



Summary

April 2022
Bank of Japan



Topics of the April 2022 issue

- **Impact of stress in the real economy brought about by COVID-19 on credit risk (domestic credit risk):** this *Report* presents a simulation of developments in SMEs' probability of default (PD) and financial institutions (FIs)' credit cost ratio for their SME loans.
- **Risk of global economic and financial shocks, such as an adjustment in global financial markets, affecting overseas lending and foreign currency funding:** this *Report* estimates the impact of global risk factors such as a rise in U.S. interest rates and widespread deterioration in financial conditions on firms' creditworthiness by industry and rating, and analyzes the risk characteristics of Japanese banks' overseas loan portfolios relative to those of U.S. banks. The *Report* also examines factors that stabilize foreign currency funding through an event study of the market turmoil in March 2020.
- **Developments in vulnerabilities that have been present since before the pandemic:** this *Report* outlines the risk characteristics of lending to the domestic real estate industry, in which FIs had been active in risk-taking since before the pandemic. The *Report* also examines changes in the structure of profitability since the pandemic and the impact of developments in foreign funds on real estate prices.
- **Macro stress testing:** the resilience of Japan's FIs and financial system is examined under two downside scenarios.
 - ⇒ (1) scenario in which domestic and overseas economies deteriorate due to a resurgence of COVID-19 infections and a rise in U.S. long-term interest rates
 - (2) scenario in which there is a substantial and rapid adjustment in financial markets comparable to that of the global financial crisis (GFC)

Executive summary

Current assessment of the stability of Japan's financial system

- Japan's financial system has been maintaining stability on the whole, while COVID-19 continues to affect economic and financial activity at home and abroad.
- The Japanese government and the Bank of Japan have been implementing large-scale fiscal and monetary policy measures and taking flexible regulatory and supervisory actions, with the aim to support economic activity and maintain the functioning of financial markets. Profits of firms that have been significantly affected by the pandemic are weak. However, underpinned by the financial soundness of FIs on the whole, the policy responses have been effective and the financial intermediation function is being fulfilled smoothly. Financial markets have been nervous, reflecting concerns about a reduction in the degree of monetary easing in the United States and Europe as well as the situation in Ukraine.

Future risks and caveats

- Japan's financial system is likely to remain highly robust even in the case of a resurgence of COVID-19 and a simultaneous rise in U.S. long-term interest rates leading to an adjustment in the real economy and global financial markets.
- However, in the event of a substantial and rapid adjustment in global financial markets, a deterioration in FIs' financial soundness and the resultant impairment of the smooth functioning of financial intermediation could pose a risk of further downward pressure on the real economy. In this regard, the following three risks warrant particular attention: (1) the impact of the pandemic on credit costs of domestic loans; (2) the risk that future global economic and financial shocks, such as an adjustment in global financial markets, will have an adverse impact on Japanese FIs' overseas lending, securities investment, and foreign currency funding; and (3) risks associated with vulnerabilities that have been present since before the pandemic.
 - The impact of the situation in Ukraine on Japan's financial system is likely to be limited at this point. However, there is high uncertainty over future developments, and attention should be paid to the possibility that the impact on the financial system will become larger, possibly through an adjustment in global financial markets.
- From a longer-term perspective, attention should be paid to the risk that the low interest rate environment and structural factors continue to exert downward pressure on FIs' profits for a prolonged period, leading to a gradual pullback in financial intermediation, or on the contrary, to the possibility that the vulnerability of the financial system increases, mainly as a result of FIs' search for yield behavior.

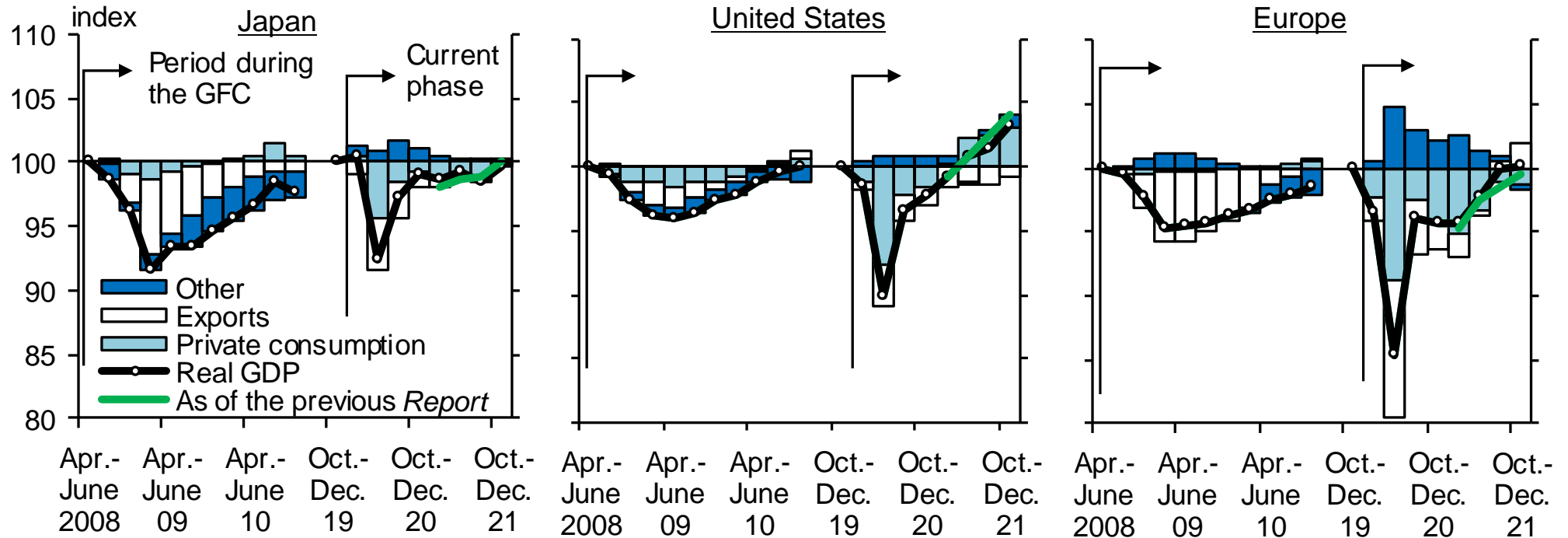
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- 3 . Transmission of global economic and financial shocks
- 4 . Materialization of vulnerabilities since before the pandemic
(real estate-related risks)
- 5 . Macro stress testing

Developments in GDP in Japan, the U.S., and Europe

- Due to the spread of COVID-19, domestic and overseas economies experienced a significant downturn, particularly in the first half of 2020.
- Although the pace of economic recovery since then has been moderate, the Japanese, U.S., and European economies have recovered in line with research institutions' average forecasts and market expectations at the time of the previous *Report*.

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



Note: Indexation with the real GDP in the April-June quarter of 2008 is set at 100 for the period during the GFC and that in the October-December quarter of 2019 is set at 100 for the current phase.

"As of the previous *Report*" indicates the average forecasts of professionals and markets in September 2021.

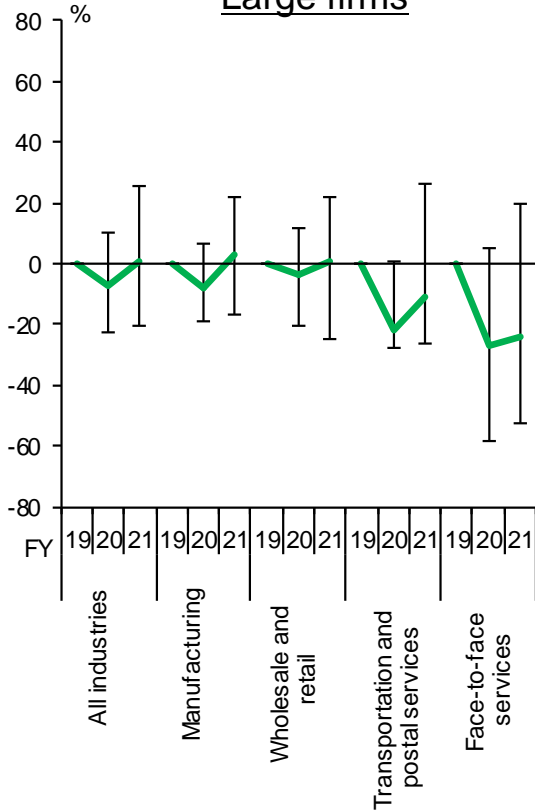
Source: BEA; Cabinet Office; Eurostat; IMF; Japan Center for Economic Research, "ESP forecast."

Firms' sales forecasts and financial positions

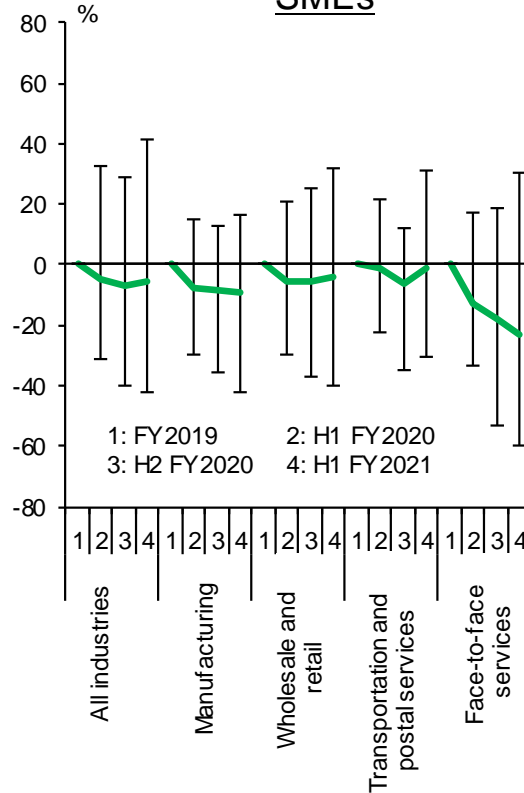
- The sales of large firms for fiscal 2021 are expected to recover to a level comparable to that in fiscal 2019. SMEs' pace of recovery is expected to be moderate. The pace of recovery in the transportation and postal services as well as face-to-face services industries is expected to be sluggish.
- The DI of financial positions generally has improved slightly, but many firms in the face-to-face services industry continue to regard their financial positions as "tight."

Charts IV-1-6,8: Sales changes by industry (from fiscal 2019)

Large firms



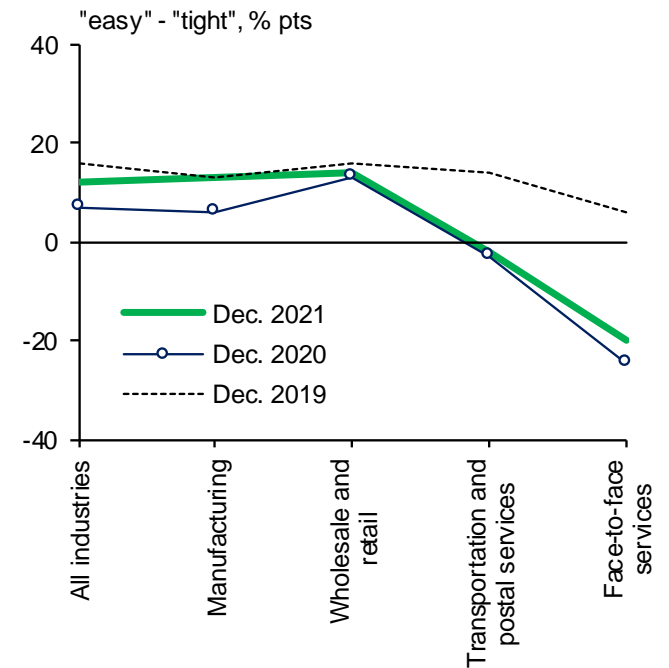
SMEs



Note: 1. The solid lines indicate weighted averages. The bands indicate 10th-90th percentile points. The left-hand chart covers firms listed on the domestic stock exchanges.
 2. H1 (H2) in the right-hand chart represents financial results for the one-year period of firms whose accounting period ends in the first (second) half of the fiscal year, and not the half-yearly results.
 3. "Face-to-face services" consists of food, accommodation, and consumer services. The same applies to subsequent charts.

Source: CRD Association; Nikkei Inc., "NEEDS-Financial QUEST"

DI of financial positions (all firm sizes and by industry)



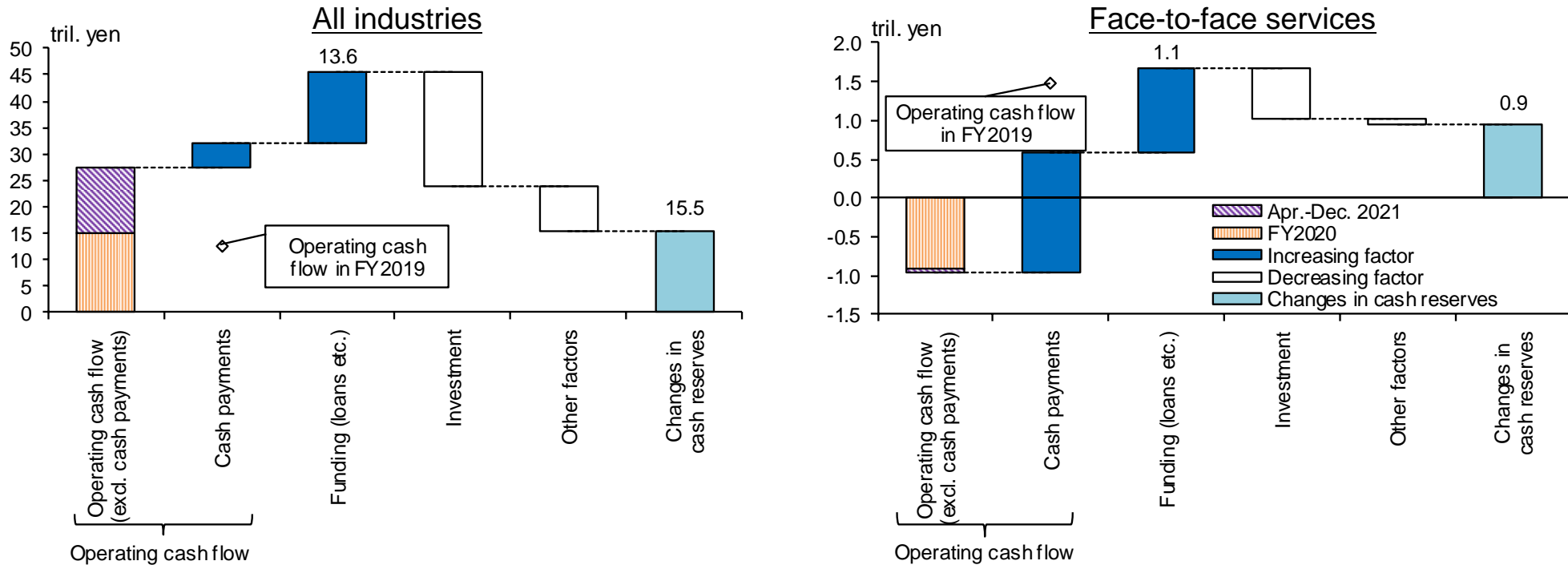
Note: The figures for "Face-to-face services" are weighted averages by the number of firms that responded to the question in each industry.

Source: BOJ, "Tankan."

Financial conditions as shown by macro indicators

- On an all-industries basis, cash reserves have increased as operating cash flows have recovered. Despite active funding, the amount remains smaller than the increase in cash reserves.
- In the face-to-face services industry, the operating cash flow has been positive but is underpinned by cash payments and remains low compared to the level in fiscal 2019. Although cash reserves have increased, this increase almost equals the amount of funding, suggesting that a fair number of SMEs in this industry may be more vulnerable in terms of debt repayment capacity than those on an all-industries basis.

Chart IV-1-9: Changes in cash reserves since the outbreak of COVID-19 (SMEs)



Note: Calculated based on the survey results from the April-June quarter of 2020 through the October-December quarter of 2021 by accumulating the changes in balance sheet items etc. in each survey term.

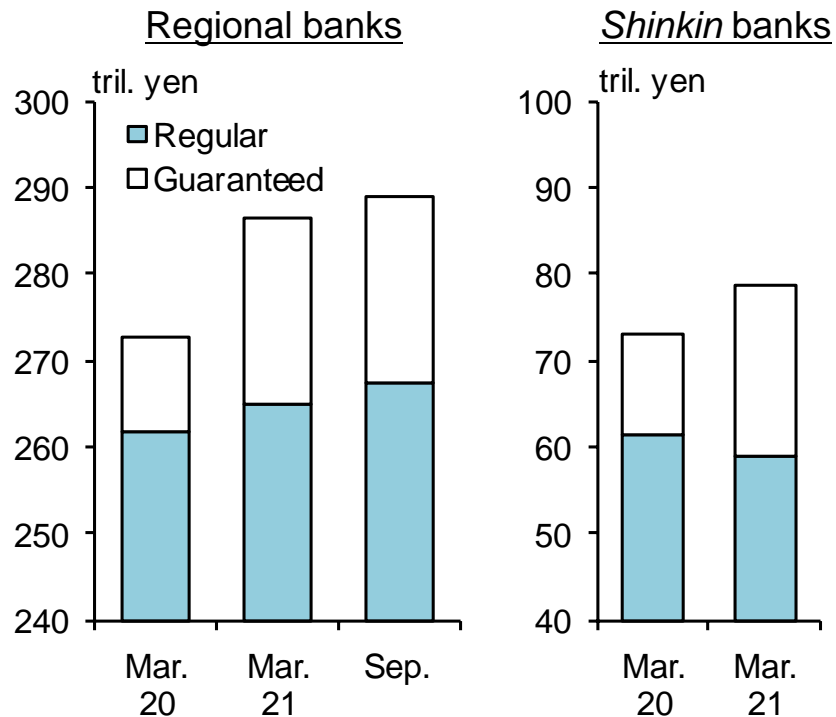
For simplicity, "Cash payments" is calculated as the changes in non-operating profits from the average figure before the outbreak of COVID-19. "Other factors" includes securities investment etc.

Source: Ministry of Finance, "Financial statements statistics of corporations by industry."

Changes in loans since the outbreak of COVID-19

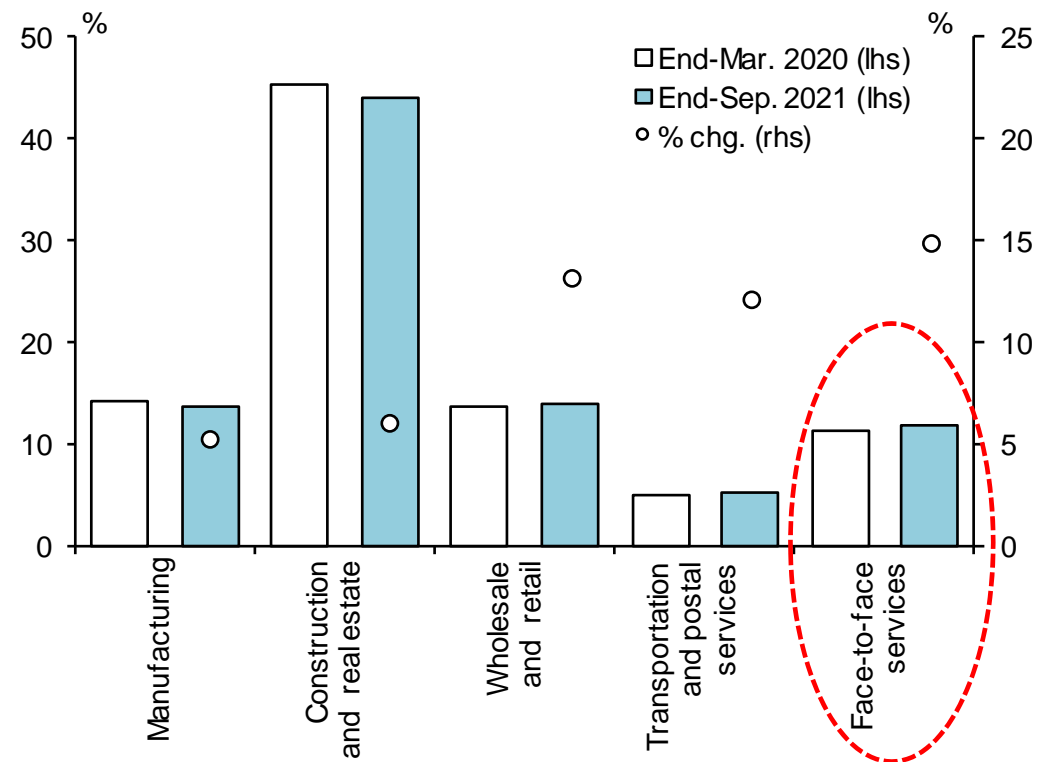
- At regional FIs, loans guaranteed by credit guarantee corporations have increased substantially.
- By industry, the increase in loans to the face-to-face services industry has been pronounced. The share of loans to the face-to-face services industry in FIs' loan portfolios overall remains at only a little over 10 percent.

Chart IV-1-4: Loans outstanding since the outbreak of COVID-19



Note: Increases in guaranteed loans after March 2020 are mainly effectively interest-free loans.
Source: BOJ.

Chart IV-1-5: Breakdown of loans to SMEs by industry



Note: Covers regional banks and *shinkin* banks. "% chg." indicates changes in loans to SMEs from end-March 2020 to end-September 2021.
Source: BOJ, "Loans and bills discounted by sector."

Assumptions on corporate profits

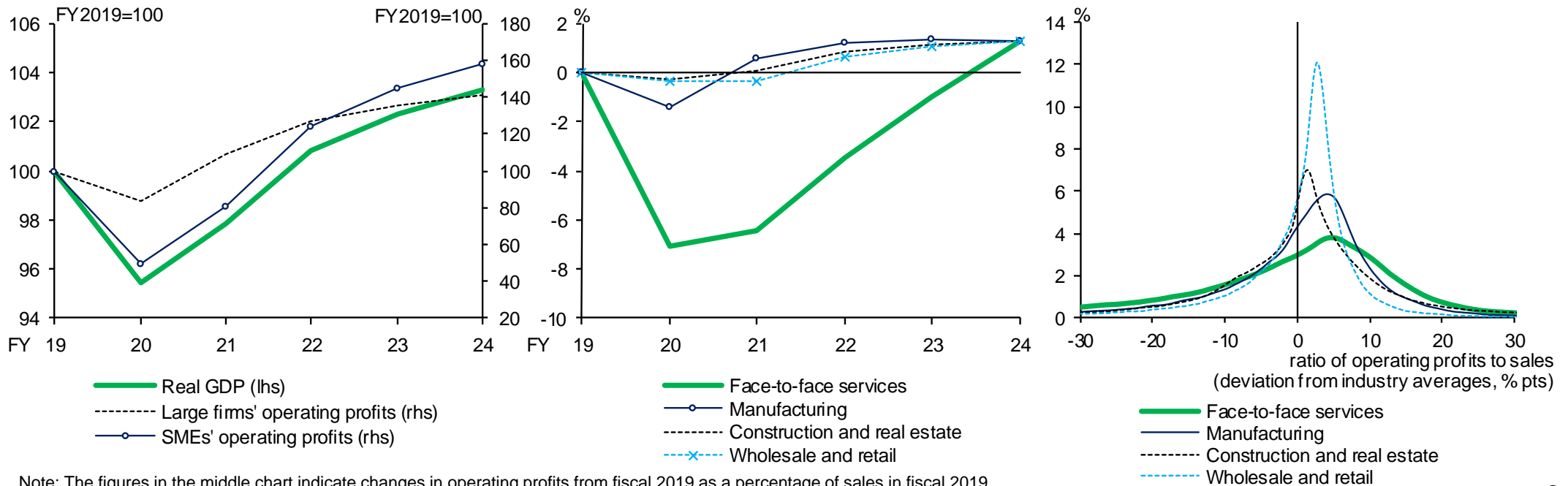
- Individual firms' profits are estimated taking into account differences in firm sizes and industries, as well as heterogeneity among SMEs within the same industry.
 - The estimates of aggregate corporate profits based on the future path of GDP and profits by firm size and industry are calculated using macro data through the end of 2021. Heterogeneity among SMEs is calculated using firm-level data.
- Individual firms' balance sheet variables are calculated using the future path of profits based on the assumption for cash reserves, etc.

Chart IV-1-12: Assumptions on GDP and corporate profits for medium-term simulation

Real GDP and corporate profits by firm size

Operating profits of SMEs by industry

Distribution of SMEs' operating profits within industries in fiscal 2021

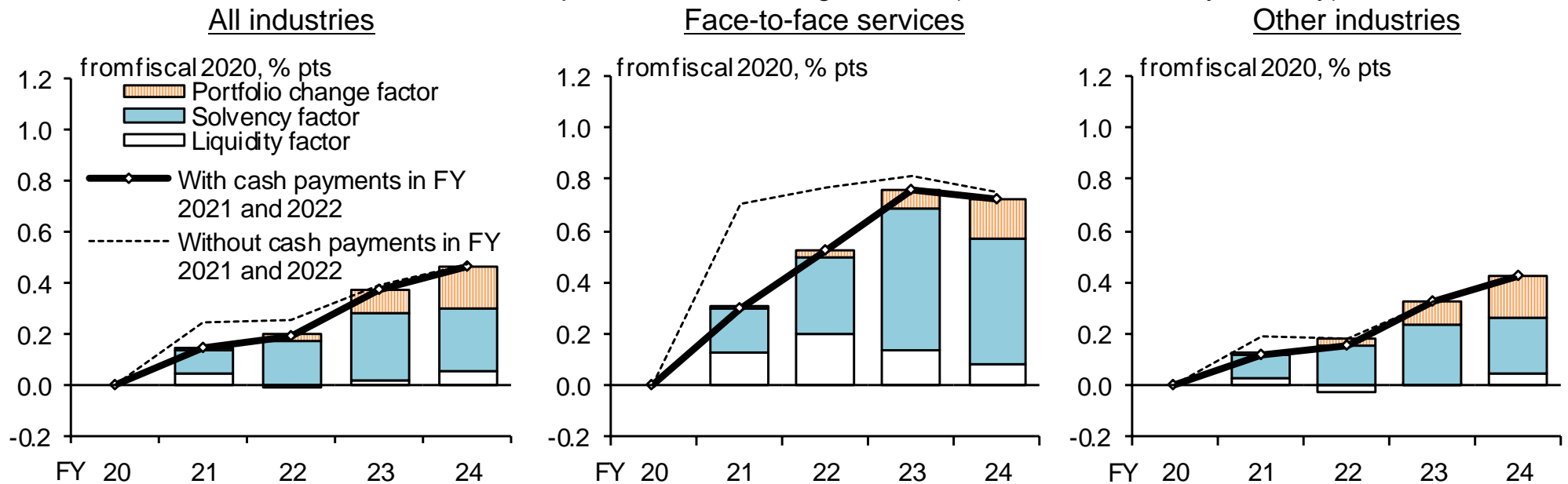


Note: The figures in the middle chart indicate changes in operating profits from fiscal 2019 as a percentage of sales in fiscal 2019.
 Source: Japan Center for Economic Research, "ESP forecast"; Ministry of Finance, "Financial statements statistics of corporations by industry."

Simulation results: SMEs' PD

- Borrowing increases from fiscal 2021, particularly among firms that face a decline in their operating cash flow. Interest payments on effectively interest-free loans increase from fiscal 2023. As a result, mainly due to changes in firms' creditworthiness, the overall PD of SMEs increases slightly in fiscal 2021 and beyond from the low, restrained level in fiscal 2020.
- In the face-to-face services industry, assuming that the pace of recovery overall is moderate, the PD is pushed up to a greater degree than in other industries since firms take out more loans to offset the decline in cash reserves.
- Measures to support corporate financing from fiscal 2021 continue to push down the PD, mainly of face-to-face services.

Chart IV-1-15: Decomposition of the changes in PD (all industries and by industry)



Note: PD is defined as the probability that a firm within one year is downgraded to a borrower classification of "special attention" or below, becomes delinquent for three months or longer, or is subject to subrogation by a credit guarantee corporation. "Portfolio change factor" is changes in financial institutions' credit portfolios for which PD is estimated. For example, when firms in a relatively healthy financial position drop out of financial institutions' credit portfolios, this leads to an increase in the PD. Thus, the "portfolio change factor" makes a positive contribution to the increase in PD.

Simulation results: share of defaulting firms and credit cost ratio

- Although the share of defaulting firms for all industries increases gradually, the increase is limited and the share remains at a low level in fiscal 2024. However, in the face-to-face services industry, the share increases further through fiscal 2023 from the current level.
- FIs' credit cost ratio for their SME loan portfolios increases through fiscal 2024 against the backdrop of a rise in firms' PD. However, the increase is contained, partly due to the increase in the share of defaulting firms remaining marginal and the relatively small share of loans to the face-to-face services industry in FIs' loan portfolios overall.

Chart IV-1-16: Share of firms in default

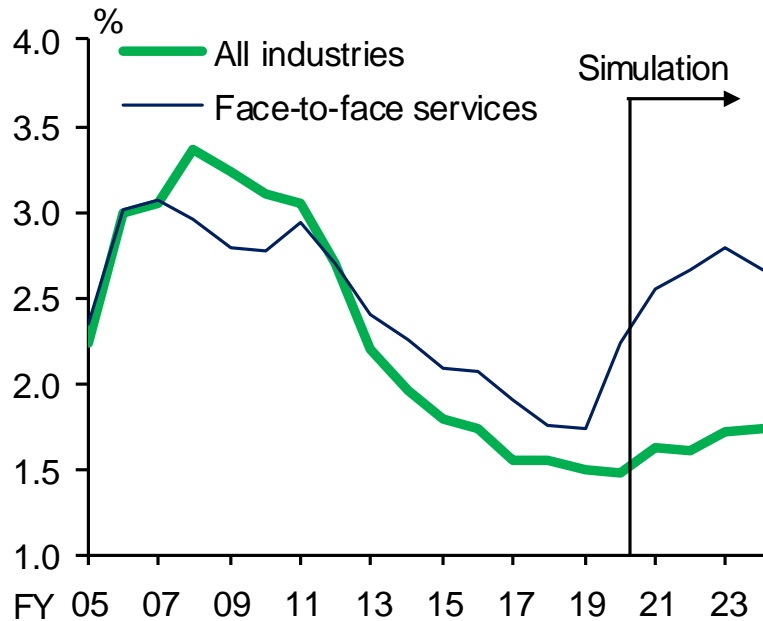
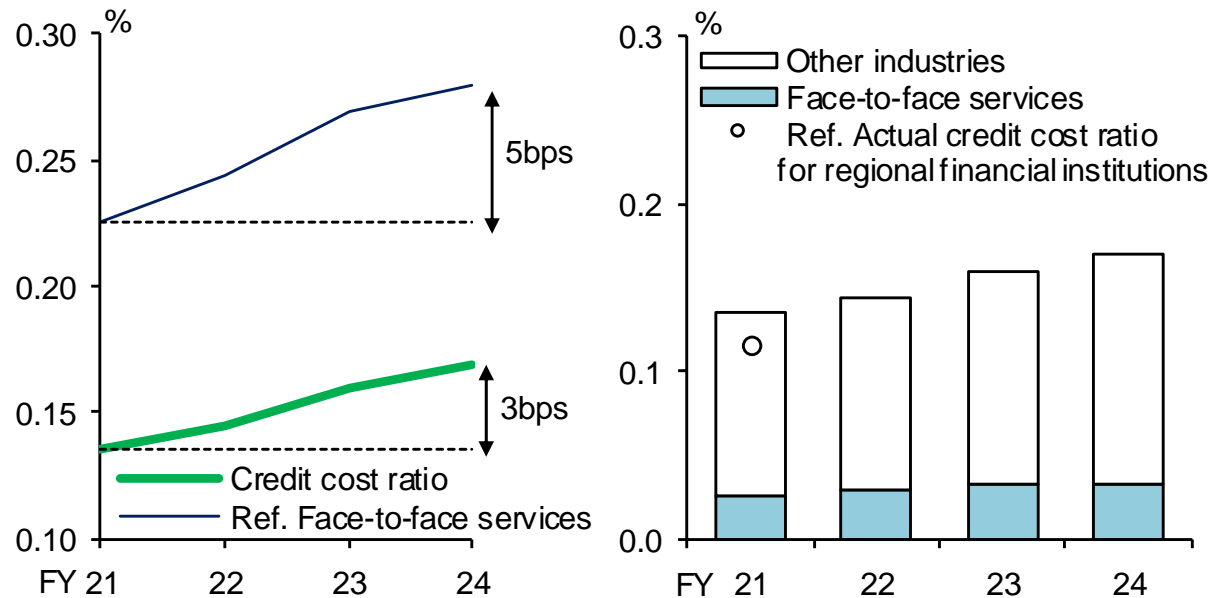


Chart IV-1-18: Financial institutions' credit cost ratios (loan portfolios to SMEs)



Note: The share of firms in default is calculated as the number of firms in default during the fiscal year divided by the number of existing firms at the beginning of the fiscal year.

Source: CRD Association.

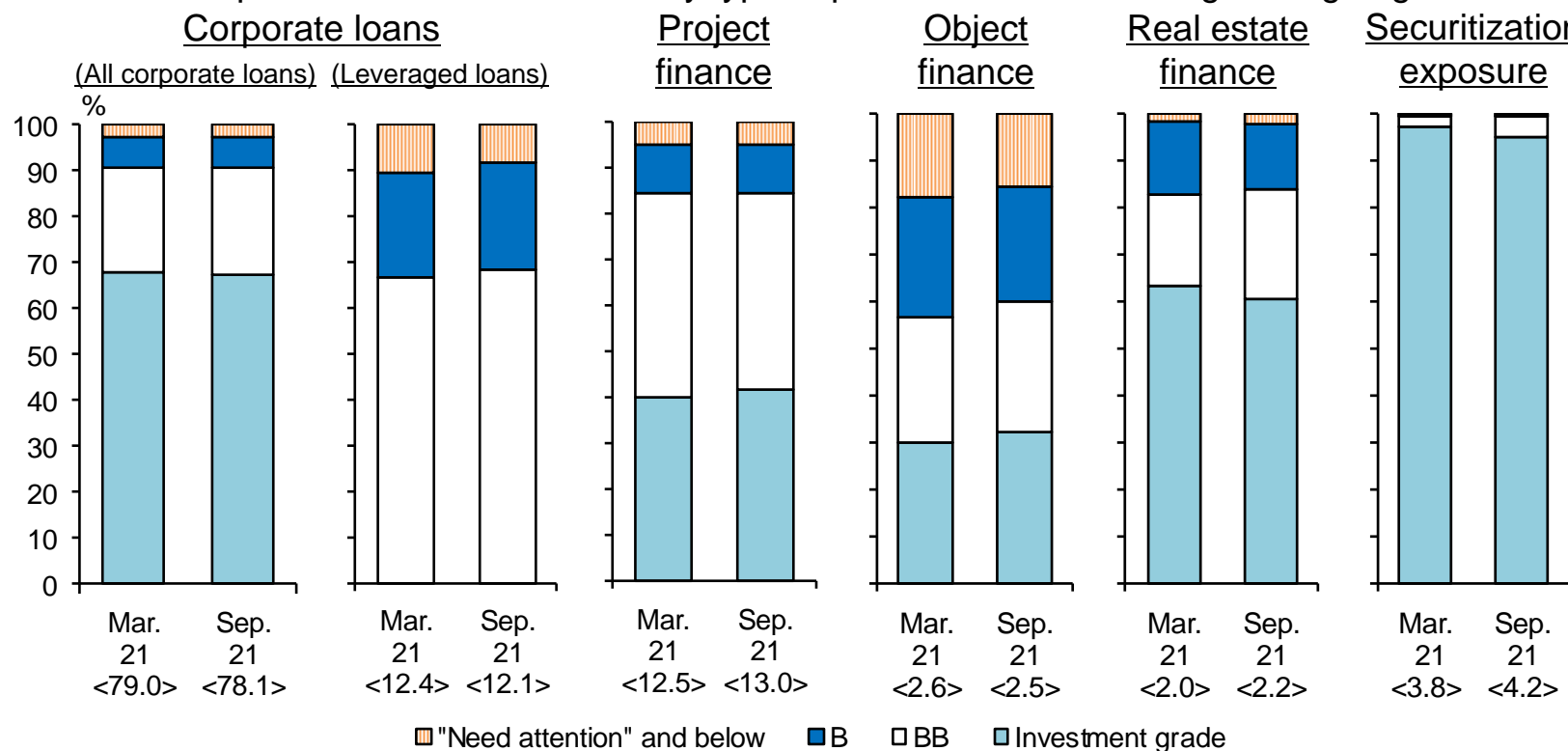
Note: The marker in the right-hand chart indicates the average of actual credit cost ratios over the last three years for regional financial institutions. The loan coverage ratio is calculated as the latest value of regional financial institutions (about 60 percent). The recovery rate for uncovered loans is assumed to be 60 percent.

Source: BOJ.

Rating composition of overseas loans

- Looking at the rating composition of Japanese banks' overseas loans, investment grade (IG) loans account for about 70 percent of corporate loans.
- However, the quality of loan portfolios remains in a worse state than before the pandemic, and continued attention needs to be paid to developments in industries and products that are susceptible to the pandemic.

Chart III-1-18: Composition of overseas loans by type of product and credit rating among large financial institutions



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

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

Source: BOJ.

Default rates of overseas loans

- Although the corporate bond default rates in overseas markets rose following the outbreak of COVID-19, especially in the retail and energy industries, they have declined to below pre-pandemic levels on the whole in the second half of 2021.
- The quality of some portfolios has deteriorated compared with before the pandemic, particularly in transportation and postal services as well as in processing. However, the increase in the outstanding amount of non-investment grade (non-IG) loans has paused recently and the overall quality of loan portfolios has remained high.

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

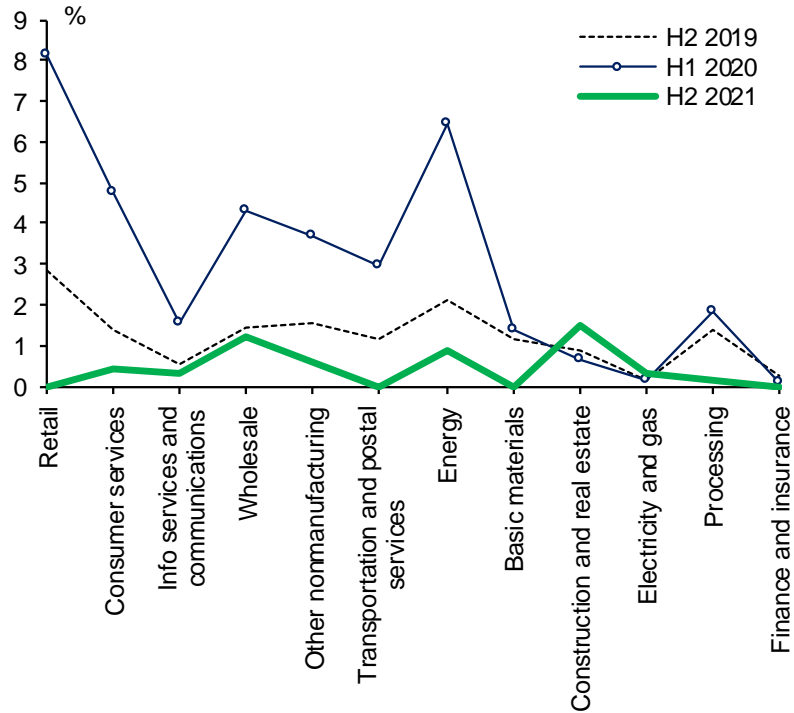
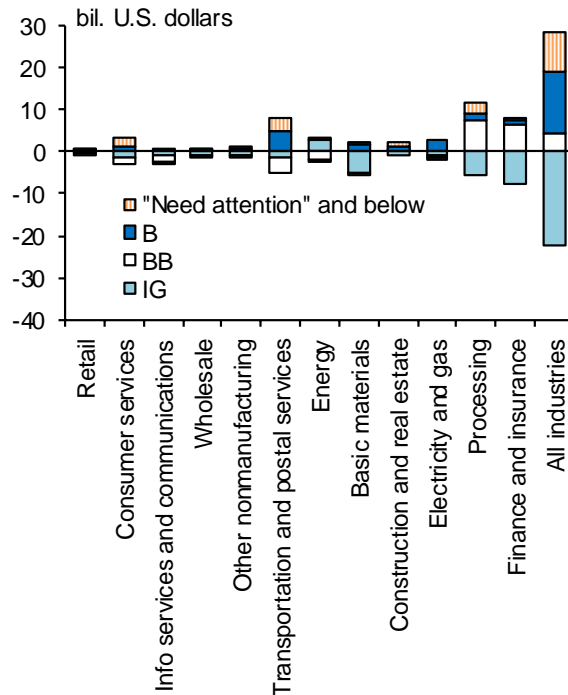
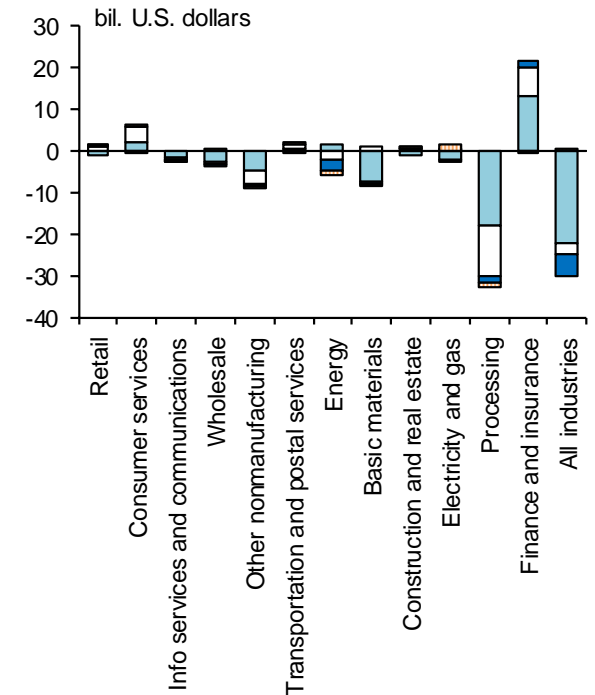


Chart IV-2-3: Overseas corporate loans outstanding by industry

Changes from end-September 2019 to end-September 2020



Changes from end-September 2020 to end-September 2021



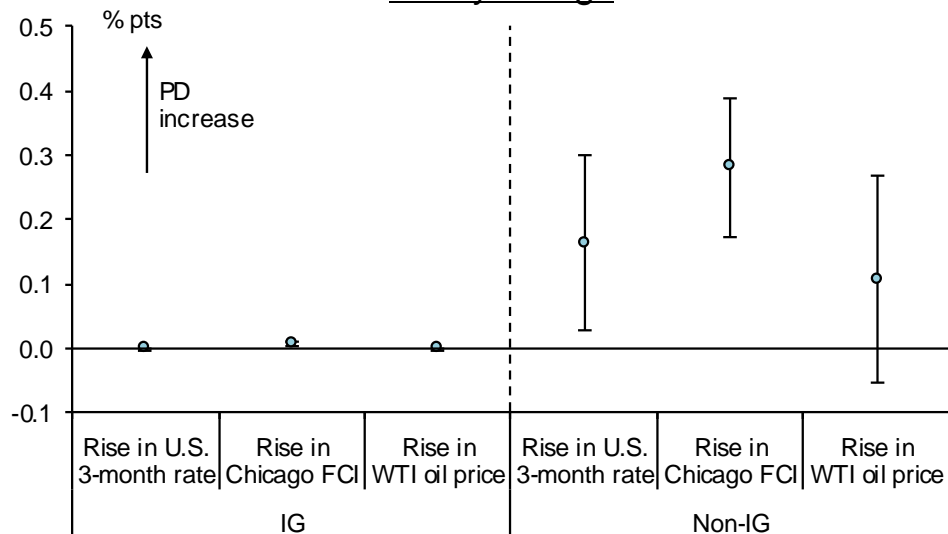
Note: 1. Default rates are on the issuer basis, including bond and loan issuers.
 2. Energy covers oil and natural gas development. Same for the right-hand chart.
 Source: Moody's.

Note: Covers the three major banks' lending.
 Source: BOJ.

Degree of impact of global economic and financial shocks

- The PD of non-IG firms increases more significantly than that of IG firms in response to a rise in the three-month U.S. interest rate, a widespread deterioration in financial conditions, and a rise in crude oil prices.
- Responses to changes in financial and economic conditions differ by industry. The PD increases in the finance and insurance and the construction and real estate industries in response to a rise in the three-month U.S. interest rate. In response to an increase in the Chicago Fed FCI, the PD increases in a wide range of industries. In response to a rise in crude oil prices, while creditworthiness in the energy industry improves, the PD increases in other industries such as transportation and postal services.

Charts IV-2-8,9: Changes in global risk factors and probability of default



PD by industry

(↑ Rise in PD, ↓ Decline)

Industry	Rise in U.S. 3-month rate	Rise in Chicago FCI	Rise in WTI oil price
Manufacturing		↑	↑
Electricity and Gas			
Finance and insurance	↑	↑	↑
Energy			↓
Transportation and postal services		↑	↑
Construction and real estate	↑	↑	
Wholesale and retail		↑	↑

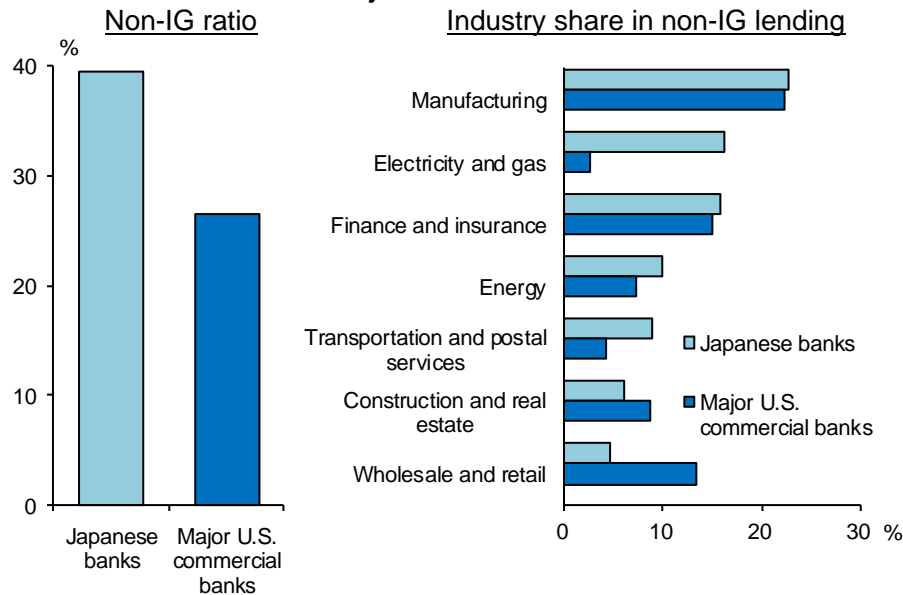
Note: The chart shows changes in the PD for non-IG issuers when each risk factor increases by one standard deviation, which corresponds to 0.42 percentage points for the U.S. 3-month rate, 0.24 points for the FCI, and 14.10 percent for WTI prices. The bands represent 90 percent confidence intervals. Observations consist of issuers worldwide excluding Japan. See footnotes in the main text for the estimation period. The right chart shows rises and declines in the PD that are statistically significant.

Source: Haver Analytics; Moody's.

Comparison between Japanese and U.S. commercial banks

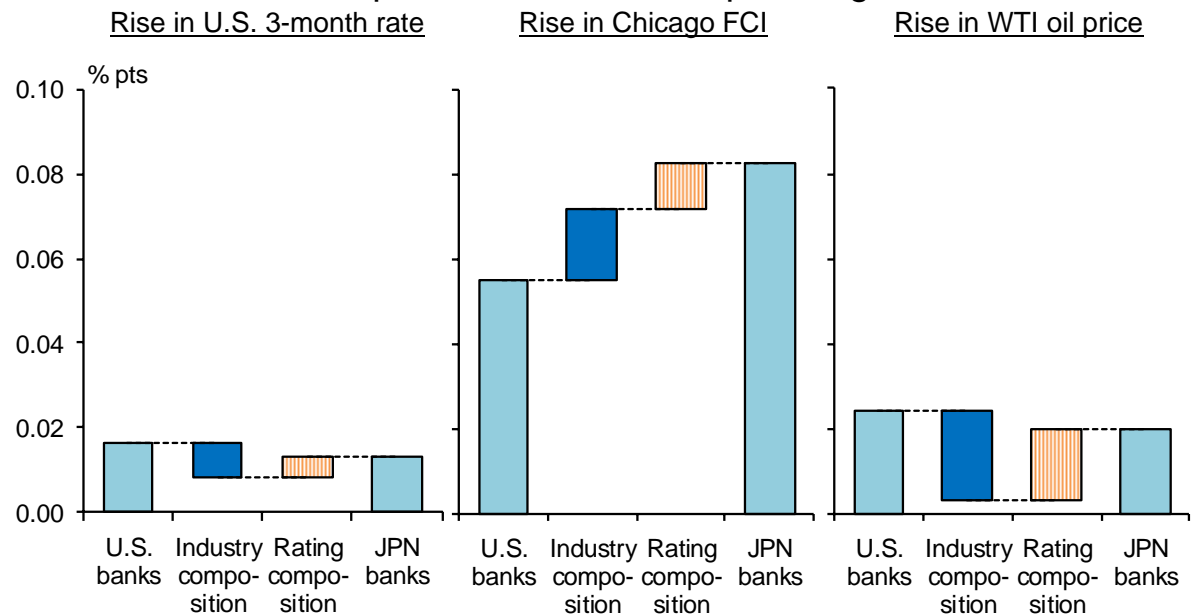
- Compared with the average tendency of major U.S. commercial banks, the share of non-IG loans in overseas loans of Japanese banks is higher, and the energy industry and the electricity and gas industry make up larger shares of the loan portfolios while the wholesale and retail industry and the construction and real estate industry make up a smaller share.
- Based on the rating and industry composition of Japanese banks' overseas loans, an increase in the Chicago Fed FCI may have a greater impact on the PDs in Japanese banks' portfolios.
 - Regarding the impact of a rise in the three-month U.S. interest rate and crude oil prices, the industry composition of Japanese banks' loan portfolios may work to mitigate the deterioration in PDs relative to their U.S. counterparts.

Chart IV-2-10: Composition of overseas loans for Japanese and major U.S. commercial banks



Note: "Japanese banks" covers the three major banks. "Major U.S. commercial banks" covers Bank of America, Citigroup, JPMorgan Chase, and Wells Fargo. As at end-September 2021.
Source: Published accounts of each financial institution; BOJ.

Chart IV-2-11: Sensitivity of Japanese and U.S. banks' loan portfolio PDs with respect to global risk factors

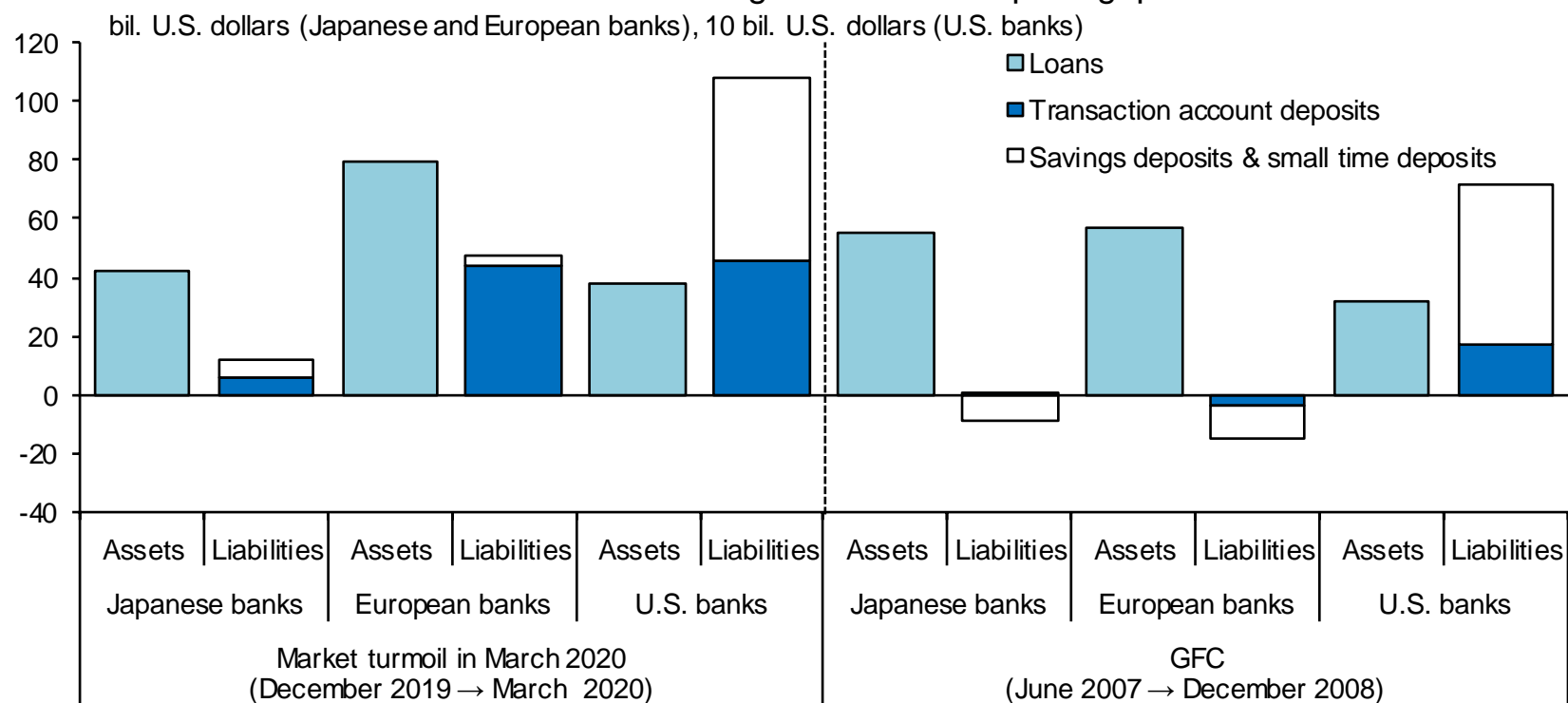


Note: Changes in the 2-year PD are calculated as the weighted averages of PD increases by industry and investment grade, using the composition of U.S. and Japanese banks' loan portfolios as weights.
Source: Moody's; Published accounts of each financial institution; BOJ.

Deterioration in financial conditions and changes in loan-to-deposit gap

- When there is stress in financial conditions, such as during the GFC or the market turmoil in March 2020, the loan-to-deposit gap of Foreign Banking Offices (FBOs) in the United States tends to widen as lending increases due to the drawdown of committed lines while the growth in deposits is either limited or negative.
- In particular, during the GFC, Japanese banks in the United States tended to rely on FX and currency swaps because, in addition to the widening of loan-to-deposit gaps, they faced difficulty in funding through CDs and CP.

Chart B4-1: Changes in loan-to-deposit gap



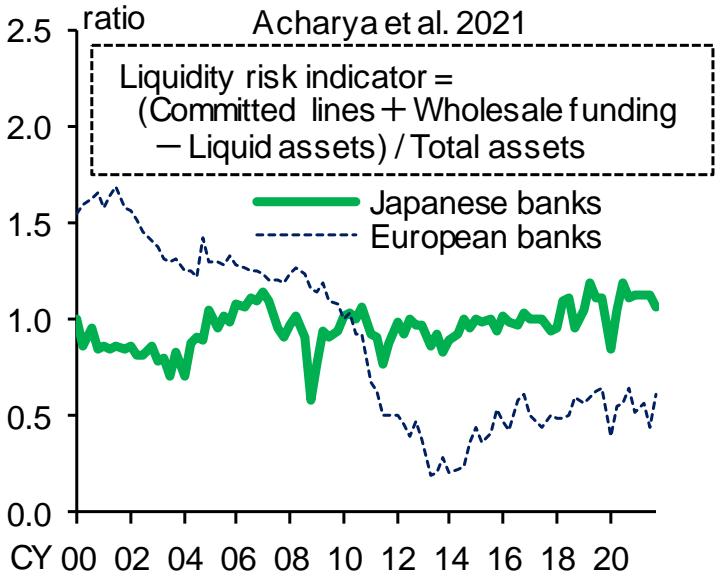
Note: "Japanese banks" and "European banks" refer to the U.S. branches of Japanese and European banks.
 Source: FDIC; Federal Reserve Bank of Chicago.

Liquidity risk indicator taking into account committed lines

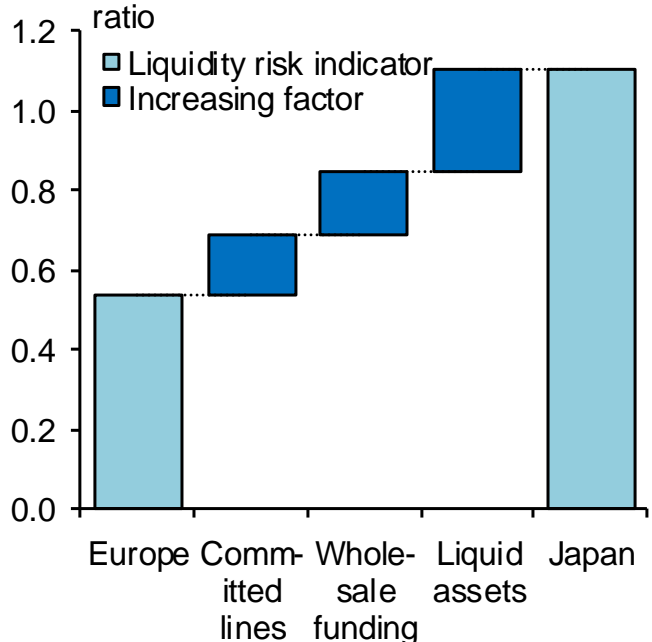
- Japanese banks have worked on enhancing resilience in terms of foreign currency funding by securing liquid assets and expanding transaction account deposits as they expand their foreign currency balance sheets.
- However, the liquidity risk indicator taking into account the possibility of a drawdown of unused committed lines for Japanese banks is higher than that for European banks in the United States, since Japanese banks have less liquid assets and their share of wholesale funding is higher.

Chart B4-3: Liquidity risk indicator and liquid assets
Decomposition of difference between Japanese and European banks

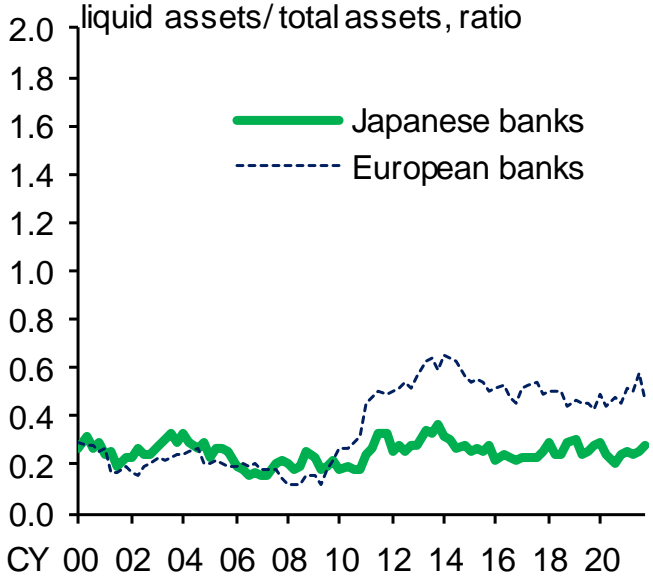
Liquidity risk indicator



Decomposition of difference between Japanese and European banks



Liquid asset ratio



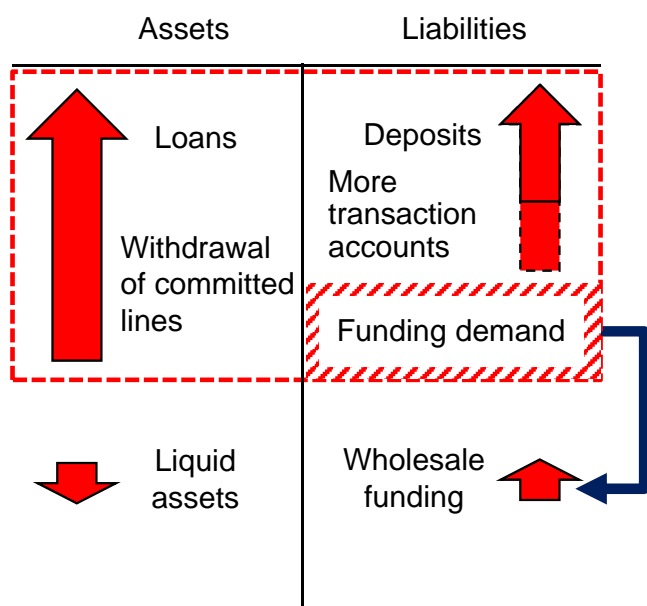
Note: The liquidity risk indicator is calculated for FBOs in the U.S. Wholesale funding consists of large time deposits, repos, and other borrowings of the U.S. branches. Liquid assets consist of cash and deposits, U.S. government securities, and reverse repos of the U.S. branches. "Committed lines," "wholesale funding," and "liquid assets" in the middle chart represent the contribution of differences between Japanese and European banks in the U.S. in terms of the percentage of total assets. Data are the averages for 2021.

Source: Federal Reserve Bank of Chicago; FFIEC.

Role of liquid assets and transaction account deposits

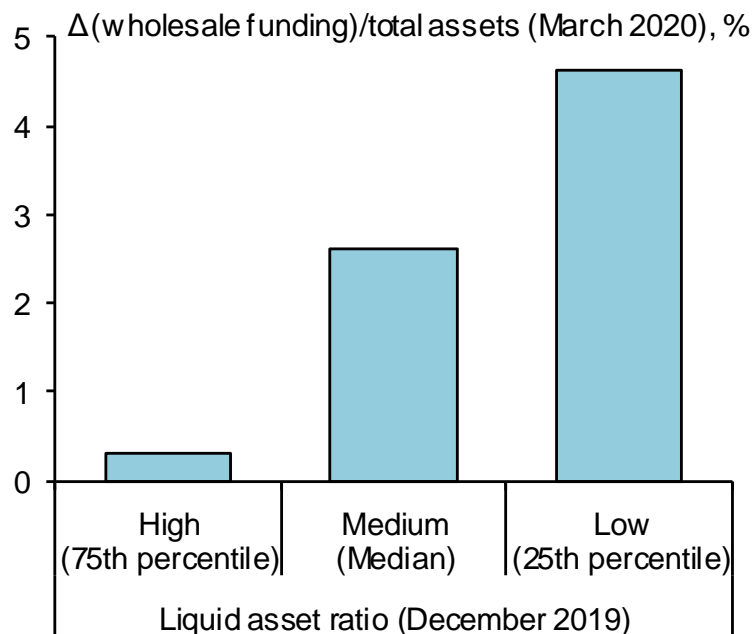
- When the loan-to-deposit gap widens as lending increases due to the drawdown of committed lines during a crisis, FIs need to use liquid assets or obtain wholesale funding. Ample liquid assets may reduce the necessity of wholesale funding.
- Transaction account deposits contain the outflow of deposits and this may reduce the necessity of wholesale funding.

Role of liquid assets and transaction accounts in stress periods



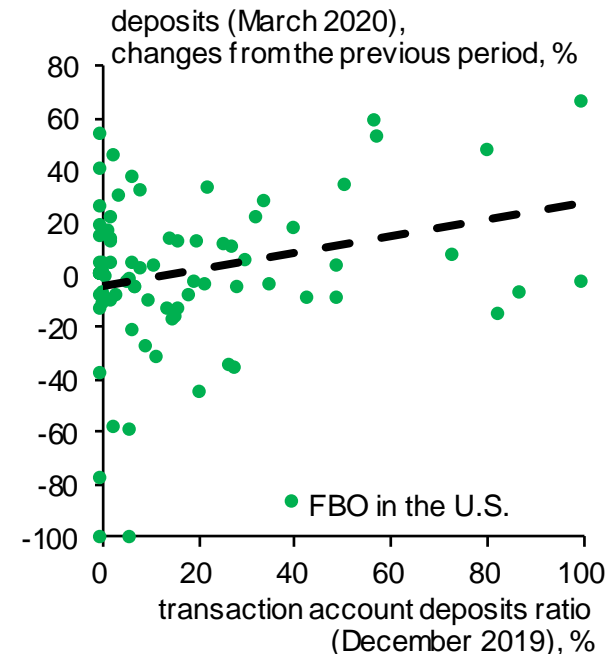
↑ : Increase ↓ : Decrease

Chart B4-4: Liquid assets and wholesale funding



Note: This figure shows the estimates from regressing the changes of FBOs' wholesale funding on committed lines and liquid asset ratio. Estimated as of end-March 2020.
Source: Federal Reserve Bank of Chicago.

Chart B4-5: Transaction account deposits and changes in deposits



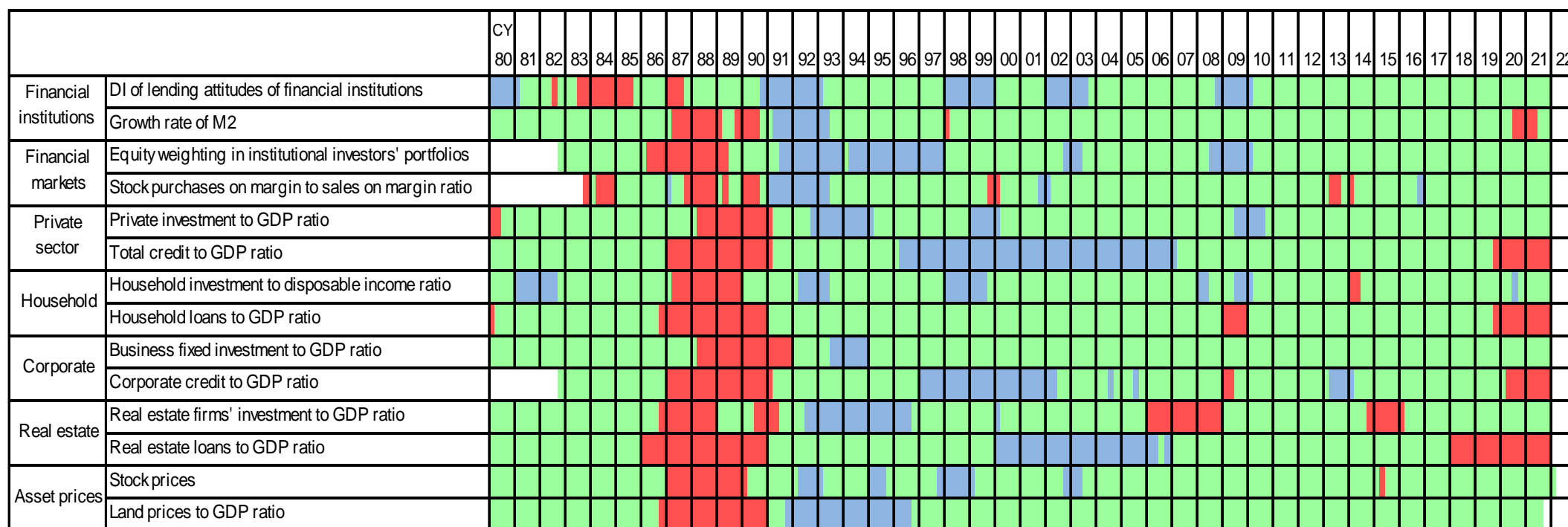
Note: The figures for FBOs in the U.S. represent the total for branches of each financial institution. Deposits exclude large time deposits. The slope of the regression line is statistically significant at the 5% level.
Source: Federal Reserve Bank of Chicago.

4. Vulnerabilities since before the pandemic 1/6

Heat map

- The four "red" Financial Activity Indexes (FAIXs) can be regarded as the result of developments in nominal GDP since the outbreak of COVID-19, the proactive implementation of measures to support corporate financing, and the fact that financial intermediation activities are operating smoothly. They do not signal overheating of financial activities but represent vigorous financial intermediation activities to underpin firms' operating liquidity.

Chart III-3-1: Heat Map

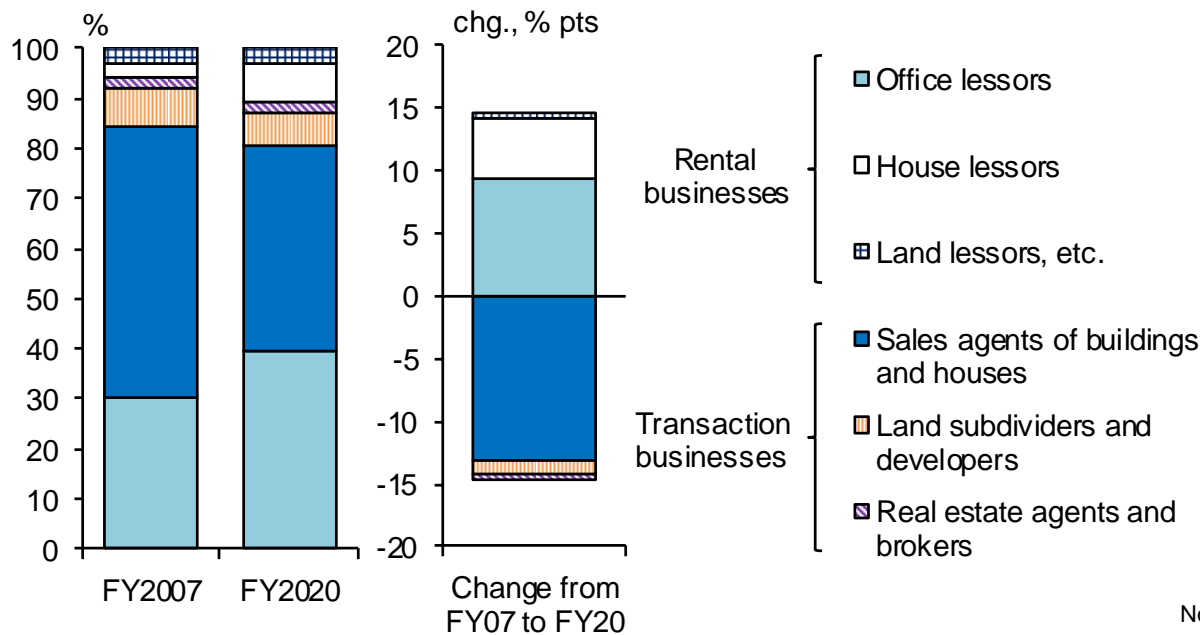


Source: Bloomberg; Cabinet Office, "National accounts"; Japan Real Estate Institute, "Urban land price index"; Ministry of Finance, "Financial statements statistics of corporations by industry"; Tokyo Stock Exchange, "Outstanding margin trading, etc."; BOJ, "Flow of funds accounts," "Loans and bills discounted by sector," "Money stock," "Tankan."

Developments in lending to the real estate industry

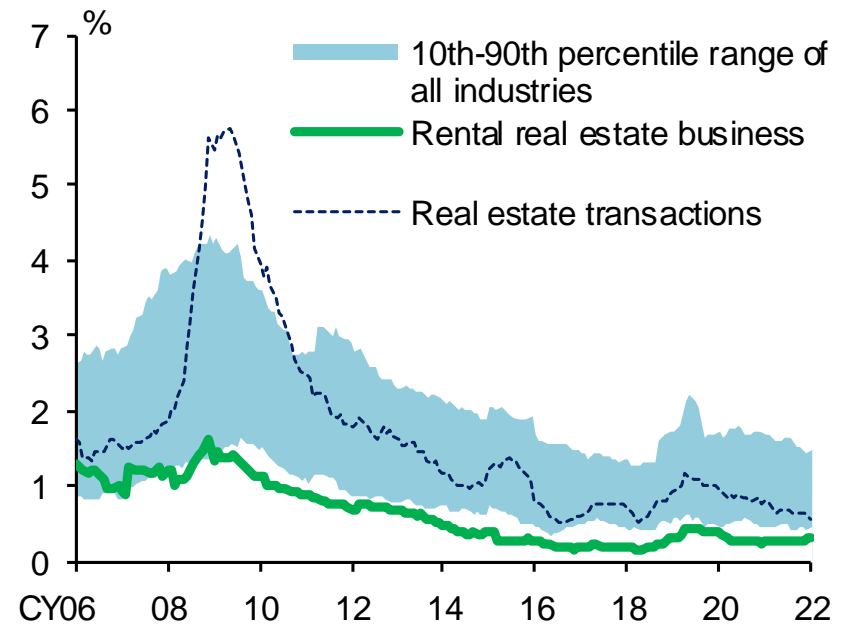
- A breakdown of loans to SMEs by business category shows that, compared to the period before the GFC, there has been a relatively small increase in loans to real estate transaction businesses, such as sales agents of buildings and houses and land subdividers and developers, while there has been a marked increase in loans to rental businesses, especially office lessors.
- Although default rates increased especially among real estate transaction businesses during the GFC, they have been low recently both for rental real estate businesses and real estate transaction businesses.

Chart IV-5-9: Composition of loans outstanding to small and medium-sized real estate firms



Source: Teikoku Databank.

Chart IV-5-8: Default rates by industry



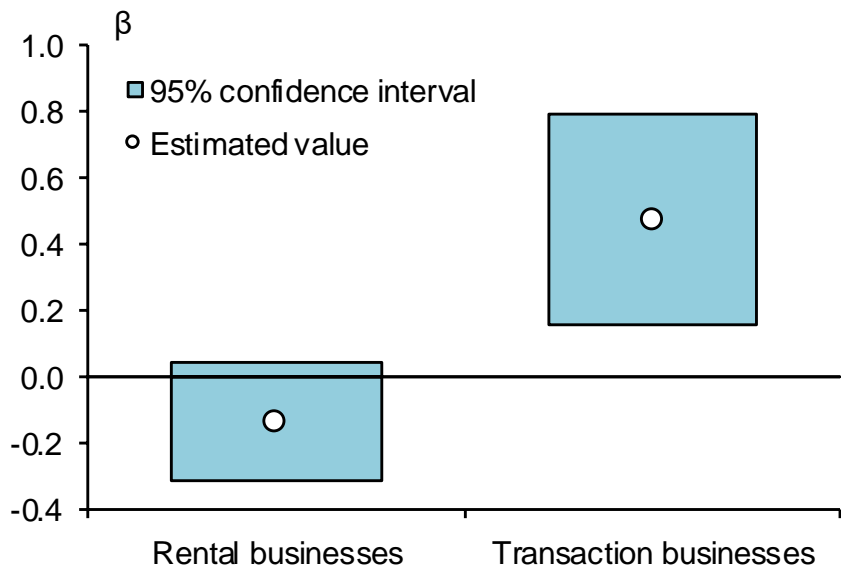
Note: "10th-90th percentile range of all industries" indicates the distribution of default rates of a total of 24 industries, divided into manufacturing industries and non-manufacturing industries.

Source: The Risk Data Bank of Japan.

Comparison of real estate transaction and rental businesses

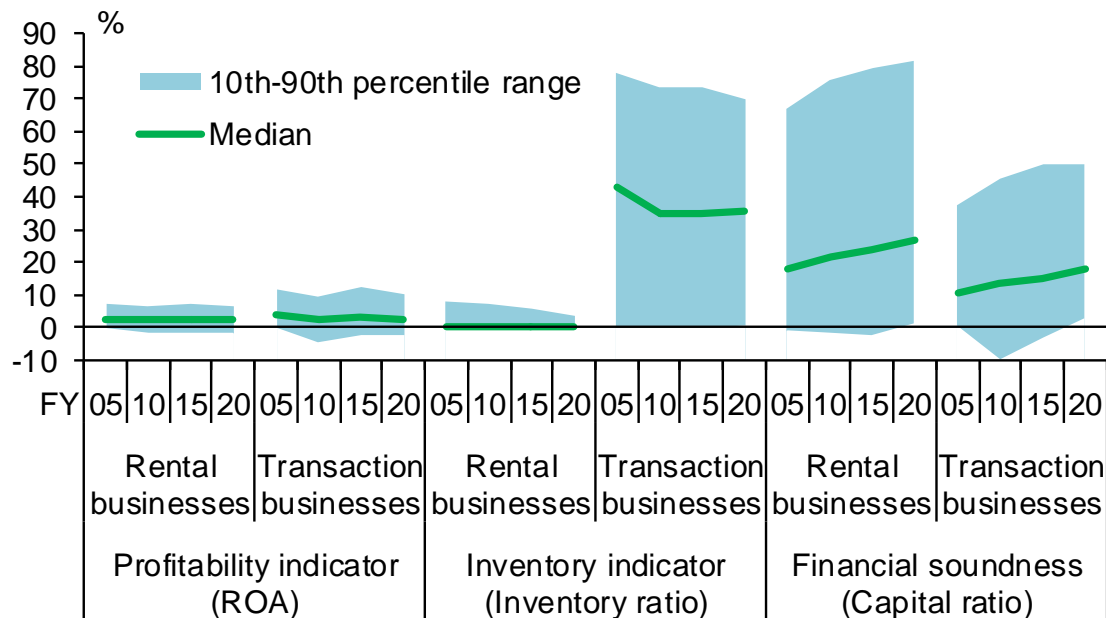
- Profits of rental real estate businesses tend to be less affected by business cycles while those of real estate transaction businesses tend to be more affected by the cycles.
- Looking at financial conditions of rental businesses, the ROA has been more stable and less volatile than that of transaction businesses. They do not hold inventories, and their capital ratios are higher than those of transaction businesses.

Linkage between the ROA of each business and of all industries



Note: "Rental businesses" consists of office lessors, land lessors, and house lessors.
 "Transaction businesses" consists of sales agents of buildings and houses as well as land subdividers and developers (same for the right chart).
 Source: Teikoku Databank.

Differences in financial vulnerabilities between rental real estate businesses and real estate transaction businesses

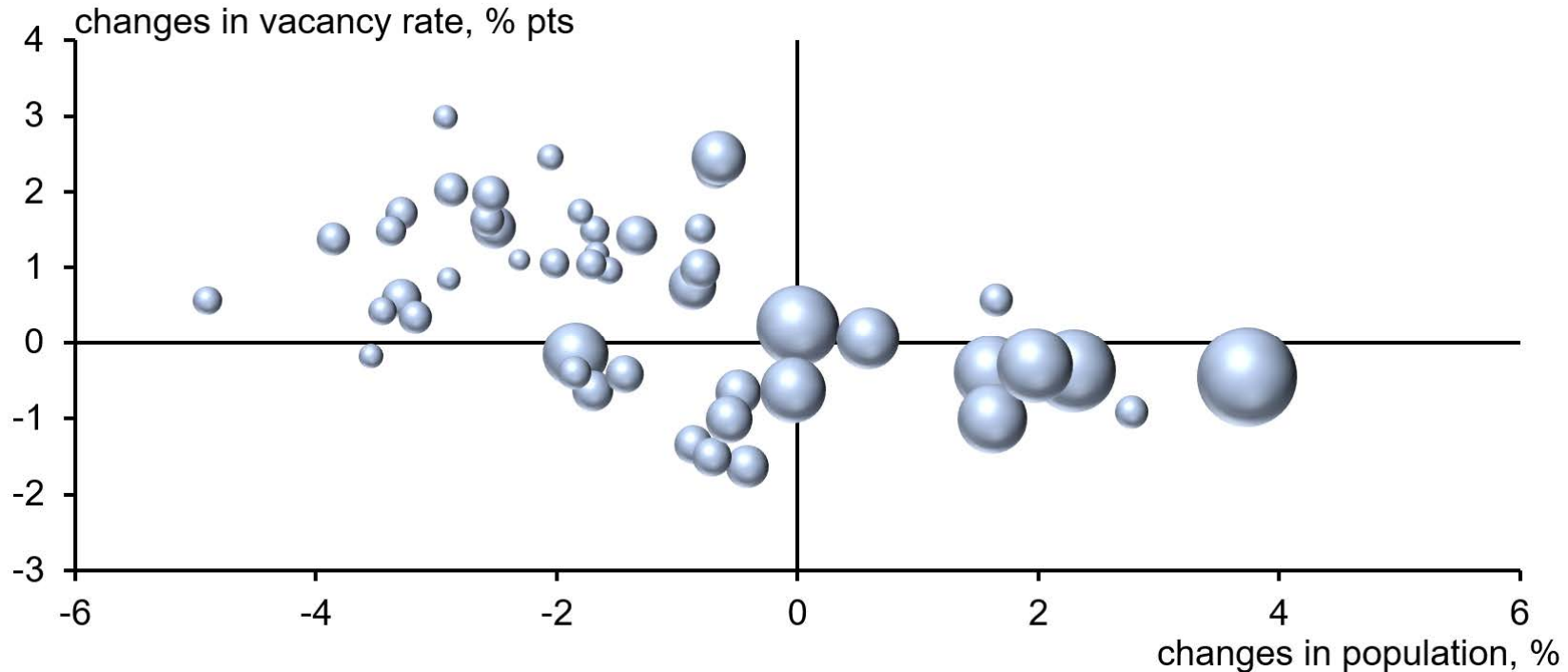


Note: ROA, inventory ratio, and capital ratio are ratios to total assets.
 Source: Teikoku Databank.

Characteristics of rental real estate businesses

- Examining the risk characteristics of profits in the rental real estate businesses in relation to economic environment shows that the profits may be closely linked to the medium- to long-term demand structure, as seen in the negative correlation between demographic changes and vacancy rates.

Chart IV-5-11: Relationship between changes in population and vacancy rates

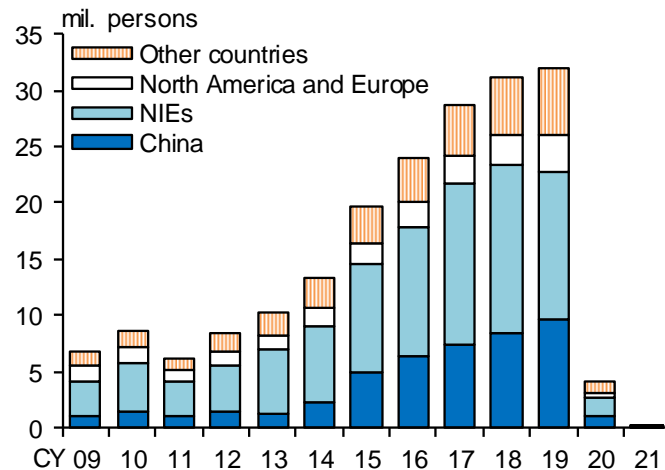


Note: 1. Each prefecture is represented by a bubble, where its size indicates the size of population.
2. The chart shows average changes for every five years between 1998 and 2018.
3. Vacancy rate = (number of vacant rooms in flats) / (total number of rooms in flats).
Source: Ministry of Internal Affairs and Communications, "Housing and land survey," "Population estimates."

Risk factors in real estate prices (1)

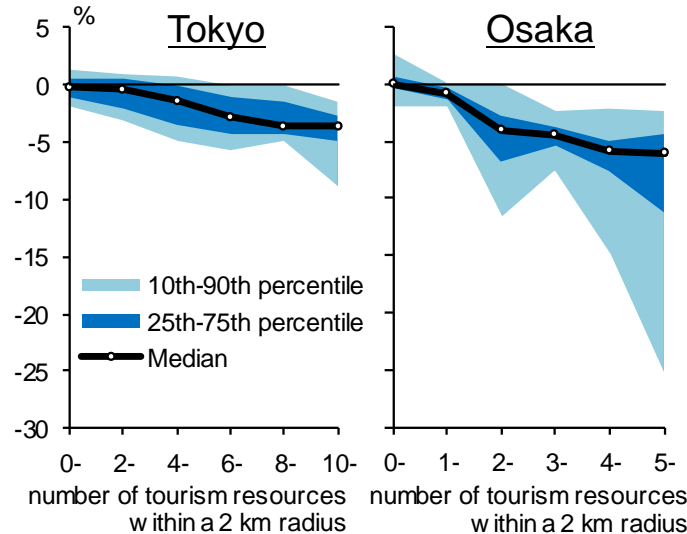
- The decline in current and future earnings from land use, such as the decline in inbound tourism demand, could affect land values. Looking at developments in land values in tourist areas, the closer sites are to tourism resources, the more their land values have tended to fall since the start of the pandemic.
- The estimation of the relationship between revenue and land values using the "Land Market Value Publication" and controlling for differences in land characteristics shows that a permanent decline in revenue may lead to a subsequent persistent decline in land values.

Chart B1-1: Developments in the number of inbound visitors



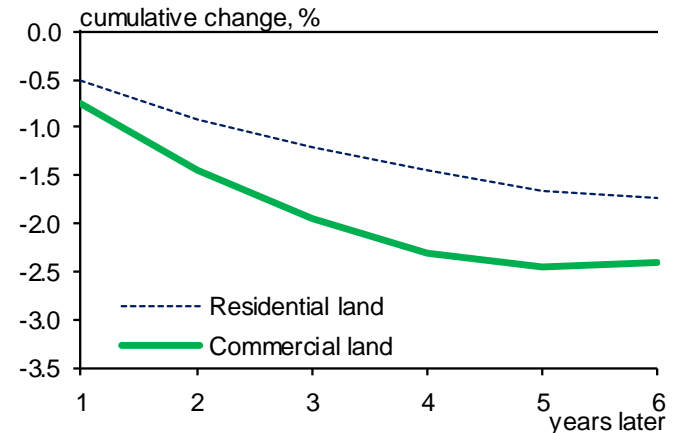
Note: "North America and Europe" includes the United States, Canada, the United Kingdom, France, and Germany.
Source: Japan National Tourism Organization (JNTO).

Chart B1-2: Changes in land values around tourism resources



Note: Changes in land values are based on the location of commercial land aggregated in terms of the tourism resources. The charts indicate changes from 2020 to 2022.
Source: Ministry of Land, Infrastructure, Transport and Tourism, "Land Market Value Publication," "Tourism Resource Data."

Chart B1-3: Effects of a 1 percentage point decline in the changes in income on land values

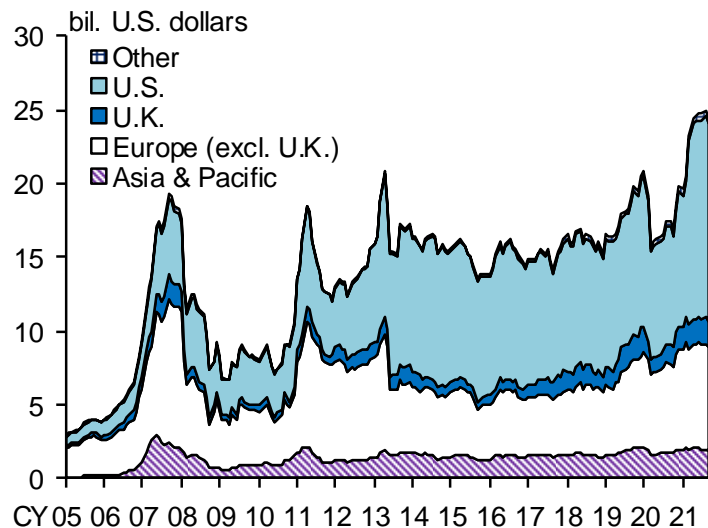


Note: The estimation period is from 2001 to 2021. The chart shows the response of land values to a 1 percentage point decline in the growth in taxable income per capita. Estimated using local projection.
Source: Ministry of Internal Affairs and Communications; Ministry of Land, Infrastructure, Transport and Tourism.

Risk factors in real estate prices (2)

- Domestic real estate funds such as J-REITs, which account for a large share in the commercial real estate market, have seen inflows of funds from foreign investment funds in recent years, mainly from the United States and Europe.
- Investment flows into real estate funds in different regions including Japan fall in response to changes in global financial conditions such as a rise in 10-year U.S. Treasury yield and a widespread deterioration in financial conditions, i.e., a worsening of the FCI, and as a result prices of real estate funds in each region also decline.

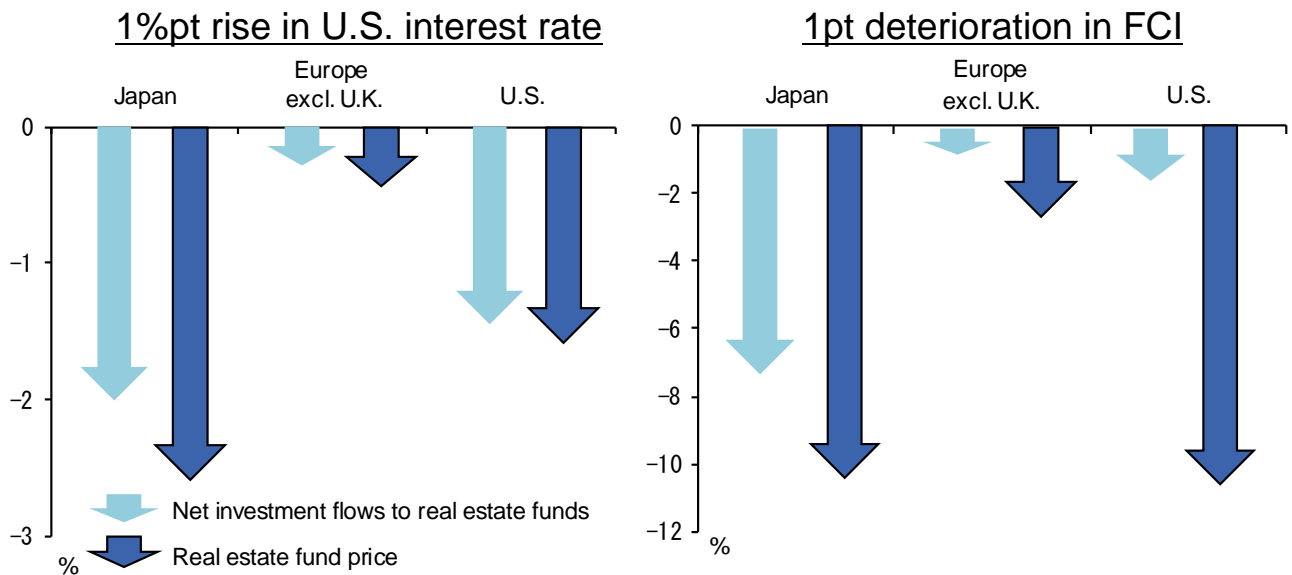
Chart B2-2: Japanese real estate fund holdings of foreign investment funds



Note: Figures are calculated using the regional share of AUM (assets under management) for investment funds that mainly invest in real estate funds. "Asia & Pacific" excludes Japan. The number of investment funds is about 12 thousand.

Source: Refinitiv Lipper.

Sensitivity of investment flows to real estate funds and their prices to global shocks






Note: Arrows represent estimated sensitivities. Real estate fund prices are calculated from the relationship between AUM and net investment flows. The U.S. interest rate is the 10-year U.S. Treasury yield. The FCI is the Chicago Fed National Financial Conditions Risk Subindex calculated by the Federal Reserve Bank of Chicago. The estimation period is from the January-March quarter of 2003 through the January-March quarter of 2021.




Source: Federal Reserve Bank of Chicago; OECD; Refinitiv Lipper.

Scenarios for macro stress testing

- Macro stress testing examines the resilience of Japan's financial system under two downside scenarios.

Chart V-2-1: Scenarios for simulation

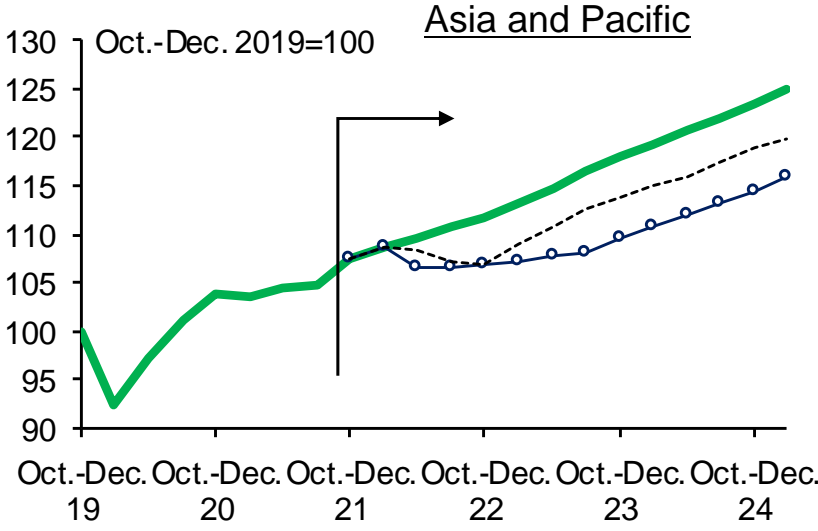
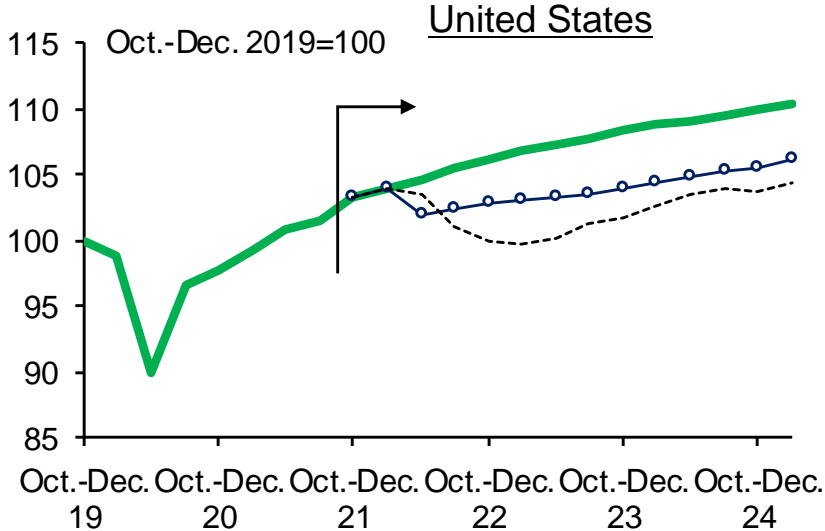
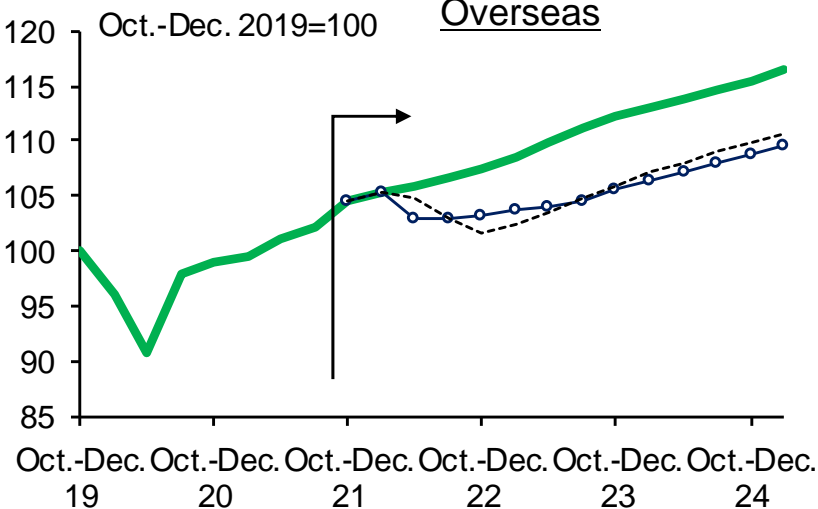
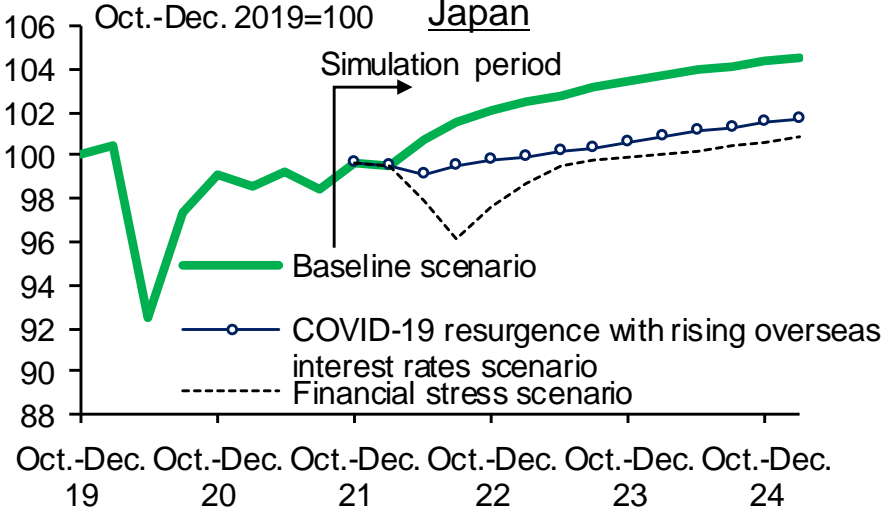
		Real economy	Financial variables
Baseline scenario		Moderate recovery in line with average forecasts of professionals and markets	Unchanged from the level at mid-March 2022
Downside scenarios	COVID-19 resurgence with rising overseas interest rates scenario	 Downturn in domestic and overseas economies mainly due to COVID-19 resurgence and a rise in the U.S. long-term interest rate	 Historical average reaction to shocks on the real economy as well as financial shocks due to a rise in the U.S. long-term interest rate (+100bps)
	Financial stress scenario	Severe downturn in domestic and overseas economies due to financial shocks	 Substantial and rapid financial shocks comparable to the GFC

Note: Long- and short-term interest rates evolve in line with the forward rates under the baseline scenario while they fall to the lowest levels observed until mid-March 2022 under the "financial stress scenario." Under the "COVID-19 resurgence with rising overseas interest rates scenario," they are subject to the shocks due to a rise in the U.S. long-term interest rate (+100bps).

Economic scenarios

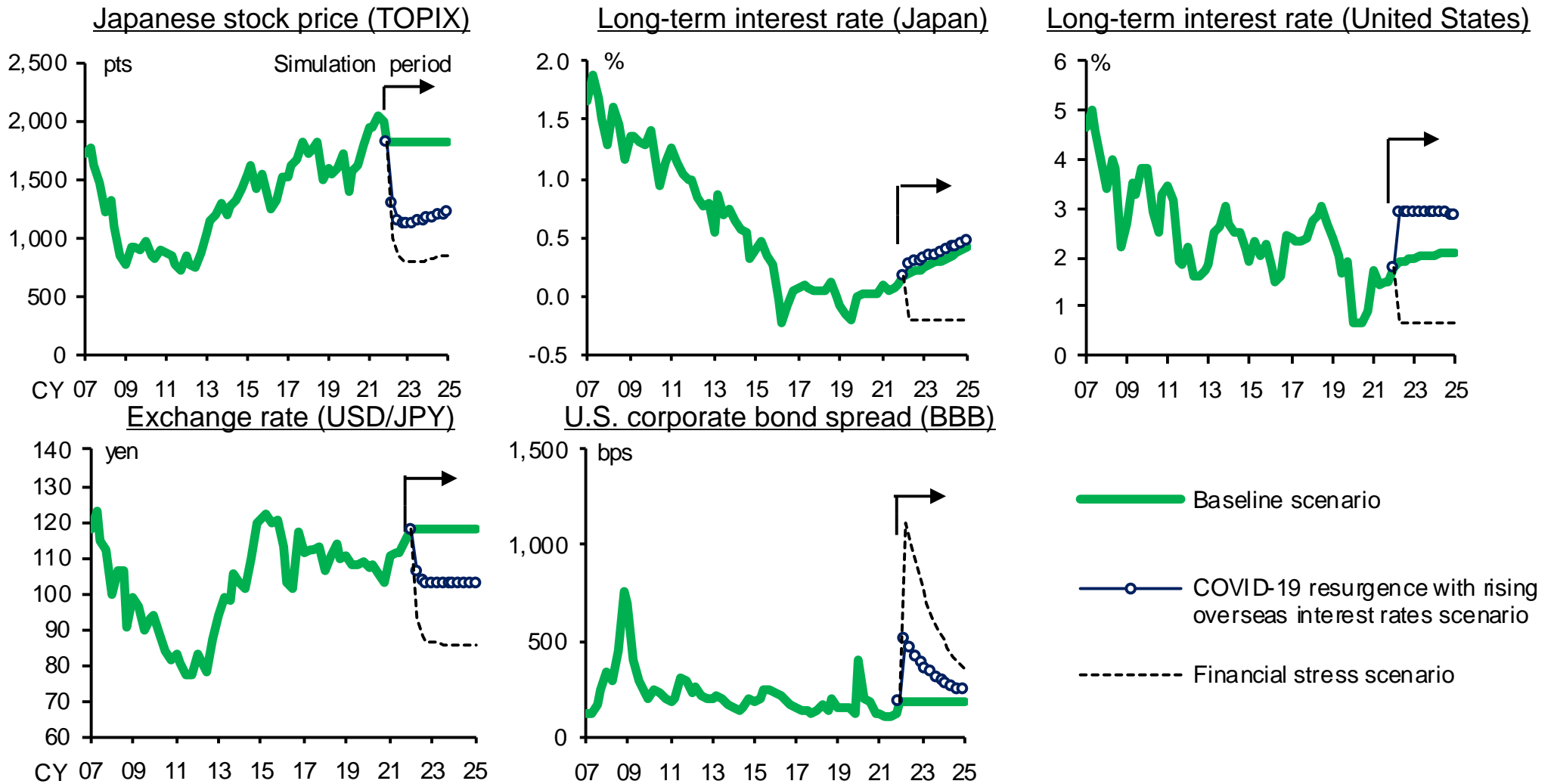
Chart V-2-2: Economic scenarios for simulation (real GDP)



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

Financial market scenarios

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

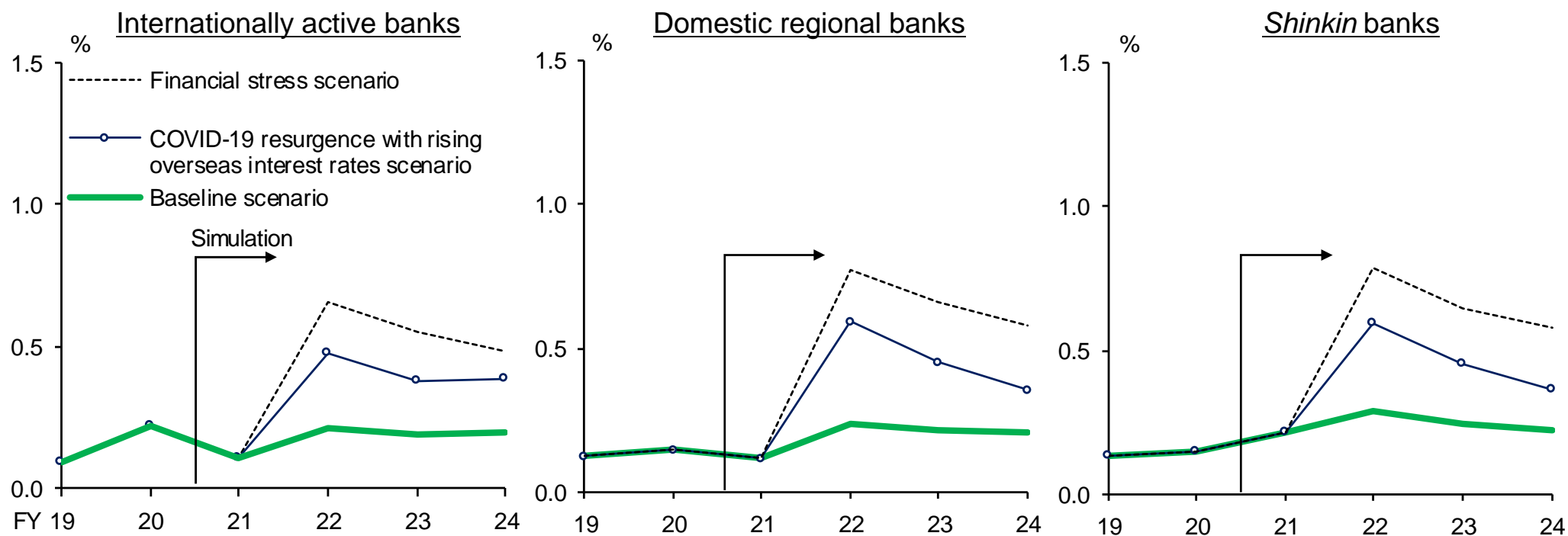


Note: Long-term interest rate indicates 10-year government bond yield.
 Source: Bloomberg; FRB; Haver Analytics; Ministry of Finance, "Interest rate."

Stress testing results: credit cost ratios

- In the baseline scenario, the average credit cost ratios for fiscal 2021-2024 (annualized) remain at about 0.2 percent for all types of banks.
- In the two downside scenarios, credit cost ratios increase more than in the baseline scenario for all types of banks.
- Moreover, for all bank types, credit cost ratios are higher in the "financial stress scenario" than in the "COVID-19 resurgence with rising overseas interest rates scenario."

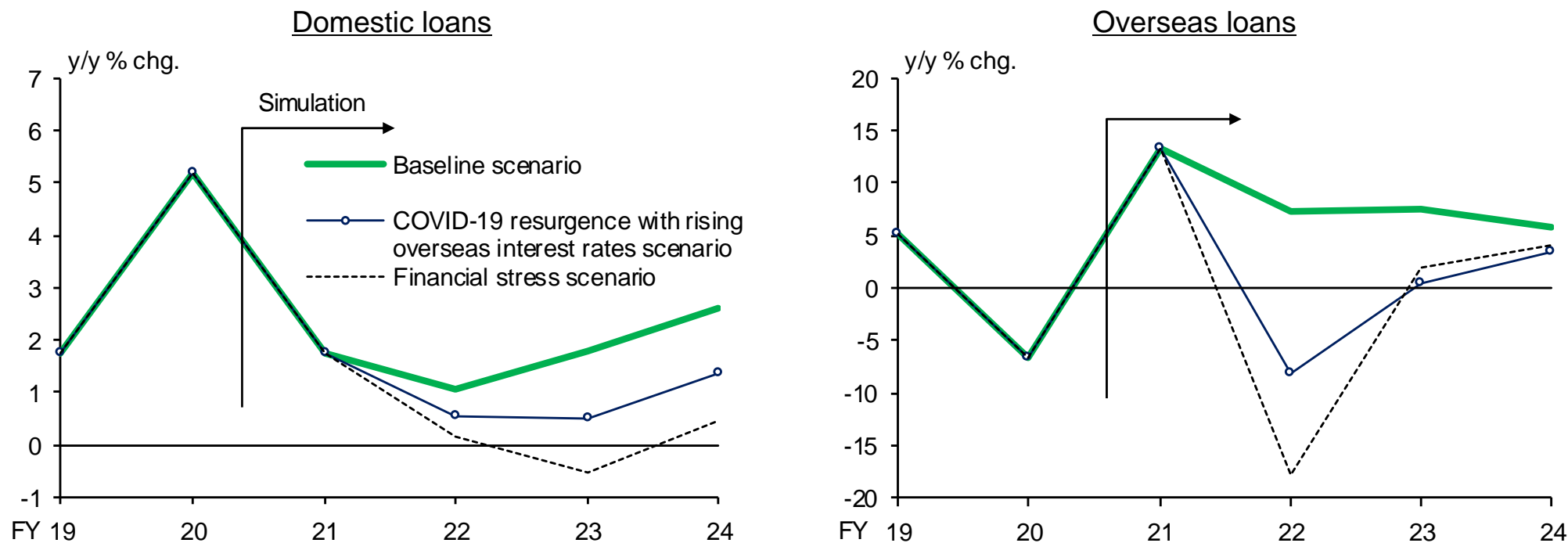
Chart V-2-5: Credit cost ratios



Stress testing results: domestic and overseas loans outstanding

- In the baseline scenario, domestic and overseas loans outstanding continue to show positive growth throughout the simulation period as economic activity recovers at home and abroad.
- The growth in domestic loans outstanding in the downside scenarios falls below the baseline scenario. In the "financial stress scenario" in particular, the annual rate of change turns negative in fiscal 2023.

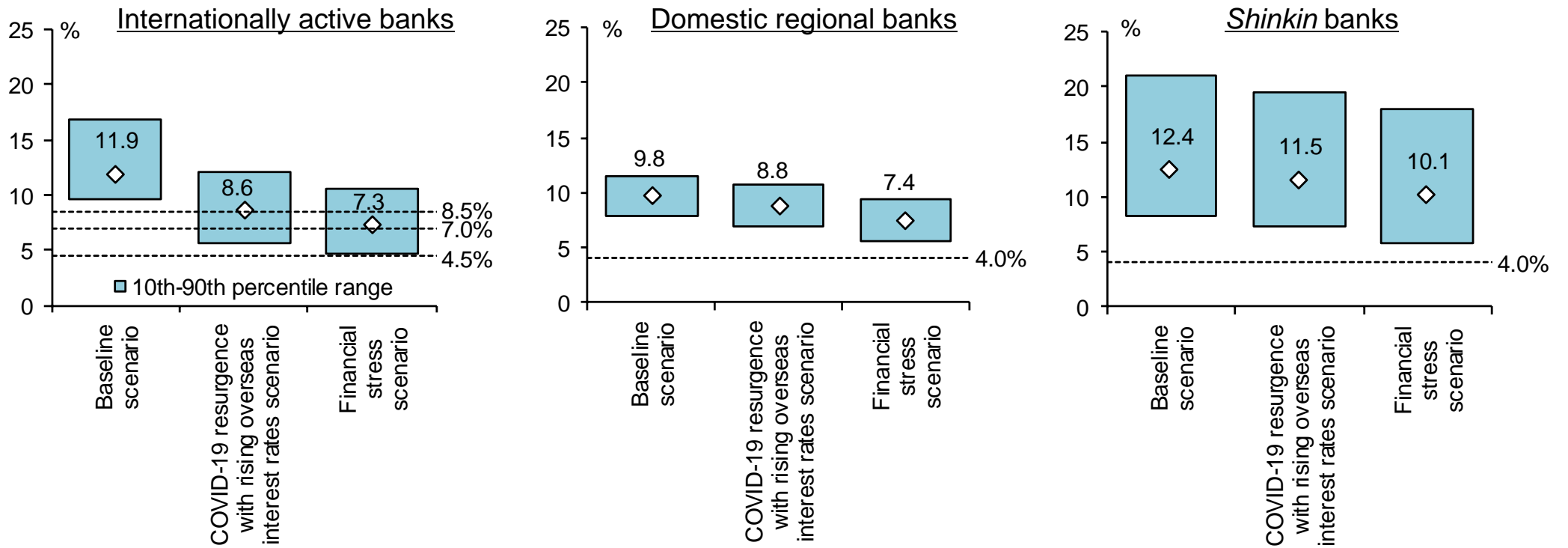
Chart V-2-8: Loans outstanding (total of financial institutions)



Stress testing results: capital adequacy ratios and summary

- Japan's financial system is likely to remain highly robust even in the event of a resurgence of COVID-19 and a simultaneous rise in U.S. long-term interest rates.
- However, in the event of a substantial and rapid adjustment in global financial markets, a deterioration in FIs' financial soundness and the resultant impairment of the smooth functioning of financial intermediation could pose a risk of further downward pressure on the real economy.

Chart V-2-12: Capital adequacy ratios (fiscal 2024)



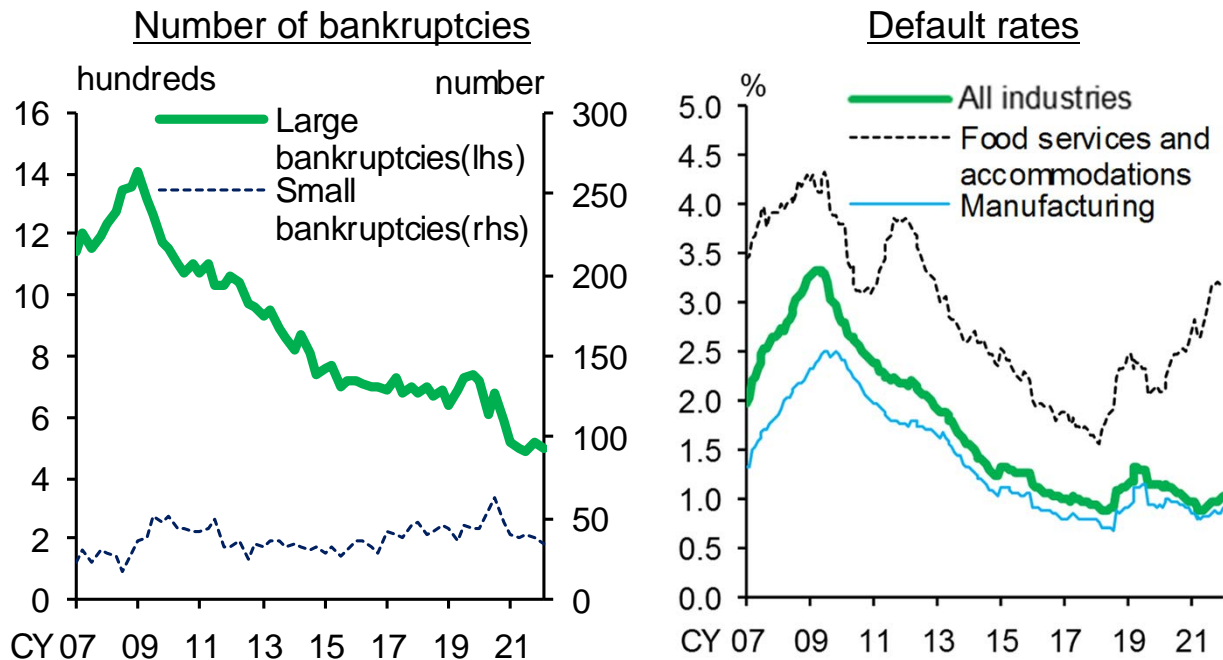
Note: 1. The left chart shows the CET1 capital ratios of internationally active banks. The middle and right charts show the core capital ratios of domestic regional banks and *shinkin* banks. The transitional arrangements for domestic regional banks and *shinkin* banks are taken into consideration.
 2. Markers in the charts indicate the total of financial institutions for each type of bank.

Appendixes

Developments in bankruptcies and default rates

- The number of bankruptcies and default rates have generally remained at low levels. So far, a rise in default rates has been limited to a few industries severely affected by the pandemic (e.g., the food services and accommodations industry).
- FIs' credit cost ratios remains low.
 - Although credit costs of major and regional banks increased slightly in fiscal 2020, they declined in the first half of 2021.

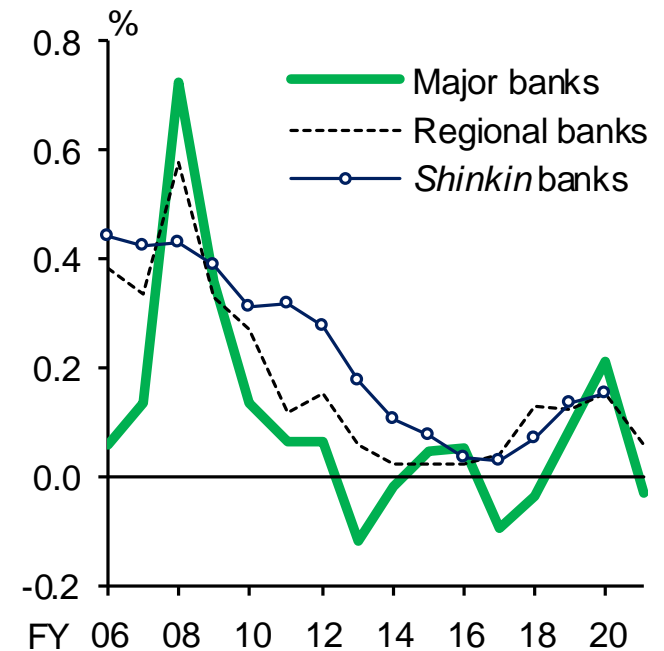
Chart III-1-13: Developments in bankruptcies and default rates



Note: The data for the number of bankruptcies are quarterly averages. "Large bankruptcies" and "Small bankruptcies" indicate above and below 10 million yen of total debt, respectively. Latest data as at January-March 2022. The default rates are calculated based on the default numbers (past due more than three months or classified as "in danger of bankruptcy" and below) for the past 12 months. Latest data as at January 2022.

Source: The Risk Data Bank of Japan; Tokyo Shoko Research.

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



Source: BOJ.

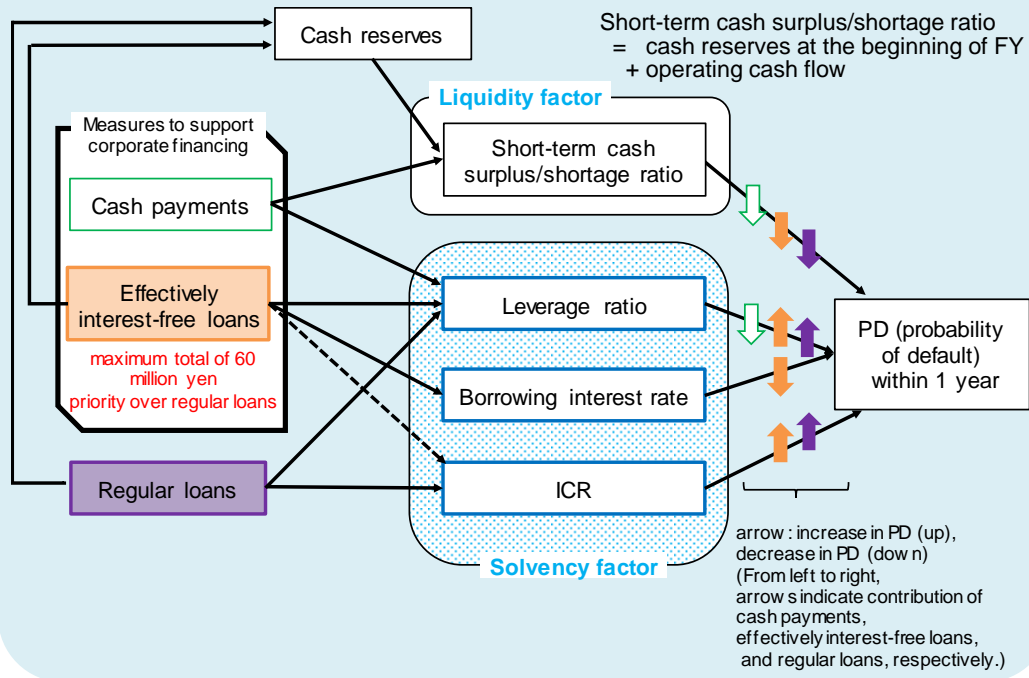
Medium-term simulation of firms' PD and FIs' credit cost ratio

- FIs' credit cost ratio for their SME loan portfolios is estimated using the following steps.
 - (1) Financial variables such as profits of about 750 thousand SMEs are simulated from fiscal 2021 onward.
 - (2) Individual SMEs' PD is calculated using financial variables for each fiscal year simulated in (1).
 - Effects of measures to support corporate financing (cash payments and effectively interest-free loans) are considered.
 - (3) Defaulting firms are selected based on their PDs and FIs' credit costs are calculated from their loans outstanding.
 - (4) Simulated credit costs are obtained by repeating the third step 5,000 times and used to estimate FIs' credit cost ratio.

Steps in the medium-term simulation

(2) Model-based estimation of firm level PDs

Chart IV-1-14: Transmission mechanism in PD model



(3) Determining defaulting firms and credit cost calculation

Chart IV-1-17: Calculation procedure of credit costs

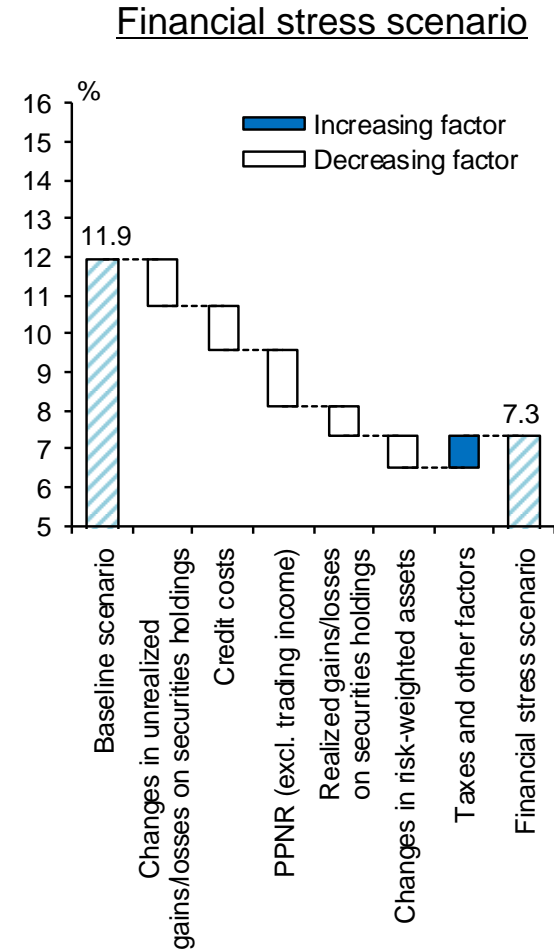
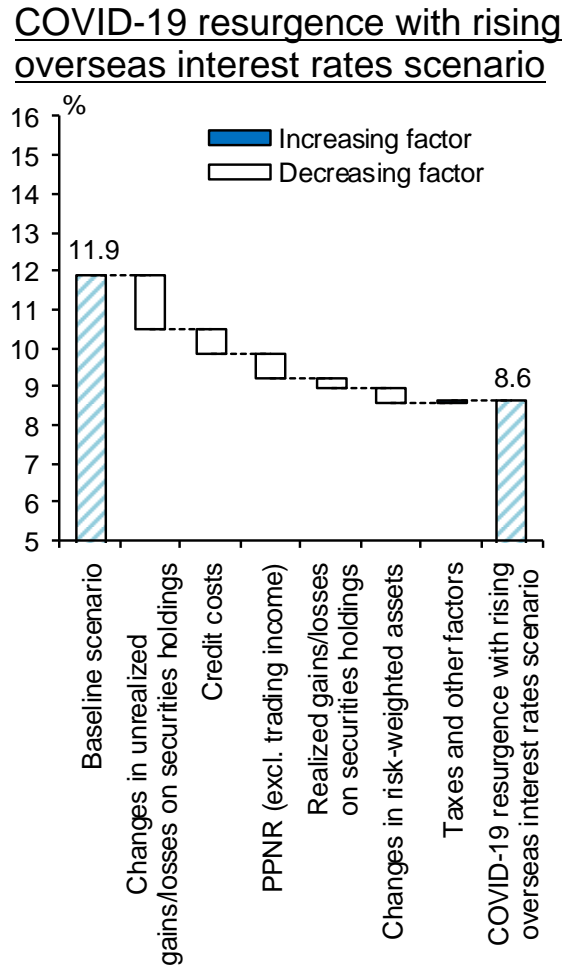
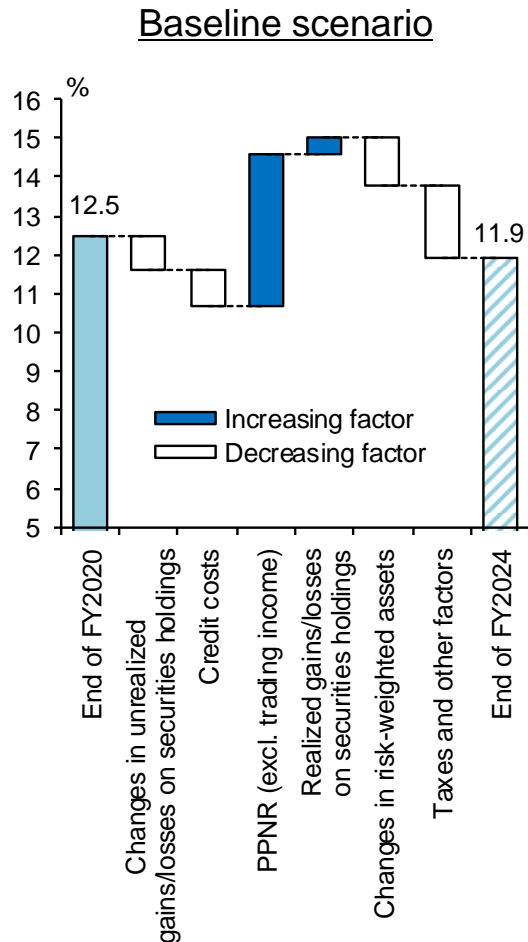
Firms	Probability of default (p)	Determination of defaulting firms	Credit amount (Regular loans)
1	p_1	x	1 billion yen
2	p_2	x	5 billion yen
3	p_3	x	2 billion yen
4	p_4	o (defaulting)	3 billion yen
5	p_5	x	10 billion yen
6	p_6	o (defaulting)	5 billion yen
7	p_7	x	3 billion yen
8	p_8	o (defaulting)	2 billion yen
⋮	⋮	⋮	⋮
Total credit amount (regular loans) of defaulting firms			50 billion yen
Credit costs (losses) = credit amount x the uncovered ratio x (1 - the recovery rate)			8 billion yen = 50 bil. yen x 0.4 x 0.4

Credit cost ratio = Credit costs / total credit amount to existing firms

- (4) The above procedure is repeated 5,000 times and the average value is considered as the credit cost.

Stress testing results: decomposition of CET1 capital ratio

Charts V-2-13,14,15: Decomposition of CET1 capital ratio (internationally active banks)



Note: The left chart indicates the contribution of each factor to the difference between the capital adequacy ratios at end-March 2021 and the end of the simulation period (as at end-March 2025) under the baseline scenario. The other charts indicate the contribution of each factor to the difference between the capital adequacy ratios at the end of the simulation period (as at end-March 2025) under the baseline and downside scenarios. "Changes in unrealized gains/losses on securities holdings" takes tax effects into account. "Taxes and other factors" includes foreign currency translation adjustments, dividends, and CET1 regulatory adjustments.