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Financial System FSR report



BANK OF JAPAN
APRIL 2023

The total of major banks, regional banks, and *shinkin* banks covered in this *Report* is as follows (as at end-March 2023).

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, SBI 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-March 2023.

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Objectives of the *Financial System Report*

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

The *Report* assesses the vulnerabilities of the financial system from a macroprudential perspective. Within a macroprudential framework, institutional designs and policy measures are developed based on risk assessments in the financial system in order to ensure the stability of the overall financial system. In so doing, the interconnectedness of the real economy, financial and capital markets, and financial institutions' behavior are taken into account.

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 April 2023 issue

This issue of the *Report* assesses potential vulnerabilities in Japan's financial system and the effects of changes in banks' balance sheets during phases of rising foreign interest rates by analyzing them from the following two perspectives.

First, global tightening of financial conditions has exerted stress on Japan's financial system. Rises in foreign interest rates could contribute to pushing down banks' loss-absorbing capacity through shrinkage in interest margins and an increase in valuation losses on their securities holdings. Rising input costs and a slowdown in the global economy could push up banks' credit costs through a deterioration in financial conditions of domestic and foreign firms. Since March, uncertainty about the financial sector in the United States and Europe has increased. It is important to accurately assess the impact of these changes in the environment on the financial system.

Second, as pointed out in the previous issue of the *Report*, private debt has increased in Japan against the background of smooth functioning of financial intermediation. The increase in private debt since the outbreak of COVID-19, on the one hand, reflects firms' cautious cash management aimed at securing ample cash reserves. On the other hand, such an increase also reflects banks' active lending stance. Under these circumstances, it is important to monitor whether there has been an increase in lending to borrowers with relatively low debt repayment capacity, which entails high credit risk.

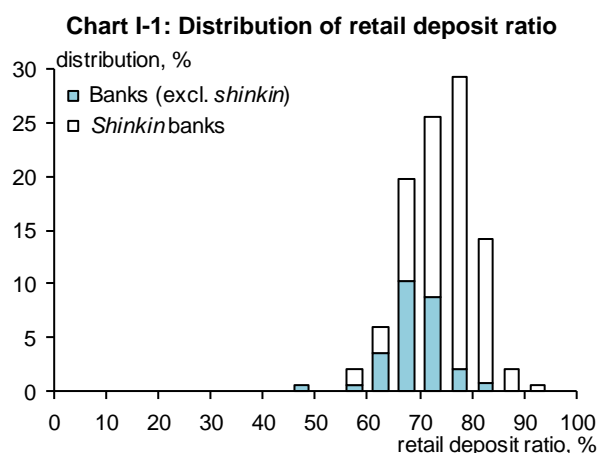
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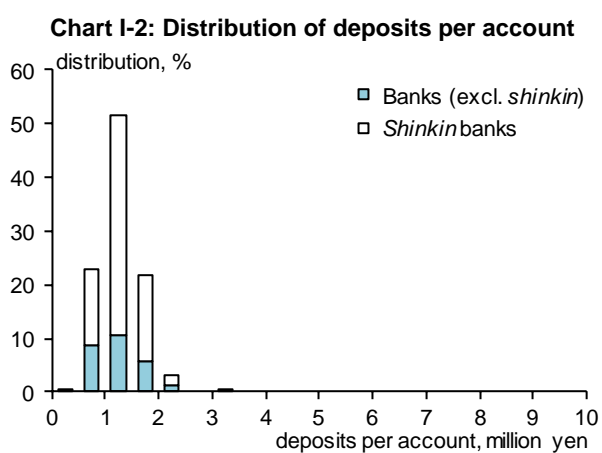
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I. Executive summary: Stability assessment of Japan's financial system

Japan's financial system has been maintaining stability on the whole. Japanese banks have sufficient capital bases to perform financial intermediation activities appropriately even amid the global tightening of financial conditions and the resultant various types of stress. They also have stable funding bases, especially small, sticky retail deposits (Charts I-1 and I-2). Despite heightened uncertainty about the financial sector in the United States and Europe, triggered by the U.S. bank failures in March, Japan's financial system has been sound and resilient (see Box 1 on the impact of the U.S. bank failures).¹



Note: The chart shows the ratios to overall banks including major, regional, and *shinkin* banks. See Chart B1-6.



Note: The chart shows the ratios to overall banks including major, regional, and *shinkin* banks. See Chart B1-7.

However, vigilance against tail risks continues to be warranted. Future developments remain highly uncertain as financial and capital markets have been nervous. Although the quality of banks' domestic and foreign loan portfolios has remained high on the whole, some loans entail high credit risk. From a long-term perspective, if banks' core profitability were to stagnate and capital accumulation were to stall, financial intermediation could be impaired due to a decline in loss-absorbing capacity, or vulnerabilities in the financial system could increase through excessive search for yield. To ensure the stability of Japan's financial system, it is necessary to examine these risks of contraction and overheating in the financial system and address potential vulnerabilities appropriately.

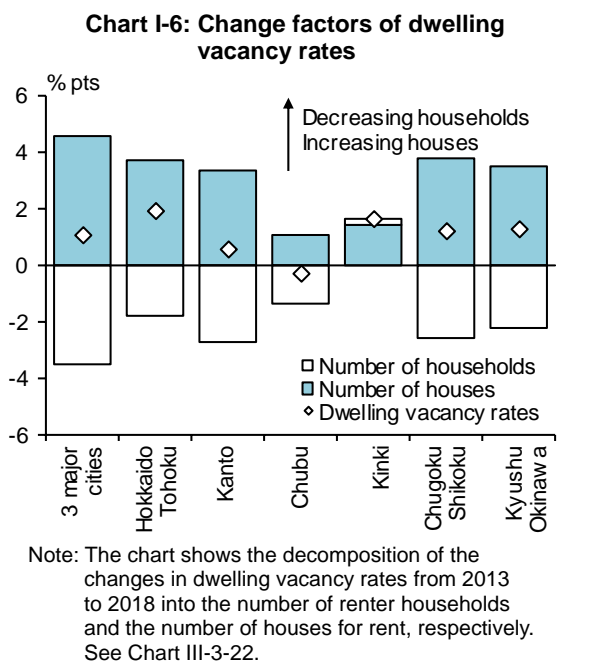
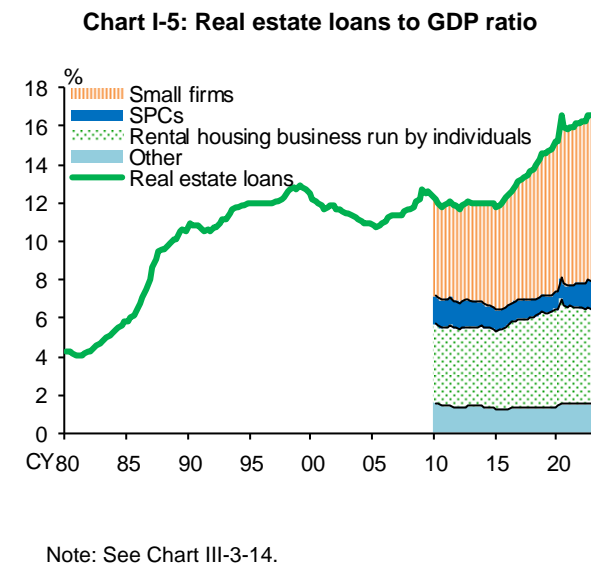
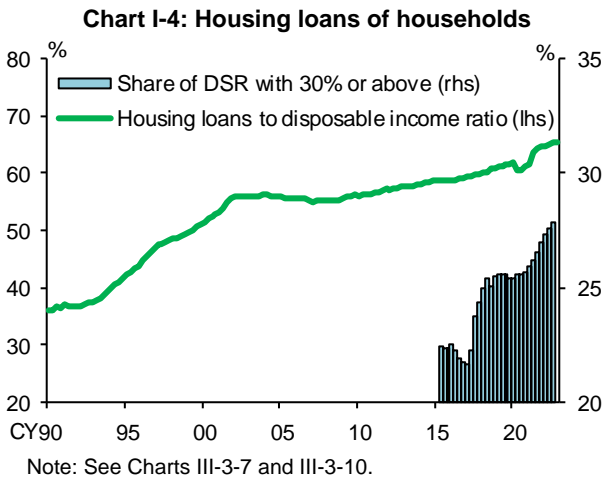
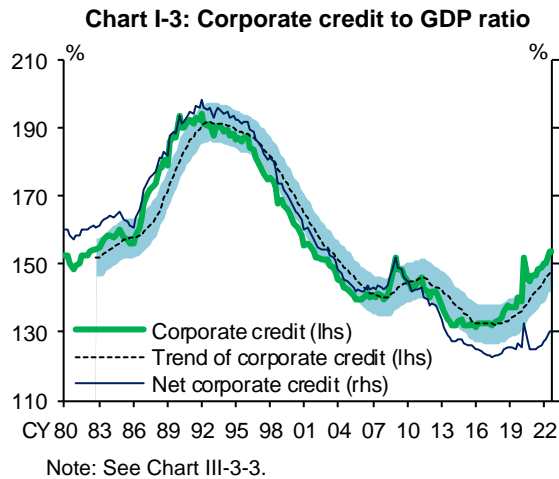
The current phase of the financial cycle → Chapters III-A and III-C

Although the current expansionary phase of the financial cycle has been prolonged, due mainly to the increase in private debt, no major financial imbalances can be observed in current financial activities. The increase in corporate credit, which is one of the reasons for the rise in private debt, reflects firms' cautious cash management, mainly by small and medium-sized enterprises (SMEs), aimed at securing ample cash reserves (Chart I-3). As suggested by the fact that net corporate credit (gross corporate credit minus firms' cash and deposits) has hardly expanded despite the increase in gross corporate credit, many SMEs have continued to secure cash reserves through borrowings.

The increase in private debt partly reflects borrowing by those with relatively low debt repayment

¹ One of the failed U.S. banks had a unique feature of liabilities, with deposits per account of 150 million yen (more than four times the deposit insurance coverage limit, at end-2022). There are no Japanese banks with such feature.

capacity. The household debt to disposable income ratio, which is equivalent to the loan-to-income (LTI) ratio on a macro basis, has continued to increase, reaching an all-time peak (Chart I-4). The share of housing loans with a high debt servicing ratio (DSR) -- the ratio of annual repayments to annual income -- has been increasing. Moreover, real estate loans have risen even amid the increase in dwelling vacancy rates across Japan (Chart I-5). Such an increase in vacancy rates for dwellings can be observed not only in areas where the number of renter households has declined but also in areas where the number of renter households has increased (Chart I-6). Attention should be given to these developments in private debt.

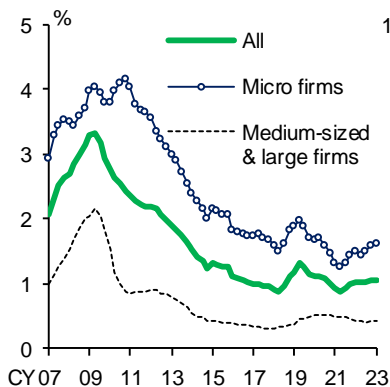


Domestic firms' default and cash reserves → Chapters III-A and IV-A

So far, firms' defaults have remained at a low level (Chart I-7). Recent trends in firms' defaults depend largely on the amount of cash reserves. Firms with lower profit margins have larger debt relative to total assets and little cash reserves such as cash and deposits (Chart I-8). Micro firms in particular have higher financial leverage (loans/total assets) in both gross and net terms, making

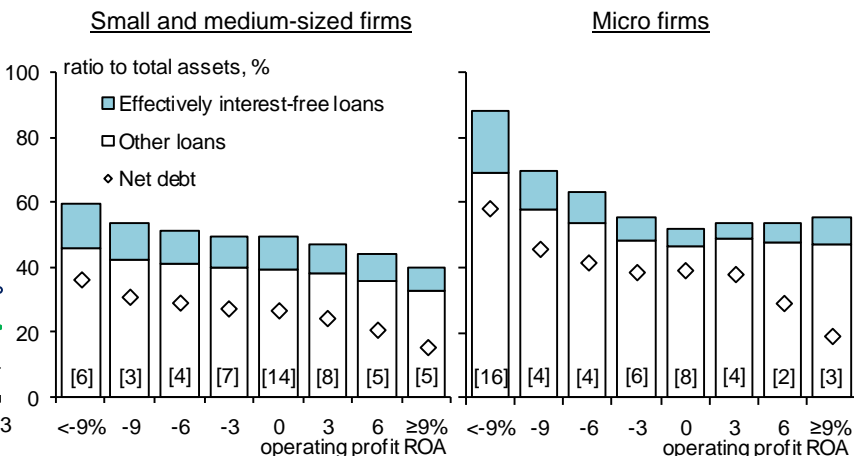
them more financially vulnerable. Indeed, default rates among smaller firms are beginning to rise gradually.

Chart I-7: Firms' default rates



Note: See Chart IV-1-7.

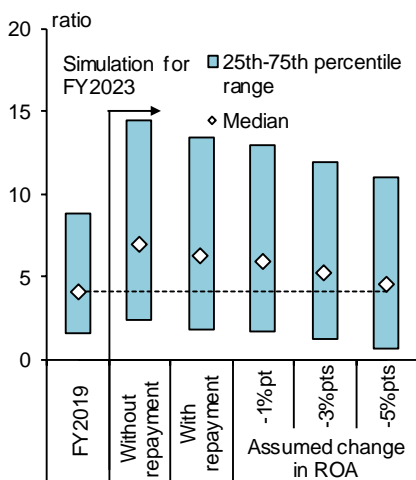
Chart I-8: Firms' financial liabilities



Note: The figures in brackets indicate the shares of small and medium-sized firms or micro firms to all SMEs. See Chart IV-1-8.

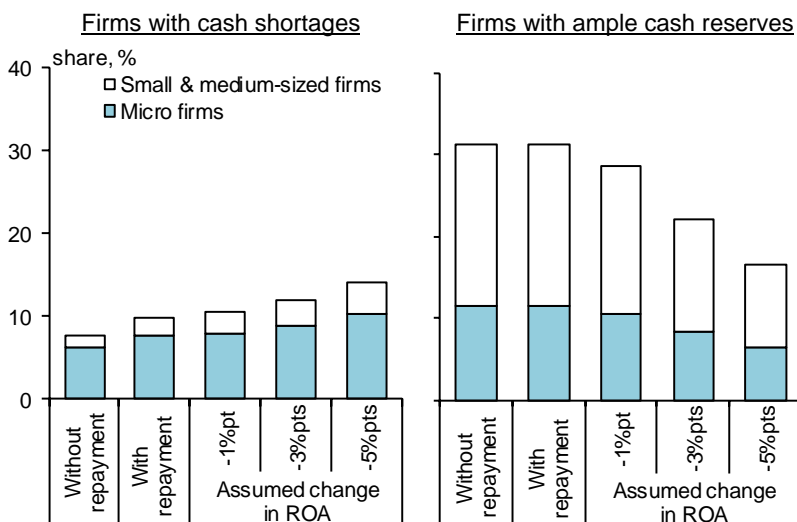
As principal and interest repayments on effectively interest-free loans begin in full, firms' debt servicing costs will increase. Estimating the impact of these repayments, even in the case where principal and interest repayments on such loans are made ("with repayment" in the chart), more than half of the firms have liquidity buffers equal to or greater than before the pandemic in fiscal 2019 (Chart I-9). It should be noted, however, that there are firms with cash shortages (left panel of Chart I-10). The default risk of these firms could be concentrated in banks that deal more with micro firms. On the other hand, there are firms that would be able to maintain a high liquidity buffer even after full repayment of their effectively interest-free loans (right panel of Chart I-10). If many firms prepay these loans, corporate loans and deposits will decline at the same time.

Chart I-9: Distribution of liquidity buffer



Note: Covers micro firms. See Chart IV-1-11.

Chart I-10: Tails of distribution of firms' cash reserves

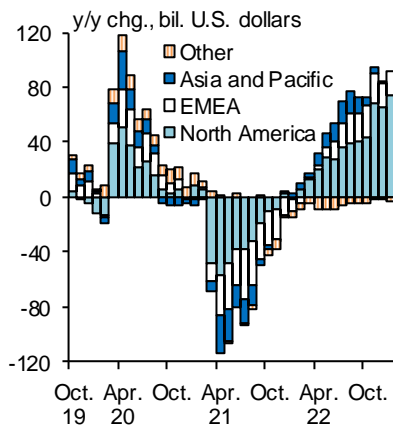


Note: See Chart IV-1-12.

Changes in the risk profiles of foreign loans → Chapters III-A and IV-B

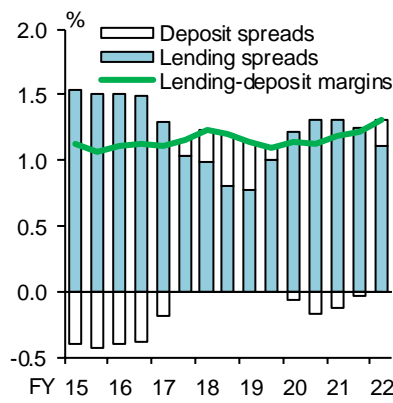
Foreign credit risk has remained low even amid the global tightening of financial conditions. However, there have been some changes in the risk profiles of foreign loans. First, banks have changed the composition of loans to reduce risks. By region, while major banks have been active in meeting demand for funds, particularly from the United States and Europe, they have been reluctant to extend loans to the Asia-Pacific region, where there are concerns over the Chinese real estate market (Chart I-11). Second, lending-deposit interest margins have improved somewhat together with the rise in market interest rates (Chart I-12). The improvement in lending-deposit interest margins has also led to an improvement in major banks' loss-absorbing capacity. Third, some foreign loans have become larger and more concentrated. The trend toward larger loans has been driven by the fact that major banks have been actively responding to the loan demand of their borrowers (Chart I-13). Moreover, there has been an increase in the number of borrowers overlapping among major banks with regard to loans to the Europe, Middle East, and Africa (EMEA) and Asia-Pacific (APAC) regions (Chart I-14). The foreign loan portfolios of major banks are more likely to be interconnected in response to a shock.

Chart I-11: Foreign loans outstanding by region



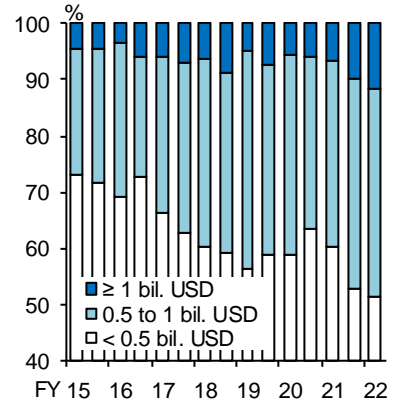
Note: See Chart III-1-14.

Chart I-12: Foreign lending-deposit interest margins



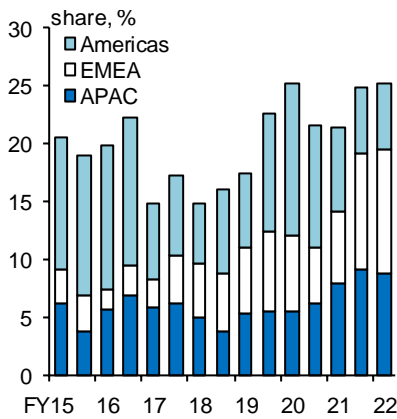
Note: See Chart IV-2-3.

Chart I-13: Composition of large borrowers



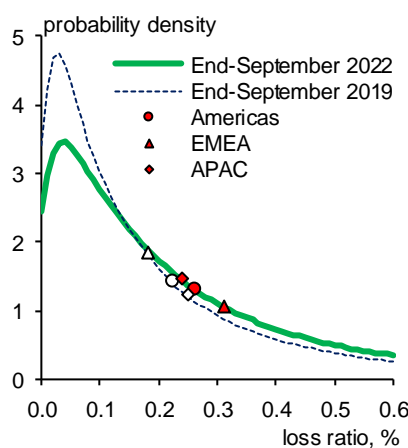
Note: See Chart IV-2-5.

Chart I-14: Shares of overlapping large borrowers



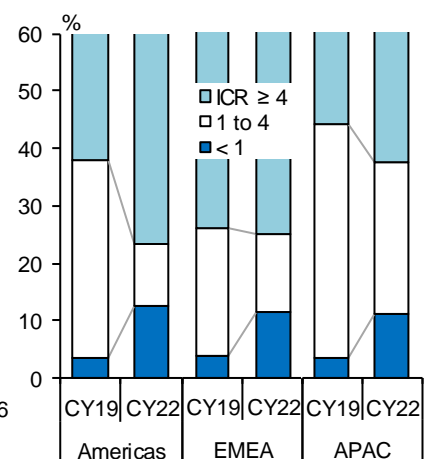
Note: The shares of outstanding loans to large borrowers that overlap for all three major banks. See Chart IV-2-6.

Chart I-15: Expected losses of large loans



Note: See Chart IV-2-11.

Chart I-16: ICR composition of large borrowers



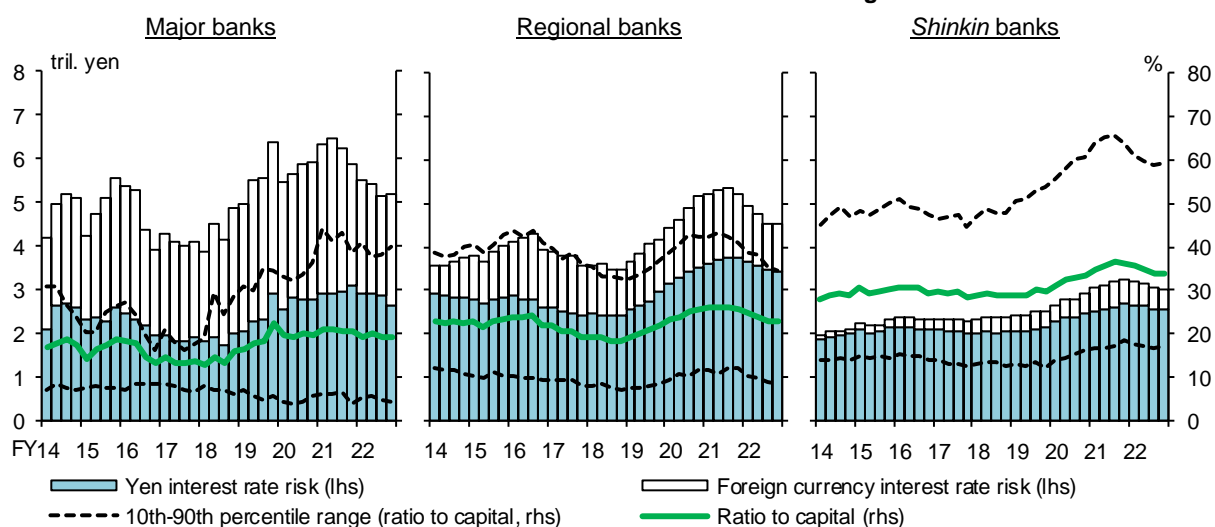
Note: See Chart IV-2-12.

The credit risk associated with large foreign loans has increased somewhat, partly due to the growing trend toward larger loans (Chart I-15). As a whole, strong sales of firms have prevented a deterioration in their interest coverage ratios (ICRs) even as funding costs have risen. However, the percentage of firms with an ICR of less than one -- i.e., firms that cannot cover their interest payments with their profits from core business alone -- has been rising (Chart I-16). If there is a substantial slowdown in foreign economies going forward, putting downward pressure on firms' profits, a deterioration in ICRs is inevitable. In such a case, the probability of default (PD) would be likely to rise since large borrowers of major banks tend to have relatively high financial leverage.

Banks' resilience to foreign interest rate rises → Chapters II-A, IV-C, and V

Amid concerns over rising interest rates, foreign currency interest rate risk associated with banks' securities investment has been on a clear declining trend not only for major banks but also for regional and *shinkin* banks (Chart I-17). Yen interest rate risk, which had been on an uptrend, has also started to decline. The results of the macro stress testing, which assumes that the yield curve in foreign markets remains substantially inverted, also indicate that changes in banks' balance sheets have contributed to improvements in their resilience against the risk of rising interest rates.

Chart I-17: Interest rate risk of securities holdings

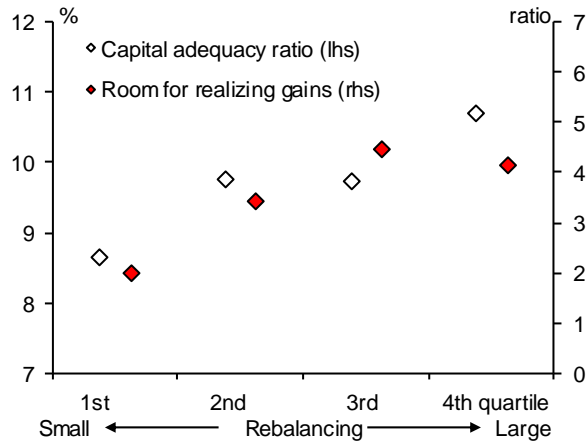


Note: "Yen interest rate risk" is a 100 BPV. "Foreign currency interest rate risk" is a 200 BPV. Off-balance-sheet transactions are included for foreign currency interest rate risk. See Chart IV-3-2.

However, heterogeneity is large in terms of the amount of foreign currency interest rate risk and the underlying rebalancing behavior of individual banks. Banks that rebalanced significantly were those that had high loss-absorbing capacity to start with (Chart I-18). In addition, changes in risk profiles vary depending on the extent to which banks rebalanced (Chart I-19). Banks that rebalanced significantly (those in the third and fourth quartiles in the chart) have improved their yields on securities and contained the risk of negative interest margins. This is due to the realization of losses on selling some of their foreign currency interest rate risk positions. Among these banks, some that also realized gains in conjunction with sales to book losses saw a reduction in their valuation gains (i.e., room for realizing gains), while others that did not restore positions that they had reduced (e.g., banks in the fourth quartile) have lost profit opportunities; however, both groups of banks have lowered the risk of valuation losses as a result. Meanwhile, at some banks that maintained their positions (those in the first and second quartiles in the chart), the risk associated with rising interest rates has materialized in the form of negative interest margins and valuation

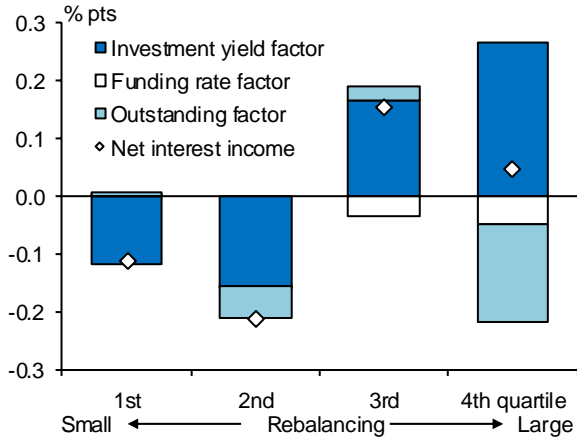
losses. It should be noted that the increase in valuation losses, like realized losses, can affect banks' financial conditions through declines in allocated capital to market divisions and the income distributable to shareholders.

Chart I-18: Distribution of loss-absorbing capacity



Note: The chart shows the medians of capital adequacy ratios and room for realizing gains for each quartile of the degree of rebalancing. See Chart IV-3-4.

Chart I-19: Changes in net interest income related to securities portfolios



Note: The chart shows, for each quartile of the degree of rebalancing, the medians of changes in net interest income in 2022 as ratios to capital, and their decomposed factors. See Chart IV-3-7.

The Bank of Japan will promote financial institutions' initiatives to address these potential vulnerabilities through on-site examinations and off-site monitoring. It will continue to closely monitor the impact of various risk-taking moves by financial institutions on the financial system from a macroprudential perspective.²

² See "On-Site Examination Policy for Fiscal 2023" (March 2023) for details on the basic approach in conducting on-site examinations in fiscal 2023.

II. Risks observed in financial and capital markets

- In global financial markets, prices of risky assets rose over the second half of fiscal 2022.³ Market sentiment has shown some improvement, as concerns over the issue of energy supply in Europe diminished and the U.S. inflation rate decelerated. However, global financial markets have remained nervous. Market attention has continued to be paid to uncertainties about monetary tightening by central banks in the United States and Europe and to a slowdown in the global economy. Moreover, uncertainty has arisen about the financial sector in the United States and Europe, triggered by the U.S. bank failures in March 2023.
- Japanese financial markets have been generally calm. Japanese long-term interest rates have been at around 0 percent under Quantitative and Qualitative Monetary Easing (QQE) with Yield Curve Control, although they temporarily increased within the range of the target level after the expansion of that range was decided at the Monetary Policy Meeting (MPM) held in December 2022. Meanwhile, the liquidity and functioning of Japanese government bond (JGB) markets have remained low as a whole amid high volatilities of interest rates at home and abroad, although some indicators have shown signs of improvement since mid-January 2023. Japanese stock prices have risen, generally in tandem with those in the United States. In the corporate bond market, the widening of yield spreads in both the primary and secondary markets has come to a halt; however, developments such as the shortening of maturity of newly-issued bonds have been observed.
- Uncertainty about financial markets remains high. There remain concerns in global financial markets over whether it is possible to contain inflation and maintain economic growth simultaneously. Moreover, market attention has been paid to uncertainty about the financial sector in the United States and Europe. In this situation, attention should continue to be paid to the possibility that global financial conditions will tighten further through channels such as repricing of assets and outflows of funds from emerging market economies.

A. Global financial markets

In global financial markets, prices of risky assets rose over the second half of fiscal 2022. Market sentiment has shown some improvement, as concerns over the issue of energy supply in Europe diminished and the U.S. inflation rate decelerated. However, global financial markets have remained nervous. Market attention has continued to be paid to uncertainties about monetary tightening by central banks in the United States and Europe and to a slowdown in the global economy. Moreover, uncertainty has arisen about the financial sector in the United States and Europe, triggered by the U.S. bank failures in March 2023.

U.S. and European bond markets

U.S. and European long-term interest rates have remained volatile. Over the second half of fiscal 2022, long-term interest rates in the United States declined, mainly in response to a deceleration in the U.S. inflation rate, while those in Europe rose as market attention was paid to prolonged monetary tightening (Chart II-1-1). Federal funds futures curves have risen over the near term but declined over the longer term (Chart II-1-2). Under these circumstances, the yield curve for U.S.

³ In Japan, the fiscal year starts in April and ends in March of the following year.

Chart II-1-1: Global financial markets

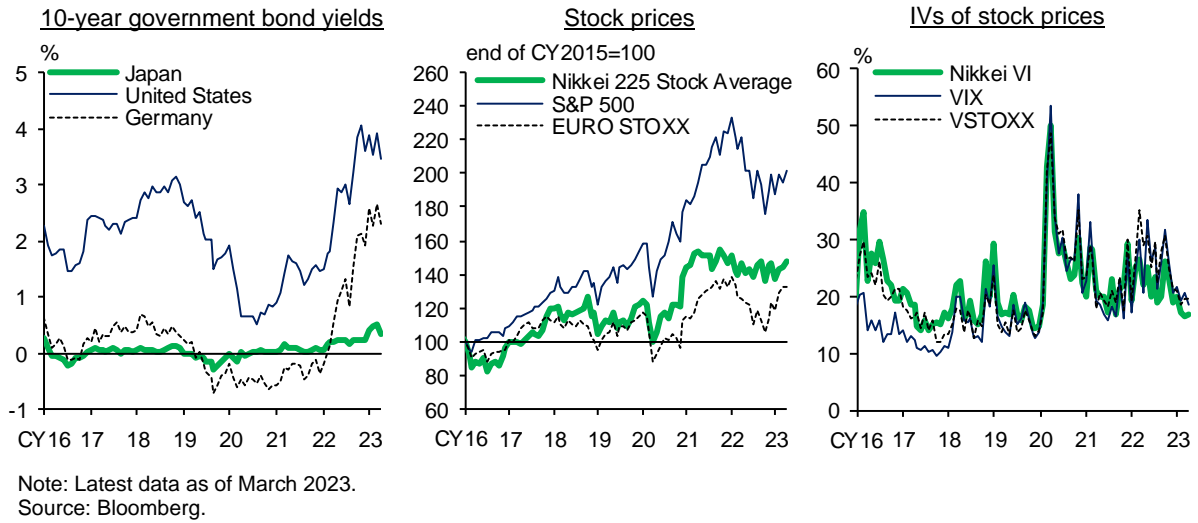


Chart II-1-2: Federal funds futures curves

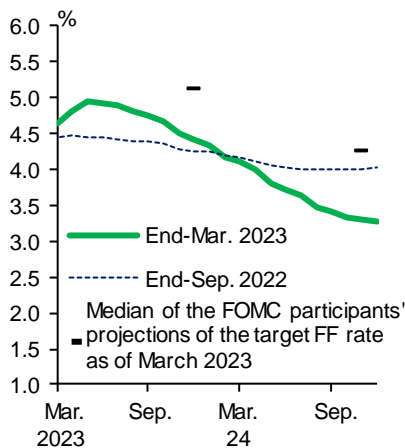


Chart II-1-3: U.S. Treasury yield curves

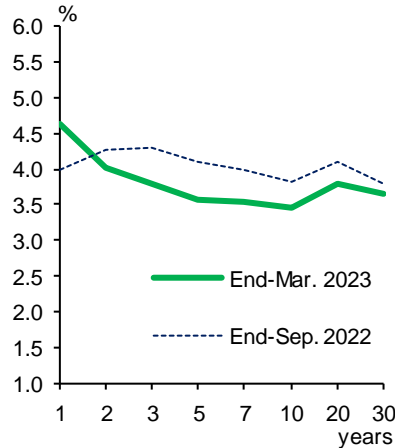


Chart II-1-4: IVs of government bond futures

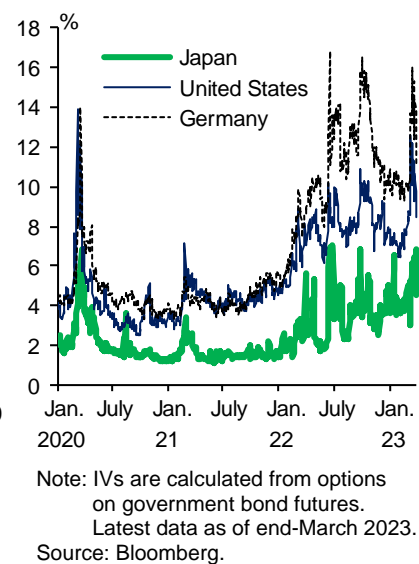
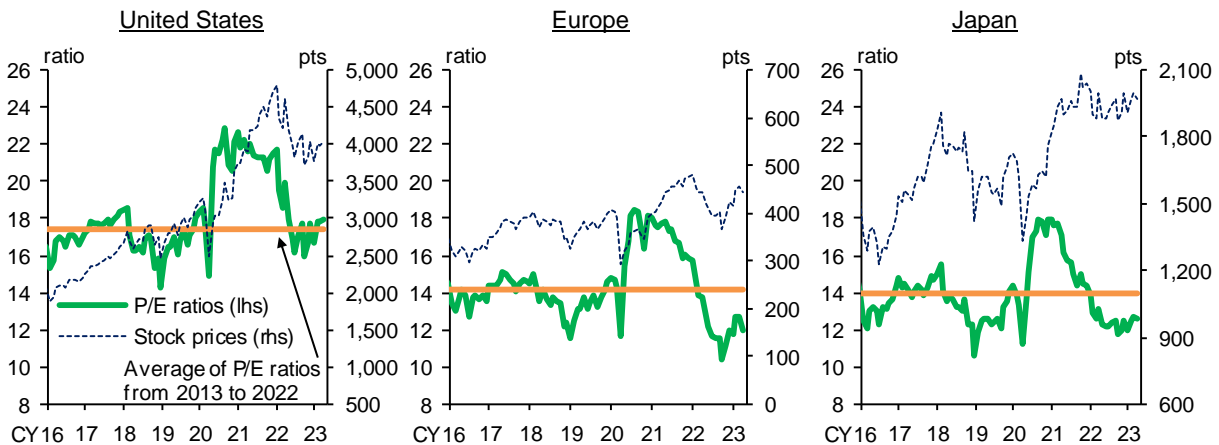


Chart II-1-5: Stock prices and valuation

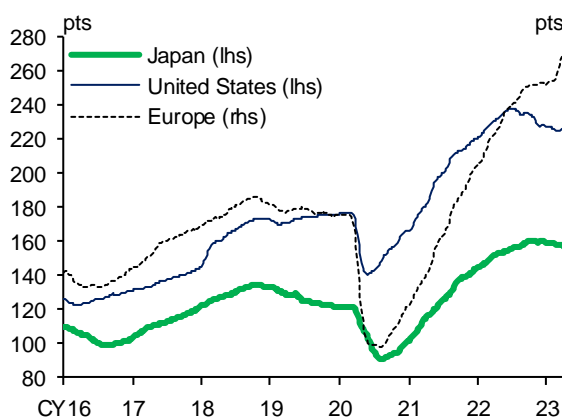


Treasuries has remained inverted (Chart II-1-3). Meanwhile, implied volatilities (IVs) of government bond futures have stayed high in both the United States and Germany (Chart II-1-4). Specifically, they spiked temporarily in March 2023 as the U.S. bank failures raised uncertainty about the financial sector in the United States and Europe.

U.S. and European stock markets

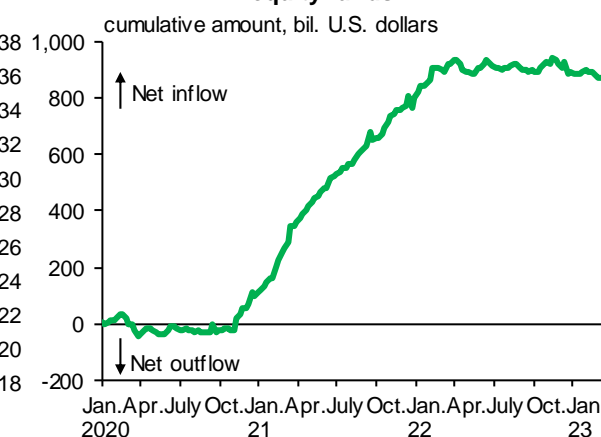
U.S. and European stock prices rose and IVs of stock prices decreased over the second half of fiscal 2022, as concerns over the issue of energy supply in Europe diminished and the U.S. inflation rate decelerated (Charts II-1-1 and II-1-5). That said, expected earnings per share (EPS) for U.S. firms turned to a decline and the increase in those for European firms slowed temporarily, mainly reflecting concerns over an economic slowdown due to the past policy rate hikes (Chart II-1-6). Meanwhile, net inflows of equity funds have remained at a halt (Chart II-1-7).

Chart II-1-6: Expected EPS



Note: The data for 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. Latest data as of end-March 2023.
Source: Refinitiv Datastream.

Chart II-1-7: Net flows of U.S. and European equity funds



Note: The vertical axis indicates the cumulative amount from the beginning of 2020. Latest data as of March 29, 2023 (weekly data).
Source: EPFR; Haver Analytics.

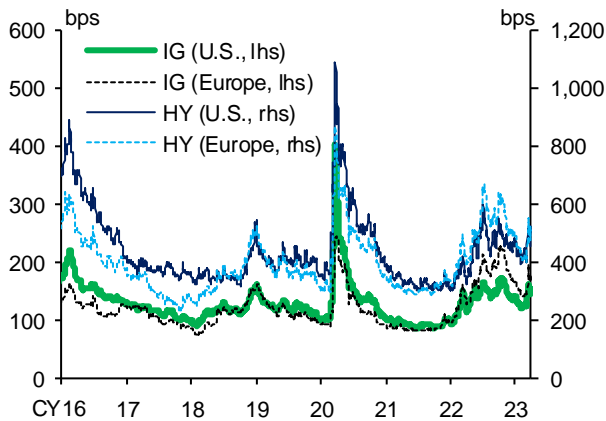
U.S. and European credit markets

In U.S. and European credit markets, credit spreads on both investment-grade bonds and high-yield bonds narrowed over the second half of fiscal 2022, mainly in response to the increase in stock prices (Chart II-1-8). However, in response to heightened uncertainty about the financial sector in the United States and Europe, triggered by the U.S. bank failures in March 2023, credit spreads widened temporarily again. Meanwhile, there has been a slight pause in the decline in leveraged loan prices (Chart II-1-9).

Emerging markets and commodity markets

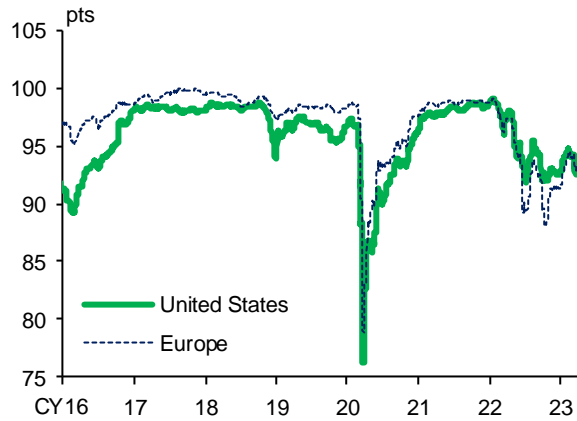
In emerging markets, both stock prices and currencies rose and credit spreads of government bonds narrowed over the second half of fiscal 2022, mainly reflecting market expectations for the stimulus effects of China's policy shift from the strict preventive measures against COVID-19 (Charts II-1-10 and II-1-11). Meanwhile, equity funds have registered net inflows to emerging markets. On the other hand, bond funds have registered net outflows with fluctuations smoothed out, although they temporarily saw net inflows (Chart II-1-12).

Chart II-1-8: Credit spreads on corporate bonds



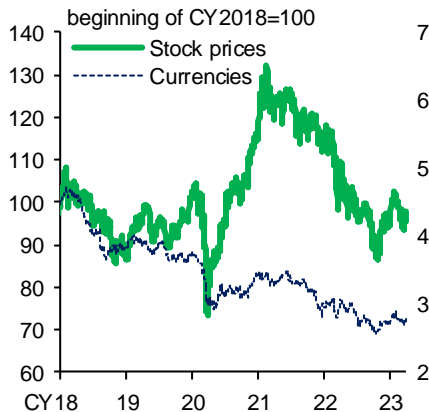
Note: "IG" and "HY" indicate investment-grade bonds and high-yield bonds, respectively. Latest data as of end-March 2023.
Source: ICE Data Indices.

Chart II-1-9: Leveraged loan prices



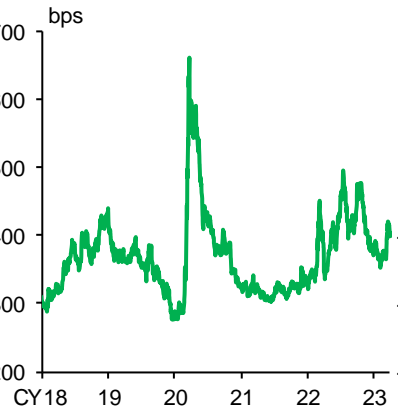
Note: The figures indicate the index of leveraged loan prices in the secondary markets. Latest data as of March 30, 2023.
Source: LCD, an offering of PitchBook Data.

Chart II-1-10: Stock prices and currencies in emerging markets



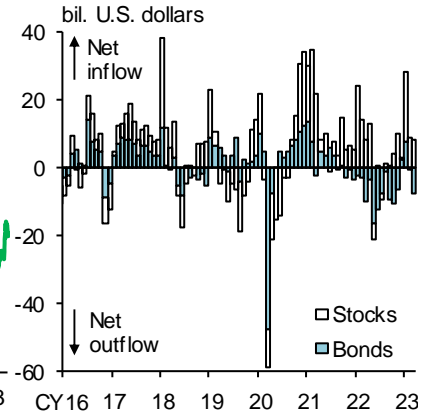
Note: "Stock prices" indicates the MSCI EM Local Index. "Currencies" indicates the J.P. Morgan EMCI Index. Latest data as of end-March 2023.
Source: Bloomberg.

Chart II-1-11: Credit spreads in emerging markets



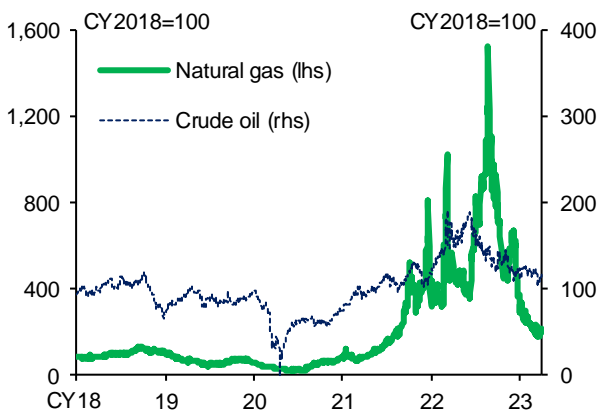
Note: Yield spreads of the EMBI Global over U.S. Treasuries. Latest data as of end-March 2023.
Source: Bloomberg.

Chart II-1-12: Net flows of emerging market funds



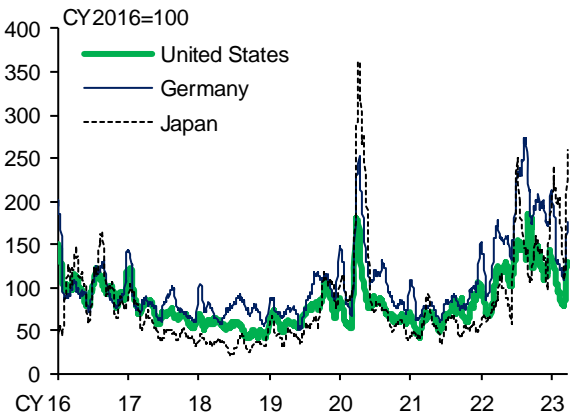
Note: Latest data as of March 2023.
Source: EPFR; Haver Analytics.

Chart II-1-13: Commodity prices



Note: "Natural gas" and "Crude oil" indicate Dutch TTF futures and WTI crude oil futures, respectively. Latest data as of end-March 2023.
Source: Bloomberg.

Chart II-1-14: Daily price range to transaction volume ratio of government bond futures



Note: 1. Calculated as difference between the highest and lowest prices divided by transaction volume. 20-day backward moving averages.
2. Latest data as of end-March 2023.
Source: Bloomberg; Osaka Exchange; QUICK.

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

In commodity markets, prices of natural gas have declined significantly, as concerns over the issue of energy supply in Europe diminished, and prices of crude oil have also fallen somewhat (Chart II-1-13).

Fluctuations in interest rates and repricing of risky assets

As mentioned, in global financial markets, prices of risky assets have risen since autumn 2022, as market sentiment has shown some improvement. However, there is still high uncertainty over the outlook for foreign economic activity and prices. U.S. and European interest rates have remained susceptible to developments in economic and price indicators. Moreover, uncertainty about the financial sector in the United States and Europe has increased, triggered by the U.S. bank failures in March 2023. In fact, IVs, which represent the expected future volatility of interest rates, have stayed high (Chart II-1-4).

Given these circumstances, there is a possibility that the risk of interest rate rises could materialize and prices of risky assets, which have risen since autumn 2022, could fall again, depending on future developments in economic and price indicators. The liquidity of bond markets has shown some improvement globally since autumn 2022, but some liquidity indicators temporarily deteriorated again in March 2023 (Chart II-1-14). In this situation, it warrants attention that price changes induced by trading and the resultant trading costs tend to increase substantially. The impact of such repricing risk on Japanese financial institutions is examined in Sections C and D of Chapter IV.

B. Japanese financial markets

Japanese financial markets have been generally calm while continuing to be strongly affected by high volatilities in foreign bond markets. Japanese long-term interest rates have been at around 0 percent under QQE with Yield Curve Control, although they temporarily increased within the range of the target level after the expansion of that range was decided at the December 2022 MPM. Meanwhile, the liquidity and functioning of JGB markets have remained low as a whole amid high volatilities of interest rates at home and abroad, although some indicators have shown signs of improvement since mid-January 2023. Japanese stock prices have risen, generally in tandem with those in the United States. In the corporate bond market, the widening of yield spreads in both the primary and secondary markets has come to a halt; however, developments such as the shortening of maturity of newly-issued bonds have been observed.

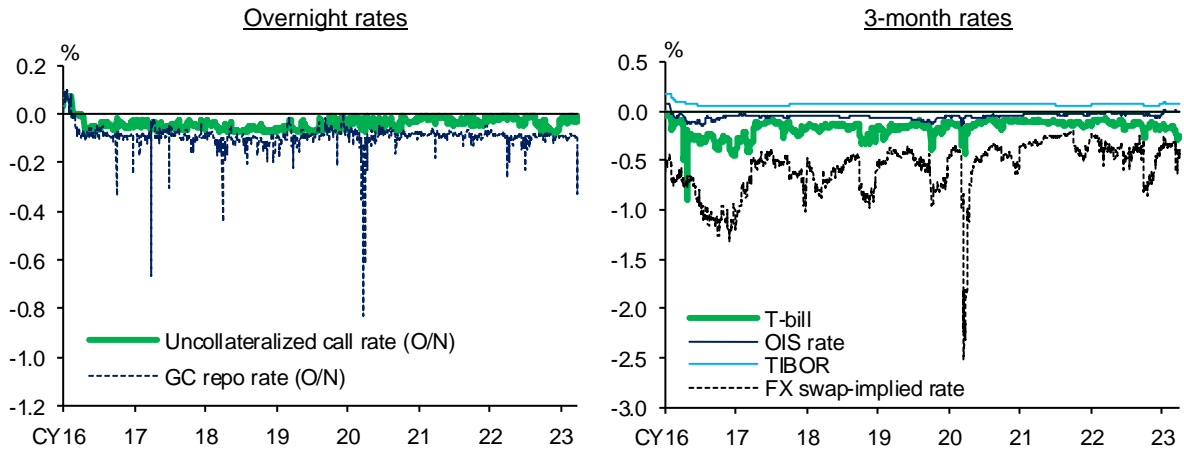
Short- and long-term interest rates

The short-term yields of both overnight and term instruments have generally been in negative territory (Chart II-2-1). The 10-year JGB yields have been around 0 percent under the Bank's nimble conduct of JGB purchases and other market operations, although they temporarily increased within the range of the target level after the expansion of that range was decided at the December 2022 MPM (Chart II-2-2).⁴ Meanwhile, the yield curve for JGBs was more or less unchanged over the second half of fiscal 2022 (Chart II-2-3). IV of JGB futures has been high, albeit with fluctuations,

⁴ At the December 2022 MPM, the Bank decided to modify the conduct of yield curve control. As part of the decision, while significantly increasing the amount of JGB purchases, it expanded the range of 10-year JGB yield fluctuations from the target level: from between around plus and minus 0.25 percentage points to between around plus and minus 0.5 percentage points.

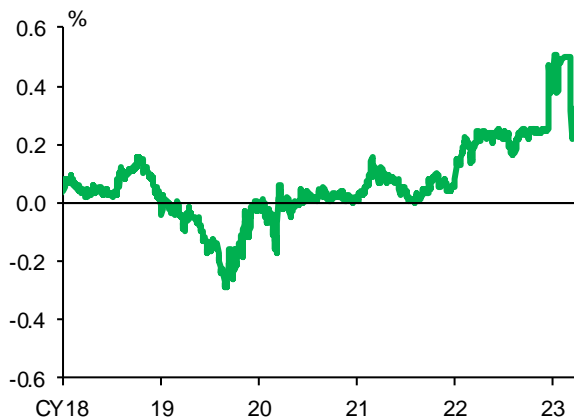
while affected mainly by developments in U.S. interest rates and speculation over the modification of the Bank's monetary policy (Chart II-1-4).

Chart II-2-1: Short-term rates



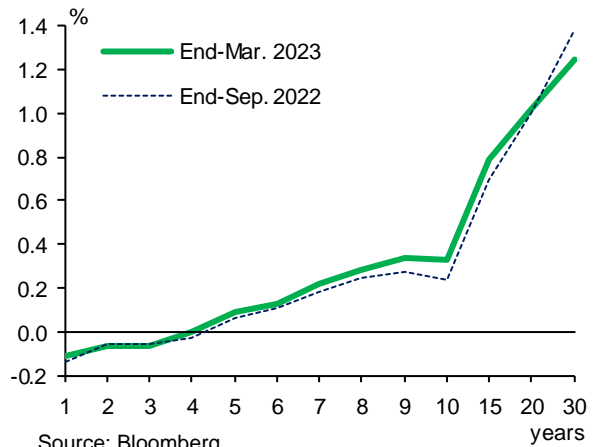
Note: 1. In the left-hand chart, the horizontal axis indicates the starting date of transaction settlement. Up to April 27, 2018, "GC repo rate (O/N)" indicates the T/N rate.
 2. In the right-hand chart, "FX swap-implied rate" is estimated based on the U.S. dollar funding rate (the OIS rate before January 3, 2019, and the SOFR thereafter) and FX swaps (forward spread).
 3. In both charts, the latest data are as of end-March 2023.
 Source: Bloomberg; Japan Bond Trading; JSDA; BOJ.

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



Note: Latest data as of end-March 2023.
 Source: Bloomberg.

Chart II-2-3: JGB yield curves



Source: Bloomberg.

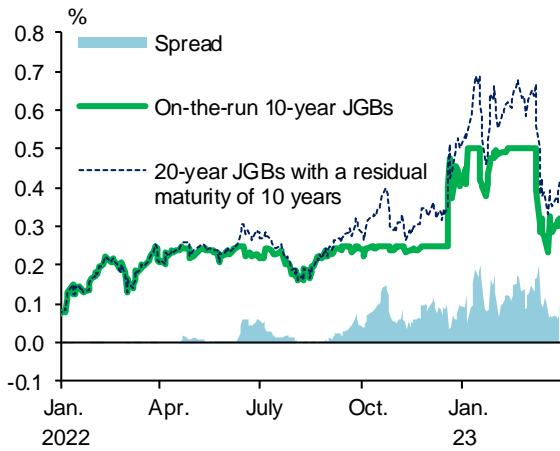
Liquidity and functioning of JGB markets

The liquidity and functioning of JGB markets have remained low as a whole amid high volatilities of interest rates at home and abroad, although some indicators have shown signs of improvement since mid-January 2023.⁵ The functioning of bond markets has stayed low, particularly in terms of relative relationships among interest rates of bonds with different maturities (Charts II-2-3 and II-2-4). In addition, inter-dealer transaction volume for cash JGBs has been low with fluctuations

⁵ For details, see "Liquidity Indicators in the JGB Markets" on the Bank of Japan's website. The Financial Markets Department of the Bank generally updates and releases liquidity indicators of the JGB markets on a quarterly basis.

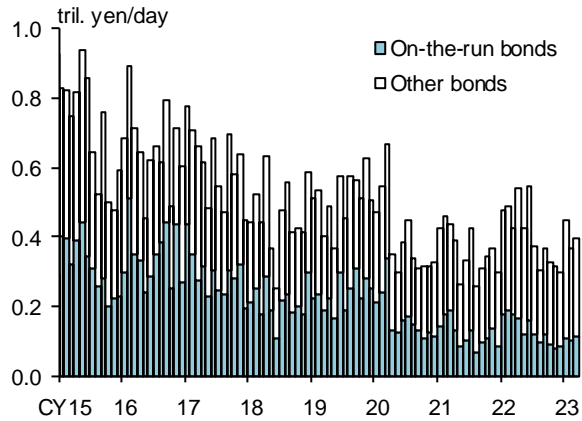
II. Risks observed in financial and capital markets
 B. Japanese financial markets

Chart II-2-4: Yield spread between on-the-run 10-year JGBs and 20-year JGBs



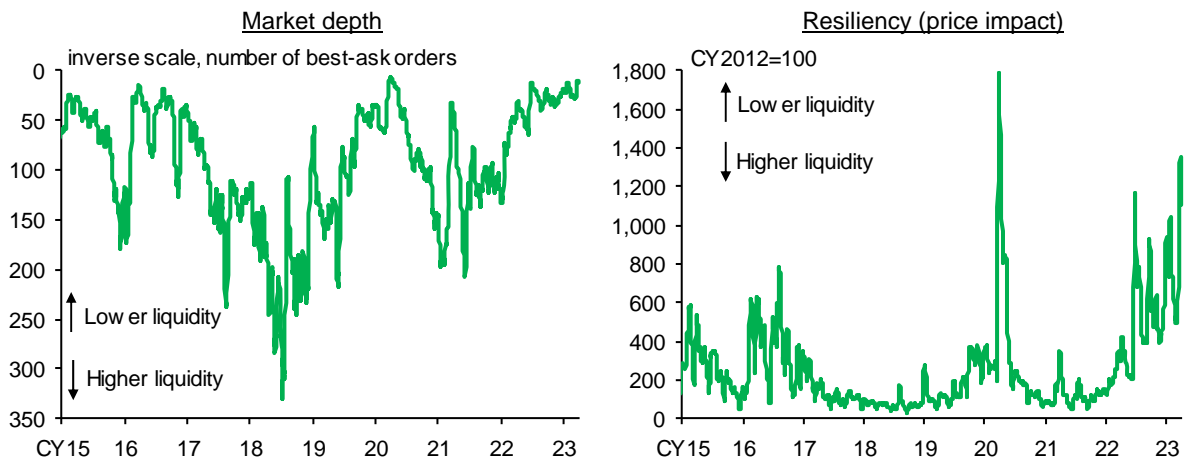
Note: Based on the trading reference statistics of the JSDA. Compound yield. Latest data as of end-March 2023.
 Source: QUICK.

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



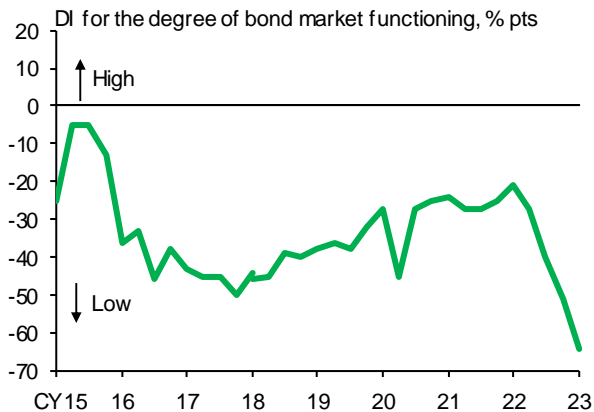
Note: Inter-dealer transaction volume for cash JGBs (2-, 5-, 10-, 20-, 30-, and 40-year JGBs) via Japan Bond Trading. Latest data as of March 2023.
 Source: Japan Bond Trading; QUICK.

Chart II-2-6: 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 of end-March 2023.
 Source: Nikkei Inc., "NIKKEI NEEDS."

Chart II-2-7: 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 February 2023 survey.
 Source: BOJ.

smoothed out, although it has somewhat increased since the start of 2023 (Chart II-2-5). Liquidity indicators in the JGB futures market, such as market depth, resiliency, and the daily price range to transaction volume ratio, deteriorated when volatility of interest rates increased after the December 2022 MPM (Charts II-1-14 and II-2-6). However, some of the indicators have started to show signs of improvement since the January 2023 MPM. Meanwhile, according to the latest *Bond Market Survey* conducted in February 2023, the diffusion index for the degree of bond market functioning from the surveyed institutions' viewpoint has deteriorated from the previous round of the survey conducted in November 2022 and has stayed in deep negative territory (Chart II-2-7). Since these indicators tend to be volatile and are affected by developments in foreign bond markets, it is not straightforward to assess them in the short term. Close attention should continue to be paid to the effects that such events as the modification of the conduct of yield curve control have had on market functioning.

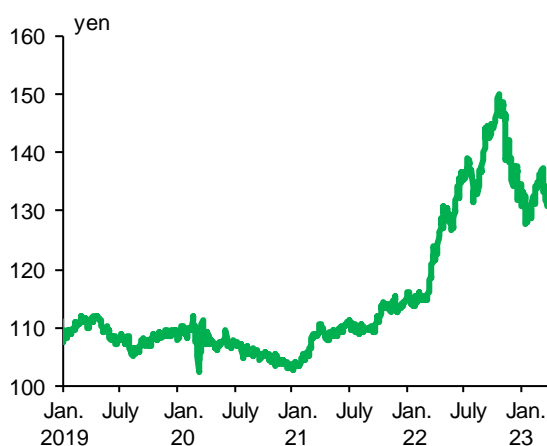
FX, stock, and credit markets

In FX markets, the yen appreciated against the U.S. dollar over the second half of fiscal 2022, mainly on the back of a narrowing of the yield differential between Japan and the United States (Chart II-2-8).

In capital markets, Japanese stock prices have risen, generally in tandem with those in the United States (Chart II-1-1). Meanwhile, the expected EPS for Japanese firms has declined somewhat (Chart II-1-6).

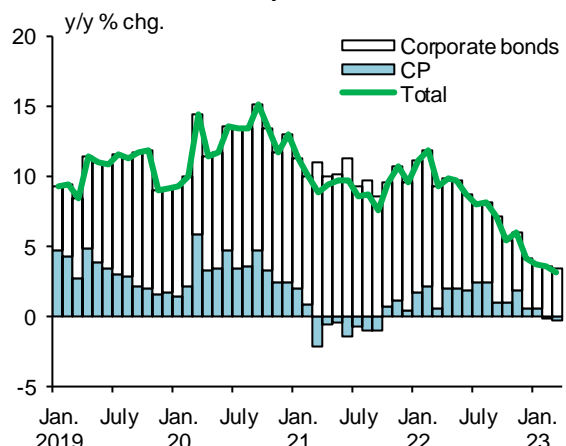
The outstanding amounts of corporate bonds and CP have stayed high, as demand for working capital has increased, mainly reflecting rises in energy and raw material input costs (Chart II-2-9). In this situation, issuance rates for CP have been extremely low (Chart II-2-10). In the corporate bond market, the widening of yield spreads in both the primary and secondary markets has come to a halt; however, developments such as the shortening of maturity of newly-issued bonds have been observed (Chart II-2-11).

Chart II-2-8: U.S. dollar/yen rates



Note: Latest data as of end-March 2023.
Source: Bloomberg.

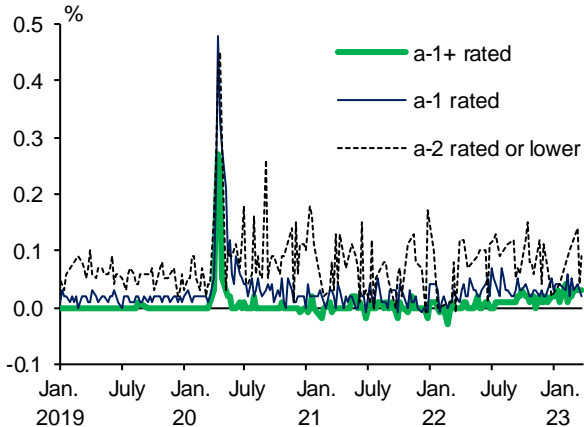
Chart II-2-9: Outstanding amounts of corporate bonds and CP



Note: "Corporate bonds" and "CP" exclude those issued by financial institutions. Latest data as of end-March 2023.
Source: I-N Information Systems; JASDEC.

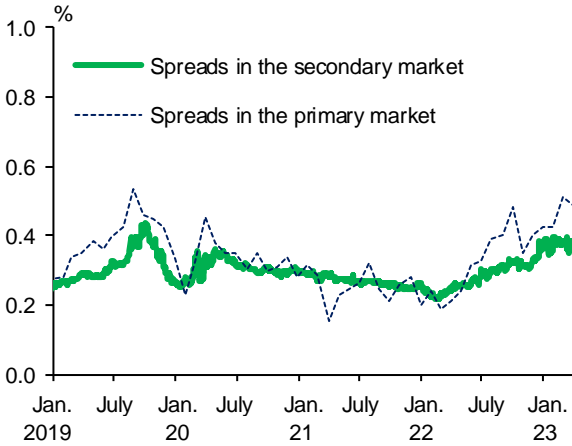
II. Risks observed in financial and capital markets
 B. Japanese financial markets

Chart II-2-10: CP issuance rates



Note: Average rates of issuance for CP issued by business companies with remaining maturity of 3 months. In principle, rated by R&I. Latest data as of March 31, 2023 (weekly data).
 Source: JASDEC.

Chart II-2-11: Credit spreads on corporate bonds (AA-rated)



Note: 1. "Spreads in the secondary market" (daily data) indicates yield spreads of corporate bonds with remaining maturity of 3 or more years but less than 7 years over government bonds. Latest data as of end-March 2023.
 2. "Spreads in the primary market" (monthly data) indicates yield spreads of newly-issued corporate bonds with maturity of less than 15 years over government bonds. Bonds issued by banks and securities companies, etc. are excluded. Latest data as of March 2023.
 Source: Bloomberg; Capital Eye; I-N Information Systems; JSDA; QUICK.

III. Financial intermediation

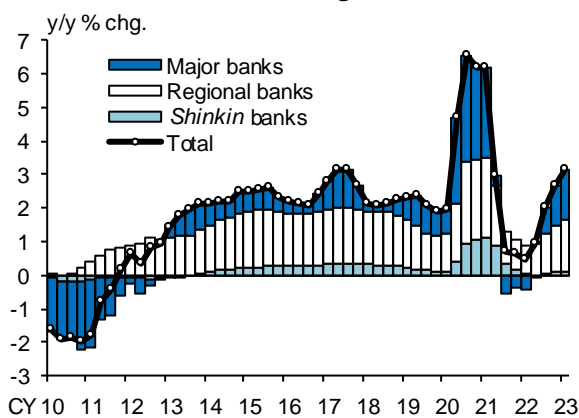
- Financial intermediation has continued its smooth functioning in Japan. As for domestic loans, banks have met the demand for real estate-related loans as well as that for working capital that has been driven by higher energy and raw material input costs and the pick-up in economic activity. Regarding foreign loans, major banks have actively met loan demand, particularly from North America. Meanwhile, banks have rebalanced their securities portfolios, mainly reflecting the rise in foreign interest rates.
- Assets under management held by non-bank financial intermediaries (NBFIs) have remained on an uptrend. Among the NBFIs, insurance companies, pension funds, and securities investment trusts have managed assets with little reliance on external funding such as loans. There have also been short-term repo transactions on both the asset and liability sides by financial dealers and brokers, as well as repo funding by insurance companies.
- The financial gap, which captures the financial cycle, has been widening moderately against the background of a smooth functioning of financial intermediation. Although the current expansionary phase of the cycle has been prolonged, due mainly to the increase in private debt, no major financial imbalances can be observed in current financial activities. The increase in private debt reflects firms' cautious cash management aimed at securing ample cash reserves. However, the increase in private debt partly reflects borrowing by those with relatively low debt repayment capacity. Attention should continue to be paid to these developments in private debt.

A. Financial intermediation by the banking sector

1. Loans

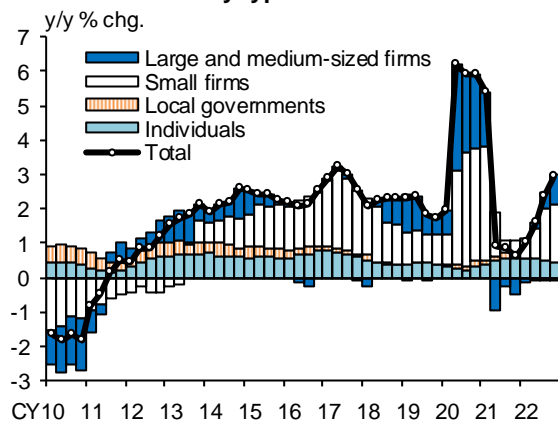
The annual growth rate in domestic loans by private banks has increased to around 3 percent

Chart III-1-1: Banks' domestic loans outstanding



Note: Latest data as of the January-March quarter of 2023.
Source: BOJ.

Chart III-1-2: Banks' loans outstanding by type of borrower



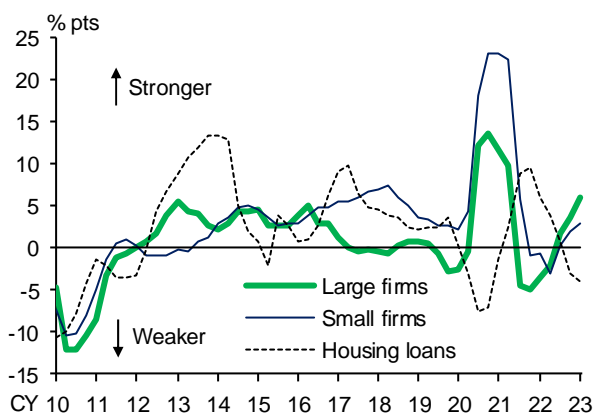
Note: Loans to banks and insurance companies are excluded. Latest data as of end-December 2022.
Source: BOJ.

III. Financial intermediation
A. Financial intermediation by the banking sector

recently (Chart III-1-1).^{6,7} Major and regional banks in particular have seen a rise in the demand for real estate-related loans and that for working capital that has been driven by higher energy and raw material input costs and the pick-up in economic activity. Meanwhile, demand for additional loans due to the pandemic has subsided on the whole.

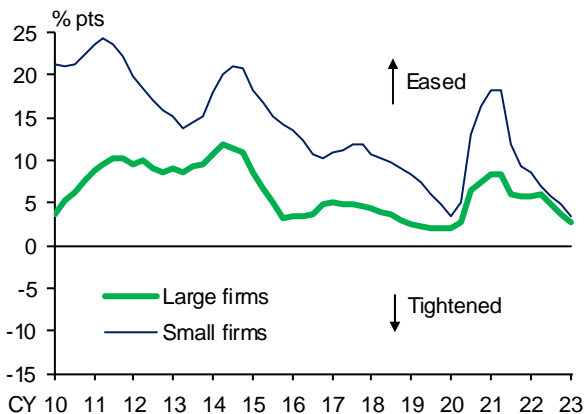
Loans to both large and medium-sized firms and small firms have grown at an increasing rate (Charts III-1-2 and III-1-3). Loans to individuals have grown but their growth rate has decelerated somewhat due to the decline in housing loan demand. Meanwhile, banks' lending stance continues to be active (Chart III-1-4).

Chart III-1-3: DI of demand for loans as perceived by banks



Note: 4-quarter backward moving averages. Latest data as of January 2023.
Source: BOJ.

Chart III-1-4: DI of credit standards

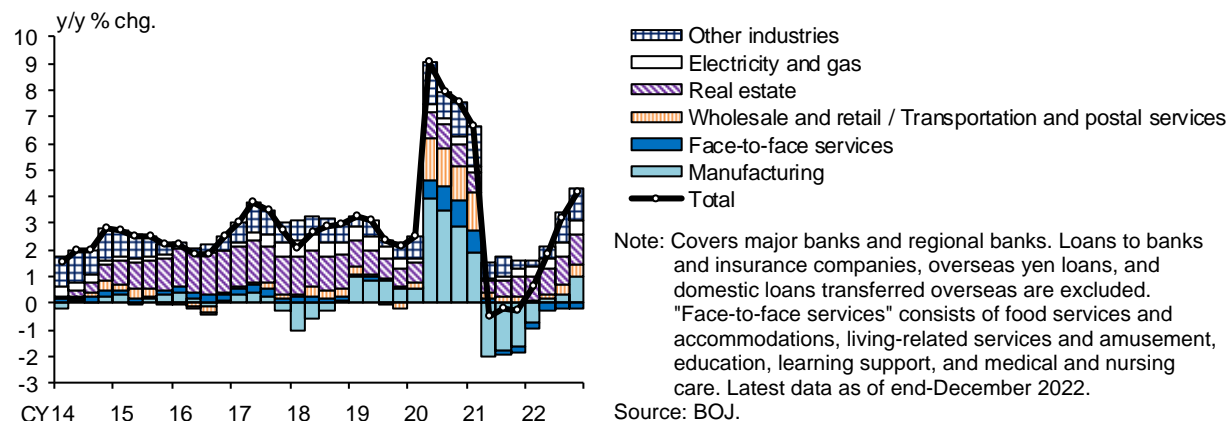


Note: 4-quarter backward moving averages. Latest data as of January 2023.
Source: BOJ.

Loans by type of borrower

Loans to real estate businesses have continued to grow at an increasing rate (Chart III-1-5). Loans to a wide range of industries, including manufacturing, electricity and gas, as well as wholesale and retail, have also seen an acceleration in growth, reflecting firms' demand for loans due to higher

Chart III-1-5: Corporate loans outstanding by industry



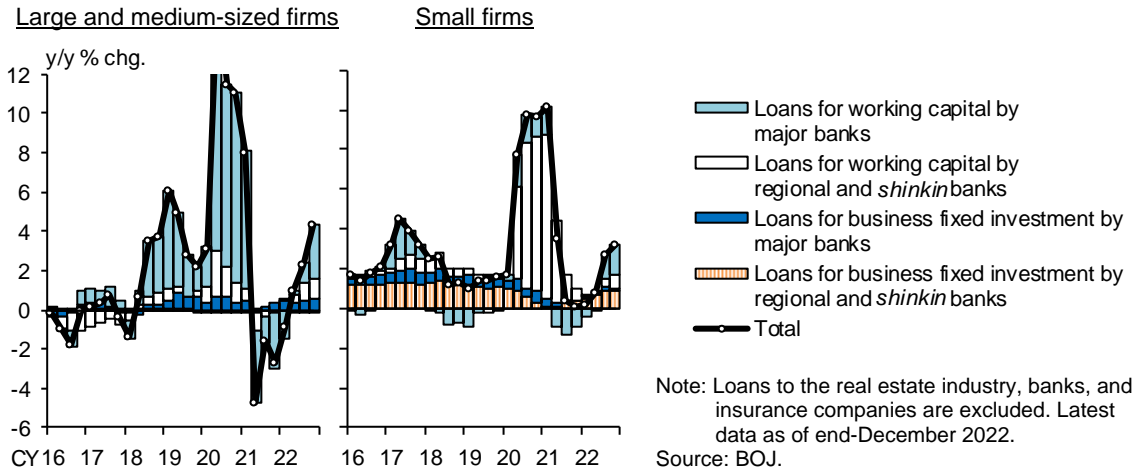
Note: Covers major banks and regional banks. Loans to banks and insurance companies, overseas yen loans, and domestic loans transferred overseas are excluded. "Face-to-face services" consists of food services and accommodations, living-related services and amusement, education, learning support, and medical and nursing care. Latest data as of end-December 2022.
Source: BOJ.

⁶ Corporate loans supported by public financing -- defined as the sum of loans by government-affiliated banks and loans by private banks guaranteed by credit guarantee corporations -- have been more or less flat since last year. While firms' demand for loans due to the pandemic has waned, there has been demand for loans due to higher energy and raw material input costs.

⁷ The annual increase in the yen-denominated value of foreign currency-denominated loans (foreign currency-denominated impact loans) is attributable to the effect of the depreciation of the yen.

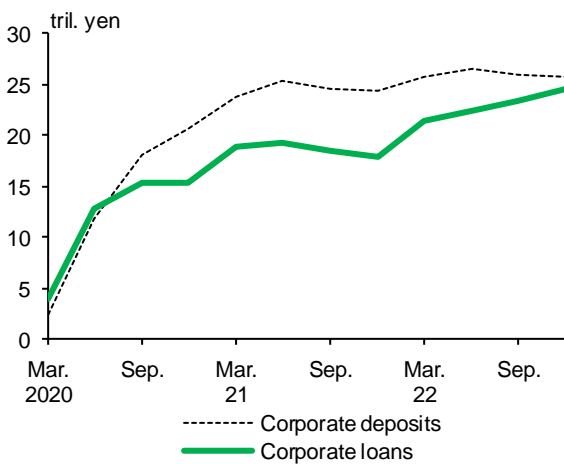
energy and raw material input costs and the pick-up in economic activity. For large and medium-sized firms and for small firms, loans for working capital have grown at an increasing rate (Chart III-1-6). Loans for business fixed investment have increased moderately.

Chart III-1-6: Corporate loans outstanding by type of loan



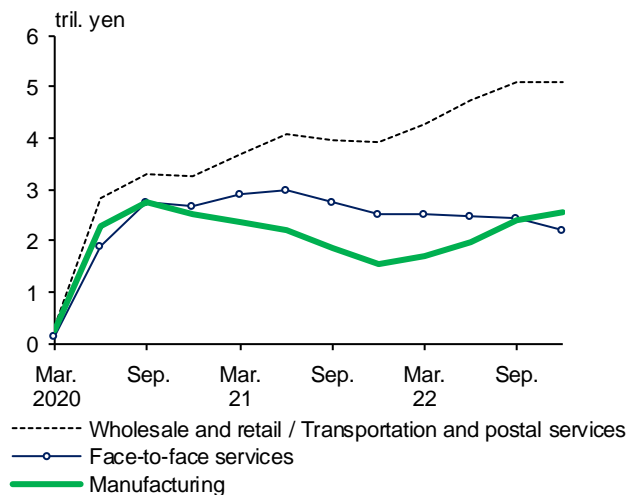
The uptrend in corporate loans by regional and *shinkin* banks, which serve many small firms, has become more pronounced (Charts III-1-7 and III-1-8). The increase in demand for working capital due to higher energy and raw material input costs and the pick-up in economic activity is also evident in loans to small firms. Meanwhile, many firms have secured ample cash reserves for some time to come, as indicated by the fact that corporate deposits have remained at high levels.

Chart III-1-7: Corporate loans by regional and *shinkin* banks



Note: The chart shows changes in the outstanding amount compared to 2019. Latest data as of end-December 2022.
Source: BOJ.

Chart III-1-8: Regional and *shinkin* banks' corporate loans by industry



Note: 1. The chart shows changes in the outstanding amount compared to 2019. Latest data as of end-December 2022.
2. "Face-to-face services" consists of food services and accommodations, living-related services and amusement, education, learning support, and medical and nursing care.
Source: BOJ.

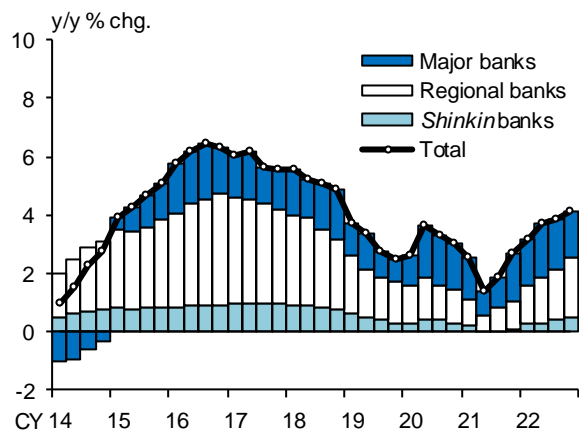
Real estate-related loans

Loans to real estate businesses have grown at an increasing rate, hitting a new record high of about 96 trillion yen as of the end of December 2022 (Chart III-1-9). Major banks have continued

III. Financial intermediation
A. Financial intermediation by the banking sector

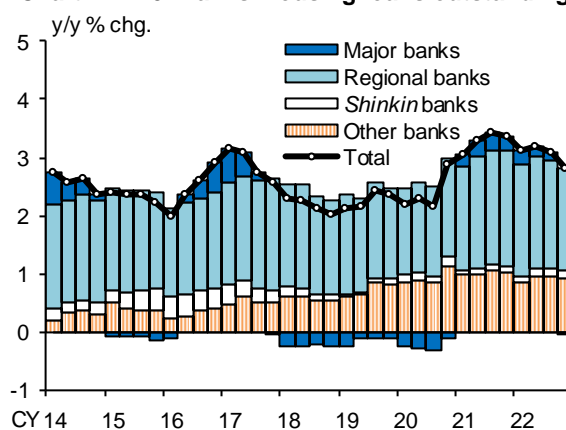
to increase lending to real estate businesses, particularly to real estate investment funds and real estate investment trusts (REITs), while managing credit exposures cautiously based on current real estate market conditions and past periods of market stress (see Box 2). Loans by regional banks to real estate leasing businesses have continued to increase.

Chart III-1-9: Banks' real estate loans outstanding



Note: Latest data as of end-December 2022.
Source: BOJ.

Chart III-1-10: Banks' housing loans outstanding



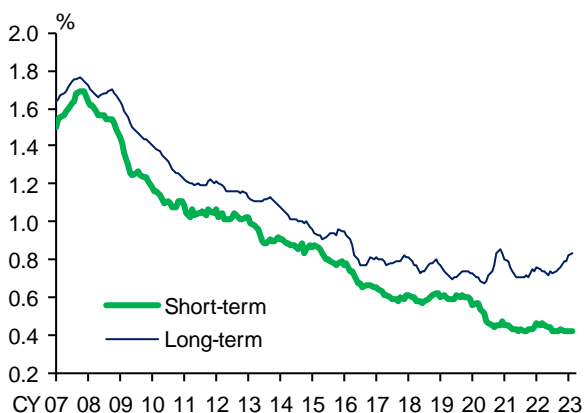
Note: "Other banks" covers domestically licensed banks but excludes major banks and regional banks.
Latest data as of end-December 2022.
Source: BOJ.

Housing loans, which account for a large share of loans to individuals, have continued to grow at around 3 percent (Chart III-1-10). However, the growth rate has decelerated somewhat due to the decline in loan demand, which partly reflects the rise in property prices.

Loan interest rates

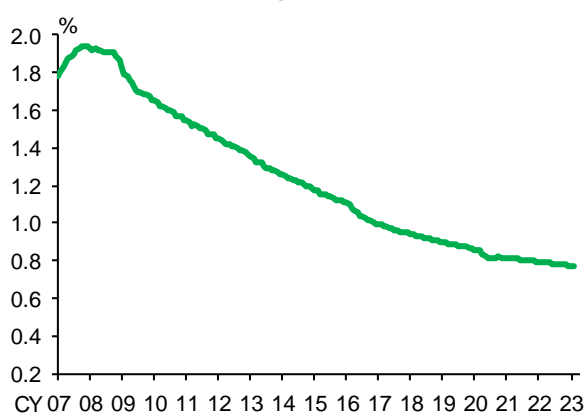
With regard to banks' average contract interest rates on new loans and discounts, short-term lending rates have been hovering around record low levels (Chart III-1-11). Long-term lending rates have increased somewhat, mainly reflecting a rise in fixed interest rates for corporate loans. Meanwhile, the average interest rate on loans outstanding has been more or less flat (Chart III-1-12).

Chart III-1-11: Average contract interest rates on new loans and discounts



Note: Covers domestically licensed banks. 6-month backward moving averages. Latest data as of February 2023.
Source: BOJ.

Chart III-1-12: Average contract interest rates on outstanding loans and bills discounted

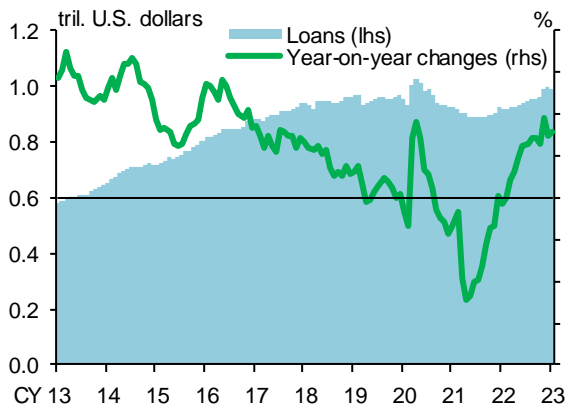


Note: Covers domestically licensed banks. Latest data as of February 2023.
Source: BOJ.

Foreign loans

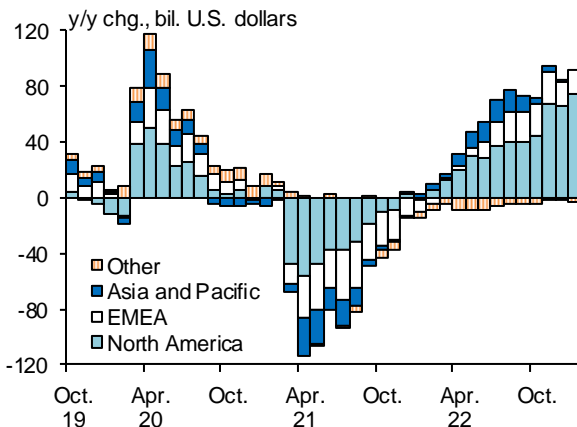
Foreign loans have grown at an increasing rate (Charts III-1-13 and III-1-14). By region, loans to North America have increased further. This has been driven by (1) demand for working capital due to the rise in raw material input costs and labor costs, (2) a shift from funding from capital markets to borrowing, and (3) loans to investment funds, on which major banks have been focusing.⁸ Unsold leveraged buyout (LBO) loans through the end of 2022 also contributed to the increase in foreign loans. Meanwhile, the pace of growth in loans to the Asia-Pacific region has slowed as major banks' lending stance has become cautious, reflecting uncertainties over future developments in the Chinese real estate market.

Chart III-1-13: Foreign loans outstanding among major banks



Note: Covers internationally active banks. Latest data as of end-January 2023.
Source: BOJ.

Chart III-1-14: Foreign loans outstanding of the three major banks by region



Note: "EMEA" includes Europe, the Middle East, and Africa. Latest data as of end-January 2023.
Source: BOJ.

2. Securities investment

The outstanding amount of banks' securities investment has been on a downward trend since peaking at the beginning of last year (Chart III-1-15).⁹ Banks have rebalanced their portfolios since last year; for example, by reducing positions and replacing products, mainly reflecting the rise in foreign interest rates.

Major banks' holdings of yen-denominated bonds, including JGBs, municipal bonds, and corporate bonds, have declined due to the rise in interest rates and the decline in demand for collateral. They have taken a cautious stance toward investing in foreign bonds due to the rise in foreign interest rates. Amid concerns over the risk of higher interest rates, some major banks have raised interest rate hedge ratios; for example, by purchasing inverse mutual funds. 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 awareness regarding corporate governance.

Regional and *shinkin* banks' investment stance has been restrained, reflecting the rise in interest rates. Their holdings of yen-denominated bonds have declined, particularly at *shinkin* banks. As for foreign bonds, regional banks in particular have continued to reduce their holdings due to the rise

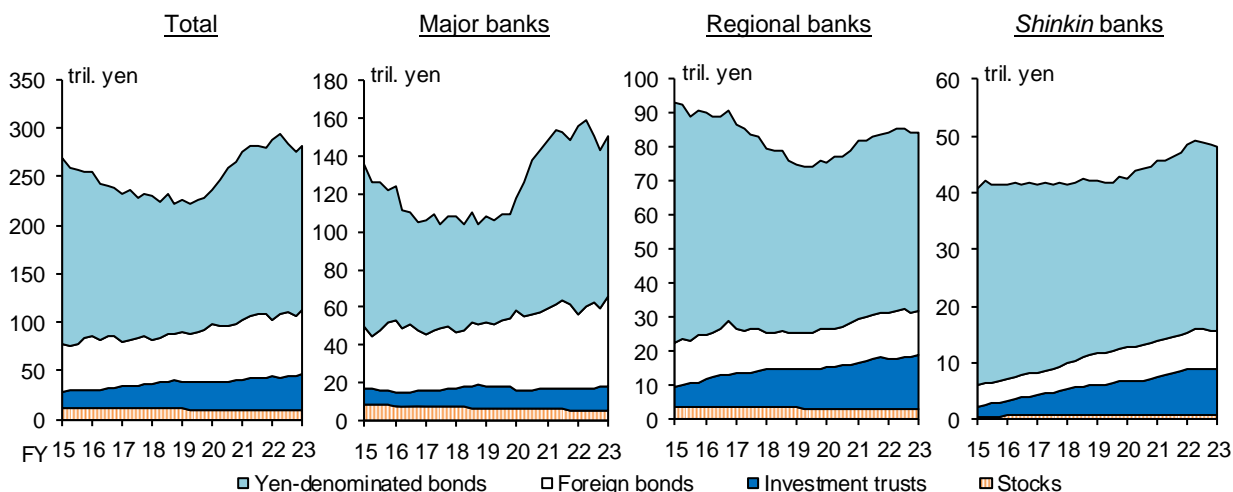
⁸ The increase in loans to North America since November 2022 also reflects loan transfers resulting from the sale of the subsidiaries of some banks.

⁹ The decline in the amount outstanding of foreign currency-denominated securities investment (calculated in yen terms) is also attributable to the yen's appreciation since last autumn.

III. Financial intermediation
A. Financial intermediation by the banking sector

in foreign interest rates. Amid concerns over the risk of higher interest rates, some regional banks have purchased inverse mutual funds (see Section C of Chapter IV for regional banks' hedging against interest rate risk). Holdings of investment trusts are generally unchanged. While some regional banks have increased their investment in real estate investment funds, the investment stance of regional and *shinkin* banks overall has remained cautious.

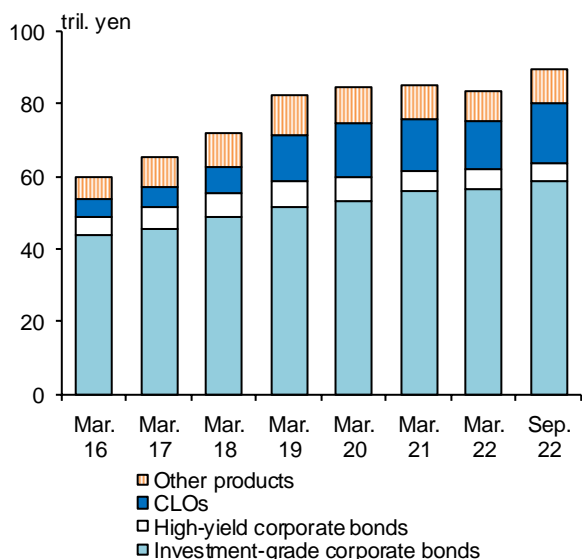
Chart III-1-15: Outstanding amount of securities among banks



Note: 1. The data for "Investment trusts" include domestic and foreign investment, and some securities other than investment trusts.
2. The data for "Stocks" are based on the outstanding amount on a book value basis and exclude foreign stocks.
3. The data are the sum of figures for domestic and foreign branches, with the exception of those for major banks' "Stocks," which are figures for domestic branches. Latest data as of end-February 2023.

Source: BOJ.

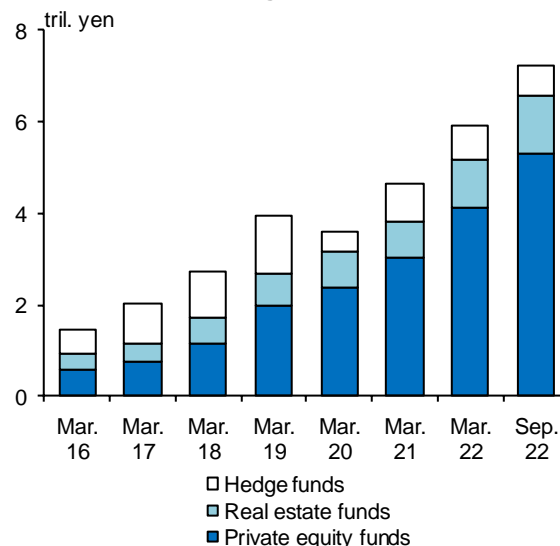
Chart III-1-16: Foreign credit product investment



Note: Covers major banks, regional banks, *shinkin* banks, Japan Post Bank, and a central organization of financial cooperatives.

Source: BOJ.

Chart III-1-17: Foreign alternative investment



Note: 1. Covers major banks, Japan Post Bank, and a central organization of financial cooperatives.
2. "Real estate funds" excludes publicly traded REITs.

Source: BOJ.

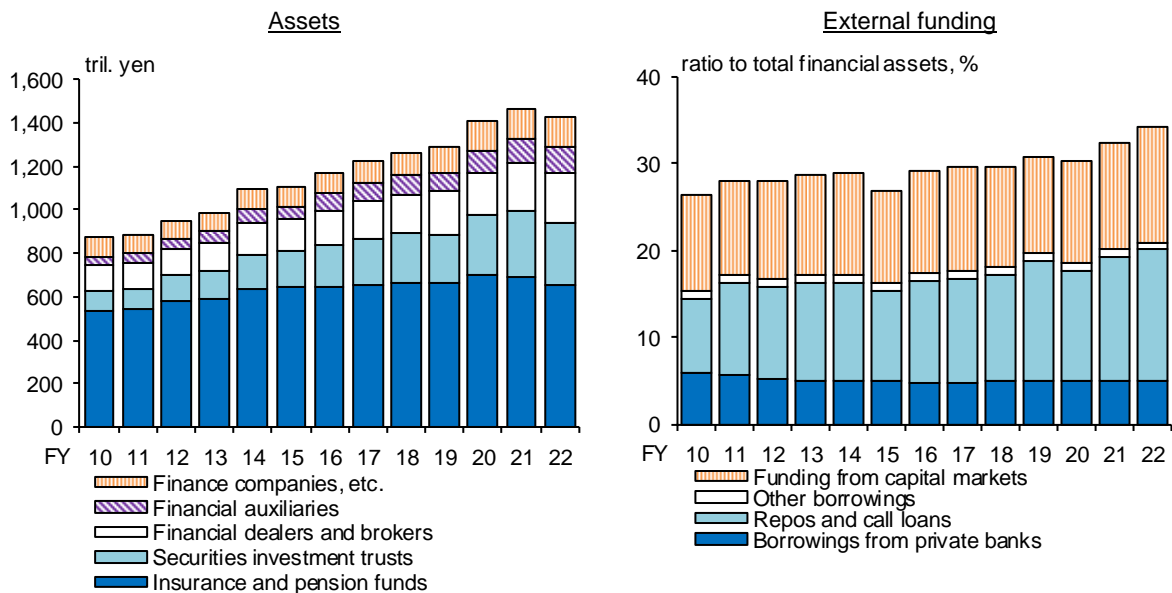
The outstanding amount of investment in foreign credit products by Japanese banks, including Japan Post Bank and a central organization of financial cooperatives, has risen slightly, due partly to the depreciation of the yen, particularly for products such as investment-grade corporate bonds and collateralized loan obligations (CLOs) (Chart III-1-16). Although regional and *shinkin* banks'

holdings of foreign credit products have been small, some have accumulated holdings of floating-rate bonds. Moreover, large financial institutions have increased their alternative investment holdings, such as private equity holdings, with the aim of diversifying risk (Chart III-1-17).

B. Financial intermediation by the non-bank financial sector

Assets under management held by non-bank financial intermediaries (NBFIs) have remained on an uptrend (Chart III-2-1).¹⁰ Insurance companies, pension funds, and securities investment trusts -- which account for nearly 70 percent of NBFIs' financial assets -- have managed assets with little reliance on external funding such as loans. In recent years, however, insurance companies and financial dealers and brokers have expanded their repo funding, contributing to an increase in the interconnectedness between NBFIs and banks.

Chart III-2-1: Balance sheets of Japan's NBFIs



Note: "Financial auxiliaries" includes financial holding companies, stock exchanges, and financial instruments exchanges.
 "Financial companies, etc." includes finance companies, securities finance companies, and the Resolution and Collection Corporation. Latest data as of end-December 2022.
 Source: BOJ.

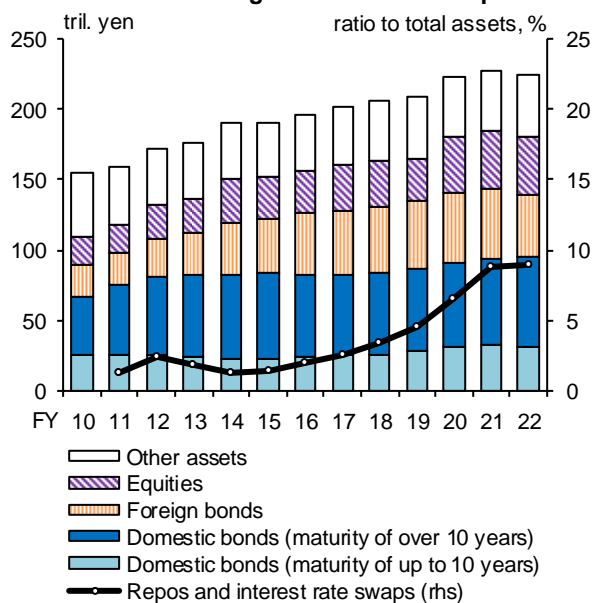
Insurance companies and pension funds

Life insurance companies have continued to invest in super-long-term JGBs with a view to reducing the duration gap between assets and liabilities (Charts III-2-2 and III-2-3). In 2025, economic value-based capital regulations to internationally active insurance groups will be fully applied and economic value-based solvency margin ratio (ESR) regulations among domestic insurance companies will be introduced. Against this background, in addition to investment in super-long-term JGBs, life insurance companies' interest rate swaps and repo funding have been on an uptrend. Turning to foreign securities investment to secure profits, some life insurance companies -- due to the rise in foreign currency funding costs -- have sold their currency-hedged U.S. Treasuries and unhedged foreign bonds and shifted their investment to U.S. corporate bonds with higher yields and super-long-term JGBs. Meanwhile, the currency hedge ratios of foreign securities investment have remained more or less flat (Chart III-2-4).

¹⁰ In line with the definition of the Financial Stability Board (FSB), NBFIs here include all financial institutions that are not depository financial institutions, central banks, and public financial institutions.

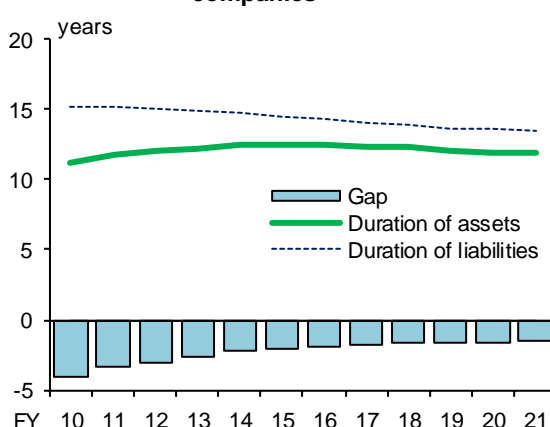
III. Financial intermediation
 B. Financial intermediation by the non-bank financial sector

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



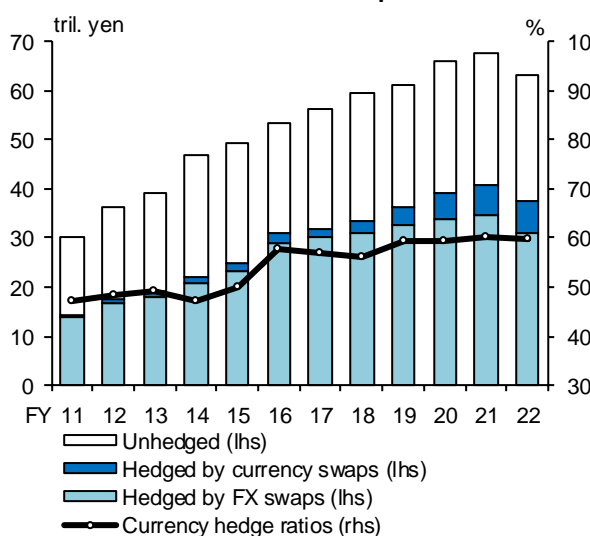
Note: 1. Covers nine major life insurance companies. Based on general accounts.
 2. "Repos and interest rate swaps" consists of repo funding and net positions of IRS calculated based on notional amounts outstanding of four major life insurance companies.
 3. Latest data as of end-September 2022.
 Source: Published accounts of each company.

Chart III-2-3: Duration gap of life insurance companies



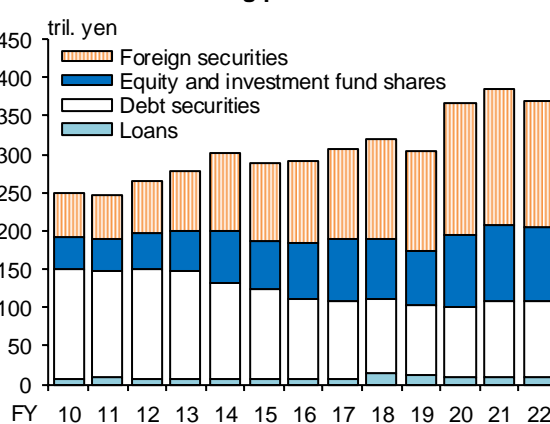
Note: Covers four major life insurance companies. Estimated based on general accounts.
 Source: Japan Institute of Life Insurance; Ministry of Internal Affairs and Communications; National Institute of Population and Social Security Research; Published accounts of each company; BOJ.

Chart III-2-4: Currency hedge ratios among life insurance companies



Note: Covers nine major life insurance companies. Estimated based on general accounts.
 "Unhedged" includes foreign bonds earmarked for foreign currency-denominated insurance.
 Latest data as of end-September 2022.
 Source: Published accounts of each company.

Chart III-2-5: Investment assets outstanding among pension funds



Note: Covers pension funds and public pensions. Latest data as of end-December 2022.
 Source: BOJ.

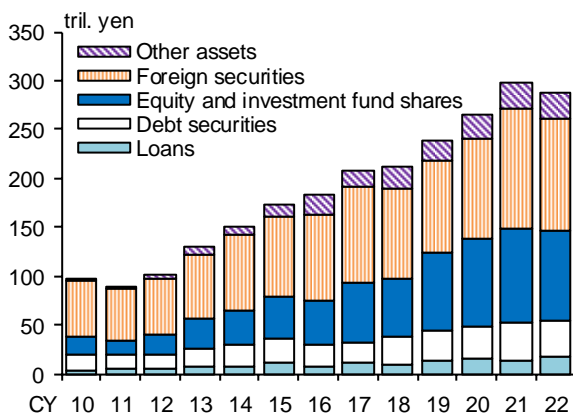
Pension funds have continued to invest in foreign securities while rebalancing their portfolios in response to changes in stock prices (Chart III-2-5). However, reflecting the rise in foreign currency hedging costs, pension funds have been selling currency-hedged U.S. Treasuries, so that the

growth in foreign securities investment has decelerated.¹¹ Corporate pension funds have maintained their cautious investment stance without depending on leverage, with many of them having secured net assets in excess of policy reserves. 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 rebalancing its portfolio in response to changes in stock prices in line with the basic portfolio allocation, which 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.

Investment funds

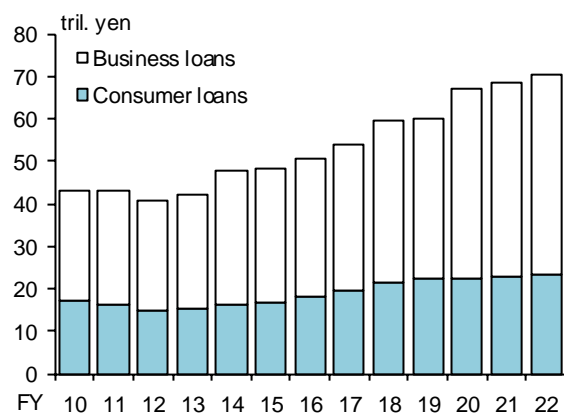
Investment funds' assets under management, especially those of securities investment trusts, have continued to increase on the back of steady inflows of funds (Chart III-2-6). Meanwhile, although the assets under management of leveraged private funds and real estate investment funds have surged in recent years, such assets only account for slightly less than 20 percent of total assets held by all investment funds.

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



Note: Latest data as of end-December 2022.
Source: BOJ.

Chart III-2-7: Loans outstanding among finance companies



Note: "Business loans" includes loans to governments.
Latest data as of end-December 2022.
Source: BOJ.

Finance companies

Loans outstanding of finance companies such as money lenders have been on an uptrend (Chart III-2-7). By type of loans, business loans have increased, mainly driven by inter-firm loans among related firms within the same group, amid the global rise in demand for working capital. Consumer loans have increased moderately due to the use of credit cards in online shopping.

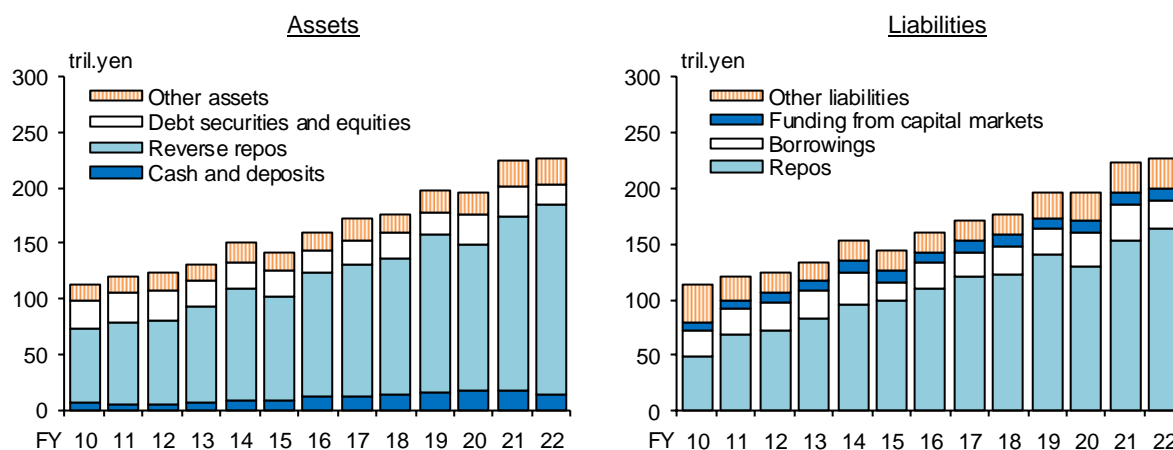
Financial dealers and brokers

Financial dealers and brokers have expanded their balance sheets mainly by increasing short-term

¹¹ Japan's pension funds primarily follow simple investment strategies consistent with the policy asset mix or the basic portfolio allocation instead of strategies that make use of leverage, such as liability-driven investment strategies. For details, see Box 3 and Ito, Y., Kasai, Y., Todoroki, R., Toyoda, A., and Horie, R., "Corporate Pension Funds' Investment Strategies and Financial Stability: Lessons from the Turmoil in the UK Gilt Market," *Bank of Japan Review Series*, no. 2023-E-3, March 2023.

repo transactions on both the asset and liability sides (Chart III-2-8).¹² This reflects an increase in brokerage of arbitrage transactions by Japanese securities companies and *tanshi* companies (money market brokers) between short-term money market transactions and current account deposits at the Bank of Japan. It also reflects an increase in repo transactions by foreign securities companies' branches in Japan to broker JGB transactions to meet their headquarters' demand for JGBs as collateral. It should be noted that, in most of these transactions by financial dealers and brokers, there is no duration mismatch between their assets and liabilities. However, financial dealers and brokers could face liquidity risks when there is a duration mismatch or they broker transactions between participants and non-participants of central counterparties (CCPs).

Chart III-2-8: Balance sheets of financial dealers and brokers



Note: "Equities" includes investment fund shares. Latest data as of end-December 2022.
Source: BOJ.

C. Financial cycle

As confirmed in the preceding sections, financial intermediation has continued its smooth functioning in Japan. This section examines whether this financial intermediation and the resultant increase in private debt have led to a buildup of financial imbalances that could cause a significant downturn in future economic activity.

1. The financial cycle and risks to economic growth

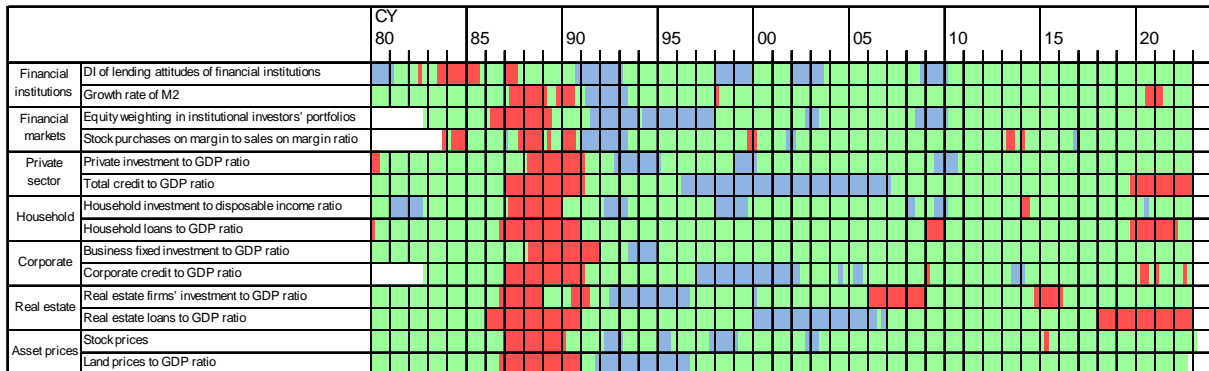
A heat map and the financial gap are used to assess whether the current phase of the financial cycle shows any signs of overheating or contraction. Using three different colors, the heat map depicts whether various Financial Activity Indexes (FAIXs) point to an overheating or contraction of activity based on the degree to which the indexes deviate from their trends. The latest heat map shows that 12 out of the 14 FAIXs are "green," which signals neither an overheating nor a contraction, and the two remaining FAIXs are "red," which signals an overheating (Chart III-3-1).¹³

¹² For details on off-balance-sheet transactions of financial dealers and brokers, see Inoue, S., Miki, S., and Gemma, Y., "The Japanese Yen Interest Rate Swap Market Observed from OTC Derivative Transaction Data: The Impact of COVID-19," *Bank of Japan Review Series*, no. 2021-E-3, September 2021.

¹³ The heat map in Chart III-3-1 represents a mechanical assessment of whether financial activity is overheating or contracting. Specifically, the colors represent the following: (1) red indicates that an index is above its upper threshold; (2) blue indicates that an index 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.,

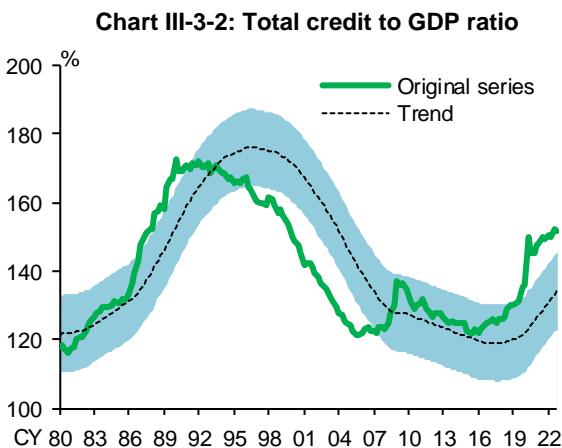
Compared with the previous issue of the *Report*, the *corporate credit to GDP ratio* has turned from "red" to "green."¹⁴

Chart III-3-1: Heat map

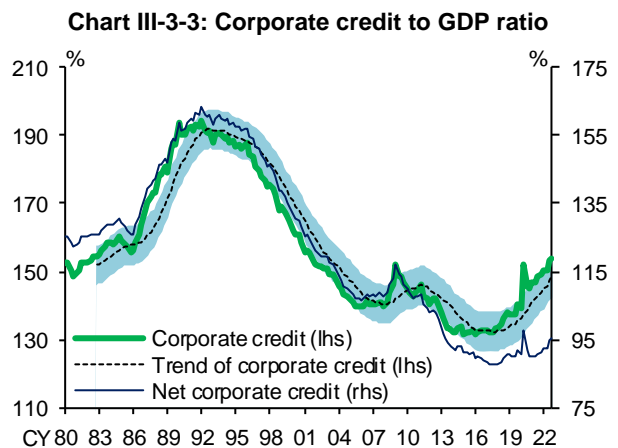


Note: The latest data for stock prices are as of the January-March quarter of 2023. The latest data for the land prices are as of the July-September quarter of 2022. Those for the other indexes are as of the October-December quarter of 2022.
Source: Bloomberg; Cabinet Office; Japan Real Estate Institute; Ministry of Finance; Tokyo Stock Exchange; BOJ.

Of 14 FAIXs, the *total credit to GDP ratio* and the *corporate credit to GDP ratio* have remained at high levels, due partly to the cautious cash management, mainly by small and medium-sized enterprises (SMEs), aimed at securing ample cash reserves (Charts III-3-2 and III-3-3). Moreover, additional demand for working capital due to the recent rise in energy and raw material input costs has also contributed to the two FAIXs remaining at high levels. As suggested by the fact that net corporate credit (gross corporate credit minus firms' cash and deposits) has hardly expanded despite the increase in gross corporate credit, many SMEs have continued to secure cash reserves through borrowings and other external financing (see Section A of this chapter). Given these observations, there is no overheating of current financial activities.



Note: 1. "Trend" is calculated using the one-sided HP filter. The shaded area indicates the root mean square of the deviation from the trend.
2. Latest data as of the October-December quarter of 2022.
Source: Cabinet Office; BOJ.



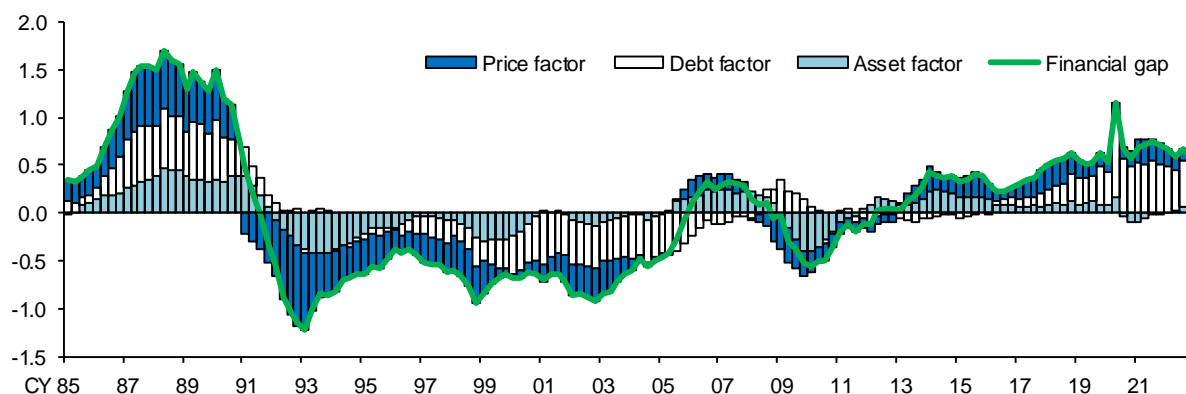
Note: 1. "Trend of corporate credit" is calculated using 3-year backward moving averages. The shaded area indicates the root mean square of the deviation from the trend.
2. "Net corporate credit" is the ratio to GDP of gross corporate credit excluding firms' cash and deposits.
3. Latest data as of the October-December quarter of 2022.
Source: Cabinet Office; BOJ.

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.

¹⁴ However, although in the "green" zone, the *corporate credit to GDP ratio* has been close to "red" in the heat map.

Next, the financial gap -- a summary measure of the 14 FAIXs -- is examined to quantify changes in the financial cycle. It is calculated as the weighted average of the deviations of the 14 FAIXs from their trends (Chart III-3-4).¹⁵ Almost a decade has passed since the financial gap turned positive in the early 2010s. The positive gap has been widening moderately, driven mainly by the increase in private debt (the "debt factor"). On the other hand, unlike in the previous episode when financial imbalances built up, the contribution of active real investment (the "asset factor") due to leverage and asset price increases (the "price factor") has remained limited in the current phase. Thus, no major financial imbalances can be observed in current financial activities.

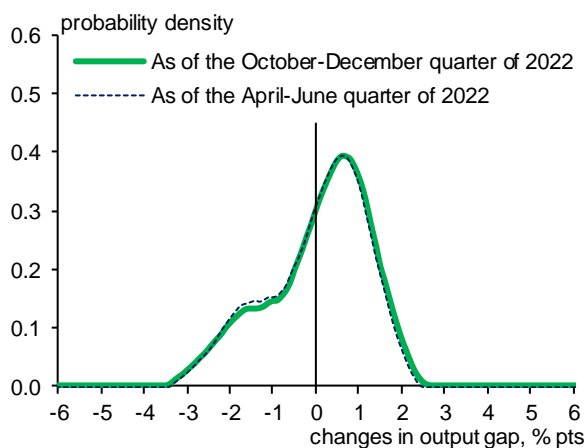
Chart III-3-4: Financial gap



Note: "Asset factor" consists of indexes of fixed investment by the private sector, households, firms, and real estate businesses. "Debt factor" consists of indexes of their debt financing. "Price factor" consists of the remaining indexes. Latest data as of the October-December quarter of 2022 (land prices to GDP ratio is imputed by the value as of the July-September quarter of 2022).

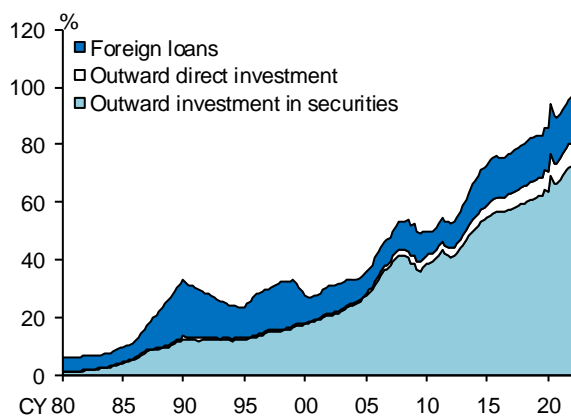
Source: BOJ.

Chart III-3-5: Risks to future economic growth



Note: Shows the changes in output gap over the next 3 years. Estimated based on output gap, financial gap, and U.S. NFCI for each time point.

Chart III-3-6: External credit to GDP ratio



Note: 1. Covers depository financial institutions and NBFIs. 4-quarter backward moving averages.
2. Latest data as of the October-December quarter of 2022.

Source: Cabinet Office; BOJ.

However, the current phase of a positive financial gap is the longest on record in the post-bubble period. If the rebalancing of private debt and economic activity were to slow going forward, and if the *total credit to GDP ratio* were to remain "red" for a further prolonged period, major financial

¹⁵ In Chart III-3-4, larger weights are assigned to indexes that have a higher correlation with other indexes in calculating the weighted average of individual FAIXs. The weights vary based on changes in the degree of correlation over time.

imbalances could build up (Chart III-3-2).¹⁶ Looking at "GDP-at-risk" (GaR), which shows the probability distribution of future GDP growth rates, the distribution over the next three years remains skewed to the left, toward an economic downturn (Chart III-3-5).¹⁷ This pattern suggests that increased private debt could result in balance sheet adjustment pressures and increase the risk of an economic downturn.

Meanwhile, not only domestic credit but also foreign credit has increased. In addition to foreign loans by major banks, foreign bond investments by banks and institutional investors have increased significantly, which has led to a rise in foreign currency interest rate risk (Chart III-3-6). Due to this increase in foreign credit, Japan's financial system has become more susceptible to foreign economic and financial conditions through not only the real economic channel but also the financial channel. In particular, the global tightening of financial conditions has affected financial institutions' business conditions through the repricing of foreign assets and a rise in foreign currency funding costs (see Chapter IV).

2. Changes surrounding the financial cycle

The increase in private debt since the start of the pandemic reflects firms' cautious cash management aimed at securing ample cash reserves and banks' active lending stance. Against this background, it is important to monitor whether there has been an increase in lending to borrowers with relatively low debt repayment capacity, which entails high credit risk. The following provides an overview of the increase in debt in the household, corporate, and non-bank financial sectors during the current expansionary phase of the financial cycle.

Increase in debt in the household sector

The outstanding amount of housing loans, which account for the largest part of household debt, has continued to increase, reaching an all-time peak relative to disposable income (Chart III-3-7).¹⁸ Some of the increase in housing loans reflects borrowing by households with relatively low debt repayment capacity. Specifically, households with a debt servicing ratio (DSR) -- the ratio of annual repayments to annual income -- of 25 percent or above account for almost 20 percent of all households in the housing loan market (Chart III-3-8). One reason for this is the entry of younger households into the housing loan market. Younger households not only tend to have a lower income level than other age groups at the time of loan origination, they also tend to take out larger loans. These younger households account for a non-negligible share of households with a high DSR.

In general, in the initial screening of housing loan applications, banks specify a stress interest rate

¹⁶ 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*.

¹⁷ GaR applies the value-at-risk (VaR) approach, a method for assessing the risk associated with financial assets, to the GDP growth rate. Specifically, the regression equation used to estimate GaR here is as follows:

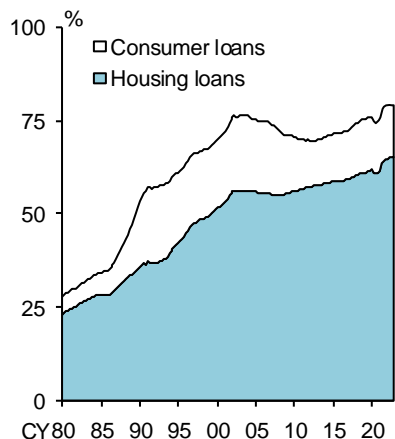
$$\left(\begin{array}{c} \text{Changes in the output gap} \\ \text{over the next } X \text{ years} \end{array} \right) = \alpha \left(\begin{array}{c} \text{Changes in the output gap} \\ \text{from the previous period} \end{array} \right) + \beta(\text{Financial gap}) + \gamma(\text{U.S. NFCI}) + \delta.$$

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

¹⁸ For details on the international comparison of housing loan markets, see Box 1 of the October 2022 issue of the *Report*.

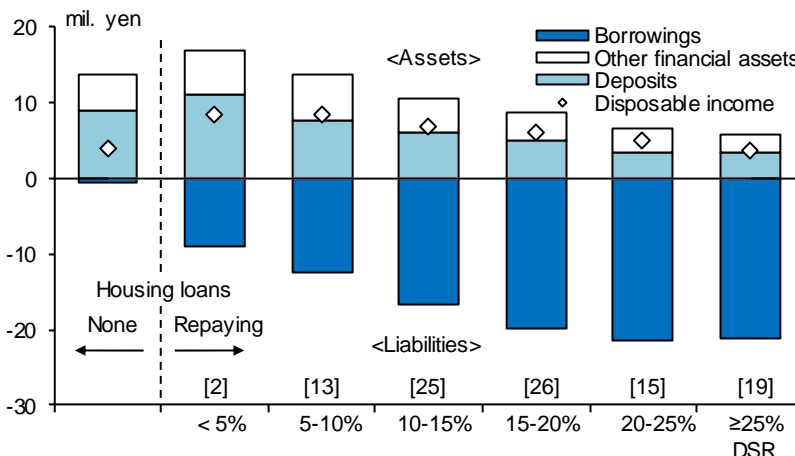
that is higher than the actual loan interest rate, in order to take into account the risk that borrowers' debt repayment capacity could deteriorate during the loan period. Banks prevent the deterioration in the quality of housing loans by securing a sufficient "interest rate buffer" or a gap between the stress interest rate and the actual loan interest rate. However, estimating an interest rate buffer that is necessary to keep each bank's average DSR no greater than 30 percent shows that it has generally been shrinking in the past few years due to a decline in the stress interest rate (Chart III-3-9).¹⁹ Moreover, the larger the decline banks have experienced in their interest rate buffer, the

Chart III-3-7: Household debt to disposable income ratio



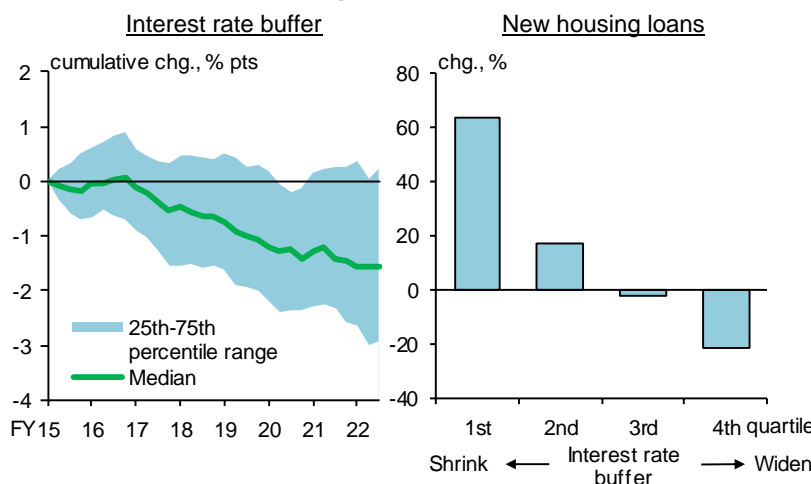
Note: 4-quarter backward moving averages. Latest data as of the October-December quarter of 2022.
Source: Cabinet Office; BOJ.

Chart III-3-8: Financial assets and liabilities of households



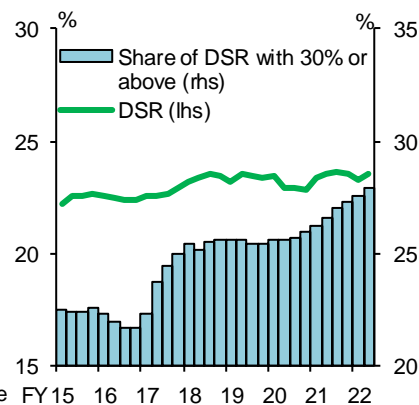
Note: The data for financial assets, liabilities, and disposable income are averages per household. Figures in brackets indicate the share of each DSR in total households repaying housing loans. Based on the 2019 survey.
Source: Ministry of Internal Affairs and Communications.

Chart III-3-9: Housing loans and interest rate buffer



Note: 1. Covers regional and *shinkin* banks.
2. The left chart shows cumulative changes from the April-June quarter of 2015 to the October-December quarter of 2022. 4-quarter backward moving averages. The right chart shows the changes in new housing loans (from fiscal 2015 to April-December of fiscal 2022), for each quartile of cumulative changes in the interest rate buffer.
Source: BOJ.

Chart III-3-10: DSR for housing loans



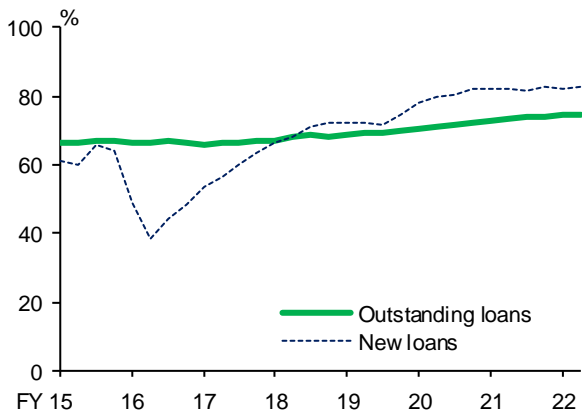
Note: Covers major, regional, and *shinkin* banks. 4-quarter backward moving averages. Latest data as of the July-September quarter of 2022.
Source: BOJ.

¹⁹ The interest rate buffer was calculated for each bank by conducting a simple reverse stress test with regard to the bank's average DSR. Specifically, using data on borrowers' annual repayment amount, disposable income, and actual interest rate, the stress interest rate was inversely calculated so that the average DSR would hit 30 percent after adjusting a repayment term. The difference between this stress interest rate and the actual loan interest rate is then regarded as the interest rate buffer.

larger the increase in their housing loans. As a result, the share of housing loans with a DSR of 30 percent or above has been increasing (Chart III-3-10).

The analysis above suggests that the number of households with relatively low resilience to a decline in income or a rise in interest rates has been increasing somewhat. Especially among households with a high DSR, asset portfolios are heavily skewed toward real assets and the share of financial assets is low. In addition, the share of floating-rate housing loans is close to 80 percent for both new loans and outstanding loans (Chart III-3-11). Recently, refinancing costs have increased somewhat, as seen in the rise in interest rates for fixed-rate housing loans (Chart III-3-12). For banks, while risks are more diversified in housing loans than in corporate loans and it seems unlikely that housing loans will give rise to a large amount of credit costs, housing loan profitability has been below 1 percent.²⁰ Banks therefore need to carefully examine housing loan applications and households' income situation, taking the risk of a deterioration in households' debt repayment capacity into account.

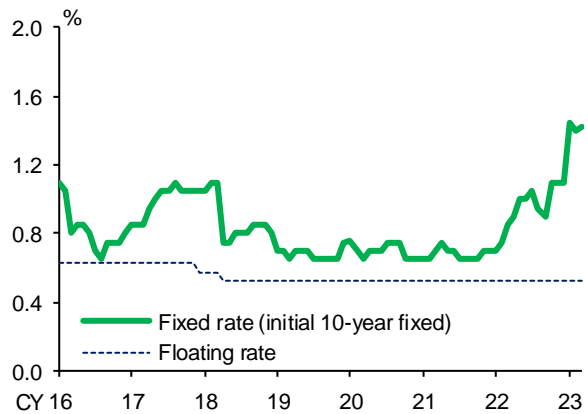
Chart III-3-11: Share of floating-rate housing loans



Note: Covers major banks and regional banks. The latest data for "Outstanding loans" are as of end-September 2022. The latest data for "New loans" are as of the July-September quarter of 2022.

Source: BOJ.

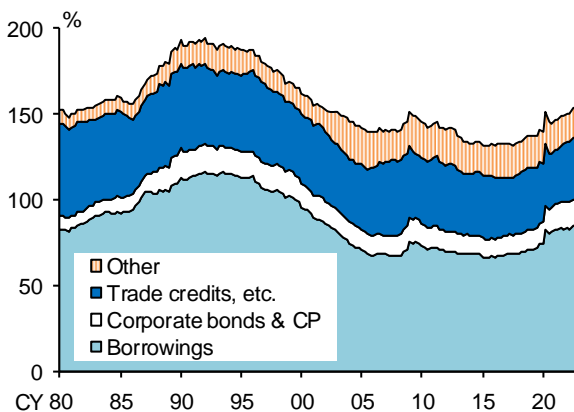
Chart III-3-12: Interest rates on housing loans



Note: The chart shows medians of some major banks (preferential rates are taken into account). Latest data as of March 2023.

Source: Published accounts of each bank.

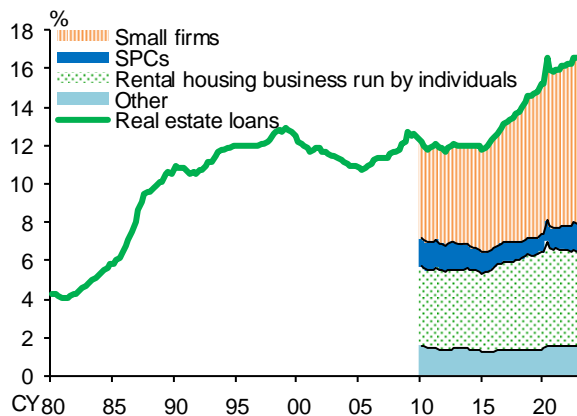
Chart III-3-13: Corporate credit to GDP ratio



Note: 4-quarter backward moving averages. Latest data as of the October-December quarter of 2022.

Source: Cabinet Office; BOJ.

Chart III-3-14: Real estate loans to GDP ratio



Note: 1. 4-quarter backward moving averages. Latest data as of the October-December quarter of 2022.

2. "Small firms" includes J-REITs.

Source: Cabinet Office; BOJ.

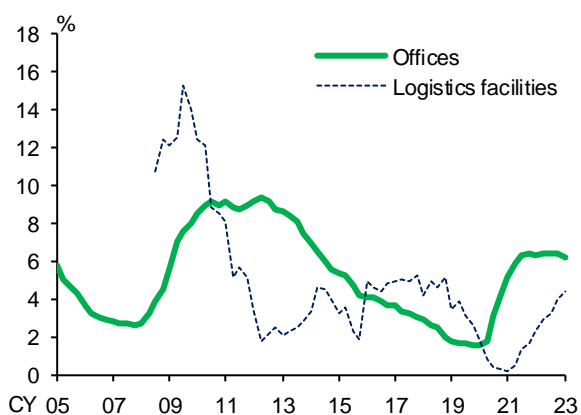
²⁰ Loan profitability here is calculated as housing loan interest rates minus funding costs minus group credit life insurance premiums (assumed to be 0.3 percent).

Increase in debt in the corporate sector

Credit to the corporate sector has expanded through various channels, including through bank loans as well as through CP and corporate bonds (Chart III-3-13). Recently, rising energy and raw material input costs have also been one of the reasons for the increase in corporate credit. Another reason is that real estate loans, which account for almost 30 percent of corporate loans (as of end-2022), have been on a long-term uptrend (Chart III-3-14).

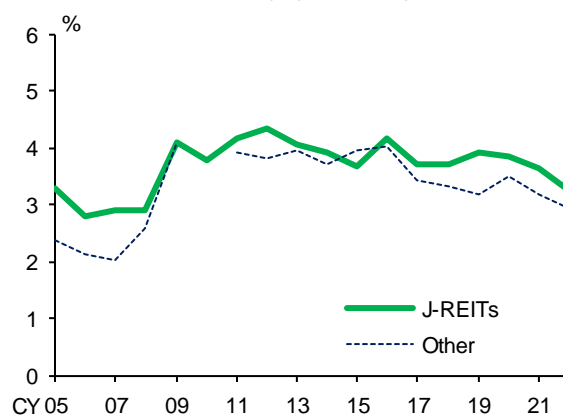
In the real estate transaction market, with vacancy rates for office buildings and logistics facilities rising, there have been some investment properties with low yield spreads (the difference between property yields and swap rates) that are below the target of J-REITs, stable domestic investors (Charts III-3-15 and III-3-16). However, so far, there is no clear indication from the FAIXs that real

Chart III-3-15: Vacancy rates in Tokyo



Note: The latest data for "Offices" (Tokyo Business area) and "Logistics facilities" (Tokyo area) are as of February 2023 and January 2023, respectively.
Source: Miki Shoji Co., Ltd.; K.K. Ichigo Real Estate Service.

Chart III-3-16: Yield spreads on individual properties traded by type of buyer

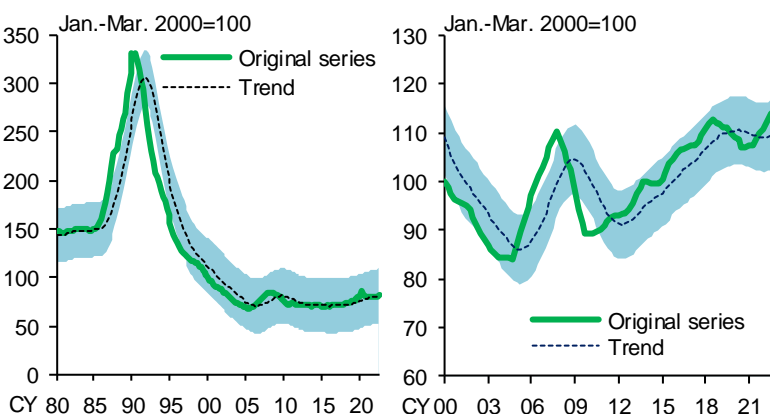


Note: Calculated based on "Nikkei Real Estate Market Report DEAL SEARCH." The differences in the characteristics of individual properties (type of use, location, age, total floor area, number of aboveground and basement floors) are controlled in the estimation. Latest data as of 2022.
Source: Bloomberg; Nikkei Business Publications, Inc.

Chart III-3-17: Real estate prices indicators

Land prices to GDP ratio

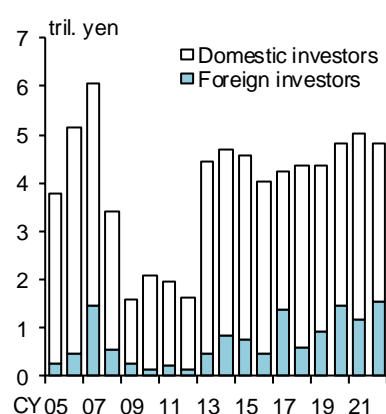
CRE prices to rent ratio



Note: "Trend" is calculated using 3-year backward moving averages. The shaded area indicates the root mean square of the deviation from the trend. Latest data for the left-hand chart and right-hand chart are as of the July-September quarter of 2022 and the October-December quarter of 2022, respectively.

Source: Cabinet Office; Japan Real Estate Institute; Ministry of Land, Infrastructure, Transport and Tourism; BOJ.

Chart III-3-18: Real estate property acquisitions

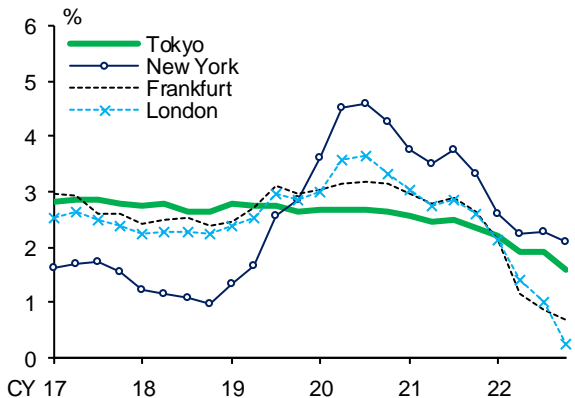


Source: Japan Real Estate Institute.

estate valuations in Japan as a whole are stretched. The *land prices to GDP ratio* has been flat and the commercial real estate prices to rent ratio, although rising, has not deviated significantly from the trend (Chart III-3-17).²¹ Moreover, even amid J-REITs becoming more cautious in their investment stance, foreign investors have continued to engage in trades (Chart III-3-18). Although some foreign investment funds and individual investors that are sensitive to exchange rate changes have been holding off on investing, foreign institutional investors -- insurance companies, pension funds, and sovereign wealth funds, which typically hold real estate for the long term -- have been active in investment on the whole.

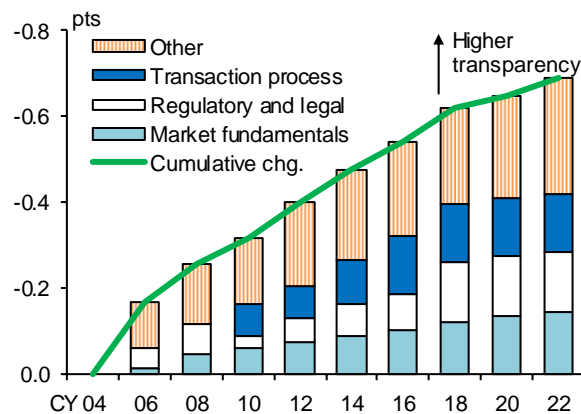
One of the reasons for the active investment stance of foreign institutional investors is that investment profitability in Japan's real estate market has remained relatively solid, in contrast to the unstable profitability of foreign real estate markets (Chart III-3-19). Moreover, the continued improvement in the transparency of Japan's real estate market has attracted foreign institutional investors (Chart III-3-20).²² Their investment behavior is one factor containing the risk of a substantial adjustment in Japan's real estate transaction market. On the other hand, close attention should continue to be paid to the fact that Japan's real estate market has become more susceptible to developments in the global market, such as a global portfolio rebalancing by foreign investment funds, etc.

Chart III-3-19: Yield spreads of commercial properties



Note: Yield spreads = grade-A office yields – 10-year overnight index swap rates. Latest data as of the October-December quarter of 2022.
Source: JLL; Refinitiv Eikon.

Chart III-3-20: Real estate market transparency



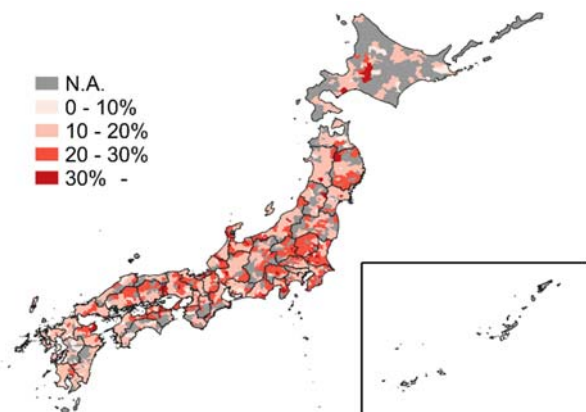
Note: The chart indicates cumulative contributions for Japan Index since 2004.
Source: JLL.

In the real estate leasing market, real estate leasing businesses have continued to invest in fixed assets. Against this background, the decline in rental income and the increase in the number of vacant houses have become more pronounced across Japan (Chart III-3-21). Rises in vacancy rates for dwellings can be observed not only in areas where the number of renter households has declined but also in areas where the number of renter households has increased (Chart III-3-22). Dwelling vacancy rates have risen in many regions because the supply of rental houses has continued to exceed the projected increase in the number of households.

²¹ The FAIXs in Chart III-3-1, such as the *land prices to GDP ratio*, are designed so that they signal "red" for the bubble period in the late 1980s. In contrast, for the commercial real estate (CRE) prices to rent ratio in Chart III-3-17, the trend and threshold are set so that the ratio signals "red" for the so-called mini-bubble period in 2007.

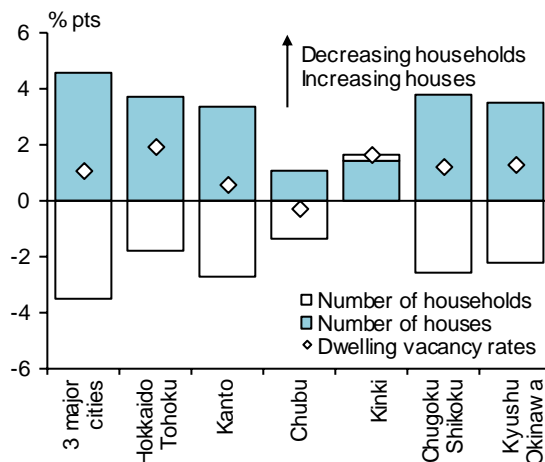
²² The Global Real Estate Transparency Index (jointly published by JLL and LaSalle Investment Management) scores and indexes the transparency of 94 real estate markets around the world from the following perspectives: (1) performance measurement, (2) market fundamentals, (3) governance of listed vehicles, (4) regulatory and legal, (5) transaction process, and (6) sustainability. A score of 1 indicates the highest level of transparency, while a score of 5 indicates the lowest level of transparency. In the latest survey (the 2022 survey), the Japanese market ranked 12th with an overall score of 1.88 (compared to 16th in the previous survey in 2020).

Chart III-3-21: Dwelling vacancy rates by municipality



Note: Based on Ministry of Land, Infrastructure, Transport and Tourism, "National Land Numerical Information (administrative district data)" and Ministry of Internal Affairs and Communications, "2018 Housing and Land Survey."

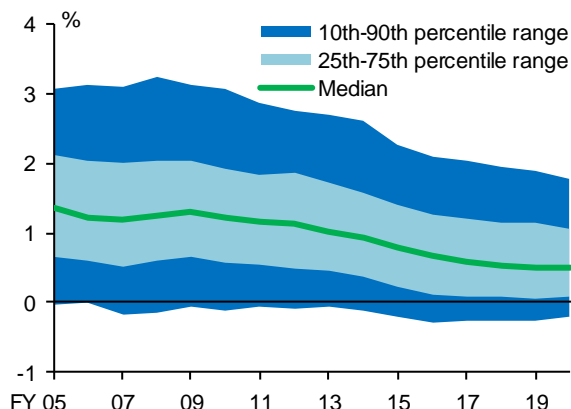
Chart III-3-22: Change factors of dwelling vacancy rates



Note: 1. The chart shows the decomposition of the changes in dwelling vacancy rates from 2013 to 2018 into the number of renter households and the number of houses for rent, respectively.
2. "3 major cities" includes Tokyo, Osaka, and Fukuoka. "Kanto," "Kinki," and "Kyushu" exclude 3 major cities.
Source: Ministry of Internal Affairs and Communications.

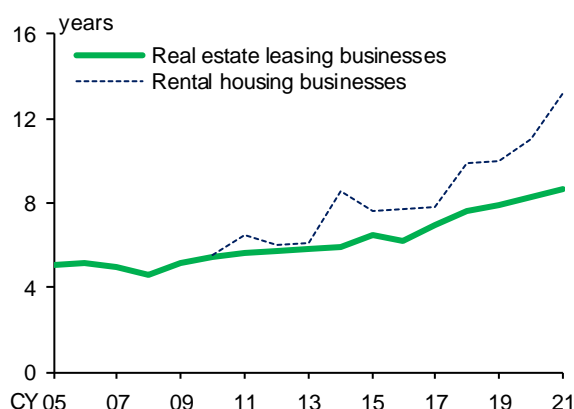
Banks' active lending to real estate businesses has also contributed to the increase in rental housing. Meanwhile, regional and *shinkin* banks in particular have provided long-term loans at low interest rates to real estate leasing businesses (Charts III-3-23 and III-3-24). Among loans to leasing businesses, there are some cases where banks have set loan durations in excess of the useful life of properties. It is necessary for banks to strengthen their monitoring of their borrowers, taking the dynamics in the number of households and resultant risk of rising dwelling vacancy rates into account.

Chart III-3-23: Profitability of loans to real estate leasing businesses



Note: The chart shows the distribution of profitability of banks. Profitability is calculated as: interest rates for loans – overhead ratios for the domestic business – Japanese yen funding costs. Latest data as of fiscal 2020.
Source: Teikoku Databank.

Chart III-3-24: Average redemption period of real estate loans

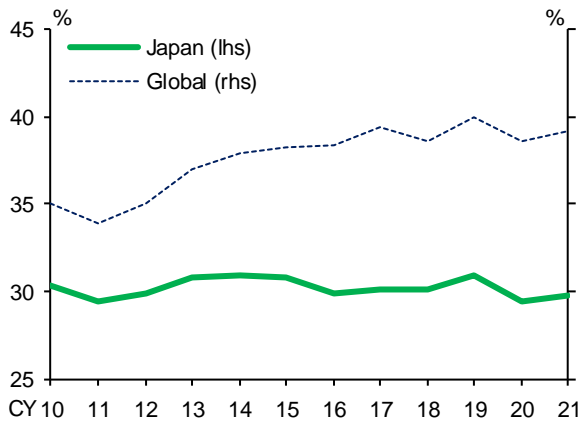


Note: Average redemption period is calculated as the borrowings divided by short-term (within 1 year) borrowings.
Source: CRD Association.

Increase in debt in the non-bank financial sector

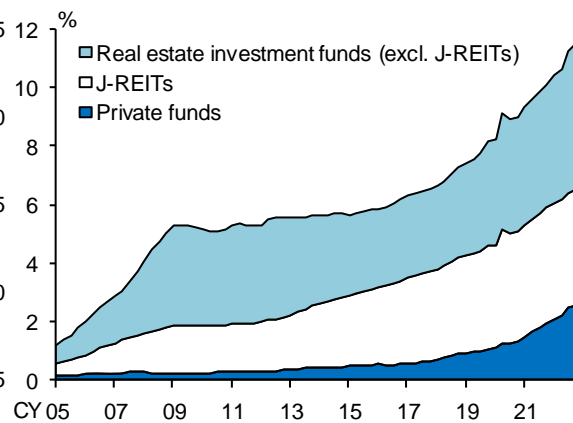
Amid discussions over global financial stability, the increase in leverage by NBFIs and the resulting liquidity mismatch have been pointed out as potential vulnerabilities. While the share of financial assets held by NBFIs has risen to around 50 percent on a global basis, it has remained at about 30 percent in Japan (Chart III-3-25). However, the amount of assets held by investment funds, while still small, is increasing rapidly (Chart III-3-26). Moreover, with the rise in bank lending to private funds and REITs, the banking sector is more likely to be affected by NBFIs. Against this background, the possibility of a build-up in leverage not only within but also outside the banking system through these changes in market structure needs to be closely monitored.

Chart III-3-25: Share of financial assets held by NBFIs



Source: FSB; BOJ.

Chart III-3-26: Fund assets to GDP ratio



Note: 4-quarter backward moving averages. Latest data as of the October-December quarter of 2022.

Source: Cabinet Office; Preqin; Sumitomo Mitsui Trust Research Institute; The Investment Trusts Association, Japan.

IV. Risks faced by financial institutions

- The quality of banks' domestic and foreign loan portfolios has been maintained. As for domestic loans, with principal and interest repayments on effectively interest-free loans beginning in full, the ample cash reserves can be expected to keep firm defaults low on the whole. However, there are firms with cash shortages. The default risk of these firms could be concentrated in banks that deal more with micro firms. On the other hand, there are firms with ample cash reserves. If many firms prepay the effectively interest-free loans, corporate loans and deposits will decline at the same time.
- There have been some changes in the risk profiles of foreign loans. In terms of resilience, banks have changed the composition of loans to reduce risks, and their lending-deposit interest margins have improved somewhat together with the rise in market interest rates. However, some foreign loans have become larger and more concentrated. Since large borrowers of major banks tend to have relatively high financial leverage, the probability of default (PD) would be likely to rise in the event of an economic slowdown. In particular, financial conditions of large borrowers in the Asia-Pacific region are relatively vulnerable.
- As banks have rebalanced their securities portfolios, the amount of yen and foreign currency interest rate risk has been reduced. It can be assessed that banks' resilience to the risk of higher interest rates has been improving on the whole. However, heterogeneity is large in terms of the amount of interest rate risk and the underlying rebalancing behavior of individual banks. At some banks, the risk of negative interest margins on foreign bonds has materialized. As uncertainty about future developments remains high, banks need to manage market risk appropriately based on changes in the risk profiles.
- Banks have sufficient funding liquidity, which mainly consists of stable retail deposits. They have also conducted liquidity risk management properly depending on their risk profiles. There are no Japanese banks with a unique feature of liabilities similar to that of the failed U.S. bank (see Box 1).
- In addition to these risks, banks need to continue to properly manage risks posed by changes in the business environment.

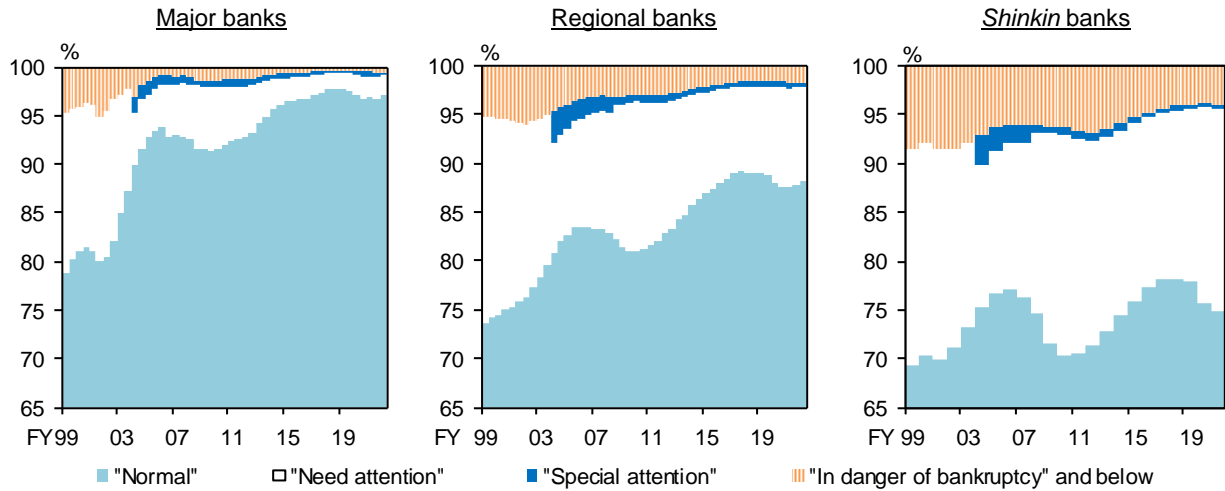
A. Domestic credit risk

The credit risk posed to banks has remained low. The shares of normal loans have stayed high, especially for major and regional banks (Chart IV-1-1). The unsecured and unprovisioned loan ratios and credit cost ratios have generally remained low (Charts IV-1-2 and IV-1-3). There are some cases where forward-looking and precautionary loan-loss provisions have been reversed.

However, estimates of unexpected losses (including on foreign loans) have been increasing recently, reflecting the increase in domestic and foreign loans and the trend to larger loans in foreign lending (Chart IV-1-4; see Section B for a discussion of the trend to larger loans in foreign lending).²³ Borrower firms have been under various types of stress, such as the cumulative impact

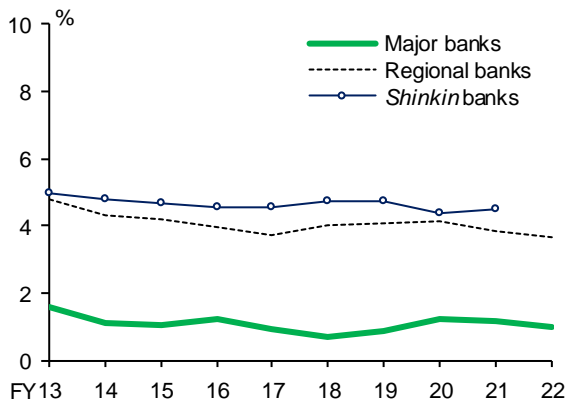
²³ Unexpected losses in Chart IV-1-4 are defined as the difference between the maximum amount of losses on loans that could occur with a 99 percent probability within a year and the amount of losses that occur on average in a year (expected losses). The calculation is based on the actual default rate from fiscal 2005 to each point in time. The loss given default is assumed to be equal to the average ratio of unsecured loans to borrowers that need "special attention" or are "in danger of bankruptcy."

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



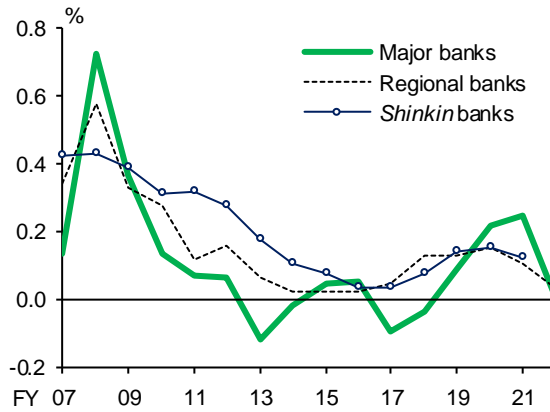
Note: "Need attention" excludes "Special attention" from fiscal 2004. The latest data for major and regional banks are as of end-September 2022, and the latest data for *shinkin* banks are as of end-March 2022 (the same applies to the charts below). Source: BOJ.

Chart IV-1-2: Unsecured/unprovisioned ratios



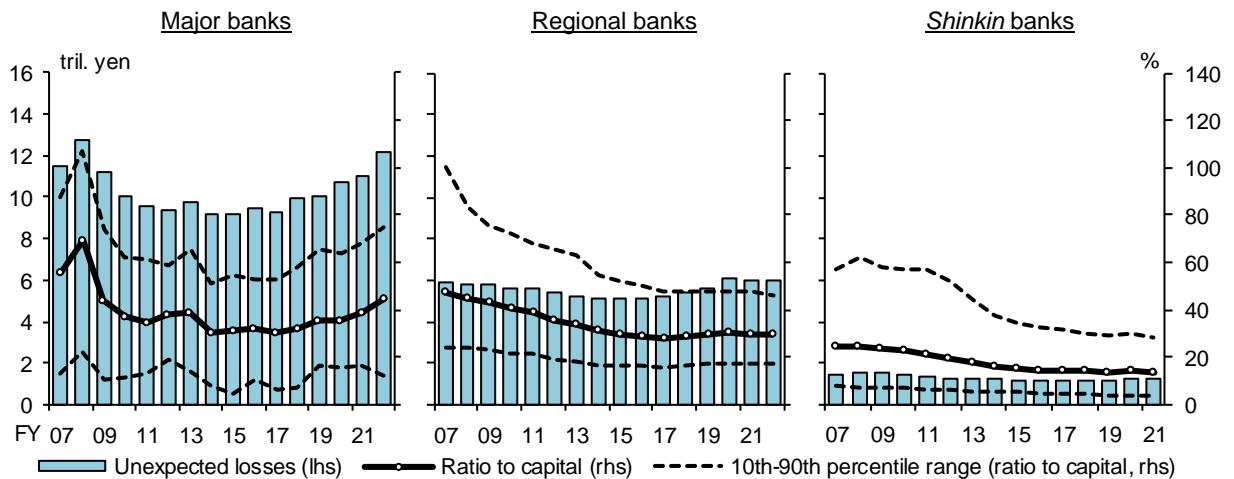
Note: The figures indicate the ratios of unsecured and unprovisioned loans classified as "need attention" and below to overall loans. Source: BOJ.

Chart IV-1-3: Credit cost ratios



Note: The latest data for "Major banks" and "Regional banks" are annualized values for the first half of fiscal 2022. Source: BOJ.

Chart IV-1-4: Unexpected losses of domestic and foreign loans



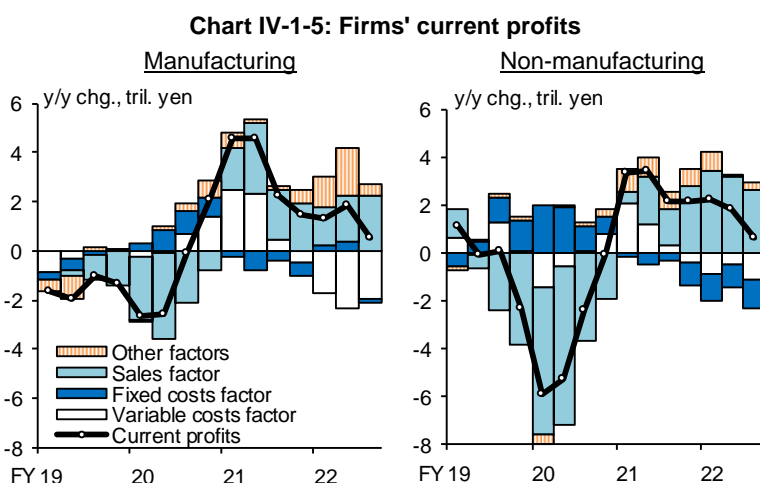
Note: Unexpected losses are the difference between the maximum amount of losses with a 99 percent confidence level and expected losses. The chart covers credit that is subject to self-assessment. Source: BOJ.

of rising energy and raw material input costs and the risk of a slowdown in foreign economies, as well as the lingering impact of the COVID-19 pandemic. Moreover, many firms have begun to repay the principal of the effectively interest-free loans that have provided strong support for firms' cash positions. Interest subsidies for these loans will gradually come to an end from fiscal 2023 onward. This section examines banks' domestic credit risks, focusing on the impact of these changes in the environment for firms' financial conditions.

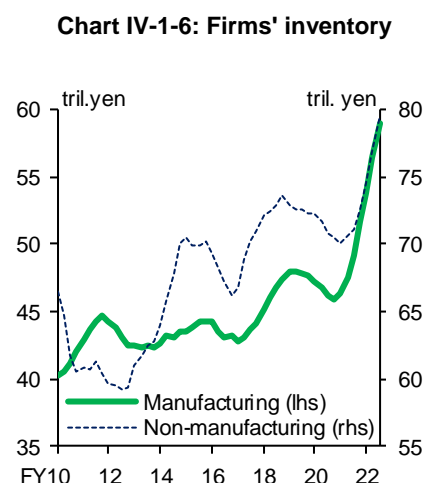
1. Risk of a deterioration in firms' financial conditions

Firms' financial conditions

With economic activity picking up, sales in a wide range of industries including face-to-face services, which were particularly hard hit by the pandemic, are recovering (Chart IV-1-5).²⁴ On the other hand, many firms, especially those in the manufacturing sector, have seen their variable costs increase, reflecting rising energy and raw material input costs. The cost of holding inventories to ensure a stable supply of goods and services is another factor adding financial pressure (Chart IV-1-6). Fixed costs, such as labor costs, are also weighing on firms' financial conditions, particularly for small and medium-sized firms in the non-manufacturing sector.



Note: 2-quarter backward moving averages. Latest data as of the October-December quarter of 2022.
Source: Ministry of Finance.



Note: 4-quarter backward moving averages. Latest data as of the October-December quarter of 2022.
Source: Ministry of Finance.

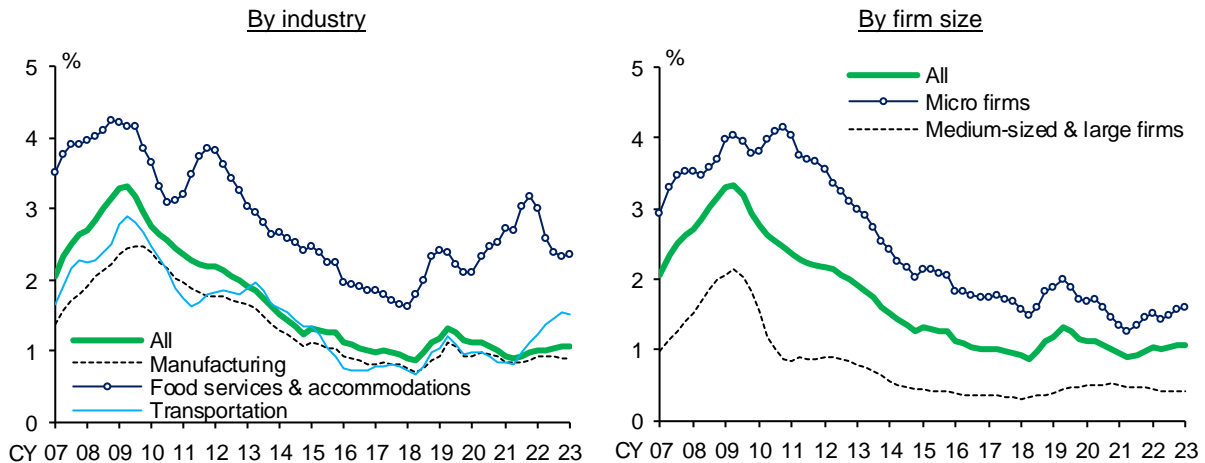
So far, firms' defaults have remained at a low level (Chart IV-1-7). By industry, the default rate in food services and accommodations, which were largely impacted by the pandemic, has already peaked. However, the default rate in the transportation industry, where it is difficult to pass on input cost increases, has been on the rise. Moreover, by firm size, while default rates among relatively large firms are at historically low levels, those among smaller firms are beginning to rise gradually.

²⁴ In Chart IV-1-5, current profits (π) are decomposed as follows:

$$\Delta\pi = \left(1 - \frac{V}{S}\right) \times \Delta S - \Delta \frac{V}{S} \times S - \Delta F,$$

where fixed costs (F) are the sum of labor costs, depreciation, and interest expenses, and variable costs (V) are the sum of the cost of sales and administrative expenses (excluding fixed costs). S represents firms' sales. The first term on the right-hand side represents "Sales factor," while the second term shows "Variable costs factor" and the third term corresponds to "Fixed costs factor." "Other factors" represents the contribution of the remaining factors, such as changes in non-operating profits as well as the residual of the above decomposition.

Chart IV-1-7: Firms' default rates

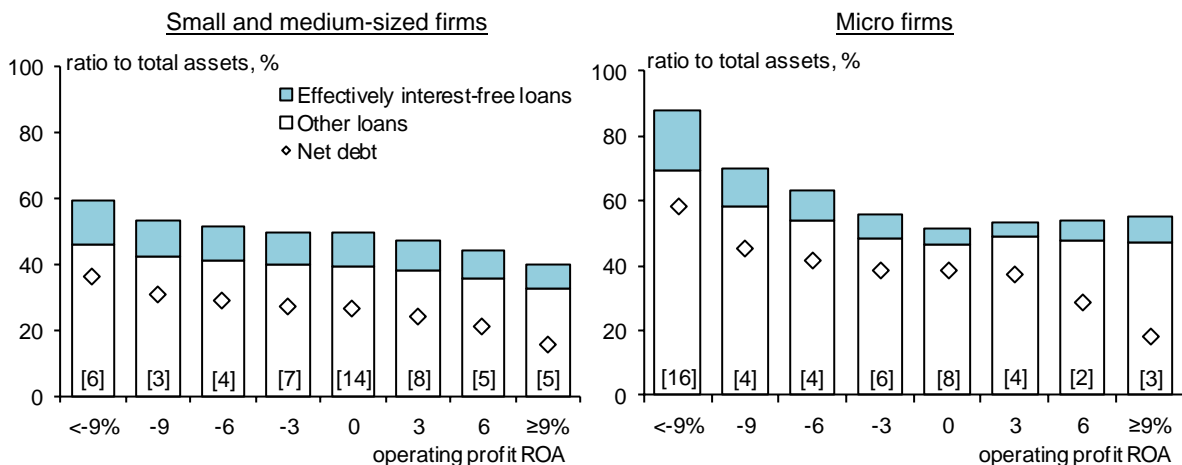


Note: 1. Default rates indicate the share of borrowers that meet the following conditions for the first time: becoming delinquent for 3 months or longer, or being downgraded to "in danger of bankruptcy" and below. Latest data as of January 2023.
 2. In the right-hand chart, "Micro firms" covers firms with sales of less than 100 million yen. "Medium-sized & large firms" covers firms with sales of 1 billion yen or more.

Source: The Risk Data Bank of Japan.

Recent trends in firms' defaults depend largely on the amount of cash reserves. Since the start of the pandemic, many SMEs (hereafter including small and medium-sized firms and micro firms) have made efforts to secure cash reserves by taking advantage of corporate financing support measures such as effectively interest-free loans. However, firms with low profit margins have been unable to halt the outflow of cash reserves. Regarding firms' balance sheets, firms with lower profit margins (operating profit ROA) have larger debt relative to total assets (Chart IV-1-8).²⁵ These firms have relatively little cash reserves and larger net debt (loans minus cash and deposits). Micro firms in particular have higher financial leverage (loans/total assets) in both gross and net terms, making them more financially vulnerable than other firms.

Chart IV-1-8: Firms' financial liabilities



Note: The charts show the ratios of financial liabilities and net debt (calculated as borrowings minus cash reserves) to total assets. The figures in brackets indicate the shares of small and medium-sized firms or micro firms in all SMEs. Data as of fiscal 2021.

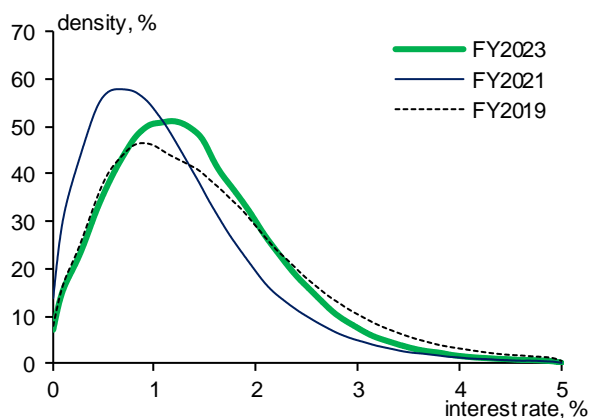
Source: CRD Association.

²⁵ The analysis in Chart IV-1-8 and the subsequent charts cover about 780,000 firms for which financial information for fiscal 2021 is available among the firms contained in the CRD Association's Credit Risk Database for SMEs. The ratio of the number of small and medium-sized firms (firms with sales of 100 million yen or more) to micro firms (firms with sales of less than 100 million yen) is roughly 1:1. The contribution of effectively interest-free loans is calculated by assuming that the entire increase in loans in fiscal 2020 consisted of such loans.

Financial risks ahead

Currently, repayments of principal have begun on nearly 60 percent of effectively interest-free loans. Repayments of principal on a further 30 percent of such loans are expected to begin by the end of fiscal 2023. In addition, as interest subsidies for these loans gradually end, interest rates paid by firms could rise to the same level as before the pandemic (Chart IV-1-9).²⁶ To examine the impact of principal and interest repayments on effectively interest-free loans, the impact of such payments on SMEs' interest payment capacity (interest coverage ratio, ICR) and liquidity buffer (cash reserves/administrative expenses) is estimated, holding all else constant.

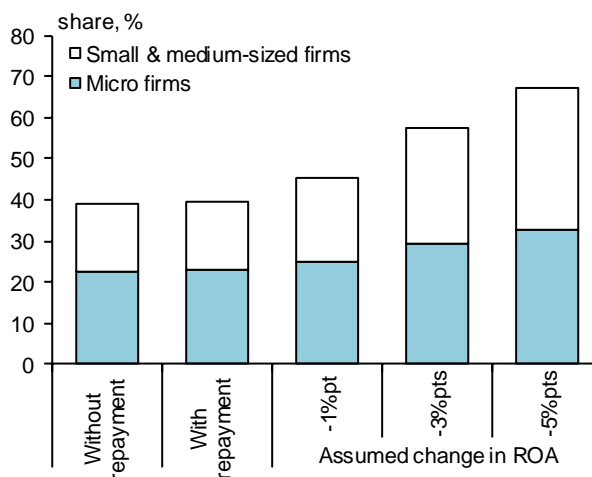
Chart IV-1-9: Distribution of SMEs' interest rates



Note: "FY2023" shows estimated values by taking into account the repayment of effectively interest-free loans.

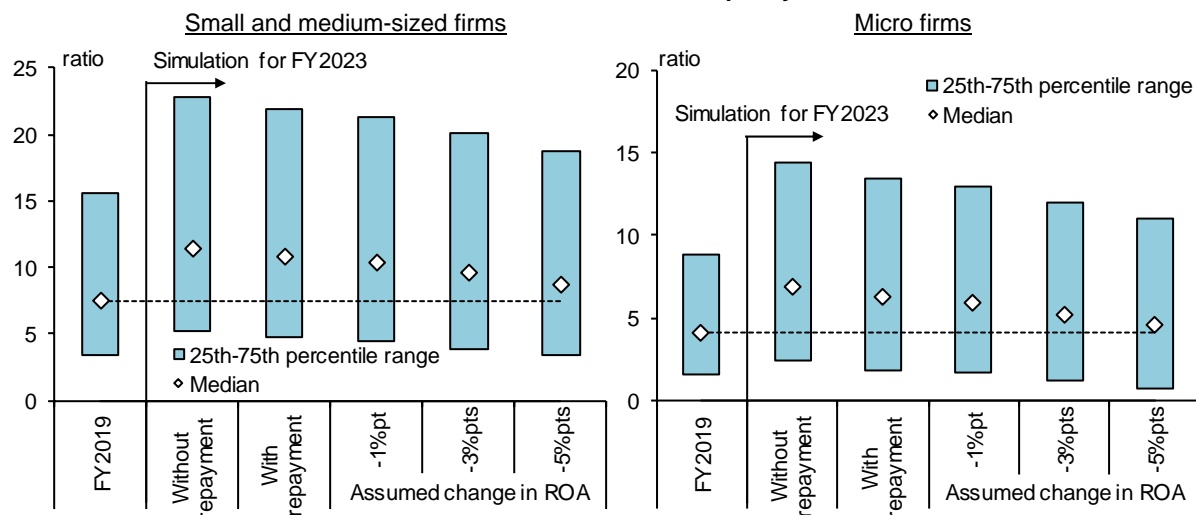
Source: CRD Association.

Chart IV-1-10: Share of firms with ICR less than 1



Source: CRD Association.

Chart IV-1-11: Distribution of liquidity buffer



Note: Liquidity buffer is calculated as the ratios of cash reserves to monthly average administrative expenses. The dotted lines indicate median values of the actual level of fiscal 2019.

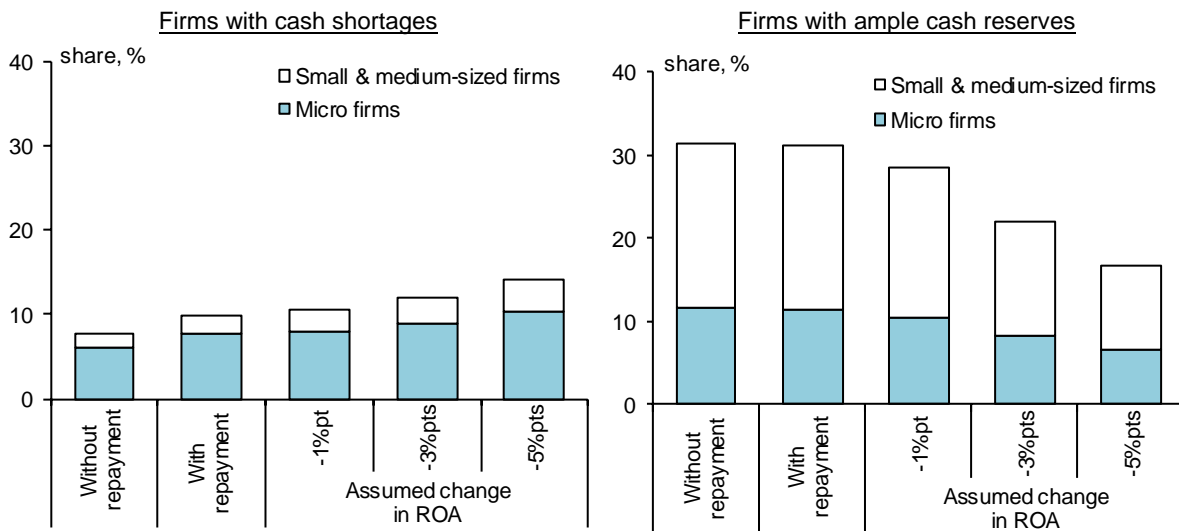
Source: CRD Association.

²⁶ For Chart IV-1-9, interest rates paid by firms are calculated by dividing firms' interest payments by their total borrowings. The impact of effectively interest-free loans is calculated by assuming that the entire increase in borrowing in fiscal 2020 consisted of such loans. Further, for simplicity, (1) a loan period of 8 years, (2) a deferment period of 3 years, and (3) an interest rate paid by firms of 1.5 percent are assumed. The same applies to the charts below.

Chart IV-1-10 shows the estimated share of firms whose ICR could fall below one -- i.e., whose interest payments would not be covered by their core business profits alone -- in fiscal 2023. In comparing the case where principal and interest repayments on effectively interest-free loans are made ("with repayment" in the chart) and the case where these are not made ("without repayment" in the chart), no significant difference is observed.²⁷ For firms as a whole, the increase in the interest payment burden due to the principal and interest repayments is limited. The impact on firms' cash reserves is also limited. The distribution of firms' liquidity buffers shows that the median of the distribution is still higher than in fiscal 2019 even when principal and interest repayments on effectively interest-free loans are made (Chart IV-1-11). More than half of the firms have liquidity buffers equal to or greater than just before the pandemic in fiscal 2019.

Firms' difficulties in passing on increases in input costs to selling prices, as well as declining sales, also weigh on their ability to repay debt and secure cash reserves. Further, to facilitate comparison across firms, an extreme situation is assumed in which firms experience a uniform decline in operating profit ROA, and the impact on their interest payment burden and cash reserves is estimated.²⁸ The estimation results show that the larger the decline in ROAs, the larger the increase in the number of firms whose ICR would fall below one (Chart IV-1-10). However, even with a deterioration in ICRs, the cash reserves secured during the pandemic remain as a buffer (Chart IV-1-11). The ample cash reserves can be expected to keep firm defaults low as a whole even in the event of stress going forward.

Chart IV-1-12: Tails of distribution of firms' cash reserves



Note: The left-hand chart indicates the share of firms whose operating cash outflow during fiscal 2023 exceeds their cash reserves at the beginning of that year. The right-hand chart indicates the share of firms with operating profits that are positive and for which the liquidity buffer after repayment of all the effectively interest-free loans is 10 times or more.

Source: CRD Association.

²⁷ In the "without repayment" case, operating profit ROAs for fiscal 2023 by industry and firm size are estimated based on the output gap (see the baseline scenario in Section B of Chapter V), and the ICR and liquidity buffer for each firm are calculated. The "with repayment" case, on the other hand, reflects the impact of principal and interest repayments on effectively interest-free loans, compared with the ICR and the liquidity buffer in the "without repayment" case.

²⁸ The assumption of an ROA decline here is purely hypothetical to examine firms' resilience and does not represent the likelihood of future events. Meanwhile, the deterioration in firms' ICRs in case of a 3 percentage point decline in their ROA is roughly equivalent to the deterioration in ICRs during the global financial crisis.

Tail risk with regard to firms' financial conditions

While firms as a whole are quite resilient to stress, there is a large degree of heterogeneity in firms' financial conditions. At the lower tail of the distribution of firms in terms of their cash reserves, when the assumed stresses materialize, there are not a few firms with cash shortages, i.e., firms whose operating cash outflow during fiscal 2023 exceeds their cash reserves at the beginning of that year (Chart IV-1-12). This is particularly pronounced for micro firms.

The size of individual loans to small and medium-sized firms and micro firms is small, thus the impact of default on banks' financial conditions would be limited. However, if the risk of default materializes due to a common event such as principal and interest repayments on effectively interest-free loans, it could have a sizeable impact. In the "with repayment" case in the left panel of Chart IV-1-12, the number of firms with cash shortages is several percentage points higher than in the "without repayment" case. Assuming an extreme situation in which all loans without credit guarantees to newly cash-shortage firms default, and further assuming a coverage ratio of 60 percent and a recovery rate for uncovered loans of 60 percent, banks' credit cost ratios could potentially be pushed up by around 0.1 percentage point. The credit costs would not necessarily be large from a macro perspective; however, it should be noted that such default risk is likely to be concentrated in smaller banks, which deal more with micro firms.^{29,30}

At the opposite tail of the distribution of firms in terms of their cash reserves, there are firms with ample cash reserves -- i.e., firms that would be able to maintain positive operating profits in the event of stress and maintain a liquidity buffer of 10 times or more even after full repayment of their effectively interest-free loans (right panel of Chart IV-1-12). These firms have two options for the future. One is to make interest payments and hold on to the borrowed funds from the effectively interest-free loans as "insurance." With the outlook highly uncertain and rising energy and raw material input costs increasing the need for working capital, it is likely that many firms will choose this option.

The other option is to prepay the effectively interest-free loans in order to decrease interest payment costs. With their operating profits recovered and no need for holding onto precautionary funds by incurring the associated costs, such firms are likely to choose this option. If more firms choose the latter option, banks' financial conditions will be affected correspondingly through a decline in corporate loans and corporate deposits. The quality of banks' loan portfolios will see relative declines as guaranteed effectively interest-free loans are repaid, and opportunities to earn interest on loans will be eroded. Moreover, the duration gap between assets and liabilities could widen for some banks (see Section D of this chapter for the impact on banks' asset and liability management). Against this background, banks need to carefully monitor developments in borrower firms' operating profits and cash reserves taking into account both corporate financing support measures and their ALM.

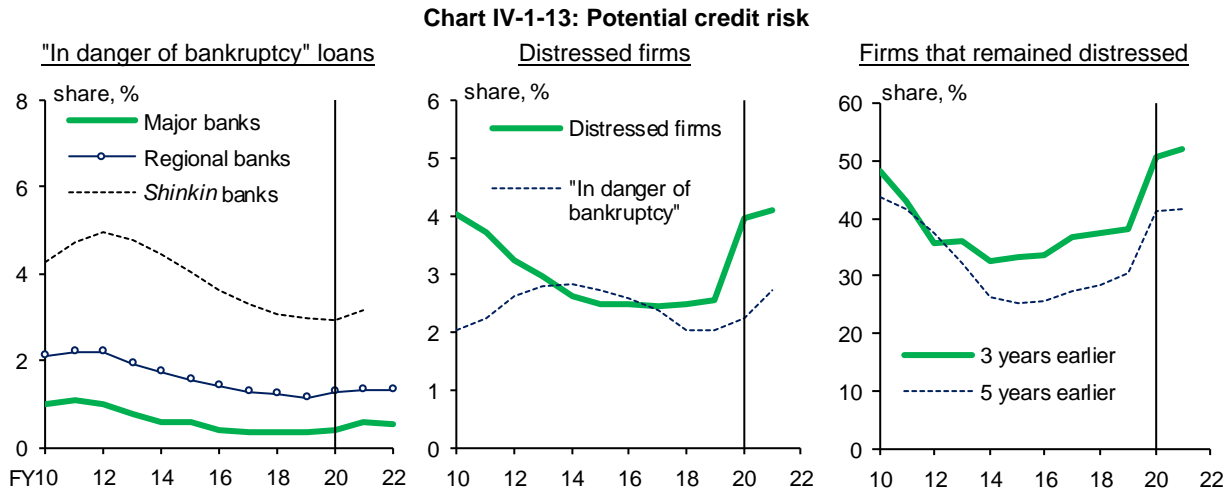
2. Potential credit risks

As mentioned, the quality of banks' loan portfolios has been maintained despite the COVID-19

²⁹ The recent level of the credit cost ratio has been around 0.1 percent (Chart IV-1-3).

³⁰ It should be noted that the estimates here do not take additional corporate financing support measures into account. In practice, a new corporate financing support measure -- the COVID-19 refinancing guarantees -- has been introduced. The use of these guarantees and other support measures is expected to help firms secure necessary funds even if they have insufficient cash reserves.

pandemic (Chart IV-1-1). A breakdown of loans by borrower classification shows that the share of loans to borrowers "in danger of bankruptcy" has been on a downward trend for a long time (left panel of Chart IV-1-13). Among borrowers categorized as "need attention" or "special attention" who have not been downgraded to "in danger of bankruptcy," however, there are not a few whose business conditions have been unfavorable since before the pandemic.³¹ The presence of such borrowers poses a potential credit risk. Without a turnaround at these firms, it will be difficult for banks to maintain the quality of their loan portfolios into the future. Against this background, the following examines potential credit risks that are not necessarily captured by banks' borrower classification.



Note: 1. In the left-hand chart, the latest data for "Major banks" and "Regional banks" are as of end-September 2022 and the latest data for "Shinkin banks" are as of end-March 2022. The latest data for the middle and right-hand charts are as of fiscal 2021.
 2. The right-hand chart shows the share of firms classified as distressed at each point in time when they were classified in the same category three or five years earlier.
 3. The vertical lines indicate the beginning of the pandemic.
 Source: CRD association, BOJ.

In this section, firms that are both insolvent and are making operating losses are referred to as "distressed" firms.³² The share of distressed firms did not decline during the 2010s, when the economy was improving prior to the pandemic, but instead was unchanged (middle panel of Chart IV-1-13). Rather, once firms become distressed, it is difficult for them to get out of that situation. The share of firms that continued to be distressed was on a gradual upward trend before the start of the pandemic (right panel of Chart IV-1-13).

The financial conditions of firms that have been financially distressed for a prolonged period of time are prone to a vicious cycle (Chart IV-1-14). First, the profit margins of distressed firms on average are lower than those of other firms, and their operating cash flows are unstable. In the late 2010s, the profit margins of distressed firms were on a downward trend even when those of many other firms continued to improve. Second, the unstable operating cash flow tends to make firms more dependent on additional financing. As a result, their financial leverage remains high, and their interest payment burden is on an uptrend. Even compared to firms classified as "in danger of bankruptcy," distressed firms have a high leverage and low ICR. Third, for distressed firms, the

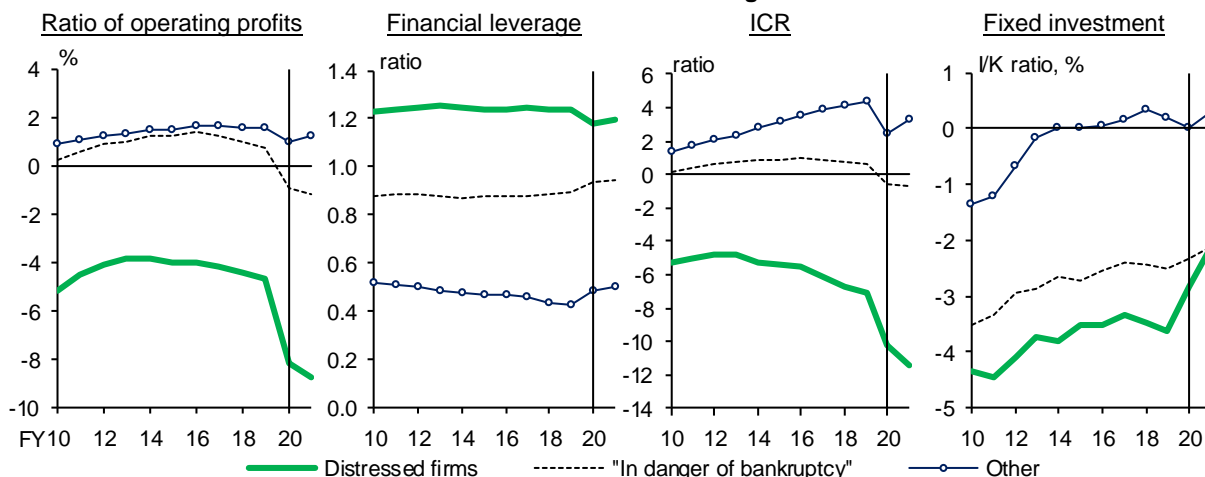
³¹ From the perspective of ensuring a wide range of options for corporate support, in some cases, banks do not downgrade firms to "in danger of bankruptcy" even if their business conditions are unfavorable.

³² Operating profit ROA can be decomposed into the asset turnover ratio (sales/total assets) and the ratio of operating profits to sales (operating profits/sales). Thus, firms that are making operating losses refer to those with a negative ratio of operating profits to sales for which value added (gross profits) is smaller than administrative expenses.

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

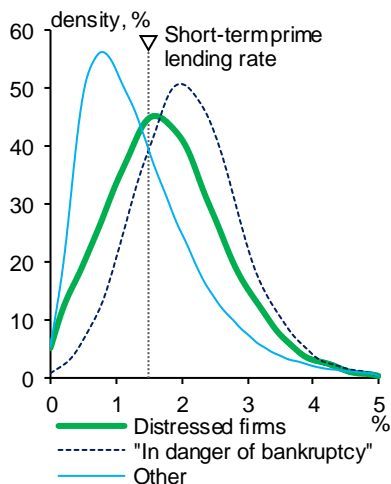
priority is to secure working capital, including for interest payments, making it difficult to allocate funds to make proactive investments. Their fixed investment is, therefore, substantially lower than that of other firms. Since such firms put off making proactive investments, they struggle to improve the core profitability (operating cash flow).

Chart IV-1-14: Financial indicators among distressed firms



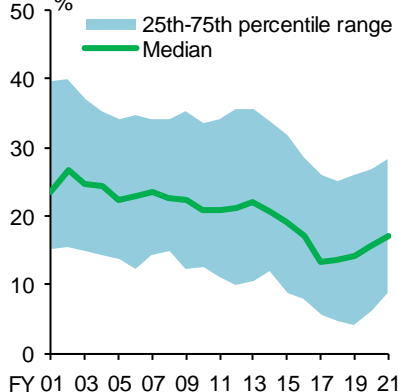
Note: Financial leverage is the ratio of borrowings to total assets. ICR = (operating profits + interest and dividends received) / interest payments. Investment (I) is calculated as the change (ΔK) in fixed assets (K) from the previous year. The charts show the median values. The vertical lines indicate the beginning of the pandemic. Latest data as of fiscal 2021.
Source: CRD Association.

Chart IV-1-15: Distribution of loan interest rates



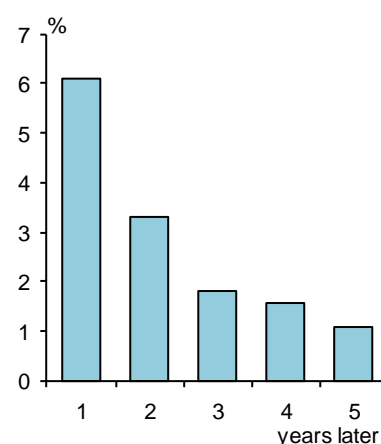
Note: As of fiscal 2021.
Source: CRD Association.

Chart IV-1-16: Distribution of loan-loss provision ratios for "special attention" loans



Note: The ratios of loan-loss provisions to unsecured "special attention" loans. Covers regional and *shinkin* banks.
Source: BOJ.

Chart IV-1-17: Probability of turnaround for distressed firms



Note: The share of firms that remained distressed for 2 years and then turned around from the third year ("1 year later" in the chart) onward. The observation period is from fiscal 2010 to 2019.
Source: CRD Association.

Banks need to strengthen their credit risk management and support for these firms with high potential credit risk. Among distressed firms, there are some for which it is difficult for banks to set interest rates commensurate with their credit risk. The relationship between interest rates and credit risk shows that nearly half of distressed firms pay interest rates below the short-term prime lending rate (Chart IV-1-15).³³ Among distressed firms with higher financial leverage and lower ICRs than

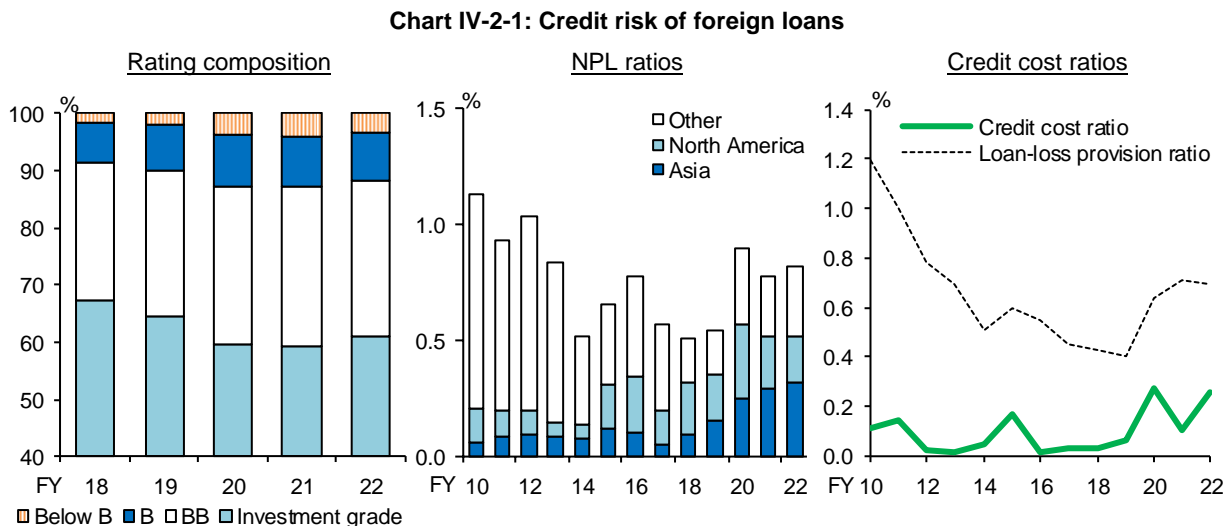
³³ Chart IV-1-15 shows the short-term prime lending rate as an indicator of the most favorable lending rate.

firms classified as "in danger of bankruptcy," there are quite a few who pay interest rates as low as those of firms "in danger of bankruptcy." Moreover, some banks have significantly lowered their loan-loss provision ratios for firms categorized as "special attention," reflecting the low number of distressed firms that have been downgraded (Chart IV-1-16). In fact, some have loan-loss provision ratios below 10 percent.

As mentioned, borrower firms will start to make interest payments on effectively interest-free loans in fiscal 2023. In order to improve firms' financial conditions, banks need to seize this opportunity to strengthen their support for borrowers' core business. The longer firms continue to be financially distressed, the lower the likelihood that their financial conditions will improve (Chart IV-1-17).³⁴ In other words, the longer firms continue to be distressed, the more their profit margins and ICRs deteriorate, and the more difficult it becomes to turn themselves around (Chart IV-1-14). Many banks are already engaged in providing support to firms to improve their business conditions. Going forward, it is important for banks to continue to provide support, including not only funding but also support for borrowers' core business, in accordance with each borrower firm's condition. In addition, banks should examine their loan-loss provisions as necessary.

B. Foreign credit risk

Foreign credit risk has remained low even amid the global tightening of financial conditions (Chart IV-2-1). While foreign loans have been on an uptrend, particularly to the Americas, as major banks have strived to expand their international business, the share of non-investment grade (non-IG) loans has remained at around 40 percent. Downgrades of borrowers due to an increase in firms' interest payments have been limited to date. Non-performing loan (NPL) ratios and credit cost ratios have been flat even after the downgrading of a major real estate developer, due to the sluggish Chinese real estate market, is taken into account. Loan-loss provisions in the past few years have remained at relatively high levels.



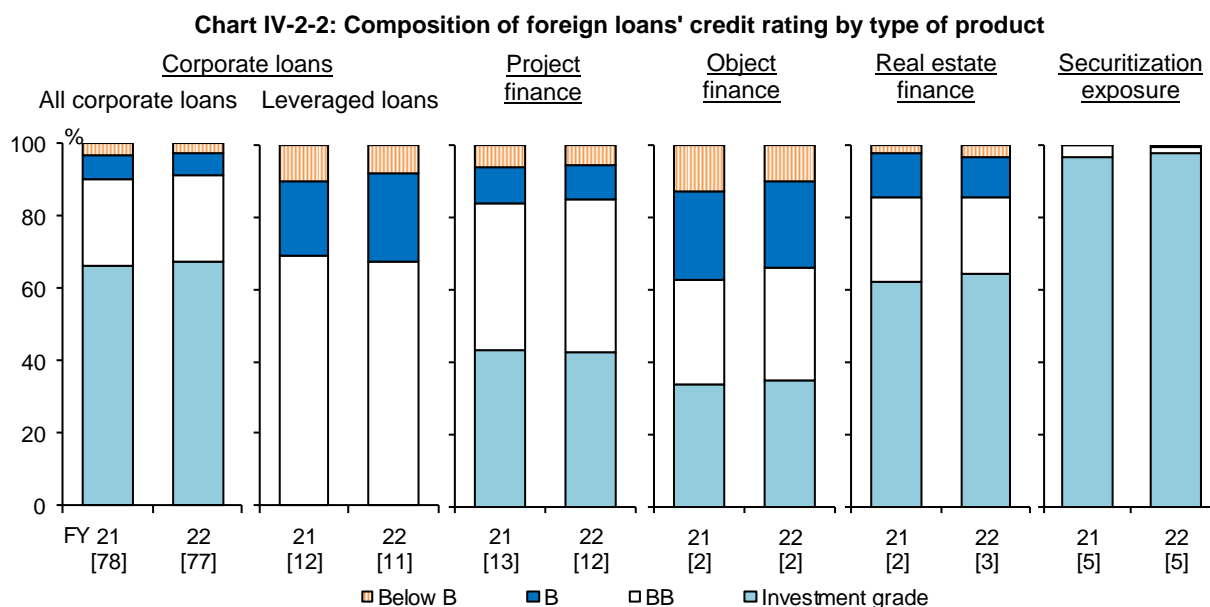
- Note: 1. The left-hand chart covers the three major banks (based on the internal rating of each bank). Latest data as of the first half of fiscal 2022.
 2. The middle chart covers the three major banks (on a non-consolidated basis). Latest data as of the first half of fiscal 2022.
 3. The right-hand chart covers the international business of the three major banks (on a non-consolidated basis). Latest data as of the first half of fiscal 2022.

Source: Published accounts of each bank; BOJ.

³⁴ Firms whose financial conditions deteriorated due to a temporary downturn in sales have a higher probability of turning themselves around quickly. To remove this effect and confirm the underlying pattern, for Chart IV-1-17 the probability of turnaround was calculated for firms that have been financially distressed for multiple years.

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

There has been no major change in the credit risk of foreign loans by type of product (Chart IV-2-2). IG loans have continued to account for almost 70 percent of corporate loans on the whole, although the share of B-rated leveraged loans has increased somewhat. Regarding project finance loans and object finance loans, which entail relatively high risk, the share of IG loans is unchanged. Additional downgrades of Russia-related loans to the energy as well as electricity and gas industries have been limited.



Note: "FY21" and "FY22" indicate the second half of fiscal 2021 and the first half of fiscal 2022, respectively. Figures in brackets indicate the share of the respective product types at each time point. The chart covers major banks, Japan Post Bank, and a central organization of financial cooperatives.
 Source: BOJ.

1. Changes in foreign loan portfolios

The environment surrounding the foreign loan market has changed significantly, as seen in the rise in foreign interest rates and resultant growing concerns about a slowdown in foreign economies. These changes have also affected major banks' foreign loan portfolios. While the share of IG loans among foreign loans has remained high, there have been some changes in the risk profiles of foreign loans, such as changes in the composition of loans, an improvement in lending-deposit interest margins, and an increasing trend to larger loans and loan concentration.

Changes in the composition of loans

First, banks have changed the composition of loans to reduce risks. The moderate downtrend in the share of IG loans has come to a halt recently (Chart IV-2-1). The increase in foreign loans over the past few years was mainly driven by relatively low-rated loans such as leveraged loans and loans to investment funds. In contrast, more recently, the driving force behind increases in foreign loans has been loans for working capital to IG firms in the United States and Europe, reflecting the rise in raw material input costs and labor costs (Chart III-1-14). In addition, some firms shifted from market funding to borrowing, partly because the rise in interest rates in the loan market was smaller than that in the bond market.

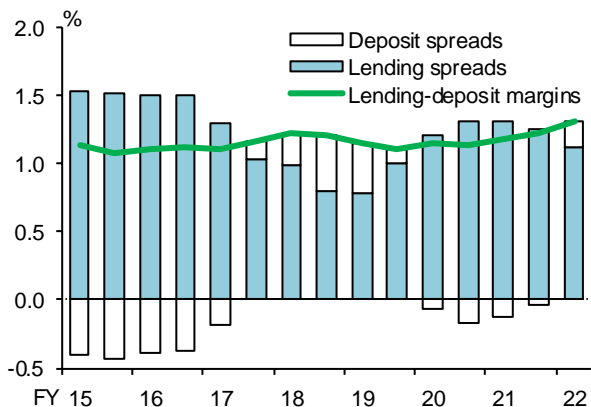
While major banks have been active in meeting demand for funds, particularly from the United States and Europe, they have been somewhat cautious in their risk-taking amid concerns over the risk of a slowdown in foreign economies. With regard to leveraged loans, which until recently had

been the driving force behind increases in foreign loans, major banks have been reluctant to extend new loans as it has become more difficult to sell loans in the secondary market. They have also been reluctant with regard to loans to the Chinese economy and its peripheral economies, where adjustment pressure remains in the real estate market and there are concerns over frictions with the United States. Major banks therefore have become more selective in their foreign lending.

Improvement in lending-deposit interest margins

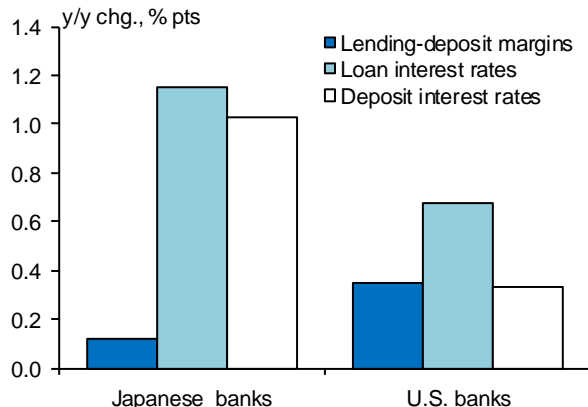
Second, lending-deposit interest margins have improved somewhat together with the rise in market interest rates (Chart IV-2-3). About 90 percent of foreign loans consist of floating-rate loans, and base rates for these floating-rate loans have risen in line with short-term market interest rates. Lending spreads (loan interest rates minus base rates) have remained at a somewhat high level, although an increase in short-term loans with a relatively high rating has put downward pressure on the spreads. Meanwhile, deposit spreads (base rates minus deposit interest rates) have widened. The increase in deposit interest rates paid by Japanese banks has been smaller than that in market interest rates, partly because U.S. banks have kept their deposit interest rates low (see Section D of this chapter).³⁵ The improvement in lending-deposit interest margins has led to an improvement in profit buffers, which represent one element of banks' loss-absorbing capacity.

Chart IV-2-3: Foreign lending-deposit interest margins



Note: 1. Deposit/lending spreads respectively are the differences between deposit/lending rates and base rates (the U.S. 3-month rate).
 2. Covers the international business of the three major banks (on a non-consolidated basis).
 Source: FRB; BOJ.

Chart IV-2-4: Comparison of lending-deposit interest rates



Note: "Japanese banks" refers to the three major banks, while "U.S. banks" consists of Bank of America, Citigroup, and J.P. Morgan Chase. The chart shows the year-on-year changes from April-September 2021 to April-September 2022.
 Source: FFIEC; BOJ.

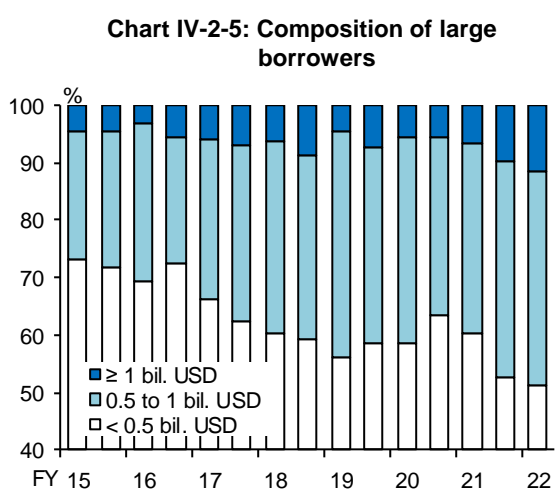
Such improvement in lending-deposit interest margins associated with the rise in market interest rates has been observed not only among Japanese banks but also among banks around the world. However, there are differences in the degree to which lending-deposit interest margins have improved. Comparing the deposit and loan interest rates of the three major Japanese banks with those of the three major U.S. banks, the rise in loan interest rates of Japanese banks has been larger than that of their U.S. counterparts, partly because Japanese banks have reviewed loans to low-return borrowers (Chart IV-2-4). The rise in Japanese banks' deposit interest rates is also larger than that of U.S. banks. On the other hand, U.S. banks have been restraining the pass-through of market interest rates to deposit interest rates during the current phase of rising interest rates. As a

³⁵ In the U.S. deposit market, strategic complementarity regarding the setting of deposit interest rates is at play, where Japanese banks are unlikely to lose customers even if they follow the lead of U.S. banks in keeping deposit interest rates low. This situation helps Japanese banks maintain their lending-deposit interest margins.

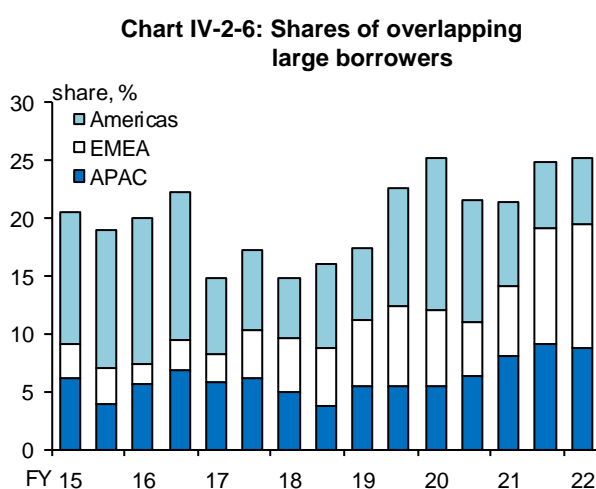
result, the positive impact of the improvement in lending-deposit interest margins on net interest income has been larger for U.S. banks.

Trend to larger loans and loan concentration

Third, some foreign loans have become larger. Looking at the loan amount per large borrower, the share of relatively large borrowers has increased (Chart IV-2-5).³⁶ Borrowers with loans of 1 billion U.S. dollars or more now account for 10 percent of all large borrowers. The trend toward larger loans has been driven by the fact that major banks, in order to strengthen their relationships with their clients, have been actively responding to the loan demand of commodity traders and investment funds. More recently, additional borrowing and committed line drawdowns reflecting borrowers' growing demand for working capital have also contributed to the trend toward larger loans per borrower.



Note: Covers the three major banks' large borrowers (non-Japanese firms). Latest data as of the first half of fiscal 2022.
 Source: BOJ.



Note: The chart shows the shares of outstanding loans to large borrowers that overlap for all three major banks. Covers the three major banks' large borrowers. Latest data as of the first half of fiscal 2022.
 Source: BOJ.

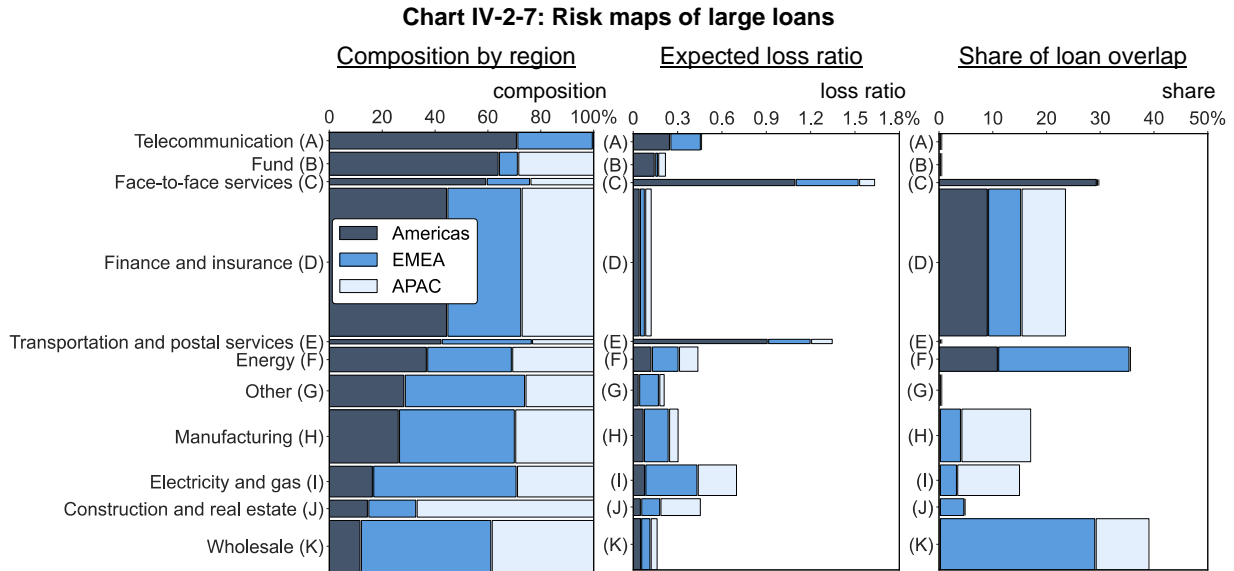
Meanwhile, there has been an increase in the number of borrowers overlapping among major banks. Larger loans have been made to these overlapping borrowers, increasing common exposures among major banks (Chart IV-2-6). While the increase in common exposures in loans to the Americas is limited, where the loan portfolios are relatively more diversified, it is pronounced in loans to the Europe, Middle East, and Africa (EMEA) and Asia-Pacific (APAC) regions, where loan portfolios are becoming more homogeneous. Individually, these loans fall within the exposure limits set by each bank and are therefore unlikely to pose a direct problem to banks' financial soundness; however, attention needs to be paid to the fact that when such large loans represent common exposures, in response to a foreign shock, the loan portfolios of major banks are more likely to be interconnected and the impact on the financial system to be greater.

2. Risks associated with large loans

Chart IV-2-7 presents a risk map that visualizes the risks associated with large loans for the three

³⁶ The analyses in Chart IV-2-5 and onward target the pre-identified large borrowers of the three major banks. Therefore, the increasing size of large loans discussed in this section strictly refers to the increasing size of large foreign loans, rather than to the increasing size of total foreign loans.

major banks. The vertical axis of this risk map shows the industry composition of loans outstanding. The horizontal axis shows, starting from the left, the regional composition of loans outstanding, the expected loss ratio, and the rate of loan overlap.³⁷ The different shades of blue in the panels show the contribution of the three regions, respectively.



Note: 1. The vertical axis in each chart shows the industry composition of the three major banks' outstanding loans to large borrowers. Data as of the first half of fiscal 2022.
 2. "Finance and insurance" excludes banks and investment funds.
 Source: Moody's; S&P Global Market Intelligence; The Global Credit Data Consortium, "LGD Report 2020: Large Corporate Borrowers"; BOJ.

The risk map shows that concentration of large borrowers varies by region, as can be seen in the left panel on the regional composition of loans outstanding. In the Americas, investment funds and borrowers providing face-to-face services account for substantial shares of large loans; in the EMEA region, borrowers in the electricity and gas as well as wholesale industries (commodity traders) account for large shares; in the APAC region, borrowers in the construction and real estate industry account for large shares.

Risk characteristics of loans to the Americas

The expected loss ratio for loans to borrowers in the face-to-face services industry in the Americas is considerably higher than that for borrowers in other regions and industries, and the rate of loan overlap among major banks is high (Chart IV-2-7). Seventy percent of this lending is provided through leveraged loans (Chart IV-2-8). In other words, among major banks' large borrowers, there are quite a few borrowers with high financial leverage and a low credit rating.

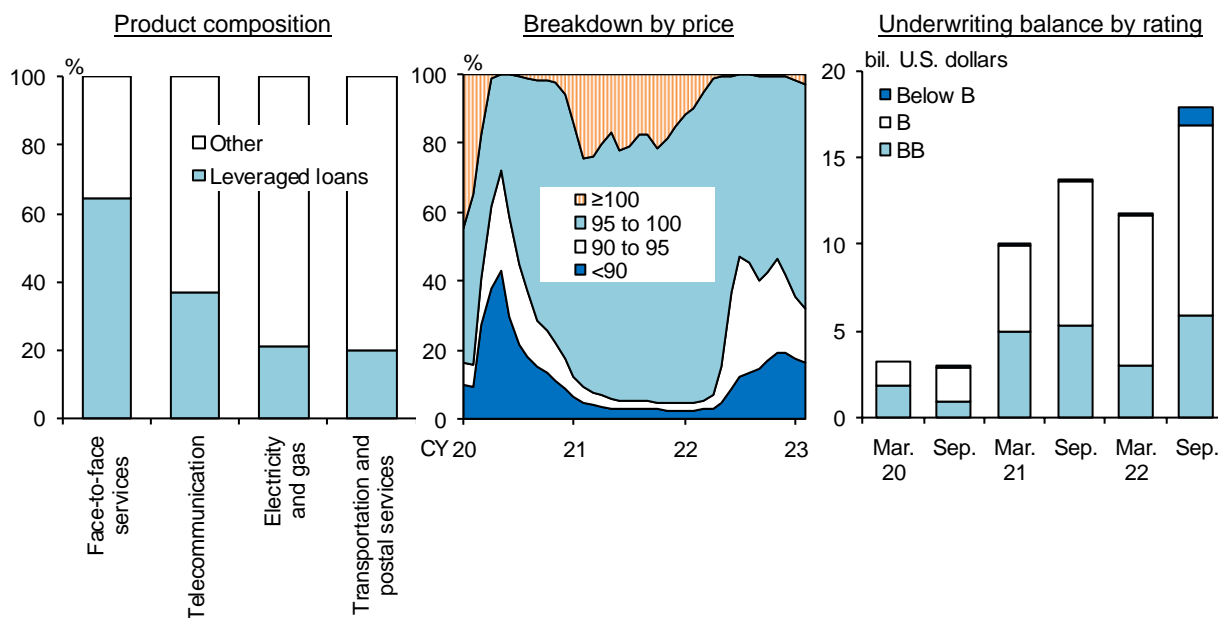
Especially in the Americas, major banks have been focusing on LBO financing for investment funds. In such lending, the loan amount per borrower is large and competition among banks is fierce. As major banks' presence in the market has grown, so has the size of their loans per investment fund. Although, due in part to their selective stance on lending, the expected loss ratio is not high, the

³⁷ Expected losses were calculated by determining whether borrowers would default using Monte Carlo simulations with 1 million iterations and then aggregating the losses for defaulted borrowers (loans outstanding multiplied by the loss given default). The loss given default was assumed to be 24 percent, which is the average level of major foreign banks, and the correlation coefficient with macro factors was assumed to be 0.24, which is the value used in the internal ratings-based approach when measuring credit risk-weighted assets. Moreover, the probability of default thresholds by rating category are based on the averages for 2000-2022 obtained from Moody's.

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

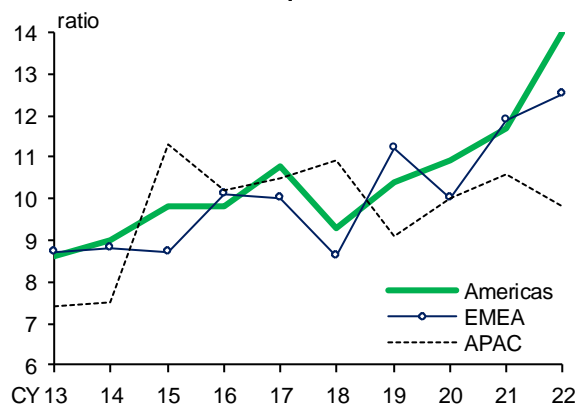
leveraged loan market has seen an increasing number of cases in which leveraged loan prices have fallen 10 percent or more on the back of concerns over a deterioration in firms' performance. Among leveraged loans originated by major banks, there were some that could not be sold as originally planned.

Chart IV-2-8: Leveraged loan market



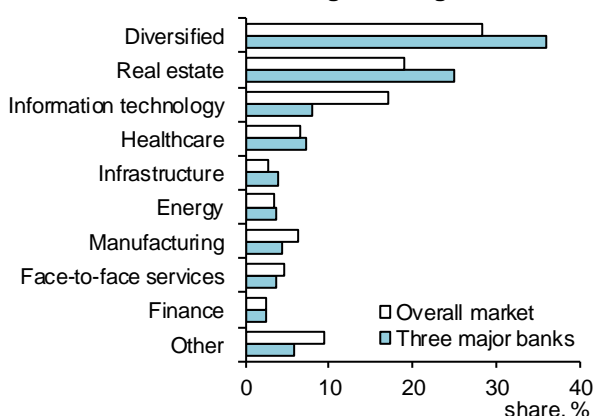
Note: 1. The left-hand chart covers the three major banks' large borrowers. "Leveraged loans" consists of the syndicated loan offerings where the three major banks acted as lead banks. Data as of September 2022.
 2. The middle chart covers the index components of leveraged loan prices in the secondary markets (3-month backward moving averages). Latest data as of February 2023.
 3. The right-hand chart covers the three major banks (based on the internal rating of each bank).
 Source: Dealogic; LCD, an offering of PitchBook Data; BOJ.

Chart IV-2-9: Enterprise value of acquired firms



Note: Shows the median values of enterprise value/EBITDA of buyout deals. Enterprise value is calculated as equity value + net debt (interest-bearing debt - cash and cash equivalents). Latest data as of January-September 2022.
 Source: Preqin.

Chart IV-2-10: Industry composition of the major banks' foreign lending to funds



Note: "Three major banks" covers the three major banks' large borrower funds. Shares are calculated on the basis of the number of investment funds.
 Source: Preqin; BOJ.

Major banks' loans to investment funds have been primarily in the form of subscription financing, a form of committed lines of credit; however, as they expand their business with investment funds, they have also increasingly been providing net asset value (NAV) financing and direct loans, which

entail relatively high risk.³⁸ In the market for buyouts, which constitute the majority of investment deals for private funds, competition for deals has led to higher acquisition prices and an increase in highly leveraged deals (Chart IV-2-9). These deals with high financial leverage and low credit ratings are vulnerable to rising interest rates and a slowdown in the economy. Further, it is important to note that the three major banks' loans to investment funds are concentrated in real estate funds, compared with the share of real estate funds in all investment funds (Chart IV-2-10). Through the channel of the common exposures of the three major banks, Japan's financial system has become more likely to be affected by the ongoing repricing of real estate in the United States and Europe.

Risk characteristics of loans to Europe and Asia

Regarding loans in the EMEA region, there is a pronounced concentration in large loans to commodity traders, which are classified as wholesalers in Chart IV-2-7. Commodity trading is concentrated in two senses: first, it is concentrated among a few dozen major commodity traders, and second, lending to these commodity traders is concentrated among Asian financial institutions, including Japanese banks.³⁹ Although major banks' expected loss ratios with regard to loans to commodity traders are not necessarily high, this is the area with the highest overlap in lending on a regional and on an industry basis. Moreover, this is also the area in which stress was concentrated among a number of financial institutions, including Japanese banks, during the commodity price hikes in spring 2022, when committed credit lines were drawn down. With geopolitical risks remaining high, monitoring of credit and liquidity risks stemming from commodity traders will continue to be important.

Meanwhile, in the APAC region, loans to the construction and real estate industry make up a substantial share of large loans (Chart IV-2-7). Seventy percent of large loans to the construction and real estate industry go to the APAC region, and the expected loss ratio is relatively high. Reflecting the slow recovery of the Chinese real estate market, major banks have been cautious about lending to major real estate developers in Hong Kong and Singapore that are involved in the real estate business in China. However, they have already built up a substantial amount of large loans to the construction and real estate industry. Against this background, major banks will be expected to manage their credit exposure while keeping an eye on the financial, economic, and political situation.

Economic fluctuations and firms' financial risks

The credit risk associated with large foreign loans has increased somewhat due to the growing trend toward larger loans and the downgrading of some firms. Expected loss ratios have risen, especially in the EMEA region (Chart IV-2-11). Looking at borrowers overall, strong sales have prevented a deterioration in ICRs even as funding costs have risen. However, the percentage of firms with an ICR of less than one -- i.e., firms that cannot cover their interest payments with their profits from core business alone -- has been rising (Chart IV-2-12). If there is a substantial economic slowdown going forward, putting downward pressure on firms' profits (return on assets, ROA), a further deterioration in ICRs is inevitable. In such a case, the probability of default (PD) would be likely to rise since large borrowers of major banks tend to have relatively high financial leverage.⁴⁰

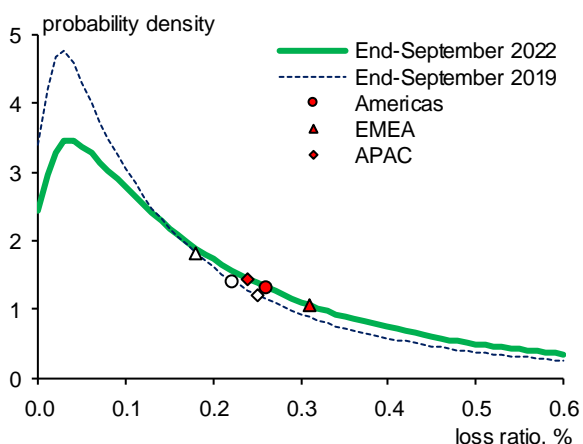
³⁸ Subscription financing is a type of bridge funding provided until a fund receives the invested funds from investors, NAV financing is a form of asset-based lending and refers to loans such as acquisition financing up to a fund's total net assets, and direct lending refers to lending to funds that provide loans to small and medium-sized firms.

³⁹ For details, see Box 2 in the October 2022 issue of the *Report*.

⁴⁰ Highly leveraged firms make up a larger share in the number of large borrowers of major banks than in global firms with total assets of 1 billion U.S. dollars or more.

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

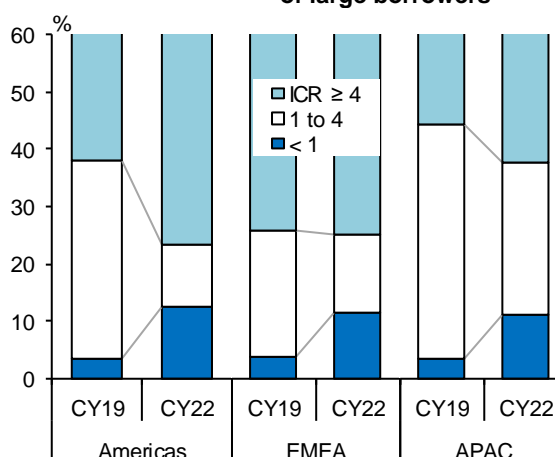
Chart IV-2-11: Expected losses of large loans



Note: Shows the distribution of loss ratios (losses/loans outstanding) of the three major banks' large loans. The markers indicate the expected loss ratios for each region.

Source: Moody's; The Global Credit Data Consortium, "LGD Report 2020: Large Corporate Borrowers"; BOJ.

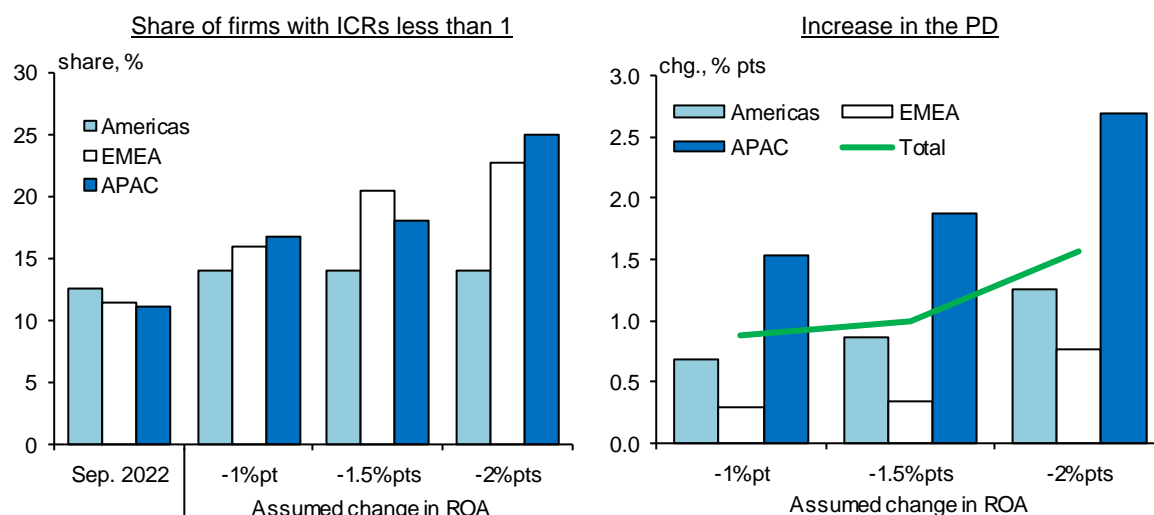
Chart IV-2-12: ICR composition of large borrowers



Note: "CY19" and "CY22" indicate December 2019 and September 2022, respectively. Covers the three major banks' large borrowers (non-Japanese firms).

Source: S&P Global Market Intelligence; BOJ.

Chart IV-2-13: ICR and PD



Note: The left-hand chart shows the share of firms with ICRs less than 1 under the assumed ROA decline. The right-hand chart shows the top 25 percentile points in terms of the increase in the PD under the assumptions.

Source: S&P Global Market Intelligence; BOJ.

Thus motivated, the impact of a deterioration in large borrowers' ROA on borrowers' ICR and PD is examined (Chart IV-2-13).^{41,42} The estimation results presented in the chart show that the extent to which ICRs would deteriorate differs by region. The ICRs of large borrowers in the Americas are relatively robust to a shock, partly because their interest payments relative to their operating cash flow are small. Conversely, in the APAC region, where borrowers' interest payments relative to their

⁴¹ The assumption of a decline in borrowers' ROA here is purely hypothetical to examine firms' resilience and does not represent the likelihood of future events. Meanwhile, a 2 percentage point decline in borrowers' ROA is roughly equivalent to the ROA shock experienced during the global financial crisis.

⁴² The right panel of Chart IV-2-13 shows the results of estimating the impact of a deterioration in borrowers' ROA and the resultant worsening of their ICR on the probability distribution of firms' credit ratings using a rating classification model based on machine learning techniques (gradient boosting decision tree). For details of the model, see Hashimoto, R., Miura, K., and Yoshizaki, Y., "Application of Machine Learning to a Credit Rating Classification Model: Techniques for Improving the Explainability of Machine Learning," Bank of Japan Working Paper, no. 23-E-6, April 2023.

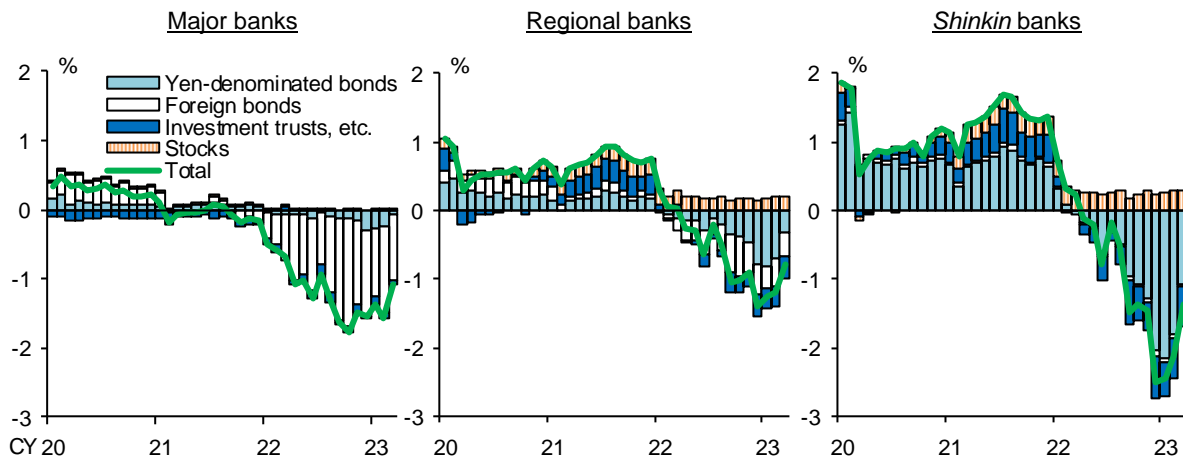
operating cash flow are generally high, the share of borrowers whose ICR falls below one would rise significantly.

Mirroring these regional differences in ICRs, it is particularly in the APAC region that the PD would increase. The higher firms' financial leverage, the more their PD tends to rise when their ICR deteriorates. Among large borrowers in the APAC region, there is a high concentration of firms with high financial leverage and an ICR that is low to begin with. Moreover, there is a large overlap in loans to these borrowers among major banks. Therefore, amid concerns about the risk of an economic slowdown, banks continue to need refined credit risk management that takes into account the risk-return balance, including decisions on additional loans and forward-looking management of existing loans, especially with regard to highly leveraged firms.

C. Market risk associated with securities investment

Banks' securities portfolios show that valuation losses on securities (including held-to-maturity securities and excluding strategic stockholdings) have increased for all types of banks (Chart IV-3-1). Reflecting the rise in foreign and domestic interest rates, market risk has materialized in the form of valuation losses on foreign bonds, foreign bond investment trusts, and yen-denominated bonds. Although valuation losses have declined since this March, partly due to the fall in domestic interest rates, they could increase again depending on developments in foreign interest rates and the resulting repricing of risky assets (see Section A of Chapter II). On the other hand, valuation losses could decrease if foreign interest rates decline. Against this background, this section examines changes in banks' market risk profiles caused by market fluctuations and the rebalancing of their securities portfolios, focusing in particular on yen and foreign currency interest rate risk (see Box 1 on banks' resilience to valuation losses on securities holdings and Section D of this chapter and Box 4 on the interest rate sensitivity of the entire banking book).

Chart IV-3-1: Valuation gains/losses on securities holdings



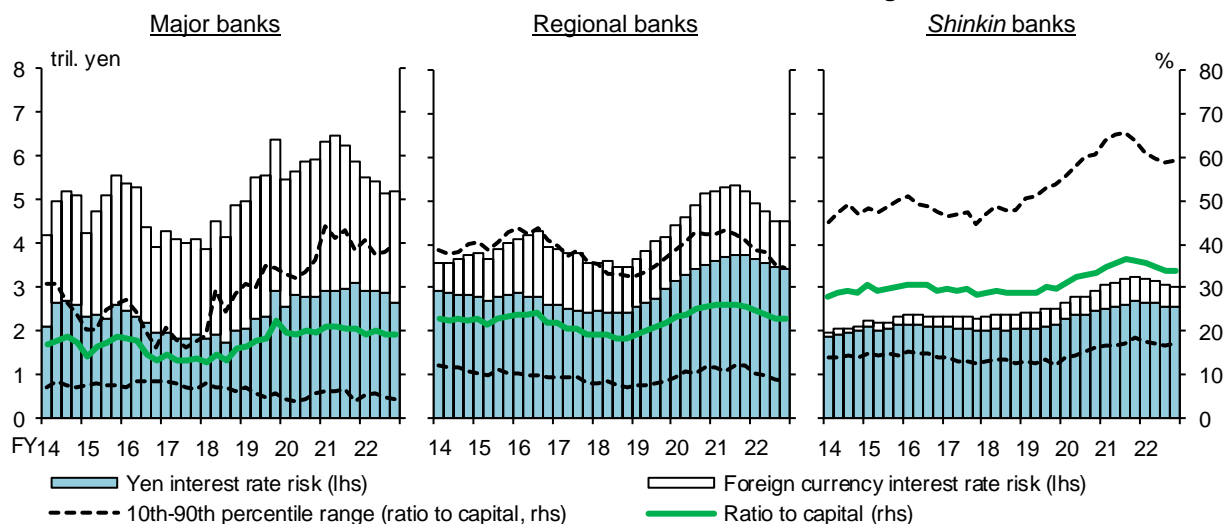
Note: The ratio of valuation gains/losses on securities (including held-to-maturity securities and excluding strategic stockholdings) to risk-weighted assets. Latest data are estimated based on interest rates as of end-March 2023. Latest data for "Stocks" and "Investment trusts, etc." are imputed by the values as of February 2023.
Source: BOJ.

1. Interest rate risk

To start with, the amount of interest rate risk associated with banks' securities investment is examined, where the risk is measured in terms of the 100 basis point value (BPV) for yen interest rate risk and the 200 BPV for foreign currency interest rate risk. Chart IV-3-2 shows that, amid

concerns over rising interest rates, foreign currency interest rate risk has been on a clear declining trend not only for major banks but also for regional and *shinkin* banks.⁴³ Yen interest rate risk, which had been on an uptrend, has also started to decline. As a result, the ratio of the amount of interest rate risk to the amount of capital has been around 20 percent for major banks, around 25 percent for regional banks, and around 35 percent for *shinkin* banks. However, for some banks, the ratio is significantly above the average of banks of the same type.⁴⁴

Chart IV-3-2: Interest rate risk of securities holdings



Note: 1. "Yen interest rate risk" is a 100 BPV. "Foreign currency interest rate risk" is a 200 BPV. Off-balance-sheet transactions are included for foreign currency interest rate risk. Latest data as of end-February 2023.

2. "Ratio to capital" is calculated using CET1 capital for internationally active banks and core capital for domestic banks (excluding the transitional arrangements).

Source: BOJ.

Rebalancing of interest-rate portfolios

The portfolio rebalancing strategies with respect to interest rate risk that banks can take differ depending on their outlook for interest rates and risk position at the time. For example, if a rise in interest rates is not expected to last for long and there is no major risk of negative interest margins, the basic strategy would be to maintain current positions. In that case, a temporary increase in valuation losses would be avoided by hedging against the risk of higher interest rates. Moreover, by adding higher yielding products to their portfolios, banks could secure interest margins and valuation gains if interest rates decline in the future. Conversely, if interest rates are expected to continue rising for a prolonged period (or remain elevated) and there is a major risk of negative interest margins, the basic strategy would be to replace low-yielding products with relatively high-yielding ones. If the interest income that would be lost by maintaining current positions (i.e., the

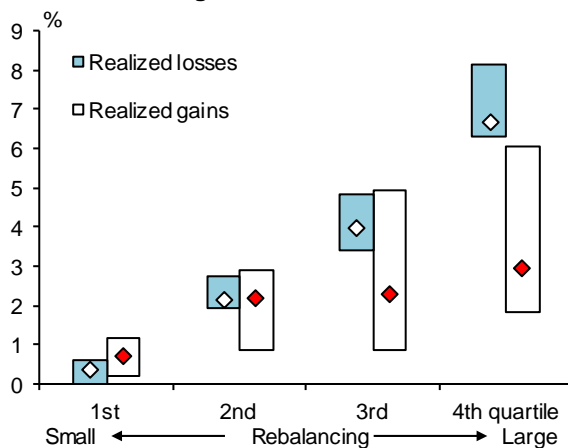
⁴³ In Chart IV-3-2, changes in the economic value of interest rate products are calculated assuming a parallel shift in interest rates for all maturities. With regard to the increase in interest rates, upward parallel shifts of 1 percentage point and of 2 percentage points are assumed for yen interest rates and foreign currency (dollar and euro) interest rates, respectively, so that they are in line with the Financial Services Agency (FSA)'s public notice about interest rate risk in the banking book (IRRBB).

⁴⁴ Chart IV-3-2 uses the ratio of interest rate risk to capital as an indicator of loss-absorbing capacity. It should be noted that a high ratio does not necessarily mean that a bank is financially vulnerable. In fact, regional and *shinkin* banks with high ratios of interest rate risk to capital not only have a large amount of interest rate risk relative to their capital, but also have high ratios of retail deposits, liquid assets, and/or capital adequacy. Therefore, even if they were faced with an outflow of large corporate deposits like the failed Silicon Valley Bank, it is unlikely that they would fire-sell their securities holdings in order to secure cash. Moreover, even if a large part of the interest rate risk on securities were to materialize in the form of realized losses, both banks and *shinkin* banks would have the capital to absorb such losses.

negative interest income) is larger than the losses on sales when replacing products, booking these losses early is an option.

Prior to the recent rise in foreign interest rates, many banks had accumulated foreign bonds during the period of low interest rates leading up to the rise. To reduce the risk of negative interest margins, many banks therefore booked losses on sales of foreign securities and replaced low-yielding products with higher-yielding ones. Against this background, this section provides an overview of the rebalancing behavior of regional banks using losses on sales (specifically, the ratio of losses on sales to capital) as a proxy for securities rebalancing (i.e., the replacement of products). Starting with the distribution of gains/losses on sales, there was considerable heterogeneity in rebalancing behavior, ranging from banks that booked losses on sales of nearly 10 percent of their capital to those that booked almost no losses on sales (Chart IV-3-3).⁴⁵ This heterogeneity may reflect differences in banks' interest rate outlook and risk position (risk of negative interest margins). However, the distribution of regional banks' capacity to absorb losses suggests that their capital adequacy and room for realizing gains, which represent their loss-absorbing capacity, also affected their rebalancing behavior (Chart IV-3-4). Banks that rebalanced significantly, such as those in the third and fourth quartiles in the chart, were those that had high capital adequacy ratios and ample room for realizing gains to start with.

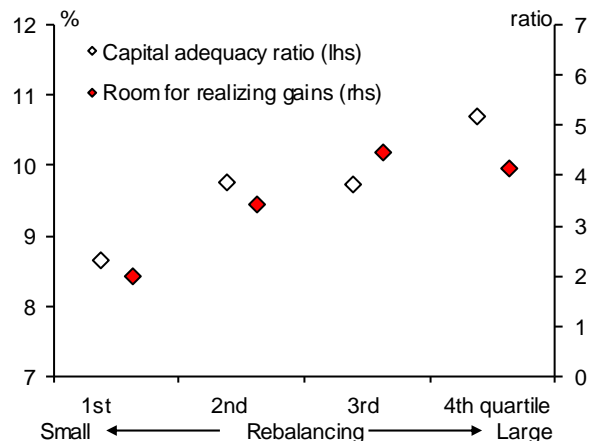
Chart IV-3-3: Distribution of realized gains/losses



Note: 1. The chart shows the medians (markers) and 25th-75th percentile ranges (bands) of realized gains/losses in 2022 as ratios to capital for each quartile of the degree of rebalancing.
 2. Ratios to capital are calculated using Tier 1 capital for internationally active banks and core capital for domestic banks.

Source: BOJ.

Chart IV-3-4: Distribution of loss-absorbing capacity



Note: 1. The chart shows the medians of capital adequacy ratios (as of end-September 2021) and room for realizing gains (as of end-December 2021) for each quartile of the degree of rebalancing.
 2. "Capital adequacy ratio" refers to the Tier 1 capital ratio for internationally active banks and the core capital ratio for domestic banks.
 "Room for realizing gains" = valuation gains or losses on securities holdings / PPNR excluding trading income (average over the last three years).

Source: BOJ.

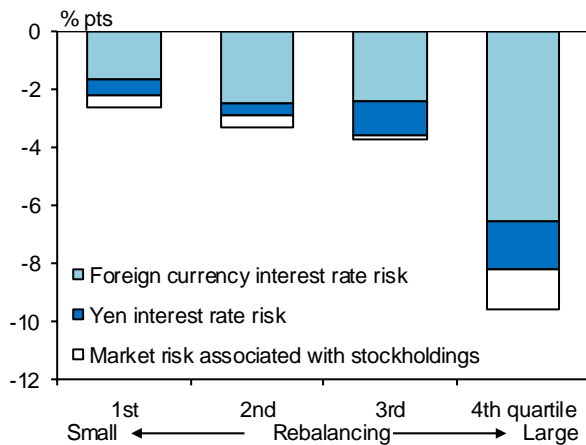
Changes in risk profiles

The risk profiles of banks' securities portfolios have changed as a result of their rebalancing. Looking at the amount of market risk, there has been an overall reduction, especially in foreign currency interest rate risk (Chart IV-3-5). In particular, the average duration of foreign bondholdings has been shortened by nearly one year (Chart IV-3-6).

⁴⁵ In Chart IV-3-3, regional banks are grouped into quartiles based on their degree of rebalancing (losses on sales during 2022). The same applies to Charts IV-3-4, IV-3-5, IV-3-7, IV-3-8, and IV-3-9.

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

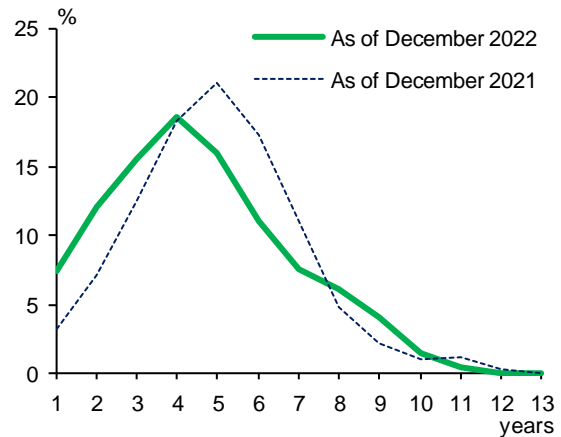
Chart IV-3-5: Changes in market risk



Note: 1. The chart shows the medians of changes in market risk in 2022 as ratios to capital for each quartile of the degree of rebalancing.
 2. "Yen interest rate risk" refers to a 100 BPV; "Foreign currency interest rate risk" refers to a 200 BPV; "Market risk associated with stockholdings" refers to valuation changes in response to a 10% decline in the stock price index. Ratios to capital are calculated using Tier 1 capital for internationally active banks and core capital for domestic banks.

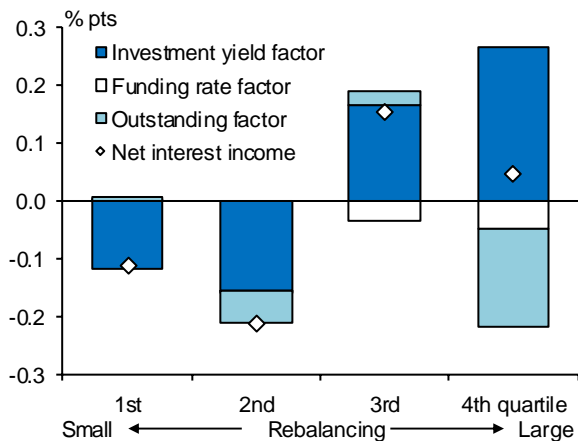
Source: BOJ.

Chart IV-3-6: Distribution of duration of foreign bondholdings



Note: Covers regional banks.
 Source: BOJ.

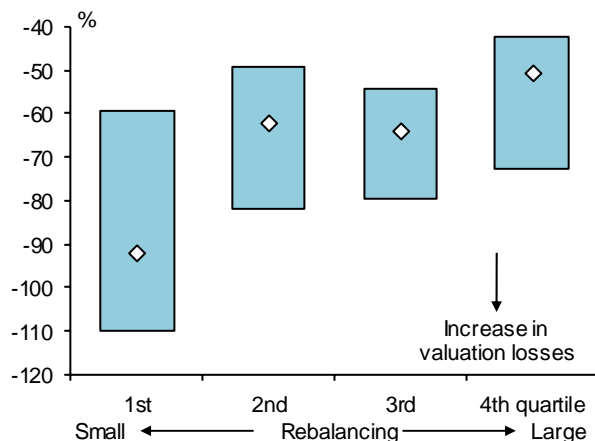
Chart IV-3-7: Changes in net interest income related to securities portfolios



Note: 1. The chart shows, for each quartile of the degree of rebalancing, the medians of changes in net interest income (including foreign currency-denominated foreign bonds and investment trusts) in 2022 as ratios to capital, and their decomposed factors.
 2. Ratios to capital are calculated using Tier 1 capital for internationally active banks and core capital for domestic banks.

Source: BOJ.

Chart IV-3-8: Distribution of valuation losses



Note: 1. The chart shows the medians (markers) and 25th-75th percentile ranges (bands) of changes in valuation losses (relative to expected losses) in 2022 for each quartile of the degree of rebalancing.
 2. Valuation losses cover foreign bonds and investment trusts. Expected losses refer to a 400 BPV of foreign currency interest rate risk as of end-December 2021.

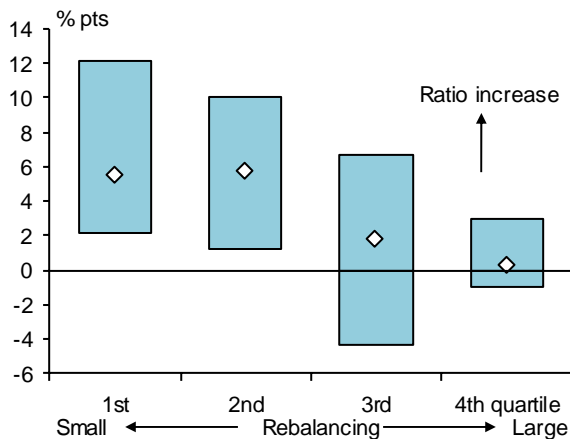
Source: BOJ.

Changes in risk profiles vary depending on the extent to which banks rebalanced (Chart IV-3-7). Banks that rebalanced significantly, such as those in the third and fourth quartiles, have improved their yields on securities and contained the risk of negative interest margins (Chart IV-3-3). This is due to the realization of losses on selling some of their foreign currency interest rate risk positions. Among these banks, some that also realized gains in conjunction with sales to book losses saw a reduction in their remaining valuation gains (i.e., room for realizing gains), while others that did not

restore positions that they had reduced (e.g., banks in the fourth quartile) have lost profit opportunities; however, both groups of banks have lowered the risk of valuation losses as a result. For banks that replaced interest-rate products with credit products such as CLOs, interest rate risk has been replaced by market credit risk.

For banks that maintained their positions, such as those in the first and second quartiles, the risk associated with rising interest rates has materialized in the form of a narrowing of interest margins and valuation losses. The yields on securities have been one reason for the decline in net interest income (Chart IV-3-7). Moreover, a comparison of actual valuation losses with the expected losses from the recent rise in foreign interest rates -- i.e., the amount of foreign currency interest rate risk corresponding to a 4 percentage point rise in foreign interest rates -- shows that some banks, especially those in the first quartile, posted valuation losses that were of a similar size as the expected losses (Chart IV-3-8). This increase in valuation losses, like realized losses, can affect banks' financial conditions through several channels. For example, if economic capital allocated to banks' market divisions decreases, i.e., if the ratio of allocated capital utilization increases, it will become more difficult for them to adjust positions in a flexible manner (Chart IV-3-9). Another channel is that the increase in valuation losses reduces the income distributable to shareholders (Chart IV-3-10).

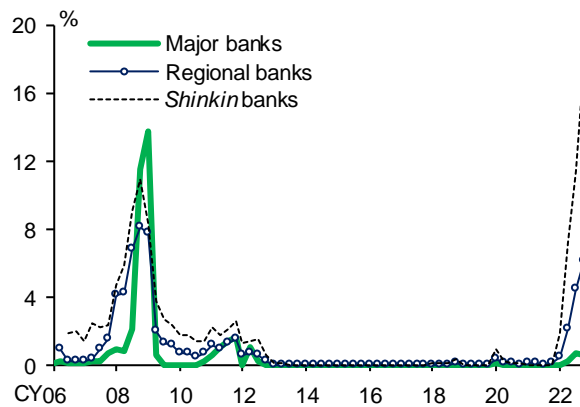
Chart IV-3-9: Distribution of the ratio of capital utilization



Note: The chart shows the medians (markers) and 25th-75th percentile ranges (bands) of changes in the ratio of capital utilization allocated to market divisions in the first half of fiscal 2022 for each quartile of the degree of rebalancing.

Source: BOJ.

Chart IV-3-10: Valuation losses on securities to distributable income ratio



Note: Valuation losses on available-for-sale securities divided by distributable income before deducting valuation losses on available-for-sale securities. The tax effects are taken into account. Latest data as of December 2022.

Source: BOJ.

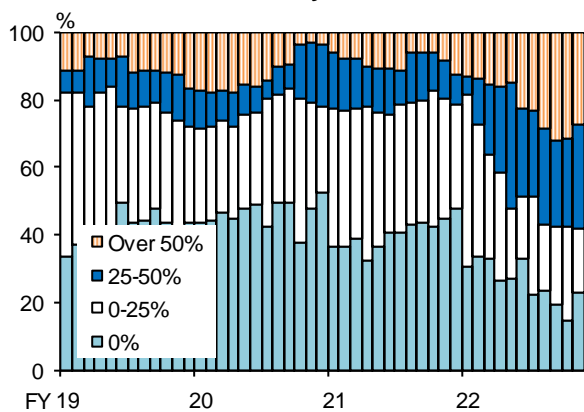
Uncertainty about future developments remains high. It is therefore essential that banks be prepared for interest rate fluctuations going forward (see Section A of Chapter II). Over the past year, an increasing number of banks have strengthened their hedging against the risk of rising interest rates by taking on off-balance-sheet positions and by purchasing bear funds (Chart IV-3-11). There are also some banks that have held-to-maturity securities.⁴⁶ Amid the heightened volatility in foreign interest rates, the use of interest rate hedging is an effective option. Moreover, the depreciation of the yen has worked to limit valuation losses on regional and *shinkin* banks' holdings of foreign currency-denominated products during the period of rising interest rates. The

⁴⁶ By holding held-to-maturity securities, banks no longer need to perform daily mark-to-market valuations, thereby reducing the risk of valuation losses. However, even for held-to-maturity securities, banks still need to manage the risk of impairment losses and negative interest margins. Against this background, in Chart IV-3-1, valuation gains/losses on held-to-maturity securities are also included in the calculation.

IV. Risks faced by financial institutions
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appreciation of the yen could lead to an increase in valuation losses. Thus, banks need to review their currency hedge ratios depending on changes in market developments.

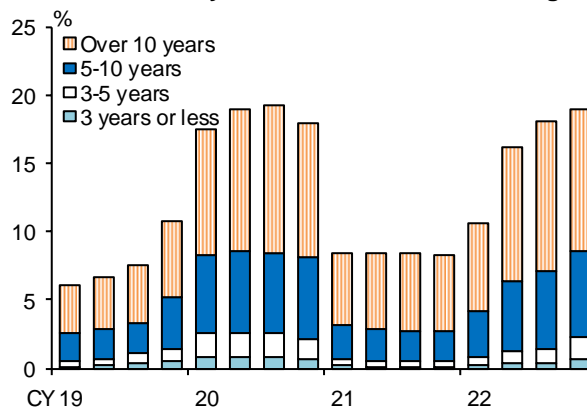
Chart IV-3-11: Hedge ratios against foreign currency interest rate risk



Note: The chart shows percentage shares of hedge ratios weighted by foreign currency interest rate risk. Covers regional banks. Latest data as of February 2023.

Source: BOJ.

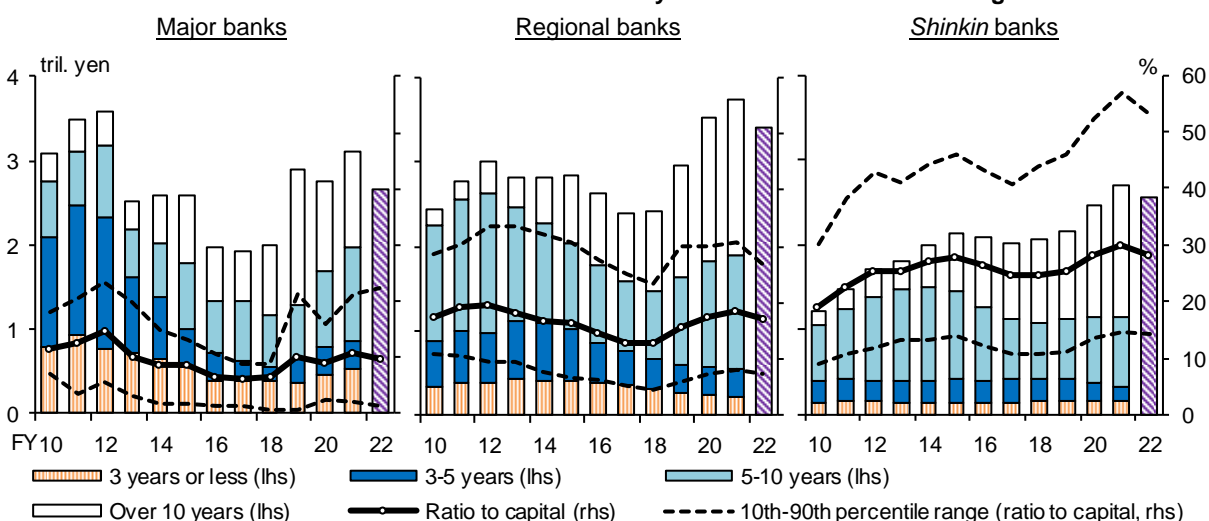
Chart IV-3-12: VaR associated with yen-denominated bondholdings



Note: The chart shows the ratio of VaR (with a 99 percent confidence level and a 1-year holding period) to capital. Covers regional and *shinkin* banks.

Source: BOJ.

Chart IV-3-13: 100 BPV associated with yen-denominated bondholdings



Note: 1. Interest rate risk is a 100 BPV in the banking book. Convexity and higher order terms are taken into account. The data for fiscal 2022 are estimated as of end-February 2023.

2. "Ratio to capital" is calculated using 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 all others (excluding the transitional arrangements).

Source: BOJ.

The risk profiles for investments in yen-denominated bonds have also changed. Despite the reduction in the outstanding amount of bondholdings, the amount of interest rate risk in terms of value at risk (VaR) is increasing due to the rising volatility of domestic interest rates (Chart IV-3-12).⁴⁷ Moreover, the amount of interest rate risk in terms of the 100 BPV remains near its historical peak, particularly for regional and *shinkin* banks, although it has started to decline (Chart IV-3-13). Against this background, banks need to manage market risk, including interest rate risk, appropriately based on changes in the risk profile of each product. It is also important for banks to

⁴⁷ Chart IV-3-12 shows the historical VaR (with a 99 percent confidence level and an observation period and holding period of 1 year) for swap rates based on the outstanding amount of yen-denominated bonds at each point in time.

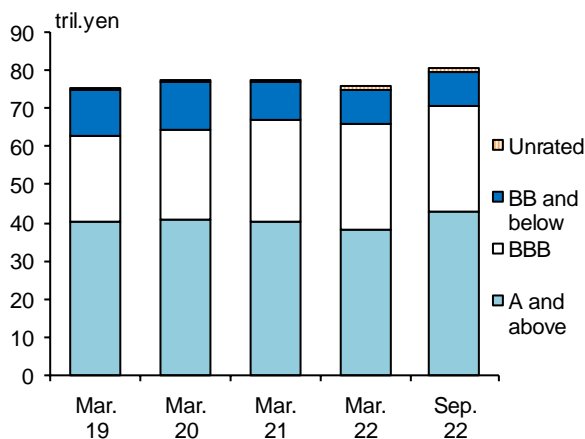
improve the effectiveness of their risk management by examining their loss-absorbing capacity and formulating policies to respond to sudden changes in markets.

2. Other market risk

Risk associated with foreign credit product investment

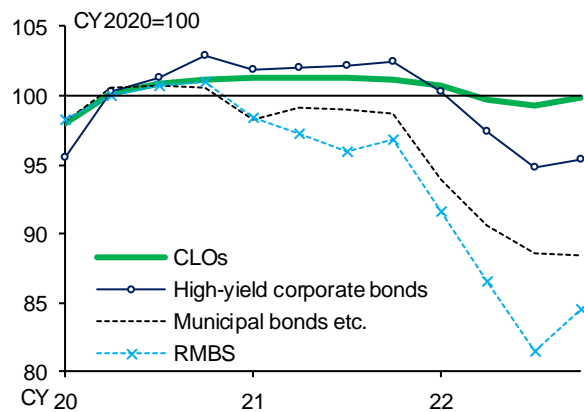
Banks have continued to manage their foreign credit product portfolios in a risk-conservative manner on the whole. Although some banks have purchased foreign credit products such as CLOs, which offer floating-rate coupons, in order to raise investment yields and reduce the risk associated with rising interest rates, the increase in the overall outstanding amount of foreign credit product investment has been limited (Chart III-1-16). Moreover, the rating composition of banks' foreign credit product investment shows no major changes in market credit risk (Chart IV-3-14). Banks' holdings of securitized products, including CLOs -- credit products that are backed by leveraged loans -- have continued to consist almost entirely of AAA-rated tranches.

Chart IV-3-14: Foreign credit product investment by credit rating



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

Chart IV-3-15: Prices of credit products



Note: Calculated based on foreign credit products held by regional and *shinkin* banks. Latest data as of end-December 2022.
Source: BOJ.

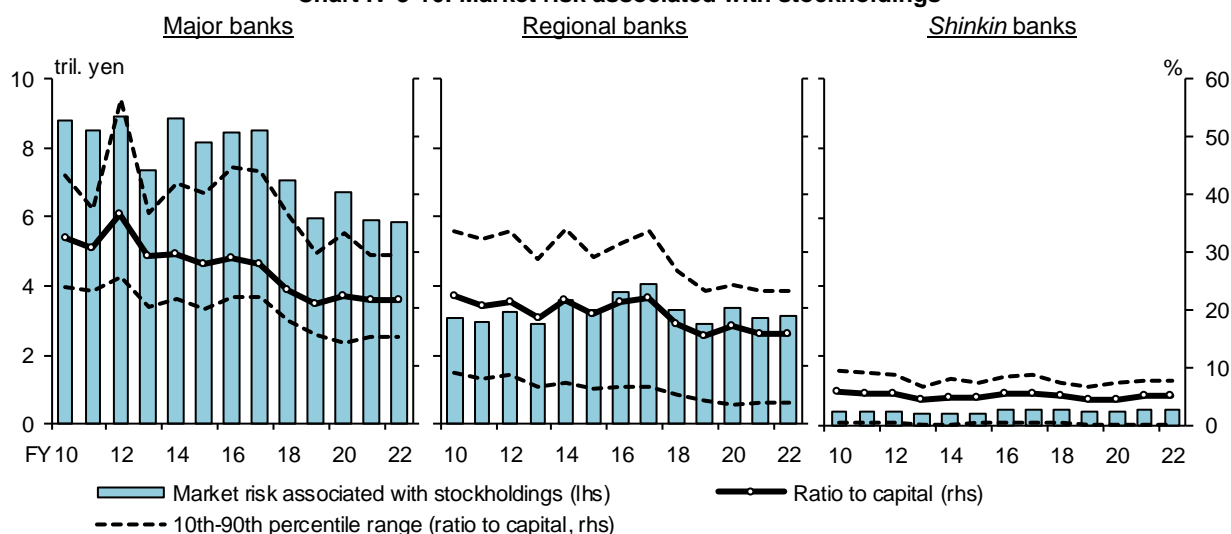
Prices of foreign credit products have fallen due to the recent rise in foreign interest rates (Chart IV-3-15). Among the securities portfolios of banks, there are some products for which valuation losses have approached 30 percent, which is the benchmark for recording impairment losses. Banks that engage in foreign credit product investment need to continuously increase the sophistication of their risk management while taking into account the effect of future developments in interest rates and economic conditions on foreign credit markets.

Market risk associated with stockholdings

Banks' strategic stockholdings have been decreasing. Some banks have further reduced the amount of market risk associated with stockholdings by realizing gains on their stockholdings when they realize losses on interest rate products (Chart IV-3-5). Nevertheless, for major banks and regional banks, the amount of market risk associated with stockholdings remains at around 20 percent of their capital, which is sufficiently large to have a substantial impact on their balance sheets and profits (Chart IV-3-16). If market volatility were to increase further, market risk associated with stockholdings could increase even more.

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

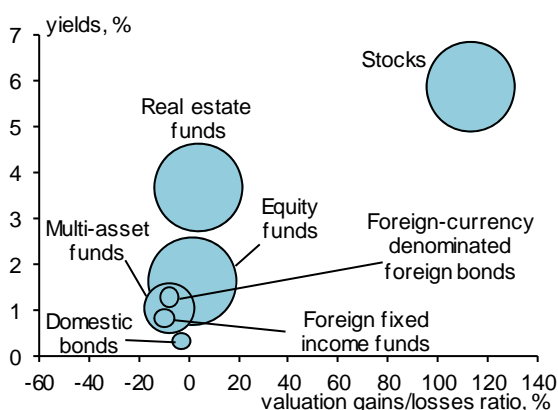
Chart IV-3-16: Market risk associated with stockholdings



Note: 1. "Market risk associated with stockholdings" is VaR with a 99 percent confidence level and a 1-year holding period, and excludes risk associated with foreign currency-denominated stockholdings.
 2. "Ratio to capital" is calculated using CET1 capital for internationally active banks from fiscal 2012 onward, core capital for domestic banks from fiscal 2013 onward, and Tier 1 capital for all others (excluding the transitional arrangements).
 3. The data for fiscal 2022 are estimated using the outstanding amount of stockholdings as of end-February 2023 and stock prices up to end-February 2023.

Source: BOJ.

Chart IV-3-17: Yields and valuation gains/losses ratio by product



Note: 1. "Yields" indicates those accrued by interest and dividends (adjusting funding costs) as of fiscal 2021. The data for "valuation gains/losses ratio" are as of end-December 2022. The size of each circle indicates the level of risk weighting.
 2. Covers regional banks.

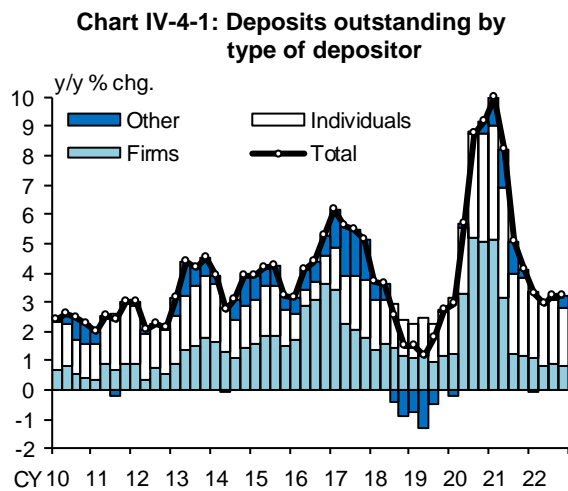
Source: BOJ.

From a corporate governance and regulatory compliance perspective, it is becoming more difficult for banks to hold stocks. In terms of corporate governance, proxy advisory firms have recommended proxy voting guidelines against the election of top executives at companies with excessive strategic stockholdings. Moreover, with the finalization of the Basel III regulations, the risk weighting of stocks will be gradually increased from the current 100 percent to 250 percent from 2024 onward. On the other hand, from a risk and return perspective, stockholdings can boost the performance of banks' securities investment through dividend income and gains on sales during phases of rising interest rates such as the current phase (Chart IV-3-17). Banks need to manage the market risk associated with stockholdings within an appropriate range, in line with their financial soundness, while taking into account the assessment of costs and returns of stockholdings. It is also important for banks to make an objective assessment of the cost and benefits of strategic stockholdings and share their policies with regard to holding and selling these stocks with a wide range of stakeholders.

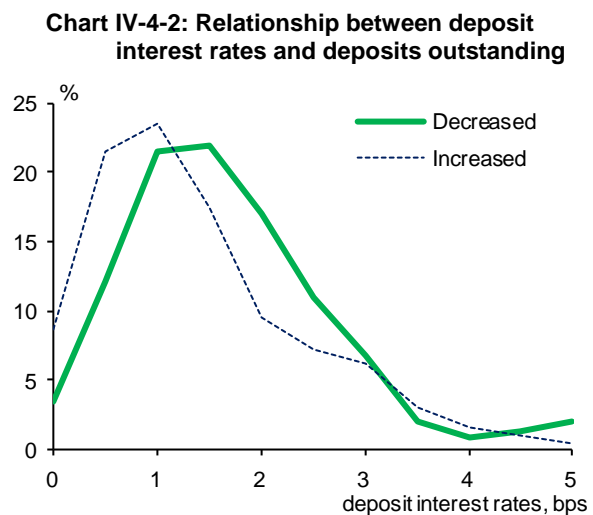
D. Funding liquidity risk

Yen funding liquidity risk

Banks have sufficient yen funding liquidity. Since the majority of funding consists of stable retail deposits and the outstanding amount of deposits is far larger than total loans outstanding, banks have been able to secure yen funding at low interest rates in a stable manner. Deposits by both individuals and firms have remained on an uptrend (Chart IV-4-1).



Note: Covers domestically licensed banks. Latest data as of the October-December quarter of 2022.
Source: BOJ.



Note: 1. The chart shows the distributions of deposit interest rates in fiscal 2021, after dividing banks into two groups based on whether retail deposits outstanding in the first half of fiscal 2022 increased or decreased from the previous year.
2. Covers major, regional, and *shinkin* banks.
Source: BOJ.

However, deposits at some regional and *shinkin* banks have declined, reflecting differences in the business environment, such as demographic changes. As shown in Chart IV-4-2, the deposit funding rates of banks for which retail deposits have declined tend to be higher than those of banks for which they have increased. This tendency has been an additional factor contributing to the deterioration in loan profitability for some banks.

The pace of increase in deposits outstanding has been decelerating on the whole. One reason for this deceleration is progress in scheduled repayments of pandemic-related loans. For some banks, the fact that firms are withdrawing deposits due to the rise in input costs is another factor contributing to the slowdown in deposits. Going forward, changes in deposits are expected to see dispersions across individual banks as firms' precautionary demand for funds declines.

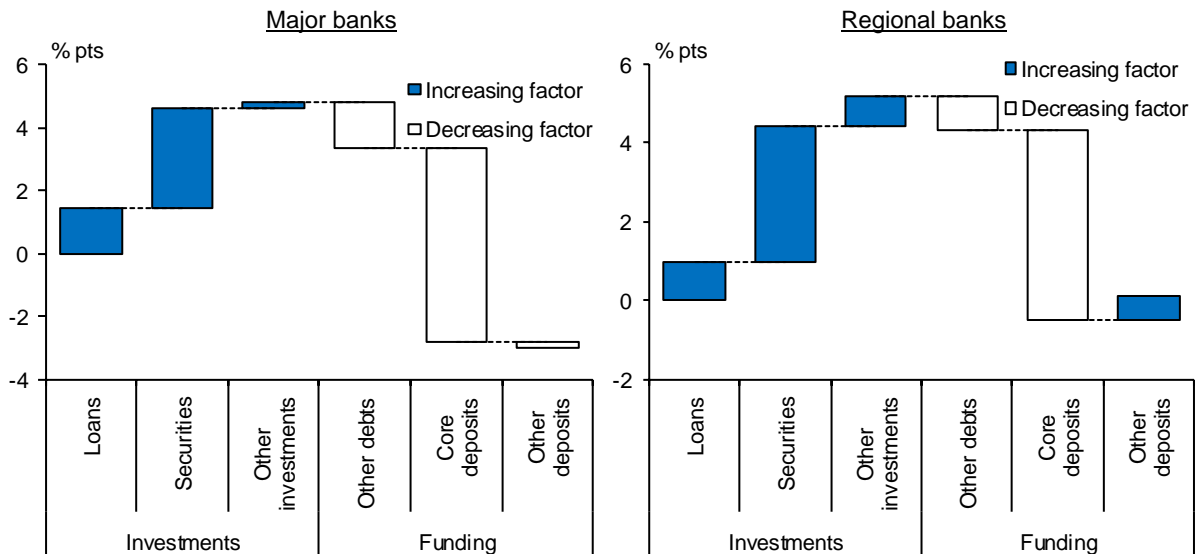
As pointed out in Section A of this chapter, since interest subsidies for effectively interest-free loans will gradually end from fiscal 2023 onward, firms with ample cash reserves are likely to make early repayments of these loans. On the other hand, many banks have assumed some part of deposits that have increased since the start of the pandemic as regulatory core deposits on the liability side, and have taken on interest rate risk such as bond investment on the asset side (Chart IV-4-3).⁴⁸ Amid the progress in repayments of pandemic-related loans, banks' corporate loans and deposits are likely to decline in the same way. If there is a decrease in their core deposits, which have longer

⁴⁸ Of deposits that contractually have no maturity and can be withdrawn at any time, such as ordinary deposits, core deposits refer to sticky deposits, which are actually not withdrawn and remain in an account for a long time.

IV. Risks faced by financial institutions
D. Funding liquidity risk

durations than loans, some banks will see a widening in the duration gap between assets and liabilities.

Chart IV-4-3: Changes in yen interest rate risk

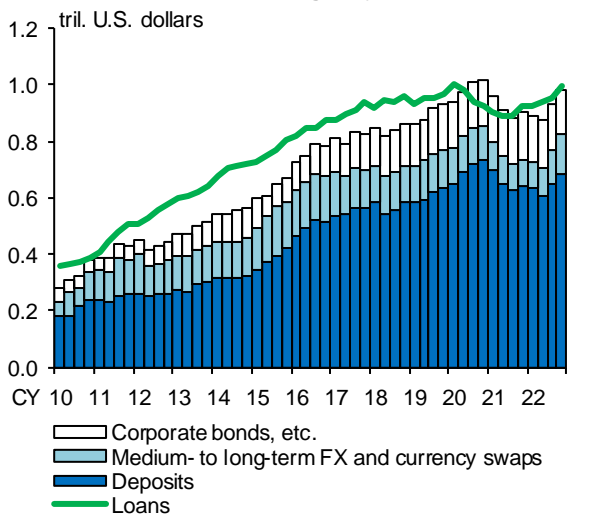


Note: 1. The chart shows changes from end-December 2019 to end-September 2022 in yen interest rate risk (a 100 BPV) in the banking book as ratio to capital.
2. Ratio to capital is calculated using CET1 capital for internationally active banks and core capital for domestic banks.
Source: BOJ.

Foreign currency funding liquidity risk

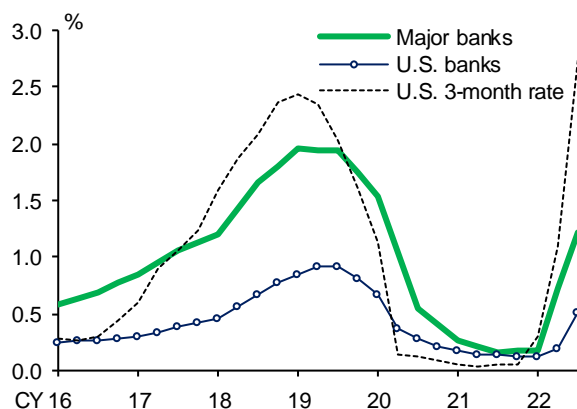
The stability of foreign currency funding has been maintained. At major banks, the loan-to-funding gap -- the difference between the outstanding amount of loans and the outstanding amount of long-term funding, such as through the issuance of corporate bonds, and deposits -- narrowed through the end of 2022 after it had widened amid the continued rise in foreign lending (Chart IV-4-4). Since

Chart IV-4-4: Loan-to-funding gap among major banks



Note: 1. "Corporate bonds, etc." and "Medium- to long-term FX and currency swaps" indicate funding maturing in over 1 year from end-June 2012 onward, with funding maturing in over 3 months prior to that time.
2. Covers internationally active banks. Latest data as of end-December 2022.
Source: BOJ.

Chart IV-4-5: Dollar deposit interest rates



Note: Deposit interest rates include CDs. "Major banks" indicates deposit interest rates in the international business. Latest data as of September 2022.
Source: FFIEC; FRB; BOJ.

last summer, major banks have secured corporate deposits by raising deposit interest rates and have increased long-term funding using currency swaps. Moreover, despite the rise in dollar funding premiums through the end of fiscal 2022 triggered by the collapse of U.S. banks, there were no particular disruptions because major banks had already secured in advance funds maturing beyond the fiscal year-end (see Box 1).

The increase in major banks' deposit funding rates has been limited relative to market interest rates (Chart IV-4-5). A reason is that, in the dollar deposit market, U.S. banks have held deposits significantly in excess of loans (Chart IV-4-6). In the United States, pandemic-related subsidies have pushed up households' transaction account deposits considerably. Against this background, the pass-through rate of market interest rates to U.S. banks' deposit interest rates, particularly retail deposit interest rates, has been limited. Reflecting this supply-demand balance in the overall deposit market, major banks have been able to build up dollar deposits.

Chart IV-4-6: Loan-deposit balance in U.S. banks

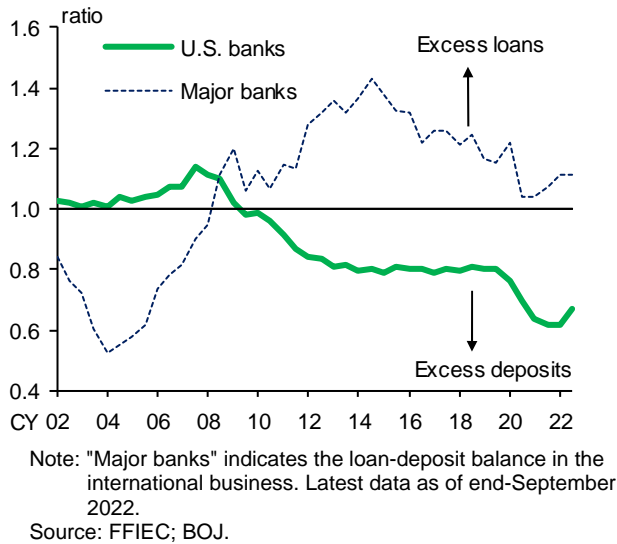


Chart IV-4-7: Composition of deposits by currency

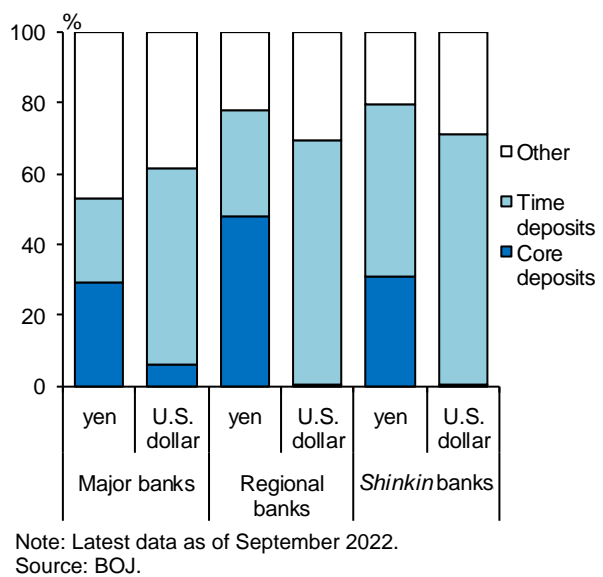


Chart IV-4-8: Distribution of dollar deposit rates of transaction accounts

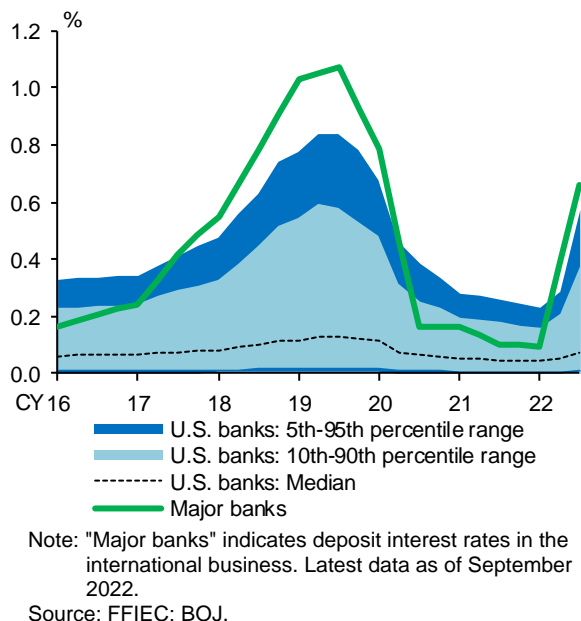
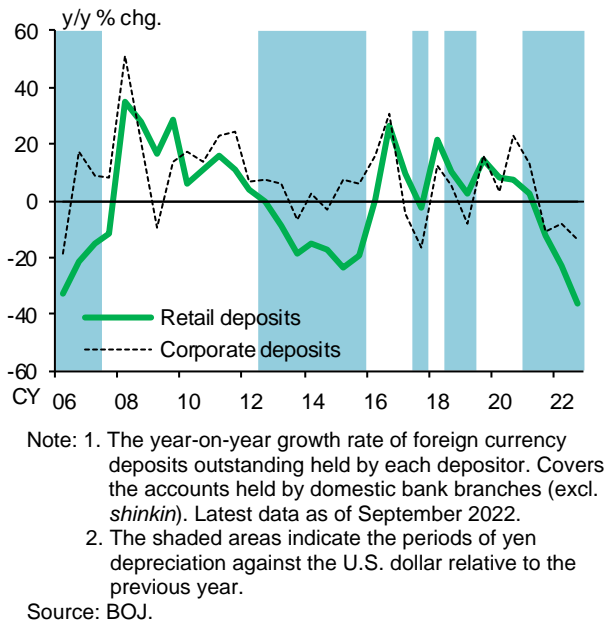


Chart IV-4-9: Relationship between exchange rates and foreign currency deposits



- IV. Risks faced by financial institutions
- E. Risks posed by changes in the business environment

However, in terms of major banks' dollar funding, transaction account deposits of firms are more sensitive to interest rates than those of individuals. Therefore, for major banks, the share of core deposits to total dollar deposits is smaller than its yen counterpart (Chart IV-4-7). In the current phase of interest rate rises, in order to maintain the stability of dollar funding, major banks have raised deposit interest rates more than their U.S. counterparts and made use of long-term market funding, as mentioned earlier (Chart IV-4-8). Moreover, dollar deposits held by Japanese banks' domestic branches are sensitive to exchange rate changes.⁴⁹ Dollar retail deposits in particular have declined during the current phase of yen depreciation (Chart IV-4-9).

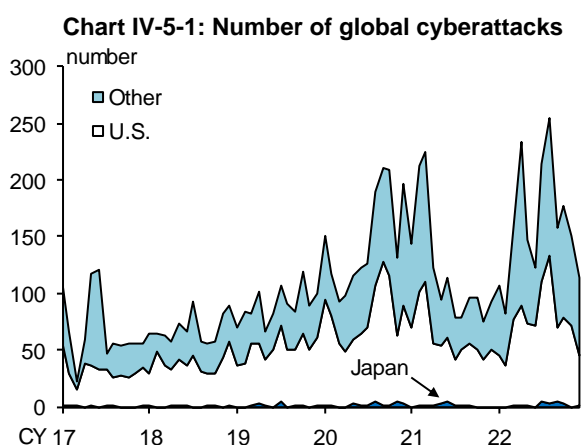
So far, major banks have actively attracted firms' transaction account deposits to build stable dollar funding bases. It is desirable for these banks to further increase transaction account deposits that are sticky and less sensitive to interest rates. Major banks need to establish stable funding bases by providing value-added services other than interest rate services; for example, non-interest services such as transaction banking.⁵⁰

E. Risks posed by changes in the business environment

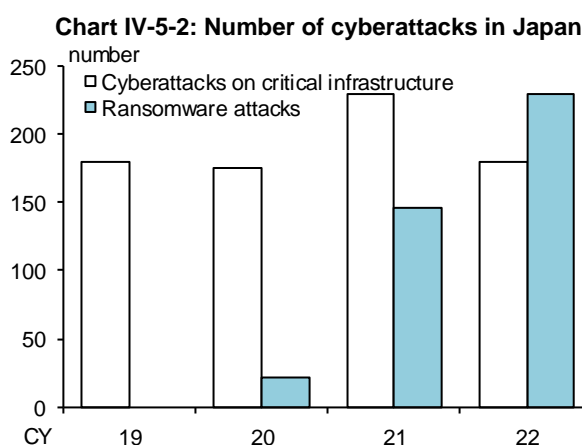
1. Risks related to digital technologies

While the spread of digital technologies provides banks with opportunities to improve operational efficiency and provide new services, it also represents a new source of business and operational risks.⁵¹ For example, if highly secure crypto-asset transactions become available, banks will need to reconsider the payment and custody services that they have been providing so far. On the other hand, if transactions between the banking sector and the crypto-asset sector expand, it will become increasingly important to deal with the interconnectedness of these two sectors from the perspective of stability of the financial system (see Box 5).

Against this background, the possible impact of cyberattacks on banks' operations has become larger. So far, the number of cyberattack cases confirmed in Japan has been minimal compared to



Note: Based on public information. Latest data as of December 2022.
Source: University of Maryland CISSM Cyber Attacks Database.



Note: The data for "Ransomware attacks" start from the second half of 2020.
Source: National Center of Incident Readiness and Strategy for Cybersecurity (NISC); National Police Agency.

⁴⁹ Of Japanese banks' foreign currency funding, the share of foreign currency deposits held by domestic branches is 6 percent for major banks and 13 percent for regional banks (as of end-September 2022).

⁵⁰ For details, see Box 4 in the April 2022 issue of the *Report*.

⁵¹ For risks associated with digitalization, see Financial System and Bank Examination Department, "Digital Transformation of Japanese Banks," *Bank of Japan Review Series*, no. 2021-E-2, May 2021.

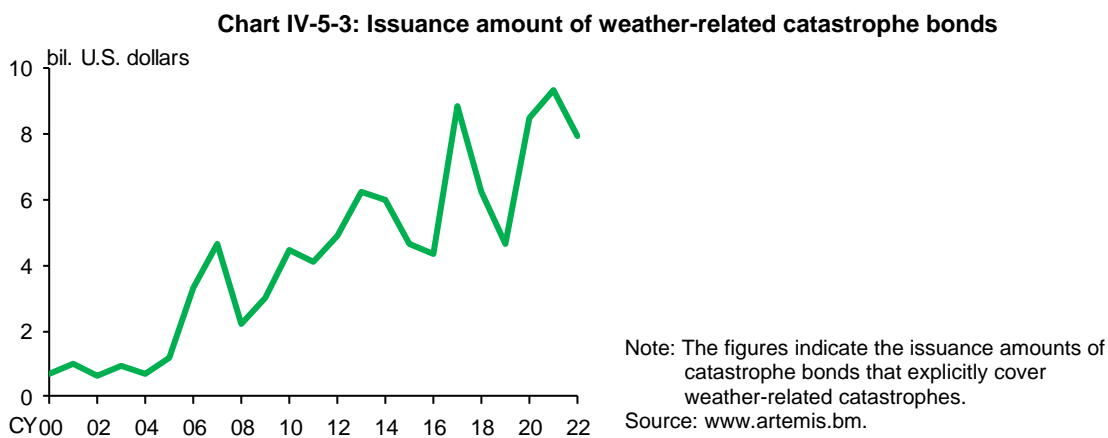
the number of cases seen abroad (Chart IV-5-1). In addition, the systemic impact of these attacks has been limited. However, the number of ransomware attacks on businesses has increased considerably (Chart IV-5-2). Coupled with geopolitical issues such as Russia's invasion of Ukraine, the threat of cyberattacks remains elevated. Banks need to remain vigilant against cyber risks.

Responses to and recovery from cyberattacks are also essential. Stopping cyberattacks completely is difficult, if not impossible. What is important is to limit the potential damage as much as possible by reducing the risk of information leakage and avoiding the suspension of critical business operations. Last year, the Bank, in cooperation with the FSA, examined the status of major banks' cybersecurity management frameworks and implemented a self-assessment survey on regional and *shinkin* banks' cybersecurity management frameworks. Banks need to enhance their cyber resilience while referring to the basic elements of risk management: (1) identification, (2) prevention, (3) detection, (4) response, and (5) recovery.

In addition, banks need to manage the service providers to which they outsource operational activities. Reflecting the spread of digital technologies, the presence of third parties in banks' operations has been increasing. For example, there is a growing number of banks that use services provided by vendors, such as cloud services. It is important for these banks to mitigate third-party risks by closely monitoring whether cyber risk is managed appropriately by vendors that are responsible for system development and operation, while also referring to international guidelines.⁵² In addition, from the perspective of managing risks associated with digital technologies and ensuring sufficient resilience, developing highly skilled staff is essential. Securing the staff needed to make business decisions about digital technologies is one of the key issues for the stable provision of financial services using digital technologies.

2. Climate-related financial risks

Climate change can threaten the stability of the financial system through physical and transition risks. As for physical risk, the damage from extreme weather events is observed every year, and the past year again has seen record damage in many parts of the world. Against the backdrop of the increase in such weather-related disasters, the size of the market for catastrophe bonds, which are used to hedge losses from compensation for weather damage, is rapidly expanding (Chart IV-5-3).



To support the transition to decarbonization on the financial front, banks are expected to provide

⁵² In October 2022, the G7 Cyber Expert Group updated the "G7 Fundamental Elements for Third Party Cyber Risk Management in the Financial Sector."

IV. Risks faced by financial institutions

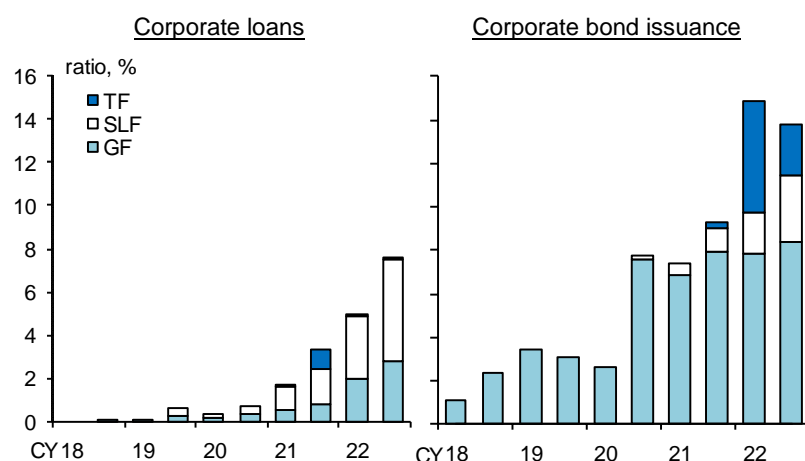
E. Risks posed by changes in the business environment

(1) green finance (GF), i.e., financing for projects that contribute to decarbonization, (2) sustainability-linked finance (SLF), i.e., financing for entities that are engaged in initiatives that contribute to decarbonization, and (3) transition finance (TF), i.e., financing where the use of funds and the initiatives of entities contribute to step-by-step decarbonization. In promoting TF, entities are required to transparently disclose their transition strategies based on scientific evidence to rule out any greenwashing. The credibility of transition strategies for decarbonization and an international understanding that TF is indispensable for decarbonization are key to promoting TF.

Progress has been made in this regard in international initiatives by private organizations. In November 2022, the Glasgow Financial Alliance for Net Zero (GFANZ) finalized its "Financial Institution Net-Zero Transition Plans" and announced a new strategy of a managed phaseout of high-emitting assets. This strategy contrasts with the previous one of a rapid phasing out of financing for coal. It suggests a shift to a more pragmatic approach, according to which orderly decarbonization cannot be achieved simply by withdrawing investment and loans from brown assets. Moreover, in October, the GFANZ-affiliated Net-Zero Banking Alliance (NZBA) released its "NZBA Transition Finance Guide." The guide highlights the importance of TF in promoting decarbonization and the requirements for TF.

In Japan, efforts toward TF are making progress. The Ministry of Economy, Trade and Industry (METI) and other relevant ministries and agencies have begun discussions to expand the sector-specific roadmaps for decarbonization. If cross-industry views are reflected on these sector-specific roadmaps, this will not only increase the connectedness and consistency of the roadmaps across industries but also raise their external persuasiveness. Meanwhile, there has also been progress in financial institutions' responses. Major banks and insurance companies have developed their own guidelines for TF initiatives and have established new investment frameworks for TF. In addition, efforts by regional and *shinkin* banks to help local companies deal with climate change have been expanding.

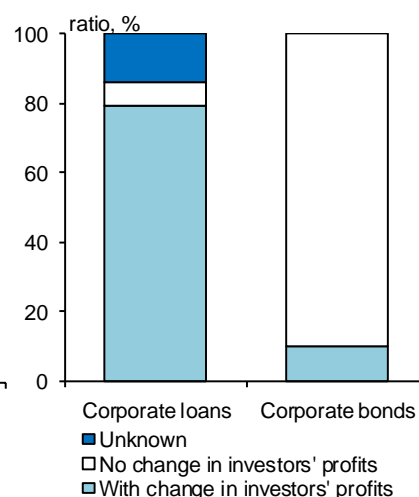
Chart IV-5-4: Climate-related loans and investments



Note: The left-hand chart shows the ratio of climate-related corporate loans to the amount of new loans for fixed investments. The right-hand chart shows the ratio of climate-related corporate bond issuance to the issuance amounts of publicly-offered domestic bonds.

Source: Japan Securities Dealers Association; JPX Market Innovation & Research, Inc., "ESG Bond Information Platform"; Ministry of Economy, Trade and Industry; Ministry of the Environment; BOJ.

Chart IV-5-5: Product design of SLF



Note: Covers the loan and issuance amounts of SLF originated from 2019 to 2022.

Source: Ministry of the Environment.

Climate-related markets are growing steadily. Newly issued climate-related loans and bonds (categorized as GF, SLF, or TF) now each account for nearly 10 percent of the total amount of newly issued loans and bonds (Chart IV-5-4). In the loan market, while GF was the first to take off,

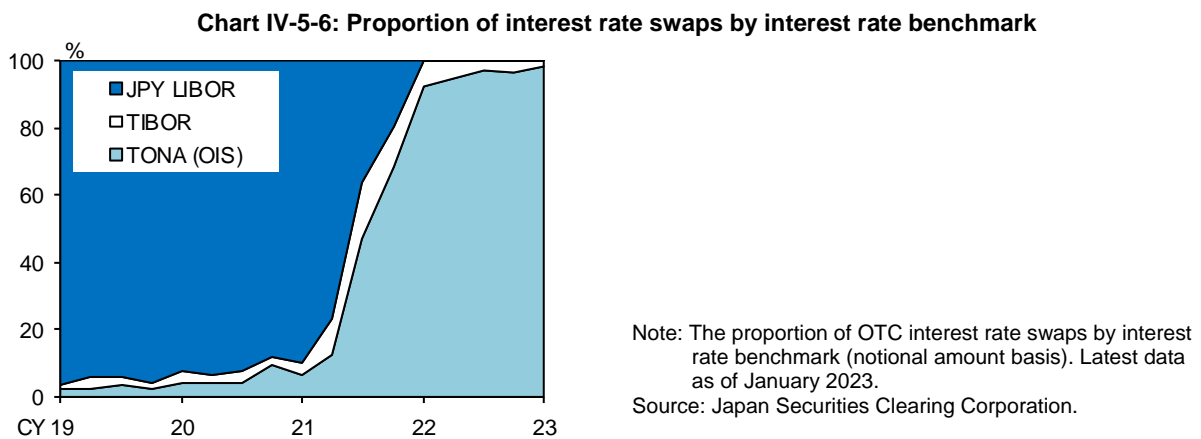
SLF has become dominant more recently. In the corporate bond market, while GF has remained dominant, SLF and TF are also increasing.

Turning to challenges for the sustainable development of climate-related markets, these include expanding the number of market participants as well as improving information disclosure and enhancing the sophistication of risk assessment. With regard to information disclosure, in the run-up to discussions by the International Sustainability Standards Board (ISSB), a Cabinet Office order in Japan was revised in January 2023 to make it mandatory for firms to disclose sustainability-related initiatives in their annual securities reports. Regarding risk assessment, while some take the view that climate-related risks are reflected in the prices of financial instruments (stocks and corporate bonds) to some extent, others see room for these risks to be reflected to a greater extent.⁵³ In particular, it is pointed out that, because the coupon of corporate bonds is fixed, the degree to which upside and downside risks in corporate profits are reflected in prices is limited compared to stocks. In Japan, most SLF-type bonds are designed in such a way that investors' benefits do not change in line with firms' progress in addressing climate change, and this also likely has led to such assessment (Chart IV-5-5).⁵⁴

Financial intermediation through loan and capital markets is essential to raising the funds necessary for achieving decarbonization. Appropriately incorporating the risks of and opportunities of climate change into loan interest rates and the prices of financial instruments will lead to the smooth supply of funds necessary for decarbonization.

3. Interest rate benchmark reform

The publication of U.S. dollar LIBOR will cease at the end of June 2023. In Japan, like other countries, the transition away from U.S. dollar LIBOR has been progressing. According to a survey with a reference date of end-December 2022, there are no major obstacles regarding the transition away from U.S. dollar LIBOR.⁵⁵ The Bank will continue to cooperate with the FSA and engage in dialogue with relevant parties at home and abroad, including financial institutions, so that relevant parties can smoothly proceed with the transition.



⁵³ For details, see Eren, E., Merten, F., and Verhoeven, N., "Pricing of Climate Risks in Financial Markets: A Summary of the Literature," BIS Papers, no.130, December 2022.

⁵⁴ The terms of most SLF-type bonds state that, if the firm fails to meet its climate change commitments, it needs to purchase emission credits or make donations to a third party (such bonds are shown as "no change in investors' profits" in Chart IV-5-5). Only a minority of bonds link bond yields to the achievement of performance targets (shown as "with change in investors' profits" in Chart IV-5-5), as is the case with foreign SLF-type bonds.

⁵⁵ See FSA and the Bank, "Summary of Results of the Fourth Survey on the Use of LIBOR," March 2023.

IV. Risks faced by financial institutions

E. Risks posed by changes in the business environment

Since the cessation of yen LIBOR publication at the end of 2021, transactions referencing alternative benchmarks have been made without any particular problems (Chart IV-5-6). The publication of synthetic yen LIBOR, which was prepared as a safety net, ceased at the end of 2022. Regarding some existing contracts using synthetic yen LIBOR, relevant parties have reached agreement on transition plans, meaning that transition arrangements are essentially completed.

V. Resilience of the financial system

- With regard to loss-absorbing capacity, banks' capital exceeds regulatory requirements. Their profitability has been on an improving trend, although it remains low. Loan-loss provision ratios have been relatively high. Banks have managed to curtail the risk of additional valuation losses on securities holdings by rebalancing their portfolios. However, attention should be paid to the fact that room for realizing gains on securities holdings has declined due to higher foreign interest rates.
- Given banks' loss-absorbing capacity, macro stress testing is conducted under two downside scenarios: a "financial stress scenario," which assumes stress similar to the global financial crisis, and an "inverted yield curve scenario," which assumes that the yield curve in foreign markets becomes and stays substantially inverted. By considering the same scenarios used in the previous issue of the *Report*, changes in the resilience of the financial system against these stress events are examined.
- The results of the macro stress testing indicate that changes in banks' balance sheets have contributed to improvements in their resilience against rising foreign interest rates. However, attention should be paid to the risk that foreign interest rates will rise further and remain high for longer. If this risk were to materialize, financial intermediation could be impaired for some banks with low loss-absorbing capacity.

A. Banks' capacity to absorb losses

Ahead of the macro stress testing in the next section, this section examines banks' loss-absorbing capacity from various perspectives.

1. Capital adequacy and loss-absorbing capacity

Capital

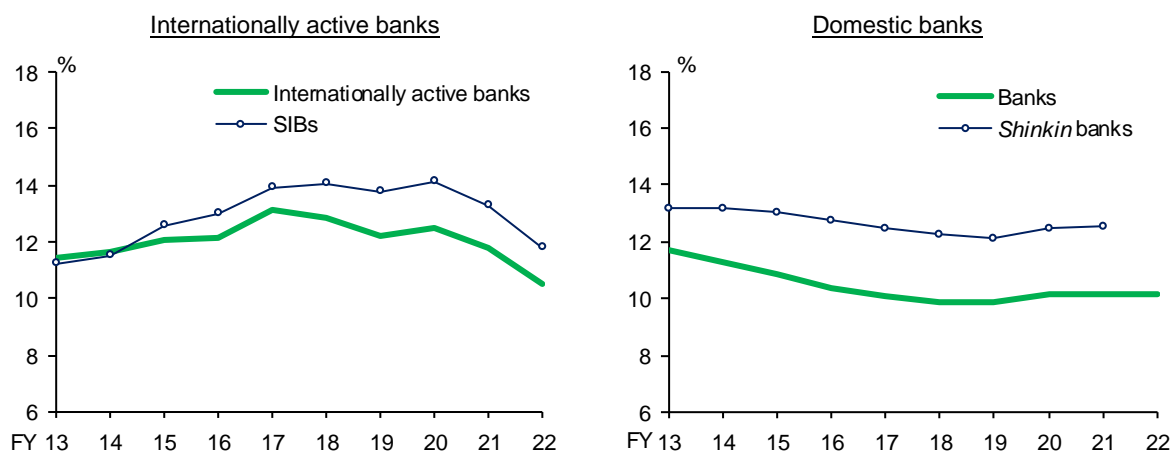
Banks have maintained sufficient capital. Both the common equity Tier 1 (CET1) capital ratio of internationally active banks and the core capital ratio of domestic banks substantially exceeded the regulatory requirements in the first half of fiscal 2022 (Chart V-1-1).⁵⁶ Although valuation losses on securities holdings have put downward pressure on CET1 capital ratios, banks have sufficient capital bases overall, which will enable them to continue with risk-taking.

The application of the finalized Basel III regulations will, in principle, start from end-March 2024 for internationally active banks and domestic banks that use the internal ratings-based approach, and from end-March 2025 for domestic banks that use the standardized approach. Going forward, the increase in the risk weight for stockholdings will lower the capital adequacy ratios of, in particular, domestic banks that use the standardized approach. However, banks will likely be able to address

⁵⁶ 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, including 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. While valuation gains/losses on securities holdings are included in the regulatory capital for internationally active banks, they are not included in the regulatory capital for domestic banks.

the change without delay, as the risk weight will be raised in a phased manner.

Chart V-1-1: Capital adequacy ratios



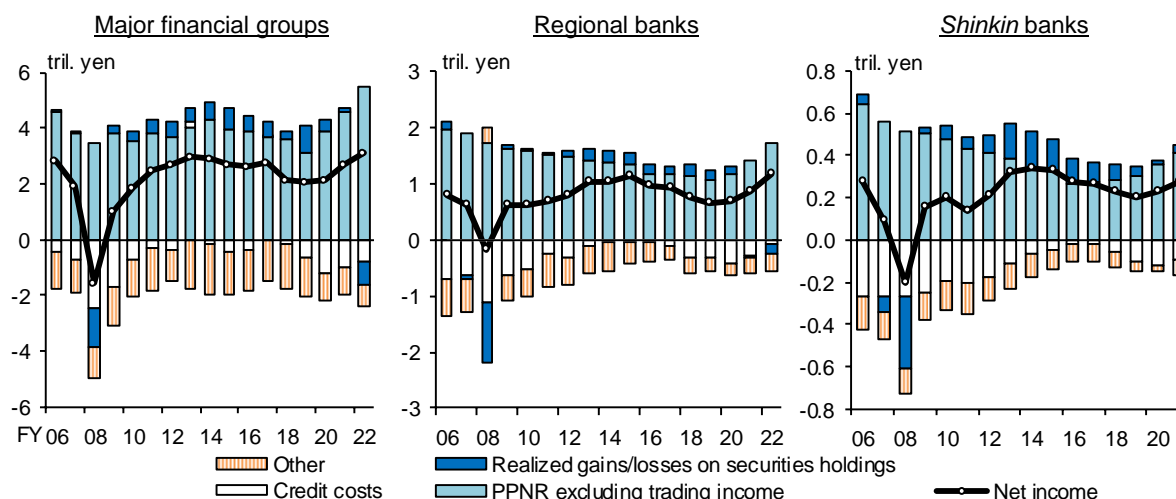
Note: 1. The left-hand chart shows the CET1 capital ratio of internationally active banks. The right-hand chart shows the core capital ratio of domestic banks. The transitional arrangements are taken into consideration.
2. The latest data for internationally active banks, SIBs, and domestic banks (excl. *shinkin*) are as of end-September 2022 and the latest data for domestic *shinkin* banks are as of end-March 2022.

Source: Published accounts of each company; BOJ.

Profit buffers

Banks' net income has started to increase (Chart V-1-2). The deterioration in realized gains/losses on securities holdings resulting from loss-cutting, which has weighed on net income since the start of fiscal 2022, has been more than compensated for by the positive contribution of improvements in pre-provision net revenue (PPNR) excluding trading income. PPNR excluding trading income has continued to be pushed up by a reduction in overhead costs in the domestic business sector. More recently, rising net interest income has also contributed to the increase in PPNR excluding

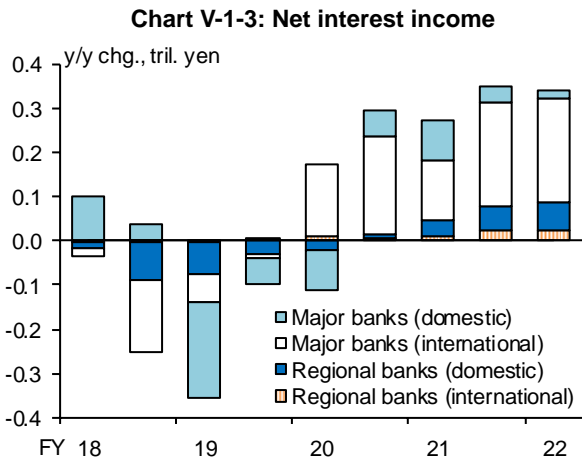
Chart V-1-2: Net income



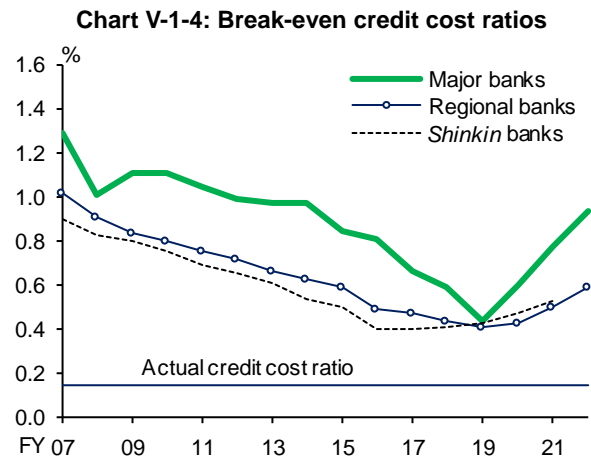
Note: 1. From fiscal 2012, profits and losses from investment trusts due to cancellations are excluded from "PPNR excluding trading income" and included in "Other."
2. Major financial groups cover Mizuho Financial Group, Mitsubishi UFJ Financial Group, Sumitomo Mitsui Financial Group, Resona Holdings, Sumitomo Mitsui Trust Holdings, SBI Shinsei Bank, and Aozora Bank. Adjusted for special items.
3. The latest data for major financial groups and regional banks are annualized values for the first half of fiscal 2022 and the latest data for *shinkin* banks are as of fiscal 2021.

Source: Published accounts of each bank; BOJ.

trading income, reflecting the increase in domestic and foreign loans outstanding and the improvement in foreign lending-deposit margins (Chart V-1-3).



Note: The chart shows the changes in net interest income by the domestic and international business sector.
Source: BOJ.



Note: 1. Break-even credit cost ratio is the ratio at which credit costs equal PPNR excluding trading income, which from fiscal 2012 onward excludes profits and losses from investment trusts due to cancellations. "Actual credit cost ratio" is the average of all banks from fiscal 2005 to the latest year.
2. The latest data for "Major banks" and "Regional banks" are annualized values for the first half of fiscal 2022 and the latest data for "Shinkin banks" are as of fiscal 2021.
Source: BOJ.

On the back of the improvement in PPNR excluding trading income, break-even credit cost ratios (PPNR excluding trading income/loans outstanding) also have been improving (Chart V-1-4). The break-even credit cost ratio represents credit costs that can be absorbed by PPNR excluding trading income in a single fiscal year, relative to loans outstanding. The higher the ratio, the greater banks' capacity to absorb losses. While the capital adequacy ratio represents banks' loss-absorbing capacity on a stock basis, the break-even credit cost ratio captures their short-term loss-absorbing capacity (profit buffer) on a flow basis (i.e., on the basis of their profits). For all types of banks, the break-even credit cost ratios are well above their past averages of actual credit cost ratios.

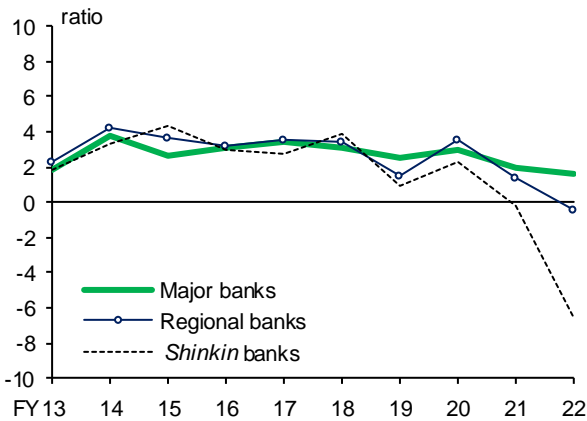
Room for realizing gains

Valuation gains/losses on securities holdings, which are not included in the regulatory capital for domestic banks, can function as a capital buffer on an economic value basis. However, the "room for realizing gains" -- defined as net valuation gains/losses on securities holdings (including strategic stockholdings and excluding held-to-maturity securities) divided by the past average of PPNR excluding trading income -- has fallen further, mainly due to the rise in interest rates (Chart V-1-5). It has turned negative for more than half of regional and *shinkin* banks.

To summarize loss-absorbing capacity, banks' capital exceeds regulatory requirements and their profit buffers have improved. Loan-loss provision ratios for unsecured loans have been relatively high in the past few years (Chart V-1-6). Banks have also managed to curtail the risk of additional valuation losses on securities holdings. This is especially the case for banks that have been rebalancing their portfolios. However, attention should be paid to the fact that room for realizing gains on securities holdings, which can be used to offset losses in a relatively flexible manner, has declined for many banks due to higher foreign interest rates.

V. Resilience of the financial system
A. Banks' capacity to absorb losses

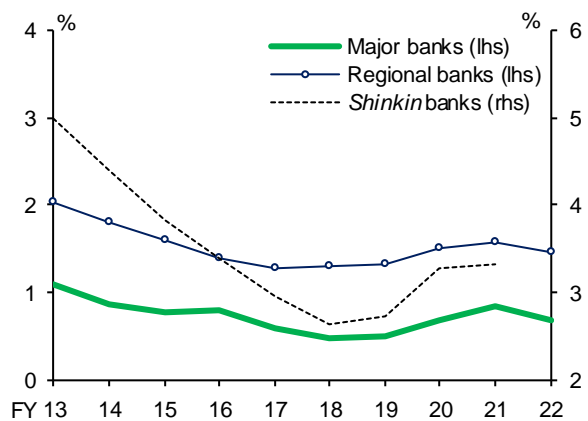
Chart V-1-5: Room for realizing gains



Note: 1. Room for realizing gains = valuation gains or losses on securities holdings / PPNR excluding trading income. The numerator excludes held-to-maturity securities and includes strategic stockholdings. The denominator excludes profits and losses from investment trusts due to cancellations (3-year backward moving averages). The chart shows the median values.
2. The latest data for fiscal 2022 are calculated with valuation gains/losses on securities holdings as of February 2023 and PPNR excluding trading income as of fiscal 2021.

Source: BOJ.

Chart V-1-6: Loan-loss provision ratios



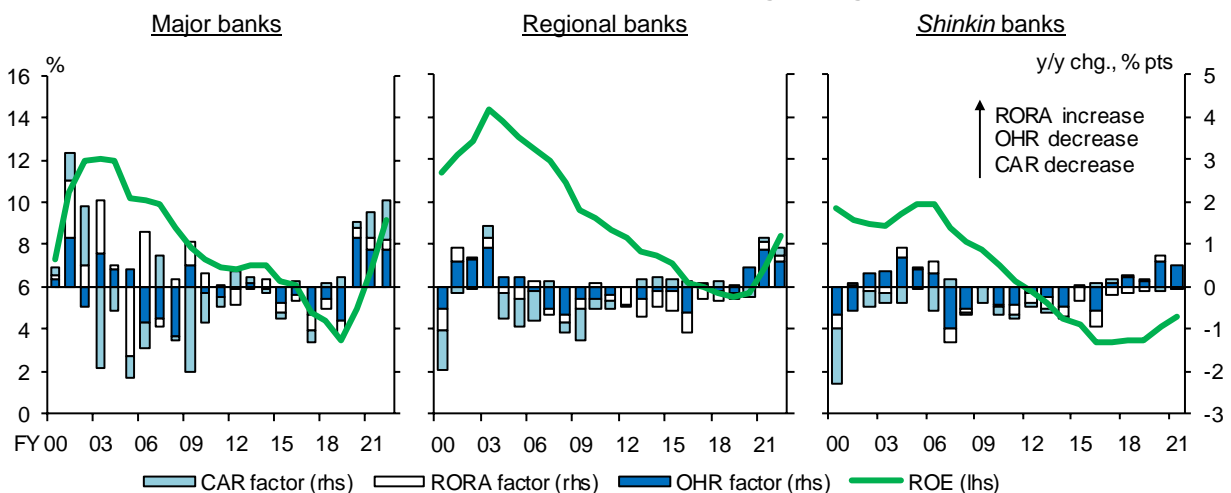
Note: 1. Loan-loss provisions are compared to unsecured loan amounts.
2. The latest data for "Major banks" and "Regional banks" are as of end-September 2022 and the latest data for "Shinkin banks" are as of end-March 2022.

Source: BOJ.

2. Balance between capital bases and profitability

To perform financial intermediation activities in a sustainable manner, banks need to maintain sufficient capital bases and at the same time secure stable profit bases. To this end, it is essential for banks to achieve a virtuous cycle in which they accumulate retained earnings by securing a certain level of profits and use such earnings to provide high-quality financial services. With this virtuous cycle, banks will be able to provide financial services in a sustainable and stable manner. Although banks' return on equity (ROE) based on PPNR excluding trading income has started to increase, it remains at a historically low level, particularly for regional and *shinkin* banks (Chart V-

Chart V-1-7: ROE based on PPNR excluding trading income



Note: From fiscal 2012, profits and losses from investment trusts due to cancellations are excluded. The latest data for major and regional banks are annualized values for the first half of fiscal 2022 and the latest data for *shinkin* banks are as of fiscal 2021.

Source: BOJ.

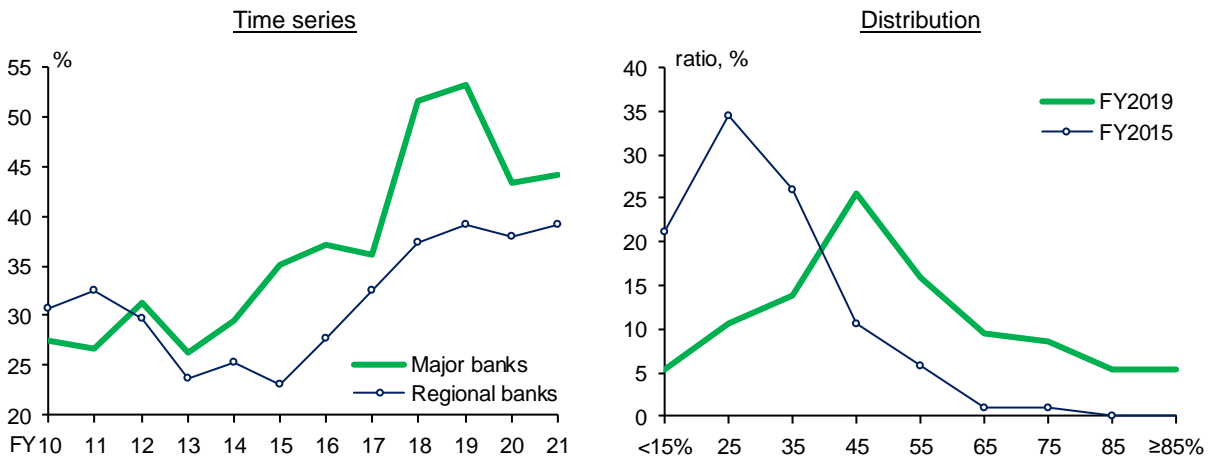
1-7).⁵⁷

Regarding the recent improvement in banks' ROE, improvements in the overhead ratio (OHR) factor and capital adequacy ratio (CAR) factor have started to make larger contributions. OHRs (overhead costs/gross operating profits), which represent banks' operating efficiency, have improved significantly due to reorganization of branch networks. However, the degree to which improvements in OHRs alone can further push up ROEs is limited.⁵⁸ The decline in major banks' CARs (capital/risk-weighted assets) mainly reflects the increase in valuation losses on securities holdings. Meanwhile, banks' return on risk-weighted assets (RORA; gross operating profits/risk-weighted assets), which shows their investment efficiency, has remained low for all types of banks.

With banks required to enhance their financial services, it is essential for them to invest in digital technology (which increases overhead costs) and secure specialized staff (which increases personnel expenses). Clearly, banks need to take advantage of these investment opportunities in order to improve their RORA and consequently ROE in a sustainable manner. However, if banks were to engage in excessive risk-taking, vulnerabilities in the financial system could increase. At the same time, if their profitability were to stagnate and their loss-absorbing capacity were to decline, financial intermediation could be impaired. Amid such risks of an overheating or contraction in banks' activities, it is important for banks to establish stable profit bases.

Since the Corporate Governance Code was formulated in 2015, the financial industry has seen an increased emphasis on payouts to shareholders. For example, the total payout ratio -- the ratio of the amount of dividends and share repurchases to net income -- of listed banks has risen sharply from its bottom around fiscal 2015 (left panel of Chart V-1-8). Moreover, the total payout ratios of individual banks have risen, and for many banks, the ratios have converged to around 40 percent, which is the level many banks have set as a key performance indicator (KPI) for themselves (right panel of Chart V-1-8).

Chart V-1-8: Total payout ratios of listed banks



Note: Covers listed bank groups.

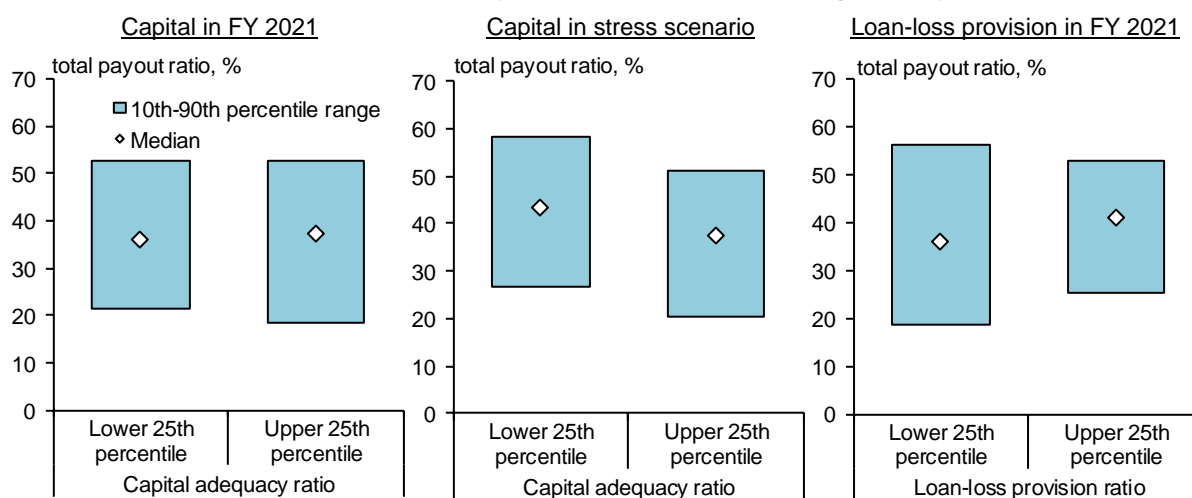
Source: I-N Information Systems; Nikkei Inc., "NEEDS-Financial QUEST"; BOJ.

⁵⁷ In Chart V-1-7, changes in ROE based on PPNR excluding trading income are decomposed into the contribution of (1) RORA factor (gross operating profits from core business/risk-weighted assets), (2) OHR factor (PPNR excluding trading income/gross operating profits from core business), and (3) CAR factor (inverse of capital adequacy ratio).

⁵⁸ One reason for the improvement in regional and *shinkin* banks' OHRs is that they have accelerated efforts to strengthen their business base under the "Special Deposit Facility to Enhance the Resilience of the Regional Financial System." The screening period for the facility ended at end-March 2023.

Against the background of these changes, even banks with low loss-absorbing capacity have raised their dividend payout ratios. As a result, no significant difference can be observed in the total payout ratios of individual banks regardless of their capital levels (Chart V-1-9). Recently, even banks with low capital adequacy ratios have been making payouts at more or less the same levels as other banks. A similar tendency can also be observed in banks' total payout ratios irrespective of their capital adequacy ratios in the event of stress -- i.e., the capital adequacy ratios obtained under the assumption of a financial stress scenario (see next section) -- and in loan-loss provision ratios for loans to borrowers in danger of bankruptcy. From the viewpoint of providing financial services in a sustainable manner, banks should conduct capital policies including payouts to shareholders while keeping a balance between maintaining their capital bases and their profitability.

Chart V-1-9: Total payout ratios and loss-absorbing capacity



- Note: 1. Total payout ratios shown in the charts are the distribution of the averages of the past 5 years (fiscal 2017-2021).
 2. The horizontal axes in the left-hand and middle charts show the classification based on the deviation of capital adequacy ratios from the regulatory requirements (CET1 for internationally active banks and core capital for domestic banks). The horizontal axis in the right-hand chart shows the classification based on the loan-loss provision ratios for "in danger of bankruptcy" and below.
 3. Covers listed bank groups.

Source: I-N Information Systems; Nikkei Inc., "NEEDS-Financial QUEST"; BOJ.

B. Macro stress testing

This section comprehensively examines the stability of the financial system using macro stress testing. Macro stress testing aims to dynamically examine the resilience of the financial system and the impact on financial intermediation under specific hypothetical stress events.^{59,60}

The stress testing assumes two downside scenarios: a "financial stress scenario" and an "inverted yield curve scenario." The "financial stress scenario" assumes acute stress such as the global financial crisis (GFC) and has been examined regularly. The "inverted yield curve scenario," which was also assumed in the previous issue of the *Report*, is used to examine the impact of the global tightening of financial conditions. In the United States and Europe, if higher-than-expected policy

⁵⁹ 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 Abe, N., Chikamatsu, K., Kanai, K., Kawasumi, Y., Munakata, K., Nakayama, K., Okuda, T., and Takano, Y., "The Financial Macro-econometric Model (FMM, 2022 Version)," *BOJ Reports & Research Papers*, March 2023.

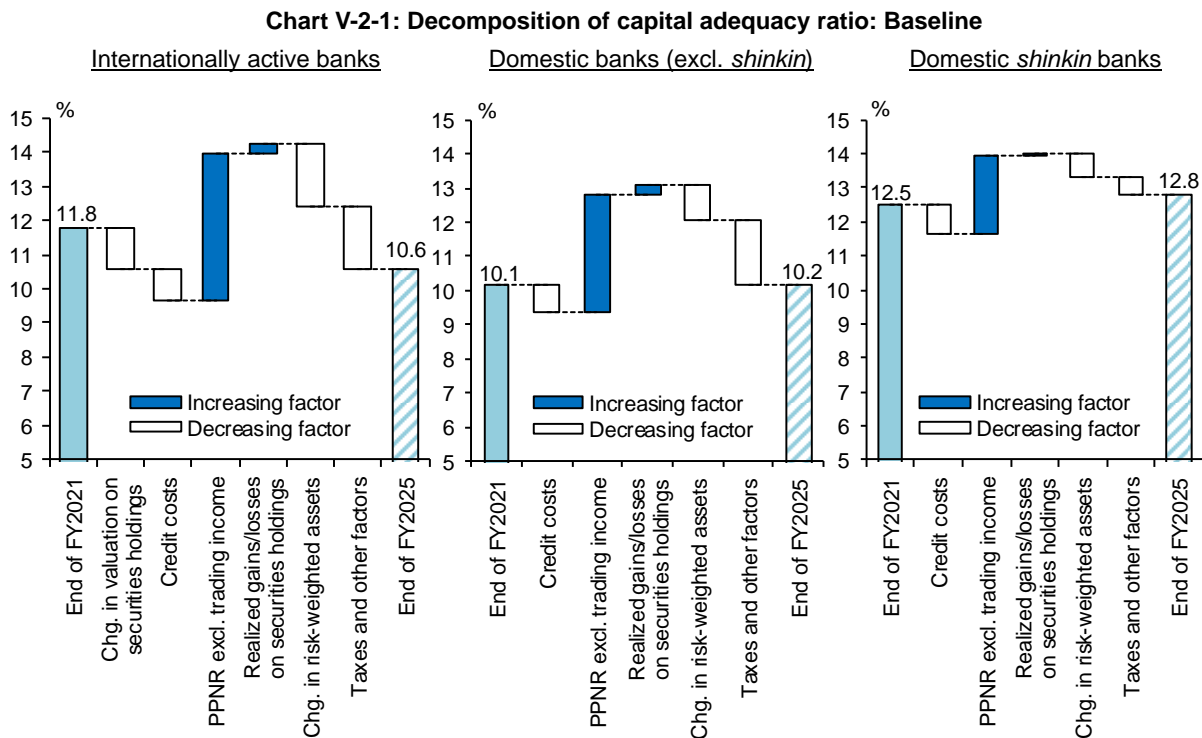
⁶⁰ The stress testing targets 109 banks and 247 *shinkin* banks (accounting for 80 to 90 percent of total loans outstanding of depository financial institutions). The simulation period is from the October-December quarter of 2022 through the January-March quarter of 2026. For the main economic and financial variables for and simulation results of the assumed scenarios, refer to the "Scenario Tables" on the Bank's website.

rate hikes become necessary to address inflationary pressures, economic activity could slow down and the yield curve could be inverted. This would likely affect Japan's financial system through both financial and real economic channels. This section examines changes in the resilience of the financial system against these stress events assuming the same scenarios used in the previous issue of the *Report*.

These downside scenarios are hypothetical and designed to effectively examine the resilience of the financial system. They represent neither the Bank's outlook for the future economic and financial environment, asset prices, and policy conduct, nor the likelihood of the outcome.

1. Baseline scenario

The baseline scenario assumes that Japan's economy recovers as foreign economies continue to recover moderately, based on average forecasts by several research institutions and market expectations as of January 2023.⁶¹ Compared to the baseline scenario in the previous issue of the *Report*, the assumed pace of economic growth is somewhat slower, particularly in foreign economies, partly due to inflation. As for financial variables, it is assumed that all of the currently available information on the outlook for the domestic and foreign economies is appropriately priced in by financial markets. Specifically, the baseline scenario assumes that, under the current



Note: 1. The charts indicate the contribution of each factor to the difference between the capital adequacy ratios at end-March 2022 and the end of the simulation period (as of end-March 2026) 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 banks. The transitional arrangements for domestic banks are taken into consideration.

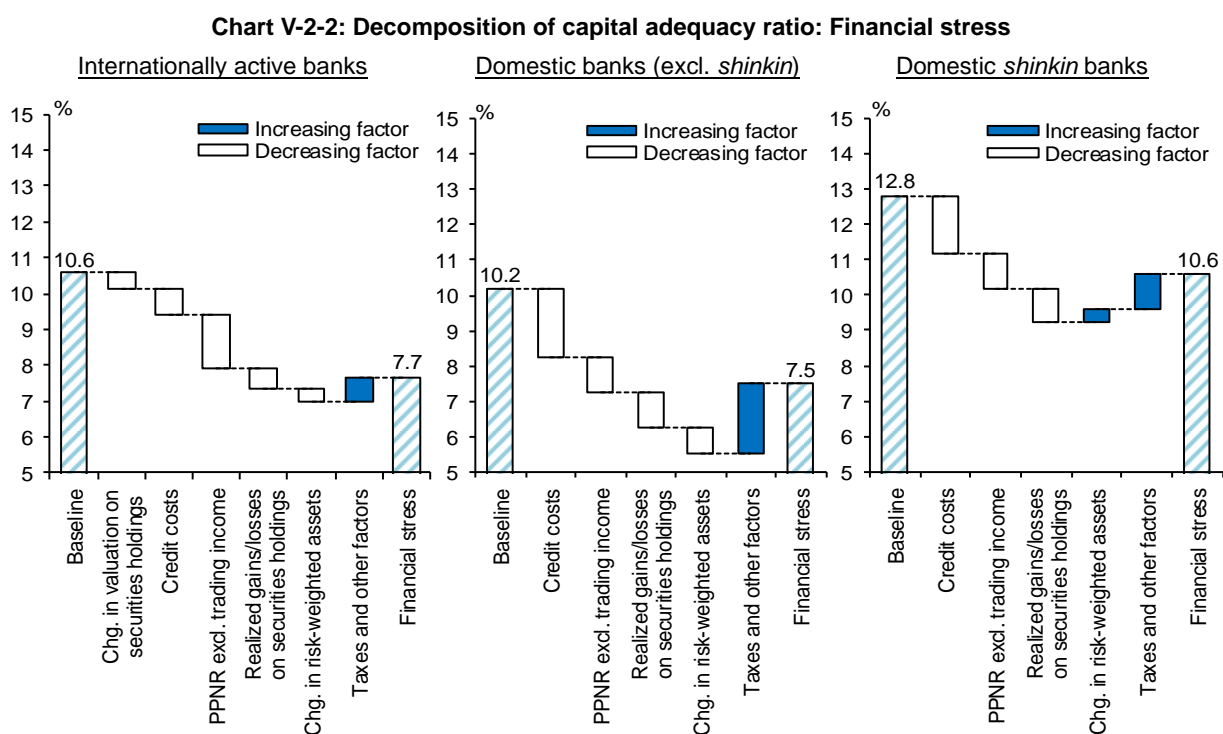
⁶¹ The baseline scenario takes into account the effects of corporate financing support measures implemented since the start of the pandemic, including the policy measures taken by the government and the Bank as well as lending by banks, as in the previous issue of the *Report*. Specifically, the baseline scenario assumes that benefits from the government support corporate profits and that resulting credit costs are kept restrained. Regarding effectively interest-free loans, the scenario assumes that the outstanding amount (as of end-September 2022) is repaid over a period of five years and that firms start to pay interest from fiscal 2023, which lowers their ICRs. The effects of corporate financing support measures are assumed in the same manner in the financial stress scenario and the inverted yield curve scenario.

monetary policy framework, domestic market interest rates rise slightly in line with the rates implied by the average forward rate curve of the past one year. It is assumed that long-term foreign interest rates remain at high levels in line with the forward rate curve in January 2023, and that other financial variables (stock prices, crude oil prices, exchange rates, and various credit spreads) are unchanged from their levels in January 2023.

The simulation results indicate that capital adequacy ratios at the end of fiscal 2025 -- the end of the simulation period -- remain sufficiently above the regulatory requirements for all types of banks (Chart V-2-1). However, the ratio for internationally active banks declines by around 1 percentage point, while the ratio for domestic banks is unchanged. A key factor in the decrease in internationally active banks' capital is a deterioration in valuation gains/losses on foreign bondholdings.⁶² Moreover, their foreign risk-weighted assets are pushed up by an increase in foreign loans.

2. Financial stress scenario

The financial stress scenario assumes that global financial markets experience a negative shock in the April-June quarter of 2023 comparable to that during the GFC. Regarding financial variables, it is assumed that, with domestic and foreign interest rates declining to record low levels, prices of risky assets plummet and the yen appreciates in foreign exchange markets.⁶³ Regarding economic variables, Japan's economy decelerates endogenously in the model, reflecting the substantial repricing in financial markets and a slowdown in foreign economies similar to that seen during the GFC.



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 of end-March 2026) under the baseline scenario and the financial stress scenario.

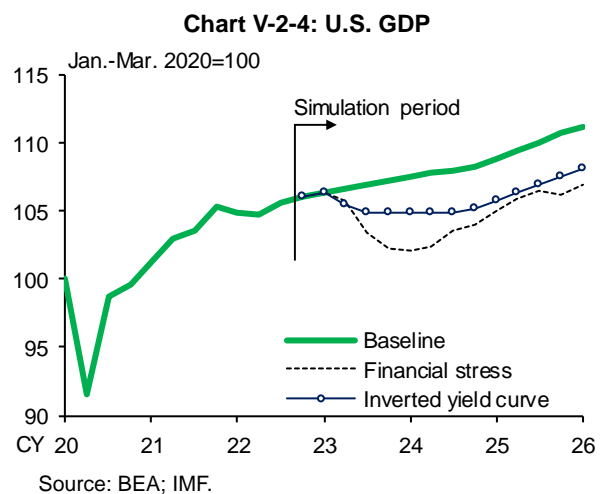
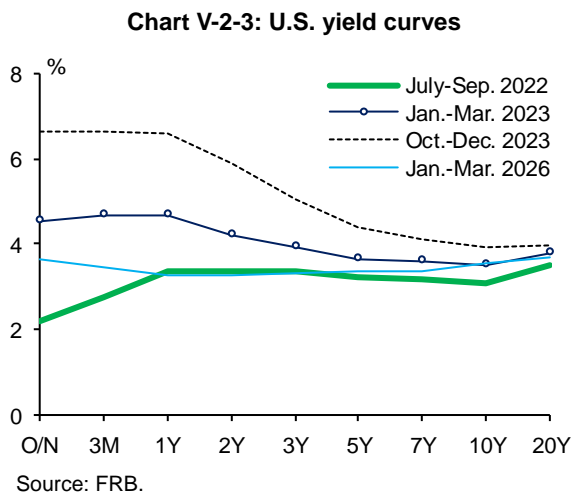
⁶² The capital adequacy ratio is also pushed down by losses on sales of securities recorded in the first half of fiscal 2022. In contrast, the increase in PPNR excluding trading income recorded during the same period pushes up the capital adequacy ratio.

⁶³ Regarding U.S. corporate bonds and securitized products, it is assumed that the pass-through rate of spreads on low-rated bonds to spreads on high-rated bonds rises to the same level as at the time of the market turmoil in March 2020.

The simulation results indicate that capital adequacy ratios at the end of fiscal 2025 are substantially lower than in the baseline scenario, although they remain above regulatory levels on average for all types of banks (Chart V-2-2). The decrease in capital adequacy ratios reflects a decline in interest margins due to the fall in interest rates (decline in PPNR excluding trading income), an increase in credit costs resulting from the economic downturn, and a decline in prices of risky assets (deterioration in valuation and realized gains/losses on securities holdings).

3. Inverted yield curve scenario

The inverted yield curve scenario assumes that interest rates in the United States and Europe remain substantially inverted (Chart V-2-3). Specifically, it is assumed that the U.S. federal funds rate rises to a range of 6-7 percent, in line with the upper end of the confidence interval in the FOMC projections (as of December 2022), and then remains high for one year before decreasing toward the end of the simulation period. The interest rates for other maturities are assumed to be formed in line with the pure expectations hypothesis and move in a manner consistent with developments in policy rates. Therefore, it is assumed that the rise in long-term interest rates remains relatively small and yields remain substantially inverted for most of the simulation period. Similarly, interest rates in Europe are assumed to remain inverted like those in the United States. Meanwhile, crude oil prices are assumed to rise and prices of risky assets to fall as the real economy deteriorates.



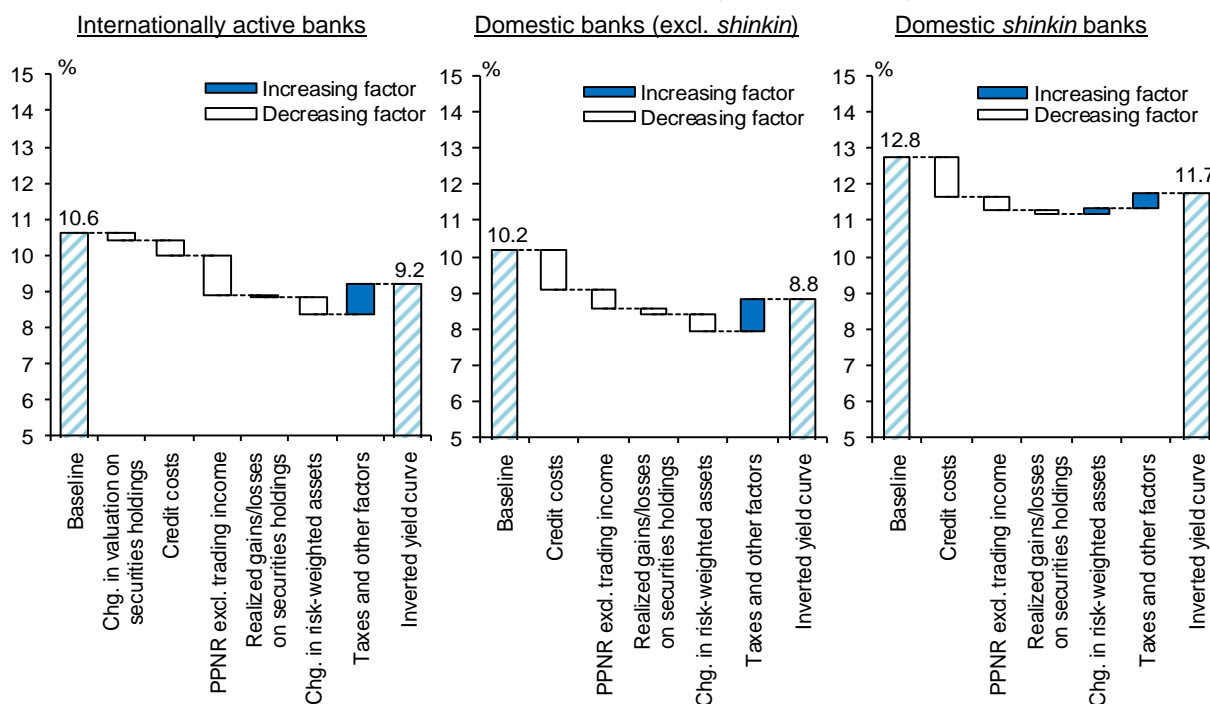
Turning to the real economy, both the U.S. and European economies are assumed to decelerate. The growth rate of the U.S. economy is assumed to turn slightly negative within fiscal 2023, in line with the lower end of the confidence interval in the FOMC projections, and remain zero thereafter for one year (Chart V-2-4). In the model, Japan's economy slows down endogenously due to the rise in foreign interest rates and deterioration in foreign economies, and roughly follows the same pace of growth as the U.S. economy.

The simulation results indicate that capital adequacy ratios at the end of fiscal 2025 are lower than in the baseline scenario for all types of banks (Chart V-2-5).⁶⁴ The ratios are pushed down by a

⁶⁴ Investment trust dividends and hedging against interest rate risk are not explicitly taken into account in the FMM. Regarding the former, the impact of rising foreign interest rates on investment trust dividends is calculated separately, as in the previous issue of the *Report*. Regarding the latter, it is assumed that hedge ratios against foreign interest rate risk are constant throughout the simulation period, and the effect of hedging against interest rate risk in terms of restricting fluctuations in valuation gains/losses on foreign bondholdings is calculated separately.

decrease in foreign bond-related net interest income (decline in PPNR excluding trading income) due to rising foreign currency funding costs. However, the decrease in capital adequacy ratios is relatively modest compared to the financial stress scenario, and overall, the ratios remain above the regulatory requirements throughout the simulation period. It can be judged that the stability of the financial system as a whole is maintained even with the yield curve in foreign markets remaining substantially inverted.

Chart V-2-5: Decomposition of capital adequacy ratio: Inverted yield curve



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 of end-March 2026) under the baseline scenario and the inverted yield curve scenario.

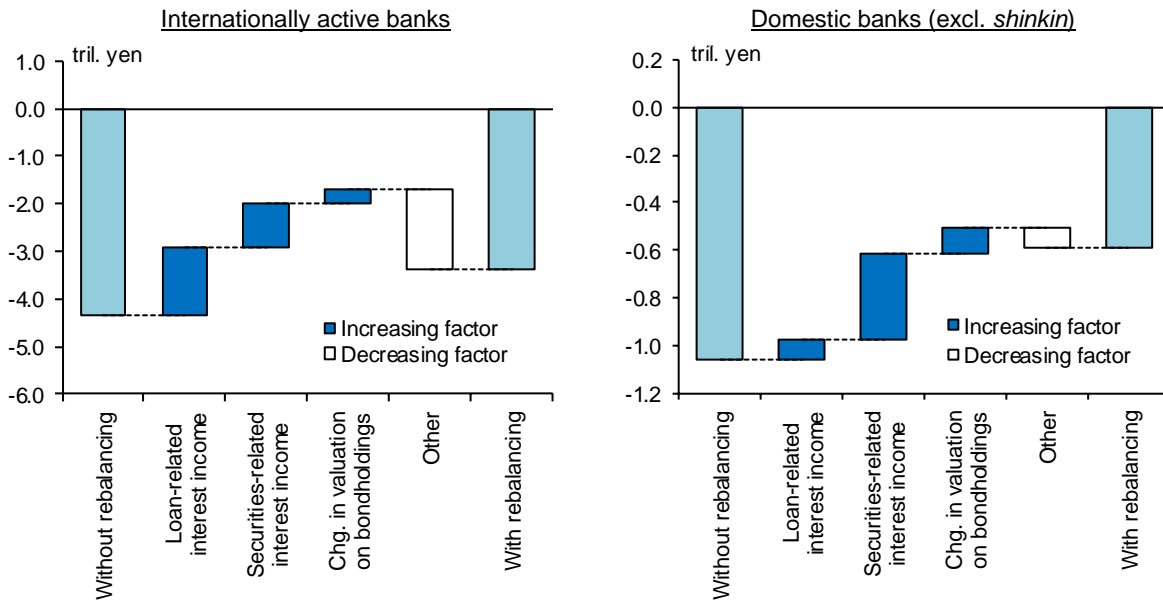
Effects of changes in banks' balance sheets

As pointed out in Chapter IV, banks have been rebalancing their foreign exposures in terms of their loans, securities investment, and funding. To examine the effects of this rebalancing, banks' foreign comprehensive income under the inverted yield curve scenario with and without rebalancing is compared. Specifically, for both major and regional banks, two simulations are conducted. The first uses banks' foreign exposures as of end-September 2022, with the rebalancing that had occurred since end-March 2022. The second simulation uses their foreign exposures as of end-March 2022, without such rebalancing. The simulation results highlight the following three points regarding differences in banks' foreign comprehensive income with and without rebalancing (Chart V-2-6).

First, the rebalancing improves banks' loan-related interest income. Loan-related interest income is pushed up by the increase in lending due to the growing demand for working capital. Moreover, because loan durations have become somewhat shorter, lending interest rates are more likely to reflect the rise in borrowers' refinancing costs. Thanks to the increase in loans outstanding and shortening of loan maturities, the improvement in loan-related interest income brought by rebalancing contributes to mitigating the decline in foreign comprehensive income, particularly at major banks.

Second, the rebalancing improves securities-related interest income. Interest margins on securities investment are negative throughout the simulation period due to the difference in the pass-through rate of market interest rates to investment yields and funding rates. However, rising yields on securities due to the replacement of products restrain the widening of negative interest margins to some degree. A reduction in the outstanding amount of securities also partly offsets the contribution of negative interest margins on foreign comprehensive income.

Chart V-2-6: Decomposition of foreign comprehensive income



- Note: 1. The chart shows the direct impact of changes in yield curves on the cumulative foreign comprehensive income from fiscal 2023 to 2025. "Without rebalancing" and "With rebalancing" indicate the decrease in the foreign comprehensive income based on balance sheet information as of end-March 2022 and end-September 2022, respectively. The foreign comprehensive income includes net interest income and valuation on bondholdings.
2. "Chg. in valuation on bondholdings" indicates the value in the first half of fiscal 2023. Hedging against interest rate risk is taken into account.
3. "Other" includes funding costs and changes in valuation on bondholdings from the second half of fiscal 2023 to 2025.

Third, the rebalancing improves valuation on bondholdings. This improvement reflects the fact that foreign currency interest rate risk has been reduced and kept low because banks have curtailed foreign bond positions and shortened their foreign bond durations. Moreover, the rise in hedge ratios against foreign interest rate risk amid rising interest rates helps to mitigate a deterioration in valuation gains/losses on securities holdings.

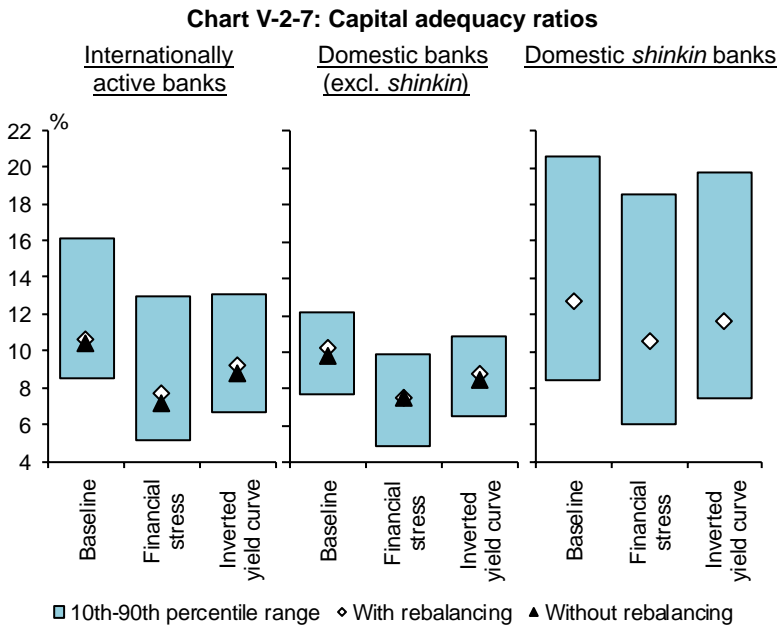
Compared to the simulation without rebalancing, banks' capital adequacy ratios in the event of stress are about 0.5 percentage point higher with rebalancing (Chart V-2-7). Capital adequacy ratios are pushed up by the aforementioned improvements in foreign net interest income and valuation gains/losses on securities holdings. Losses on sales of securities due to the recent rebalancing are more than offset by the positive contribution of factors pushing up the ratios during the simulation period.

Impact on loss-absorbing capacity

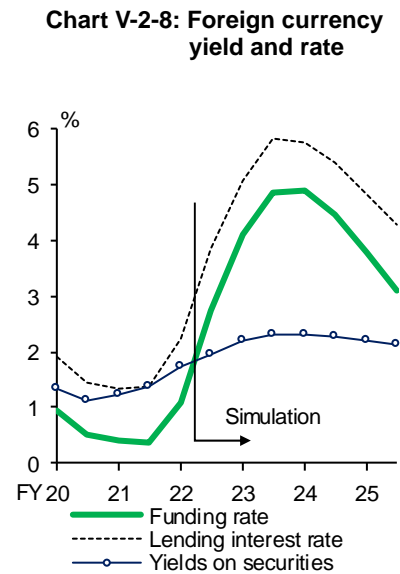
Despite banks' rebalancing of their portfolios, the simulation shows that the inversion of the yield curve puts pressure on narrowing the interest margins between investment yields and funding rates. In the current phase of rising foreign interest rates, the pass-through rate of market interest rates to funding rates has been lower than in past phases of interest rate rises (see Section D of Chapter IV). However, even in the simulation in this *Report*, which explicitly takes this difference in the pass-

V. Resilience of the financial system
 B. Macro stress testing

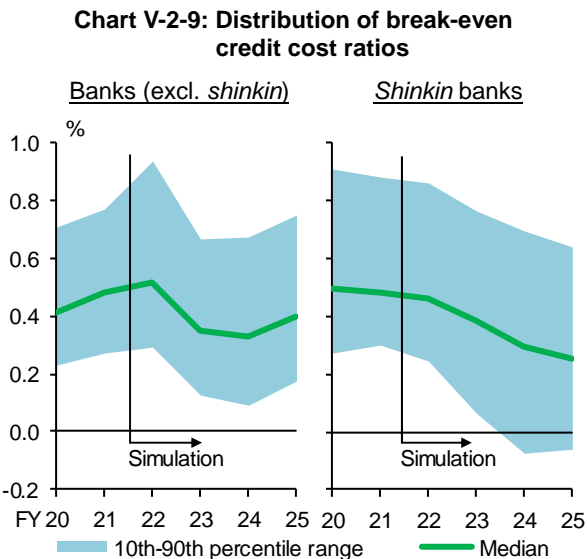
through rate into account, interest margins on securities investment are significantly negative (Chart V-2-8).⁶⁵ The decline in securities-related net interest income inevitably exerts downward pressure on their loss-absorbing capacity, even though many banks have been rebalancing their portfolios.



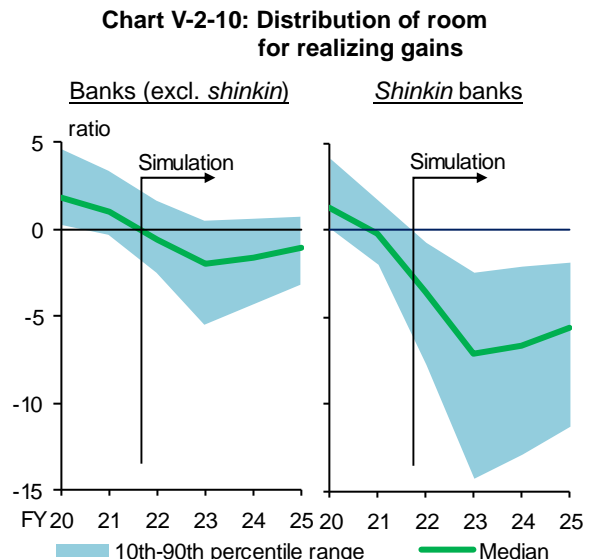
Note: The white markers and bands indicate the averages and the 10th-90th percentile ranges of capital adequacy ratios as of end-fiscal 2025, respectively, based on the portfolio with rebalancing. The black markers indicate the averages of capital adequacy ratios based on the portfolio without rebalancing.



Note: Covers internationally active banks and domestic banks (excl. *shinkin*).



Note: The break-even credit cost ratios are the ratios at which credit costs equal PPNR excluding trading income.



Note: Room for realizing gains = valuation gains or losses on securities holdings / previous 3-year average of PPNR excluding trading income.

In fact, the distribution of the break-even credit cost ratios, which represent profit buffers, shows a decline overall, as in the previous issue of the *Report* (Chart V-2-9). For some banks, the ratio even

⁶⁵ In the current phase of rising foreign interest rates, foreign lending margins have improved, unlike in past phases. To reflect this feature of interest rate developments, interest rate models in the FMM have been revised in this *Report*. These revisions make foreign lending margins less likely to shrink than in the simulation results shown in Chart V-2-7 of the previous issue of the *Report*.

becomes negative, indicating a deficit in PPNR excluding trading income. This means that their PPNR excluding trading income in one fiscal year can no longer cover their credit costs.

Moreover, banks' room for realizing gains in terms of net valuation gains on securities holdings declines markedly due to the deterioration in valuation gains/losses, particularly on foreign bondholdings (Chart V-2-10). Even for banks that have been rebalancing their portfolios to date, the room for realizing gains could turn negative if market interest rates were to rise further.⁶⁶ In particular, the room for realizing gains declines substantially for banks with large securities portfolios relative to their profitability. The decline in banks' loss-absorbing capacity in terms of both profit buffers and room for realizing gains makes them more vulnerable to additional stress during the simulation period. Banks for which loss-absorbing capacity has fallen may find it difficult to engage in additional risk-taking, and their financial intermediation could be impaired.

4. Evaluation of the resilience of the financial system

The results of the macro stress testing indicate that Japan's financial system would remain stable even in the event of a certain level of stress. Japanese banks on the whole are resilient to stress events such as financial stress similar to that experienced during the GFC or an inverted yield curve in foreign markets. Ample capital and liquidity enhance the resilience of the financial system as a whole. Recent changes in banks' balance sheets have also contributed to improvements in their resilience against the risk of rising interest rates.

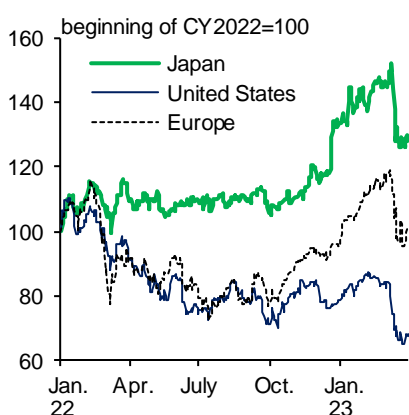
However, the degree of resilience varies across banks. There are still banks with small profit buffers and/or little room for realizing gains. Moreover, even banks that have been rebalancing their portfolios may need to rebalance further to avoid negative interest margins, if, contrary to market expectations, foreign market interest rates were to rise further and remain high for longer. Banks therefore need to be prepared to appropriately manage a variety of risks, including the risk of interest rate fluctuations, based on the premise that uncertainty will remain high.

⁶⁶ In the simulation, securities portfolios (the outstanding amount and composition of products) are assumed to be constant and no flexible replacement of products is assumed.

Box 1: Impact of the U.S. bank failures on Japan's financial system

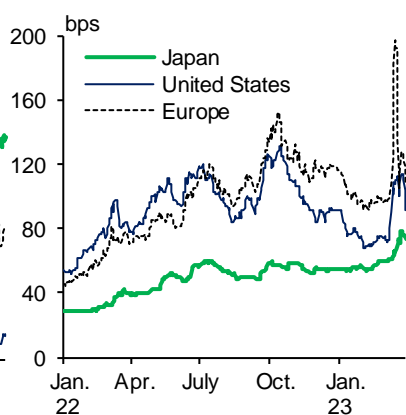
In March 2023, the successive failures of Silicon Valley Bank (SVB) and Signature Bank in the United States led to increased uncertainty about the financial sector in the United States and Europe.⁶⁷ In response to these failures, immediate action was taken in the United States, including the decision by relevant authorities to fully protect the deposits of the two banks, the creation of the Bank Term Funding Program by the Federal Reserve, and the announcement by major U.S. banks to place deposits with a medium-sized bank. Nevertheless, financial markets remained nervous, with bank stock prices falling and credit default swap (CDS) spreads widening (Charts B1-1 and B1-2). The stock prices of small and medium-sized U.S. banks, for which deposit bases have been pointed out as vulnerable, experienced particularly large declines.

Chart B1-1: Bank stock prices



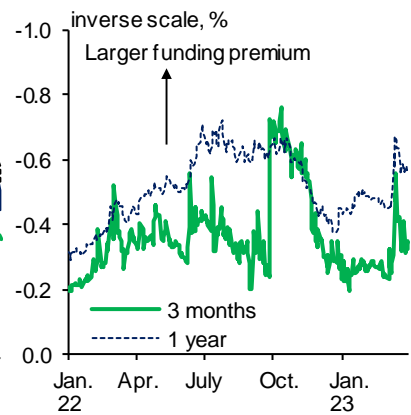
Note: The data for Japan, United States, and Europe indicate bank prices indices of the TOPIX, the S&P 500, and the EURO STOXX, respectively. Latest data as of end-March 2023.
Source: Bloomberg.

Chart B1-2: CDS spreads of banks



Note: Figures are averages for G-SIBs for which data are available. Latest data as of end-March 2023.
Source: Bloomberg; ICE Data Services; QUICK.

Chart B1-3: U.S. dollar funding premiums



Note: "3 months" refers to premiums on FX swaps (inverse scale). "1 year" refers to alpha of basis swaps. Latest data as of end-March 2023.
Source: Bloomberg.

The impact of this heightened uncertainty on Japan's financial system is limited. Although prices of bank stocks fell in Japan's stock market, assessment for banks in the credit market, including that of banks' Additional Tier 1 (AT1) bonds, has been stable compared to the United States and Europe. The rise in U.S. dollar funding premiums in the FX swap market has remained modest relative to that observed beyond the year-end (Chart B1-3). Valuation losses on securities, which many banks have suffered, have not affected the resilience of the financial system or the functioning of financial intermediation.

It is worth noting that the failed SVB (with total assets of slightly more than 200 billion dollars at the end of 2022) had unique characteristics in terms of both its liabilities and assets. On the liability side, the growth rate of deposits (2.8-fold from end-2019 to end-2022 versus +32 percent for U.S. banks overall) as well as deposits per account (1.12 million dollars at end-2022 compared to around 20 thousand dollars for U.S. banks overall) were particularly high. Similarly, on the asset side, the

⁶⁷ In March 2023, a number of U.S. and European banks experienced financial difficulties in short succession, starting in the United States with the liquidation of Silvergate Bank (March 8) and the collapse of SVB (March 10) and Signature Bank (March 12), followed in Europe by the sale of Credit Suisse to UBS (March 19).

high.^{68,69} The increase in the outstanding amount of securities (+89.5 billion dollars) was almost the same as that of deposits (+112.4 billion dollars) over the most recent three-year period (end-2019 to end-2022). The securities accumulated over a relatively short period of time when interest rates were low suggest that the time diversification of investment did not work sufficiently, and the bank had been exposed to risks of valuation losses and negative interest margins, which exceeded its loss-absorbing capacity. Given this distinctive feature of assets and liabilities, the bank appears to have been caught in a vicious cycle; once deposits began to be withdrawn, it was forced to convert assets, including held-to-maturity securities, into cash, and thus recorded realized losses on the securities and rapid withdrawals of deposits.⁷⁰ These facts lead to the following observations.

First, the failure concerns a bank under the supervision of financial authorities. SVB's asset-and-liability situation was readily apparent, and this was a classic form of failure in which the bank ran out of funding. Thus, the failure differs from the situation during the global financial crisis following the collapse of Lehman Brothers, when the location of risk could not be identified due to securitization, nor was it a situation in which the hidden leverage of unsupervised NBFIs came to light.

Second, as for valuation losses on securities, which played a role in the failure, it is important for banks to secure loss-absorbing capacity commensurate with the valuation losses. Moreover, as for funding bases, it is also important not to be overly dependent on one funding source, as was the case with SVB, for which funding consisted primarily of large deposits from a specific industry. All banks, to a greater or lesser extent, take interest rate risk and rely on a combination of funding sources with relatively low stickiness, such as corporate deposits and short-term market funding. Banks need to appropriately manage interest rate risk and maintain stable funding bases in order to ensure they have sufficient flexibility in their business as well as securities investment strategies (such as whether to adjust or rebalance their positions or hold securities for a long period).

Third, there are no Japanese banks with a unique feature of balance sheets similar to that of SVB. With regard to loss-absorbing capacity, Japanese banks would have capital bases to withstand losses even if they realized all valuation losses on securities. Banks with a large amount of valuation losses on securities are those that have high capital adequacy ratios. Their ratios remain above regulatory requirements even after including valuation gains/losses on securities (including held-to-maturity securities and excluding strategic stockholdings) in the capital for domestic banks (Charts B1-4 and B1-5). In terms of resilience to the risk of a further rise in interest rates, banks have been rebalancing their securities holdings, and their foreign lending-deposit interest margins have improved somewhat. They are also resilient to a stress event in which foreign yield curves remain substantially inverted (see Section B of Chapter V).

In terms of funding, Japanese banks have stable funding bases. They have diversified their yen funding sources by using a variety of funding sources together, especially small, sticky retail deposits (Charts B1-6 and B1-7). Banks that mainly focus on corporate business have a relatively high share of corporate deposits, but these do not consist primarily of deposits from specific industries. As for their foreign currency funding, the share of retail deposits is low. Japanese banks, however, have been using medium- to long-term FX and currency swaps to stabilize their funding. During the most

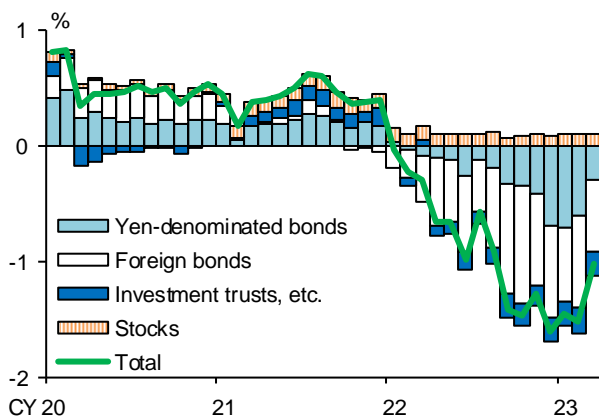
⁶⁸ The figures for SVB are based on *Call Report* released by the Federal Financial Institutions Examination Council.

⁶⁹ In addition, it has been pointed out that (1) SVB's share of uninsured deposits (in the United States, deposit protection is capped at 250,000 dollars per account), at 90 percent, was also much higher than at other U.S. banks (less than 50 percent on average at the end of 2022), and (2) SVB's deposit base depended on depositors with the similar risk characteristics, with a concentration of large deposits from venture capital firms.

⁷⁰ Of the 89.5 billion dollars increase in the outstanding amount of securities, 77.5 billion dollars consisted of held-to-maturity securities. As a result, at the end of 2022, almost 80 percent of SVB's outstanding amount of securities were held-to-maturity securities that did not require daily mark-to-market valuation.

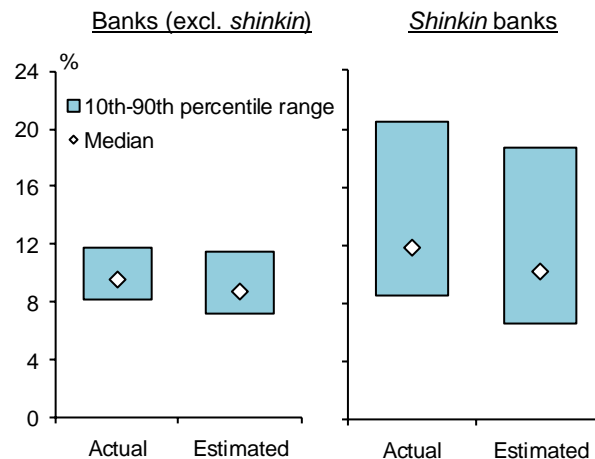
recent episode in March, there were no particular disruptions to their funding; the dollar deposits of major banks remained stable, and major and regional banks procured funds beyond the fiscal year-end in advance.

Chart B1-4: Valuation gains/losses for Japanese banks



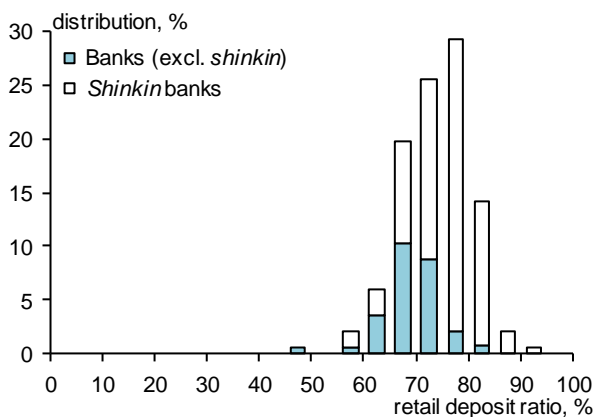
Note: 1. The chart shows the ratio of valuation gains/losses on securities (including held-to-maturity securities and excluding strategic stockholdings) to risk-weighted assets. Latest data are estimated based on interest rates as of end-March 2023. Latest data for "Stocks" and "Investment trusts, etc." are imputed by the values as of February 2023.
2. Covers major, regional, and *shinkin* banks.
Source: BOJ.

Chart B1-5: Capital adequacy ratios including valuation gains/losses



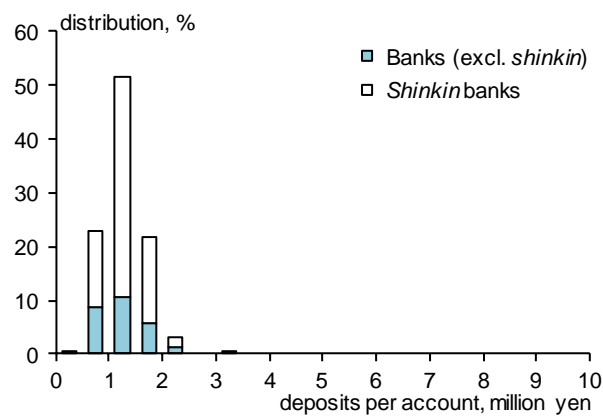
Note: 1. "Actual" indicates ratios as of end-March 2022. "Estimated" indicates ratios estimated based on the valuation gains/losses on securities as of end-March 2023. Core capital basis.
2. Covers domestic banks among major, regional, and *shinkin* banks.
Source: BOJ.

Chart B1-6: Distribution of retail deposit ratio



Note: The chart shows the ratios to overall banks including major, regional, and *shinkin* banks on a bank group basis. Covers the accounts held by domestic branches. Financial institutions' deposits are excluded. Data as of end-September 2022.
Source: BOJ.

Chart B1-7: Distribution of deposits per account

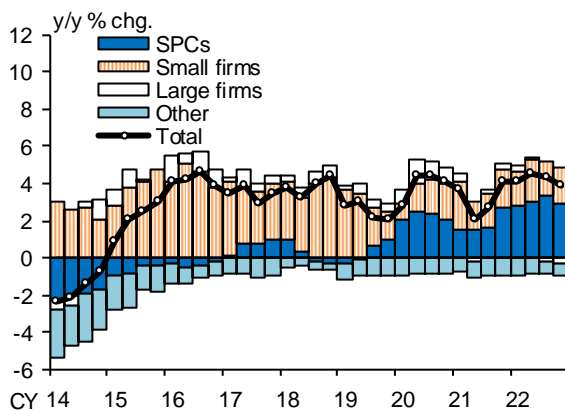


Note: The chart shows the ratios to overall banks including major, regional, and *shinkin* banks on a bank group basis. Covers the accounts held by domestic branches. Financial institutions' deposits are excluded. Data as of end-September 2022.
Source: BOJ.

Box 2: Loans to real estate investment funds by major banks

Loans to real estate businesses by major banks have increased, driven by loans to real estate investment funds along with loans to REITs ("SPCs" and "small firms" in Chart B2-1, respectively). Loans to real estate investment funds are a lucrative area where banks -- due to solid demand for funds from foreign investors -- can earn relatively high loan spreads. Moreover, major bank groups can expect to earn ancillary revenues not only for their banks but also for their trust and securities companies within the group resulting from the fund-raising, sale and purchase intermediation, and asset management stages of the real estate business. Therefore, major banks have been actively engaged in lending to real estate investment funds, making that one of their focal areas.

Chart B2-1: Lending to real estate businesses by major banks



Note: "Small firms" includes J-REITs. Latest data as of end-December 2022.
Source: BOJ.

Chart B2-2: SPCs' balance sheets

Assets	Funding
Beneficiaries' interest in real estate	Senior loans
	Mezzanine loans
	Equity

Loans to real estate investment funds have a different loan structure from corporate loans, and are managed accordingly. In terms of loan structure, lenders provide non-recourse loans to special purpose companies (SPCs) established with equity investments from sponsors such as foreign investors (Chart B2-2). Loans are classified into tranches and are divided into senior loans, which have the highest repayment priority, and mezzanine loans, which fall between senior loans and equity. Each lender provides a loan according to the risk-taking and investment stance. In the Japanese real estate market, the main lenders are major bank groups for senior loans and other financial firms for mezzanine loans.

Turning to risk management, it is important to understand the risk profile of the property, including the cash flow and market value. This is because loans to real estate investment funds are non-recourse, and the source of repayment is limited to the rental income and/or sales value of the property. Specifically, credit risk indicators such as the debt service coverage ratio (DSCR) and the loan-to-value (LTV) ratio are used. As part of such risk management, major banks assess cash flows and valuations assuming stress events. Moreover, they make comprehensive judgments based on qualitative factors such as the location of the property, the credibility of the sponsor, and the operational capability of the operators; they select and manage loan projects accordingly.

Compared to past periods of stress, such as the burst of the so-called "mini-bubble," the quality of major banks' portfolio of loans to real estate businesses has improved on the whole. However, as loans to real estate investment funds have increased, the risk profiles have been transformed

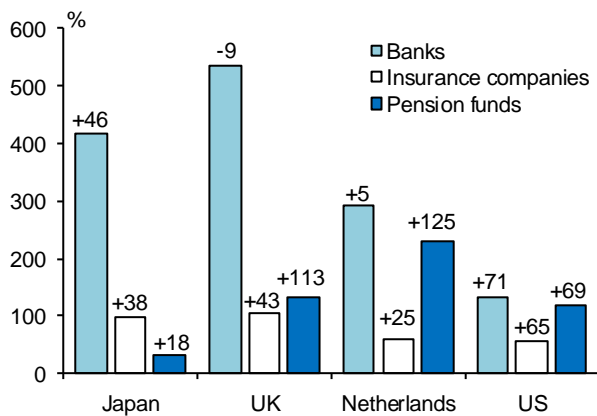
qualitatively. Major banks and other banks that have been focusing on lending to real estate investment funds need to continue to appropriately manage the associated risks; for example, by examining the credit risk of their loans in a timely manner, taking real estate market conditions and financial conditions into account.

Box 3: International comparison of corporate pension funds' balance sheets

The surge in interest rates in the UK gilt market in September 2022 suggests that even institutional investors that make long-term investments, such as corporate pension funds, can amplify fluctuations in financial markets, depending on their investment strategies and risk characteristics. Corporate pension funds make long-term investments to fulfill long-term pension contracts. While this is common across countries, the size and allocation of their assets vary from country to country, leading to differences in risk characteristics.

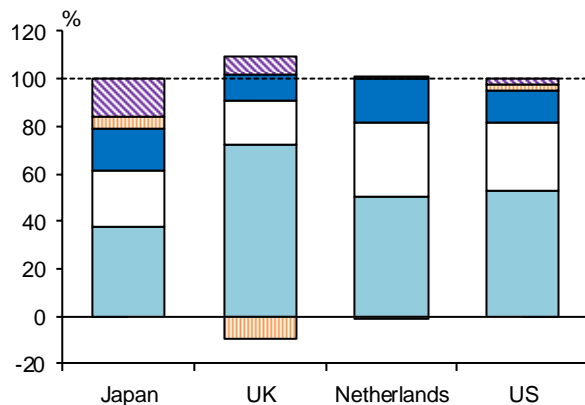
To start with, in the Netherlands and the United States, the size of assets held by corporate pension funds is comparable to that of the banking sector (Chart B3-1). This is in contrast to Japan's corporate pension funds, which are much smaller than the banking and insurance sectors, partly because they are placed in the third tier, above the national pension and the employees' pension. Globally, corporate pension funds have a large presence in financial markets, and in the United Kingdom and the Netherlands their assets have been increasing rapidly. The possible impact of corporate pension funds on financial markets is clearly rising.

Chart B3-1: Financial assets among financial intermediaries



Note: 1. The bars show the ratios of financial assets to nominal GDP. Data as of 2021.
 2. The figures in the chart show percentage changes in outstanding financial assets for the past 10 years.
 Source: FSB.

Chart B3-2: Asset allocations of corporate pension funds



Note: 1. Repo funding is deducted from "Cash and deposits."
 2. Data for Japan and other countries are as of March 2022 and December 2021, respectively.
 Source: De Nederlandsche Bank; Pension Fund Association; Pension Protection Fund; WTW, "2021 Asset Allocations in Fortune 1000 Pension Plans."

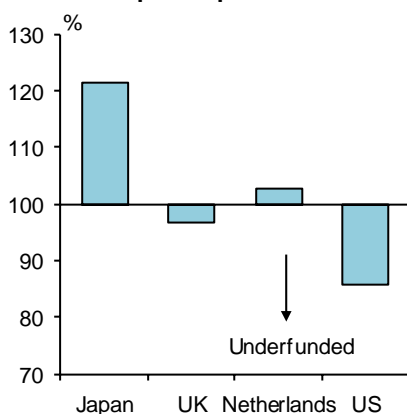
Next, asset allocations vary from country to country, reflecting differences in the nature of pension contracts -- whether they are defined benefit or defined contribution, lifetime guarantees or fixed-term guarantees -- as well as in the structure of financial and capital markets in the respective countries (Chart B3-2). In corporate pension funds in Japan, equities and alternative assets, which offer higher yields than bonds, account for a large share of assets in order to achieve sufficient investment yields. In countries where pension funds have adopted an investment strategy called liability-driven investment (LDI), such as the United Kingdom, the Netherlands, and the United States, the majority of assets under management are interest rate products, such as bonds, in order to balance changes in the market value of pension liabilities and assets in response to changes in market interest rates.

Among these countries, in the United States, corporate pension funds -- partly because the duration of their liabilities is relatively short -- mainly invest in domestic corporate bonds with ample market depth. On the other hand, in the United Kingdom and the Netherlands, where corporate pensions mainly consist of defined benefit plans providing lifetime annuities, the duration of liabilities tends to become longer as the population ages. Corporate pension funds in the United Kingdom and the Netherlands therefore need to devise ways to reduce the duration gap between assets and liabilities; for example, by using interest rate swaps, lengthening the duration of assets by investing in super-long-term bonds, and shortening the duration of liabilities by funding investment assets through repo transactions.

These efforts to reduce the duration gap to stabilize pension fund finances can lead to a surge in demand for liquidity in the event of stress, such as the market turmoil last September. Specifically, sudden changes in interest rates may cause leveraged positions using repo funding and interest rate swaps to face margin calls in excess of what was assumed under normal risk management. In the case of UK corporate pension funds, they were unable to meet large margin calls and were forced to liquidate their assets due to a low ratio of cash and deposits as a result of leverage.

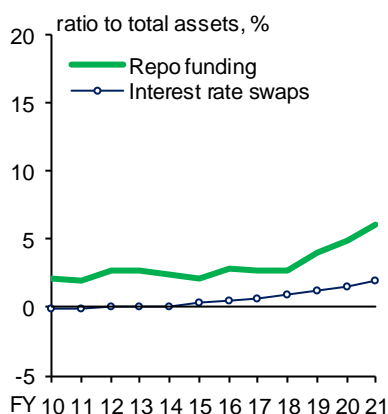
In contrast, in Japan, where the majority of corporate pensions consists of defined benefit plans providing fixed-term annuities, corporate pension funds rarely enter the kind of leveraged positions seen in the United Kingdom and the Netherlands. A key characteristic of Japan's corporate pension funds is that they are less susceptible to day-to-day market fluctuations, partly because the present value of liabilities is discounted by the assumed rate of return (guaranteed rate of return) instead of market interest rates. Moreover, the funding ratio calculated based on the assumed rate of return is significantly higher than 100 percent, so there is little need for leverage (Chart B3-3). Thus, asset allocations of corporate pension funds vary depending on their investment strategies, and their risk characteristics differ accordingly.

Chart B3-3: Funding ratios of corporate pension funds



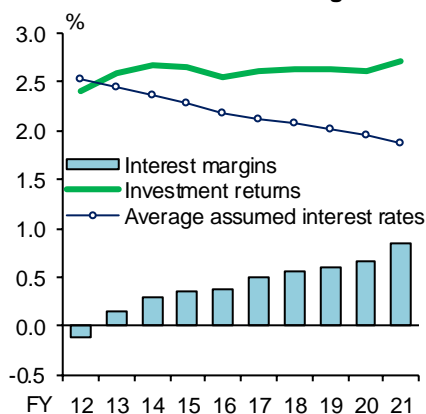
Note: 1. 5-year averages (between fiscal 2016 and 2020) of funding ratios. Covers defined benefit plans.
 2. The data for Japan are the ratio of net assets to policy reserves.
 Source: De Nederlandsche Bank; Milliman; Pension Fund Association; Pension Protection Fund.

Chart B3-4: Leverage of life insurers



Note: "Interest rate swaps" consists of net positions of interest rate swap calculated based on notional amounts outstanding of four major life insurance companies.
 Source: Published accounts of each company; BOJ.

Chart B3-5: Life insurers' interest margins



Note: Covers three out of the four major life insurance companies for which data are available.
 Source: Published accounts of each company.

Life insurance companies have different risk characteristics from corporate pension funds, although they are both institutional investors that make long-term investments. The size of assets held by the insurance sector is large in Japan compared to other countries. Moreover, the duration of Japanese

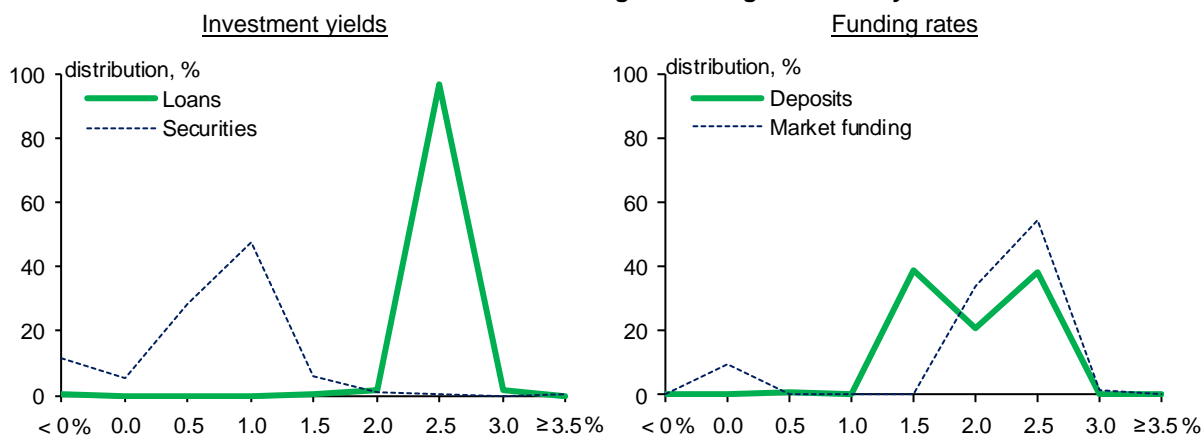
life insurance companies' liabilities is relatively long, as fixed-amount whole life insurance contracts account for more than a quarter of the total value of insurance policies. Although life insurance companies have worked on reducing the duration gap between assets and liabilities in view of the introduction of economic value-based solvency regulations (ESR) in 2025, there remains a gap (Chart III-2-3). To close this, life insurance companies in the past decade have continued to invest in super-long-term bonds, and their leveraged positions using repo funding and interest rate swaps have also been on the rise (Chart B3-4).

On the other hand, life insurance companies' interest margins (investment returns minus assumed interest rates) have continued to increase moderately (Chart B3-5). Life insurance companies' ESR, assuming interest rate fluctuations, has been above 200 percent. In addition, they have a certain level of liquidity reserves. While there are no particular concerns over life insurance companies' financial soundness, due attention should continue to be paid to how risk characteristics will change in line with changes in their asset allocations.

Box 4: Interest rate sensitivity of the banking book

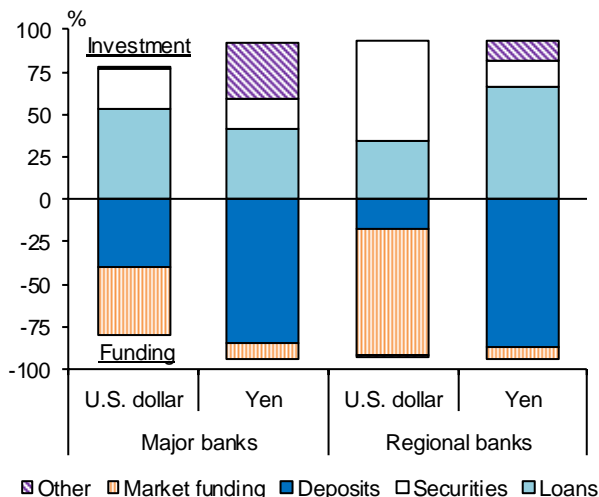
The rise in foreign interest rates during the current phase has affected the banking sector in Japan through various direct and indirect channels. Direct channels include (1) funding rates such as interest paid on deposits, (2) lending interest rates, (3) yields on securities, and (4) discount rates for mark-to-market accounting. Through these channels, the rise in foreign interest rates has affected the interest rate risk of the banking sector -- such as the net interest income on loans and securities and valuation gains/losses on securities. However, even though banks all face the same shift in foreign yield curves, the impact is not uniform. There is heterogeneity in the impact of rising foreign interest rates, reflecting banks' balance sheet structure -- the composition of their assets and liabilities and the duration gap in that composition -- and the pass-through rate of changes in market interest rates for individual products (Chart B4-1).

Chart B4-1: Distribution of changes in foreign rates and yields



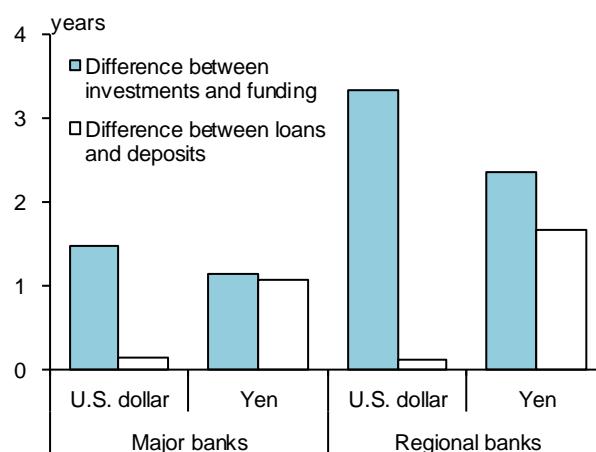
Note: The charts indicate the distribution of changes (from September 2021 to September 2022) in U.S. dollar funding rates and investment yields. Covers major and regional banks.
Source: BOJ.

Chart B4-2: Composition of assets and liabilities



Note: 1. "Other" refers to the net position of other investments and funding.
2. Data as of September 2022.
Source: BOJ.

Chart B4-3: Average repricing schedule



Note: Data as of September 2022.
Source: BOJ.

Starting with the composition of assets and liabilities, unlike in their yen balance sheets, banks' loans are in excess of deposits in their foreign currency balance sheets (Chart B4-2). For major banks that

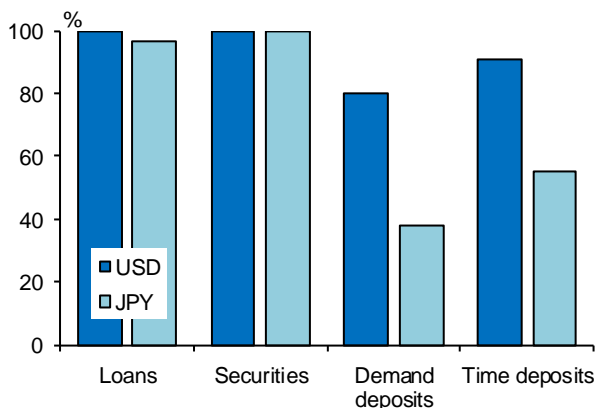
have been active in foreign lending, loans have increased at a faster pace than deposits (see Section D of Chapter IV). This loan-to-deposit gap has been filled through market funding. Moreover, market funding has also been used to maintain securities positions.

Next, looking at repricing schedules, for foreign currency balance sheets of both major and regional banks, the duration gap between investments and funding ("difference between investments and funding" in the chart) is relatively large, due mainly to securities (Chart B4-3). Although the duration gap in banks' foreign currency balance sheets has shortened somewhat amid the recent rise in interest rates, reflecting the rebalancing of foreign bondholdings, it continues to exceed the duration gap in their yen balance sheets.

However, in banks' foreign currency balance sheets, there is no major duration gap between loans and deposits ("difference between loans and deposits" in the chart). For both major and regional banks, the repricing schedules of foreign currency deposit funding are similar to those of yen deposit funding and are quite short, averaging less than one year. Moreover, 90 percent of major banks' foreign loans are floating-rate loans that are linked to market interest rates, and the repricing schedules of foreign currency loans are around three months, about the same length as those of foreign currency funding. As a result, the term structure of foreign currency loans and deposits is such that interest rate risk is unlikely to materialize. This is significantly different from yen loans, which have a relatively large share of fixed-rate loans, with repricing schedules of close to two years.

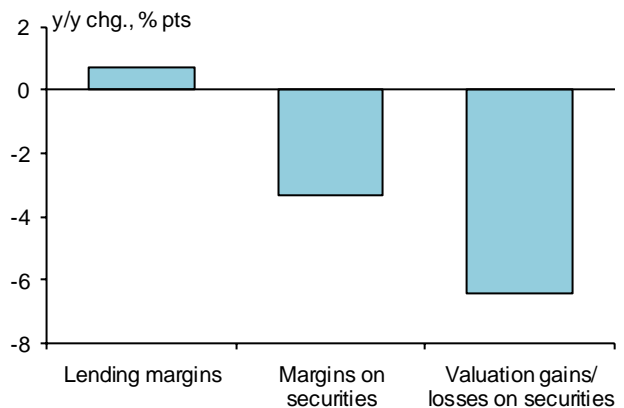
Lastly, the pass-through rate assumed by banks of market interest rate changes differs depending on the product (Chart B4-4). Rates and yields of market products -- such as market funding, base rates for loans linked to market rates, and securities -- mechanically follow changes in market interest rates due to the nature of these products. In contrast, the pass-through to other products -- such as deposits, fixed-rate loans, and the spread on loans linked to market rates -- potentially depends on supply and demand conditions and the degree of competition in the deposit and loan markets at the time, as well as on banks' business strategies.

Chart B4-4: Pass-through rates of market interest rate changes



Note: The pass-through rates that major banks assume when calculating the amount of interest rate risk in the banking book. Data as of September 2022.
Source: BOJ.

Chart B4-5: Foreign currency margins and ratio of valuation gains/losses



Note: 1. "Lending margins" is calculated as loan interest rates minus funding rates (deposits, etc.). "Margins on securities" is calculated as yields on securities minus market funding rates. "Valuation gains/losses on securities" includes held-to-maturity securities.
2. Covers U.S. dollar positions among major banks.
Data as of February 2023.
Source: BOJ.

In the current phase, foreign interest rates have risen with a flattening of the yield curve. This change in the yield curve has led to an increase in the interest margin of lending with a smaller duration gap

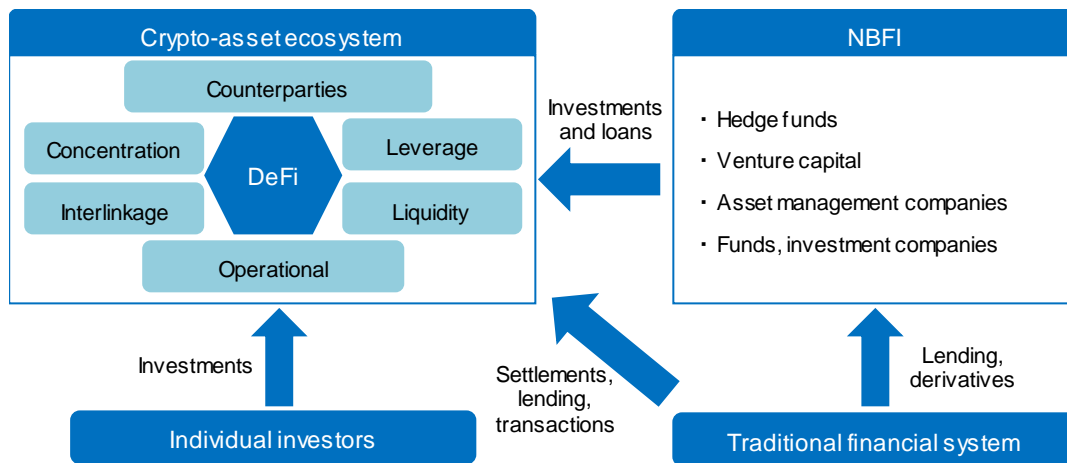
(Chart B4-5). The relatively high interest rate pass-through on loans has also contributed to the increase in lending margins. On the other hand, for securities with a large duration gap, funding costs rose ahead of securities yields, which contributed to the contraction in margins. Moreover, valuation gains/losses deteriorated significantly due to the increase in the discount rate. Thus, interest rate risk in the banking book is determined by the term structure of banks' assets and liabilities, the pass-through of market interest rate changes, and the shape of the yield curve. In the current phase of large interest rate fluctuations, banks are expected to manage interest rate risk in a finely tuned manner in line with their own interest rate projections and risk positions.

Box 5: The crypto-asset ecosystem and financial risk

Following the run on crypto-asset TerraUSD in May 2022, FTX Trading, a major crypto-asset exchange, went out of business in November. The market value of the tokens issued by the company plummeted, leading to a run by its customers. The company's disorderly business practices, including the misappropriation of customer assets, also came to light, and losses spread throughout the world. Following the series of bankruptcies, the market capitalization of crypto-assets has fallen by half from its peak.

Crypto-assets and the underlying decentralized finance (DeFi) ecosystem are based on new technologies. However, the characteristics of the financial risk pertaining to the services they provide are similar to those provided by the traditional financial system, in that they are complex and systemic in nature.⁷¹ The functions of the ecosystem are not literally decentralized, but rather like a financial conglomerate. In addition to providing exchange and intermediary functions, the DeFi ecosystem fulfills a wide variety of functions, including custody, lending, deposit, market making, clearing and settlement, and initial coin offering. Reflecting these functions, the DeFi ecosystem has a complex risk profile. The vulnerabilities of the ecosystem exposed by last year's bankruptcies -- runs on crypto-assets, fire sales due to deleveraging, and defaults by lenders -- are similar to those inherent in the traditional financial system (Chart B5-1).

Chart B5-1: Crypto-asset and DeFi ecosystem



Risks that materialize within one ecosystem can affect other ecosystems and the traditional financial system through the interconnectedness of such systems. In this regard, the series of bankruptcies of crypto-asset-related companies seen in the past year suggest that the connectedness of ecosystems has increased. Links with the traditional financial system range from direct channels, such as banks providing account and payment services to the crypto ecosystem, to indirect channels, such as banks lending to crypto-asset investors. At present, the linkages through these channels are limited, but during last year's bankruptcies, some U.S. banks experienced a run on their deposit and some hedge funds and institutional investors suffered losses.

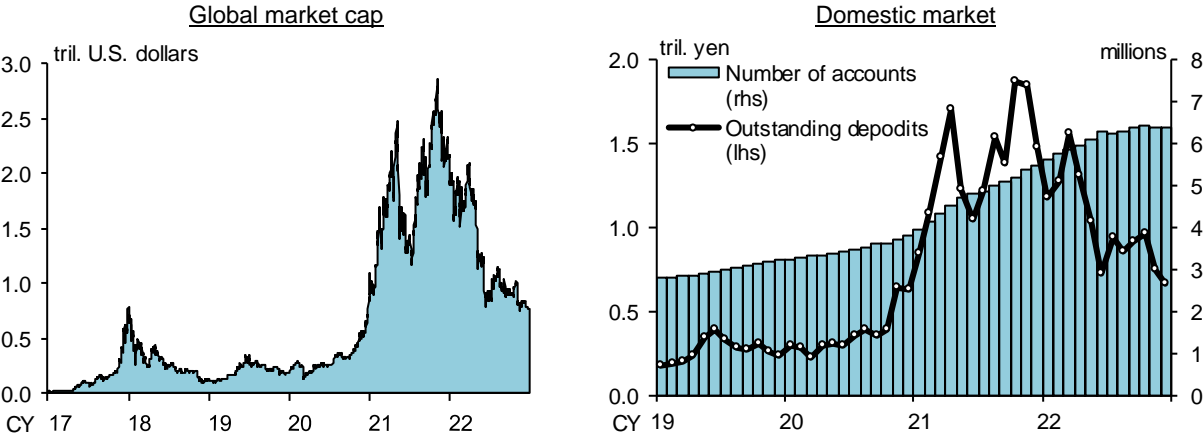
Against this backdrop, financial authorities in Japan and abroad are accelerating efforts to formulate regulations and supervision for crypto-assets grounded in the principle of "same activity, same risk,

⁷¹ DeFi refers to financial services for crypto-assets built on the blockchain that are provided autonomously and automatically without a specific administrator.

same regulation."⁷² Last December, as part of the Basel regulations, "Prudential Treatment of Cryptoasset Exposures" was finalized. If crypto-assets held by banks meet a set of classification conditions, they are subject to the same capital requirements as the underlying assets; if they fail to meet those classification conditions, they are subject to a maximum risk weight of 1,250 percent. These regulations are scheduled to be introduced in Japan in 2025.

So far, the size of the crypto-asset market in Japan appears to be extremely limited. Crypto-assets under custody at domestic exchanges amount to less than 1 trillion yen, while securities companies have 180 trillion yen in individual assets under custody (Chart B5-2). Trading volume has also been sluggish since May 2021, when margin requirements were introduced. However, even following the crypto firm bankruptcies abroad, there has been a gradual increase in the number of accounts, especially retail accounts. As crypto-assets and DeFi continue to develop, the market will keep growing and the risk profile of the market will continue to change. Identifying and appropriately addressing these changing risks will encourage sound innovation and contribute to the development of the overall financial system.

Chart B5-2: Crypto-asset markets



Note: Latest data as of December 2022.
 Source: Coin Dance; Japan Virtual and Crypto assets Exchange Association.

⁷² In October 2022, the Financial Stability Board (FSB) published three market consultation documents for the international regulation of crypto-assets. All are expected to be finalized by the middle of this year.

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 valuation 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 valuation 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.