3.3 Financial infrastructure

In 2022, Taiwan's payment and settlement systems operated smoothly and continued to develop. The FSC planned to implement appropriate monitoring of crypto assets in a gradual manner. Furthermore, in order to align with the government's policy of Taiwan's Pathway to Net-Zero Emissions in 2050, the Bank released the "CBC Strategic Plan to Address Climate Change Issues." Meanwhile, the FSC also continued an aggressive effort in implementing the green finance action plan with the aim of facilitating Taiwan's sustainable development, and continuously amended regulations to bolster the sound development of the financial sector.

3.3.1 Payment and settlement systems

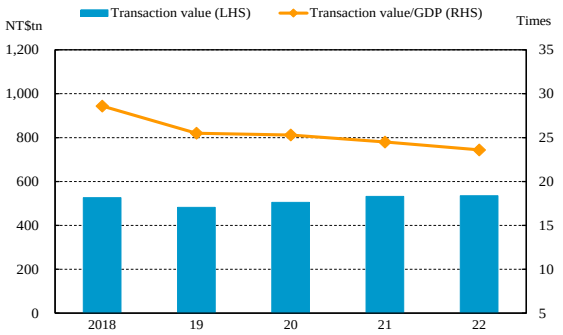
The transaction value of the CBC's CIFS and the IFIS, operated respectively by the Bank and the FISC, grew steadily and functioned smoothly. The FISC continued to strengthen the shared infrastructure for retail payments. Moreover, with an increase in the public's willingness to use non-cash payment instruments, consumer spending related to these instruments has also been expanding. Meanwhile, in light of recent risk events in the international crypto asset market, the FSC planned to take a step-by-step approach to enhance the protection of customer interests on domestic crypto asset platforms.

Overview of the CIFS's operation

The CIFS deals with large-value interbank funds transfers and provides the final settlement of interbank transfers. It is connected to each clearing system, such as those for domestic securities, bills, bonds and retail payments. In 2022, the amount of funds transferred via the CIFS was approximately NT$535 trillion, about 23.6 times the GDP for the year (Chart 3.52).

In terms of the retail payments, they are primarily processed by the IFIS, which utilizes the funds deposited by financial institutions in the Interbank Funds Transfer Guarantee Special Account (hereinafter the Guarantee Account) under the CIFS to clear and settle

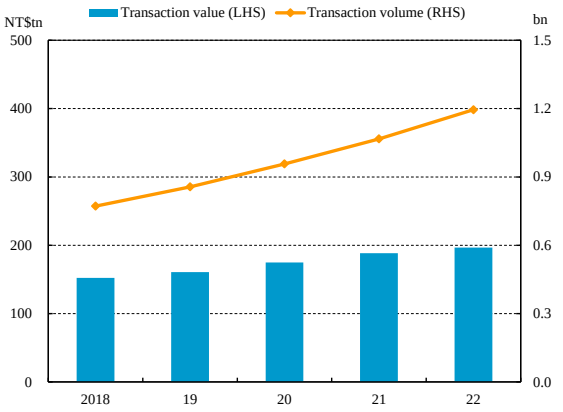
Chart 3.52 Funds transferred via the CIFS



Note: Figure for GDP in 2023 is published by DGBAS on May 26, 2023.
Sources: CBC and DGBAS.

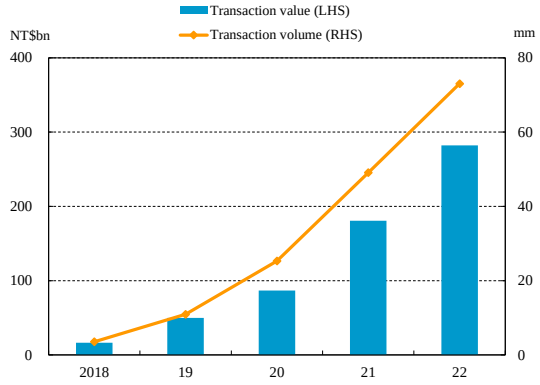
interbank payment transactions on a trade-by-trade basis.[56] In 2022, approximately 1.19 billion transactions were processed by the IFIS with the value totaling NT$197 trillion (Chart 3.53), increasing respectively by 12.00% and 4.32% compared to 2021.

Chart 3.53 Transaction value and volume processed by the IFIS



Source: CBC.

Chart 3.54 Transaction value and volume via QR code payment standard



Source: CBC.

Development of shared infrastructure for retail payments

To enhance the convenience of using mobile payment for the public, the Bank continues to urge the FISC to establish a common QR Code payment standard. Since its launch in September 2017 till the end of 2022, a total of 37 participating institutions and over 250,000 affiliated merchants have joined this initiative. The accumulated volume of transactions processed through this common standard has exceeded 160 million with a total value of approximately NT$616.5 billion. The volume and value of transactions in 2022 increased by 48.79% and 56.11%, respectively, compared to the previous year (Chart 3.54).

Additionally, to facilitate the interconnection of information and cash flows between banks and e-payment institutions, the FISC established a shared platform for cross-institution e-payments in October 2021. This platform subsequently added various functions, such as e-payments for taxes and utility bills from 2022 onwards and is expected to provide a payment service for shopping in 2023 Q3.

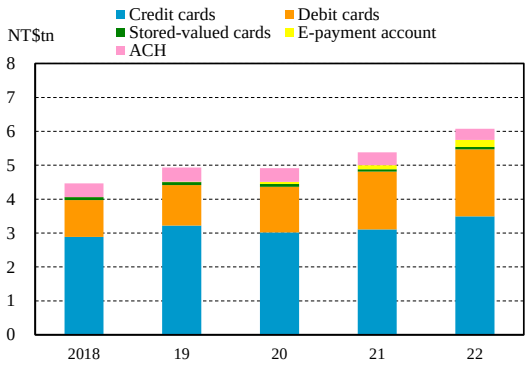
Domestic consumption via non-cash payment instruments

In 2022, the overall expenditure on non-cash payment instruments reached NT$6.08 trillion (Chart 3.55), an increase of 12.92% year on year. Among a variety of these payment instruments, the consumption amount via credit cards, debit cards, and e-payment accounts

[56] Interbank payment transactions include remittances, automated teller machine (ATM) withdrawals, transfers (including online and mobile transfers), tax payments and corporate funds transfers.

increased by NT$382.5 billion, NT$274.9 billion, and NT$86.5 billion, respectively. The growth could be attributed to the rising demand for contactless payments amid the pandemic and an improvement in convenience of e-payments.

Chart 3.55 Consumption via non-cash payment tools



Notes: 1. The consumption statistics of debit cards include consumer purchases with domestic chip bank cards, VISA and other international debit cards, UnionPay cards, and ATM transfers for shopping payments.
2. ACH inter-bank collection means that the payment institutions handle deduction and account entry through the ACH system of the TCH after obtaining the entrustment of the public.

Sources: CBC, FSC and FISC.

Development, risks, and international regulatory trends of the crypto asset market

In 2022, the crypto asset market remained highly volatile, triggered by multiple risk events such as the collapse of the stablecoin UST and the bankruptcy of the trading platform FTX. These developments caught the attention of international regulatory authorities. International institutions, including the Bank for International Settlements (BIS), have also advocated country-level regulation based on the principles of "same activity, same risk, same regulation." In this vein, the FSC also expressed its policy stance to implement appropriate monitoring of crypto assets in a gradual manner.

3.3.2 The Bank adopted policy measures in response to climate change

In recent years, extreme weather events attributable to climate change have led to substantial economic losses. As a result, the international community has been prompting nations to progressively adopt measures for transitioning towards a low-carbon economy. However, the transition process may pose operational challenges for industries, exert upward pressures on prices through green inflation, increase risks within the financial sector, and have an impact on financial stability. In this context, major central banks and financial supervisory agencies have been proactively evaluating the economic and financial impacts of climate change risks and progressively incorporated such risks into the realm of prudential supervision. They also carry out studies on the influence of climate change risks on the efficacy of monetary policies and corresponding countermeasures.

To align with the global development trajectory and support the government's 2050 net-zero transition plan, the Bank formulated the "CBC Strategic Plan to Address Climate Change Issues"

and released it on December 30, 2022. The plan includes two policy objectives and three core strategies which are expected to be achieved through the gradual implementation of five categories of policy measures as follows: (1) to conduct research on the impact of climate change on monetary policies; (2) to utilize monetary policy operational tools to facilitate sustainable financial development; (3) to conduct research on macroprudential instruments to address climate change risks; (4) to incorporate green bonds into the foreign exchange reserve management consideration; and (5) to actively engage in international projects and collaboration pertaining to climate change risks.

Given that the economic and financial implications of climate change are highly uncertain and that international research in this field is still at an early stage, the Bank will conduct a rolling review to fine-tune the aforementioned measures. To understand the potential impacts of climate change risks on various aspects of the economy and the financial system, the Bank will draw insights from international organizations. Furthermore, the Bank has enhanced supervisory cooperation with the FSC on climate change issues to jointly facilitate Taiwan's sustainable development, mitigate the impact of climate change risks on the domestic economy, and bolster resilience of the financial system to climate change risks (Box 2).

Box 2
CBC Strategic Plan to Address Climate Change Issues

In recent years, extreme weather events resulting from climate change have become more frequent, which not only poses serious threats to life, property, and the ecosystem but also exerts a substantial impact on global economic output. Climate change risks could adversely affect the real economy and through the interconnections across economic and financial sectors amplify financial risks, and even build up systemic risks that threaten financial stability. In light of this, the Bank released the "CBC Strategic Plan to Address Climate Change Issues" on December 30, 2022. Based on the plan, the Bank will progressively implement a series of measures to maintain financial stability and foster sustainable economic development in Taiwan.

1. Definition and impact of climate change risks

1.1 Climate change might result in physical and transition risks

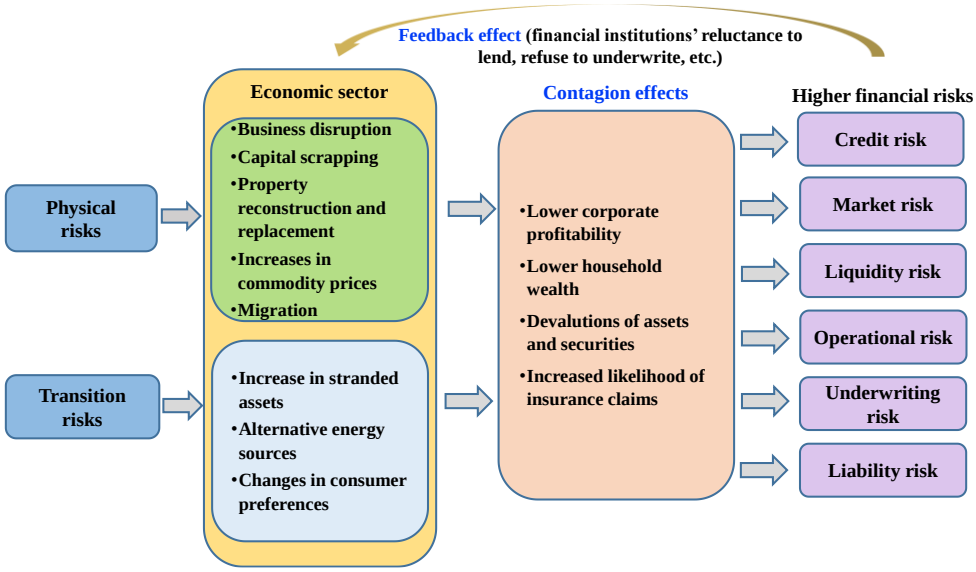
According to the Network for Greening the Financial System (NGFS),[1] climate change risks include physical risks and transition risks.

- **Physical risks** refer to the risks associated with acute impacts from extreme weather events (such as hurricanes and floods) and chronic impacts from global warming (such as increased average temperatures and sea levels), with such adverse implications as business disruption, capital impairment, property reconstruction or replacement, increases in commodity prices, and forced migration.
- **Transition risks** refer to the risks arising from the process of transition towards a low-carbon economy, including policy changes leading to the accumulation of stranded assets in specific industries, the impact of alternative energy sources resulting from advancements in energy technology, or changes in consumer preferences driven by households conforming to environmental protection policies.

1.2 Climate change risks amplify the contagion and feedback effects across the economic and financial sectors, posing a threat to financial stability

When the economic sector is exposed to physical risks and transition risks, it could heighten the risks of the financial sector through contagion effects. These risks encompass credit, market, and liquidity risks related to investments or financing positions, operational risks arising from business disruptions owing to disasters, and an increase in underwriting and liability risks owing to an upsurge in compensation claims or indemnity payouts. Consequently, the impacts could be transmitted from the economic sector to the financial

Chart B2.1 Contagion effects and feedback effects of climate risks



Sources: FSB (2020), NGFS (2019), NGFS (2020), and CBC.

sector. In turn, to prevent such risks from increasing, the financial sector might take a series of countermeasures against the shocks, which would generate feedback effects through channels such as capital markets, business adjustments, and cross-border contagion effects, thereby amplifying the impact on the economic sector (Chart B2.1).[2]

2. Policies and measures adopted by the Bank in response to climate change

Being a responsible member of the global community, the Taiwanese government announced the *Taiwan Sustainable Development Goals (T-SDGs)* in December 2018, and has actively engaged in sustainable development initiatives. In April 2021, the government declared its commitment to achieving net-zero transition in 2050. Subsequently, in March 2022, it unveiled the comprehensive action plans and measures covering the *12 Key Strategies*[3] to fulfill the long-term net-zero transition goal.

Although the Bank is not the primary driver of the climate change-related actions in Taiwan, it recognizes the importance of aligning itself with the international trend and supporting the government's 2050 net-zero transition plan. The Bank thus formulated two policy objectives and three core strategies after drawing on the experiences and practices of major international central banks and developed a policy framework for the Bank's response actions to address climate change challenges (Chart B2.2). To achieve its policy objectives, the Bank will progressively implement the following measures across five key aspects, namely monetary policy, monetary policy tools, macroprudential surveillance, foreign exchange reserve management, and international engagement and collaboration.

Chart B2.2 The Bank's policy framework in response to climate change

Policy objectives	• Strengthen the resilience of the economic and financial system in response to climate risks • Facilitate the smooth transition of the economic system towards a sustainable green economy				
Core strategies	• Support the establishment of a green and sustainable investment and financing environment • Proactively enhance the Bank's expertise and capabilities to address climate-related issues • Incorporate climate risk considerations into the Bank's operation and management of foreign exchange reserves				
	Monetary policy	Monetary policy operating tools	Macroprudential surveillance	FX reserve management	International collaborations
Policy measures	Conduct research on the impact of climate change upon monetary policies	Utilize monetary policy operational tools to facilitate the development of sustainable finance	Conduct research on macroprudential instruments to address climate change risks	Incorporate green bonds into the FX reserve portfolio	Actively engage in international collaborations pertaining to climate change risks

Source: CBC.

2.1 Conducting research on the impact of climate change upon monetary policy

The Bank is deliberating on how to incorporate weather factors into its price forecasting model and plans to collect climate change-related data to compile climate indicators. In the medium term, the Bank will explore the development of industry-specific models and multi-sector models, combined with the results from macro-econometric model analysis, to investigate the impacts of changes in energy or food prices under various scenarios, seeking a deeper understanding of the implications of climate change risks on the economy and the financial system.

2.2 Utilizing monetary policy operational tools to facilitate the development of sustainable finance

The Bank is mulling over the adoption of domestic banks' performances of implementing green/sustainable finance as a component of the Bank's reference indictors when conducting open market operations and accepting redeposits from domestic banks. In addition, the Bank plans to include sustainability debentures issued by banks in its annual small-scale test repo operation targets, in order to encourage banks to increase the issuance of such instruments and enhance investors' willingness to hold them.

2.3 Conducting research on macroprudential instruments to address climate change risks

The Bank stays updated with the latest international advancements in climate risk

assessment data and methodologies and studies the experiences of major central banks in assessing climate change-related risks and in developing prudential instruments. Going forward, the Bank will collaborate with experts and scholars to conduct research, aiming to enhance expertise in developing in-house climate risk-related models. This will serve as a basis for planning climate risk-related macro-stress testing and for evaluating viable options of macroprudential instruments.

2.4 Incorporating green bonds into the FX reserve portfolio

Under the principles of safety, liquidity, and profitability, the Bank will incorporate green bonds into its consideration of foreign exchange reserve portfolio management. On the premise that bond issuers meet the Bank's credit rating requirements, the Bank will continuously invest in green bonds that meet international standards and are issued by foreign governments or international financial organizations. Moreover, the Bank will gather and analyze information related to the implementation of sustainable development goals by stakeholders directly involved in foreign exchange reserve portfolio management, thereby contributing to the development of the international green finance market.

2.5 Actively engaging in international cooperation and collaboration pertaining to climate change risks

Sustainable development has become a key focus in financial policies of various countries. The Bank continues to participate in climate change risk- and green finance-related seminars, and establish interactive channels such as bilateral video conference mechanisms with major central banks and international organizations. These initiatives have facilitated exchanges on the best practices in response to climate change risks and sharing of relevant experiences among central banks.

3. Conclusion

Although the Bank is not the primary driver of climate change-related actions in Taiwan, it will proactively monitor the evolution and developments of climate-related issues. Given that the impact of climate change on the economy and the financial system is highly uncertain and migrates greatly over time, and that international research in this field is just emerging, the Bank will draw insights from international organizations and continuously review and adjust the aforementioned measures. In addition, the Bank has strengthened collaborative efforts with the FSC on climate change issues, aiming to collectively mitigate the impact of climate change risks on Taiwan's economy and enhance the financial system's resilience to climate change risks, so as to ensure the sound development of

Taiwan's financial sector and sustainable economic growth.

Notes: 1. NGFS (2020), "Climate Change and Monetary Policy Initial Takeaways," June; NGFS (2021), "NGFS Climate Scenarios for Central Banks and Supervisors," June.
2. FSB (2020), "The Implications of Climate Change for Financial Stability," November; NGFS (2019), "A call for Action, Climate Change as a Source of Financial Risk," April; NGFS (2020), "Climate Change and Monetary Policy Initial Takeaways," June.
3. Including wind/solar photovoltaics, hydrogen, innovative energy, power systems and energy storage, energy saving and efficiency, carbon capture utilization and storage, carbon-free and electric vehicles, resource recycling and zero waste, carbon sinks, green lifestyle, green finance and just transition.

3.3.3 The FSC continues to take measures related to green finance

In order to coordinate financial resources to support net-zero transition in Taiwan and continuously enhance the management of climate risk for the financial industry, the FSC has successively implemented important measures since 2022 as follows:

Launching "Green Finance Action Plan 3.0"

The FSC launched the Green Finance Action Plan 3.0 (hereinafter referred to as the Plan) in September 2022. The vision of the Plan will be achieved through the efforts in five aspects,[57] namely "deployment, funding, data, empowerment, and ecosystem," and via 26 measures. The Plan is expected to encourage financial institutions to: (1) identify GHG emissions of their own operations and of their investments and financing positions; (2) assess climate-related risks and opportunities; and (3) set goals and strategies to reduce their GHG emissions. Financial institutions could in turn drive corporate efforts towards low-carbon transition and enhance the disclosure of information related to environmental, social, and governance (ESG) performance.

Strengthening financial institutions' management of climate-related risks and disclosure of GHG emission information

To assess the impact of climate change risks on the banking industry, the FSC commissioned the Bankers Association of the Republic of China to draw up the "Plan for Climate Change Scenario Analysis of Domestic Banks." The climate change scenarios, based on the scenarios designed by the NGFS, are used to assess the impact of climate change risks on the credit risk positions of domestic banks and evaluate their ability to withstand climate-related risks. Moreover, in order to enhance the disclosure of GHG emission information of the financial industry, the FSC's compulsory disclosure of scope 1 and scope 2 inventory and verification by financial institutions[58] will be phased in gradually from 2024 onwards based on the size of their capital or asset management business.

[57] The five major aspects include: (1) Deployment: to require compulsory disclosure of information about GHG emissions by financial institutions and set strategies and objectives, so as to drive companies to reduce their GHG emissions; (2) Funding: to promote the adoption of Taiwan Sustainable Taxonomy and to channel funds into promoting sustainable development; (3) Data: to integrate information from different institutions and to build an ESG data platform; (4) Empowerment: to enhance the professional competencies of sustainable finance for financial institutions' employees through training programs and certification; (5) Ecosystem: to foster cooperation among financial institutions and to conduct the evaluation of sustainable finance.

[58] Financial institutions comprise banking enterprises, insurance firms, financial holding companies, bills finance companies, securities firms, futures commission merchants, and securities investment trust enterprises.

Formulating the "Taiwan Sustainable Taxonomy"

The FSC, the Environmental Protection Administration (EPA), the Ministry of Economic Affairs (MOEA), the Ministry of Transportation and Communications (MOTC), and the Ministry of the Interior (MOI) jointly issued the "Taiwan Sustainable Taxonomy" (the Taxonomy) in December 2022, as a reference guide[59] for corporates to determine whether their economic activities are in conformity with sustainable finance. The Taxonomy offers, as a start, guidance for the top three industries in terms of the amount of investment and financing by domestic financial institutions, which are manufacturing, building and construction, and transportation and storage, so as to help them identify whether their economic activities, namely 16 ordinary economic activities and 13 forward-looking economic activities, qualify as sustainable.

Establishing the "Financial Industry Net-Zero Working Platform"

The FSC and the Taiwan Financial Services Roundtable jointly established the "Financial Industry Net-Zero Working Platform" with five workstreams in December 2022. The platform has invited 16 peripheral institutions and financial industry associations to become members to develop relevant tools, guidelines and plans in a collective effort while serving as a space in which financial institutions can cooperate, collaborate, and exchange ideas.

3.3.4 Reclassifying financial assets by some insurers

Form March 2022 onwards, rapid interest rate hikes of major central banks led to a sharp decline in profits or net worth of insurance companies in Taiwan. The reason is that insurance companies applied different accounting treatment principles to the valuation bases for assets and liabilities. While their financial assets are measured at fair value in accordance with International Financial Reporting Standard (IFRS) 9, their liabilities are still recognized on a lock-in basis as Taiwan has not yet adopted the IFRS 17 *Insurance Contracts*, and thus have not yet been valued at current market rates. As a result, when market interest rates rise sharply, the asset side reflects huge unrealized evaluation losses, while the liability side cannot reflect the gains correspondingly.

To mitigate the impact of large fluctuations in interest rates on their balance sheets, some

[59] The Taxonomy is to provide one of five judgments (aligned; working on it; improving; not aligned; and not eligible) regarding the degree of sustainability of the primary economic activities in terms of certain conditions such as "substantial contribution to climate change mitigation," "shall not significantly harm five other environmental goals," "shall not significantly harm social safeguards," and whether they have adopted any concrete improvement or transition plans.

insurance companies planned to change their business models for managing financial assets to address the challenges resulting from changes in the external environment to their operations. Moreover, in October 2022, Taiwan's Accounting Research and Development Foundation also provided reference guidelines to address the issues and questions about the reclassification of financial assets as drastic changes in the international economic situation ushered in different business models in managing financial assets. As of the end of March 2023, nine life insurance companies have reclassified their financial assets.

In addition, in order to maintain capital soundness of the insurance industry, the FSC required those insurers who had reclassified financial assets to set aside a provision for special reserves. Furthermore, for net worth increases after reclassification, the FSC required that special reserves should be set aside by insurers' parent financial holding companies to reflect the full amount of the increases and by the public companies with equity method investments in life insurers based on their shareholding ratio, so as to prevent the reclassification from leading to increased distribution of dividends.

3.3.5 Establishing the financial vulnerability index of Taiwan

In the wake of the 1997 Asian financial crisis, central banks and regulatory authorities have been devoted to developing indicators for measuring financial stability or vulnerability, with the intention of reflecting the current financial condition, or even predicting crises. For instance, the International Monetary Fund (IMF) has been collaborating with various economies since 1999 to promote the compilation of financial soundness indicators (FSIs), so that central banks and regulatory authorities are able to enhance surveillance of relevant financial systems through more comprehensive information on financial and real sectors. In accordance with international standards, the Bank also consulted the IMF compilation guide on FSIs and began to regularly publish the Taiwan FSIs in 2008.

Despite the fact that FSIs can be employed to monitor changes in financial soundness across various sectors on a regular basis, the trends of different financial indices may sometimes take divergent paths, making it difficult to grasp the full picture of the financial landscape. Therefore, in 2018, the Bank conducted a pilot study to develop the TFVI based on the FSIs by referring to the methodologies used in past research and literature. Subsequently, in view of a major revision of the FSIs framework by the IMF in 2019, along with the fact that the aforementioned TFVI still needs improvement on the correlation among variables and on the warning thresholds, the Bank therefore worked with domestic academics[60] to utilize the hierarchical

[60] See Hsu, Shih-Hsun (2023) "Taiwan Financial Vulnerability Index," commissioned research report by the Bank, February.

common factor model to develop the TFVI in a more comprehensive manner for the index to better reflect the vulnerability dynamics of the Taiwanese financial system (Box 3).

With the abovementioned effort, the TFVI is able to offer a broad picture of the current financial system's vulnerabilities, and its trend is correlated, to some extent, with material financial distress episodes over the past years in Taiwan. Moreover, the lead-lag relationship between the TFVI and the credit-to-GDP gap is statistically significant, indicating that the TFVI aggregated by extracted information from multiple sectors does possess a certain degree of early warning capability. In the future, subsequent to trial calculations, the TFVI can serve as a reference for the Bank to monitor the vulnerability of the financial system.

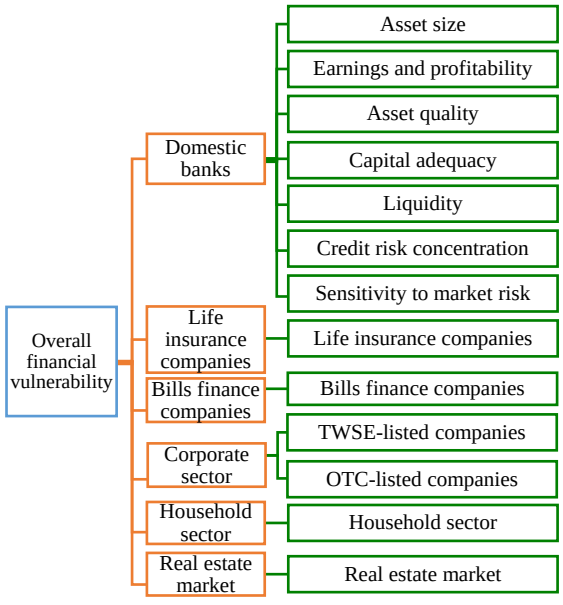
Box 3
Establishing the Financial Vulnerability Index of Taiwan

From 2008 onwards, the Bank has compiled and published Taiwan's FSIs after taking reference from the FSI compilation guidelines published by the IMF.[1] These indicators, regularly disclosed in the *Financial Stability Report* and on the Bank's website, are used to monitor changes in individual sectors as well as financial markets. However, given that the FSIs currently comprise as many as 58 indicators and cover multiple sectors, it is not meant to promptly gauge the overall stability or vulnerability of the financial system. Against this backdrop, in collaboration with domestic academics,[2] the Bank endeavored to establish the Taiwan Financial Vulnerability Index (TFVI) based on the existing framework of the FSIs. The TFVI aims to provide a comprehensive measurement of financial system vulnerabilities, which helps the Bank to identify the source of vulnerabilities and take response measures in a timely manner. In this Box, we would like to briefly introduce the methodology applied to establish the TFVI, and the interpretation of the preliminary research results.

1. Compilation methodology for the TFVI

The TFVI, built on the basis of the FSIs compiled by the Bank, is divided into six sectors, including domestic banks, life insurance companies, bills finance companies, non-financial corporate sector, household sector and real estate market. The banking sector is further classified into seven subsectors, while the corporate sector is split into two (Chart B3.1). Finally, each sector or subsector consists of a different number of indicators.[3] The methodology for compiling the TFVI is as follows:

Chart B3.1 The structure of the TFVI



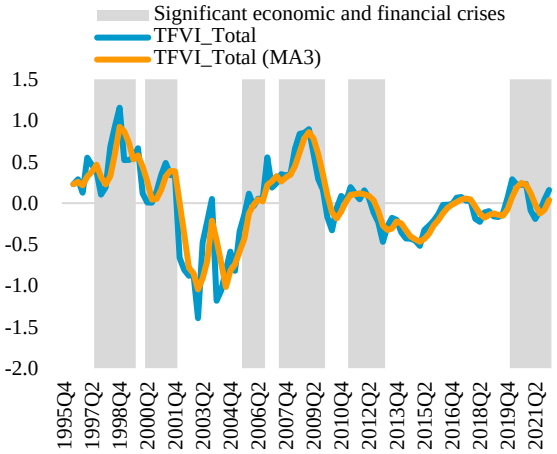
Note: For more details about the indicators, please refer to the "Appendix: Financial soundness indicators," in the *Financial Stability Report*, May 2023.
Source: CBC.

(1) After computing the differences of the FSIs, we employ sequential principal component analysis to estimate a hierarchical common factor model. This methodology allows us to decompose the trend and variance of each FSI

into two parts - one affected by multilevel common factors and the other capturing the variable-specific variation.

(2) Via a linear regression analysis of the FSIs treated as explained variables, together with the previous period's value of the hierarchical common factors constructed in the above step as explanatory variables, we obtain the residuals corresponding to each FSI.[4] The residuals, representing uncertain information that cannot be captured by previous hierarchical common factors, serve as the basis for establishing the vulnerability index.

Chart B3.2 The movement of the TFVI



Notes: 1. TFVI_Total is the original FVI, and TFVI_Total (MA3) is the moving average of the TFVI from time t to t - 3.
2. For more detailed information about significant economic and financial crises, please see Note 7.

Source: CBC.

(3) After adjusting the signs of the corresponding residuals in respect of the correlation between each FSI and financial vulnerability,[5] we aggregate the weighted residuals in every subsector so as to acquire the respective financial vulnerability index. The weighted subsectoral indices are then summed up to create sectoral indices. Lastly, the overall financial vulnerability index can be calculated by combining the six sectoral indices.[6]

2. Preliminary TFVI research results

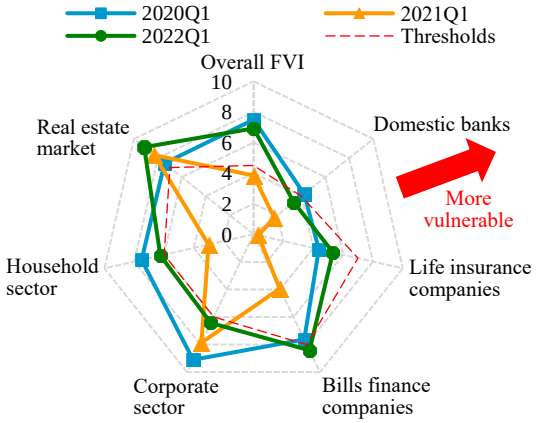
2.1 The movement of the TFVI and its association with financial crises

In order to assess whether the TFVI is capable of accurately reflecting changes in the vulnerability of Taiwan's financial system, this study defines eight material economic and financial events domestically and globally since 1995 Q4,[7] and explores their relationship with the TFVI. As shown in Chart B3.2, the TFVI shows a trend highly correlated to the aforementioned events. Furthermore, with regard to the smoothed TFVI,[8] points in time where the index exceeded 1.65 times standard deviation coincide with the periods of domestic financial distress (from 1998 Q4 to 1999 Q3) and the global financial crisis (from 2008 Q4 to 2009 Q2). These results exhibit that the TFVI compiled in this study should have the ability to identify notable changes in domestic and international financial conditions.

2.2 Visualization analysis of the TFVI

Apart from the overall TFVI, this study further adopts visualization analysis to present the variations in vulnerability for each sector. The main approach involves specifying optimal thresholds by applying the Youden index. Subsequently, we transform these threshold values and subsectoral indices into a scale ranging from 0 to 10. These figures are depicted on a radar chart, aiming to compare the extent of adverse impacts across different sectors.

Chart B3.3 The radar chart of the TFVI



Source: CBC.

Taking the period of the COVID-19 crisis for example, the subsectoral indices for the household sector, corporate sector and real estate market were more significantly affected by the pandemic than the others (see Chart B3.3). The result suggests that the COVID-19 pandemic had a more profound impact on household income and corporate profits, thereby disturbing the supply-demand balance in the real estate market. By contrast, domestic banks and life insurance companies have generally maintained TFVI levels well below the threshold values over the past three years, showing relatively less vulnerability.

3. Conclusion

This study uses the FSIs compiled by the Bank to construct the TFVI. A hierarchical common factor model is introduced to filter the co-movement and common trends between variables and to subsequently build the TFVI for each sector and total TFVI from the bottom up. In sum, the TFVI is able to broadly reflect changes in Taiwan's financial vulnerability and possesses an early warning capacity. Thus, it can be a vital supplementary tool for the Bank to monitor the financial stability landscape.

Notes: 1. For more details about the FSIs of the Bank, please see the "Appendix: Financial soundness indicators" in the *Financial Stability Report*, May 2023.

2. See Hsu, Shih-Hsun (2023), "Taiwan Financial Vulnerability Index," commissioned research report by the Bank, February.

3. The construction of the TFVI utilized a total of 63 FSIs, including the current 58 indicators and the other five indicators removed according to the 2019 IMF compilation guide (i.e., household loans to total loans, corporate loans to total loans, large exposure to capital, gross asset positions in financial derivatives to capital, and gross liability positions in financial derivatives to capital).

4. Baker, Scott R., Nicolas Bloom, and Steven J. Davis (2016), "Measuring economic policy

uncertainty," *Quarterly Journal of Economics*, March.

5. Positive/negative values represent an increase/decrease in financial vulnerability caused by movement of the indices. For example, a higher return on assets (ROA) of financial institutions indicates better profitability and lower financial vulnerability. Therefore, ROA and financial vulnerability tend to move in opposite directions, and a negative sign should be applied when aggregating its residuals for subsector indices.
6. All indices are aggregated using equally-weighted averages owing to various starting points for each FSI, and only indices available at specific points in time are summed up when calculating the corresponding vulnerability index. Furthermore, under the current methodology for compiling financial soundness indicators, only domestic banks and the corporate sector have subsectoral indices.
7. The eight material economic and financial events refer to the Asian financial crisis (from 1997 Q3 to 1998 Q3), the domestic financial crisis (from 1998 Q4 to 1999 Q3), the bursting of the dot-com bubble (from 2000 Q2 to 2001 Q4), the credit card crisis in Taiwan (from 2005 Q3 to 2006 Q3), the subprime mortgage crisis (from 2007 Q3 to 2008 Q2), the global financial crisis (from 2008 Q3 to 2009 Q4), the European sovereign debt crisis (from 2011 Q2 to 2013 Q1), and the COVID-19 pandemic (from 2020 Q1 onwards).
8. TFVI_Total (MA3) refers to the moving average of the TFVI over the past three quarters.