaning that the fact that they are signaling "red" is largely due to developments in nominal GDP since the outbreak of COVID-19. Moreover, all five relate to credit or money, and the fact that they are signaling "red" likely also reflects the proactive implementation

<sup>4</sup> In Chart III-3-1, the colors represent the following: (1) red indicates that an indicator is above its upper threshold; (2) blue indicates that an indicator is below its lower threshold; (3) green indicates no signs of either extreme; and (4) white indicates that no data for that period are available. For details on the FAIXs, see Ito, Y., Kitamura, T., Nakamura, K., and Nakazawa, T., "New Financial Activity Indexes: Early Warning System for Financial Imbalances in Japan," Bank of Japan Working Paper, no. 14-E-7, April 2014.

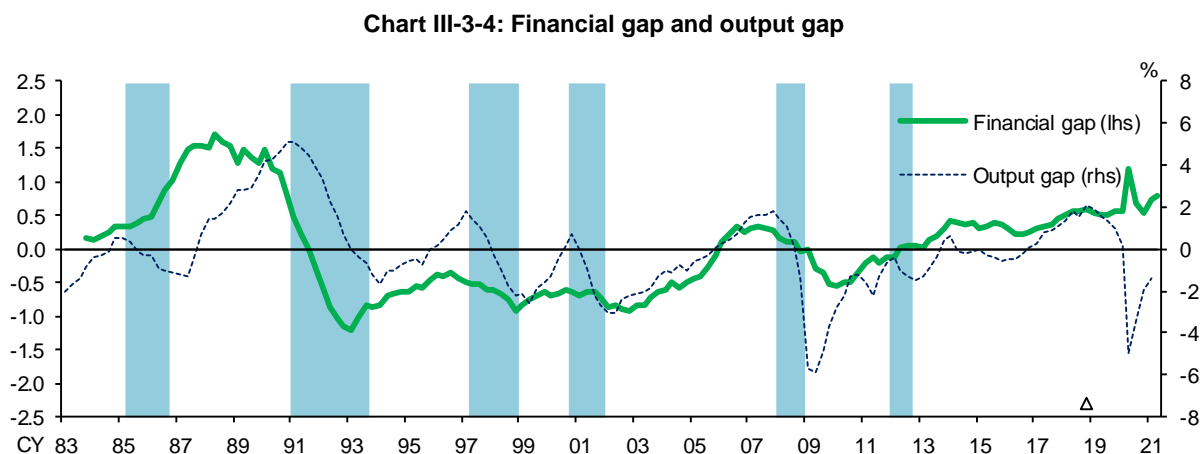


stalls and the *total credit to GDP ratio* remains "red" for a protracted period, increased vigilance will be required with regard to the risk of financial imbalances building up.<sup>5</sup>

As indicated in previous issues of the *Report*, since before the outbreak of COVID-19, financial institutions have been actively taking risks mainly in (1) lending to middle-risk firms, (2) lending to rental real estate businesses, and (3) lending to high-leverage projects such as large-scale M&A deals. As a result, credit growth has outpaced economic growth, and in this situation, lending to low-return borrowers, for which the loan interest rate is not necessarily high enough to cover the credit risk, is on an uptrend. It is necessary to closely monitor how the spread of COVID-19 and the resultant increase in lending will affect existing vulnerabilities. (As for developments in the real estate market, see Box 2.)

## 2. Financial gap and GDP-at-risk (GaR)

The "financial gap," which is constructed by calculating the weighted average of the deviation rates of individual FAIXs in the heat map from their trends, has remained clearly positive, although the positive gap has narrowed compared with the peak in fiscal 2020 (Chart III-3-4).



Note: The latest data for the output gap and financial gap are as at the January-March quarter and the April-June quarter of 2021, respectively. The shaded areas indicate recession phases, and the triangle on the right bottom corner of the chart indicates the recent peak (October 2018).

Source: Cabinet Office; BOJ.

Looking at the estimated probability distribution of GDP growth over the next 3 years conditional on these developments in the financial gap in terms of "GDP-at-risk" (GaR) shows that the lower tail of the distribution, which at one point was fatter than during the bubble period after the outbreak of COVID-19, has shrunk, suggesting that tail risks to the real economy have declined (Chart III-3-5).<sup>6</sup>

<sup>5</sup> Cross-country evidence of banking crises since 1980 shows that the probability of a subsequent crisis tends to be greater the longer the total credit to GDP ratio signals "red" for a protracted period or when that ratio and certain other financial activity indexes simultaneously signal "red." For details, see Box 1 in the April 2021 issue of the *Report*.

<sup>6</sup> Specifically, the regression equation for GaR is as follows:

$$\left( \begin{array}{c} \text{changes in the output gap} \\ \text{over the next } Y \text{ years} \end{array} \right) = \alpha \left( \begin{array}{c} \text{changes in the output gap} \\ \text{from the previous period} \end{array} \right) + \beta(\text{financial gap}) + \gamma(\text{U.S. NFCI}) + \delta.$$

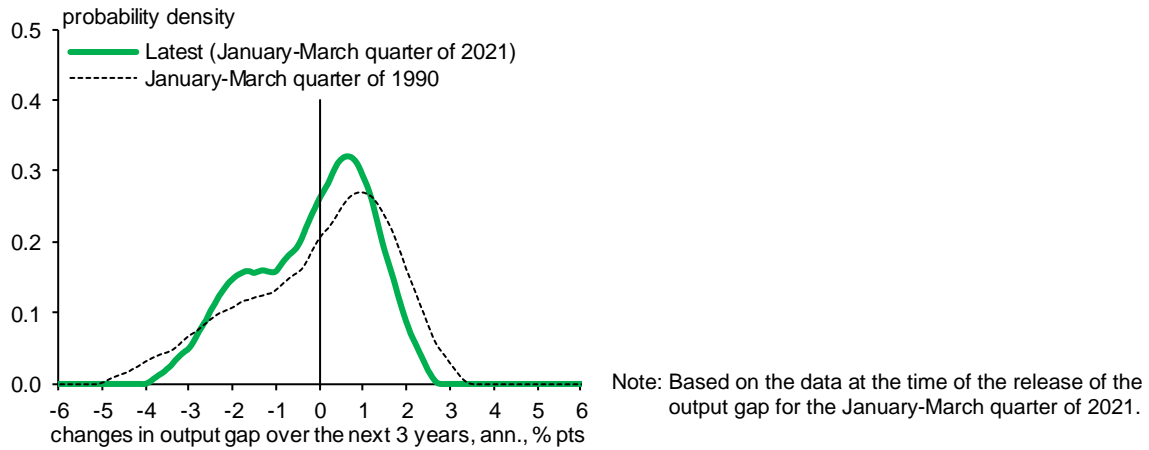
For details on the GaR approach, including the underlying rationale, estimation method, and caveats regarding its use, see Chapter IV and Box 1 of the October 2018 issue of the *Report*.



In addition to the narrowing of the positive "financial gap," this is due to the fact that quarter-on-quarter changes in the output gap remain positive as the economy is picking up.

However, as the course of the pandemic and its impact on the domestic and overseas economies remain uncertain, attention needs to be paid to the possibility that, depending on the impact of the pandemic, the existing vulnerabilities underlying developments in the financial gap could lead to a full-fledged adjustment on the financial front.

**Chart III-3-5: Comparison of risks to economic growth by period**

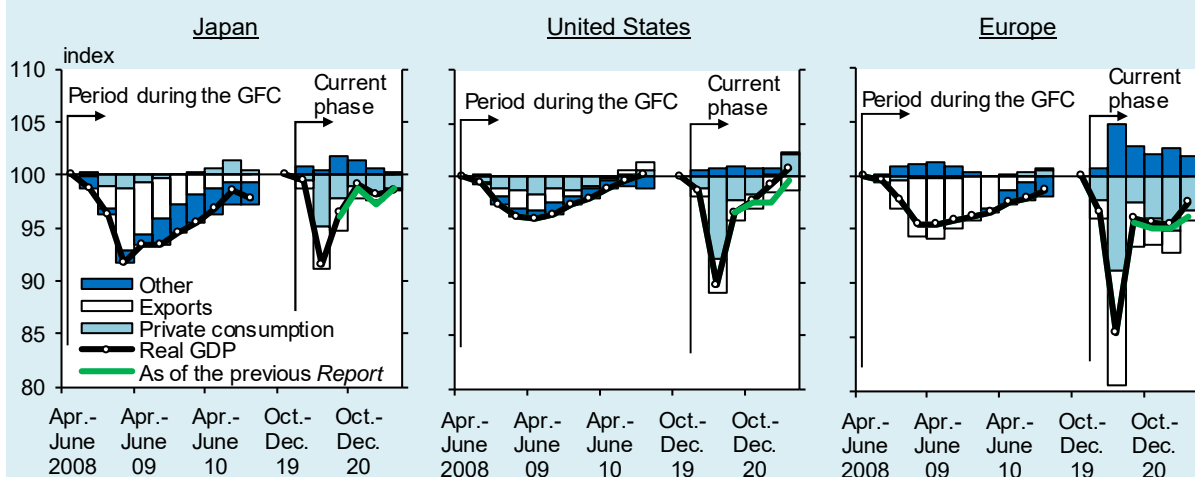


## IV. Risks faced by financial institutions

### Risks that warrant particular attention

- Due to the spread of COVID-19, domestic and overseas economies experienced a significant downturn in the first half of 2020. Although the pace of economic recovery thereafter has been moderate, the Japanese and European economies have generally recovered in line with the average forecasts by research institutions and markets at the time of the previous *Report* and the pace of recovery in the U.S. economy has been faster than forecasted (Chart IV-1-1).

Chart IV-1-1: GDP levels in current phase and during GFC



Note: Indexation with the real GDP in the April-June quarter of 2008 is set at 100 for the period during the GFC and that in the October-December quarter of 2019 is set at 100 for the current phase. "As of the previous *Report*" indicates the average forecasts of professionals and markets in March 2021.

Source: BEA; Cabinet Office; Eurostat; IMF; Japan Center for Economic Research, "ESP forecast."

- Although Japan's economy is likely to follow an improving trend with the impact of COVID-19 waning gradually, the impact on medium- to long-term growth expectations, as well as domestic and overseas economies, is highly uncertain. In global financial markets, due attention needs to be paid to the possibility that prices of risky assets will correct in the event of, for example, a sudden rise in U.S. long-term interest rates, as well as depending on developments in the spread of COVID-19 including its variants.
- With a view to ensuring the stability of Japan's financial system, the following risks warrant particular attention going forward: (1) an increase in credit costs at home and abroad; (2) a deterioration in gains/losses on securities investment; and (3) a destabilization of foreign currency funding due to the tightening of foreign currency funding markets, mainly for the U.S. dollar.

### Domestic credit risk

- Many large firms generally have secured ample liquidity and capital relative to small and medium-sized enterprises (SMEs), and their financial bases have therefore remained robust, as seen before the pandemic.
- SMEs' financial bases are more vulnerable than those of large firms, and their pace of recovery is expected to be relatively moderate, mainly for face-to-face services.
- The analysis shows that the overall probability of default (PD) of SMEs is restrained to a fair degree due to the significant impact of measures to support corporate financing, such as cash payments and effectively interest-free loans. However, as the impact of these measures will fade gradually in the medium term, the PD could exceed the level that would

prevail if the pandemic had not happened, and there is a possibility that it will increase significantly for the face-to-face services industry and firms that had vulnerable financial bases before the pandemic.

### Overseas credit risk

- The quality of Japanese banks' overseas loan portfolios has remained high on the whole. However, it has deteriorated for some industries compared with before the pandemic. Moreover, it is seen that the relative advantage in large overseas borrowers' financial condition within the same industry may have been on a downtrend.
- As for project finance loans and object finance loans, downgrades of loans have increased after the pandemic, and recently the share of object finance loans needing attention has risen modestly. Attention is warranted on the creditworthiness of aircraft-related object finance loans, which have been severely affected by the pandemic.

### Market risk associated with securities investment

- The amount of interest rate risk associated with the yen-denominated bond investments has reached the highest level, and the amount of market risk associated with stockholdings has been at a level that is large enough to have a substantial impact on financial institutions' financial soundness and profits. The amount of interest rate risk associated with foreign currency-denominated bond investments generally has been limited and the portfolio of overseas credit products is managed cautiously against risks on the whole.
- Attention needs to be paid to the possibility that interlinkages between the domestic and international financial systems are increasing, reflecting, for example, increases in overseas securities investment by Japanese financial institutions and investment in Japan by NBFIs entities, such as investment funds. The analysis shows that there has been a growing overlap in the securities portfolios of individual Japanese financial institutions and investment funds, measured by the correlation of market values of the portfolios, and that the higher a financial institution's degree of overlap, the larger the decline in the market value of its securities portfolio is at times of stress.

### Foreign currency funding risk

- Since Japanese banks have worked on increasing the stability of foreign currency funding in recent years, the outstanding amount of stable funding such as deposits and corporate bonds has exceeded that of illiquid loans, and the "stability gap," which is the difference between the two, has been in negative territory. More recently, however, the negative stability gap has narrowed, reflecting banks' efforts to reduce the costs of foreign currency funding and manage deposits with more consideration to profitability.
- Changes in global market conditions could have a significant impact on Japanese banks' foreign currency funding. The analysis shows that increases in interest rates and fund redemption rates, as well as widespread deterioration in financial conditions, have been affecting the composition of funding instruments such as CDs and CP, repos, as well as FX and currency swaps in an important manner. Moreover, an increase in fund redemption rates has been putting upward pressure on the level and volatility of the funding rates. The analysis also shows that the funding composition is relatively stable for financial institutions with more transaction account deposits, and those with diversified funding counterparties tend to see lower and more stable market funding rates, indicating that differences in financial institutions' funding profiles play an important role as well.

## A. Domestic credit risk

### 1. Financial institutions' credit costs and borrower classification

Although the credit cost ratios of Japanese financial institutions have remained low, they have risen modestly. Major banks' credit costs have risen recently due to a rise in loan-loss provisioning for some industries that have been significantly affected by the pandemic or an expansion in the coverage of precautionary loan-loss provisioning under the continuing impact of the pandemic (Chart IV-1-2). Although regional banks have also put precautionary loan-loss provisioning in place, their credit cost ratios have risen only slightly so far, partly due to the impact of the measures to support corporate financing for SMEs.

Looking at loans by borrower classification, the share of normal loans remains high at major and regional banks, exceeding the peak before the global financial crisis (GFC), but it has recently been declining, particularly at regional and *shinkin* banks, and the share of loans needing attention has risen slightly (Chart IV-1-3).

Chart IV-1-2: Credit cost ratios by type of bank

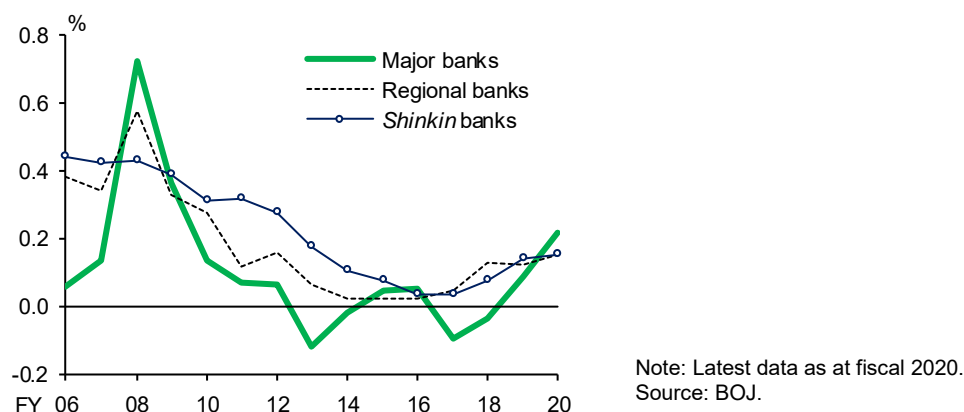
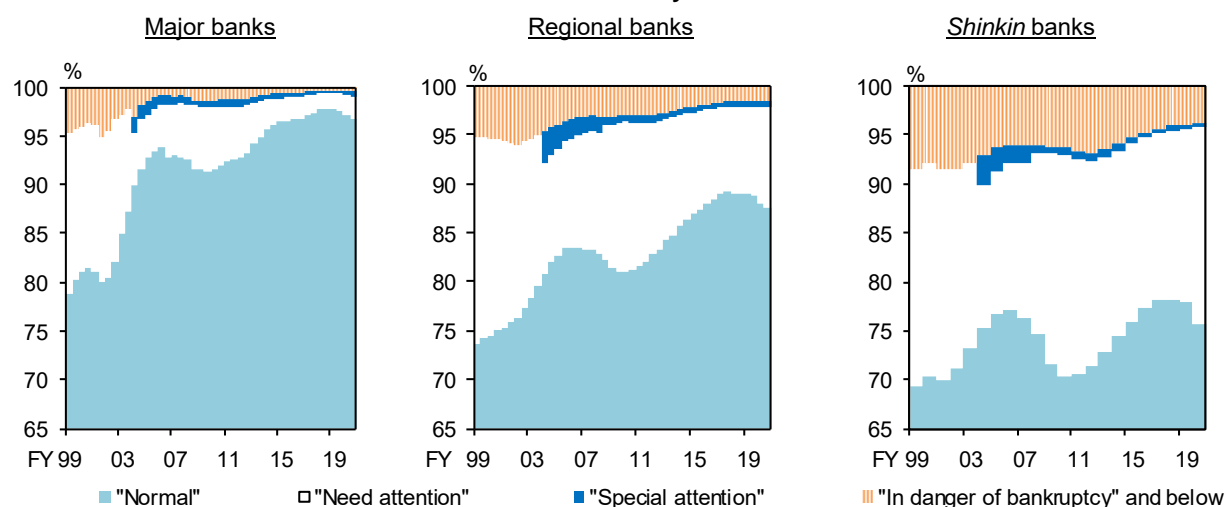


Chart IV-1-3: Breakdown of loans by borrower classification

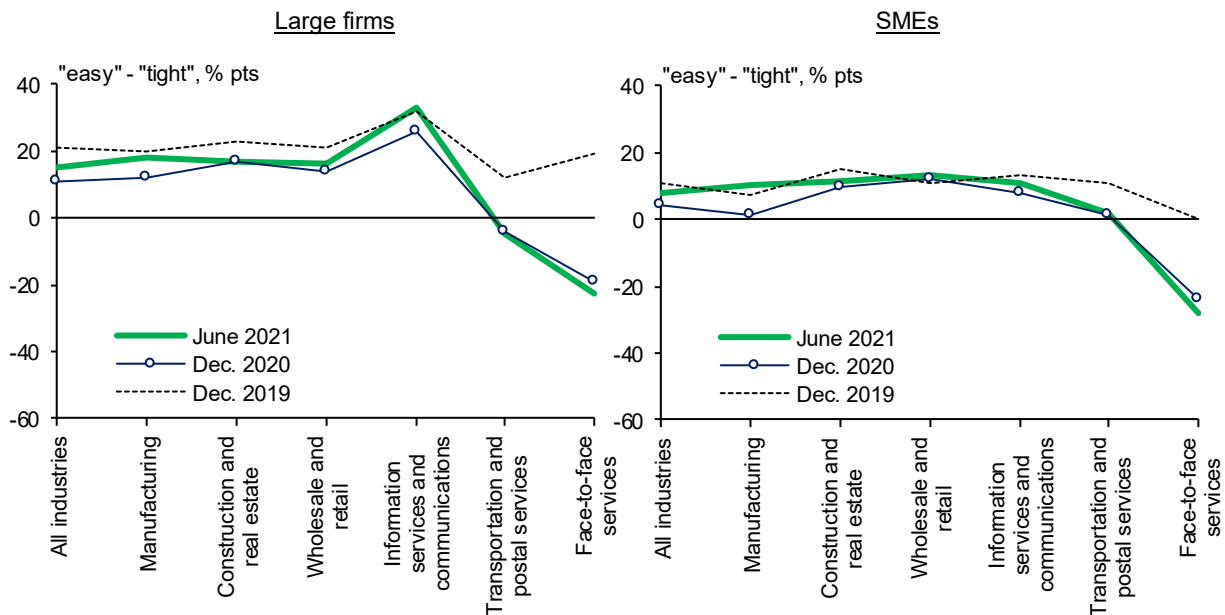


Note: 1. "Need attention" indicates "Need attention excluding special attention" from fiscal 2004.  
2. Latest data as at end-March 2021.  
Source: BOJ.

## 2. Firms' financial conditions under the spread of COVID-19

Firms' financing shows that, on the whole, many large firms continue to perceive their financial position as "easy," and even for SMEs, the number of firms responding that their financial position is "easy" slightly exceeds the number responding that it is "tight" (Chart IV-1-4). Compared to the time of the previous *Report*, corporate financing of both large firms and SMEs has improved slightly on the whole. However, many firms in the face-to-face services industry, which has been severely affected by the pandemic (food, accommodation, and consumer services) still regard their financial positions as "tight," and the heterogeneity in funding conditions across industries has continued to be large (Chart IV-1-4).

**Chart IV-1-4: DI of financial positions (by firm size and industry)**

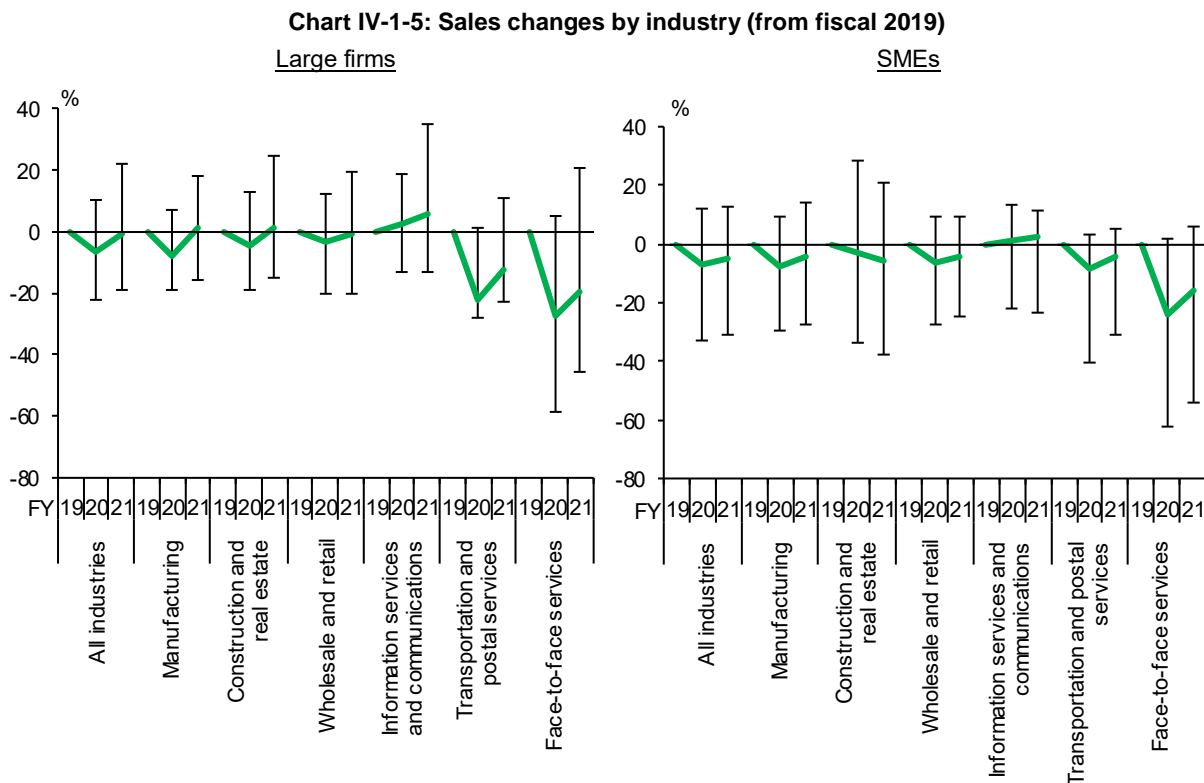


Note: 1. The figures for "Construction and real estate" and "Face-to-face services" are weighted averages by the number of firms that responded to the question in each industry.  
 2. "Face-to-face services" consists of food, accommodation, and consumer services. The same applies to subsequent charts.

Source: BOJ, "Tankan."

Next, sales forecasts for fiscal 2021 are examined using the settlement reports of listed firms for large firms and microdata from the June 2021 *Tankan* (Short-Term Economic Survey of Enterprises in Japan) for SMEs (Chart IV-1-5). For all industries, while sales of large firms are expected to recover to a level comparable to that seen in fiscal 2019, before the outbreak of COVID-19, those of SMEs likely will not reach that level. By type of industry, while sales of firms in some industries are expected to exceed the level in fiscal 2019, those of firms in the face-to-face services and transportation and postal services industries are likely to remain considerably below the fiscal 2019 level, suggesting that heterogeneity across industries will remain large. The same applies to heterogeneity within industries: many firms in the face-to-face services industry are expecting sales in fiscal 2021 to be considerably lower than in fiscal 2019, and heterogeneity not only across industries but also across firms within the industry will likely remain large.

IV. Risks faced by financial institutions  
A. Domestic credit risk



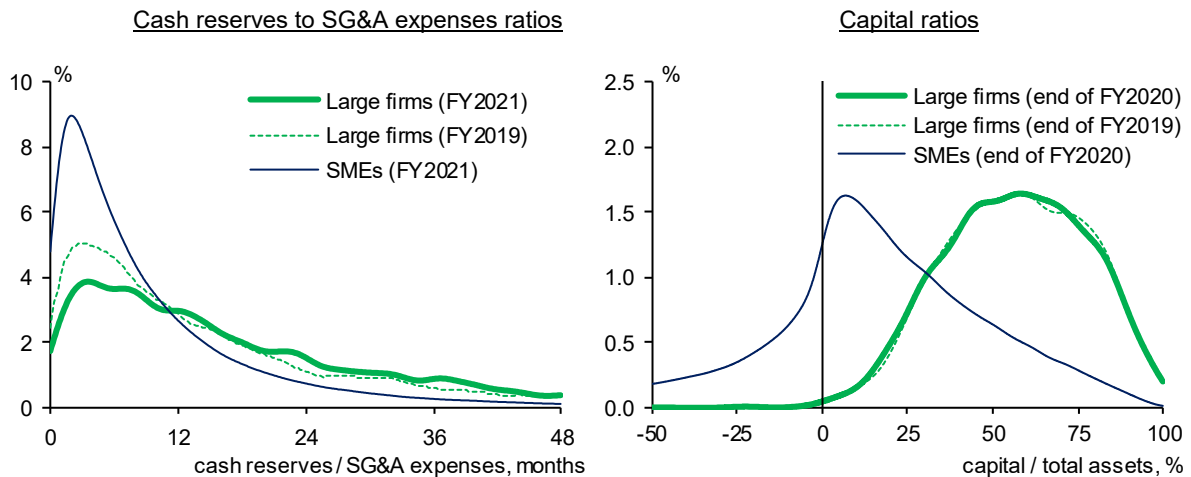
Note: 1. The left-hand chart covers firms listed on the domestic stock exchanges.  
2. The solid lines indicate weighted averages. The bands indicate 10th-90th percentile points.  
3. The data for fiscal 2021 indicate the forecasts.  
Source: Nikkei Inc., "NEEDS-Financial QUEST"; BOJ, "Tankan."

### Large firms

The magnitude of the impact of future developments in the pandemic on firms' finances is likely to depend not only on future sales and profits of these firms but also on their current financial conditions. Looking at firms' liquidity and capital positions at present, many large firms have secured ample liquidity and capital relative to SMEs (Chart IV-1-6). Compared to before the pandemic, the robustness of large firms in terms of liquidity may have improved as an increasing number of them hold larger cash reserves, and there have been no material changes in their capital amount. Large firms' financial bases have therefore remained robust on the whole, as seen before the pandemic.

However, as mentioned above, a large portion of the firms in the face-to-face services and transportation and postal services industries have been facing relatively severe funding conditions with profits that are expected to remain at low levels in the future. Moreover, the amount of credit extended to each of large firms is often significant and attention needs to be paid to the fact that a credit rating downgrade could have a massive impact on financial institutions' credit costs.

**Chart IV-1-6: Cash reserves to SG&A expenses ratios and capital ratios**



Note: 1. Cash reserves to SG&A expenses ratios (FY2019) are calculated as cash reserves (end of FY2018) / SG&A expenses (FY2019).  
 2. For simplicity, cash reserves to SG&A expenses ratios (FY2021) are calculated as cash reserves (end of FY2020) / SG&A expenses (FY2020).  
 Source: CRD Association; Nikkei Inc., "NEEDS-Financial QUEST."

### SMEs

The previous *Report* conducted a dynamic simulation analysis of the impact of the spread of COVID-19 on firms' PD, taking individual firms' financial conditions, changes in business conditions due to the pandemic, and measures to support corporate financing into account. This *Report* conducts a medium-term simulation through fiscal 2023 using the same framework while making some elaborations regarding the degree of heterogeneity in corporate profits across firms and incorporating recent changes in the economic environment, including details of measures to support corporate financing.<sup>7,8</sup>

## 3. Simulation analysis

### a. Methodology and assumptions

The analysis is based on various medium-term assumptions about firms' future profits, investment, and finances. First, aggregate corporate profits (operating profits, etc.) are estimated based on the assumption that they move together with macroeconomic developments (left panel of Chart IV-1-7). Next, the corporate profits of large firms and SMEs and those of different industries as a whole are computed, ensuring consistency with the estimates of aggregate corporate profits and taking

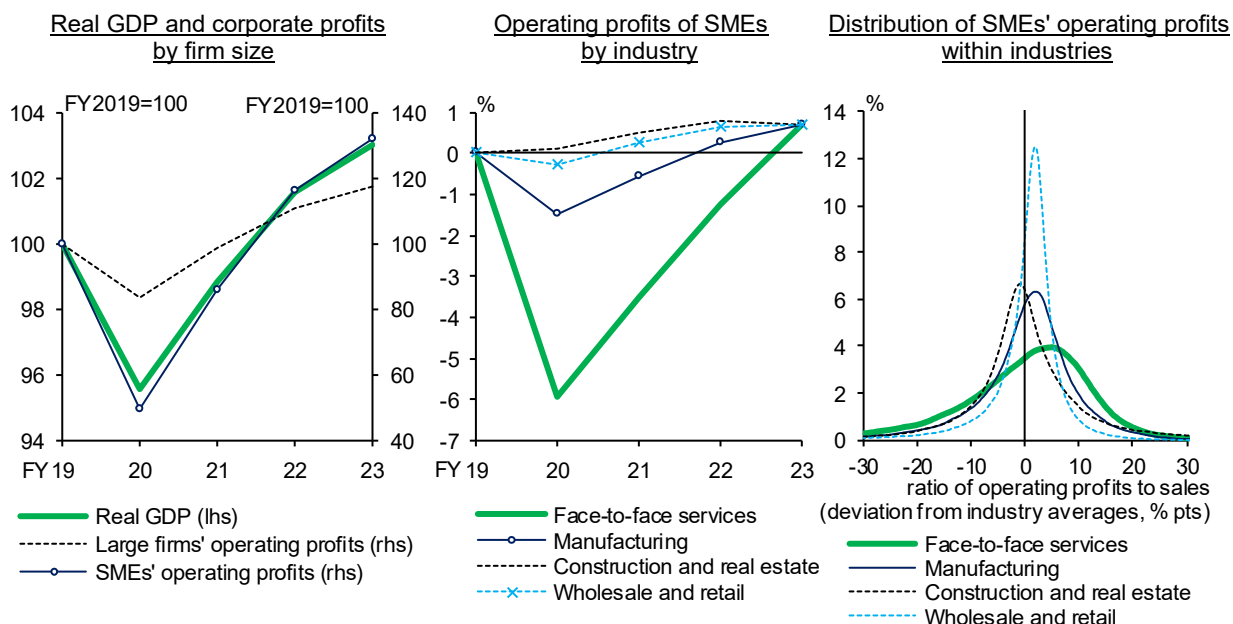
<sup>7</sup> The simulation analysis uses firm-level data from the Credit Risk Database (CRD) of the CRD Association, which covers about 2.61 million SMEs that have transactions with private and government financial institutions as well as credit guarantee corporations. The simulation covers about 880 thousand SMEs, of which the necessary data items for the analysis are registered.

<sup>8</sup> In the simulation, the probability of default is defined as the probability that a firm within one year is downgraded to a borrower classification of "special attention" or below, is delinquent for three months or more, or is subject to subrogation by a credit guarantee corporation.

IV. Risks faced by financial institutions  
A. Domestic credit risk

differences in the impact of COVID-19 into account (left and middle panels of Chart IV-1-7).<sup>9</sup> Individual firms' profits are computed, taking the impact of the increased heterogeneity among SMEs within the same industry into account, making use of microdata from the *Tankan* (right panel of Chart IV-1-7).<sup>10</sup> The computed profits of SMEs in all industries in fiscal 2023 based on these settings above exceed the level of fiscal 2019.

**Chart IV-1-7: Assumptions on GDP and corporate profits for medium-term simulation**



Note: The figures in the middle chart indicate changes in operating profits from fiscal 2019 as a percentage of sales in fiscal 2019. In the right-hand chart, the horizontal axis indicates operating profits divided by sales in fiscal 2021.  
Source: Japan Center for Economic Research, "ESP forecast"; Ministry of Finance, "Financial statements statistics of corporations by industry."

It is assumed that SMEs' investment activity in fiscal 2021 and beyond will be restrained and their investments will equal the amount of capital depreciation. As for the firms' financing activity, it is assumed that at the end of fiscal 2020 they hold cash reserves that are 10 percent larger than at the end of fiscal 2019 (as a "precautionary level"), and thereafter lower the precautionary level

<sup>9</sup> Regarding the operating profits of each firm size group, the actual level of operating profits in fiscal 2020 is used as the starting point, and the assumed overall profits for firms of all sizes in each period are proportionally allocated based on sales in fiscal 2019 to obtain the assumed future profits for each firm size group. Moreover, with regard to the operating profits of SMEs in each industry, the actual level of operating profits in fiscal 2020 is again used as the starting point, and it is assumed that the gap across industries gradually narrows through fiscal 2023.

<sup>10</sup> The future operating profits of individual firms are set using the actual level of operating profits in fiscal 2019 as the starting point and the estimated operating profits at the industry level for each year, where the latter values are allocated to each firm using its actual sales in fiscal 2019 and the distribution of profits across firms within its industry. As seen in microdata from the *Tankan*, the heterogeneity in operating profits across firms within an industry is assumed to increase substantially in fiscal 2020, narrow modestly in fiscal 2021, and be unchanged in years thereafter.



gradually to the end-fiscal 2019 level by the end of fiscal 2023, as the impact of the pandemic wanes.<sup>11,12</sup>

Further, it is assumed that firms relied on effectively interest-free loans in fiscal 2020 before borrowing regular loans without public guarantee from financial institutions, and that the grace period for principal, the repayment period, and the interest subsidy period are one year, five years, and three years, respectively.<sup>13</sup> Thus, firms will gradually start repaying effectively interest-free loans from fiscal 2021 onward and making interest payments from fiscal 2023 onward. Regarding firms in the face-to-face services industry, it is assumed that uncertainty over their future corporate profits is high and they hold cash reserves for a longer period and start repaying their loans one year later than those in other industries.

**Chart IV-1-8: Overview of measures to support corporate financing**

	Major measures to support corporate financing	Overview of measures	Fiscal expenses and total size of measures
Cash payments	Subsidies for sustaining businesses	Cash payments for SMEs and sole proprietors (up to 2 mil. yen)	5.7 tril. yen
	Rent assistance subsidies	Cash payments for supporting rent payments (up to 6 mil. yen)	1.1 tril. yen
	Expansion of employment adjustment subsidies program, etc.	Subsidy rates increased for leave allowance (up to 100%)	4.6 tril. yen
	Cooperation fees for shortening business hours	Cash payments for restaurants, etc. that cooperate with local governments' requests, such as shortening their business hours during the state of emergency (grants are delivered to each prefecture)	3.6 tril. yen
	One-off support payments and monthly support payments	Cash payments for SMEs and sole proprietors during the state of emergency, etc. (up to 0.2 mil. yen per month)	0.7 tril. yen
Tax measures	Special tax measures such as tax payment moratorium	National and local taxes and/or social insurance contributions possibly deferred for one year	Approx. 26 tril. yen
Financial measures	Effectively interest-free loans by government-affiliated and private financial institutions	Interest subsidies provided to government-affiliated and private financial institutions	Approx. 110 tril. yen
	Crisis response loans to medium-sized and large firms by government-affiliated financial institutions	Long-term loans with preferential interest rates through government-affiliated financial institutions	Approx. 10 tril. yen
	Equity support by government-affiliated financial institutions and funds	Equity support, mainly through subordinated loans and capital injections	Approx. 12 tril. yen

Note: Based on announcements by the government until end-August 2021. "Fiscal expenses" includes the expenses from contingency funds and announced budget diversions.

Source: Cabinet Office; Ministry of Finance; Ministry of Health, Labour and Welfare.

<sup>11</sup> The Financial Statement Statistics of Corporations by Industry, Quarterly, shows that SMEs' cash reserves at the end of fiscal 2020 increased by about 10 percent compared to the end of fiscal 2019 in almost all industries. In the previous *Report*, it was assumed that the firms hold a precautionary level of cash reserves that are 10 percent larger than at the end of fiscal 2019 throughout the simulation period ending in fiscal 2023. By contrast, in this *Report*, taking into account the recent movement of firms' debt repayments, the precautionary level is assumed to decline to 5 percent at the end of fiscal 2021, to 0 percent at the end of fiscal 2022, and stay at that level in fiscal 2023. (However, as for the firms in the face-to-face services industry, the precautionary level is assumed to decline with a lag of one year, as they have been facing relatively severe funding conditions.)

<sup>12</sup> It is assumed that, if cash reserves fall below the precautionary level due to a decline in operating cash flows, firms will borrow additional loans, such as regular loans, and reduce the outstanding amount of loans if cash reserves exceed the precautionary level instead.

<sup>13</sup> While the grace period for principal was assumed to be five years in the previous *Report*, this has been changed to one year in this *Report*, reflecting the average period in practice seen up to now.

## IV. Risks faced by financial institutions

### A. Domestic credit risk

**Chart IV-1-9: Assumption on major measures to support corporate financing for medium-term simulation**

	Assumptions for calculating amounts of each firm's subsidies and borrowing
Subsidies for sustaining businesses	Each eligible firm receives the amount equivalent to the decrease in sales during fiscal 2020 from the previous year (up to 2 mil. yen). The amount is received from firms with a larger rate of sales decrease during fiscal 2020 in order until the total amount reaches the fiscal spending for SMEs, which is estimated by the BOJ.
Rent assistance subsidies	Each eligible firm receives the amount calculated by multiplying the amount of its rent payments for 6 months by its subsidy rate (up to 6 mil. yen). The monthly rent payments are calculated by using rental fee payments and estimated real estate share in the payments by industry. The subsidy rate is set depending on the amount of monthly payments (2/3 for 0.75 mil. yen or less, and 1/3 for over 0.75 mil. yen). The amount is received from firms with a larger rate of sales decrease during fiscal 2020 in order until the total amount reaches the estimated fiscal spending for SMEs.
Expansion of employment adjustment subsidies program	Eligible firms are the same as "Subsidies for sustaining businesses." Each eligible firm receives the amount proportional to the product of their rate of sales decrease and labor costs. The total amount matches the estimated fiscal spending for SMEs.
Cooperation fees for shortening business hours	Each eligible firm in the food services industry receives the amount calculated by multiplying the number of stores by 1.86 mil. yen in fiscal 2020 and the amount calculated by multiplying sales during fiscal 2019 by 0.4 and 5/12, which is assumed to be equivalent to the cooperation fees from April to August 2021, in fiscal 2021 (up to 0.1 mil. yen per store per day). The number of stores is estimated by using average sales per store. The amount is received from firms with a larger rate of sales decrease during fiscal 2020 in order until the total amount reaches the estimated fiscal spending for SMEs.
One-off support payments and monthly support payments	Each eligible firm belonging to industries such as accommodation receives the amount equivalent to the decrease in sales during fiscal 2020 from the previous year multiplied by 1/4, which is assumed to be equivalent to the support payments from January to March 2021, in fiscal 2020 and the amount equivalent to the decrease in sales during fiscal 2021 from fiscal 2019 multiplied by 5/12, which is assumed to be equivalent to the support payments from April to August 2021, in fiscal 2021 (up to 0.2 mil. yen per month). The amount is received from firms with a larger rate of sales decrease during fiscal 2020 in order until the total amount reaches the estimated fiscal spending for SMEs.
Effectively interest-free loans	Every firm borrows the amount required to meet the assumption on its cash reserve even after it receives the above cash payments (up to 60 mil. yen).

Note: Each fiscal expense for SMEs is estimated using information such as actual payment amounts and budget amounts as at August 2021.

Source: Cabinet Office; Financial Services Agency; Ministry of Economy, Trade and Industry; Ministry of Finance; Ministry of Health, Labour and Welfare.

Regarding the government's measures to support corporate financing, support measures such as the employment adjustment subsidies program and cooperation fees for shortening business hours have been in place as the pandemic has continued (Chart IV-1-8). Using data on government expenses, these support measures are also taken into account in the analysis in this *Report* (Chart IV-1-9).<sup>14,15</sup>

### b. Simulation results

#### *Indicators regarding liquidity and creditworthiness*

Starting with current profits, half of SMEs would have made losses in fiscal 2020 if there had been no support measures.<sup>16</sup> With the support measures, the share of SMEs making losses is contained to about 5 percentage points higher than in fiscal 2019 due to the effect of cash payments (left

<sup>14</sup> Specifically, using the Economic Census for Business Activity and the Unincorporated Enterprise Survey to measure the number of firms of each size, etc., the total amount of cash payments to SMEs is estimated based on actual government expenses. SMEs are then ordered in terms of their percentage decline in sales (from largest to smallest), and it is assumed that SMEs receive cash benefits in that order up to the total estimated amount of cash payments to them.

<sup>15</sup> As in previous *Reports*, with regard to support measures, the analysis focuses only on cash payments and effectively interest-free loans and does not incorporate government contingency funds for COVID-19 for which the purpose has not yet been decided as of the beginning of September 2021, or government budgets for fiscal 2022 and beyond.

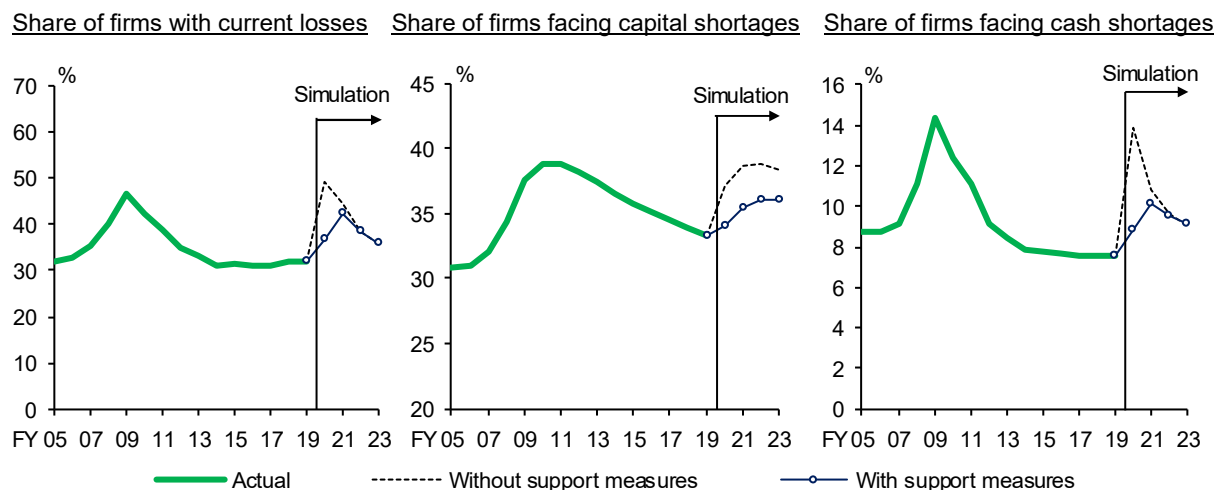
<sup>16</sup> In this simulation, for simplicity, cash payments are incorporated into current profits. Operating cash flow is the sum of current profits (including cash payments) and depreciation.

panel of Chart IV-1-10). Although the share increases by another 5 percentage points in fiscal 2021, reflecting the assumptions that the cash payments become smaller compared to fiscal 2020 and that profits recover only moderately, it declines from fiscal 2022 onward along with the recovery in corporate profits. That said, the share of SMEs making losses continues to exceed the level seen in fiscal 2019, even when the support measures are taken into account.

Turning to the share of firms facing capital shortages, if there were no support measures, the share would increase substantially, as the share of firms making current losses would remain high in fiscal 2021 and beyond, but the increase is mitigated when the support measures are taken into account (middle panel of Chart IV-1-10).

Looking at firms facing potential cash shortages -- i.e., those with cash reserves that are insufficient to cover their negative operating cash flow -- the share of such firms would increase substantially in fiscal 2020 in the absence of the support measures. However, once the support measures are taken into account, the increase is contained to a fair degree as a result of the cash payments (right panel of Chart IV-1-10). Nevertheless, the share of firms facing potential cash shortages will not fall to the level of fiscal 2019.

**Chart IV-1-10: Simulation results**



Note: Firms facing capital shortages are defined as firms whose (net assets at the beginning of the fiscal year) + (current profit) \* (1 - the effective tax rate) is negative. Firms facing cash shortages are defined as firms whose net operating cash outflow during the year exceeds their cash reserves at the beginning of the fiscal year.  
 Source: CRD Association.

**Probability of default**

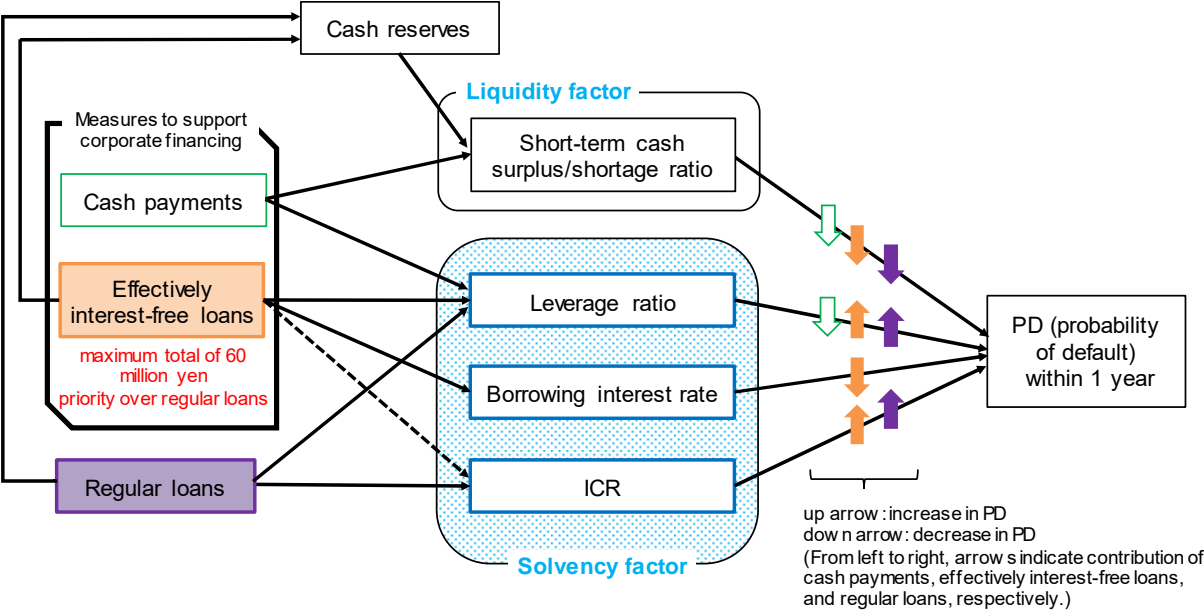
A PD model is used to assess how firms' default rates would evolve due to the changes in their liquidity and creditworthiness.<sup>17</sup> In this model, when firms' operating cash flow decreases due to the pandemic, liquidity and creditworthiness deteriorate, increasing the PD (Chart IV-1-11). The PD decreases when firms' cash reserves increase due to various measures to support corporate financing, such as cash payments and loan program. Of such measures, cash payments have the effect of pushing down the PD in subsequent years through a reduction in firms' financial leverage.

<sup>17</sup> The PD model is estimated in the same way as in the previous *Report*, using whether a firm defaults (within one year) as the dependent variable and the cash surplus/shortage ratio, the leverage ratio, the borrowing interest rate, and the interest coverage ratio (ICR) as explanatory variables. In addition, the contribution of the cash surplus/shortage ratio to changes in the PD is categorized as the contribution of changes in liquidity, while the contributions of the leverage ratio, the borrowing interest rate, and the ICR are categorized as the contribution of changes in solvency.

IV. Risks faced by financial institutions  
 A. Domestic credit risk

On the other hand, an increase in borrowing will push up the PD in subsequent years through an increase in leverage and a decrease in debt repayment capacity. An increase in borrowing effectively interest-free loans is assumed to have an impact similar to an increase in borrowing and under the setting that interest subsidies on such loans will be provided for three years, this will temporarily help to lower the PD but will then contribute to a higher PD through an increase in interest payments in fiscal 2023.

Chart IV-1-11: Transmission mechanism in PD model



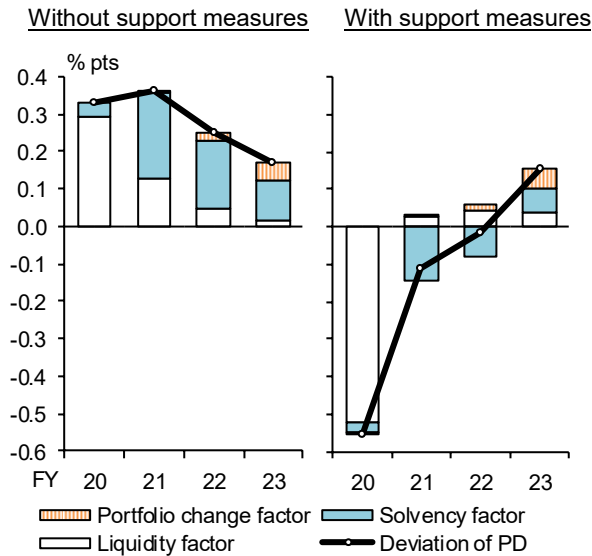
Looking into the PD of SMEs as a whole in the absence of support measures, the model suggests that the PD increases by about 30 basis points in fiscal 2020, mainly due to changes in firms' liquidity (Chart IV-1-12). The upward pressure on the PD through changes in liquidity subsequently disappears in fiscal 2023, reflecting the assumption that corporate profits will improve. Meanwhile, as the increase in borrowing to compensate for the decline in cash reserves in fiscal 2020 leads to a deterioration in firms' debt repayment capacity in subsequent years, the PD increases due to changes in firms' creditworthiness. The increase in the PD gradually becomes smaller thereafter, but the deterioration in creditworthiness leads to a higher PD throughout the simulation period.

On the other hand, when the support measures are taken into account, the PD due to changes in firms' liquidity in the simulation falls substantially in fiscal 2020 due to the improvement in firms' liquidity as a result of cash payments and effectively interest-free loans (Chart IV-1-12). The PD from fiscal 2021 onward is also restrained since additional borrowing is restrained due to cash payments and most of the loans are effectively interest-free loans. In fiscal 2023, however, when interest subsidies for effectively interest-free loans end, the PD increases slightly through an increase in interest payments.<sup>18</sup>

<sup>18</sup> The actual increase in the PD during the GFC -- that is, the change from the average of fiscal 2003-2007 to the average of fiscal 2008-2010 -- was 39 basis points for all industries and about 100 basis points for the processing and assembly manufacturing industry, which saw the largest increase. For details, see "A Forecast Model for the Probability of Default Based on Granular Firm-Level Data and Its Application to Stress Testing," *Financial System Report Annex Series*, May 2019.

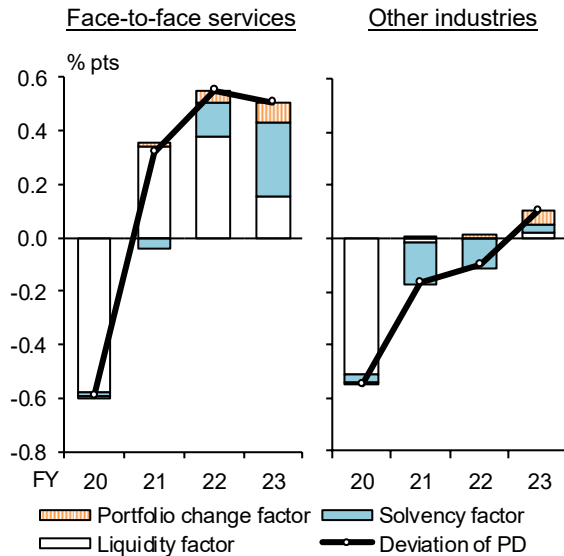
For the face-to-face services industry, the PD declines temporarily in fiscal 2020 due to the impact of the support measures. However, in subsequent years, declines in both firms' liquidity and creditworthiness push up the PD quite considerably, under the condition that the recovery in demand is assumed to be gradual (Chart IV-1-13). In other industries, an improvement in creditworthiness pushes down the PD, partly because firms reduce loans outstanding on the back of a recovery in corporate profits. However, in fiscal 2023, the PD increases due to a rise in interest payments.<sup>19</sup>

**Chart IV-1-12: Decomposition of the deviation of PD (all industries)**



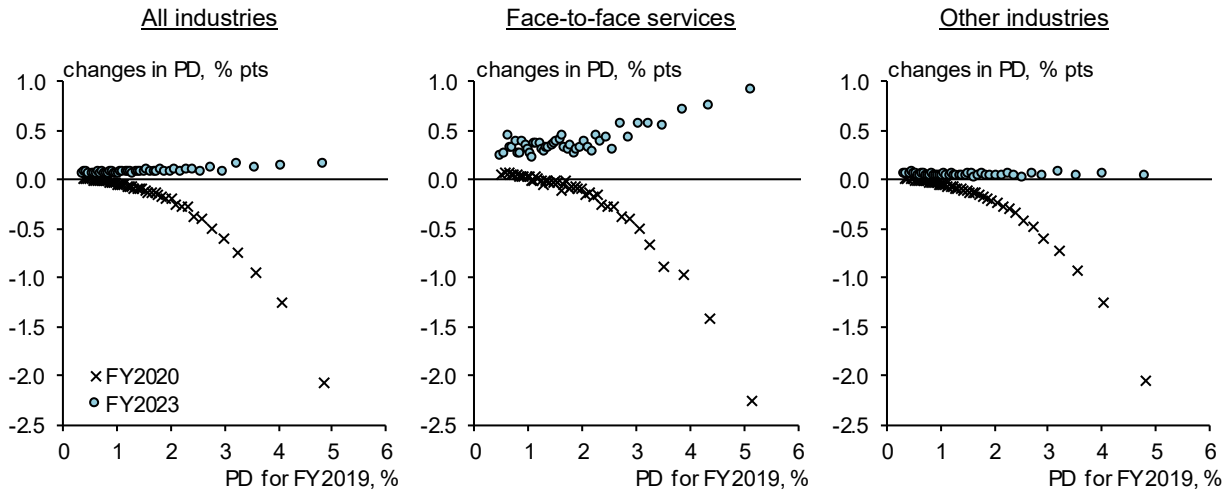
Note: The charts indicate the deviation of PD from the simulation without the COVID-19 outbreak (firms' profits are unchanged and precautionary loans are not obtained, etc.). The same applies to Charts IV-1-13 and IV-1-14.

**Chart IV-1-13: Decomposition of the deviation of PD (by industry)**



Note: The charts show the simulation with the measures to support corporate financing.

**Chart IV-1-14: Changes in PD by the PD for fiscal 2019 (with support measures)**



Note: Firms are grouped into 2-percentile bins based on their PD, which is estimated by the BOJ. The horizontal axes show the median values for each group and the vertical axes show the averages for each group. The top and bottom 4-percentile samples are excluded.

<sup>19</sup> Another factor contributing to changes in the PD is changes in financial institutions' credit portfolios ("portfolio change factor" in Charts IV-1-12 and IV-1-13). For example, assuming that differences in the extent to which firms are affected by COVID-19 continue to be observed, firms in a relatively healthy financial position will repay existing loans and drop out of financial institutions' credit portfolios, leading to an increase in the PD.

Now, individual firms' PD before the outbreak of COVID-19 is calculated using data on their financial bases in fiscal 2019, and their relationship with the PD in fiscal 2020 or fiscal 2023, taking the support measures into account, is examined. The results show that firms with a higher PD before the pandemic tend to see a larger reduction in the PD for fiscal 2020 (Chart IV-1-14, see Box 1 for the relationship between the PD and the amount of funding). However, the PD increases thereafter, and in fiscal 2023 it slightly exceeds the level that would prevail if the pandemic had not happened.

#### 4. Assessment based on the analysis

The above analysis shows that the various measures to support corporate financing have significantly reduced the overall PD of SMEs in fiscal 2020 and will likely have a substantial impact from fiscal 2021 onward, even taking changes such as those in the economic environment and firms' financial conditions since the previous *Report* into account. That said, the impact of measures to support corporate financing will become smaller in the medium term and the PD could increase slightly from the current level. It should be noted, however, that the results greatly depend on various assumptions underlying the analysis regarding developments in corporate profits at the macro-level, firms' investment and financing behavior, the heterogeneity in profits across industries and firms, etc. There is substantial uncertainty regarding these issues, and the quantitative results of the analysis should be interpreted with a considerable degree of latitude.

Financial institutions will need to take this into account, carefully assess the sustainability of borrower firms' business, provide effective support tailored to borrowers' needs, and manage credit risks appropriately.

### B. Overseas credit risk

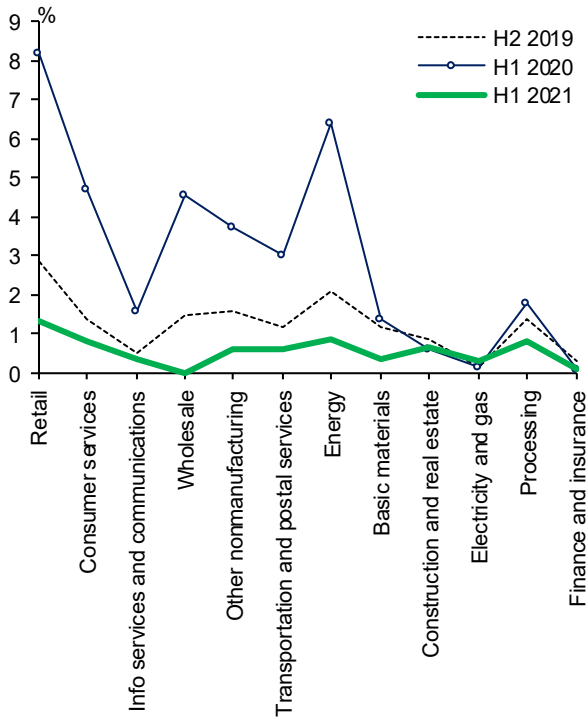
As seen in Chapter III, the quality of Japanese banks' overseas loan portfolios has remained high on the whole (Chart III-1-17). The global economy, although still affected by the pandemic, has recovered on the whole, and firms' creditworthiness as measured by corporate bond default rates is on an improving trend. However, overseas loan portfolios continue to warrant attention in terms of credit management as there are signs of deterioration in some portfolios.

#### *Japanese banks' overseas loans by industry and region*

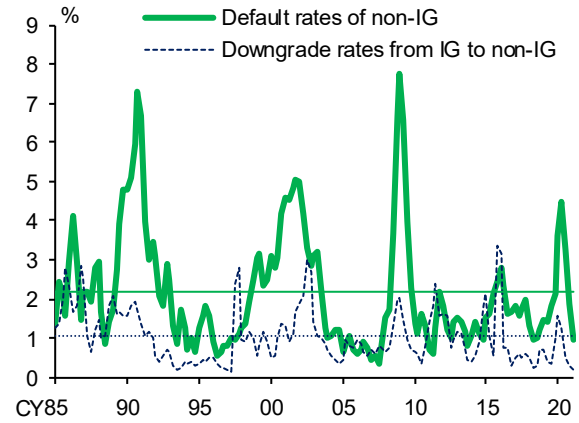
Starting with corporate bond default rates in overseas markets, although they rose following the outbreak of COVID-19, especially in the retail and energy industries, they have declined to below pre-pandemic levels on the whole in the first half of 2021 (Chart IV-2-1). Looking at the market as a whole, even though the downgrade rate from investment grade (IG) to non-investment grade (non-IG) and the default rate of non-IG corporate bonds increased in 2020, they are now clearly below historical average levels (Chart IV-2-2). Thus, with the economy recovering, firms' creditworthiness has been improving.

Next, changes in Japanese banks' overseas loans by industry and region are examined. From September 2019, before the outbreak of the pandemic, to September 2020, the outstanding amount of non-IG loans increased in the finance and insurance as well as processing industries, which account for large amounts of loans outstanding. At the same time, loans outstanding to borrowers classified as "need attention" and below increased in the transportation and postal services as well as consumer services industries, where the impact of containment measures to control the spread of COVID-19 was severe (Chart IV-2-3). The increase in non-IG loans outstanding is considered to

**Chart IV-2-1: Default rates of corporate bonds by industry**



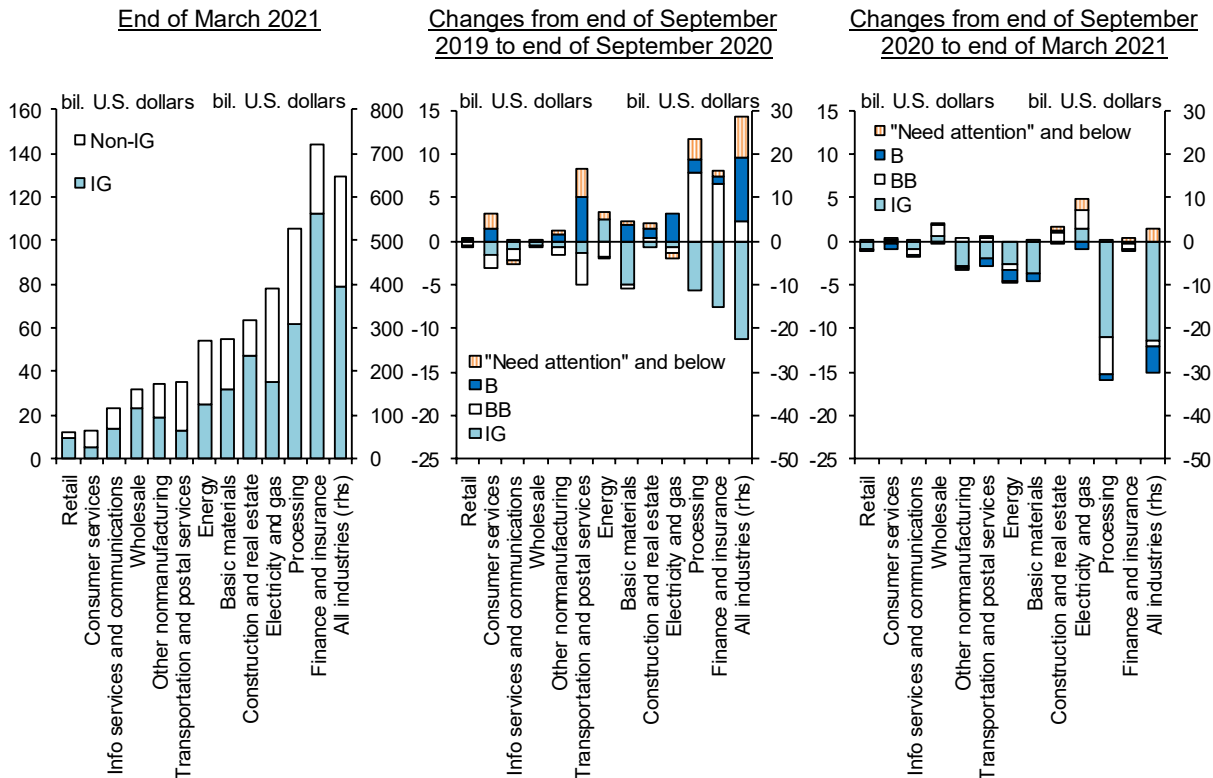
**Chart IV-2-2: Default rates of corporate bonds**



Note: 1. Default rates and downgrade rates are calculated quarterly for each 2-quarter long window on the issuer basis, including bond and loan issuers. Latest data as at January-June of 2021.  
 2. The thin solid line and the thin dotted line indicate the historical averages of default rates and downgrade rates, respectively.  
 Source: Moody's.

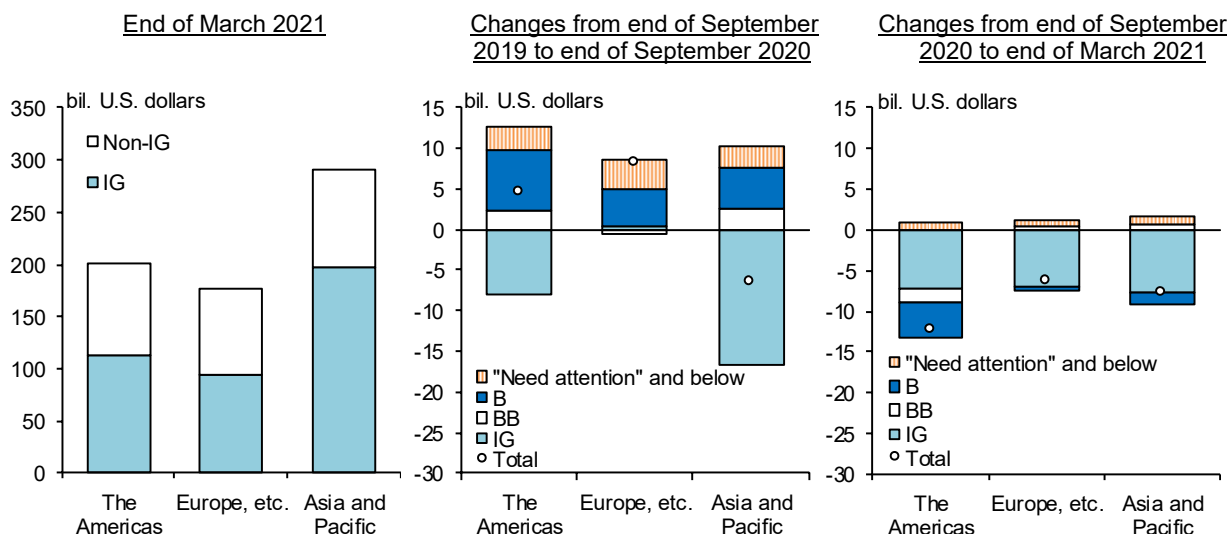
Note: 1. Default rates are on the issuer basis, including bond and loan issuers.  
 2. Energy covers oil and natural gas development.  
 Source: Moody's.

**Chart IV-2-3: Overseas corporate loans outstanding (by industry and rating)**



Note: 1. Covers the three major banks' lending.  
 2. Energy covers oil and natural gas development.  
 3. Based on internal rating of each banks.  
 Source: BOJ.

**Chart IV-2-4: Overseas corporate loans outstanding (by region and rating)**



Note: 1. Covers the three major banks' lending.  
 2. "Europe, etc." includes the Middle East and Africa.  
 3. Based on internal rating of each banks.  
 Source: BOJ.

have been driven by downgrades of existing loans. By region, loans outstanding to borrowers classified as "need attention" and below increased for all regions (Chart IV-2-4). In the six months from September 2020, the amount of loans outstanding declined, particularly of loans to firms in the processing industry and in the Americas. By rating, loans outstanding to IG- and B-rated borrowers have decreased, while those to borrowers classified as "need attention" and below have increased modestly.

### *Financial conditions of large overseas borrowers*

Dividing the large overseas borrowers into those in the "COVID-affected industries" -- industries that are considered to be particularly affected by the pandemic (transportation and postal services as well as consumer services) -- and those in all other industries, and looking at developments in borrowers' business performance before and after the outbreak of COVID-19, shows that, whereas the industry median ICR and ROA for other industries have recovered more or less to the level before the pandemic, those for the "COVID-affected industries" remain well below pre-pandemic levels (Chart IV-2-5).<sup>20</sup> Since the start of the pandemic, the leverage ratio of the "COVID-affected industries" has gradually risen to a level above that for other industries, which is consistent with the increase in non-IG loans outstanding mentioned above. Although the share of Japanese banks' loans to these industries is small, future developments warrant close attention.

Next, matching the information on the large overseas borrowers with a corporate financial database, the financial condition of these borrowers is examined through comparison with the population of firms in the database.<sup>21</sup> A time-series comparison of the ICR, ROA, and leverage ratios of large overseas borrowers and the population shows that, as for the ICR and ROA, the medians of these

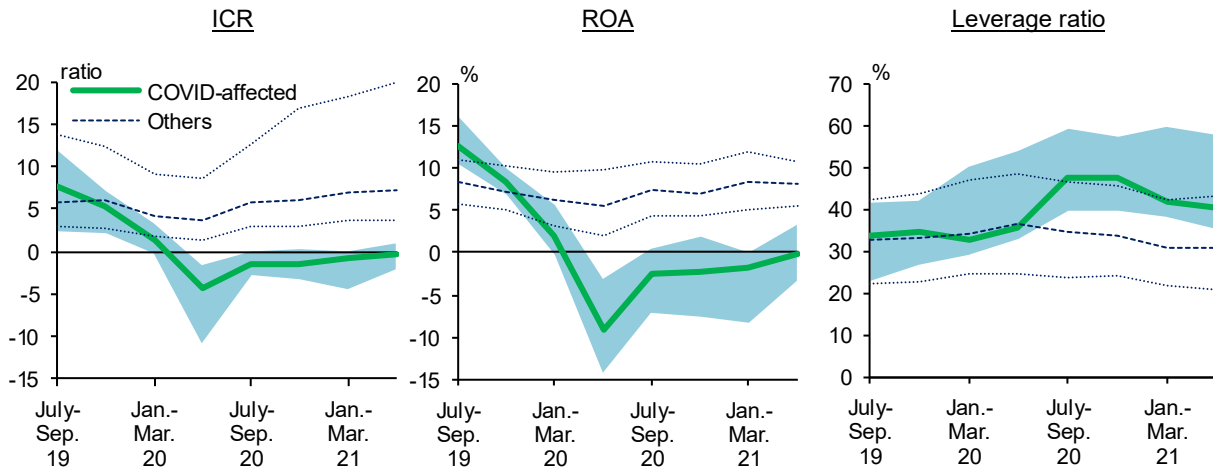
<sup>20</sup> In the analysis in this section, the large overseas borrowers are defined as the top overseas borrowers in each region and rating category of the three major banks.

<sup>21</sup> The sample population consists of approximately 40 thousand firms for which the data for the financial indicators needed for the analysis are available in the S&P Global Market Intelligence. The comparison regarding market forecasts for profits is made below, using the data of approximately 7 thousand firms out of those for which market forecasts are available.



borrowers were higher than those of the population before the pandemic. However, the gap in the ICR vis-à-vis the population has almost disappeared since the outbreak of the pandemic while the gap in the ROA has narrowed, which suggests that the relative advantage in large overseas borrowers' financial condition may have declined (Chart IV-2-6). As for the leverage ratio, whereas that of firms in the population is generally unchanged since the start of the pandemic, that of large overseas borrowers increased through the middle of 2020 and has been declining.

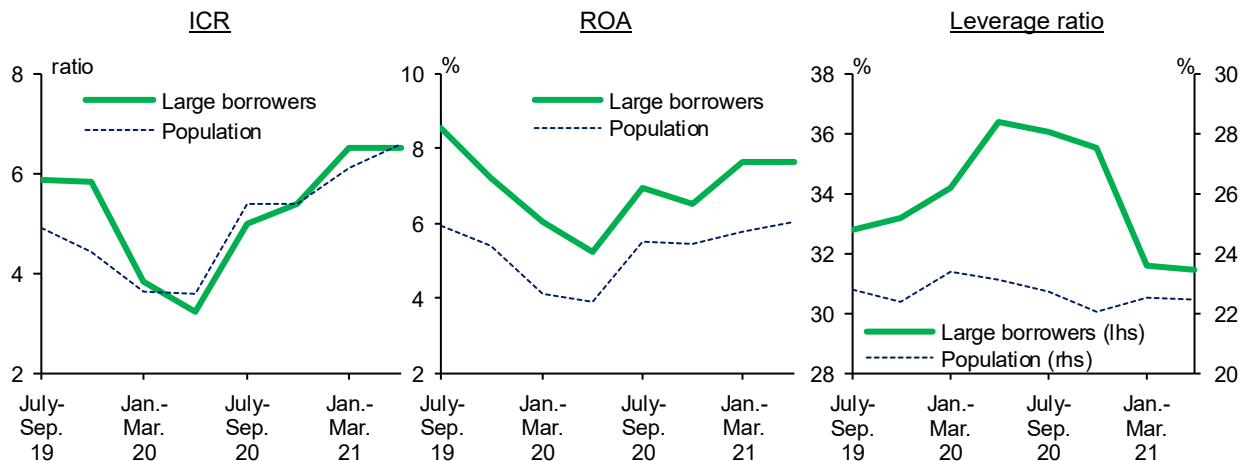
**Chart IV-2-5: Financial indicators of Japanese banks' large borrowers by industry**



Note: 1. Covers the three major banks. "COVID-affected" includes transportation and postal services and consumer services. Latest data as of April-June 2021.  
 2. ICR is measured as EBITDA / interest expenses, ROA as EBITDA / total assets, and leverage ratio as interest bearing debt / total assets (the same applies to Charts IV-2-6 and IV-2-7).  
 3. The shaded areas and the thin dotted lines indicate the 25th-75th percentile ranges for "COVID-affected" and "Others," respectively.

Source: S&P Global Market Intelligence; BOJ.

**Chart IV-2-6: Financial indicators of Japanese banks' large borrowers**



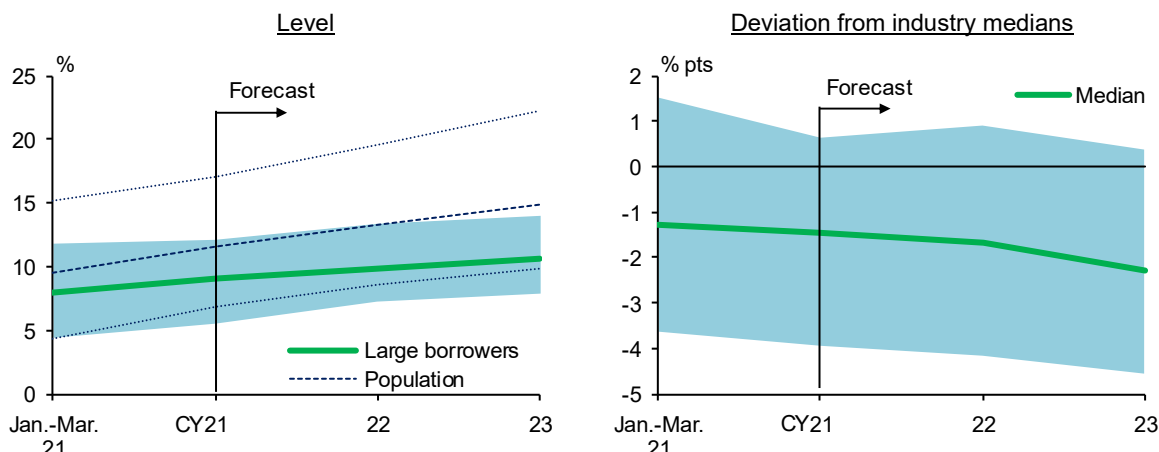
Note: Covers the three major banks. Latest data as at April-June 2021.

Source: S&P Global Market Intelligence; BOJ.

Comparing large overseas borrowers with firms in the population for which market forecasts for their future profitability are available, it is evident that the expected growth in large overseas borrowers' profits is smaller than the population of firms overall (Chart IV-2-7). Even after removing industry composition effects by looking at the difference from the median of firms belonging to the same industry, it is clear that the outlook for large overseas borrowers is judged by the market as more severe.

IV. Risks faced by financial institutions  
 B. Overseas credit risk

**Chart IV-2-7: Profitability (ROA) forecasts of Japanese banks' large borrowers**



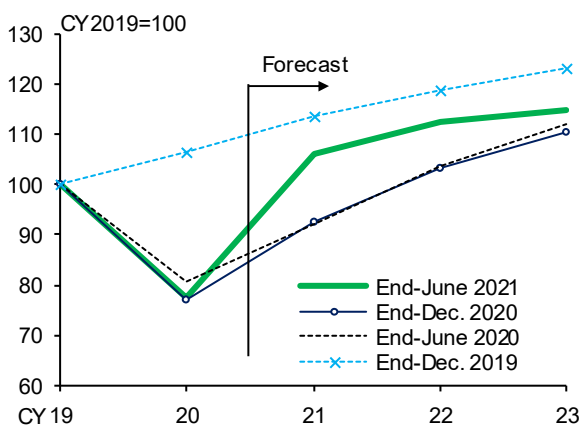
Note: 1. Covers the three major banks. Japanese banks' large borrowers are as of end-March 2021, limited to those for which EBITDA forecasts are available.  
 2. Total assets used for ROA calculation are based on the actual figures as of January-March 2021.  
 3. The shaded areas and the thin dotted lines indicate the 25th-75th percentile ranges for "Large borrowers" and "Population," respectively.  
 Source: S&P Global Market Intelligence; BOJ.

Thus, while the overall quality of Japanese banks' overseas loans portfolio is high, there are signs of a deterioration in some parts. Moreover, the pace of recovery among large overseas borrowers in industries that were severely affected by the pandemic has been slow, and relative advantages of large overseas borrowers in terms of their debt servicing capacity and profitability as measured by their ICR and ROA may be declining. Given the high uncertainty regarding the course of the pandemic and the outlook for the global economy, it is necessary to continue to pay attention to developments in the creditworthiness of overseas loans, taking the pace of economic recovery and the heterogeneity across industries into account.

*Project finance loans*

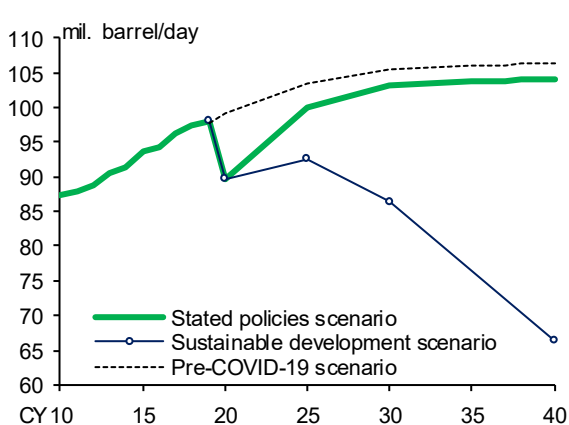
Next, energy-related loans, which account for the major part of project finance loans, are examined.

**Chart IV-2-8: Profit forecasts of energy industry**



Note: Companies are limited to those for which EBITDA forecasts are available as of each forecast date.  
 Source: S&P Global Market Intelligence.

**Chart IV-2-9: Long-term outlook for crude oil demand**



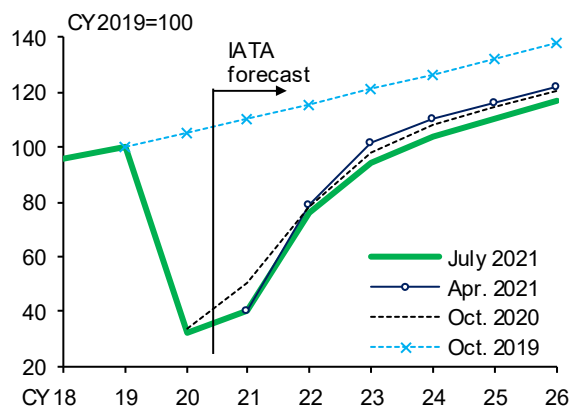
Note: 1. The values from 2020 onward are outlooks.  
 2. "Stated policies scenario" is a scenario that reflects all of today's announced policy intentions and targets. "Sustainable development scenario" is the scenario that is expected to be followed to achieve sustainable energy objectives, including the Paris Agreement. Assumptions for the economic environments other than energy policies are the same as those of "Stated policies scenario." "Pre-COVID-19 scenario" indicates "Stated policies scenario" as of 2019.  
 Source: IEA, "World Energy Outlook 2020."

As highlighted in the previous *Report*, the default and recovery rates of oil and gas projects in particular may worsen when crude oil prices fall, due to factors such as impairment of the value of the project and of the performance of the parent company of the project.<sup>22</sup> Crude oil prices are currently on a recovery trend and markets have revised upward the profit outlook for energy firms, but from a long-term perspective, it has been pointed out that there is a risk of significant price adjustments due to a decline in crude oil demand in a situation where countries accelerate their shift toward a low-carbon economy, and therefore attention is warranted (Charts IV-2-8 and IV-2-9).

### Aircraft-related object finance loans

Lastly, aircraft financing loans, which account for a large share of object finance loans, are examined. Global air passenger demand experienced a significant decrease in 2020 due to the spread of COVID-19 (Chart IV-2-10). Going forward, some experts are of the view that it will remain below pre-pandemic levels through around 2023 due to the delay in recovery in demand. In addition, there is also uncertainty over future developments as the latest forecasts have been revised downward. Going forward, it is important to keep a close eye on the possibility that the creditworthiness of aircraft-related object finance loans may be affected through lower aircraft prices and a decline in lease payments as a result of downward pressure on aviation demand.

Chart IV-2-10: Forecasts of demand for air transportation



Note: Revenue passenger kilometers. Values up to 2020 are actual values.

Source: IATA/Tourism Economics, "Air Passenger Forecasts."

## C. Market risk associated with securities investment

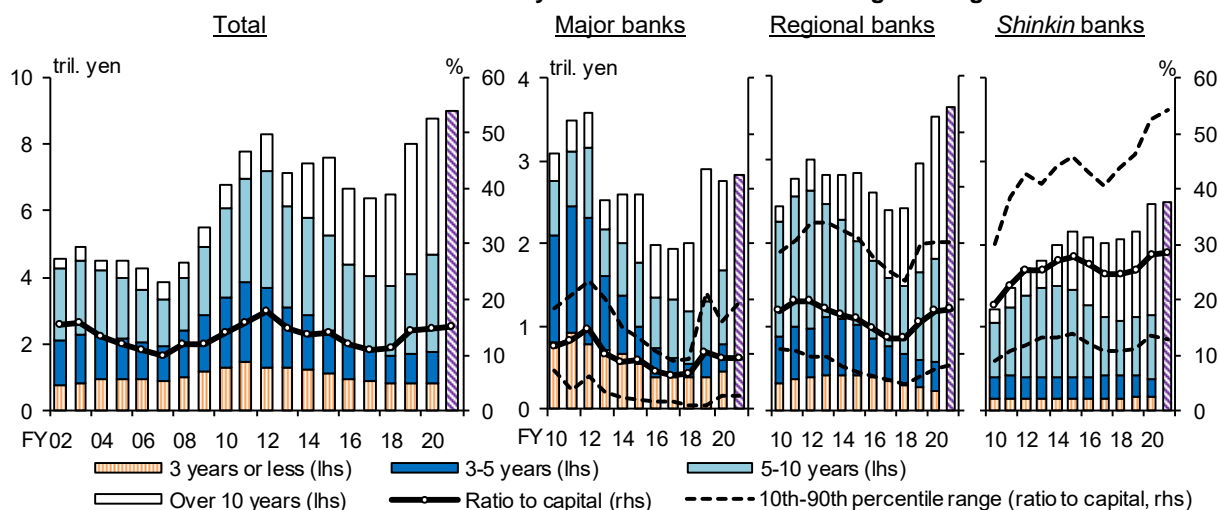
Japanese financial institutions have been actively investing in securities such as overseas credit products and investment trusts under the prolonged low interest rate environment. Since the outbreak of the pandemic, they have increased yen-denominated bond investments, partly reflecting the rise in deposit inflows against the backdrop of the increase in fiscal spending, and the substantial improvement in market conditions has had an impact on the stance of their investment on investment trusts and overseas credit products. Against this background, this section examines the market risks associated with financial institutions' securities investment.

<sup>22</sup> For details, see Box 4 in the April 2021 issue of the *Report*.

### Yen interest rate risk

The amount of interest rate risk associated with the yen-denominated bond investments of financial institutions has reached the highest level since records began in fiscal 2002 (Chart IV-3-1).<sup>23</sup> Before the pandemic, the increase in the amount of risk was driven by the lengthening of the duration of bond portfolios, especially at regional financial institutions, that was conducted for the purpose of compensating for the decline in profits from high-coupon bonds, of which these institutions held large amounts and which had reached redemption. While this trend has continued, the amount of risk has increased since the start of the pandemic because the outstanding amount of bond investments has risen at all types of financial institutions, partly due to the increase in the inflow of deposits against the backdrop of increased fiscal spending (Charts III-1-18 and IV-3-2).

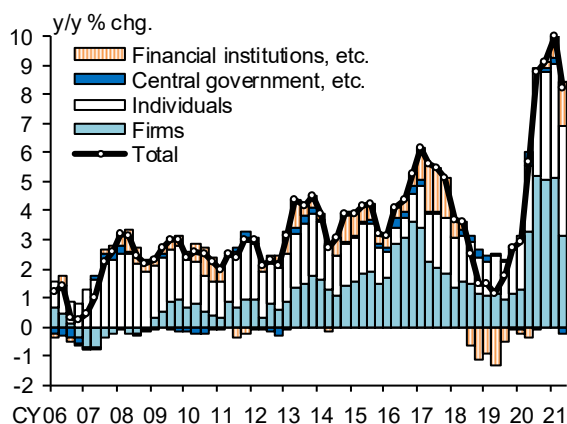
**Chart IV-3-1: Interest rate risk associated with yen-denominated bondholdings among financial institutions**



Note: 1. Interest rate risk is a 100 basis point value in the banking book. Convexity and higher order terms are taken into account. The data for fiscal 2021 are estimated as at end-August 2021.  
 2. Capital represents common equity Tier 1 (CET1) capital for internationally active banks from fiscal 2012 onward, core capital for domestic banks from fiscal 2013 onward, and Tier 1 capital for internationally active banks and domestic banks before fiscal 2012 and fiscal 2013, respectively (excluding the transitional arrangements related to the Basel III framework). Unless otherwise noted, subsequent charts are based on the same definition.

Source: BOJ.

**Chart IV-3-2: Deposits outstanding by type of depositor**



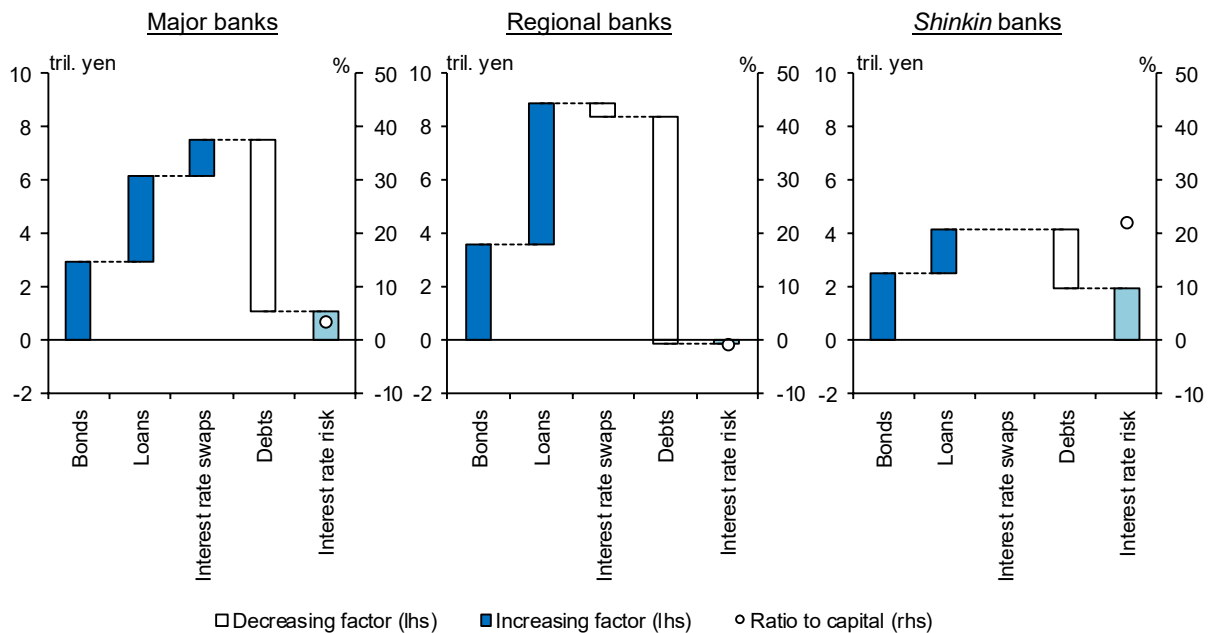
Note: 1. Covers domestically licensed banks. "Financial institutions, etc." includes NCDs.  
 2. Latest data as at the April-June quarter of 2021.  
 Source: BOJ.

<sup>23</sup> In Chart IV-3-1, changes in the economic value of bondholdings are calculated assuming a parallel shift in the yield curve in which the interest rates for all maturities rise by 1 percentage point. One of the interest rate risk scenarios assumed in the FSA's public notice about interest rate risk in the banking book (IRRBB) employs an upward parallel shift of 1 percentage point.

Looking at the ratio of the amount of interest rate risk associated with yen-denominated bond investments to the amount of capital, this ratio has risen to around 10 percent for major banks, around 20 percent for regional banks, and around 30 percent for *shinkin* banks. As for regional banks and *shinkin* banks, the dispersion in the ratio across financial institutions has been increasing to a fair degree since the pandemic.

If, similarly to normal deposits, part of the recent increase in deposits is regarded as an increase in sticky core deposits, the yen interest rate risk in the entire banking book may be considered as smaller than otherwise would be the case (Chart IV-3-3).<sup>24</sup> However, attention should continue to be paid to uncertainty regarding the stickiness of the deposits that have flowed in due to the recent increase in fiscal spending.

Chart IV-3-3: Yen interest rate risk among financial institutions



Note: Interest rate risk is a 100 basis point value in the banking book. Convexity and higher order terms, and so-called "core deposits" in debts are taken into account. For major banks and regional banks, off-balance-sheet transactions (interest rate swaps) are included. The data for major banks are as at end-June 2021, and those for regional banks and *shinkin* banks are as at end-March 2021.

Source: BOJ.

### Foreign currency interest rate risk

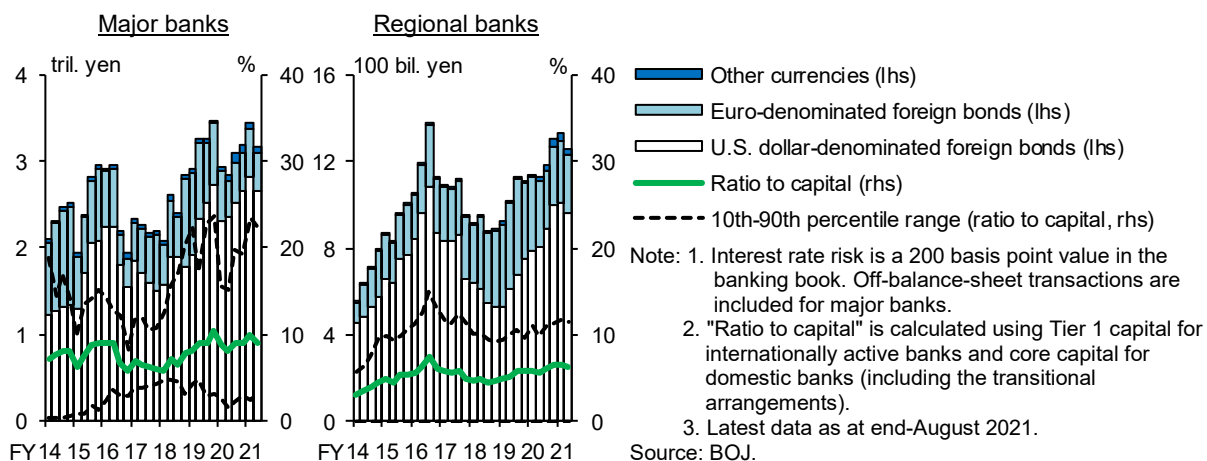
The amount of interest rate risk associated with foreign currency-denominated bond investments for major banks has increased moderately relative to March 2020, when they sold these bonds in response to the fall in overseas interest rates. The moderate increase reflects the restoration of their foreign currency-denominated bond positions in view of developments in U.S. and European interest rates. Meanwhile, the amount for regional banks has been on an uptrend that reflects the

<sup>24</sup> In Chart IV-3-3, changes in the economic value of all assets and liabilities are calculated assuming a parallel shift in the yield curve in which the interest rates for all maturities rise by 1 percentage point. When the average remaining maturity of assets is longer than that of liabilities, a widening maturity mismatch (the difference between the average maturity of assets and liabilities) will amplify the interest rate risk. The estimation of changes in value here reflects only the risk associated with yen-denominated assets (loans and bonds) and liabilities as well as yen interest rate swaps (yen interest rate swaps held by *shinkin* banks are not taken into account). When calculating the interest rate risk based on the assumption that core deposits have increased, the interest rate risk in the overall banking book will be smaller since the economic value of liabilities in the event of a rise in interest rates becomes smaller as the remaining maturity of liabilities becomes longer.

IV. Risks faced by financial institutions  
 C. Market risk associated with securities investment

continued increase in their amounts outstanding. The ratio of the amount of interest rate risk associated with foreign currency-denominated bonds to the amount of capital generally has been limited to about 10 percent for major banks and 5 percent for regional banks (Chart IV-3-4).<sup>25</sup> As for regional financial institutions, overseas interest rate risk has been the main risk factor for about 25 percent of their investment trust holdings (Chart III-1-21). Thus, attention needs to be paid to the continued importance for regional financial institutions to manage their foreign currency interest rate risk, including that associated with investment trusts.

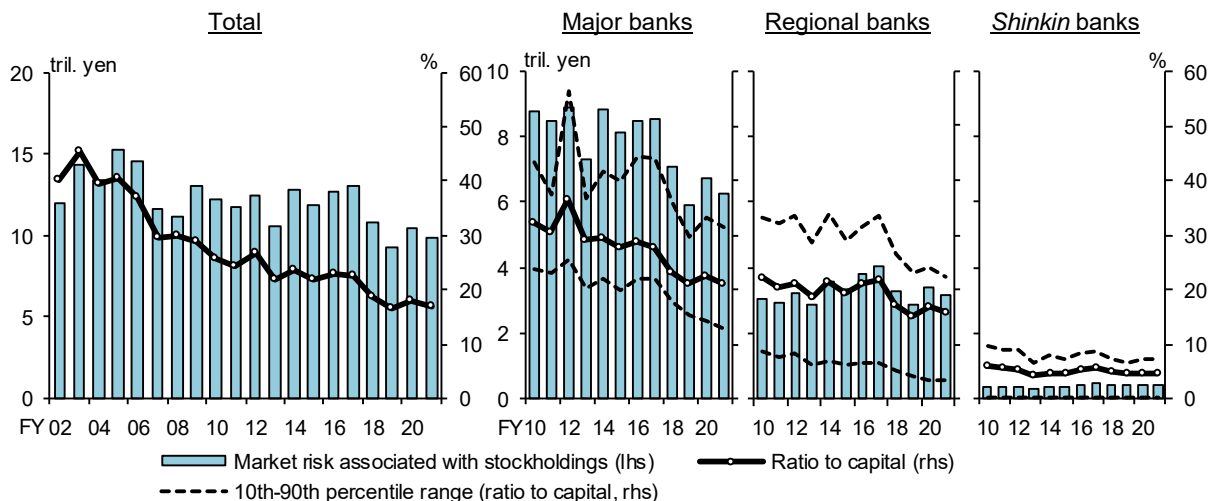
**Chart IV-3-4: Interest rate risk of foreign currency-denominated foreign bonds**



*Market risk associated with stockholdings*

The amount of market risk associated with stockholdings has been more or less flat. This is because the pace of decline in strategic stockholdings, which had slowed down temporarily after

**Chart IV-3-5: Market risk associated with stockholdings among financial institutions**



Note: 1. "Market risk associated with stockholdings" is value-at-risk with a 99 percent confidence level and a 1-year holding period, and excludes risk associated with foreign currency-denominated stockholdings.  
 2. The data for fiscal 2021 are estimated using the outstanding amount of stockholdings as at end-August 2021 and stock prices up to end-August 2021.  
 Source: BOJ.

<sup>25</sup> The FSA's public notice with regard to IRRBB sets an upward parallel shift as one of the scenarios for calculating interest rate risk, assuming the changes in the interest rates of the U.S. dollar and the euro are both 2 percentage points. Similarly, the interest rate risk of foreign currency-denominated foreign bonds in Chart IV-3-4 is calculated as the change in the economic value of bondholdings assuming a parallel shift in the yield curve in which interest rates for all maturities increase by 2 percentage points.

the COVID-19 outbreak, has recovered while some financial institutions have increased their stockholdings for the purpose of earning investment gains (Chart IV-3-5).<sup>26</sup> The ratio of the amount of market risk associated with stockholdings to the amount of capital has been around 20 percent both for major banks and regional banks. Market risk associated with stockholdings thus remains at a level that is large enough to have a substantial impact on financial institutions' profits and financial soundness. Financial institutions need to continue to make an objective assessment of the purpose and costs of strategic stockholdings and control their exposure to the market risk associated with stockholdings, including strategic stockholdings, within an appropriate range according to their financial soundness.

### *Risk associated with overseas credit product investment*

The outstanding amount of overseas credit products held by Japanese financial institutions is unchanged and the portfolio is managed cautiously against risks on the whole (Charts III-1-23 and III-1-24). In terms of the quality of assets underlying CLOs, the default rate overall has declined recently, although it had risen temporarily after the pandemic, and there have been no significant changes in measures of overcollateralization or interest coverage. Thus, the creditworthiness of the CLOs with high credit ratings appears to be generally stable.

However, as some large financial institutions have increased their investment in overseas credit product, there is a risk that major adjustments in overseas credit markets in the future could lead to large losses for Japanese financial institutions.<sup>27</sup> Financial institutions engaged in overseas credit product investment need to make efforts to continuously improve their risk management by appropriately examining the overall functioning of overseas credit markets while taking into account developments in their own foreign currency funding liquidity, such as the degree of dependence on market funding.<sup>28</sup>

### *Other market risk including that associated with investment trust holdings*

In recent years, regional financial institutions in particular have actively increased the weight of investment trusts in their securities investment portfolios. Recently, they have been investing in investment trusts incorporating a wide range of risks, such as risks related to interest rates, stocks, credit, real estate, and foreign exchange (Chart III-1-21).

Holdings of multi-asset investment trusts have continued to increase following the outbreak of COVID-19. Multi-asset investment trusts essentially aim to enhance returns by rebalancing their portfolios while controlling the risk of price declines within a certain range. Some of these trusts change their asset allocation at a high frequency in response to market changes, making it difficult for financial institutions to gauge and measure changes in the amount of risk in a timely manner. In addition, there were some cases in which multi-asset investment trusts were not always successful in diversifying risks in times of stress accompanied by large market volatility.

<sup>26</sup> In Chart IV-3-5, the market risk associated with stockholdings is calculated using VaR with a 99 percent confidence level and a 1-year holding period. Volatility is calculated based on the observed data of the past five years.

<sup>27</sup> For details, see Box 2 in the October 2019 issue of the *Report*.

<sup>28</sup> For more on the current situation and challenges regarding Japanese financial institutions' risk management frameworks for overseas credit product investment, see Financial System and Bank Examination Department of the Bank of Japan and Supervision Bureau of the Financial Services Agency, "Developments in Overseas Credit Investment and Lending by Japanese Financial Institutions: An Overview Based on the Joint Survey by the Bank of Japan and the Financial Services Agency," *Bank of Japan Review Series*, no. 20-E-2, June 2020.

When financial institutions invest in investment trusts with complex designs, they should fully understand their risk profiles and continue to improve their risk management frameworks through risk quantification and close monitoring, as well as make practical and organizational plans for contingency responses in the event of significant losses.

### *The increasing overlap between Japanese financial institutions' and investment funds' securities portfolios*

Since the GFC, the importance of NBFIs entities, such as investment funds, in financial intermediation activities in international financial markets has been growing. In March 2020, overseas investment funds rapidly sold off securities, which is thought to be one of the causes for the large market swings at the time.<sup>29,30</sup> The market portfolios of many Japanese financial institutions then breached various risk management limits.

As pointed out in the previous *Report*, it is considered that there has been a growing overlap in the securities portfolios of Japan's financial institutions as a whole and overseas investment funds, measured by the correlation of market values of the portfolios, giving rise to growing interlinkage effects between the two.<sup>31</sup> Against this background, the analysis in this subsection measures the degree of portfolio overlap between each of the individual financial institutions in Japan and investment funds by investment region and product, and examines the role that the degree of overlap plays on the transmission of market shocks to market values of securities portfolios.<sup>32</sup>

Based on correlations of the portfolios for an approximately 18 thousand pairs of combinations of each of the individual financial institutions and each type of investment fund, the overall degree of portfolio overlap between them was elevated just before the market turmoil in March 2020 relative to before the GFC (Chart IV-3-6).

In terms of differences across types of funds or types of banks, the degree of overlap with bond funds has increased for all types of banks recently, and is particularly pronounced for *shinkin* banks (Chart IV-3-7). This is probably due to the fact that, amid the prolonged low interest rate environment, financial institutions have been shifting their securities portfolios to overseas assets,

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<sup>29</sup> In light of the March 2020 market turmoil, the Financial Stability Board (FSB) is currently working on a regulatory review to improve the robustness of NBFIs such as open-ended funds (OEFs) and money market funds (MMFs). With regard to MMFs, the FSB started making market consultations on its policy proposals in June this year. With regard to OEFs, it is expected that the FSB will conduct a joint study with the International Organization of Securities Commissions (IOSCO) by the end of this year, and discussions on a regulatory review of OEFs will start in earnest over the next year.

<sup>30</sup> See Box 3 for the foreign currency funding risks of Japanese financial institutions, including those during the market turmoil in March 2020.

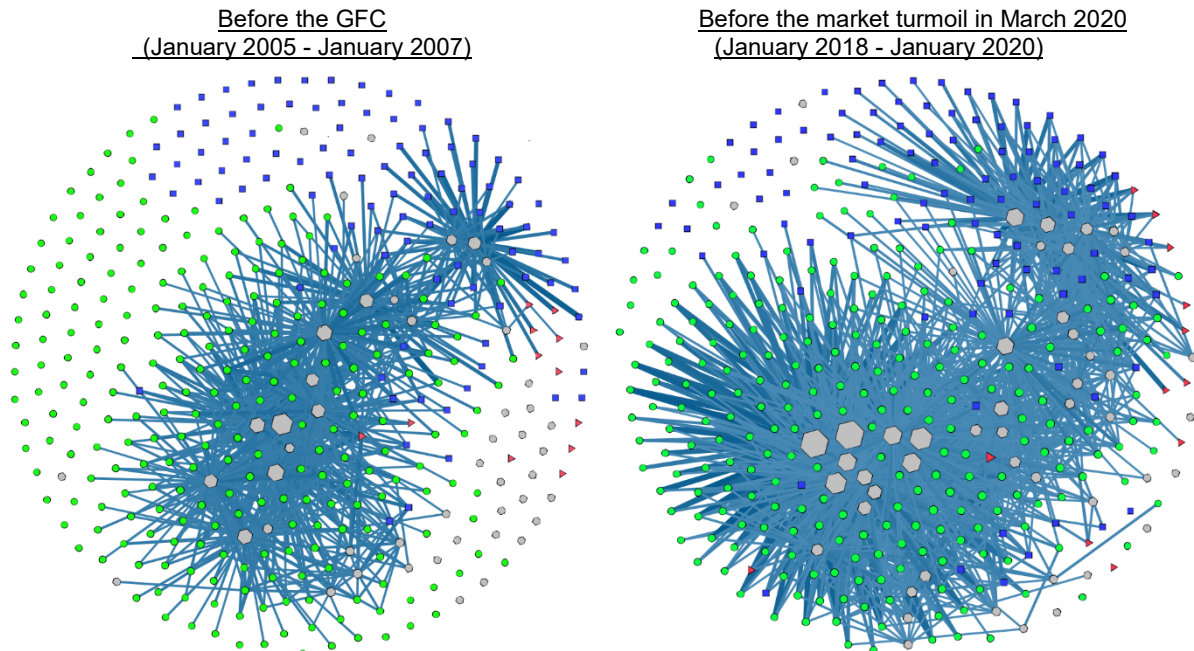
<sup>31</sup> The "interlinkage effect" refers to the effect that asset price fluctuations are amplified through transactions among different entities. This effect consists mainly of the "degree of portfolio overlap," the "portfolio adjustment rate," and the "degree of price impact." For details, see Box 5 in the April 2021 issue of the *Report*.

<sup>32</sup> The portfolio overlap is one of the indicators that measure how similar the portfolios held by two different entities are in terms of changes in market value fluctuations. For the analysis, the portfolio overlap for Japanese financial institutions (about 360 institutions) and their respective investment funds (about 50 types, aggregated by investment region and product) is calculated and for each financial institution an aggregated figure for the overlaps is examined. Due to the need to calculate a large number of overlaps and the high granularity and frequency of the data, the calculation methodology of portfolio overlaps in the current analysis differs from that employed in the previous *Report* and is based on the correlation obtained using the DCC (Dynamic Conditional Correlation)-GARCH model, which is the standard method used widely by, for example, financial institutions in their portfolio analysis. For details on the DCC-GARCH model, see Engle, R., "Dynamic Conditional Correlation: A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedasticity Models," *Journal of Business & Economic Statistics*, July 2002.



which offer relatively high yields, and *shinkin* banks are increasingly investing in multi-asset investment trusts for which overseas interest rates are the main risk factor (Chart III-1-21). In the case of equity funds, there is a notable increase in the overlap in the securities portfolios for large financial institutions and regional banks. Although major banks and regional banks have been reducing their strategic stock holdings, they still hold a considerable amount of stocks, and as seen in previous *Report*, the increasing investment in Japanese stocks by foreign funds may also be contributing to the increase in overlap.<sup>33</sup>

**Chart IV-3-6: Portfolio overlap between Japanese financial institutions and investment funds**

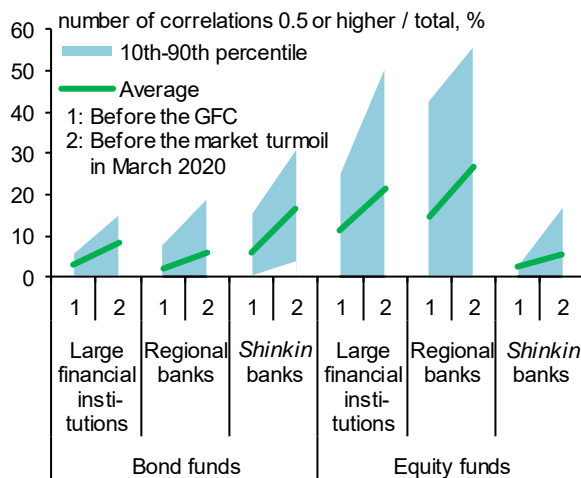


Red▲: Large financial institutions, Blue■: Regional banks, Green●: *Shinkin* banks, Gray hexagon: Investment funds

Note: Gray hexagons indicate approximately 50 types of investment funds by investment region and product. A line is drawn when the overlap between a financial institution's securities portfolio and AUM (assets under management) of an investment fund is high (i.e., correlation of price changes is 0.5 or higher). Shapes are larger the more they are connected.

Source: EPFR Global; Haver Analytics; BOJ.

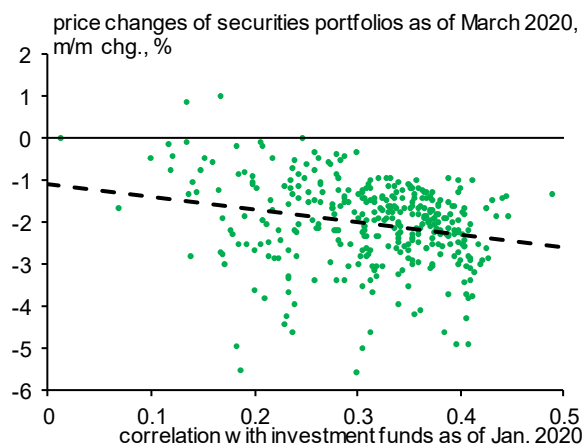
**Chart IV-3-7: Portfolio overlap with investment funds**



Note: "Before the GFC" and "Before the market turmoil in March 2020" periods are the same as those in Chart IV-3-6.

Source: EPFR Global; Haver Analytics; BOJ.

**Chart IV-3-8: Portfolio overlap with investment funds and securities portfolio price changes in the March 2020 market turmoil**



Note: Correlation with investment funds is calculated as the average across all bilateral correlations. The intercept and slope of the regression line are both statistically significant at the 1% level.

Source: EPFR Global; Haver Analytics; BOJ.

<sup>33</sup> For details, see Chart B5-4 in the April 2021 issue of the *Report*.

IV. Risks faced by financial institutions  
 C. Market risk associated with securities investment

Looking at the relationship between a financial institution's degree of overlap with investment funds and changes it faced in market values of the securities portfolios at the time of the March 2020 market turmoil shows that the higher a financial institution's degree of overlap just before the turmoil, the larger the decline in the market value of its securities portfolio tended to be (Chart IV-3-8).

Next, it is examined how the sensitivity of the market value of a financial institution's securities portfolio to changes in global market conditions (U.S. long-term interest rate, fund redemption rate, U.S. stock price, and the financial conditions index [FCI]) is affected by the degree of overlap of its securities portfolio with investment funds.<sup>34</sup> The estimation results show that the sensitivity of the market values of securities portfolios is significantly higher for financial institutions with a higher degree of overlap with investment funds. While this is the case for all the factors examined, the increase in sensitivity is particularly large with regard to the fund redemption rate (Chart IV-3-9).

Meanwhile, regional financial institutions overall have been increasing their investment trust holdings, and the overlap with investment funds is particularly high for financial institutions with a lower profitability of loans and lower indicators with regard to financial soundness (Chart IV-3-10).

**Chart IV-3-9: Portfolio overlap with investment funds and transmission of market shocks**

Explanatory variables / Dependent variable	Price changes of portfolio (m/m chg., %) Amplification effect (b/a)	
U.S. long-term interest rate (m/m chg., %pts) <a>	-0.341 ***	
× Overlap with inv. funds (high, previous period) <b>	-0.158 ***	0.46
U.S. stock price (m/m chg., %) <a>	0.021 ***	
× Overlap with inv. funds (high, previous period) <b>	0.005 *	0.22
Redemption rate of funds (m/m chg., %pts) <a>	-0.019 ***	
× Overlap with inv. funds (high, previous period) <b>	-0.076 ***	3.97
FCI (m/m chg., pts) <a>	-0.605 ***	
× Overlap with inv. funds (high, previous period) <b>	-0.197 **	0.33
Fixed effect	Yes	
Adj. R <sup>2</sup>	0.15	
Number of financial institutions	361	
Sample size	66,178	
Estimation period	Jan. 2005 - Apr. 2021	

Note: \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Financial institutions with a high degree of overlap with investment funds are those with a correlation that is at least one standard deviation higher than the full-sample average.

Source: Bloomberg; EPFR Global; Federal Reserve Bank of Chicago; Haver Analytics; ICI; BOJ.

**Chart IV-3-10: Relationship between the overlap with investment funds and financial indicators**

Explanatory variables / Dependent variable	Correlation with investment funds
Intercept	0.617 ***
Capital adequacy ratio (%)	
Internationally active banks	-0.004 **
Domestic banks	-0.003 ***
Loan-to-deposit ratio (%)	-0.003 ***
Lending margin (%)	-0.023 **
Total assets (logarithm)	-0.005
ROA (%)	0.006
Net fees and commissions / gross operating profits (%)	-0.001
Adj. R <sup>2</sup>	0.32
Sample size	351
Estimation period of dependent variables	January 2020

Note: \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Data covers regional financial institutions. Capital adequacy ratio for internationally active banks represents common equity Tier 1 (CET1) ratio. Explanatory variables are as of March 2019.

Source: EPFR Global; Haver Analytics; BOJ.

On the other hand, the fact that foreign investment funds have been increasing their investment in Japan in recent years has also increased the overlap between financial institutions and investment funds. Therefore, the impact of market shocks in international financial markets on financial institutions' securities portfolios may be amplified not only by their own risk-taking but also by the actions of investment funds, etc. Moreover, given that the number of financial institutions with a large overlap is increasing, this suggests that the impact of the behavior of investment funds, etc. may extend over wide areas of the financial system.

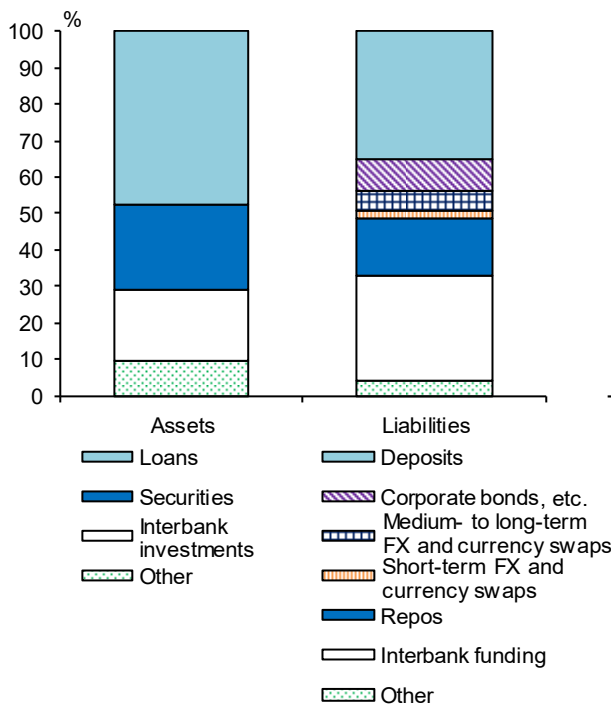
<sup>34</sup> The fund redemption rate is computed on the basis of the total for global equity, bond, MMF, and ETF funds and used to capture volatility in international financial markets related to funds' activities. Data are taken from the Investment Company Institute.

Financial institutions need to consider their investment plans and risk management policies, taking into account the possibility that the increasing interlinkages between the domestic and international financial systems may be changing the characteristics of the market risks they face and the functioning of their existing market risk management.

### D. Foreign currency funding risk

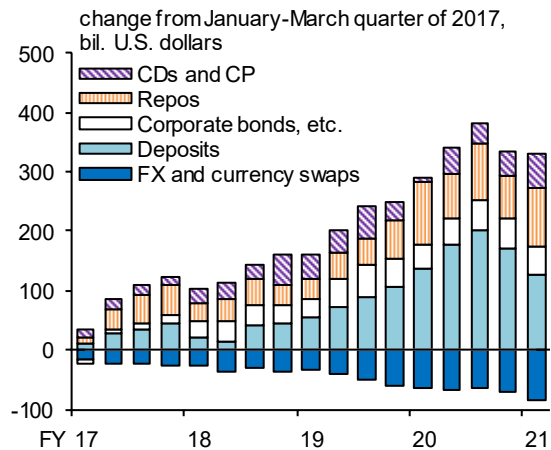
In recent years, Japanese banks' foreign currency funding needs have increased substantially on the back of the expansion of their overseas business. Their foreign currency funding tends to be more dependent on market funding than their yen funding given their weak stable funding basis in the form of retail deposits. Against this backdrop, Japanese banks have been making efforts to increase the share of stable funding in the form of deposits, especially transaction accounts from corporate customers, and corporate bonds (Charts IV-4-1 and IV-4-2).

**Chart IV-4-1: Major banks' foreign currency-denominated balance sheets**



Note: Covers internationally active banks. Data as at end-July 2021.  
Source: BOJ.

**Chart IV-4-2: Changes in major banks' foreign currency funding instruments**

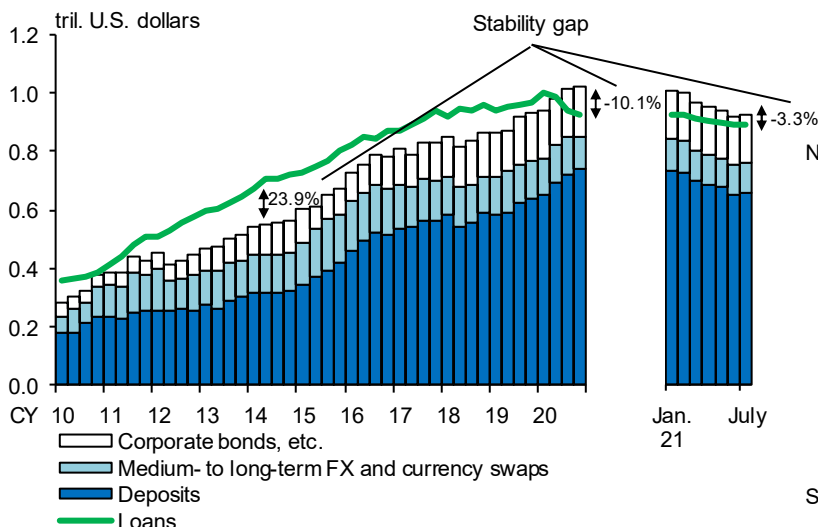


Note: 1. Covers internationally active banks. The data are based on the quarterly average.  
2. Latest data as at April-June quarter of 2021.  
Source: BOJ.

Looking at major banks' "stability gap," which is the difference between the amount of illiquid loans (=assets) and that of stable funding (=liabilities) in their foreign currency balance sheets, the negative stability gap widened by the end of 2020 due to the increase in customer deposits on the liability side and a decrease in illiquid loans on the asset side (Charts III-1-16 and IV-4-3). More recently, however, the negative stability gap has narrowed, mainly reflecting banks' efforts to reduce the costs of foreign currency funding and manage deposits with more consideration to profitability. Specifically, there are continuing moves to reduce the use of highly stable but relatively expensive market funding, such as medium- to long-term FX and currency swaps, and on the back of the massive fiscal spending and accommodative monetary policies in many countries, there are growing moves to reduce deposits collected at high cost in the past, in view of further improvements in their funding conditions.

IV. Risks faced by financial institutions  
D. Foreign currency funding risk

**Chart IV-4-3: Stability gap among major banks**



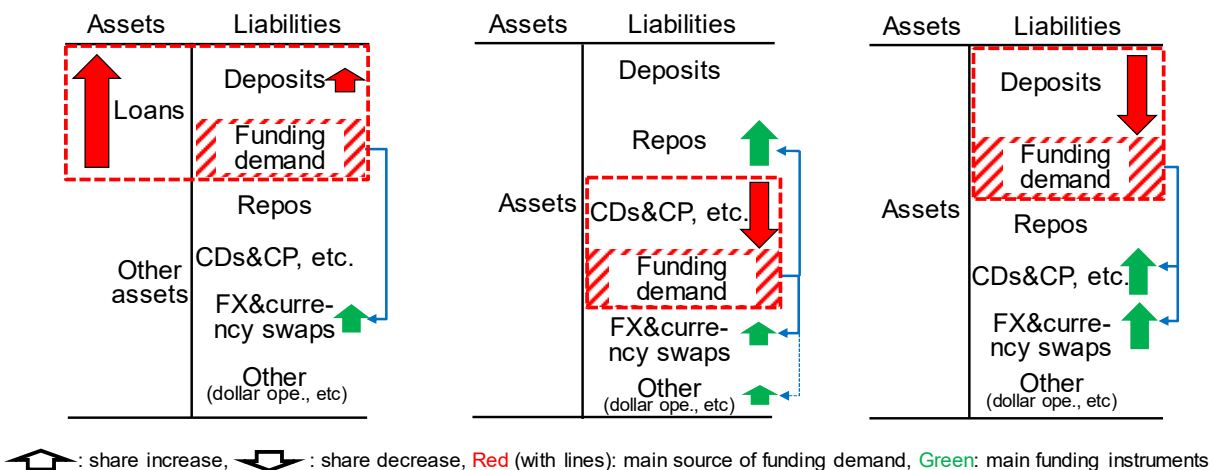
Note: 1. "Corporate bonds, etc." and "Medium- to long-term FX and currency swaps" have funding maturing in more than 3 months until end-March 2012, and funding maturing in more than 1 year from end-June 2012 onward.  
2. The figures indicate the ratios of the gaps to the loans (as at end-April 2014, end-December 2020 and end-July 2021).  
3. Covers internationally active banks.  
4. Latest data as at end-July 2021.  
Source: BOJ.

**Chart IV-4-4: Impact of changes in global market conditions on foreign currency funding instruments**

1. Widespread deterioration in financial conditions (increase in FCI)

2. Increase in fund redemption rate

3. Rise in U.S. interest rates



Note: This figure summarizes the estimation results of Chart B3-2. The up (down) arrows represent share increases (decreases) and the length of the arrows represents the degree of impact.

The availability of foreign currency funding instruments and their funding rates are strongly affected by changes in global market conditions. For example, while lending increased during the GFC on the investment side amid the widespread deterioration in market conditions, there was stress in terms of funding as market funding increased (Chart B3-1). Moreover, there were disruptions in market funding such as funding through CDs and CP in the spring of 2020.<sup>35</sup> In fact, analyses on changes in foreign currency funding instruments over time and those using granular transaction-level data show that global interest rates, fund redemption rates, and widespread deterioration in

<sup>35</sup> For details, see Aoki, R., Antoku, K., Fukushima, S., Yagi, T., and Watanabe, S., "Foreign Currency Funding of Major Japanese Banks -- Review of the March 2020 market turmoil --," *Bank of Japan Review Series*, no. 21-E-4, October 2021.

financial conditions are the main driving factors behind changes in funding instruments (Chart IV-4-4), and that they have a large impact on funding rates.<sup>36</sup>

Analyses using the same data show that efforts to acquire transaction accounts and to diversify counterparties of market funding are effective ways to stabilize funding rates and reduce the risk of being forced to substitute deposits with market funding (see Box 3).

While improving the profitability of overseas operations overall is an important agenda for Japanese banks, the above analyses indicate that improving the stability of foreign currency funding continues to be important as well. Japanese banks therefore need to pursue improving the stability of such funding in normal times as well as taking profitability into consideration. In addition, based on the lessons learned from the market turmoil in March 2020, banks need to continue to work on strengthening their crisis management and creating further sophistication of their risk management, mainly by enhancing the effectiveness of liquidity stress testing and various crisis management tools and developing institutional frameworks for swift and accurate data collection.

## E. Risks posed by structural changes in the business environment

Lastly, this section addresses risks posed by structural changes in the business environment surrounding financial institutions, focusing on recent developments and prospects regarding cyber risk, climate-related financial risks, and interest rate benchmark reform.

### 1. Cyber risk

Cyber risk has the following characteristics: (1) financial institutions may be hit by a cyberattack that goes beyond, in terms of technological aspects and scale, the self-defenses they have put in place, given the rapid sophistication of cyberattacks; (2) if a cyberattack is successful, it may instantaneously propagate to other financial institutions and to the entire financial system, since the financial institutions are interconnected through financial and securities settlement networks, etc.; (3) since whether and what information on losses from cybercrime is released is up to the victims of cyberattacks, the amount and comprehensiveness of information disclosed are insufficient; and (4) the quantification of such risk is difficult and, moreover, there remains a risk that the capital accumulation by financial institutions for the purpose of loss absorption may not be sufficient to internalize losses that arise from negative externalities.

Losses from cyberattacks are growing rapidly; on a global basis, some cyberattacks have been found to pose serious threats to a number of users simultaneously, such as large-scale software supply chain attacks.<sup>37</sup> In Japan, too, with the expansion of the use of cloud services and the spread of remote work, cyberattacks are increasing and the nodes that cyberattacks aim to penetrate are becoming more diverse, which likely increases the risk. For example, with more people working from home due to the spread of COVID-19, there have been a growing number of attacks targeting vulnerabilities in virtual private network (VPN) devices used for connecting to firms' internal systems from outside via the internet, as well as brute-force attacks on passwords

<sup>36</sup> The estimation results in Box 3 show the following: (1) a widespread deterioration in financial conditions widens the gap between loans and deposits and increases the share of FX and currency swaps, (2) a rise in the fund redemption rate reduces the share of funding through CDs and CP, etc., and especially increases the share of repo and short-term FX and currency swap funding, and (3) a rise in U.S. interest rates reduces the share of deposits.

<sup>37</sup> In a software supply chain attack, attackers exploit part of the process in which software products are developed and provided, and finally no longer used. The most common method is to compromise the software development environment or the update process.

for remote desktop applications. In addition, both the number of fraudulent online banking withdrawals of deposits and the losses involved have increased significantly since 2019, with the number of cases remaining high in 2020.

While it is difficult to avert cyberattacks completely, it is important to limit the potential damage as much as possible by reducing the risk of data breaches and avoiding the suspension of critical business operations through a strengthening of existing operational risk management and enhancing "operational resilience."<sup>38</sup> Reflecting changes in the environment such as the spread of COVID-19 and the increase in cyberattacks, the Basel Committee on Banking Supervision in March 2021 released the "Principles for Operational Resilience" and, moreover, revised the "Principles for the Sound Management of Operational Risk" to enhance the content relevant to ensuring information and communication technology (ICT) security.<sup>39,40</sup> Taking these principles into account, in addition to building defenses against threats, robustness should be enhanced by preparing plans in advance to minimize any damage and by, for example, regularly conducting vulnerability assessments and attack simulations to examine the effectiveness of the plans. For financial institutions with group companies and overseas bases, efforts to improve robustness among group companies and on a global basis are also an important issue.

Financial institutions also need to pay special attention when using external services for the management of their system infrastructure and information assets. Recently, there have been a number of customer data breaches due to unauthorized access exploiting misconfigured access settings for cloud services. When financial institutions use such external services, the scopes of responsibility of the financial institution and the service provider need to be clarified in advance, and the responsibilities within the scope of the service provider need to be properly managed within the framework of vendor management.<sup>41</sup> Moreover, financial institutions need to exercise adequate governance of those involved in API connections for cashless and other services, such as understanding and evaluating the process through which the identities of their customers, when providing their data, are verified.

## 2. Climate-related financial risks

Reflecting the frequent occurrence of extreme weather events and large-scale natural disasters around the world, there is a growing awareness that climate change is a global challenge that could have a broad impact on our society and economic activity into the future. In the area of financial transactions, there have been active international discussions on how to deal with the risks that physical phenomena, such as disasters and rising sea levels triggered by climate change, as well as policy changes and technical innovations needed for the transition to a low-carbon society, could

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<sup>38</sup> The concept of "operational resilience" refers to the ability of a financial institution to deliver critical operations even in the event of disruptions that make it difficult to perform business operations, including not only cyberattacks but also natural disasters and computer system failures.

<sup>39</sup> The "Principles for Operational Resilience" consist of principles regarding the continuation of banks' critical operations in the event of a cyberattack or natural disaster in seven categories: governance; operational risk management; business continuity planning and testing; mapping of interconnections and interdependencies of critical operations; third-party dependency management; incident management; and resilient information and communication technology (ICT), including cyber security.

<sup>40</sup> The "Principles for the Sound Management of Operational Risk" (first published in 2003) provide guidelines for banks' operational risk management (identification, assessment, monitoring, and control/mitigation). They were revised in 2011 and 2021 to reflect changes in the environment.

<sup>41</sup> For details, see "Key Considerations for Risk Management in Using Cloud Services," *Financial System Report Annex Series*, March 2021.

impair the resilience of financial institutions and the stability of the financial system, including those that emerge from damage to financial institutions' assets (so-called climate-related financial risks).<sup>42</sup> In July 2021, the FSB formulated a comprehensive roadmap that incorporates relevant initiatives at standard-setting bodies, the Network for Greening the Financial System (NGFS), and other international organizations, with the aim of promoting international coordination.<sup>43</sup> The roadmap presents actions to be taken in four main, interrelated areas: firm-level disclosures, data, vulnerabilities analysis, and regulatory and supervisory practices and tools. In line with this roadmap, climate-related financial risks will be addressed on a global basis.

In response to these actions taken internationally, national and regional financial authorities as well as financial institutions have worked on developing methods to quantitatively assess climate-related financial risks and on strengthening risk management frameworks. For example, with regard to quantifying climate-related financial risks, there is widespread recognition of the benefits of conducting scenario analyses using simulations based on certain assumptions regarding the extent of climate change and its impact on the economy, and a growing number of financial authorities and financial institutions are conducting such analyses (see Box 4 for an example of this scenario analysis methodology).<sup>44</sup> The European Central Bank (ECB) conducted stress testing of euro area banks using data on millions of firms around the world, including locational information and greenhouse gas emissions, and released the results. The Bank of England (BOE) and the Autorité de Contrôle Prudentiel et de Résolution (ACPR) of the Banque de France conducted an exercise in which participating financial institutions assessed the impact of climate change on themselves based on the common scenario defined by the respective authorities. The Bank of Japan, together with the Financial Services Agency (FSA), has started a pilot exercise of such analyses, mainly on large financial institutions using the common scenarios.

Against the background of these developments, Japanese financial institutions have conducted their own scenario-based financial impact analyses in line with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) and have released the results. This trend is spreading among major financial institutions, and there are attempts to increase the sophistication of the analytical methods and expand the coverage of the analyses. Regional financial institutions have also started such analyses. Moreover, an increasing number of financial institutions have recognized climate-related financial risks as risks that could have a significant impact on their business operations, have put in place control and execution structures involving the board of directors and senior management, and have formulated guidelines with regard to investments and loans in specific sectors where there is concern about the potential impact of climate change. Recently, some financial institutions have started to attempt to grasp not only their own greenhouse gas emissions but also those associated with their investment and loan portfolios, and/or set emission reduction targets including with regard to such portfolios.

Climate-related financial risks differ from conventional financial risks, in that (1) the degree of uncertainty regarding the nature and impact of climate change and related policy and technological

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<sup>42</sup> Generally, risks of losses due to physical phenomena are referred to as physical risks and risks of losses due to changes that occur in the transition process to a low-carbon economy are called transition risks.

<sup>43</sup> For details on the FSB roadmap for addressing climate-related financial risks, see <https://www.fsb.org/2021/07/fsb-roadmap-for-addressing-climate-related-financial-risks/>.

<sup>44</sup> According to a survey conducted in autumn 2020 by the Task Force on Climate-related Financial Risks (TCFR) of the Basel Committee on Banking Supervision (hereafter the Basel Committee), 17 of the 19 financial authorities that responded said that they either had conducted or were planning to conduct scenario analysis or stress testing. For details, see "Climate-Related Financial Risks -- Measurement Methodologies" released by the Basel Committee in April 2021 (<https://www.bis.org/bcbs/publ/d518.pdf>).

changes is much greater and (2) the time horizon over which risks materialize is much longer than in the case of conventional financial risks. Financial experts have started accumulating knowledge on how to quantitatively assess the associated risks, partly due to a lack of available data. For financial institutions, this means that it is becoming increasingly important to examine how to assess and manage the risks and how to compile the necessary data to do so, while gathering information on various initiatives at home and abroad.

The Bank of Japan has been actively communicating with financial institutions and engaging in international discussions. In July 2021, the Bank, with an intention of furthering its efforts on climate change consistent with its mandate of achieving price stability and ensuring the stability of the financial system, released the comprehensive strategy.<sup>45</sup> In addition, the Bank decided to introduce a new fund-provisioning measure to support financial institutions' various efforts in fields related to climate change, and it will launch the measure likely within 2021.

### 3. Interest rate benchmark reform

It is now little more than two months until cessation of the publication of yen LIBOR, at the end of 2021.<sup>46</sup> Meanwhile, alternative interest rate benchmarks became available with the publication of production rates for term reference rates in April, and statements released in March and July by the Cross-Industry Committee on Japanese Yen Interest Rate Benchmarks, for which the Bank of Japan acts as the secretariat, set out the milestones for cessation of transactions referencing LIBOR in the yen interest rate swap markets. Through these initiatives, the environment necessary for a smooth transition has been prepared. Individual entities such as financial institutions, institutional investors, and business corporations will need to make steady progress with their transitions until the end of 2021.<sup>47</sup>

Japan's FSA and the Bank of Japan, while further deepening their dialogue with financial institutions, have examined financial institutions' preparedness based on the "Roadmap to Prepare for the Discontinuation of Japanese Yen LIBOR" jointly formulated by the public and private sectors

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<sup>45</sup> See "The Bank of Japan's Strategy on Climate Change," July 2021 ([https://www.boj.or.jp/en/announcements/release\\_2021/rel210716b.htm](https://www.boj.or.jp/en/announcements/release_2021/rel210716b.htm)).

<sup>46</sup> In March 2021, the United Kingdom's ICE Benchmark Administration (IBA) -- the administrator of LIBOR -- and the Financial Conduct Authority (FCA) announced that, with the exception of certain U.S. dollar LIBOR settings, LIBOR settings (based on the current methodology referencing rates provided by panel banks), including yen LIBOR settings, will cease at the end of December.

<sup>47</sup> In September 2021, the United Kingdom's FCA decided to use its authority to establish synthetic yen LIBOR settings (pseudo yen LIBOR calculated using market data). It states that users of yen LIBOR should continue to focus on active transition rather than relying on synthetic yen LIBOR, as it is expected to be time-limited to one year. For details, see "Further arrangements for the orderly wind-down of LIBOR at end-2021" released by the United Kingdom's FCA in September 2021. In addition, the FSA, the Bank of Japan, and the Cross-Industry Committee believe the synthetic yen LIBOR should be used as a "safety net." For details, see the Strategy Development and Management Bureau and the Supervision Bureau of the FSA and the Financial System and Bank Examination Department and the Financial Markets Department of the Bank of Japan, "Response to the announcement on the end date of LIBOR panel publication and the announcement on the intention to consult on the publication of synthetic yen LIBOR," March 2021, and Cross-Industry Committee on Japanese Yen Interest Rate Benchmarks, "Public Consultation on the Treatment of Tough Legacy Contracts in Japan," September 2021.



(Chart IV-5-1).<sup>48,49</sup> Looking at major financial institutions, the transition has been making progress in line with the roadmap.<sup>50</sup> Specifically, the issuance of new loans and bonds referencing yen LIBOR has already ceased and progress has been made with a smooth transition to the Tokyo Overnight Average rate (TONA) for overnight index swaps, from interest rate swaps referencing yen LIBOR. Finally, with the end of the year approaching, the transition away from yen LIBOR has also been accelerating for legacy contracts for loans, bonds, and derivatives.

**Chart IV-5-1: Roadmap to prepare for the discontinuation of Japanese yen LIBOR**

		2020	2021				2022
		Oct.-Dec.	Jan.-Mar.	Apr.-June	July-Sep.	Oct.-Dec.	
Products referencing LIBOR	Loans and Bonds			■ Develop systems and operations for O/N RFR Compounding (Fixing in Arrears)	■ Cease the issuance of new loans and bonds	■ Significantly reduce the amount of loans and bonds	Permanent discontinuation of LIBOR
	Interest rate sw aps				■ Adopt the new quoting conventions for the interest rate sw aps based on TONA	■ Cease the initiation of new interest rate sw aps	
Term Reference Rates		■ Start the daily publication of prototype rates		■ Start the publication of production rates			

Preparations for the cessation of the publication of yen LIBOR, which started in 2017, are now in their final stage, and financial institutions need to thoroughly proceed with the transition as the end of the year approaches.<sup>51</sup>

<sup>48</sup> The roadmap called for the issuance of new loans and bonds referencing yen LIBOR to be ceased by the end of June 2021 and a significant reduction in the amount of loans and bonds referencing yen LIBOR by the end of September. It also called for the initiation of new interest rate swaps referencing yen LIBOR to be ceased by the end of September.

<sup>49</sup> For the results of a survey on financial institutions' preparedness conducted at the end of 2020, see FSA and Bank of Japan, "Summary of Results of the Second Survey on the Use of LIBOR," May 2021. The Bank is planning to conduct a third survey together with the FSA on the use of LIBOR at the end of 2021.

<sup>50</sup> The transition of legacy contracts has been making progress at regional banks as well.

<sup>51</sup> Regarding transactions referencing LIBOR for currencies other than the yen, financial institutions are required to act in line with the guidelines set out by the home authorities and/or national working groups for the respective currencies.

## V. Examination of the resilience of the financial system

### Financial institutions' profitability and capital adequacy

- Looking at the financial results of financial institutions for fiscal 2020, net income increased for major banks, regional banks, and *shinkin* banks, mainly because pre-provision net revenue (PPNR) rose, reflecting the increase in demand for funds as a result of COVID-19. The capital adequacy ratios of financial institutions have remained sufficiently above the regulatory requirements as the ratios have increased for both internationally active banks and domestic regional banks.

### Macro stress testing

- In this *Report*, the resilience of financial institutions and the financial system is examined, under three downside scenarios.
- In the diverging business conditions scenario, it is assumed that there is a resurgence of COVID-19 from the end of 2021, putting downward pressure on the real economy with diverging business conditions across and within industries and having a negative impact on financial markets. Capital adequacy ratios on average remain above regulatory levels for all types of banks, although the increase in credit costs contributes largely to pushing down the ratios for domestic regional banks and *shinkin* banks.
- In the emerging markets stress scenario, it is assumed that the U.S. long-term interest rate rises, driven, for example, by heightened inflation expectations due to the changes in people's perceptions of supply constraints, leading to an adjustment in global financial markets and pressure for capital outflows from emerging economies; as a result, growth in the real economy decelerates at home and abroad, particularly in emerging economies. Capital adequacy ratios on average remain above regulatory levels for all types of banks, although the negative contributions of credit costs and of unrealized gains/losses on securities holdings are sizable for internationally active banks.
- The financial stress scenario assumes a situation in which global financial markets experience a substantial and rapid adjustment comparable to that during the GFC, which has a negative impact on financial intermediation activities, putting further downward pressure on the domestic and overseas economies. Capital adequacy ratios are lower than in the other downside scenarios for all types of banks due to further increases in credit costs and realized losses on securities holdings. The CET1 ratio of a fair number of internationally active banks declines to a level that breaches the capital buffer ratios.
- Japan's financial system is likely to remain highly robust even in the event of a resurgence of COVID-19 or an adjustment in global financial markets and emerging economies due to a rise in U.S. long-term interest rates. However, in the event of a substantial and rapid adjustment in global financial markets, a deterioration in financial institutions' financial soundness and the resultant impairment of the smooth functioning of financial intermediation could pose a risk of downward pressure on the real economy.

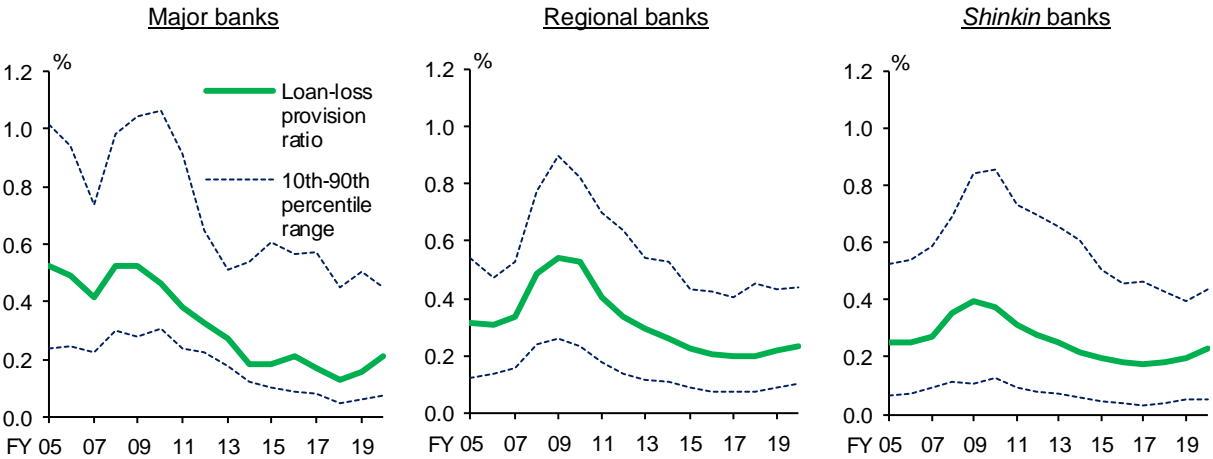


the impact of precautionary loan-loss provisioning linked to the pandemic, especially at major banks, and increased further in fiscal 2020, mainly due to a rise in loan-loss provisions for some industries that were significantly affected by the pandemic and an expansion in the coverage of precautionary loan-loss provisioning.

*Loan-loss provision ratios*

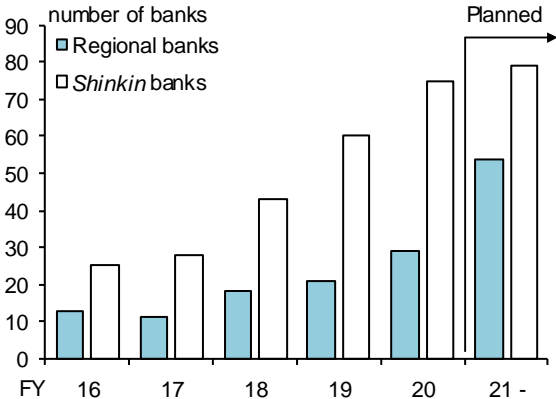
Loan-loss provision ratios in terms of the amount of general provisions for normal loans and "need attention" loans had been on a downtrend since the GFC but have seen an upturn from around fiscal 2018. In fiscal 2020, they rose for all bank types, albeit slightly, partly due to an increase in precautionary loan-loss provisions (Chart V-1-2). Regarding loan-loss provisioning methods, financial institutions have been examining since before the outbreak of COVID-19 how to address impacts of changes in the credit cycle while staying in compliance with existing accounting principles. Looking at recent developments as well as survey results, an increasing number of financial institutions have reviewed or are planning to review loan-loss provisioning methods,

**Chart V-1-2: Loan-loss provision ratios**



Note: 1. Ratios of general loan-loss provisions to the total amount of normal loans and "need attention" loans.  
 2. Latest data as at end-March 2021.  
 Source: BOJ.

**Chart V-1-3: Number of banks changing methodology of loan-loss provisions**



Source: BOJ.

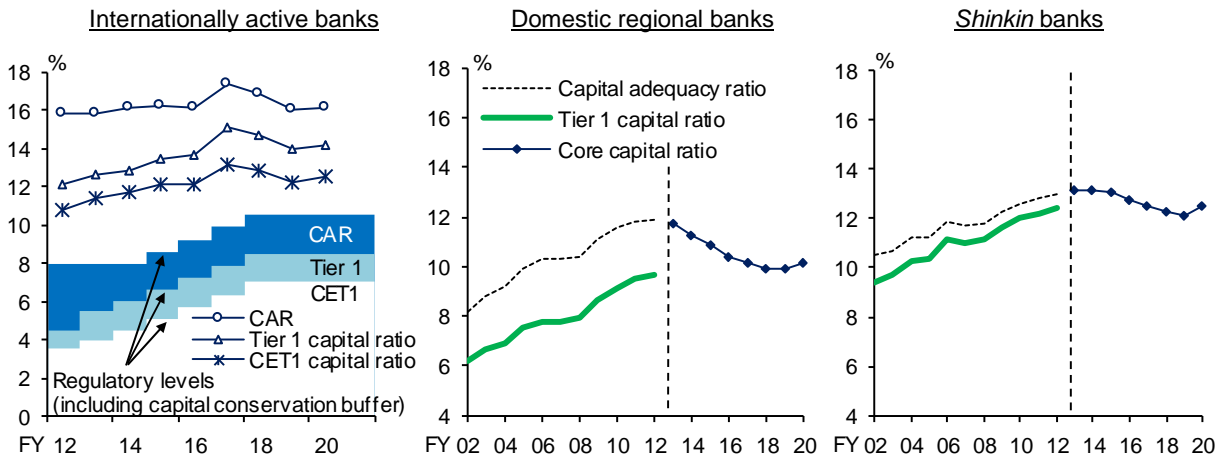
including the adoption of loan-loss provisioning that groups borrowers according to their risk characteristics, as well as forward-looking loan-loss provisioning, in order to reflect the impact of the pandemic more accurately (Chart V-1-3). Financial institutions need to consider their loan-loss provisioning methods in line with their lending policies and loan portfolios. Given the high

uncertainty surrounding corporate profits, such as with regard to the future course of the pandemic, financial institutions also need to be fully aware of the impact that a deceleration in the recovery pace of corporate profits could have on credit risk.

## 2. Capital adequacy

The capital adequacy ratios of financial institutions have been sufficiently above the regulatory requirements for all types of banks (Chart V-1-4).<sup>53</sup> Although the ratios had been declining in recent

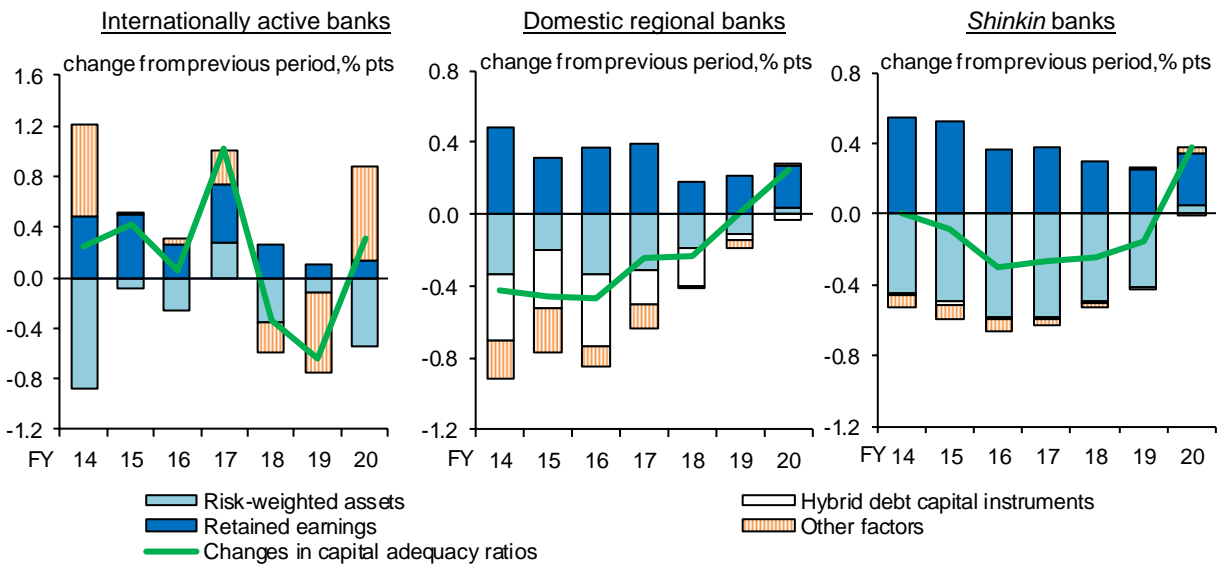
**Chart V-1-4: Financial institutions' capital adequacy ratios**



Note: "CAR" indicates the total capital adequacy ratio. Classifications of internationally active banks and domestic regional banks up to fiscal 2012 are as at end-fiscal 2013. The charts are calculated on a consolidated basis. Latest data as at end-March 2021. The transitional arrangements are taken into consideration.

Source: BOJ.

**Chart V-1-5: Factors of changes in capital adequacy ratios**



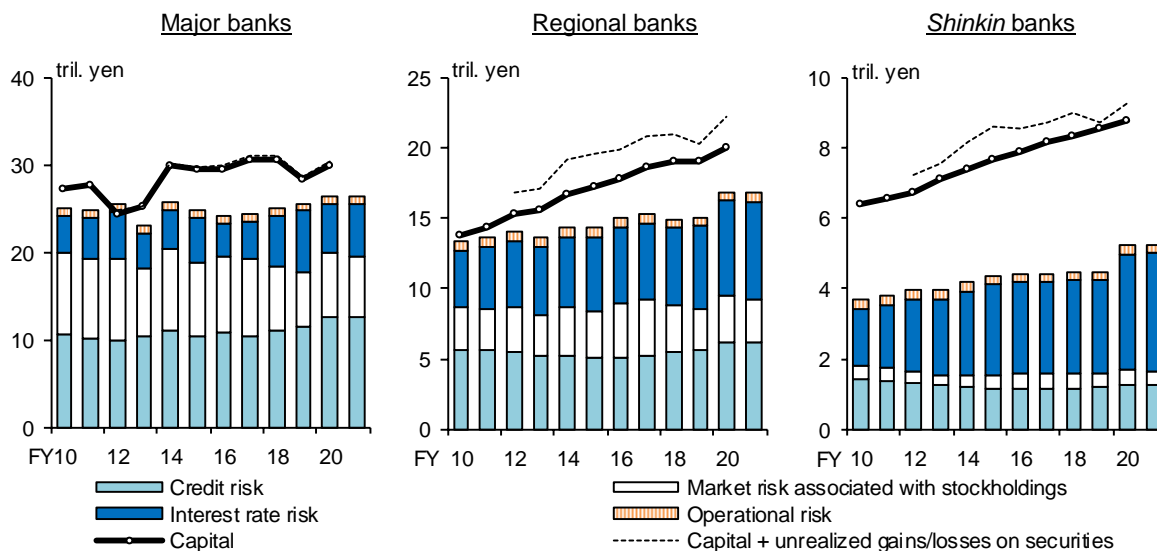
Note: The transitional arrangements are taken into consideration.

Source: BOJ.

<sup>53</sup> Internationally active banks and domestic banks are required to maintain a CET1 capital ratio of 4.5 percent and a core capital ratio of 4 percent, respectively. Internationally active banks are also required to meet capital buffer regulations designed to build up an additional buffer to prevent credit supply constraints under stress conditions. The capital buffer regulations include the requirement of a capital conservation buffer of 2.5 percent, a countercyclical capital buffer of 0 to 2.5 percent, and a capital buffer for global systemically important banks (G-SIBs) of 1 to 2.5 percent or domestic systemically important banks (D-SIBs) of 0.5 percent. Banks are able to use their buffers as necessary to maintain lending to the real economy.

years as retained earnings were growing at a slower pace than risk-weighted assets, they rose for all bank types in fiscal 2020 due to the accumulation of retained earnings and because the increase in risk-weighted assets at domestic regional banks and *shinkin* banks was constrained (Chart V-1-5). The capital level of the financial system as a whole is adequate relative to the amount of various types of risk financial institutions take, and financial institutions have sufficient loss absorption capacity (Chart V-1-6).<sup>54</sup>

**Chart V-1-6: Risks borne and amount of capital by type of bank**



Note: 1. "Credit risk" is unexpected losses with a 99 percent confidence level calculated by referring to the default rates from fiscal 2005 onward and includes foreign currency-denominated assets. See Chart IV-3-5 for the calculation method used for "Market risk associated with stockholdings" and Charts IV-3-1 and IV-3-4 for "Interest rate risk." "Market risk associated with stockholdings" includes risk associated with foreign currency-denominated stockholdings. "Interest rate risk" includes deposit-taking and lending activities and off-balance-sheet transactions. "Operational risk" is assumed to correspond to 15 percent of gross operating profits. "Capital + unrealized gains/losses on securities" is the sum of capital and unrealized gains/losses on securities (tax effects taken into account) for domestic regional banks. Risks are integrated simply by summing the different types of risk.

2. The fiscal 2021 data of each type of risk are estimated based on available data as at September 2021.

Source: BOJ.

## B. Macro stress testing

### 1. Risk recognition

With the financial vulnerabilities and risks identified and examined in the previous sections in mind, this section examines the sufficiency of financial institutions' capacity to absorb losses from these financial vulnerabilities and risks, and the resultant impact on financial system stability and financial intermediation activities, using macro stress testing.<sup>55,56</sup>

<sup>54</sup> The same method and parameters (such as confidence level and holding period) are used for all financial institutions in calculating the amount of risk they bear. Thus, the amount of risk presented here does not necessarily match that calculated internally by financial institutions themselves as part of their risk management process.

<sup>55</sup> The simulation utilizes the Financial Macro-econometric Model (FMM) developed by the Financial System and Bank Examination Department of the Bank. For the basic structure of the model, see "The Financial Macro-econometric Model (FMM, March-2020 Version): Overview and Recent Developments," *Financial System Report Annex Series*, August 2020.

<sup>56</sup> The stress testing targets 109 banks and 247 *shinkin* banks (accounting for approximately 80 to 90 percent of total loans outstanding of depository financial institutions). The simulation period is from April-June 2021 through January-March 2024. Some of the economic and financial variables for the scenarios employed in the stress testing can be downloaded from the Bank's website at <https://www.boj.or.jp/en/research/brp/fsr/fsr211021.htm>.

Looking back at economic activity after the release of the previous *Report*, although COVID-19 has continued to have a significant impact, the Japanese and European economies have generally recovered in line with the average forecasts by research institutions and markets at the time of the previous *Report*. Meanwhile, the pace of recovery in the U.S. economy has been faster than forecasted. However, there remains substantial uncertainty about the course of the pandemic and its impact on the domestic and overseas economies. Specifically, there continues to be the risk that a resurgence of COVID-19 due to, for example, the spread of variants will lead to constraining real economic activity, particularly of firms that saw their business conditions deteriorate significantly in fiscal 2020.

Moreover, as seen in Chapter II, there remains significant uncertainty surrounding financial markets. Attention needs to be paid to the possibility of a significant rise in U.S. long-term interest rates, driven, for example, by developments in U.S. inflation rates. Attention is also warranted on the risk that the significant rise in U.S. long-term interest rates generates the pressure for capital outflows from emerging economies, where the pace of recovery has been relatively slow, and eventually leads to a slowdown in economic growth, especially in these economies.

In addition, Japan's financial system appears to be more susceptible to overseas market shocks than in the past. If there is a substantial and rapid adjustment in asset prices in global financial markets, there is a risk of a manifestation of a large negative impact on financial intermediation activities that would generate downward pressure on the domestic and overseas economies.

## 2. Scenarios and their rationale

Based on the risk recognition outlined above, four scenarios are employed for the stress testing in this *Report*: a baseline scenario and three downside scenarios (a "diverging business conditions scenario," an "emerging markets stress scenario," and a "financial stress scenario") (Chart V-2-1). The assumed scenarios are hypothetical and are designed to effectively examine the stress resilience of the financial system, as in stress testing conducted in other jurisdictions. They represent neither the Bank of Japan's outlook for the future economic and financial environment or asset prices nor the likelihood of the outcome.

**Chart V-2-1: Scenarios for simulation**

		Real economy	Financial variables
Baseline scenario		Moderate recovery in line with average forecasts of professionals and markets	Unchanged from the level at end-August 2021
Downside scenarios	Diverging business conditions scenario	Downturn of domestic and overseas economies with diverging firms' business conditions across and within industries	Historical average reaction to shocks on the real economy
	Emerging markets stress scenario	Significantly slower recovery in emerging economies	Financial shocks due to a rise in the U.S. long-term interest rate (+100bps)
	Financial stress scenario	Severe downturn of domestic and overseas economies due to financial shocks	Substantial and rapid financial shocks comparable to the GFC

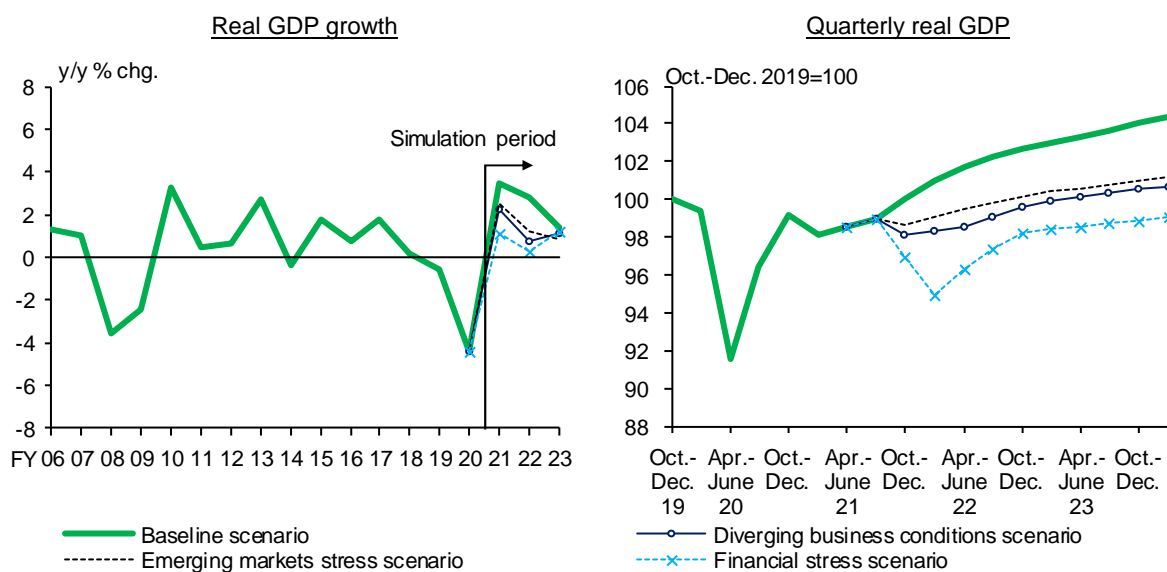
Note: Long- and short-term interest rates evolve in line with the forward rates under the baseline scenario while they fall to lowest levels observed until August 2021 under the diverging business conditions scenario and the financial stress scenario. Under the emerging markets stress scenario, they are subject to the shocks due to a rise in the U.S. long-term interest rate (+100bps).

### Assumptions regarding the real economy

The baseline scenario is based on average forecasts by several research institutions and financial markets as of September 2021. Namely, domestic and overseas economies are assumed to recover, with the impact of COVID-19 waning gradually in accordance with the progress with vaccinations (Charts V-2-2 and V-2-3).

In the diverging business conditions scenario, it is assumed that there is a resurgence of COVID-19 infections due to, for example, the spread of variants, and the pandemic continues to prevail without much improvement thereafter. In this scenario, business activity continues to be constrained, especially in industries that were significantly constrained by the spread of COVID-19 in fiscal 2020, such as the face-to-face services industry. Specifically, it is assumed that the domestic and overseas economies are hit by an adverse shock in the October-December quarter of 2021 due to a resurgence in infections, and that the level of economic activity declines to the level seen in the January-March quarter of 2021, when infections resurged in Japan and abroad. Thereafter, the economy recovers moderately at half the pace assumed in the baseline scenario (Charts V-2-2 and V-2-3). Further, it is assumed that, both at home and abroad, the gaps across industries in terms of the level of economic activity remain generally similar to those registered in the January-March quarter of 2021.<sup>57</sup> Moreover, with regard to Japan, it is assumed that the recovery in firms' business conditions diverges not only across industries but also across firms within the same industry, and that this situation continues throughout the simulation period.<sup>58</sup>

Chart V-2-2: Economic scenarios for simulation (Japan)



Source: Cabinet Office; Japan Center for Economic Research, "ESP forecast."

In the emerging markets stress scenario, it is assumed that the U.S. long-term interest rate rises in the October-December quarter of 2021, driven, for example, by heightened inflation expectations

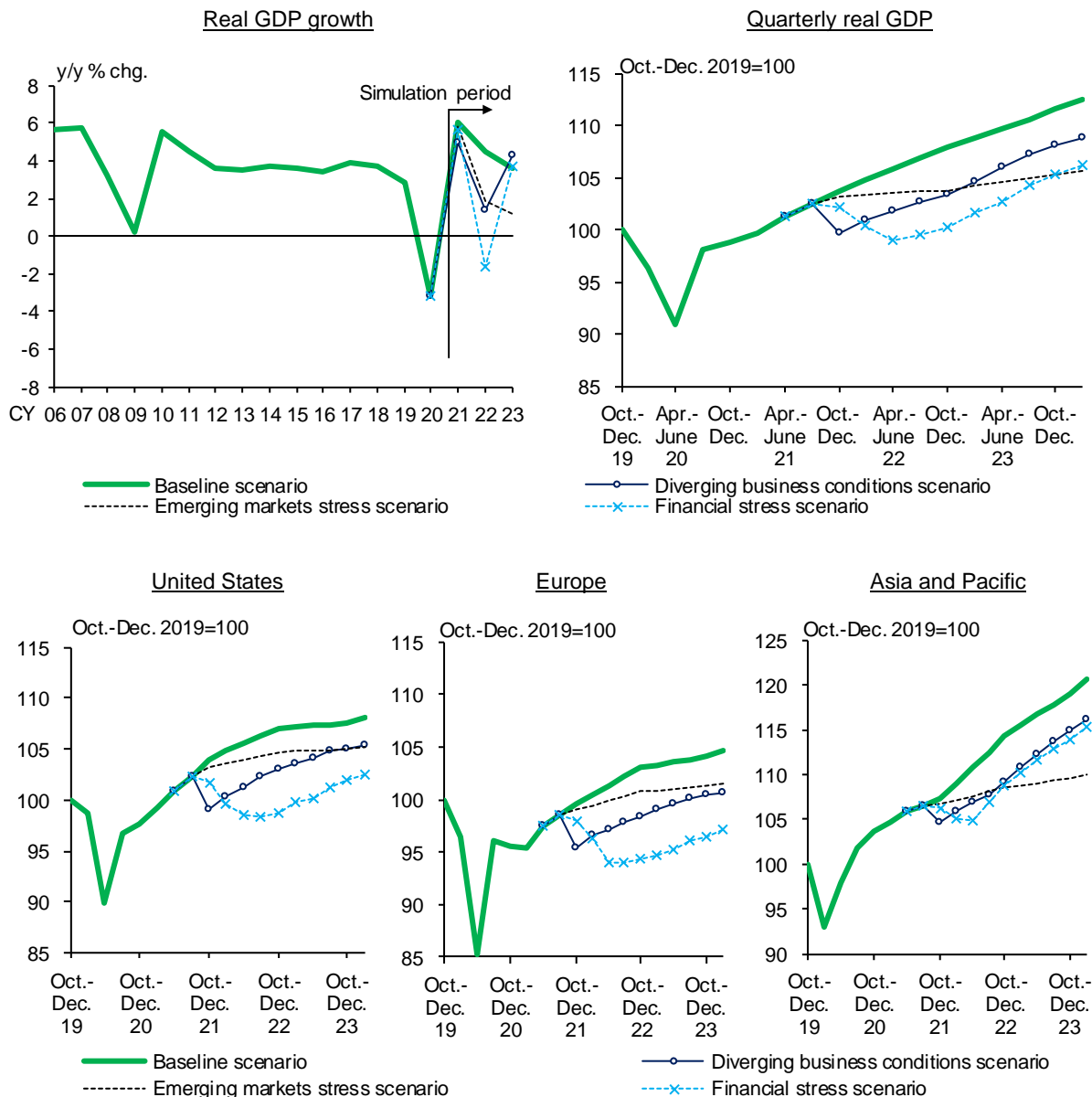
<sup>57</sup> In this *Report*, the analysis was refined by taking into account the impact of the widening gaps in business conditions across industries on domestic and overseas credit costs by using the credit share by industry and financial institutions' internal rating.

<sup>58</sup> In this scenario, the dispersion in business conditions (where business conditions are measured in terms of the ratio of operating profits to sales) across firms within the same industry is added as an explanatory variable in the credit cost model, and it is assumed that the dispersion from the October-December quarter of 2021 onward is identical to that for fiscal 2020.



due to the changes in people's perceptions of supply constraints, leading to the slowdown in economic growth in advanced economies and an even greater slowdown in emerging economies due to pressure for capital outflows. Specifically, from the October-December quarter of 2021, the quarterly GDP growth rates of advanced economies (excluding Japan) such as the United States and Europe are assumed to be half of those in the baseline scenario, while the growth rates of emerging economies are assumed to fall substantially to a quarter of those in the baseline scenario (Charts V-2-2 and V-2-3). For Japan's GDP growth, the results of a model simulation are used, including the extent to which domestic economic activity would be pushed down by such shocks as the slowdown in overseas economies.<sup>59</sup>

**Chart V-2-3: Economic scenarios for simulation (overseas)**



Source: BEA; Eurostat; Haver Analytics; IMF; Japan Center for Economic Research, "ESP forecast."

<sup>59</sup> For this *Report*, the export functions were revised. Specifically, while in the previous *Report* U.S. GDP was used as a proxy to capture the sensitivity of exports to the business cycle, in this *Report* the GDPs of Europe and Asia have been added in order to capture the impact of differences in the pace of recovery across regions. In addition, the secular shift in the trend of Japan's exports to Asia is taken into account.

The financial stress scenario assumes that, as the domestic and overseas economies recover from the impact of COVID-19, there is a substantial and rapid adjustment in global financial markets, which has an adverse impact on financial intermediation activities, leading to sluggish business fixed investment and a widespread deterioration in the employment and income situation in countries around the world. Specifically, the scenario assumes a situation in which global financial markets experience a significant negative shock in the October-December quarter of 2021 comparable to that during the GFC, which has an adverse impact on financial intermediation activities, putting downward pressure on the real economy at home and abroad (Charts V-2-2 and V-2-3). In this scenario, it is assumed that, from the October-December quarter of 2021 onward, overseas GDP growth follows a path similar to that during the GFC. For Japan's GDP growth, the results of a model simulation assuming a shock similar to the GFC are used.<sup>60</sup>

### *Assumptions regarding the financial variables*

The baseline scenario assumes that the impact of the major downturn in the domestic and overseas economies in fiscal 2020 and currently available information on the outlook for the domestic and international economies are appropriately priced in by financial markets. On this basis, it is assumed that government bond yields evolve in line with the forward rates implied by the yield curve as of end-August 2021, and that the TOPIX, foreign exchange rates, and credit spreads in Japan and abroad are unchanged from their end-August 2021 levels (Chart V-2-4).

The diverging business conditions scenario assumes that a negative shock to the real economy is digested by financial markets as a negative surprise (Chart V-2-4). In this scenario, the negative shock to the real economy is assumed to hit in the October-December quarter of 2021, and the resultant decline in stock prices, the appreciation of the yen, and the widening of various credit spreads are calculated from the average market reactions to such surprises in the past. Once the negative surprise has been reflected in financial variables, it is assumed that they revert to their long-term averages at a pace in line with historical data.<sup>61</sup>

The emerging markets stress scenario assumes a rise in the U.S. long-term interest rate in the October-December quarter of 2021 and a simultaneous adjustment in global financial markets (Chart V-2-4).<sup>62</sup> Moreover, the impact on domestic financial markets of significant downward pressure on the economy through a decline in Japanese exports is also taken into account.<sup>63</sup>

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<sup>60</sup> This makes it possible to incorporate the aspect that the increase in Japanese financial institutions' capital since the GFC has helped to underpin financial intermediation activities.

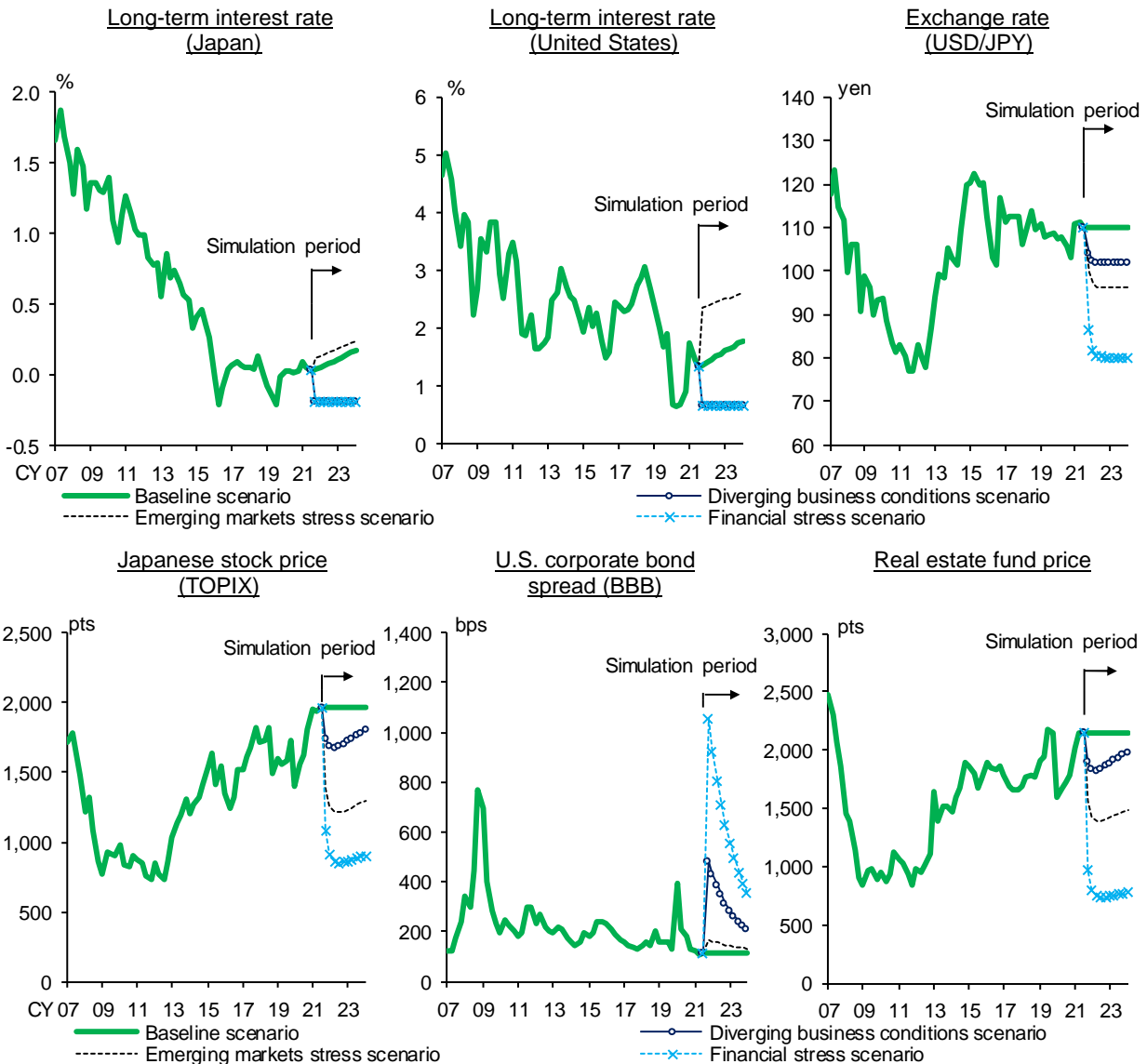
<sup>61</sup> Note that the pace at which financial variables revert to their long-term averages after a stress event tends to be faster than the pace estimated using the data that include observations for normal times. This pattern likely reflects the fact that substantial financial market stress tends to be followed by policy responses. However, to assess the impact in the absence of a policy response in the wake of a shock, the downside scenarios assume that the pace at which financial variables revert to their long-term averages is identical to the average pace in the past.

<sup>62</sup> A rise in the U.S. long-term interest rate is assumed to be 100 basis points. The other financial variables are set by multiplying the ratio between the increase in the U.S. long-term interest rate during the "taper tantrum" when the rate rose in May/June 2013 and 100 basis points by changes in a particular financial variable during that time.

<sup>63</sup> The scenarios for domestic financial variables are obtained as the sum of the response to a rise of 100 basis points in the U.S. long-term interest rate and the estimated average market reaction in the past to a negative shock to the real economy. Meanwhile, for domestic and overseas long- and short-term interest rates, unlike in the diverging business conditions scenario and the financial stress scenario (which assume that interest rates fall to their past lows in the October-December quarter of 2021 and stay at those levels until the end of fiscal 2023), the sum of the values in the baseline scenario and the increase resulting from a rise of 100 basis points in the U.S. long-term interest rate calculated with reference to interest rate developments during the taper tantrum is used.

In the financial stress scenario, it is assumed that global financial markets experience a substantial and rapid adjustment in the October-December quarter of 2021 comparable to that during the GFC (Chart V-2-4). Reflecting the growing importance of investment funds in the global financial system in recent years, the scenario assumes a situation in which, as seen during the market turmoil in March 2020, the spreads of bonds with a relatively high credit rating can rise more significantly than during the GFC.<sup>64,65</sup> Meanwhile, for many financial variables, particularly risky financial assets, the degree of adjustment assumed in this scenario is considerably larger than in the emerging markets stress scenario.

**Chart V-2-4: Financial market scenarios for simulation**



Note: Long-term interest rate indicates 10-year government bond yield. Real estate fund price indicates the TSE REIT Index. Source: Bloomberg; FRB; Ministry of Finance, "Interest rate."

<sup>64</sup> Specifically, for U.S. corporate bonds and securitized products, it is assumed that the spread on high-rated bonds increases to a greater extent than during the GFC by multiplying the ratio between the increase in spreads during the market turmoil in March 2020 and that during the GFC for low-rated bonds (in the case of U.S. corporate bonds, for example, this ratio is around three) by the increase in spreads for each rating category in March 2020.

<sup>65</sup> U.S. dollar funding premiums for Japanese banks overall are also assumed to increase to a level comparable to that during the GFC. The increase in individual banks' foreign currency funding costs is estimated taking into account the shift to deposits in banks' foreign currency funding that has been seen since the GFC and described in Chapter IV, Section D.

### *Assumptions regarding measures to support corporate financing*

Regarding the corporate financing support measures, the impact of the policy measures taken by the government and the Bank of Japan as well as lending by financial institutions implemented so far is taken into account while also considering the actual pace of budget spending.<sup>66</sup> Namely, in estimating credit costs, this *Report* assumes that the deterioration in firms' ICR, which is an indicator representing their debt servicing capacity, eases in fiscal 2021 as a result of the cash payments by the government scheduled for the year, which will underpin corporate profits.<sup>67</sup>

With regard to loans extended since April 2020 as part of the corporate financing support measures, it is assumed that the effectively interest-free loans guaranteed by credit guarantee corporations will increase financial institutions' net interest income, while credit costs will not rise even if defaults occur.<sup>68</sup> In addition, the risk-weighted assets for such loans are assumed to not increase. As in Chapter IV, it is assumed that the grace period for principal of the effectively interest-free loans is one year and the repayment period is five years, and that the loans are repaid gradually in line with this timeline.<sup>69</sup> In addition, the simulation incorporates the requirement that interest payments be made from fiscal 2023, which will lower firms' ICR. While other loans are similar to the effectively interest-free loans, in that they lead to an increase in financial institutions' net interest income, they differ in that they could lead to an increase in credit costs through a rise in firms' leverage and a decrease in their ICR, and that they could lower capital adequacy ratios through an increase in risk-weighted assets.

## 3. Results of stress testing

### *Baseline scenario*

The baseline scenario shows that the credit cost ratios for all types of banks are more or less unchanged in fiscal 2021 from the current level because cash payments by the government

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<sup>66</sup> The effects of policy measures that had not been finalized by the time of preparing this *Report* are not taken into account. Moreover, measures to support corporate financing taken such as by governments in other countries are also not taken into account.

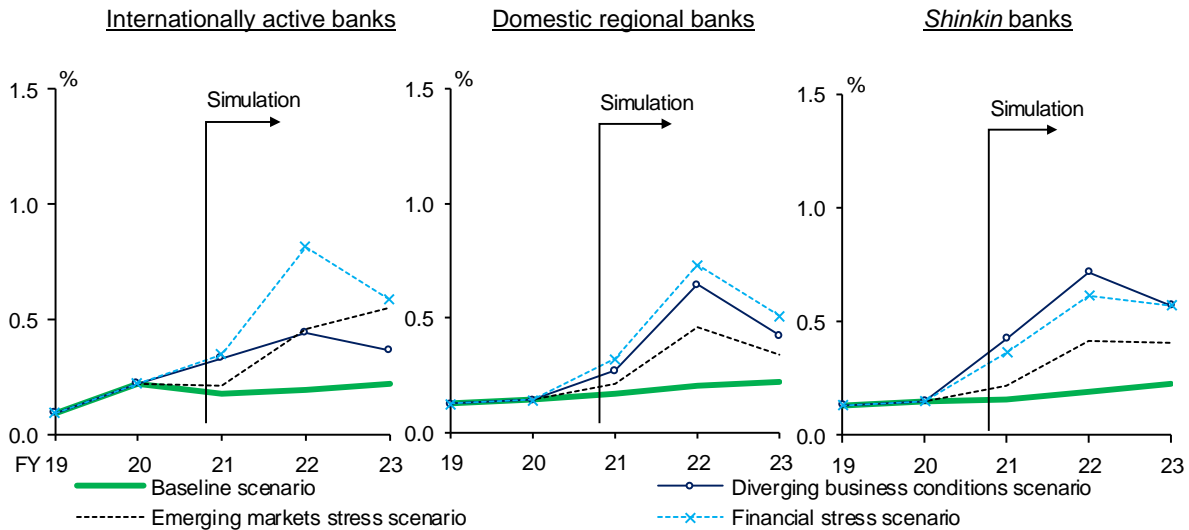
<sup>67</sup> In the estimation of credit costs, the effects of the cash payments in fiscal 2021 by firm size are incorporated. The cash payments mainly consist of the employment adjustment subsidies program, one-off support payments and monthly support payments for SMEs, and cooperation fees for shortening business hours (all estimated based on the budget plans as of late August). Meanwhile, the amount of cash payments from fiscal 2022 onward is assumed to be zero.

<sup>68</sup> Specifically, the outstanding balances of financial institutions' loans to domestic firms as of the end of March 2021 are divided into loans extended as part of measures to support corporate financing and other loans, and the former are further subdivided into effectively interest-free loans and regular loans extended as part of measures to support corporate financing. Financial institutions' outstanding balances of effectively interest-free loans as of the end of March 2021 are estimated so as to be consistent with changes in the macro-level outstanding balance of loans guaranteed by credit guarantee corporations, while also referring to the actual credit guarantees to individual financial institutions provided by credit guarantee corporations. On the other hand, the outstanding balances of regular loans extended as part of measures to support corporate financing are calculated as the amount of each financial institution's outstanding balance of loans to domestic firms as of the end of March 2021 that exceed the amount predicted by the model minus the outstanding balance of effectively interest-free loans.

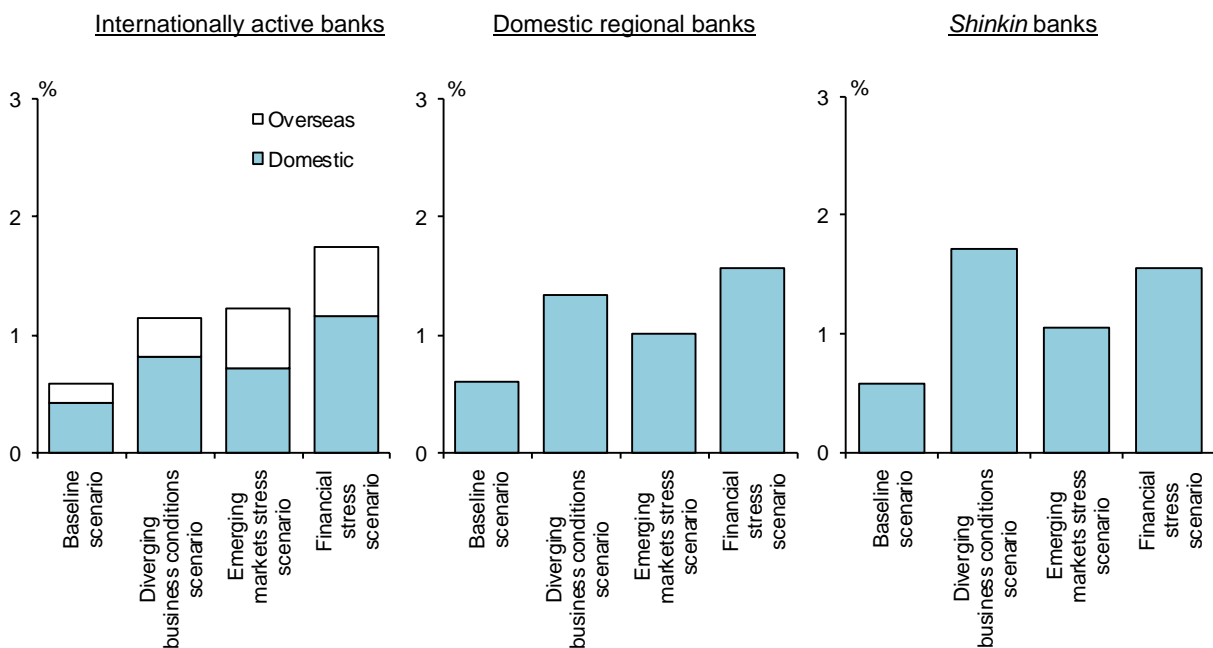
<sup>69</sup> For face-to-face services, following the analysis in Chapter IV, it is assumed that the grace period for principal is two years, as the recovery in the industry will lag behind that in other industries. It is also assumed, for simplicity, that throughout the simulation period no repayments are made for regular loans extended as part of measures to support corporate financing.

underpin corporate profits (Chart V-2-5).<sup>70</sup> Although the ratios increase modestly thereafter, the average credit cost ratios for the three years from fiscal 2021 to 2023 on an annualized basis remain at about 0.2 percent for all types of banks (Chart V-2-6).

**Chart V-2-5: Credit cost ratios**



**Chart V-2-6: Credit cost ratios (3-year cumulative totals)**

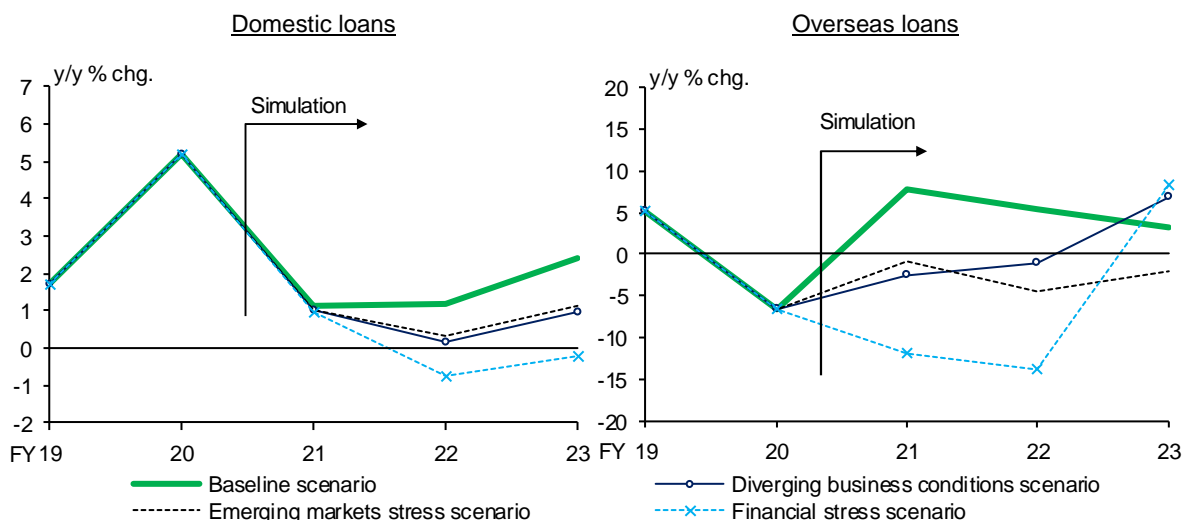


Note: Credit cost ratios are cumulative totals of fiscal 2021 to 2023.

Domestic and overseas loans outstanding continue to show positive growth throughout the simulation period as economic activity recovers at home and abroad (Chart V-2-7).

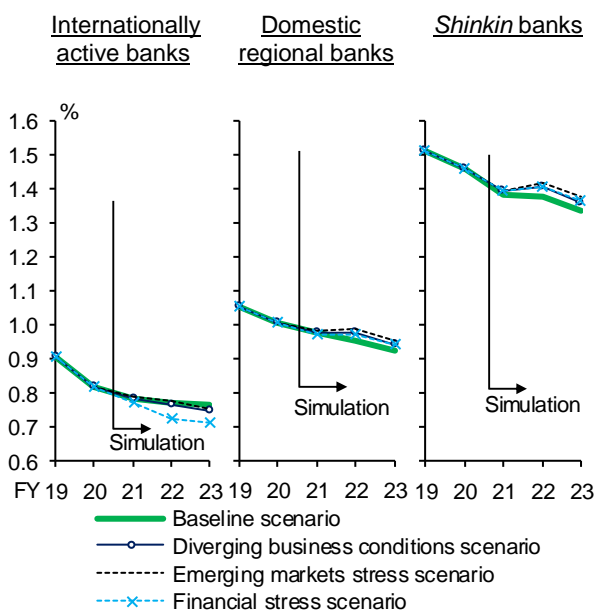
<sup>70</sup> For the domestic credit cost estimation, the sales outlook by firm size and industry weighted by each bank's loans outstanding by firm size and industry is used as a proxy to represent borrower firms' stress in short-term financing. For the estimation of overseas credit costs, sales by region and industry are estimated. These estimates are then weighted by each bank's overseas loans outstanding by region and industry. The estimation methodology is improved in this *Report*, in that the sales outlook is weighted by the composition of loans outstanding of individual banks, compared with the previous *Report*, where it was weighted by the composition of loans outstanding of each bank type. Similar methodological changes are made to the calculation of the outlook for financial institutions' borrower firms' ICR, an indicator representing firms' debt servicing capacity, both domestic and overseas.

**Chart V-2-7: Loans outstanding (total of financial institutions)**

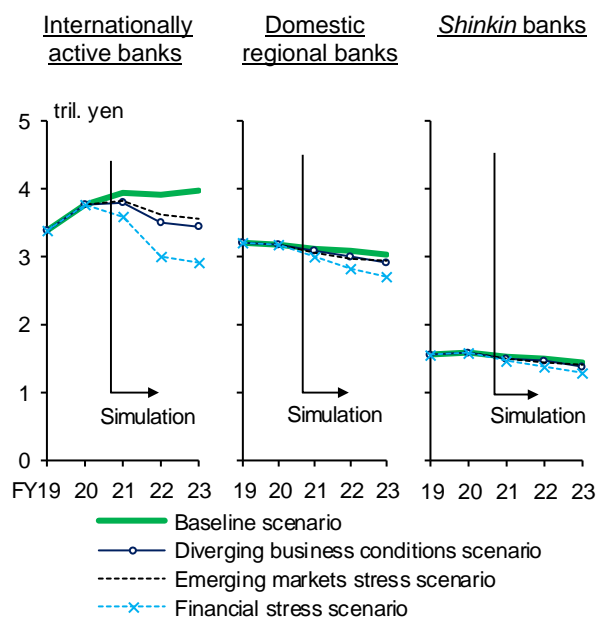


Lending margins continue to shrink moderately for all types of banks amid the continued slack in the domestic loan market (Chart V-2-8). Under these developments in lending margins, net interest income declines moderately at domestic regional banks and *shinkin* banks, while it remains more or less flat at internationally active banks due to a substantial increase in overseas lending (Chart V-2-9). As a result, the cumulative net income during the simulation period is positive for all types of banks (Chart V-2-10).<sup>71,72</sup>

**Chart V-2-8: Lending margin**



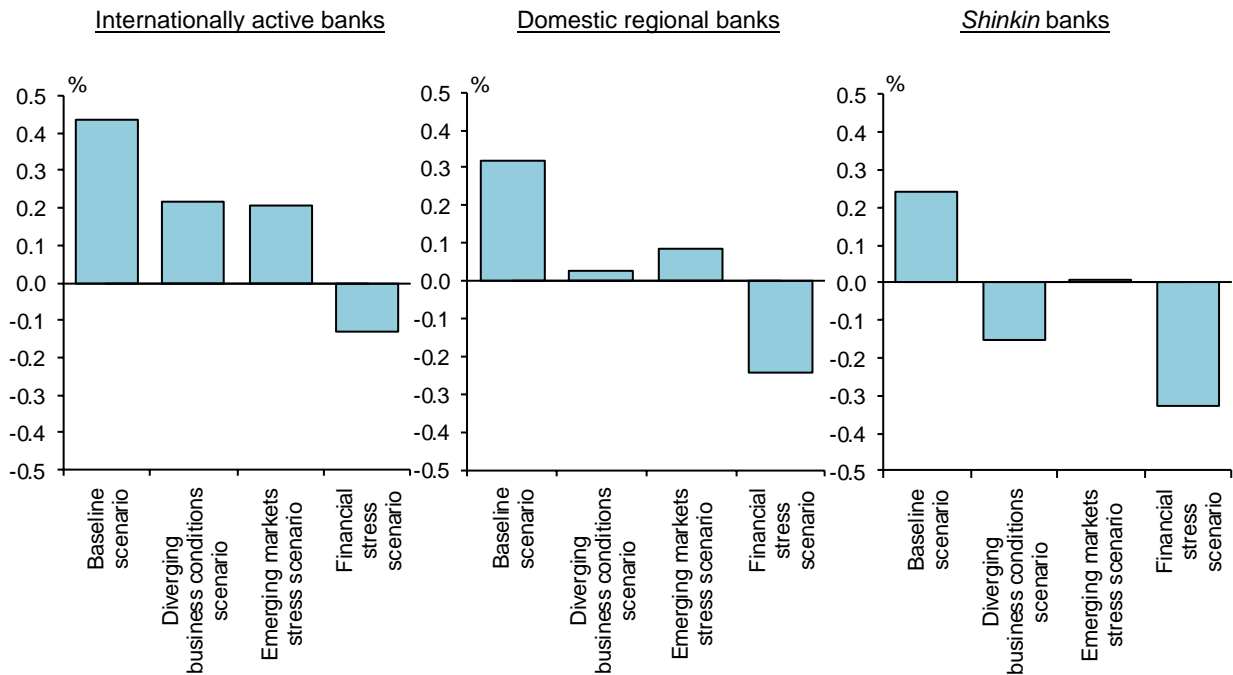
**Chart V-2-9: Net interest income**



<sup>71</sup> It is assumed that financial institutions realize gains on securities holdings basically by the same amount as the average for the past three years. Realizing such gains is subject to an upper limit, which is set to the amount of unrealized gains, and gains from the sale of securities are zero for financial institutions that have exhausted all unrealized gains.

<sup>72</sup> With regard to the estimation of other net non-interest income (the sum of profits on specified transactions and other operating profits excluding realized gains/losses on bondholdings), the previous *Report* assumed that the other non-interest income of major banks changes with the output gap. In this *Report*, the other non-interest income of major banks is broken down into (1) gains/losses on interest rate swaps, (2) gains/losses on currency swaps and foreign exchange transactions, and (3) other gains/losses, and it is assumed that gains/losses on interest rate swaps change with short-term U.S. interest rates, gains/losses on currency swaps and foreign exchange transactions change with the U.S.-Japan long-term interest rate differential as well as Japan's output gap, and other gains/losses are unchanged from their actual values throughout the simulation period.

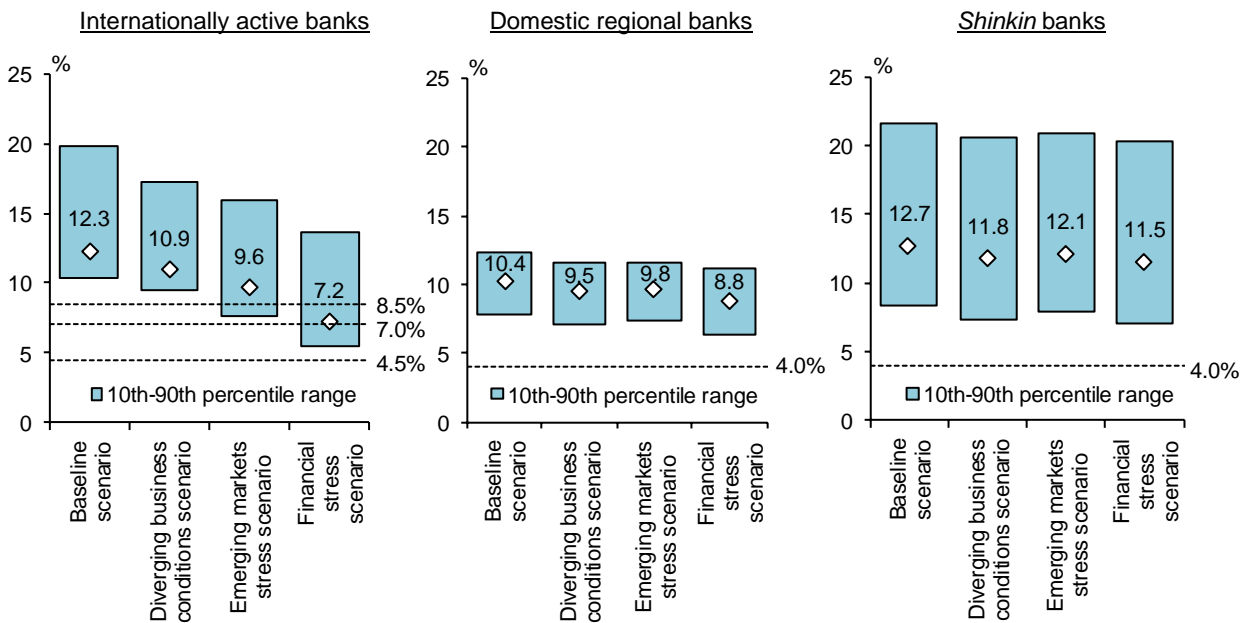
**Chart V-2-10: Net income (3-year cumulative totals)**



Note: The charts indicate the ratio of net income to total assets. The net incomes are cumulative totals of fiscal 2021 to 2023.

Consequently, the capital adequacy ratios in fiscal 2023, the final fiscal year of the simulation, are more or less unchanged from the current ratios for all types of banks (Charts V-2-11 and V-2-12).<sup>73</sup>

**Chart V-2-11: Capital adequacy ratios (fiscal 2023)**

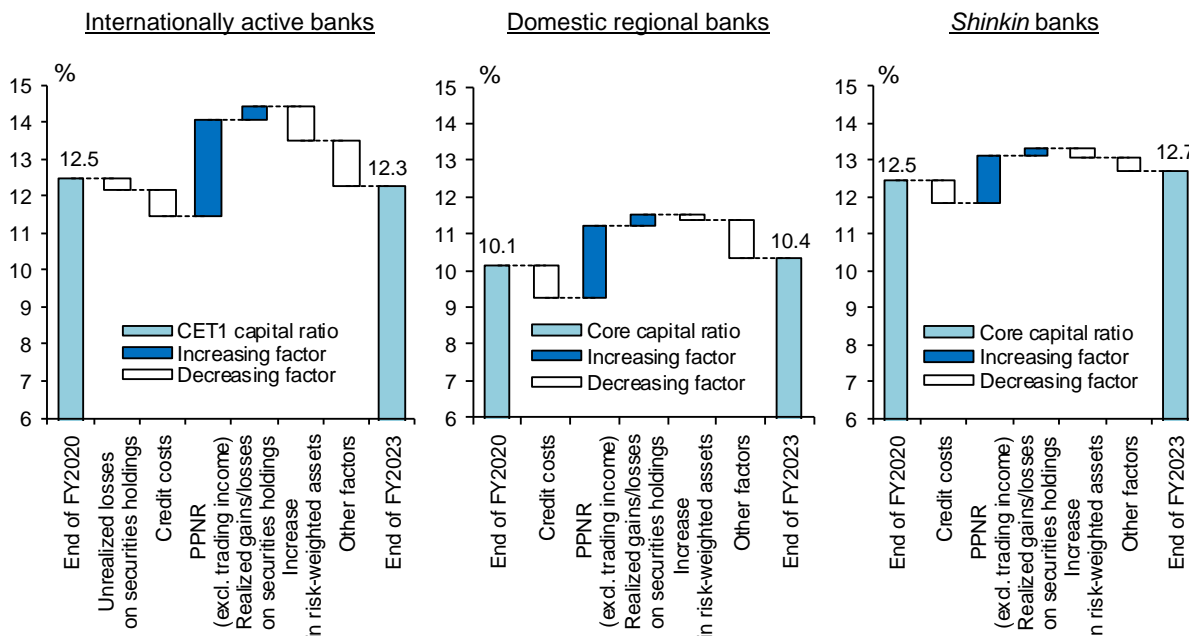


Note: 1. The left-hand chart shows the CET1 capital ratios of internationally active banks. The middle and right-hand charts show the core capital ratios of domestic regional banks and *shinkin* banks. The transitional arrangements for domestic regional banks and *shinkin* banks are taken into consideration.

2. Markers in the charts indicate the total of financial institutions for each type of bank.

<sup>73</sup> In this *Report*, a refinement is made for the estimation of risk-weighted assets. Specifically, the risk-weights of retail loans, which in the previous *Report* were assumed to be unchanged from the actual value throughout the simulation period, now vary with the rate of overdue housing loans. Moreover, credit valuation adjustment (CVA) risk that was also assumed to be unchanged from the actual value throughout the simulation period previously, now varies with the spread on U.S. corporate bonds, reflecting the impact of changes in the external credit ratings (creditworthiness) of counterparties.

**Chart V-2-12: Decomposition of CET1 capital ratio and core capital ratio (baseline scenario)**



- Note: 1. The charts indicate the contribution of each factor to the difference between the capital adequacy ratios at end-March 2021 and the end of the simulation period (as at end-March 2024) under the baseline scenario.  
 2. The left-hand chart shows the CET1 capital ratio of internationally active banks. The middle and right-hand charts show the core capital ratio of domestic regional banks and *shinkin* banks. The transitional arrangements for domestic regional banks and *shinkin* banks are taken into consideration (the same applies to Charts V-2-14 and V-2-15).  
 3. "Unrealized losses on securities holdings" takes tax effects into account (the same applies to Chart V-2-13).  
 4. "Other factors" in the left-hand chart includes taxes, dividends, and CET1 regulatory adjustments of internationally active banks (the same applies to Chart V-2-13). "Other factors" in the middle and right-hand charts includes taxes and dividends of domestic regional banks and *shinkin* banks (the same applies to Charts V-2-14 and V-2-15).

The reason is that while credit costs, etc., work in the direction of pushing down the ratios, PPNR and realized gains on securities holdings work in the direction of pushing them up.<sup>74</sup>

### Downside scenarios

#### a. Credit cost ratios

In all three downside scenarios, credit cost ratios increase more than in the baseline scenario for all types of banks (Charts V-2-5 and V-2-6). For internationally active banks, the cumulative credit cost ratios over the three years reach similar levels in the diverging business conditions and emerging markets stress scenarios and increase further in the financial stress scenario. On the other hand, for domestic regional banks and *shinkin* banks, credit cost ratios are relatively low in the emerging markets stress scenario and reach similar levels in the diverging business conditions and financial stress scenarios. This difference between the types of banks is due to the fact that overseas loans account for a high share of loans at internationally active banks, while loans to the face-to-face services industry, which is particularly prone to being affected by the spread of COVID-19, account for a high share at domestic regional banks and *shinkin* banks.

<sup>74</sup> It is assumed that the payout ratio equals the average payout ratio of the past three years when a financial institution's net income is positive and zero when its net income is negative.



#### b. Loans outstanding and lending margins

The growth in domestic loans outstanding in the diverging business conditions and emerging markets stress scenarios falls below the baseline scenario (Chart V-2-7). In the financial stress scenario in particular, the annual rate of change in overall domestic loans outstanding turns negative in fiscal 2022, due mainly to a decline in demand for funds amid the severe downturn in the domestic and overseas economies and to a deterioration in lending capacity amid lower capital adequacy ratios.

Overseas loans outstanding decline on a year-on-year basis in fiscal 2021 and 2022 in the diverging business conditions scenario and from fiscal 2021 through 2023 in the emerging markets stress scenario, mainly due to weaker demand for funds amid a downturn in the overseas economies. Additionally, in the financial stress scenario, a significant decline in the yen-denominated value of overseas loans due to the appreciation of the yen leads to a greater rate of decline in fiscal 2021 and 2022 than in the other downside scenarios.

In the diverging business conditions and emerging markets stress scenarios, the lending margins of domestic regional banks and *shinkin* banks expand modestly compared to the baseline scenario, reflecting the rise in credit spreads. On the other hand, those of internationally active banks remain at the same level as in the baseline scenario because the increase in domestic lending margins is offset by the contraction in overseas lending margins due to the deterioration of overseas economies (Chart V-2-8). The lending margins for domestic regional banks and *shinkin* banks in the financial stress scenario are more or less the same as in the other downside scenarios, but for internationally active banks, the further contraction in overseas lending margins due to higher foreign currency funding costs leads to a decline in overall lending margins.

Turning to financial institutions' net interest income in the diverging business conditions and emerging markets stress scenarios, the net interest income of internationally active banks is considerably lower than in the baseline scenario due to the substantially lower overseas loans outstanding. As for domestic regional banks and *shinkin* banks, the decrease in loans outstanding is relatively small, and the decline in net interest income is relatively moderate (Chart V-2-9). In the financial stress scenario, net interest income is lower for all types of banks than in the other two scenarios, reflecting the decline in loans outstanding. The decline in net interest income is particularly pronounced for internationally active banks due to the contraction of overseas lending margins.

#### c. Net income

The cumulative net income during the simulation period of internationally active banks contracts by similar amounts in the diverging business conditions and emerging markets stress scenarios, while it declines more significantly for domestic regional banks and *shinkin* banks in the diverging business conditions scenario than in the emerging markets stress scenario (Chart V-2-10). In the financial stress scenario, the cumulative net income over the simulation period is negative for all bank types as net interest income declines further and realized gains/losses on securities deteriorate substantially.

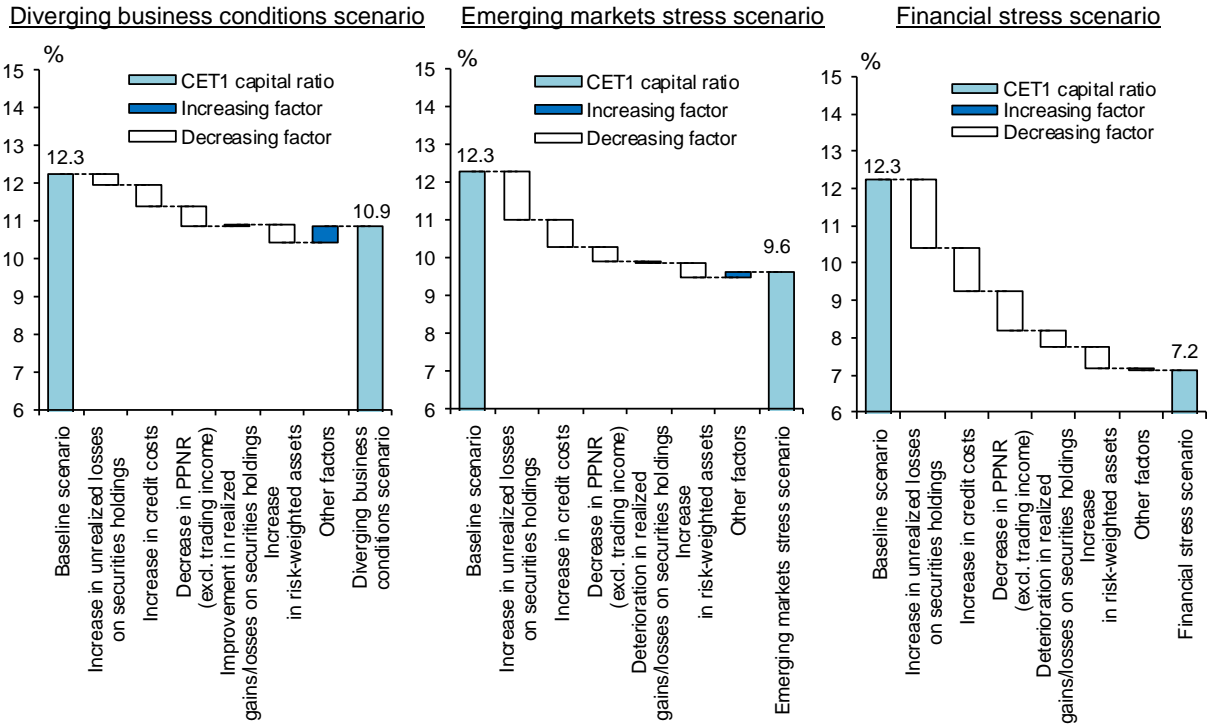
#### d. Capital adequacy ratios

In the three downside scenarios, capital adequacy ratios decline from the current level through fiscal 2023, the final fiscal year of the simulation (Chart V-2-11). In detail, in the diverging business conditions and emerging markets stress scenarios, the ratios on average remain above regulatory levels for all types of banks. On the other hand, in the financial stress scenario, the average CET1 ratio of internationally active banks falls below 8 percent, and that of a fair number of financial

V. Examination of the resilience of the financial system  
 B. Macro stress testing

institutions declines to a level that breaches the capital buffer ratios, which are set in the range of 7 to 8.5 percent depending on each financial institution's importance in the financial system. The average core capital ratio of domestic regional banks also falls to the range of 8 to 9 percent.

**Chart V-2-13: Decomposition of CET1 capital ratio in downside scenarios (internationally active banks)**



Note: The charts indicate the contribution of each factor to the difference between the capital adequacy ratios at the end of the simulation period (as at end-March 2024) under the baseline and downside scenarios (the same applies to Charts V-2-14 and V-2-15).

**Chart V-2-14: Decomposition of core capital ratio in downside scenarios (domestic regional banks)**

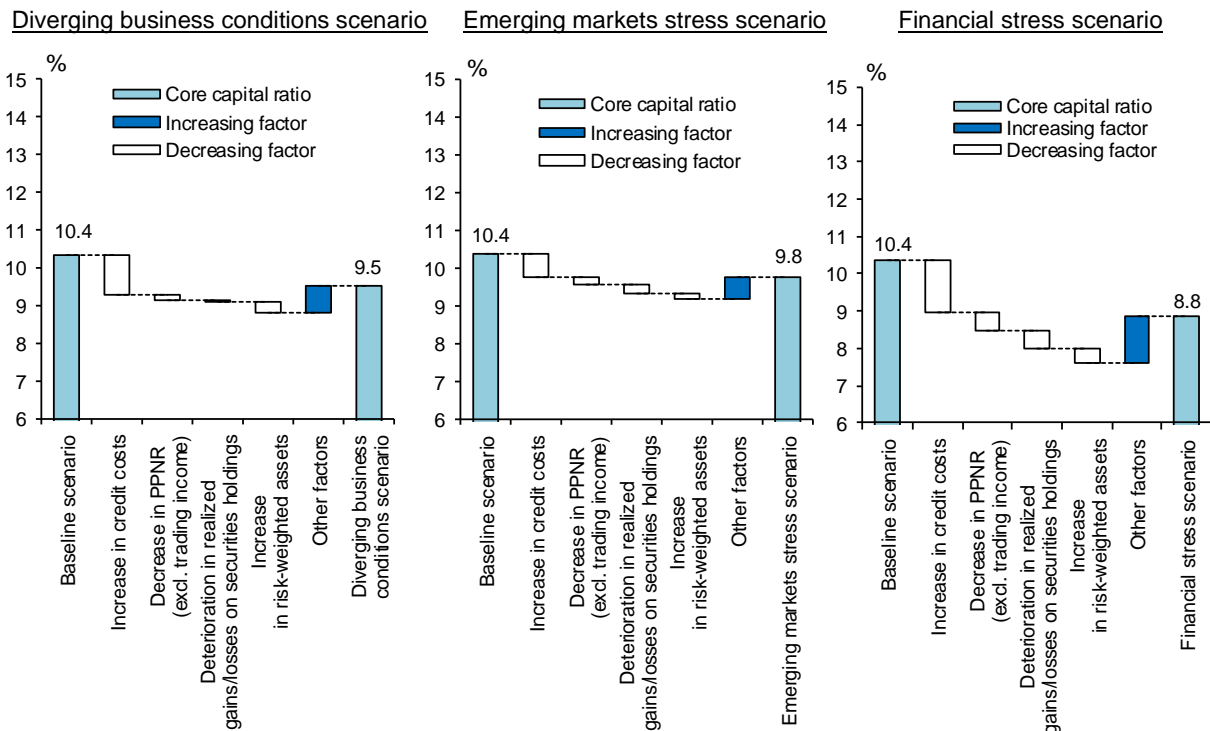
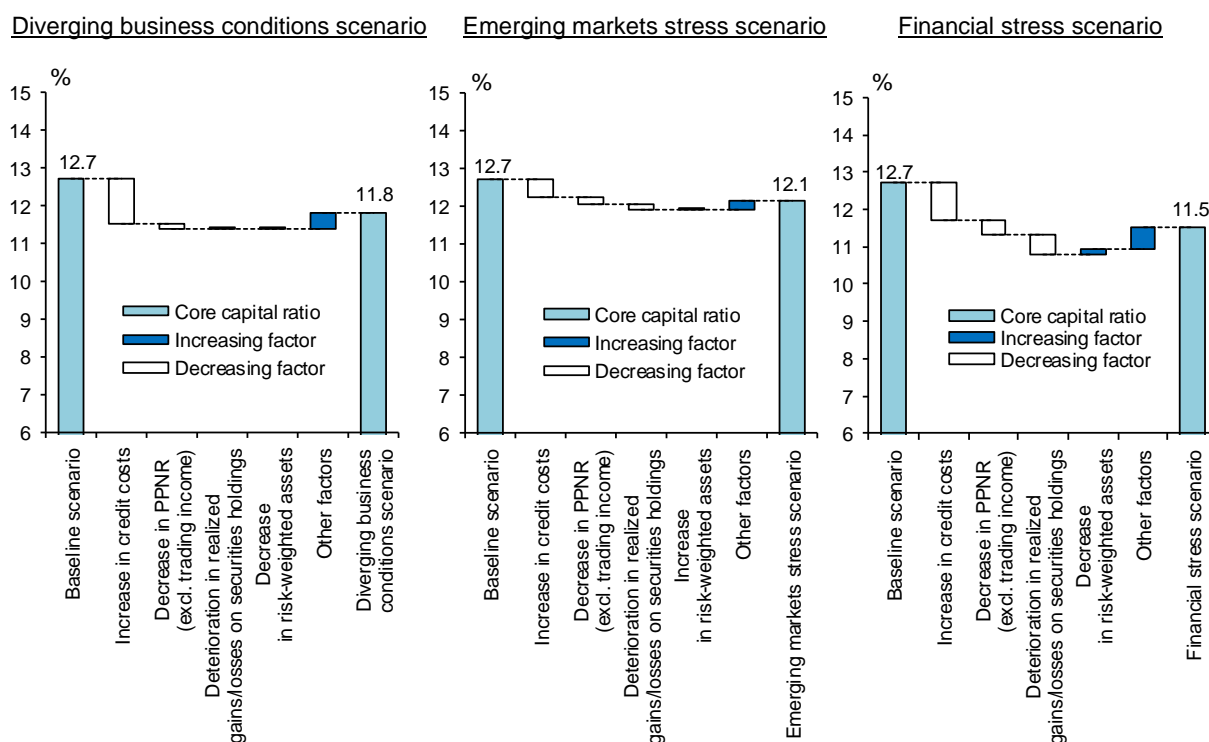


Chart V-2-15: Decomposition of core capital ratio in downside scenarios (*shinkin* banks)

Looking at the factors underlying a decline in capital adequacy ratios relative to that in the baseline scenario, for internationally active banks, an increase in credit costs makes the largest contribution in the diverging business conditions scenario. In the emerging markets stress scenario, in addition to the increase in credit costs, deterioration in unrealized gains/losses on securities holdings, due to the rise in interest rates and the decline in stock prices, also makes a contribution (Chart V-2-13). Further, in the financial stress scenario, the negative contributions of credit costs and of unrealized and realized gains/losses on securities holdings are even larger. For domestic regional banks and *shinkin* banks, in both the diverging business conditions and emerging markets stress scenarios, capital adequacy ratios are pushed down by the increase in credit costs. In the financial stress scenario, capital adequacy ratios are further reduced by the deterioration in realized gains/losses on securities holdings (Charts V-2-14 and V-2-15).

#### 4. Evaluation of the resilience of the financial system

In summary, the stability of Japan's financial system will be maintained if the economy recovers in line with the average of the current forecasts.<sup>75</sup> Reasons include that financial institutions have become more robust by building up capital, non-financial firms on the whole have maintained a sound financial position since the GFC, and, on this basis, measures to support corporate financing have been highly effective.

Japan's financial system is likely to remain robust and financial intermediation is expected to continue operating smoothly even in the event of an adverse shock to real economies at home and

<sup>75</sup> However, the impact of policy responses on credit costs, etc. in the banking sector should be regarded as subject to a considerable margin of error. For example, an increase in lending to low-return borrowers due to the policy responses may lead to an increase in credit costs and a decrease in financial institutions' profits from a medium- to long-term perspective.

V. Examination of the resilience of the financial system  
B. Macro stress testing

abroad in the form of a resurgence of COVID-19 with diverging business conditions across and within industries, followed by an adjustment in financial markets reflecting such adverse shock to the economy, or if a rise in U.S. long-term interest rates, driven, for example, by heightened inflation expectations due to changes in people's perceptions of supply constraints, leads to an adjustment in global financial markets and a significant growth slowdown in emerging market economies.

However, there is a risk that, if there is a substantial and rapid adjustment in financial markets comparable to that of the GFC and a simultaneous deterioration in global economies, a decline in financial institutions' capital adequacy ratios could have a negative impact on financial intermediation activities and exert downward pressure on the real economy. In addition to the future course of the pandemic, uncertainty regarding the global financial markets remains high, and the risk of a substantial and rapid adjustment in asset prices warrants attention.

### Box 1: Funding conditions of firms by probability of default: comparison with the global financial crisis

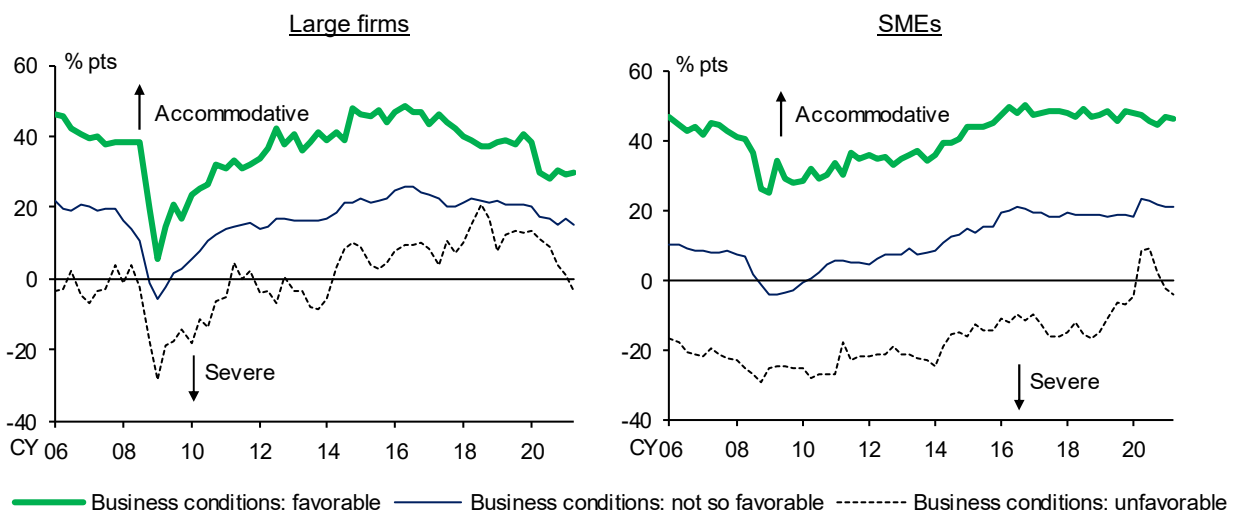
As highlighted in the main text, reasons why the PD of firms has remained low during the current crisis include that firms in recent years have strengthened their financial bases and that financial intermediation activities have continued to operate smoothly thanks to proactive measures to support corporate financing. This box examines SMEs' funding conditions during the current crisis and compares them with the situation during the GFC.<sup>76</sup>

#### Features of the current crisis

##### (1) Lending attitudes of financial institutions

First, based on the microdata from the *Tankan*, in the current crisis, the diffusion index of lending attitudes of financial institutions does not show the acute tightening that was seen during the GFC. The share of SMEs that consider the lending attitudes of financial institutions as "severe" has not increased compared to before the outbreak of COVID-19, even among SMEs that consider their business conditions to be "unfavorable" (Chart B1-1).

Chart B1-1: DI of lending attitudes of financial institutions by business condition



Note: 1. Includes all industries. Latest data as at June 2021.

2. The DIs are calculated by subtracting the share of firms that chose "3: severe" from the share of those that chose "1: accommodative" to the question related to lending attitudes. The shares are calculated relative to the total number of firms reporting the same business conditions.

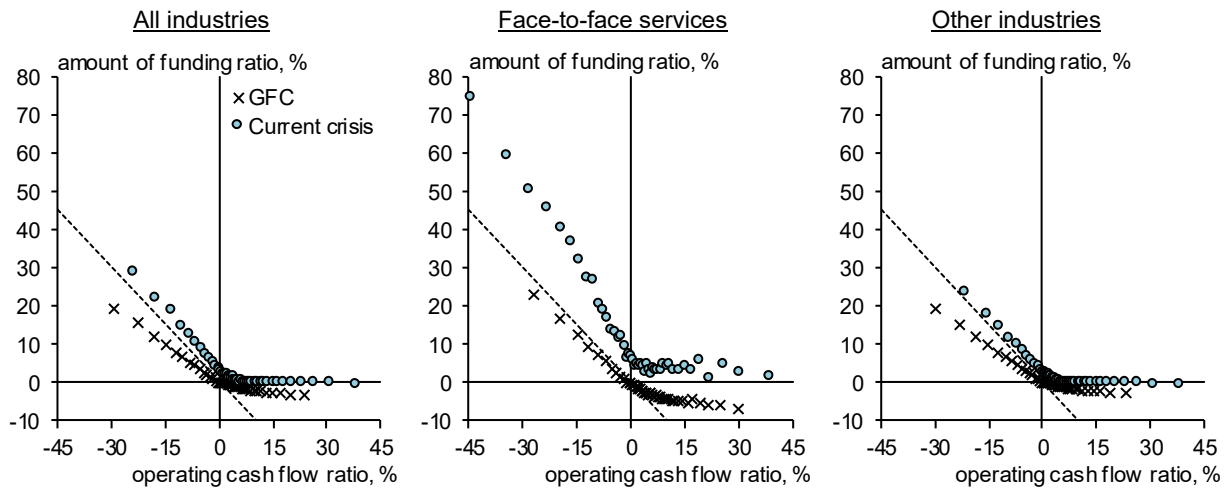
Source: BOJ, "Tankan."

##### (2) The amount of funding reflecting the decline in operating cash flow

Based on firm-level data, during both the GFC and the current crisis, SMEs that experienced a larger decline in operating cash flow increased their funding to a greater degree (Chart B1-2). This pattern is more pronounced during the current crisis, in which SMEs on an all-industry basis obtained more funding than during the GFC, regardless of their level of operating cash flow. In face-to-face services industries in particular, firms with a negative operating cash flow were able to obtain funds that went beyond their negative cash flow.

<sup>76</sup> The GFC period in this box is defined as the one-year period from the second half of fiscal 2008 through the first half of fiscal 2009, when sales saw the largest drop.

**Chart B1-2: Operating cash flow and amount of funding**



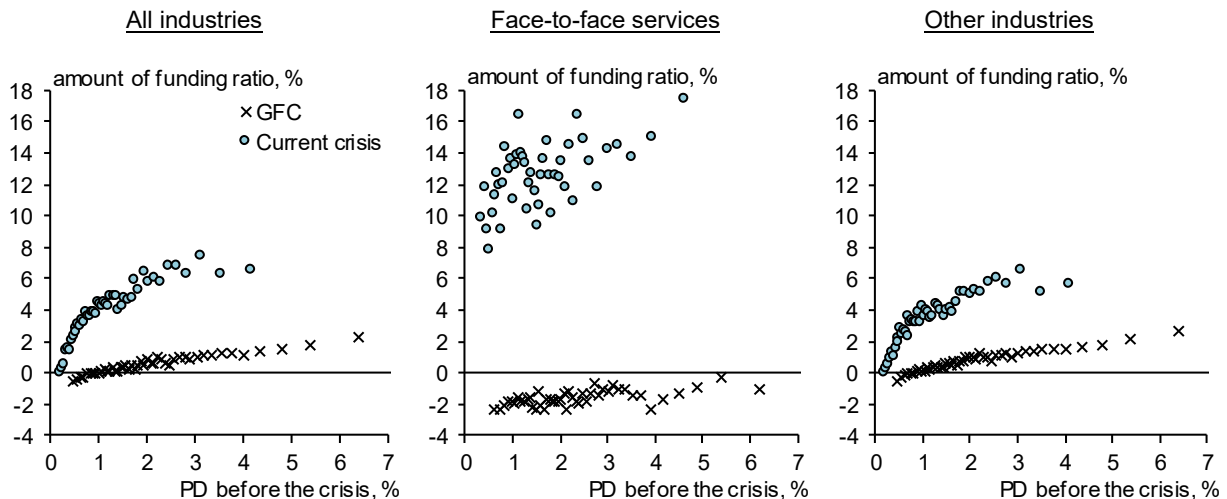
Note: 1. Amount of funding ratio = (loans at the end of the fiscal year - loans at the beginning of the fiscal year) / total assets at the beginning of the fiscal year.  
 Operating cash flow ratio = operating cash flow / total assets at the beginning of the fiscal year.  
 2. Firms are grouped into 2-percentile bins based on their operating cash flow ratios. The dots represent the median values for each group. The top and bottom 4-percentile samples are excluded.  
 3. The data for the "Current crisis" cover the currently available financial results for fiscal 2020 and those for the "GFC" cover the financial results for the one-year period from October 2008 to September 2009 (the same applies to Charts B1-3, B1-4, and B1-5).

Source: CRD Association.

**(3) Firms' financial strength before the crises and the amount of funding during the crises**

Based on the estimates of firms' PD derived from their financial conditions before each of the crises that are collected in the same dataset, the relationship between firms' financial strength as measured by the estimated PD before the crises and the amount of funding during the crises is such that, during both crises, firms with a higher estimated PD before them obtained more funding during them.

**Chart B1-3: Amount of funding by PD before the crisis**



Note: 1. Covers non-default samples as of the year before the crisis.  
 2. Amount of funding ratio = (loans at the end of the fiscal year - loans at the beginning of the fiscal year) / total assets at the beginning of the fiscal year.  
 3. Firms are grouped into 2-percentile bins based on their PD before the crisis. The dots represent the median values for each group. The top and bottom 4-percentile samples are excluded. The PD before the crisis indicates the estimated PD based on the financial results for fiscal 2019 for the "Current crisis" and for the one-year period from October 2007 to September 2008 for the "GFC."

Source: CRD Association.

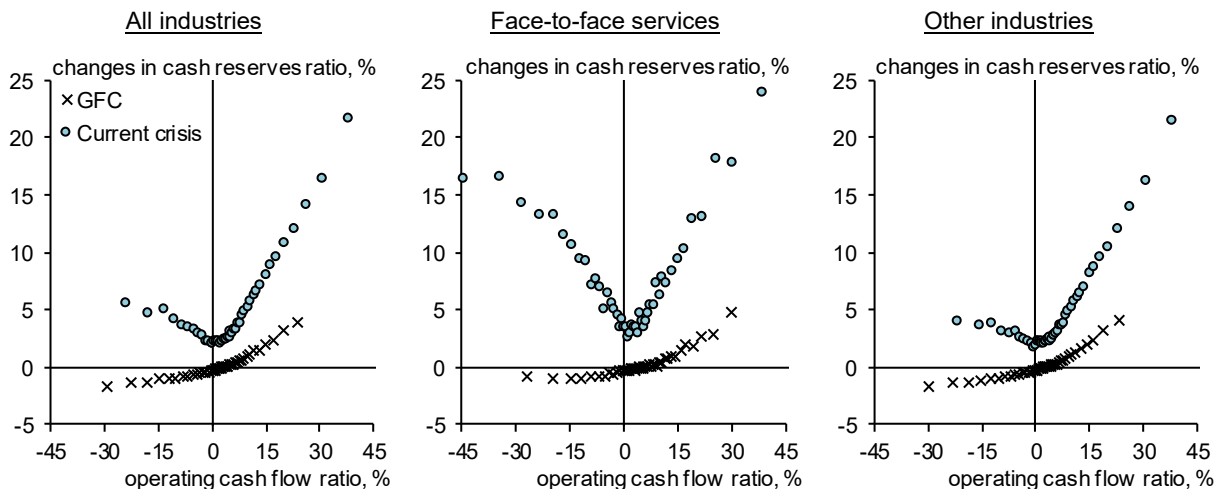
Moreover, comparing firms with the same level of the PD, firms have obtained more funding during the current crisis than during the GFC (Chart B1-3). In particular, in face-to-face services, which are regarded as being affected by the pandemic the most, firms have proactively obtained funding, including those that had a strong financial basis before the pandemic.

*Implications of the funding conditions*

As seen above, even firms with positive operating cash flows and healthy financial bases have been obtaining funds more proactively during the current crisis than during the GFC. This observation may suggest that they are borrowing relatively large precautionary loans on the back of proactive measures to support corporate financing and significant uncertainty regarding the future course of the pandemic. In fact, developments in cash reserves around the time of each of the crises shows that, during the current crisis, cash reserves have increased even among firms with negative operating cash flows or firms with a high PD before the crisis, which in turn indicates that firms are holding borrowed funds in the form of cash reserves (Charts B1-4 and B1-5).

As seen in Section A of Chapter IV, the increase in cash reserves through funding prevents a rise in the PD due to the current liquidity shortages, and if firms continue to hold such funding in the form of cash reserves going forward, this will likely prevent an increase in the PD through any future liquidity issues. However, reflecting the assumption that the pace of recovery in profits is moderate, the PD overall is expected to slightly exceed the level that would prevail if the pandemic had not happened (Chart IV-1-14). Moreover, even when the economy as a whole or economic activity in industries overall returns to a recovery trend, attention needs to be paid to the possibility that the PD may rise rather significantly among firms that faced a substantial decline in their operating cash flow during the crisis and/or those that had vulnerable financial bases before the crisis, if differences in firms' operating cash flow remain large.

**Chart B1-4: Operating cash flow and changes in cash reserves**



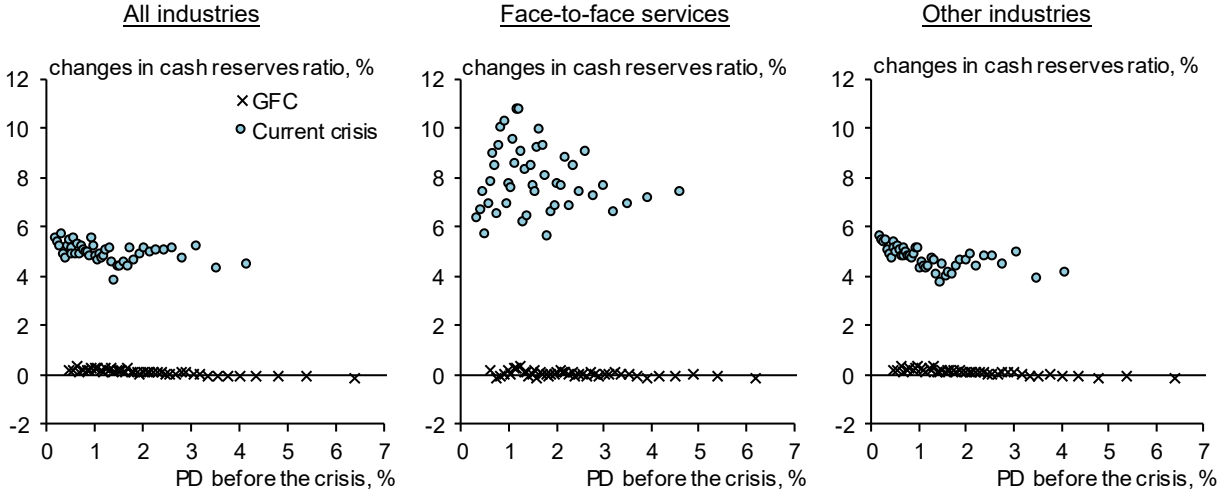
Note: 1. Changes in cash reserves ratio = (cash reserves at the end of the fiscal year - cash reserves at the beginning of the fiscal year) / total assets at the beginning of the fiscal year.

Operating cash flow ratio = operating cash flow / total assets at the beginning of the fiscal year.

2. Firms are grouped into 2-percentile bins based on their operating cash flow ratios. The dots represent the median values for each group. The top and bottom 4-percentile samples are excluded.

Source: CRD Association.

**Chart B1-5: Changes in cash reserves by PD before the crisis**



Note: 1. Covers non-default samples as of the year before the crisis.  
 2. Changes in cash reserves ratio = (cash reserves at the end of the fiscal year - cash reserves at the beginning of the fiscal year) / total assets at the beginning of the fiscal year.  
 3. Firms are grouped into 2-percentile bins based on their PD before the crisis. The dots represent the median values for each group. The top and bottom 4-percentile samples are excluded. The PD before the crisis indicates the estimated PD based on the financial results for fiscal 2019 for the "Current crisis" and for the one-year period from October 2007 to September 2008 for the "GFC."

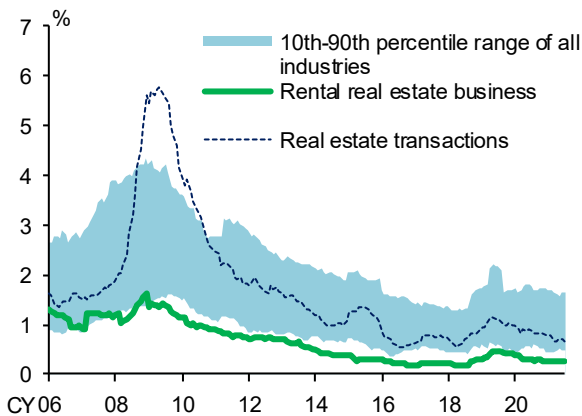
Source: CRD Association.



## Box 2: Developments in the real estate market: comparison with developments during the global financial crisis

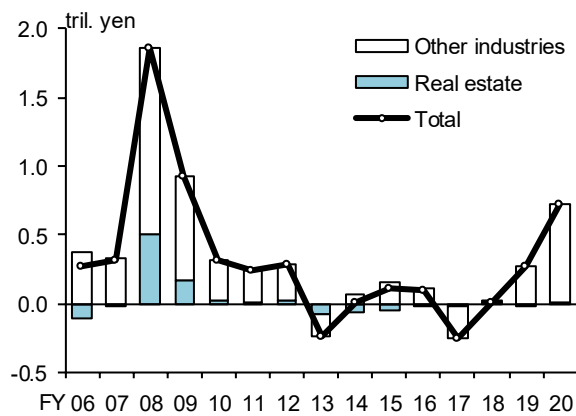
As seen in Chapter IV, shocks hitting the real estate industry in the current phase are not particularly large compared to other industries, and the default rates remain low (Chart B2-1). However, considering that financial institutions have been increasing their loans outstanding to the real estate industry, particularly rental real estate businesses, since before the outbreak of the pandemic and credit costs in lending to the real estate industry were large during the GFC, this box examines developments in the current real estate market in comparison with those during the GFC (Chart B2-2).

**Chart B2-1: Default rates by industry**



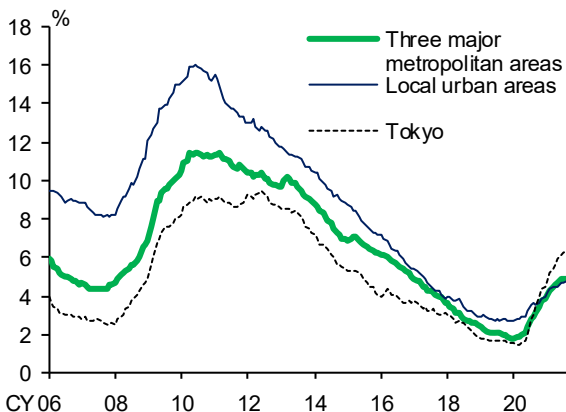
Note: 1. "10th-90th percentile range of all industries" indicates the distribution of default rates of a total of 24 industries, divided into 11 manufacturing industries and 13 non-manufacturing industries. Estimated by the BOJ.  
 2. Latest data as at July 2021.  
 Source: The Risk Data Bank of Japan.

**Chart B2-2: Credit costs of major banks by industry**



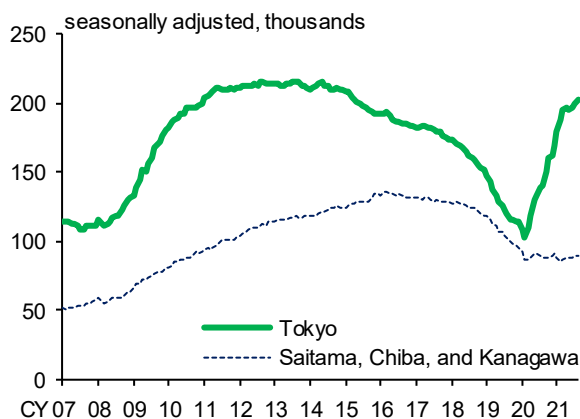
Source: BOJ.

**Chart B2-3: Vacancy rates for office buildings**



Note: 1. Vacancy rates for "Three major metropolitan areas" are the average among Tokyo, Osaka, and Nagoya, and those for "Local urban areas" are the average among Sapporo, Sendai, and Fukuoka.  
 2. Latest data as at August 2021.  
 Source: Miki Shoji Co., Ltd.

**Chart B2-4: Inventories of rental housing in Tokyo metropolitan area**

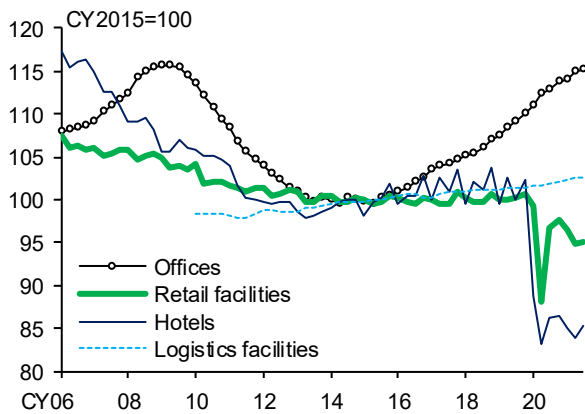


Note: 1. Estimated by the BOJ using the number of inventories registered on the REINS system.  
 2. Latest data as at August 2021.  
 Source: Real Estate Information Network For East Japan.

First, in the rental market, vacancy rates for office buildings have continued to rise, mainly due to the increase in remote work, while inventories of rental housing in Tokyo have been at a high level, reflecting a decline in population inflows to central wards of Tokyo (Charts B2-3 and B2-4). Rents of commercial real estate, such as hotels and retail facilities, have continued to be weak, and supply

and demand conditions in the rental market have yet to improve (Chart B2-5).

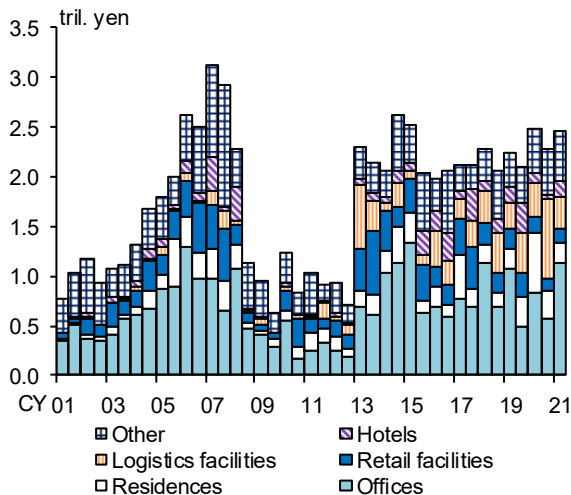
**Chart B2-5: Developments in real estate rent**



Note: The chart shows the quarterly averages. The latest data represent the July-August 2021 average.  
Source: BOJ, "Services Producer Price Index."

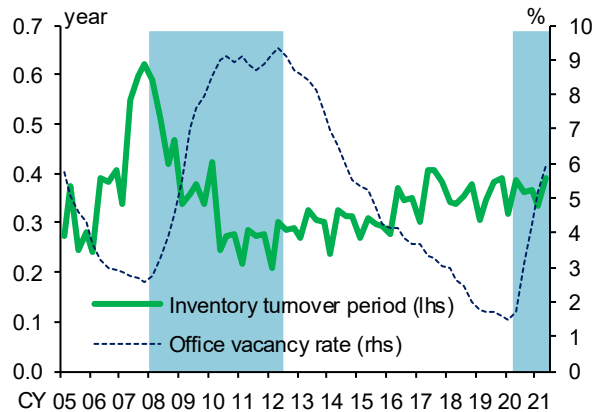
Nevertheless, the incomes of rental real estate businesses have tended to vary less relative to other industries, and did not fall much even during severe recessions such as the GFC. This may be a reason behind the current low levels of default rates.

**Chart B2-6: Real estate transaction value**



Note: Latest data as at the first half of 2021.  
Source: Japan Real Estate Institute.

**Chart B2-7: Inventory turnover period for real estate industry**

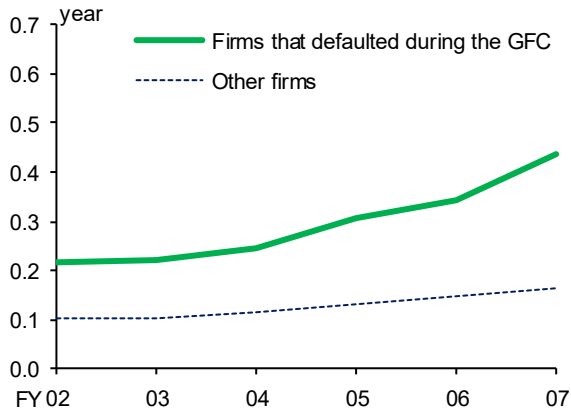


Note: 1. "Inventory turnover period" is the ratio of inventory assets to sales. The same applies to Chart B2-8.  
2. "Office vacancy rate" is the value for Tokyo. The shaded areas indicate periods when the office vacancy rate was rising.  
3. Latest data as at the April-June quarter of 2021.  
Source: Miki Shoji Co., Ltd; Ministry of Finance, "Financial statements statistics of corporations by industry."

Next, regarding the market for real estate transactions, the total value of transactions has remained at a high level, which contrasts with the developments during the GFC, when there was a notable rise in default rates, particularly among firms engaged in real estate transactions following the contraction in the transactions market (Charts B2-1 and B2-6). This seems to reflect the fact that investments -- including from foreign investors -- have been flowing into Japan's real estate market under the continued accommodative financial conditions, as highlighted in the previous *Report*. Moreover, developments in the inventory turnover period in the real estate industry during the current phase sharply contrast with the GFC, when elevated adjustment pressure on inventory could already be seen before the full-fledged deterioration of market conditions, and show no such pressure (Chart

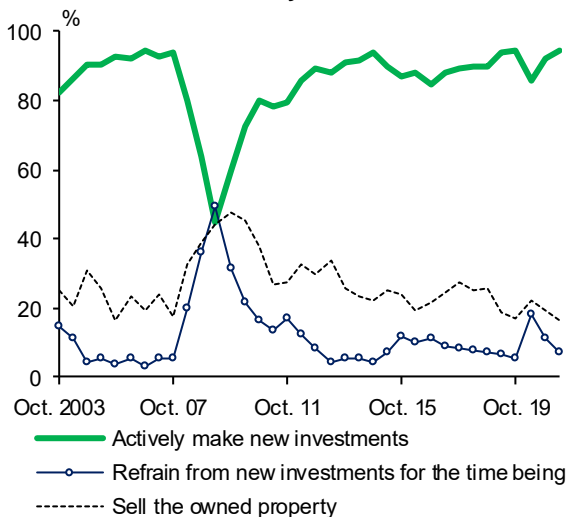
B2-7).<sup>77</sup> A more detailed look shows that firms that defaulted during the GFC tended to have longer inventory turnover periods before the GFC than firms that did not default during that time (Chart B2-8).

**Chart B2-8: Inventory turnover periods of small and medium-sized real estate transaction businesses (before the GFC)**



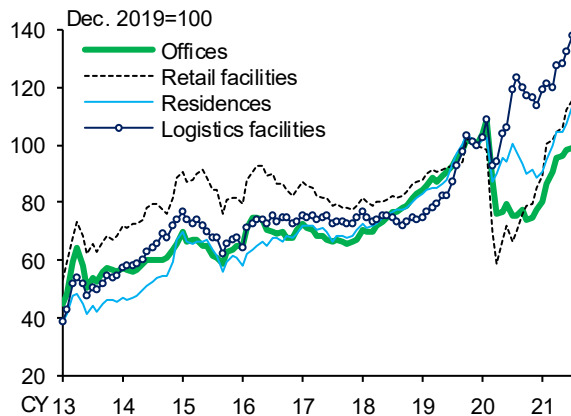
Note: "Firms that defaulted during the GFC" indicate firms that defaulted from FY2008 to 2010. The median of each is shown.  
Source: CRD Association.

**Chart B2-9: Real estate investment stance for the year ahead**



Note: The chart indicates the proportion of real estate investors (including asset managers, banks, and developers) who selected each given choice. Multiple answers are included. The survey is conducted every April and October. The April 2021 survey covers 126 respondents.  
Source: Japan Real Estate Institute, "The Japanese real estate investor survey."

**Chart B2-10: J-REIT indexes by asset**



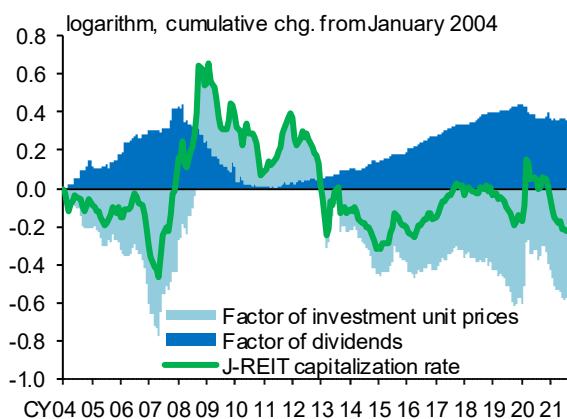
Note: 1. Classification is based on J-REITs' main assets. Total return.  
2. Monthly averages. Latest data as at July 2021.  
Source: Sumitomo Mitsui Trust Research Institute, "SMTRI J-REIT Index."

Meanwhile, looking at real estate investors' investment stance for the year ahead, survey results indicate that, although investors became somewhat cautious in the April 2020 survey, their investment stance has recovered since then, which contrasts with investors' stance during the GFC (Chart B2-9). Recently, the pace of recovery in J-REIT indexes for a wide range of real estate assets has accelerated in anticipation of favorable factors such as progress with COVID-19 vaccinations (Chart B2-10). Furthermore, J-REIT capitalization rates have declined due to an increase in investment unit prices (Chart B2-11). These developments suggest that investment sentiment among

<sup>77</sup> Inventories in the real estate industry consist primarily of real estate inventories held for the purpose of selling. The inventory turnover period is an indicator representing the size of inventories in relation to sales.

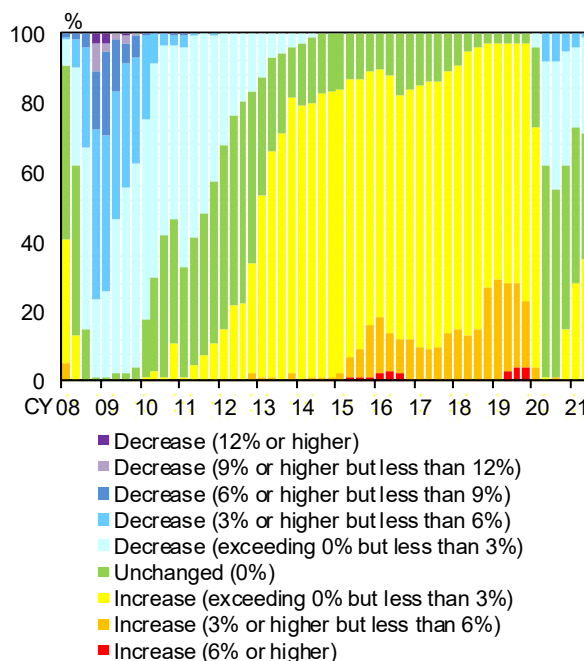
a broad range of investors appears to be recovering as well. Against this backdrop, there are signs of a bottoming out in some indicators of appraised land prices, which the previous *Report* highlighted as showing a change in trend (Chart B2-12).

**Chart B2-11: Decomposition of J-REIT capitalization rate**



Note: 1. "J-REIT capitalization rate" is the J-REIT expected distribution yield.  
 2. In the factor decomposition, the TSE REIT Index is used for investment unit prices.  
 3. Latest data as at August 2021.  
 Source: Association for Real Estate Securitization; Bloomberg.

**Chart B2-12: Land Value LOOK Report**



Note: 1. Licensed real property appraisers estimate land value trends of a total of 100 districts quarterly by using real property appraisal approaches.  
 2. Survey is conducted at the beginning of January, April, July, and October. The latest survey indicates trends from April 1, 2021 to July 1, 2021.  
 Source: Ministry of Land, Infrastructure, Transport and Tourism, "Land Value LOOK Report."

Thus, there are several factors that have helped to contain a rise in credit costs in lending to the real estate industry in the current phase. However, going forward, the following risks need to be closely monitored. The first is the risk of an adjustment in real estate prices, as pointed out in studies abroad.<sup>78</sup> Given that inflows of funds into Japan's real estate market to some extent have been underpinned by investors' expectations of favorable future developments in the rental market, attention needs to be paid to the risk that funds might flow out of the transactions market as a result of changes in domestic and overseas financial conditions and developments in the course of the pandemic. The second risk is that, as pointed out in the October 2020 *Report*, the financial vulnerability of small and medium-sized rental real estate businesses may be increasing, as their leverage ratio has been rising in recent years. Developments in the real estate market continue to warrant close attention, bearing these points in mind in addition to the impact of uncertainty regarding the pandemic on the real estate market, including the possibility of structural changes such as the spread of remote work.

<sup>78</sup> For example, the risk of adjustments in real estate prices since the outbreak of the COVID-19 was examined in the April 2021 issue of the *Global Financial Stability Report* by the International Monetary Fund (IMF).

### Box 3: Foreign currency funding risks: The link between changes in global market conditions and funding structure

This box provides an overview of how Japanese banks' funding instruments and funding rates of foreign currency are affected by changes in global market conditions and by their funding profiles, including the degree of diversification in their funding counterparties. It further explores the areas of concerns regarding funding risks and potential measures to be considered for ensuring stable funding.<sup>79</sup>

#### *Changes in global market conditions and foreign currency funding instruments*

Regarding the composition of Japan's major banks' foreign currency funding, the share of deposits has been increasing over the medium to long term, indicating that there has been progress in building a stable funding basis. However, from a short-term perspective, there were periods, such as the GFC and the market turmoil in March 2020, in which large fluctuations in the composition are observed (Chart B3-1). The two crises are characterized by (1) an increase in market funding as a result of an increase in lending that was not met by a corresponding increase in deposit funding, and (2) a large shift in market funding from CDs and CP to other market funding instruments. The latter observation suggests that substitutions within market funding instruments exerted further stress on funding. In contrast, during the European sovereign debt crisis, only an increase in market funding was observed, while during the taper tantrum neither of these two characteristics prevailed.

To examine the reason for these differences, the shares of different instruments in major banks' foreign currency funding are regressed on variables representing changes in global market conditions, specifically, U.S. interest rates (the federal funds rate, the term spread [the difference between the 10-year Treasury bond rate and the federal funds rate]), fund redemption rate, and the financial conditions index (FCI).<sup>80</sup> The estimation results indicate that a deterioration in global market conditions significantly changes the composition of foreign currency funding instruments, often increasing the share of short-term FX and currency swaps. Taking a more detailed look, on the liabilities side, a deterioration in the FCI reduces the share of repos while pushing up the share of short- as well as medium- to long-term FX and currency swaps and of deposits (Chart B3-2).<sup>81</sup> On the investment side, the share of loans increases substantially. All in all, these results suggest a possibility that the share of FX and currency swaps on the liability side expands because increases

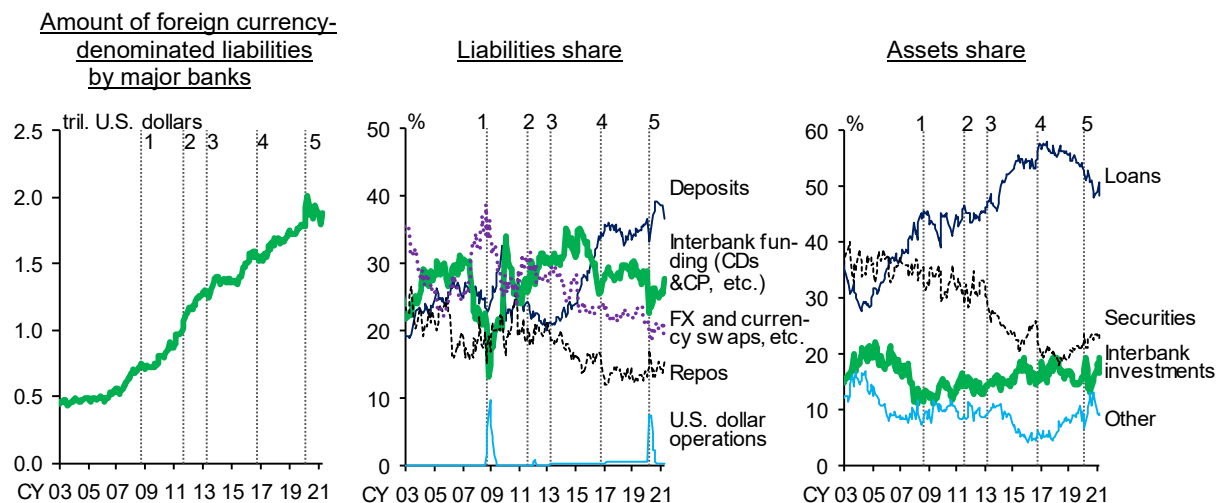
<sup>79</sup> The period covered in the analysis in this box does not include events in which there was a widespread deterioration in the creditworthiness of Japanese banks. In managing foreign currency liquidity risk, however, it is also necessary to consider the possibility of stress such as a deterioration in the creditworthiness of Japanese banks, or a combination of such stress and the market stress discussed in this box.

<sup>80</sup> The fund redemption rate was chosen as a variable to capture the materialization of risks associated with investment funds and the associated rise in demand for short-term funding at major banks, and the FCI captures the impact of a broad deterioration in financial conditions, such as rising credit spreads. The former is calculated as the amount of investment trust, ETF (stock, bond, etc.), and MMF (prime and government) redemptions in the current period divided by assets outstanding at the end of the previous period, while the latter is the FCI (Chicago Fed National Financial Conditions Risk Subindex) calculated by the Federal Reserve Bank of Chicago, which is constructed from variables, such as the volatility index (VIX) and credit spreads on corporate bonds.

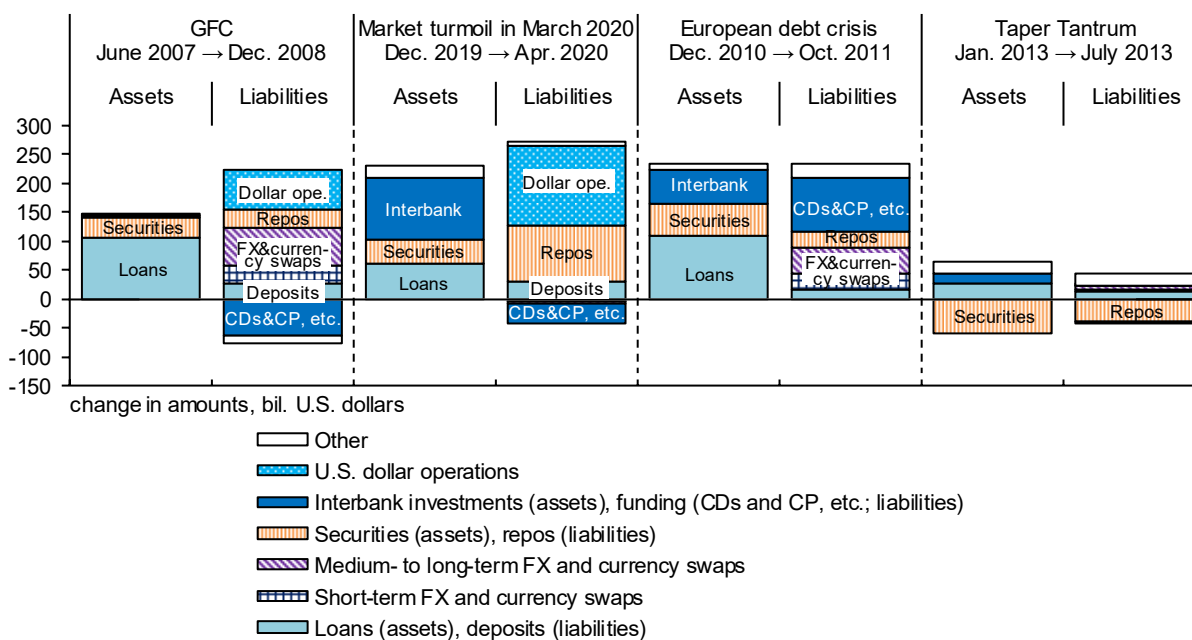
<sup>81</sup> In addition to these three variables that are included to capture changes in global market conditions, dummy variables are included as explanatory variables to control for the impact of the MMF reform in 2016 and discontinuities in the data for sampled banks. Although it is difficult to fully control for the market stabilization effect of U.S. dollar funds-supplying operations in the estimation, an alternative estimation model in which the share of U.S. dollar funds-supplying operations funding is added to the explanatory variables to control for substitutions effects with other funding instruments is also studied. The estimation results, however, barely changed.

in deposits are not large enough to cover the increase in loans.<sup>82</sup> Next, a rise in the fund redemption rate reduces the share of funding through CDs, CP, and similar instruments, and increases the share mainly of repo and short-term FX and currency swap funding. Finally, a rise in U.S. interest rates tends to reduce the share of deposits and lead to a shift to market funding such as CDs and CP.

**Chart B3-1: Event study of foreign currency-denominated balance sheets of major banks**



**Event study of foreign currency-denominated balance sheets**



Note: Covers internationally active banks among major banks (all currencies base). The event lines represent 1: the GFC (September 2008), 2: the European debt crisis (August 2011), 3: the Taper Tantrum (April 2013), 4: the MMF reform (October 2016), and 5: the market turmoil in March 2020. "FX and currency swaps, etc." in the liabilities share includes corporate bonds. "Interbank investments" in the assets share includes reserves at central banks. "Other" in the assets share includes repo and yen funds obtained in FX swap transactions. "U.S. dollar operations" represents mainly U.S. Dollar Funds-Supplying Operations. The same applies to subsequent charts. There are some discontinuities in the data around December 2009. Latest data as at April 2021.

Source: BOJ.

<sup>82</sup> Based on the estimation for the investment side, a deterioration in the FCI leads to an increase in the share of loans in investments and a decrease in the share of securities investment. The estimation result for the funding shares that the share of repo funding shrinks in response to a deterioration in the FCI may reflect that repo funding declines due to a decrease in securities used as collateral for repos.

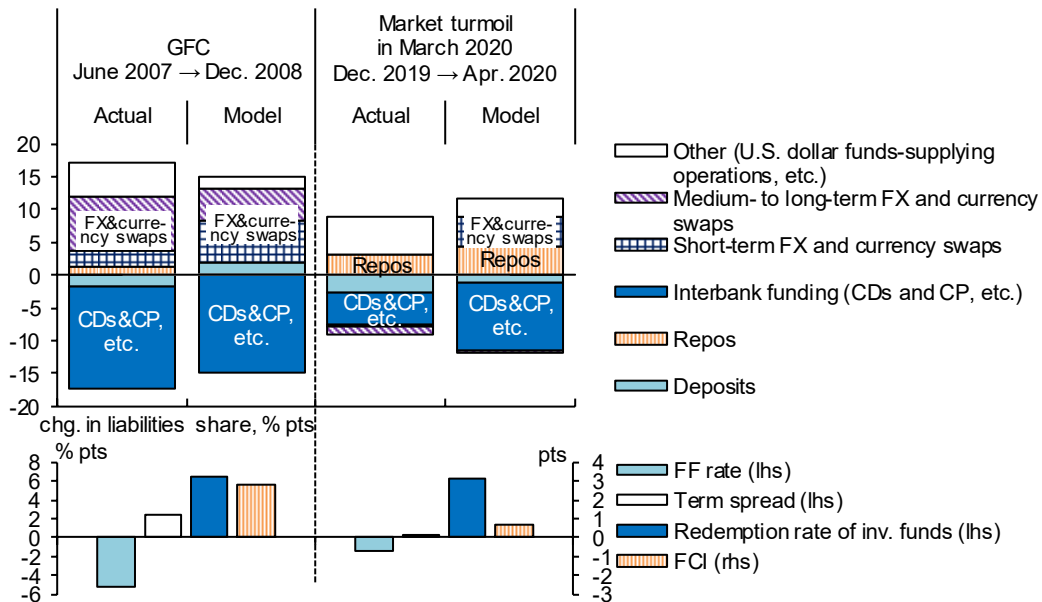
The four variables used in the estimation, especially the fund redemption rate, fluctuated significantly during the GFC and the market turmoil in March 2020. A comparison between the model estimates and the actual results for the GFC period shows that changes in the funding composition during this period are explained quite well mainly by the deterioration in the FCI and the increase in the fund redemption rate that took place simultaneously. The model also captures well the major changes in the funding compositions during the market turmoil in March 2020, suggesting that the increase in the fund redemption rate put stress on funding in the form of a decline in the share of, for example, CDs and CP (Chart B3-3).

**Chart B3-2: Changes in global market conditions and foreign currency funding instruments**

Explanatory variables / Dependent variable	Liabilities share						Assets share
	Deposits	Repos	Interbank funding (CDs and CP, etc.)	Medium- to long-term FX and currency swaps	Short-term FX and currency swaps	Other (U.S. dollar funds-supplying operations, etc.)	Loans
FCI (pts)	1.50 **	-3.50 ***	-0.25	1.01 **	1.02 **	0.21	11.14 ***
Redemption rate of funds (%)	-0.49 ***	1.00 ***	-1.38 ***	-0.28 **	0.74 ***	0.41 ***	-2.86 ***
FF rate (%)	-0.71 ***	-0.33	1.02 ***	-0.64 ***	0.66 ***	0.01	-1.01 **
Term spread (%)	-1.08 ***	0.63 **	-0.01	0.25	0.85 ***	-0.63 **	-2.52 ***
Adj. R <sup>2</sup>	0.83	0.62	0.71	0.46	0.81	0.29	0.71
Sample size	220						
Estimation period	January 2003 - April 2021						

Note: \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Source: Bloomberg; Federal Reserve Bank of Chicago; Haver Analytics; ICI; BOJ.

**Chart B3-3: Foreign currency-denominated balance sheet simulation**



Note: "Model" is calculated by multiplying the estimated results in Chart B3-2 by the actual change in the explanatory variables for each event; i.e., scenarios for the FF rate, term spread, and FCI are calculated as the difference between the beginning and end of the period for each event, and the redemption rate of investment funds is the largest increase registered since the beginning of the period for each event.

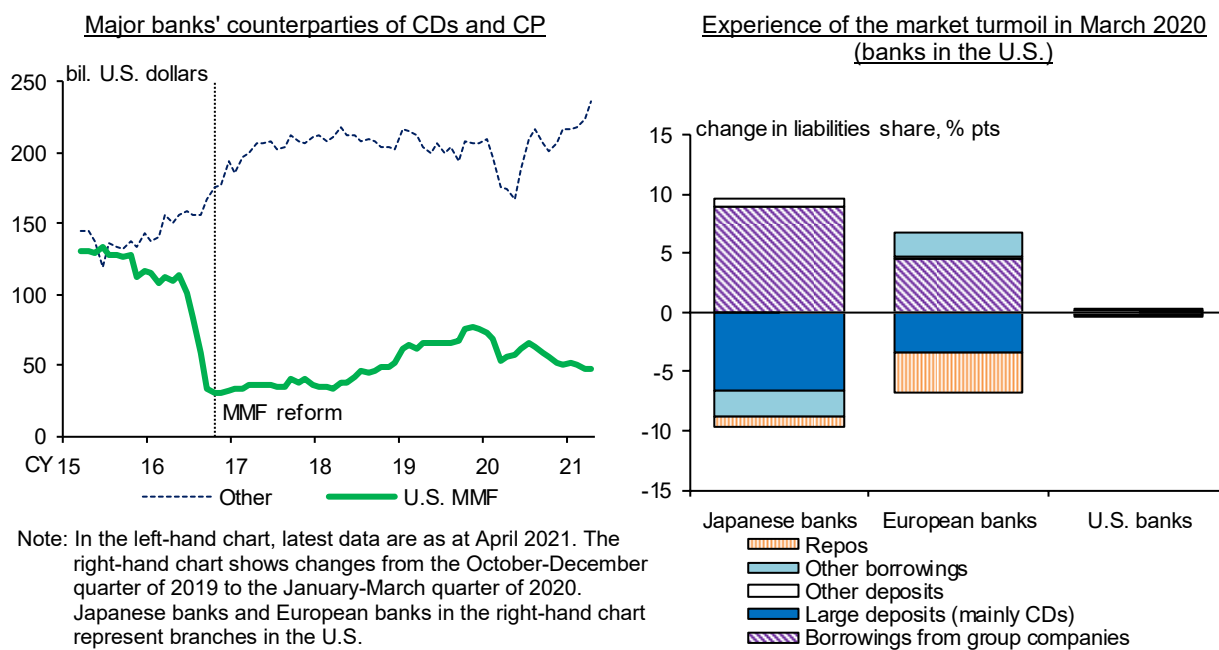
Source: Bloomberg; Federal Reserve Bank of Chicago; Haver Analytics; ICI; BOJ.

### Analysis of funding structures

Next, characteristics of each of the foreign currency funding instruments -- CDs and CP, repos, FX and currency swaps, and deposits -- are examined in more detail, touching on the role played by financial institutions' funding profiles, including the degree of diversification of funding counterparties.

The direct cause for the decline in the share of CDs, CP, and similar instruments in major banks' foreign currency funding in response to a rise in the fund redemption rate is considered to be a decline in CD and CP purchases by U.S. prime MMFs.<sup>83</sup> That said, while major banks have become less reliant on these MMFs and more reliant on other counterparties in their CD and CP funding since the MMF reform in 2016, funding from counterparties other than U.S. MMFs also decreased significantly in the March 2020 market turmoil, suggesting that there may be other causes as well (Chart B3-4).<sup>84</sup> Comparing changes in the CD and CP funding shares across banks in the United States during the March 2020 market turmoil shows that the decline in Japanese banks' share was larger than that of U.S. and European banks.<sup>85</sup> This may be because the wholesale funding share of Japanese banks in the United States has been relatively high and the amount of funding from U.S. dollar funds-supplying operations was large.

**Chart B3-4: Impact of MMF reform and experience of market turmoil in March 2020**



Note: In the left-hand chart, latest data are as at April 2021. The right-hand chart shows changes from the October-December quarter of 2019 to the January-March quarter of 2020. Japanese banks and European banks in the right-hand chart represent branches in the U.S.  
Source: Crane Data; FDIC; Federal Reserve Bank of Chicago; BOJ.

<sup>83</sup> As for developments in prime and government MMFs during the market turmoil in March 2020, see, for example, FSB, *Holistic Review of the March Market Turmoil*, November 2020 and Avalos, F., and Xia, D., "Investor Size, Liquidity and Prime Money Market Fund Stress," *BIS Quarterly Review*, March 2021.

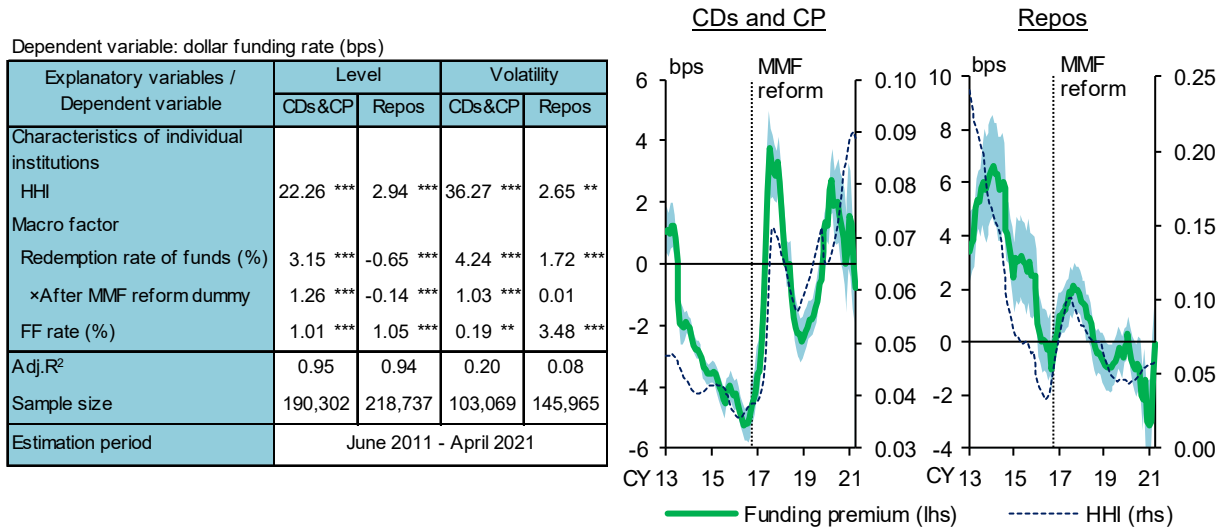
<sup>84</sup> Estimated sensitivity of major banks' share of CD and CP funding to increases in fund redemption rates does not change much from the estimates based on the data before the MMF reform, even when the estimation is conducted using the data after the MMF reform that was followed by a sharp decline in funding from the U.S. prime MMF. This suggests that the impact of changes in fund redemption rates on the share of CD and CP funding by major banks may be greater than what can be explained by changes in direct purchases by U.S. prime MMFs alone.

<sup>85</sup> In the following analysis, data for the U.S. branches of foreign banks are from the *Report of Condition and Income* (FFIEC 002 in Call Report, published by the Federal Reserve Bank of Chicago), while data for U.S. banks are from the *Statistics on Depository Institutions* (published by the Federal Deposit Insurance Corporation, [FDIC]). A comparison of the balance sheets of foreign banks in the United States suggests that while the CD funding share of European banks declined substantially during the European debt crisis, the direct impact of the increase in the redemption rate of MMFs at Japanese banks was limited.



Next, the determinants of the level and volatility of CD and CP funding rates in individual transactions are studied using data on the characteristics of financial institutions that raise funds from U.S. MMFs. The results show that rises in the fund redemption rate and the U.S. interest rate push up both the level and volatility of CD and CP funding rates.<sup>86,87</sup> It is also seen that banks with a fewer number of funding counterparties (i.e., with a higher Herfindahl-Hirschman Index [HHI]) tend to face higher levels and volatility regarding funding rates. In other words, banks enjoy lower funding costs and more stable funding when funding from a larger number of counterparties (Chart B3-5).

**Chart B3-5: U.S. dollar funding rates in CDs, CP, and repo market**



Note: 1. In the left-hand chart, \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Pairwise volatilities of funding rates are calculated over a 12-month backward window, and the explanatory variables are 12-month backward moving averages (the same applies to subsequent charts). In the estimation, the characteristics of each transaction (transaction volume, maturity, collateral type <repos only>, and counterparty fund type) and CDS of each individual institution are used as control variables, and HHI in the previous period is used as the instrumental variable.

2. In the right-hand chart, "Funding premium" is the deviation of the U.S. dollar funding premium of Japanese banks standardized by other institutions, and "HHI" is the sum of squared shares of transaction volume with funds over a 12-month backward window (weighted averages). The shaded area is the 99th percentile range. Latest data as at April 2021.

Source: Crane Data; FRB; Haver Analytics; ICI.

As for repo funding, an increase in the fund redemption rate pushes up the volatility of the funding rates but pushes down their level (Chart B3-5). As mentioned above, a rise in the fund redemption rate tends to increase major banks' share of repo funding, and one possible reason for this is that the supply of repo transactions backed by government bonds may be affected by outflows of funds from prime MMFs flowing into government MMFs. Similar to the CD and CP markets, banks tend to see higher levels and volatility of funding rates when facing fewer funding counterparties.

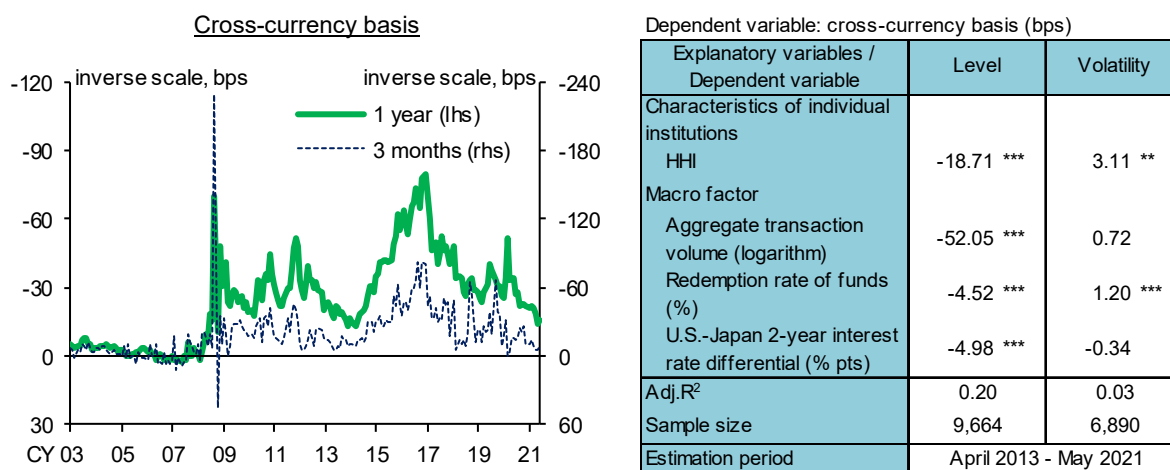
<sup>86</sup> As for the effects of funding structure, such as the degree of diversification in counterparties, on funding rates, see, for example, Aldasoro, I., Ehlers, T., and Eren, E., "Global Banks, Dollar Funding, and Regulation," *BIS Working Papers*, no. 708, May 2019.

<sup>87</sup> In the analysis on CDs and CP as well as repo funding rates, Crane Data products, which includes data on transactions with MMFs, are used.

As for FX and currency swaps, a rise in the fund redemption rate pushes up the level and volatility of the funding costs as well.<sup>88</sup> A higher fund redemption rate gives added incentives for borrowers to shift to FX and currency swaps, and possibly reduces the supply of funds from European and U.S. banks, which are considered as facing a decline in funding from MMFs, etc. A rise in the U.S. interest rate also pushes up the level of funding costs. In terms of funding counterparties, having a large number of them (i.e., a low HHI) pushes down the level and volatility of funding rates, suggesting that a diversification of funding counterparties leads to more stable funding (Chart B3-6).

With regard to deposits, existing studies have already pointed out that a rise in U.S. interest rates increases financial institutions' share of wholesale funding through a rebalancing of assets by depositors from deposits to MMFs or other assets.<sup>89</sup> Indeed, estimates based on data from individual banks located in the United States show that the wholesale funding share rises when the U.S. interest rate rises.<sup>90</sup> It is also seen that having large amounts of transaction account deposits constrains the increase in the share of wholesale funding to a certain extent (Chart B3-7). Along this line, Japanese banks have been increasing the share of transaction account deposits as they have been increasing the share of deposits, although responses of their wholesale funding share to changes in interest rates are greater than for U.S. and European banks (Chart B3-8).

**Chart B3-6: U.S. dollar funding premiums in cross-currency basis swaps**



Note: 1. Latest data in the left-hand chart as at end-June 2021.

2. \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Transaction characteristics (transaction volume and maturity years) and CDS (Japanese bank average) are used as control variables. The previous period's values of HHI, aggregate transaction volume, and Japan-U.S. interest rate differential (U.S. minus Japan) are used as instrument variables in the estimation.

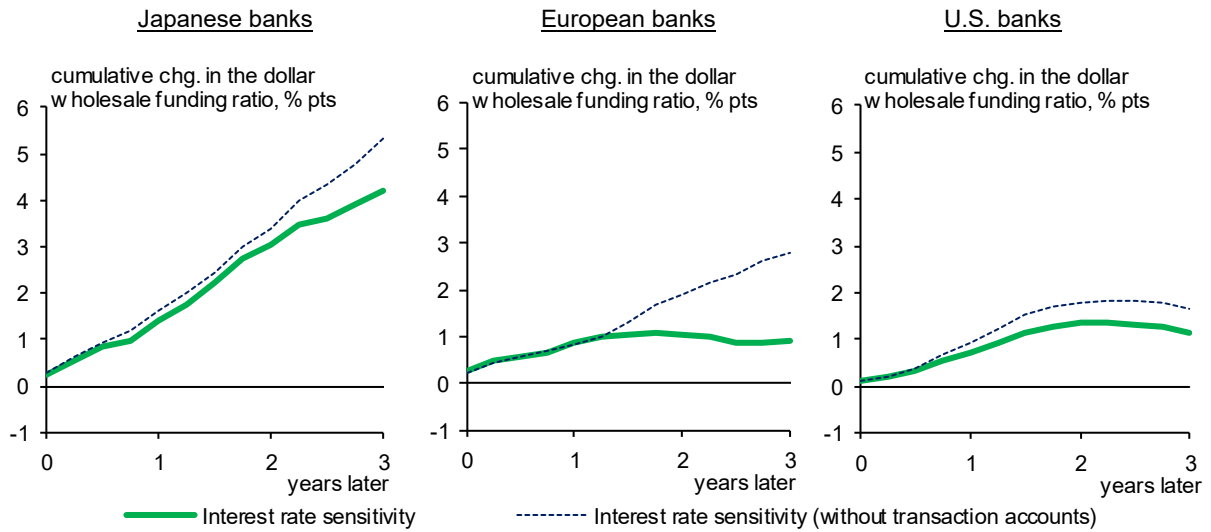
Source: Bloomberg; FSA, "OTC Derivative Transaction Data"; Haver Analytics; ICI.

<sup>88</sup> For details on data regarding FX and currency swaps, see the Financial Markets Department of the Bank of Japan and the Supervision Bureau of the FSA, "Enhancement and Utilization of OTC Derivative Transaction Data," *Bank of Japan Review Series*, no. 21-J-6, June 2021 (available only in Japanese). As for analysis using such data on developments in cross-currency swap market during the market turmoil in March 2020, see Maruyama, R. and Washimi, K., "Cross-Currency Swap Market through the Lens of OTC Derivative Transaction Data: Impact of COVID-19 and Subsequent Recovery," *Bank of Japan Review Series*, no. 21-E-1, May 2021.

<sup>89</sup> For the linkage between wholesale funding and interest rates, see, for example, Drechsler, I., Savov, A., and Schnabl, P., "The Deposits Channel of Monetary Policy," *The Quarterly Journal of Economics*, May 2017, and Choi, D. B., and Choi, H. S., "The Effect of Monetary Policy on Bank Wholesale Funding," *Management Science*, May 2020.

<sup>90</sup> The impact of a rise in the interest rate on the wholesale funding share is estimated using a local linear projection. In the estimation, the timing of explanatory variables including changes in the interest rate is fixed, and the timing of the dependent variable varies from one year to three years.

**Chart B3-7: Effects of transaction accounts on interest rate sensitivity of dollar wholesale funding**

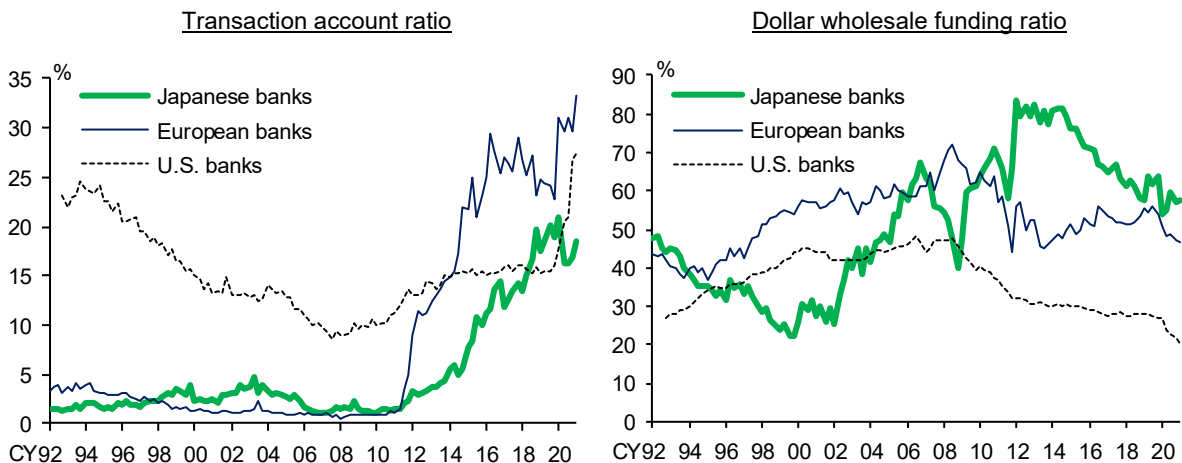


**Model**

$$\begin{aligned} \text{Cumulative chg. in the dollar w wholesale funding ratio}_{i,t,t+h} &= \beta_1 \text{ U.S. interest rate (y/y difference)}_t \\ &+ \beta_2 \text{ U.S. interest rate (y/y difference)}_t \times \text{transaction account ratio}_{i,t} \\ &+ \text{control variables} + \epsilon \end{aligned}$$

Note: 1. Each figure represents the cumulative change in the dollar wholesale funding ratio in response to a 1 percentage point rise in the U.S. interest rate estimated using local projections. The U.S. interest rate is 3-month, the estimation period is from the January-March quarter of 1992 to the January-March quarter of 2021, and the sample size is about 930 thousand. "Interest rate sensitivity" shows the changes in the dollar wholesale funding ratio taking into account the interaction term between the transaction account ratio and changes in the U.S. interest rate. The recent level of the transaction account ratio is used. "Japanese banks" and "European banks" represent branches in the U.S.  
 2. The transaction account ratio is the ratio of transaction account deposits to total deposits.  
 3. Dollar wholesale funding ratio = (large deposits <mainly CDs> + repos + other borrowings) / (other deposits + dollar wholesale funding <numerator> + borrowings from group companies, etc.).  
 Source: Bloomberg; FDIC; Federal Reserve Bank of Chicago.

**Chart B3-8: Transaction account ratio and dollar wholesale funding ratio**



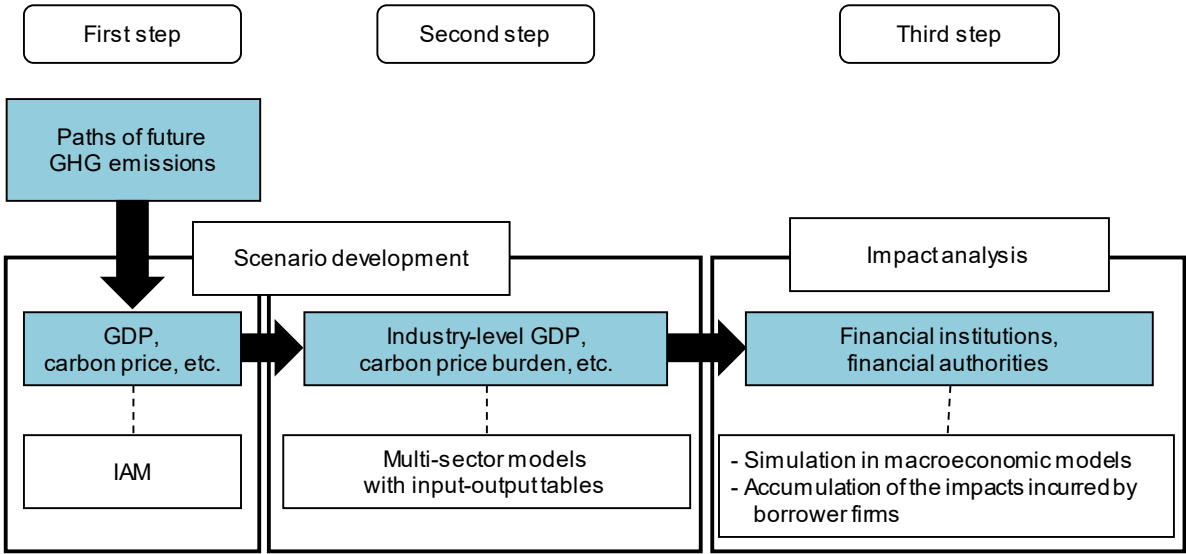
Note: 1. Latest data as at the January-March quarter of 2021. "Japanese banks" and "European banks" represent branches in the U.S.  
 2. The transaction account ratio is the ratio of transaction account deposits to total deposits.  
 3. Dollar wholesale funding ratio = (large deposits <mainly CDs> + repos + other borrowings) / (other deposits + dollar wholesale funding <numerator> + borrowings from group companies, etc.).  
 Source: FDIC; Federal Reserve Bank of Chicago.

**Box 4: The methodology of climate-related financial risk scenario analysis**

In recent years, international organizations, financial authorities, and financial institutions have increasingly recognized the usefulness of scenario analysis, in which simulations based on certain assumptions are carried out, for quantitatively understanding climate-related financial risks. This box therefore outlines an example of a scenario analysis framework for climate-related financial risks, focusing on the impact of future measures to reduce greenhouse gas (GHG) emissions on financial systems.

The analysis can be broadly divided into three steps (Chart B4-1).

**Chart B4-1: Three steps in climate-related financial risk scenario analysis**



The first step consists of calculating the aggregate GDP and carbon prices for different scenarios regarding future measures to reduce greenhouse gas emissions. This is usually done employing integrated assessment models (IAMs) that describe the interaction between economic activity and climate change -- i.e., the impact of greenhouse gas emissions due to economic activity on economic growth stemming from the rise in global average temperature. A particularly well-known IAM is the Dynamic Integrated Climate-Economy (DICE) model developed by Professor William D. Nordhaus<sup>91</sup> at Yale University.

The DICE model is augmented by the interaction between economic activity and climate change, and incorporates the findings of geophysics into a textbook neoclassical growth model. Specifically, GDP used in the DICE model is calculated by subtracting climate-related losses from output calculated using the standard production function, in which output is a function of the production inputs (Chart B4-2).<sup>92</sup> Climate-related losses consist of (1) damages resulting from rises in temperature brought about by the past greenhouse gas emissions (losses linked to physical risks), and (2) abatement costs, i.e., the costs of reducing greenhouse gas emissions (losses linked to transition risks). In so-

<sup>91</sup> Professor Nordhaus was awarded the 2018 Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel for his work on integrating climate change into long-run macroeconomic analysis.

<sup>92</sup> For details of the DICE model, see Nordhaus, W. D., *Managing the Global Commons*, (Cambridge: The MIT Press, 1994). For an overview of the DICE model, see Institute for Monetary and Economic Studies of the Bank of Japan, "Special Volume: Economics of Climate Change (1) -- Capturing the Relationship between Climate Change and Macroeconomics -- DICE Model," IMES Newsletter, October 2021 (available only in Japanese).

called growth accounting, an increase in climate change-related losses will show up as a decline in the Solow residual, i.e., a decline in the productivity level.

**Chart B4-2: Interaction between economic activity and climate change in the DICE model**

$$GDP = (Gross\ output) \times (1 - \underbrace{Cost\ coefficients\ by\ climate\ change}_{f(Temperature\ change\ damages\ by\ GHG\ stocks,\ Abatement\ costs)})$$

While the DICE model very succinctly expresses the interaction between economic activity and climate change, some limitations have been pointed out, such as the considerable uncertainty regarding the parameters or the fact that it does not incorporate nonlinearity in the relationship between economic activity and weather events, which is a lively area of research in the natural sciences. Against this background, various improvements of IAMs have been made in economics and the natural sciences by fusing knowledge from both fields, and a variety of models have been developed and put into practical use. Depending on their needs, institutions such as financial authorities have chosen IAMs to calculate GDP and carbon prices for scenarios regarding future greenhouse gas emissions. For example, the Network for Greening the Financial System (NGFS) has presented various scenarios regarding measures to reduce greenhouse gas emissions and released estimates for greenhouse gas emissions reduction, the rise in temperatures, GDP, and other indicators using IAMs, which are expanded as a multi-regional model consisting of a number of regional economies around the world, for the different scenarios.<sup>93,94</sup>

Based on the simulated paths of GDP and carbon prices at the macro level obtained in the first step, the second step of scenario analysis consists of calculating the industry-level GDP and carbon price burden for each scenario. It is pointed out that greenhouse gas emissions differ substantially across industries. Given that the abatement costs for moving toward a low-carbon economy will be larger for industries emitting larger amounts of greenhouse gases, it would be misleading to rely only on macroeconomic figures -- which are average values -- when quantifying climate-related financial risks, and thus it is desirable to examine such risks by industry.

However, standardized greenhouse gas emissions data by industry for international comparison are still in progress, and no consensus on a multi-sector IAM to analyze such data has been reached to date. The NGFS also has not released industry-level estimates in their climate scenarios. Central banks in Europe, among others, therefore have built a multi-sector model utilizing, for example, input-output tables in an attempt to calculate the industry-level GDP and carbon price burden in line with the paths of aggregate GDP and carbon prices obtained in the first step.<sup>95</sup>

The third step of scenario analysis consists of calculating the effects on financial systems and financial institutions' portfolios using variables, such as the aggregate and industry-level GDP and carbon price burden estimates, obtained in the first and second steps. For this step, there are various

<sup>93</sup> The NGFS presents three main scenarios: (1) an orderly transition scenario, in which countries continue to take action to reach net zero CO<sub>2</sub> emissions by 2050, (2) a disorderly transition scenario, in which countries maintain their current policies until 2030 and start taking action only around 2030 toward reaching net zero CO<sub>2</sub> emissions by 2050, and (3) a hot house world scenario, in which no additional climate policies are introduced until 2050. See NGFS, *NGFS Climate Scenarios for Central Banks and Supervisors*, June 2021.

<sup>94</sup> The NGFS estimations use not the DICE model but three other IAMs (GCAM, MESSAGEix, and REMIND). In addition, supplementary macroeconomic models are used to estimate macro-level asset prices such as stock prices, which are also released.

<sup>95</sup> In addition, where necessary, they have estimated the paths of stock prices by industry, etc., using time series analysis.

approaches, such as simulation analysis at an aggregate level that relies on a macroeconomic model or the ones that calculate the effects at disaggregated levels, such as by industry or individual borrower firm and then aggregate the results.<sup>96</sup>

Climate-related risk scenario analysis is still in its infancy and methodologies continue to evolve. For example, the collection of data and development of multi-sector models for the second step are important issues. Furthermore, considering that the analyses generally examine long-term developments for 30 years or more, there are remaining issues regarding how to incorporate changes in the industrial structure and in financial institutions' portfolios over the long run in the third step. Both financial authorities and financial institutions are going through trial and error on this point as the amount of academic research and practical experience on this issue are limited. It is expected that understanding of issues including those pointed to here will be deepened going forward.

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<sup>96</sup> The specific model to be used depends on the objective of the estimation, efficiency, and whether data are available or not. An approach using a macroeconomic model is effective when examining the effects on financial institutions' overall portfolios and financial system as a whole, based on developments in macroeconomic variables. Meanwhile, an approach that accumulates the effects by firm is useful when each financial institution calculates the effects on their own portfolio, as it is possible to conduct a more refined estimate incorporating the characteristics of their portfolios.