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AMRO
ASEAN +3 MACROECONOMIC RESEARCH OFFICE

AMRO Annual Consultation Report

Korea - 2022

ASEAN+3 Macroeconomic Research Office (AMRO)

Apri 2023

Acknowledgments

1. This Annual Consultation Report on Korea has been prepared in accordance with the functions of AMRO to monitor and assess the macroeconomic status and financial soundness of its members; identify relevant risks and vulnerabilities; report these to member authorities; and if requested, assist them in mitigating these risks through the timely formulation of policy recommendations. This is being done in accordance with Article 3 (a) and (b) of the AMRO Agreement.

2. This Report is drafted on the basis of the Annual Consultation Visit of AMRO to Korea from 28 November to 9 December 2022 (Article 5 (b) of the AMRO Agreement). The AMRO Mission team was led by Dr. Kevin Cheng, Group Head and Lead Economist. Members included Mr. Kimi Xu Jiang, Economist (Country desk); Ms. Wanwisa Vorranikulkij, Senior Economist; Dr. Byunghoon Nam, Senior Economist; Dr. Sungtaek Kwon, Senior Economist; Dr. Trung Thanh Vu, Associate Economist; and Mr. Monineath El, Associate. Mr. Prashant Pande and Mr. Toan Long Quach (Financial Surveillance) attended parts of the on-site meetings. AMRO Director Dr. Kouqing Li and Chief Economist Dr. Hoe Ee Khor participated in key policy meetings with the authorities. This AMRO Annual Consultation Report on Korea for 2022 was peer-reviewed by an economist group from AMRO's country surveillance, financial surveillance and fiscal teams; endorsed by Mr. Jiangyan Yu, Senior Economist, Policy and Review Group; and approved by Dr. Hoe Ee Khor, AMRO Chief Economist.

3. The analysis in this Report is based on information available up to 7 March 2023.

4. By making any designation of or reference to a particular territory or geographical area, or by using the term "member" or "country" in this Report, AMRO does not intend to make any judgments as to the legal or other status of any territory or area.

5. No part of this material may be disclosed unless so approved under the AMRO Agreement.

6. On behalf of AMRO, the Mission team wishes to thank the Korean authorities for their comments on this Report, as well as their excellent meeting arrangements and hospitality during our visit.

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Executive Summary

1. The Korean economy rebounded in 2021 and 2022 mainly on strong export growth and recovering private consumption. Real GDP in 2022 grew by 2.6 percent, which was above the potential growth rate of 2.0 percent, driving the output gap into positive territory for the first time since 2020. However, economic recovery from the pandemic remains uneven across sectors. While manufacturing activities rebounded quickly, services recovered only gradually.

2. The economic outlook in the near term has deteriorated. Private consumption and exports are forecast to decelerate, and investments are expected to remain weak amid tighter financial conditions and softening external demand. The economy is forecast to moderate to 1.7 percent in 2023. Accordingly, the output gap is projected to turn slightly negative in 2023.

3. The labor market has been tight. The annual unemployment rate fell to 2.9 percent in 2022 from 4.0 percent in 2020. Total employment exceeded pre-pandemic levels, although the recovery has remained uneven across sectors, with accommodation and food services still lagging behind due to the heavy toll imposed by the pandemic.

4. Headline inflation has probably peaked and is expected to gradually decline to an average of 3.3 percent in 2023 from 5.1 percent in 2022. The increase in inflation was broad-based in 2022, both from the supply side, reflecting rising energy and food prices, and from the demand side, spurred by the economic reopening. Short-term inflation expectations have been high, although long-term expectations remain well anchored. With energy and food prices likely to continue falling, headline inflation should continue to trend down in 2023.

5. The external sector has been resilient despite widening trade deficits and some decline in foreign reserves. The current account surplus narrowed to 1.8 percent in 2022 from 4.7 percent in 2021 mainly due to larger trade deficits. Foreign reserves dropped by USD40 billion to US423 billion in 2022, but remain ample, covering about 2.5 times short-term external debts and about six months' worth of imports.

6. Monetary policy stance has become restrictive. To tame the rapid and broad-based increase in inflation following the surge in commodity and import prices, together with rising household debt, the Bank of Korea (BOK) has raised the Base Rate ten times since August 2021, to 3.50 percent from 0.50 percent, including two big hikes of 50 basis points each. The market expects the central bank's policy rate hikes to peak in H1 2023 at the terminal rate of 3.50-3.75 percent.

7. The budget for 2023 and the National Fiscal Management Plan (NFMP) 2022–2026 envisage a fiscal policy shift from expansion to consolidation. The fiscal deficit, excluding social security funds (SSFs), is budgeted to decline sharply to 2.6 percent of GDP in 2023, mainly attributable to the spending cut of 6.0 percent. Over the medium term, the NFMP 2022–2026 aims to maintain the fiscal deficit (excluding SSFs), at mid-2 percent of GDP and the government debt below mid-50 percent of GDP.

8. Risks to the economic outlook are tilted to the downside in the near term, with high uncertainty surrounding the baseline forecast. Short-term risks include renewed commodity

price hikes, supply chain disruptions, faster-than-expected policy rate hikes by the Fed, a sharper economic slowdown in advanced economies, and a weaker-than-expected recovery in China. Over the medium term, although household and corporate debt are generally sound, a rising interest burden and slowing demand could lead to distress in vulnerable families and businesses. Distress could arise among some land developers and small securities companies. In the long term, rapid population aging will aggravate the fiscal burden and weigh on the economic potential.

9. As headwinds have mounted, the authorities need to recalibrate monetary and fiscal policy stance flexibly and prudently, while continuing efforts to preserve financial stability.

- Expediting fiscal consolidation is warranted and should be supported by an effective and credible fiscal rule. While it is appropriate to unwind the broad-based fiscal stimulus measures in light of the strong recovery, the government should continue to provide targeted support for vulnerable sectors and groups affected by high inflation and strengthen social safety nets, which serve as automatic stabilizers. Once the growth momentum is back on track, it would be prudent to raise the primary balance target to a level that will at least stabilize the debt-to-GDP ratio in the medium term to maintain fiscal buffers. In the long term, fiscal risks arising from aging should be addressed preemptively with a comprehensive approach.

- The pace of monetary policy tightening should continue to be data-dependent, weighing inflationary trends against the slowing economic growth. The current policy stance is appropriate as inflation is expected to remain above the central bank's target for considerable time. However, the BOK needs to consider the economic downside risks and financial stability risks while maintaining the restrictive policy stance. The central bank should also continue to provide hard-hit SMEs with targeted support amid tightening financial conditions and the global economic slowdown.

- Amid the monetary tightening and economic slowdown, the authorities should closely monitor the debt servicing capacity of vulnerable borrowers. Banks should maintain their capital and liquidity buffers at the current high levels, while riskier non-bank financial institutions should strengthen their financial buffers. Concerted efforts by government agencies and private financial institutions have stabilized investor sentiment in the aftermath of the default of the Legoland developer in Korea, thus preventing a systemic liquidity crunch. Separately, deregulation of the housing market should be supported by adjusting new supply plans to stabilize the market.

- The authorities should continue with efforts to pursue structural reforms and bolster economic potential. The economic policy directions of the new government, which took office in May 2022, are welcome, especially in promoting job creation and social protection for vulnerable groups. In addition, the authorities are encouraged to continue developing financial technology to enhance productivity and maintain their commitment to reducing carbon emissions while managing impacts that arise during the transition.

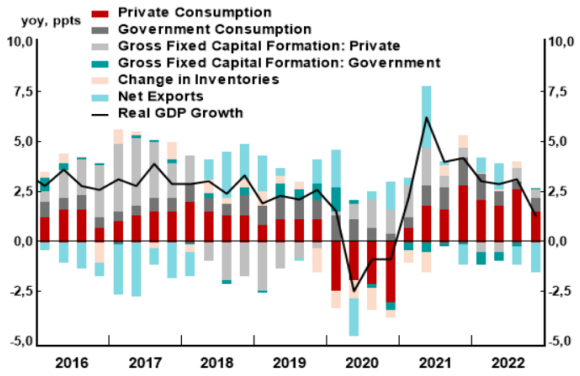
A. Recent Developments and Outlook

A.1 Real Sector Developments and Outlook

1 The Korean economy rebounded in 2021 and 2022 mainly on strong export growth and recovering private consumption (Figure 1). Growth in 2021 rebounded to 4.1 percent after a 0.7 percent decline in 2020. Real GDP in 2022 grew strongly by 2.6 percent, above the potential growth rate of 2.0 percent, driving the output gap into positive territory for the first time since 2020. The strong economic recovery recorded since Q1 2021 reflects a high vaccination rate, policy stimulus measures, and a robust IT-related manufacturing sector that is buoyed by its deep integration into global supply chains.

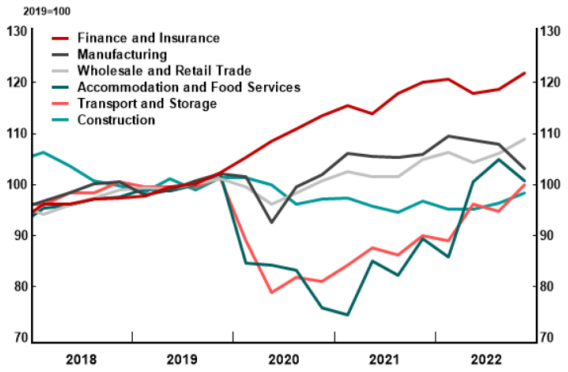
2 However, economic recovery from the pandemic remains uneven across sectors. Manufacturing activities rebounded quickly and outperformed other sectors, but transport equipment lagged as supply constraints of automobile parts affected car production. Comparatively, contact-intensive service activities, such as accommodation and food services, recovered gradually and reached pre-pandemic levels only in mid-2022 following a measured loosening of social distancing restrictions (Figure 2).

Figure 1. Contribution to Real GDP Growth
(yoy, ppts)



Source: Bank of Korea; Haver Analytics

Figure 2. Uneven Recovery Across Sectors
(2019=100)



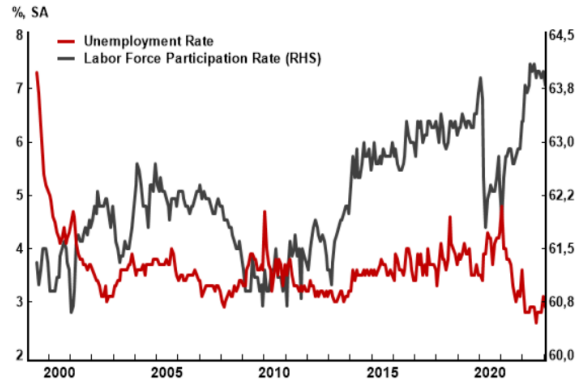
Source: BOK; Haver Analytics; AMRO Calculation

3 The economic outlook in the near term has deteriorated. Private consumption is forecast to decelerate in 2023 after accelerating vigorously in 2021-2022 due to pandemic-related pent-up demand, reflecting tighter financial conditions, high inflation and increased economic uncertainties. Investment is forecast to remain weak through 2023 amid higher funding costs, a slowdown in manufacturing exports, and the semiconductor downcycle. Considering these factors, as well as the deteriorating outlook for the trade balance, the economy is expected to moderate to a below-potential rate of 1.7 percent in 2023 after enjoying strong growth of 2.6 percent in 2022. Accordingly, the output gap is projected to turn slightly negative in 2023.

4 The labor market has been tight due to the government's efforts in job creation and economic recovery. The annual unemployment rate fell to 2.9 percent in 2022 from nearly

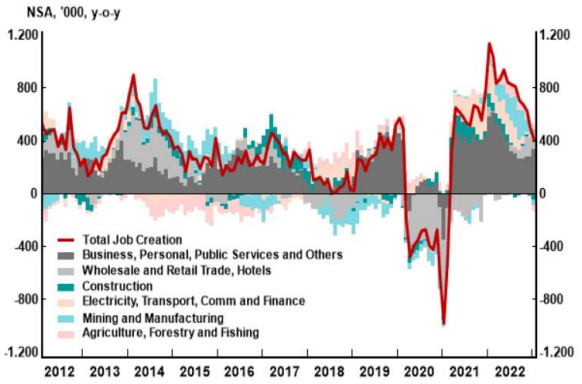
4.0 percent in 2020.[1] The labor force participation rate was 64.0 percent in December 2022, higher than pre-pandemic levels (Figure 3). Total employment has surpassed pre-pandemic levels, although the recovery remained uneven across sectors, as some sectors like accommodation and food services were heavily affected by the pandemic (Figures 4, 5). In addition, employment of working groups aged 30-49 years old has recovered slowly and remains below pre-pandemic levels (Figure 6). Looking ahead, job growth is forecast to gradually slow down as labor market participation has returned to pre-pandemic levels and the government is expected to phase out its employment support going forward.

Figure 3. Unemployment Rate and Labor Force Participation Rate
(%, SA)



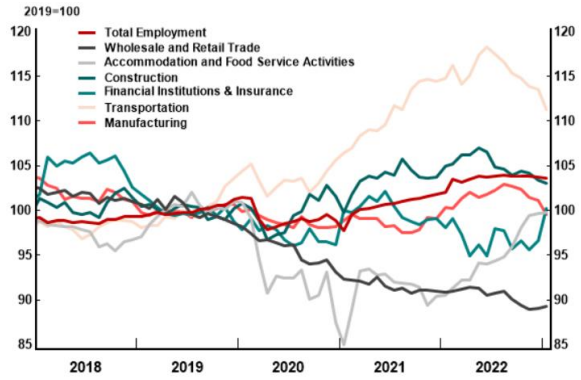
Source: Statistics Korea; Haver Analytics

Figure 4. Job Growth by Sector
(yoy, '000, NSA)



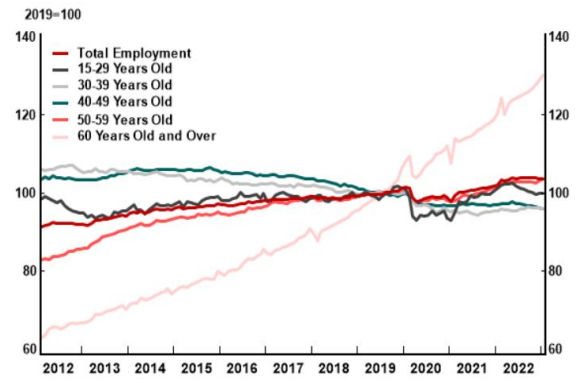
Source: Statistics Korea; Haver Analytics; AMRO calculations

Figure 5. Employment by Sector
(2019=100)



Source: Statistics Korea; Haver Analytics; AMRO calculations

Figure 6. Employment by Age Group
(2019=100, '000, SA)



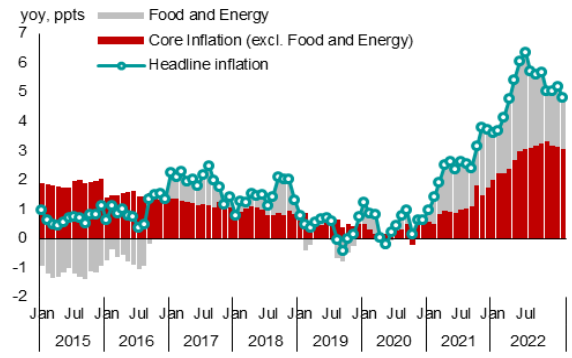
Source: Statistics Korea; Haver Analytics; AMRO calculations

5 Inflation is expected to remain above the central bank's 2.0 percent target despite some likely moderation in 2023. The increase in inflation was broad-based in 2022, both from the supply side, reflecting rising energy and food prices, and from the demand side, spurred by the economic reopening (Figures 7, 8). Core CPI inflation, which excludes food and energy prices, also rose at a fast pace of 3.6 percent. The higher inflation in 2022 was transmitted moderately to wage growth[2], and an inflation-wage spiral is unlikely despite the

[1] The average monthly unemployment rate in 2020 when the pandemic hit the country was the highest since 2001, surpassing the 2009 and 2010 levels recorded in the aftermath of the Global Financial Crisis.
[2] The average wages of the whole economy grew by 5.2 percent, yoy, in the first 11 months of 2022, only marginally higher than the growth of 5.0 percent, yoy, over the same period in 2021.

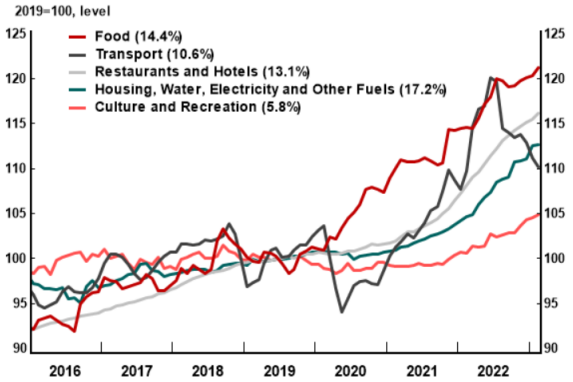
tight labor market. Short-term inflation expectations have been high, although long-term expectations[3] remain well anchored thanks to the credibility of the Bank of Korea (BOK). Amid the high inflation, the government has been providing targeted support to vulnerable households and sectors to alleviate the burden of rising living costs.[4] Looking ahead, with energy and food price inflation expected to fall, headline inflation should continue to trend down in 2023, albeit remaining above the 2.0 percent target, with annual inflation projected to moderate to 3.3 percent in 2023 after reaching 5.1 percent in 2022.

Figure 7. Headline and Core Inflation
(yoy, ppts)



Source: Statistics Korea; CEIC

Figure 8. Consumer Price Indices in Key Sectors
(2019=100)



Note: the bracketed percentages show the respective weights in the CPI for each sector.
Source: Statistics Korea; Haver Analytics; AMRO calculations

A.2 External Sector

6 The external sector has been resilient during the pandemic, supported by strong exports and ample foreign reserves. The current account surplus narrowed to 1.8 percent in 2022 from 4.7 percent in 2021. In particular, the trade balance shifted from surpluses to deficits in 2022 (Figures 9, 10), mainly reflecting the surge in raw materials imports and the slowdown in semiconductor exports. Its outlook remains challenging given mounting external headwinds from the global demand slowdown, together with an IT downcycle[5], although imports would also slow down reflecting the decline in energy prices. Foreign reserves declined by USD40 billion to US423 billion in 2022 reflecting FX authorities' market stabilization measures to moderate the volatility of won/dollar exchange rate, and currency valuation effects (Figure 11), but remain ample, covering about 2.5 times short-term external debt and about six months' worth of imports (Figure 12). In addition, Korea's net international

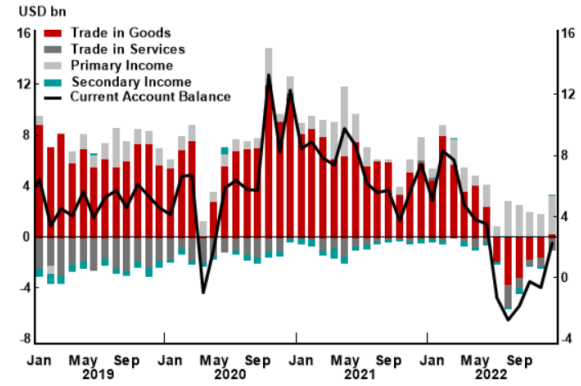
[3] The estimation of long-term expectations is based on experts' CPI inflation expectations of the next five years ahead, drawn from the Consensus Economics survey. The yield differential between 10-year nominal and inflation-linked bonds could also be used as a proxy for inflation expectations. However, it would be subject to other factors besides inflation expectations, such as the liquidity premium of the underlying nominal and inflation-linked bonds.

[4] The selection of the targeted groups was generally based on income level (below 50 percent of the median income) and was adjusted flexibly depending on specific support programs. The emergency daily support fund has provided subsidies to two million households. The fuel tax cut of 37 percent has been extended to 2023. The government will continue to distribute energy vouchers in 2023, with higher subsidies.

[5] The trade deficit of USD47.2 billion in 2022 hit an all-time high, surpassing the previous record annual trade deficit of USD20.6 billion in 1996.

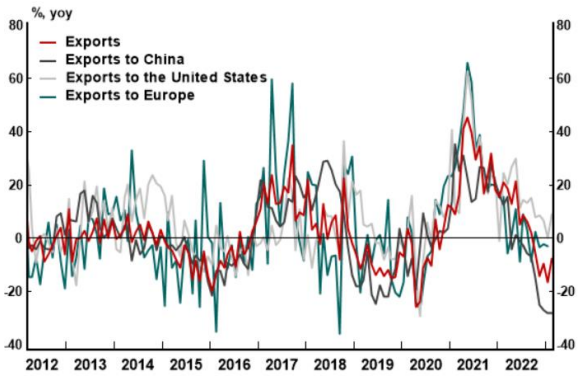
investment position has been growing more positive over time, reaching nearly 40 percent of GDP as at end 2021 (Appendix 1 Figure 1.2.).

Figure 9. Current Account Balance
(USD bn, SA)



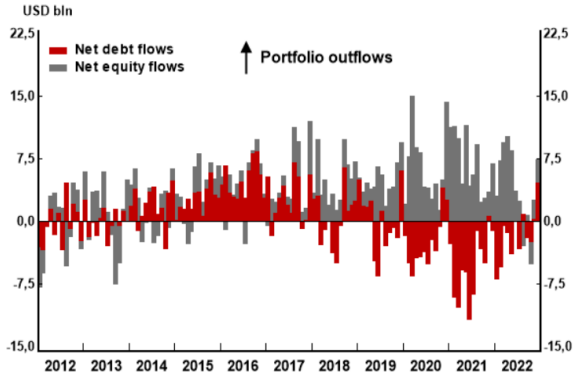
Source: BOK; Haver Analytics

Figure 10. Exports by Destination
(%, yoy)



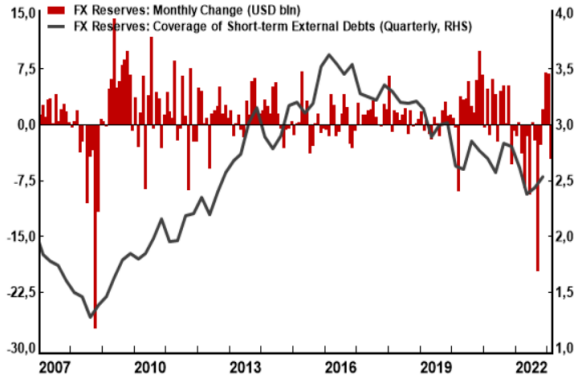
Source: Korea Customs Service; Haver Analytics

Figure 11. Net Purchases of Korean Bonds and Stocks
(USD bn, NSA)



Source: Financial Supervisory Service; Haver Analytics

Figure 12. Foreign Exchange Reserves and Coverage of Short-term External Debt
(USD bn)



Source: BOK; Haver Analytics

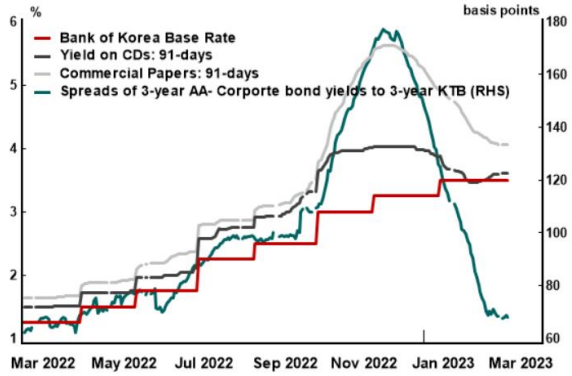
A.3 Monetary Condition and Financial Sector

7 Financial markets were volatile in H2 2021 and 2022 amid tighter financial conditions. Yields of corporate bonds and short-term money market instruments rose rapidly in October and November 2022 (Figure 13), as the default of the Legoland Korea developer triggered a spike in risk aversion and a temporary liquidity shortage, which have eased since December 2022. After the boom in H2 2020 and H1 2021, the KOSPI equity index was hit by risk-off sentiments arising from the Russian-Ukrainian war, China's slowdown, and monetary tightening in advanced economies in 2022. The Korean won has been weakening since H2 2021,[6] exceeding KRW1,400 to USD for the first time in September 2022 since March 2009, mainly driven by a strengthening U.S. dollar due to aggressive monetary tightening by the U.S. Fed, a worsening trade balance reflecting weakening exports and high oil imports, and spillovers from a weakening yen *(Selected Issue 1: The Drivers of the Korean*

[6] The real effective exchange rate (REER) also depreciated by about 1.8 percent in 2022, based on the J.P. Morgan REER index deflated by CPI.

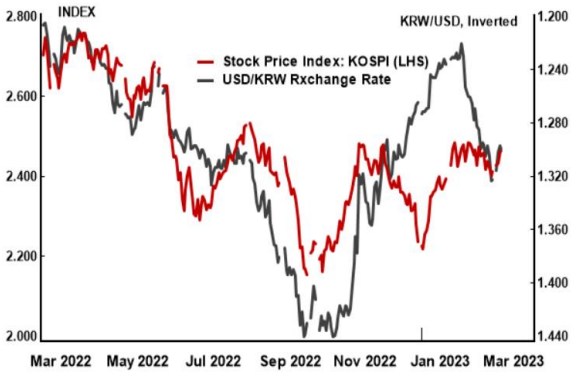
Won) (Figure 14). The rapid depreciation led the BOK to step up intervention in the FX market, undertaking net sales of USD41.3 billion in the first three quarters of 2022[7].

Figure 13. Key Policy and Market Interest Rates
(%, basis points)



Source: BOK; Haver Analytics

Figure 14. USD/KRW Exchange Rate and Equity
(level)



Source: BOK; Korea Stock Exchange; Haver Analytics

8 The stance of monetary policy has become restrictive amid greater-than-expected inflationary pressures and the Fed's hawkish stance. To tame the rapid and broad-based increase in inflation following the surge in commodity and import prices together with rising household debt, the BOK has raised the Base Rate ten times since August 2021 from 0.50 percent to 3.50 percent, including two big hikes of 50 basis points each. Concerns over a weak won that could fuel further inflationary pressure and capital outflows underpinned the hike of 50 basis points in October 2022. As a result, the current policy rate is higher than the neutral rate and the policy stance has become restrictive. However, in view of moderating inflationary pressures both domestically and internationally, the market expects the BOK's policy rate to peak in H1 2023 at the terminal rate of 3.50-3.75 percent.

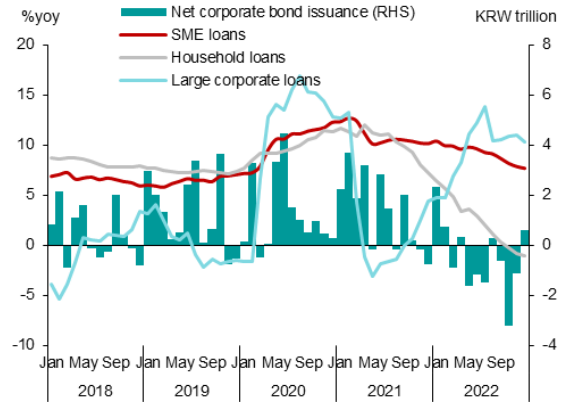
9 Financial institutions have slowed down credit intermediation since the BOK started its hiking cycle, but borrowers' debt-servicing capacity has broadly remained strong. Loan growth decelerated to 8.1 percent (yoy) in October 2022, down from its peak of 13.4 percent in April 2021 (Figure 15). The slowdown of loan growth was mainly driven by lower demand for household and SME loans due to the interest rate hikes. Meanwhile, large corporate loans continue to grow because the stress in the corporate bond market related to the default of the Legoland developer made market-based corporate fundraising more difficult. Overall, the loan quality of banks and non-bank financial institutions (NBFIs) remains sound, reflected by the low average delinquency rate of 0.2 percent for bank loans and 0.8-2.6 percent for NBFI loans. The average interest coverage ratio (ICR) of Korean companies increased to 8.9 times at the end of 2021 from 4.6 times at the end of 2020. That said, the debt-servicing capability of some borrowers, especially young adults and

[7] Net sales of U.S. dollars were 8.3 billion, 15.4 billion and 17.5 billion, respectively, in the first three quarters of the 2022. In addition, in an effort to stabilize supply and demand in the FX market, the BOK and the National Pension Service (NPS) agreed to a currency swap in September 2022 that helped the NPS borrow U.S. dollars from Korea's foreign reserves for its overseas investments.

small firms, has deteriorated somewhat and could continue to worsen amid the increase in interest burdens.[8]

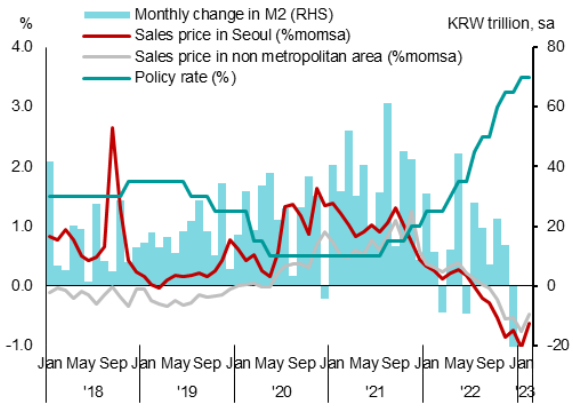
10 Banks and NBFIs have low loan impairments with ample capital and liquidity buffers, although profitability has weakened. The substandard-and-below loan (SBL) ratio remained low at 0.41 percent in Q2 2022. While the true picture of asset quality may have been partially masked by the extension of loan moratorium and payment deferral programs,[9] the amount involved should be limited because the loans under moratorium account for only around 6.0 percent of total outstanding loans. Meanwhile, the net income of NBFIs weakened in 2022, as financial institutions set aside additional loan loss provisions to guard against a potential deterioration of credit quality. Despite declining profitability, the capital adequacy ratio (CAR) and both domestic and foreign currency liquidity coverage ratios (LCRs)[10] remain well above statutory minimums.

Figure 15. Credit Growth and Net Corporate Bond Issuance



Source: BOK; AMRO staff calculations

Figure 16. House Prices and Monetary Conditions



Source: BOK; Kookmin Bank; AMRO staff calculations

11 The property market has been slowing down since mid-2021, underpinned by tighter financing conditions and the moderation in overall economic activity. Housing demand has softened due to the tighter financial conditions amid stringent macroprudential measures and real estate taxes, and a slowdown in the domestic economy. Accordingly, mortgage lending has been moderating. Meanwhile, the supply shortage has eased with new residences coming on the market and housing redevelopment regulations being relaxed. As a result, property and rental prices, especially for apartments, continue to fall

[8] By company size, the proportion of large enterprises with an ICR of less than one declined to 22.5 percent in 2021 from 28.8 percent in 2020, while the proportion of small and medium enterprises (SMEs) also fell to 48.4 percent in 2021 from 50.9 percent in 2020.

[9] The government and financial institutions mutually decided in September 2022 to extend loan maturity for up to three more years, and payment deferment for up to one more year, for pandemic-hit borrowers currently being assisted under these programs. The programs were previously scheduled to expire at the end of September 2022.

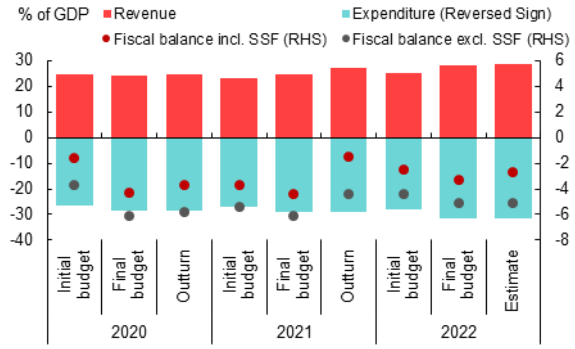
[10] Banks' CAR stood at 12.29 percent at the end of June 2022, well above the statutory minimum of 8.0 percent. NBFIs including mutual saving banks, credit-specialized financial institutions insurance companies, and securities companies, all maintained capital above their regulatory levels, although some decline has been noted recently. Commercial banks' LCR and FX-LCR stood at 104.6 percent and 111.8 percent, respectively, in April 2022, above the regulatory requirements of 100 percent (temporarily lowered to 85 percent) and 80 percent.

across the country. The month-on-month change in property prices in Seoul and other large cities, and in jeonse prices, has been negative since October 2022 (Figure 16). Property and rental prices are expected to decline further in 2023, reflecting an increase in unsold units and softening demand amid rising interest rates and weakening home-buyer sentiment. That said, the likelihood of a sharp price drop is limited, as the government has room to adjust new supply and housing market regulations.

A.4 Fiscal Sector

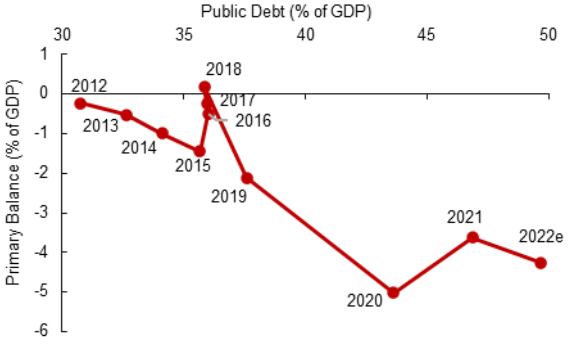
12 The fiscal policy in 2022, including two supplementary budgets, continues to support economic recovery. In addition to the ordinary budget, the government rolled out two sizable supplementary budgets, amounting to 3.3 percent of GDP, in February and May 2022 to support small merchants and vulnerable groups affected by the prolonged pandemic and containment measures. At the same time, revenue was revised up by 2.6 percent of GDP in the second supplementary budget, reflecting continued strong revenue performance from profit and income taxes amid better-than-expected economic performance. With spending increase exceeding revenue improvement, the fiscal deficit, excluding social security funds (SSFs), is estimated to rise to 5.1 percent of GDP in 2022 from 4.4 percent of GDP in 2021, resulting in a procyclically expansionary fiscal stance (Figure 17). Government debt is projected to reach 49.7 percent of GDP by the end of 2022 (Figure 18).

Figure 17. Supplementary Budgets and Fiscal Balance



Source: Ministry of Economy and Finance; AMRO staff estimates

Figure 18. Primary Balance and Government Debt

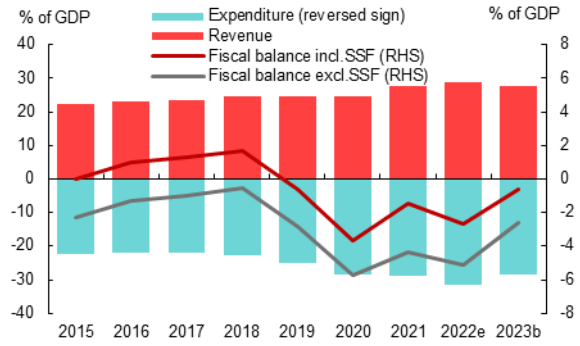


Source: Ministry of Economy and Finance; AMRO staff estimates

13 The 2023 budget and the National Fiscal Management Plan (NFMP) 2022-2026 envisage a fiscal policy shift from expansion to consolidation. The fiscal deficit (excluding SSFs) is budgeted to decline sharply to 2.6 percent of GDP in 2023, mainly attributable to the spending cut by 6.0 percent (Figures 19, 20). As the pandemic abates, the government plans to withdraw emergency support programs and containment measures rolled out during the pandemic,[11] while anticipating slower revenue growth, on account of depressed financial and housing markets, and tax reforms that lessen the tax burden.

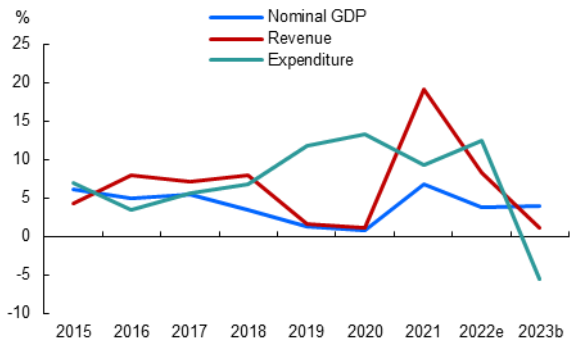
[11] Compensation for the losses of small merchants and containment measures included in the original and two supplementary budgets amount to KRW61.4 trillion, while budgeted expenditure in 2023 has lowered by KRW40.8 trillion.

Figure 19. Fiscal Balance



Source: Ministry of Economy and Finance; AMRO staff estimates

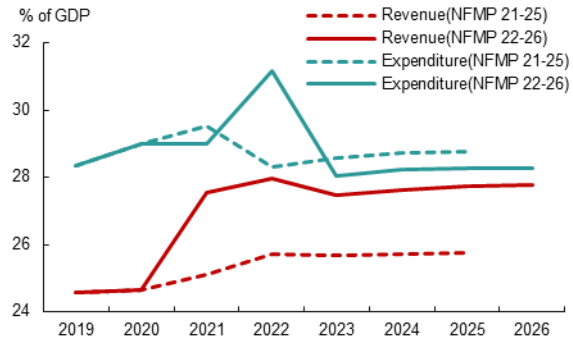
Figure 20. Revenue and Expenditure Growth



Source: Ministry of Economy and Finance; AMRO staff estimates

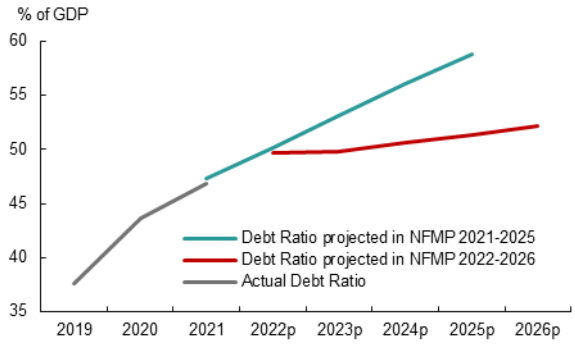
14 Over the medium term, NFMP 2022-2026 aims to maintain the fiscal deficit (excluding SSFs) at mid-2 percent of GDP, and government debt at below mid-50 percent of GDP (Figures 21, 22). Revenue is projected to grow robustly by 4.1 percent on average in 2022-2026, in line with nominal GDP growth. Despite the persistent increase in mandatory spending, the authorities plan to contain expenditure growth to 1.8 percent on average, by tightly containing discretionary spending after a sharp drop in 2023.[12]

Figure 21. Revenue and Expenditure Projection in NFMP 2021-2025 and NFMP 2022-2026



Source: Ministry of Economy and Finance

Figure 22. Government Debt Projection in NFMP 2021-2025 and NFMP 2022-2026

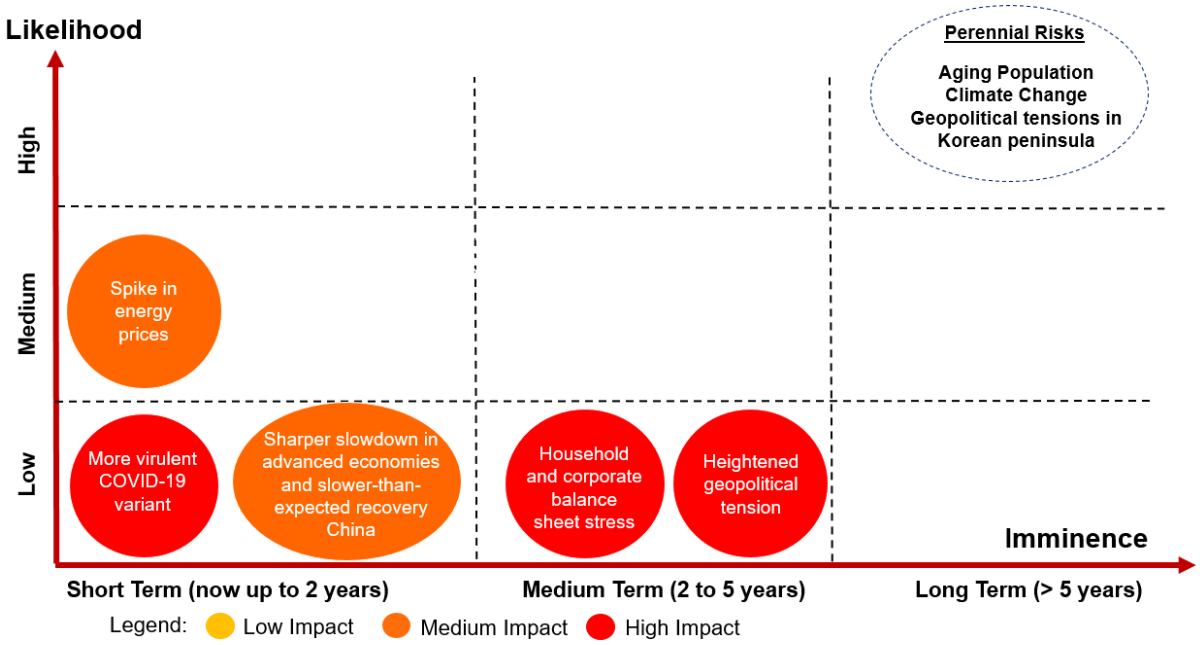


Source: Ministry of Economy and Finance

[12] The benefits and coverage of mandatory spending are determined by the law. Mandatory spending comprises the welfare spending articulated by the law, local government transfers and debt-servicing costs. The share of mandatory spending increased from 45.5 percent in 2010 to 48.5 percent in 2022, and is projected to rise further to 55.6 percent in 2026.

B. Risks, Vulnerabilities and Challenges

Risk Map: Korea



Source: AMRO staff

15 Risks to the economic outlook are tilted to the downside in the near term, with high uncertainty surrounding the baseline forecast. The spread of new and more infectious variants in Korea and its major trading partners could lead to weakening domestic and external demand. Moreover, heightened and persistent inflationary pressures might prompt faster rate hikes by the BOK, thereby dampening the recovery of private consumption.

16 The short- and medium-term economic outlook is also clouded by other external risk factors.

- Geopolitical tensions could intensify and thus dampen economic activities. Supply chain disruptions due to the prolonged Russian-Ukrainian war could hurt the manufacturing sector, particularly semiconductors and automobiles. For example, palladium from Russia is a critical input for semiconductors and alternatives are limited. Such supply constraints could reduce the production of Korean carmakers. Export restrictions imposed by the U.S. on semiconductor shipments to China might adversely affect Korea's semiconductor manufacturers as China, including Hong Kong, accounts for 60 percent of Korea's total semiconductor exports in 2021, according to data from the Korea International Trade Association.

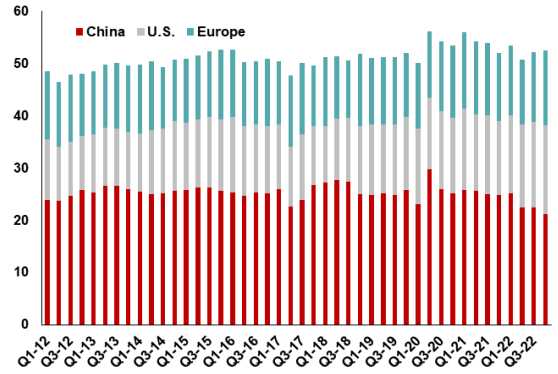
- More aggressive policy rate hikes by the Fed could put pressure on the BOK to follow suit. Interest rate differentials would widen under the Fed's aggressive rate hikes, potentially leading to capital outflows and currency depreciation. Alternatively, closely

matching the Fed's rate hike could risk a sharper tightening of domestic financial conditions, thus heightening funding and liquidity stress in domestic financial markets.

- A sharper economic slowdown in advanced economies and a weaker-than-expected recovery in China in 2023 could adversely impact Korea, an open and export-led economy. In particular, China alone accounted for 25 percent and 20 percent of Korea's exports and imports, respectively, over the past decade. Together with Europe and the U.S., these three regions receive about half of Korean exports (Figure 23). In addition, recent COVID-19 flare-ups in many parts of China after social distancing restrictions were lifted have negatively affected Korean firms, many of which have to suspend or reduce manufacturing operations.

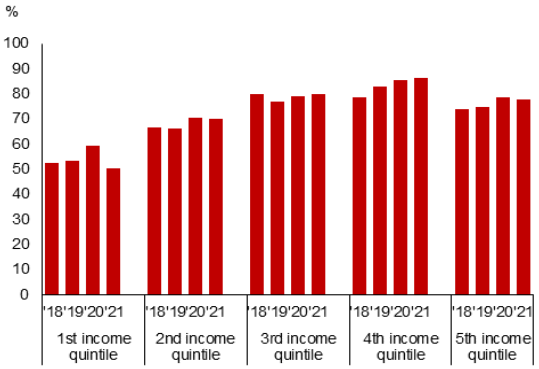
17 Households and firms may face stress in their balance sheets. By Q3 2022, household debt had reached 102 percent of GDP, among the highest in advanced economies. Staff envisages limited imminent systemic risks from the high household debt because of the overall strong household wealth, a low loan delinquency ratio and government support measures (Figure 24). That said, in light of the economic slowdown and rising interest burden, low income households with low creditworthiness [13] could become more vulnerable. Should households' balance sheet weakens sharply, it could dampen private consumption and economic growth. On the corporate side, although corporate debt is generally sound, rising interest burden, high production costs and a weaker economy, could lead to distress among small enterprises and self-employed businesses[14] (Figure 25).

Figure 23. Share of Korea's Exports by Destination
(% of total)



Source: Korea Customs Service; Haver Analytics

Figure 24. Household Financial Liabilities as a percentage of Financial Assets
(%)



Source: Statistics Korea; AMRO staff calculation

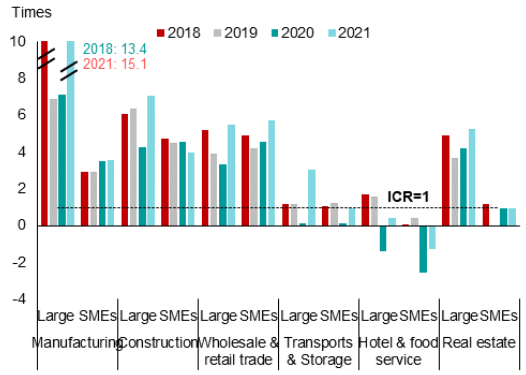
18 The default of the Legoland developer reveals vulnerabilities in both land developers and small securities companies. Under the environment of higher interest

[13] Loans to vulnerable borrowers accounted for 5 percent of total household loans.

[14] There exist pockets of weaknesses in some sectors. The debt ratios of the electricity, accommodation, and food sectors have been rising over recent years. NBFIs, particularly security companies, have increased their exposure to project-financing loans whose delinquency rate is on the rise.

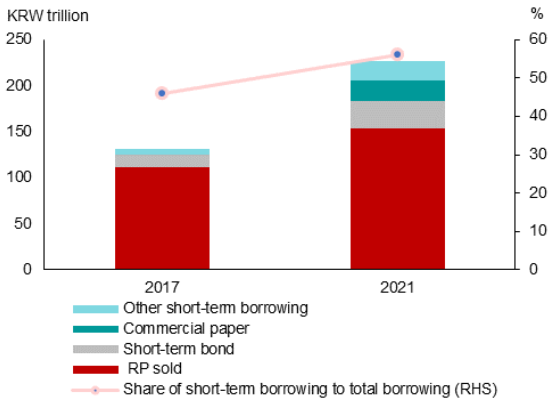
rates and weakening housing demand, many property developers are seeing shrinking profits. Thus, while the Legoland default is likely a one-off incident reflecting a confluence of idiosyncratic factors,[15] other land developers, with weaker balance sheets, could still face financial distress ahead. Meanwhile, some small securities firms are exposed to rising credit risks from property developers due to the loans and loan guarantees they have extended to developers for long-term land development projects[16]. On the liability side, small securities firms rely on short-term funding in the form of commercial papers, thereby constituting a large maturity mismatch in their balance sheets (Figure 26). Accordingly, a sharp rise in unsold housing or prolonged tepid housing demand could worsen the credit and liquidity risks of those securities companies, given their exposures to land developers. These vulnerabilities could be the weakest link in the event of a liquidity crunch triggered by some risk-off events in the future.

Figure 25. Interest Coverage Ratio of Large Enterprises and SMEs



Source: BOK

Figure 26. Funding Structure of Securities Companies as at end-2021



Source: BOK

19 Rapid population aging will aggravate the fiscal burden in the long term and weigh on the economic potential. The fertility rate dropped for the sixth straight year to 0.81 in 2021, among the world's lowest. The old-age ratio will soar to 43.6 percent in 2060 from 17.5 percent in 2022, along with a high elderly poverty rate.[17] Without extensive reforms across the economic, social, and fiscal fronts, the aging population and ongoing policy efforts to strengthen social protection would increase health and social protection spending and raise government debt significantly in the long term.[18] Moreover, the aging labor force will weigh on human capital and labor productivity, reducing potential growth.

[15] According to discussions with market participants, Gangwon Jungdo Development Corp., the developer of the new Legoland Korea theme park missed bond payments worth KRW 205 billion due on September 29. The government of Gangwon province, the bond guarantor, refused to repay the debt.

[16] This behaviour contributed to the rapid growth of project finance market from KRW37.5 trillion in 2012 to KRW112.3 trillion in June 2022.

[17] The elderly poverty rate, defined as the share of income below 50 percent of the median income, was 43.4 percent in 2018, higher than the OECD average of 13.1 percent by a large margin.

[18] OECD Economic Surveys for Korea 2022 projected the debt ratio in 2060 to be around 150 percent of GDP, compared with the National Assembly Budget Office (NABO)'s 186 percent in 2070 and the government's 81.1 percent in 2060.

Authorities' Views

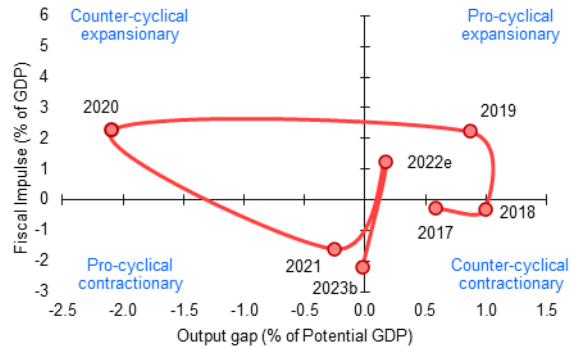
20 Concerted efforts by the Korean authorities and financial institutions have contained the market turbulence successfully. The situation is under control and the risks are sufficiently down to a manageable level. Yields of short-term commercial paper and corporate bonds have declined substantially following the introduction of market stabilization measures. Only some small securities companies are recently exposed to high credit risks stemming from weaker business prospects of real estate developers. In this regard, the authorities are closely monitoring the liquidity conditions of the entire securities industry.

C. Policy Discussions and Recommendations

C.1 Calibrating Fiscal Support and Strengthening Fiscal Sustainability

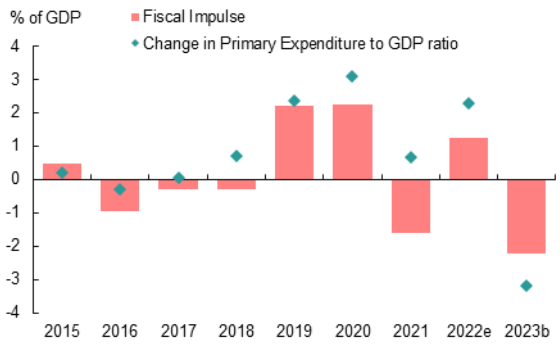
21 While a tightening of fiscal policy in 2023 is deemed broadly appropriate, the authorities should be agile in calibrating fiscal policy to respond to evolving economic situations. With the output gap closing in 2022 and the pandemic abating, unwinding the broad-based supportive measures is a move in the right direction (Figures 27, 28). However, the government should continue to provide targeted support to vulnerable sectors and groups that have not fully recovered and have suffered from rising living costs, while strengthening social safety nets as automatic stabilizers. Well-targeted fiscal measures will complement monetary policy efforts to counter inflationary pressure without undermining fiscal prudence. If downside risks were to materialize, fiscal policy should provide appropriate responses promptly amid the global monetary tightening cycle.

Figure 27. Fiscal Impulse and Output Gap



Note: Fiscal impulse is estimated by the change in structural primary balance.
Source: Ministry of Economy and Finance; AMRO staff estimates

Figure 28. Fiscal Impulse and Expenditure Growth



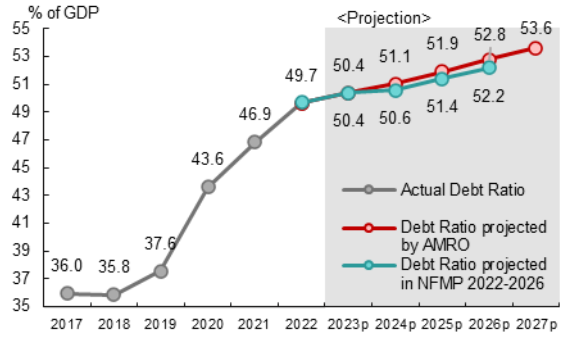
Note: Primary expenditure is defined as the expenditure excluding interest payments.
Source: Ministry of Economy and Finance; AMRO staff estimates

22 Expediting the fiscal consolidation efforts is warranted in the medium term once economic uncertainties wane. Over the medium term, the debt-to-GDP ratio will continue to rise, albeit at a slower pace, as the projected primary deficit remains above the debt-

stabilizing level by 0.8 percent of GDP on average from 2023 to 2026 (Figures 29, 30).[19] Once the growth momentum is back on track, it would be prudent to raise primary balance targets to levels that will at least stabilize the debt-to-GDP ratio in the medium term, in order to maintain sufficient fiscal buffers to address unforeseen risks and long-term fiscal challenges:

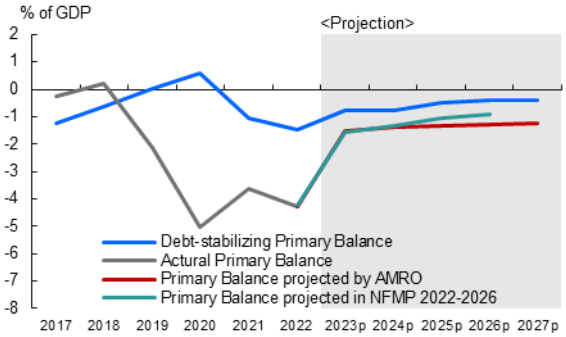
- On the expenditure side, the government's initiatives to restructure spending programs, reexamine subsidy and public funds, and reform fiscal institutions are welcome. The mechanism to review and restructure mandatory spending is also recommended.
- On the revenue side, given Korea's low tax burden as compared with OECD members, broadening the tax base should be prioritized by rationalizing tax exemptions and incentives, especially those widely provided for personal income tax.[20] Raising the value-added tax rate, which is relatively low among advanced economies, could also be considered based on social consensus.[21]

Figure 29. Government Debt Ratio Projection



Source: Ministry of Economy and Finance; AMRO staff estimates

Figure 30. Debt-stabilizing Primary Balance and Primary Balance Projection



Note: The debt-stabilizing primary balance is based on AMRO's projection.
Source: Ministry of Economy and Finance; AMRO staff estimates

23 AMRO welcomes the newly proposed fiscal rule framework (Table 1). Imposing ceilings on the fiscal deficit and/or debt-to-GDP ratio will help anchor the goal of fiscal sustainability, thereby enhancing the accountability and independence of fiscal policy. The new fiscal rule is better than the previous one, in that: (i) setting the target indicator at the fiscal deficit excluding SSFs, rather than including SSFs, is stricter, as the SSFs are expected to be in surplus until 2042, according to the National Assembly Budget Office (NABO); (ii) the formula is simple and easy to communicate to the public; (iii) the rule is stipulated in law, rather than in decree, making it more binding; and (iv) the rule is planned to be activated immediately after the National Finance Act is revised.

[19] On average, in 2023-2026, the debt-stabilizing primary deficit is estimated to be 0.6 percent of GDP, while the projected primary deficit according to AMRO's debt sustainability analysis is 1.4 percent of GDP.
[20] As of 2020, tax revenue excluding social contributions was 20.2 percent of GDP in Korea, compared to the OECD average of 24.6 percent of GDP.

[21] As of 2020, the VAT rate was 10 percent in Korea, whereas the OECD average was 19.3 percent.

Table 1. Fiscal Rule Proposed by Korean Government

	Previous Proposal	Revised Proposal
Target Indicator	Fiscal balance including SSFs + Government debt-to-GDP ratio	Fiscal balance excluding SSFs
Ceiling Formula	$\frac{Debt\ to\ GDP\ ratio}{60\%\ of\ GDP} \times \frac{Fiscal\ balance\ including\ SSFs}{-3\%\ of\ GDP} \leq 1$	$Fiscal\ balance\ excluding\ SSFs \geq -3\%\ of\ GDP$ If $debt\ to\ GDP\ ratio > 60\%\ of\ GDP$, then $Fiscal\ balance\ excluding\ SSFs \geq -2\%\ of\ GDP$
Legal Basis	Decree	Act
Year of Application	Grace period until 2025	Immediately after revision of the Act

Source: Ministry of Economy and Finance

24 AMRO mission would like to propose the following enhancements for a more effective and credible fiscal rule. Major recommendations include the following:

- First, the fiscal rule, the medium-term plan, and the annual budget should be well-aligned to properly address the growing fiscal burden in the long term. Accordingly, the fiscal rule ceiling on the fiscal deficit may need to be tightened to ensure long-term fiscal sustainability.[22]
- Second, a mechanism to review the fiscal rule regularly should be considered to reflect the changing macroeconomic and fiscal developments. Adjusting the deficit and debt ceilings as well as introducing additional disciplines could be discussed.
- Third, a strict application of the escape clause based on predetermined conditions should be warranted. After the escape clause has lapsed, the fiscal rule should be reapplied immediately, supported by strong fiscal consolidation efforts, which should be closely monitored and reviewed by an independent fiscal institution.

25 Long-term fiscal risk arising from demographic changes should be addressed preemptively with a comprehensive approach. Based on AMRO's analysis, the size of the fiscal adjustment required to maintain fiscal sustainability increases over time amid population aging, which implies that the fiscal reform should be implemented as early as possible to avoid sharper and more painful adjustments later. Accordingly, policy measures should be comprehensive to effectively address the demographic change while ensuring fiscal sustainability:

- First, the National Pension Fund reform should include parametric reforms on contribution rates, the income coverage ratio, and the retirement age so as to enhance sustainability. The increase in the Basic Pension Benefits should be targeted at supporting vulnerable groups to achieve cost-effectiveness.
- Second, the old-age poverty issue should be addressed holistically by a mix of welfare, employment, and financial policy measures. For example, in addition to income support rendered by pension and social protection schemes, job creation and retraining for retirees and near-retirees should be strengthened. Better utilization of reverse mortgage

[22] A simple simulation applying the fiscal deficit ceiling of 3 percent of GDP to the debt dynamics demonstrates that the debt-to-GDP ratio will exceed the ceiling of 60 percent by the early 2030s. Even under the assumption of mid-2 percent of GDP fiscal deficit as in NFMP 2022-2026, the debt ratio will reach 60 percent of GDP in the late 2030s.

would also improve cash flow for elderly people whose wealth/assets are concentrated in illiquid assets such as houses.

- Third, age-dependent fiscal programs should be recalibrated to better utilize public resources. For example, considering the continuously declining school-age population, mandatory transfer of fiscal resources to fund local education in primary and secondary schools should be restructured.[23]

Authorities' Views

26 The government is committed to strengthening fiscal consolidation, while standing ready to implement flexible and targeted policy measures. Given the importance of fiscal soundness as a last resort for economic stability amid increasing challenges due to population aging, the government has shifted the fiscal policy stance from expansion to consolidation. The fiscal consolidation measures include legislating a fiscal rule to tightly manage aggregate fiscal indicators, restructuring spending programs, and broadening tax bases by revamping tax exemptions and incentives. In addition, the authorities have been establishing Fiscal Vision 2050 to ensure fiscal soundness in the medium to long term. To ensure the financial sustainability of pensions, the National Pension Fund reform and Basic Pension increase will be linked, and other public pension funds will be reformed. Health insurance will also be reformed to improve sustainability while maintaining the benefits to the public. On the other hand, the fiscal buffer will be ready to be rolled out to address the economic difficulties with well-targeted programs if downside risks materialize.

C.2 Charting an Optimal Monetary Policy Path

27 The pace of monetary policy tightening by the BOK should continue to be data-dependent, weighing inflationary trends against the slowing economic growth while being mindful of the policy path of the Fed *(Selected Issue 3: Impact of Fed Hikes on Korea and BOK's Optimal Policy Response)***.** Monetary policy decisions should be calibrated based on both current economic conditions and leading economic indicators that provide information about expectations and future developments of the economy. The AMRO mission regards the BOK's monetary policy stance of maintaining the restrictive policy stance while judging whether the Base Rate needs to rise further as appropriate for the time being, as inflation is expected to remain above the target for a considerable period of time despite the recent declines in the price of petroleum products. While maintaining the restrictive policy stance, the BOK needs to consider the economic downside risks and

[23] By law, 20.79 percent of domestic tax and education tax are transferred to local education for preschool, elementary and secondary schools. In the past 20 years, the transfer to local education increased by more than 300 percent, while the school-age population decreased by 34 percent.

financial stability risks. Equally importantly, more targeted macroprudential policy measures should be introduced to contain systemic financial risks from housing and household debt to allow monetary policy to focus on its primary inflation-targeting objective.

28 Meanwhile, the BOK should continue to provide targeted support to hard-hit SMEs amid the tightening financial conditions and economic slowdown. Its steep rate hikes have spawned concerns about an increased debt servicing burden on many SMEs whose revenues were hit during the pandemic. Accordingly, the BOK should continue maintaining its support in the near term via the Support Program for SMEs affected by COVID-19 and the Support Program for Small Businesses, and keep the current interest rate on such outstanding loans at the very low level of 0.25 percent [24].

Authorities' Views

29 The authorities acknowledge the deteriorating economic outlook, but emphasize the need to maintain the current monetary policy stance while examining the need for further increases depending on the incoming data. Oil price has declined but electricity and gas prices are still on their upward trend. Headline inflation is projected to remain well above the target of 2.0 percent (yoy) in 2023, despite some slowdown compared to 2022.

30 The authorities view that the global risk sentiment could have a major role in capital outflow, rather than interest rate differentials. Other factors that could affect capital outflow include Korea's economic fundamentals and the changes of the U.S. dollar to major currencies.

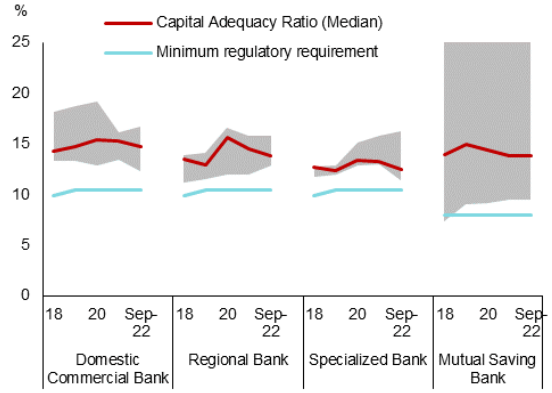
C.3 Preserving Financial Stability in the Post-pandemic Era

31 The authorities should closely monitor the debt servicing capacity of vulnerable borrowers while considering more stringent prudential measures. Although the size of loans under the moratorium program is small relative to total outstanding loans, the authorities should ensure that the scheme will not unintentionally help to perpetuate the indebtedness of non-viable borrowers. On lingering vulnerability stemming from high household indebtedness, the AMRO mission supports the application of the enhanced debt service ratio framework to individual borrowers and NBFIs. From a long-term perspective, the authorities need to consider putting in place a sectoral countercyclical capital buffer on a gradual basis for household lending to mitigate the risk of financial distress.

[24] The BOK discontinued these temporary financial support measures for COVID-hit enterprises and small businesses at the end of September 2022, while maintaining its support for existing loans until their maturities, which will take up to a year.

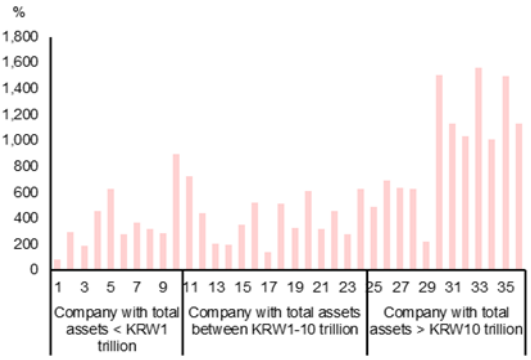
32 Banks should maintain their capital and liquidity buffers at the current high levels, while riskier NBFIs should strengthen their financial buffers. Riskier credit institutions,[25] including those with high exposures to vulnerable borrowers, low credit quality, and lean capital adequacy' should set aside more loan loss provisions, increase capital and strengthen internal risk management to guard against rising credit risks (Figure 31). In light of high volatility in the stock and bond markets, securities companies should maintain high capital and short-term liquidity buffers to cushion against risks from disruptive market conditions (Figure 32). Regulations should be enhanced regarding the liquidity management of NBFIs and its funding of long term projects, particularly small securities companies, to avoid an overreliance on short-term wholesale funding of long-term obligations.

Figure 31. Capital Adequacy Ratio of Banks



Note: The shaded area shows the distribution of the CAR of individual banks in each group.
Source: Financial Supervisory Service; AMRO staff calculations

Figure 32. Net Capital Ratio of Individual Securities Firms
(as of the end of June 2022)



Note: 1/ Securities companies are put in order of asset size, meaning that Company 1 is the smallest in terms of assets, while Company 36 is the largest securities company. 2/ The chart shows only Korean companies, not including foreign affiliations.
Source: Financial Supervisory Service; AMRO staff calculations

33 The AMRO mission commends the authorities' swift and effective market stabilization measures to calm credit markets. Concerted efforts by government agencies and private financial institutions[26] have stabilized investor sentiment in the aftermath of the default of the Legoland developer, thus preventing a systemic liquidity crunch. In the event of potential unexpected turmoil in the credit and short-term money markets, more support measures could be deployed. Among many options, the government could increase the size of the bond market stabilization fund. In addition, regulators could extend the relaxation period of LCRs and loan-to-deposit ratios for banks to increase loan supply. However, current and any further market stabilization measures should be temporary and allowed to lapse once market conditions largely return to normal.

[25] Especially specialized credit institutions, such as mutual saving banks and leasing companies.

[26] The Bank of Korea announced a package of temporary liquidity support measures on Oct. 27, 2022, totaling KRW42.5trn, after the government-led market stabilization measures of KRW 50trn announced on Oct. 23, 2022. In addition, the Financial Service Commission announced the delay of the normalization of Liquidity Coverage Ratios by 6 months to June 2023 and the temporary easing of loan-to-deposit ratio.

34 To stabilize the housing market, deregulation should be complemented by adjusting plans for new housing supply. As the housing market is slowing down, the AMRO mission welcomes the authorities' plan to normalize macroprudential measures while continuing support for first-home owners and low-income households. To address the increase in unsold apartments, the authorities should consider adjusting the supply of new residences to stabilize the market. Some housing regulations may also be considered for easing, including redevelopment and rental business measures that have distorted market functioning. In the longer term, the authorities should review the regional revitalization plan for areas outside the Seoul Metropolitan Area to ease public congestion and excessive demand for residential properties in the capital area.

C.4 Spearheading Structural Reforms to Boost Economic Potential

35 The AMRO mission welcomes the new government's economic policy directions, especially in promoting job creation and social protection for vulnerable groups *(Box A: New Government's Economic Policies)***.** The mission supports initiatives to reduce the earnings gap among worker types, expand job opportunities and protect vulnerable groups, especially the young and the elderly.[27] Moreover, policy measures to support SMEs and start-ups will help narrow the productivity and wage gaps between large and small firms. The authorities can expand the coverage of SME graduation schemes to encourage the growth of innovative firms.

Box A. New Government's Economic Policies[28]

The new Korean government continues to promote inclusive growth and enhance social protection for the vulnerable. In June 2022, President Yoon Suk-yeol and his government unveiled new economic policy directions that focused on job creation, private sector-led growth, and deregulation (MOEF 2022a). The policy aims to achieve 1) a dynamic economy that puts the private sector at the core of the economic policy; 2) an economy that pushes toward economic leaps by addressing structural problems; 3) a leading economy that prepares for the future, and 4) an inclusive economy that leaves no one behind (Table A.1).

Compared with the previous administration, the new policy directions highlight deregulation plans. The new government is pushing ahead with regulatory reforms to reduce excessive regulations and to overhaul problematic regulations. A task force on economic regulatory reforms led by Deputy Prime Minister, Choo Kyung-ho, was established in June 2022. As of 5 September 2022, the government had prepared 36 regulatory reforms aimed mainly at solving difficulties in industrial sites and promoting emerging sectors, such as autonomous robot vehicles or electric vehicles.

Job creation and labor market reforms continue to be priorities. The government plans to support 170,000 young people to find jobs in 2023 by giving them various employment opportunities. Tax support for the young is provided by broadening the age range of young people to 15-34 from 15-29 for employment tax credits. Furthermore, the government is pushing reform of the 52-hour

[27] Some measures include giving more incentives to low-income workers to increase employee retention; providing package support to help young people; strengthening the social safety net, especially for non-regular workers; and improving the platform that connects firms and the labor force.

[28] Prepared by Trung Thanh Vu, Associate Economist.

workweek scheme to make it more flexible.[29] The Minimum Wage Commission also announced in August 2022 an increase of the minimum wage by 5 percent in 2023 nationwide.

In 2023, the government will also focus policy efforts on stabilizing people's livelihoods. In contrast to the pre-pandemic period, the new government has highlighted policy directions aimed at stabilizing prices, reinforcing welfare systems for the vulnerable, and reducing living costs amid recent economic challenges such as rising prices and high interest rates (MOEF 2022b)**.** Some of the policy measures, for example, include providing energy vouchers to help households reduce burdens on electricity and gas bills, freezing the student loan rate at 1.7 percent, and extending support for kindergarten tuition fees to 2025.

Table A1. Economic Policy Directions

Panel A1.1. The Yoon Suk-yeol Administration's New Economic Policy Directions in 2022

A dynamic economy that puts the private sector at the core	An economy that pushes toward economic leaps by addressing structural problems
• Adopt regulatory reforms • Expand corporate investment • Foster SMEs and venture businesses • Establish a fair market order	• Reform public pensions • Reform labor market • Reform education • Foster financial innovation • Reform the service industry
A leading economy that prepares for the future	**An inclusive economy that leaves no one behind**
• Focus on technology and R&D • Foster hi-tech strategic industries • Respond to demographic changes • Respond to carbon neutrality goals and the climate crisis	• Enhance social safety nets • Encourage employment • Upgrade welfare systems • Achieve regionally balanced development

Panel A1.2. The Moon Jae-in Administration's Economic Policy Directions in 2017

Income-driven Growth	Job-centered Economy
• Increase households' disposable income • Secure vulnerable groups' income by strengthening social safety nets • Expand education investment to provide children with opportunities to grow their qualified professionals	• Pursue job creation-friendly economic policies to overcome jobless growth • Promote an employee-centered labor market • Strengthen active labor market policies
Innovative Growth	**Fair Competition**
• Promote cooperation and innovation to develop SMEs as the country's growth engine • Prepare for the fourth industrial revolution • Enhance economic cooperation to cope with trade protectionism	• Remove unfair practices toward subcontractors • Improve corporate governance to create a level playing field • Pursue shared growth and protect small merchants • Promote social economy

Source: Ministry of Economy and Finance; AMRO ACR 2018

[29] Companies currently need to manage working hours on a weekly basis and comply with the requirement of not more than 52 hours per week. The reforms will allow companies in certain industries to flexibly manage working hours for their staff on a monthly, biannual or annual basis. Because of seasonal factors, some companies may need their staff to work more than 52 hours per week during peak seasons, and to work fewer than 52 hours during off-peak periods.

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MOEF, 2022a, "The New Government's Economic Policy Directions", *Press Release,* Ministry of Economy and Finance, 16 June 2022.

MOEF, 2022b, "The 2023 Government's Economic Policy Directions", *Press Release,* Ministry of Economy and Finance, 21 December 2022.

36 The continued development of financial technology requires sound cyber risk management, coupled with the promotion of financial literacy and consumer protection. Fintech and digital financial services, including virtual assets, have grown rapidly in Korea, in tandem with ICT innovation *(Box B: Recent Developments of Virtual Asset Market in Korea)*. In this regard, sound risk management alongside comprehensive consumer protection measures should be established to reduce potential risks associated with cyberattacks, scams, and money laundering. Continuing education and communication efforts by the authorities could also help safeguard financial consumers against threats. Regarding a potential central bank digital currency (CBDC), the AMRO mission agrees with the authorities that its design should be done cautiously with the goal that, if issued, the CBDC would integrate well with Korea's existing advanced payment landscape while facilitating cross-border payments. *(Selected Issue 2: Retail CBDC: What Can We Learn from the Bank of Korea's and Riksbank's Pilot Studies?).*

Box B. Recent Developments of Virtual Asset Market in Korea[30]

Korea has been a hotspot for the virtual asset market due to the so-called Kimchi Premium, which has made virtual asset trading lucrative. Specifically, the Kimchi Premium refers to a gap in virtual asset prices of Korean exchanges compared with foreign exchanges, plausibly reflecting a lack of high-return investment options for investors in the country as well as national interest in technology and online gambling. In late 2017, the lucrative Kimchi Premium incentivized non-Korean virtual asset traders to buy large amounts of virtual assets from their respective home markets and then sell them in the Korean market. The premium continued to rise above 50 percent in 2018, before falling below 2 percent after the Terra-Luna crash. Driven by lucrative returns, traders have a strong speculative motive in transactions that contribute to financial misconduct, tax evasion, risks to investor protection, and transactions that trigger cyber security concerns. Until the recent Terra-Luna and FTX incident, the authorities were facing challenges in containing the growth of the virtual asset market and took several measures including, the tightening of the regulatory framework, and tax obligations.

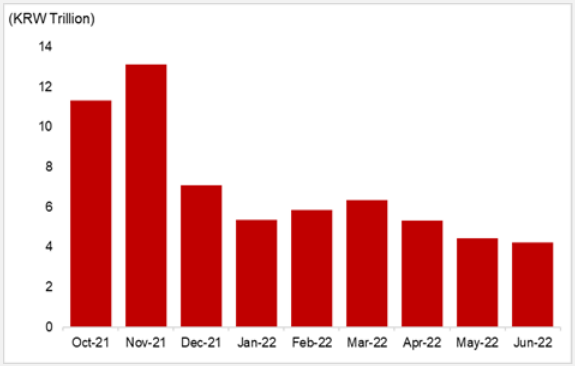
Korea's virtual asset market witnessed a plunge in 2022. As of H1 2022, the total market capitalization of the virtual asset market in Korea was KRW23 trillion, having fallen significantly from KRW55.2 trillion in H2 2021, reflecting regulatory enforcement, the economic slowdown, interest rate hikes, and notably the loss of confidence in virtual assets in the wake of the Terra-Luna crash. In addition, monthly average daily transactions fell sharply from KRW13 trillion in November 2021 to KRW4.2 trillion in June 2022 (Figure B1). Nevertheless, in H1 2022, the number of virtual assets traded in the domestic market rose to 1,371, and price volatility rose by 8 percentage points.

The younger generations tends to dominate the overall user segment of the virtual asset market. Most virtual asset users are male. People in their 20s to 40s represent 80 percent of total users while the remaining 20 percent are aged 50 or above. As enthusiastic young Koreans have strong speculative motives in the virtual asset market, the number of eligible users trading in the

[30] Prepared by Monineath El, Associate

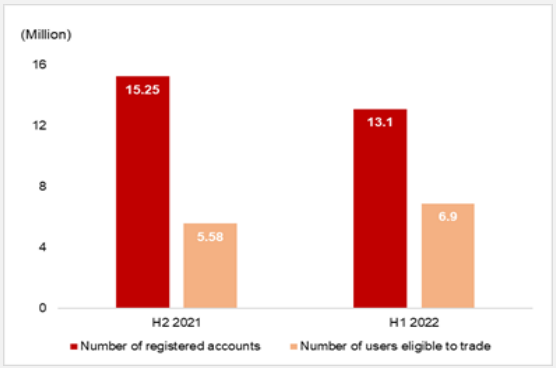
virtual asset market increased to 6.9 million in H1 2022 from 5.6 million in H2 2021 despite the turmoil in the global crypto market (Figure B2).

Figure B1. Monthly Average Daily Transaction Amount
(KRW trn)



Source: Financial Service Commission; AMRO staff calculations

Figure B2. Virtual Asset Users
(mln)



Source: Financial Service Commission; AMRO staff calculations

The collapse of FTX, one of the world's largest cryptocurrency exchanges, seems to have made a minor impact on the well-regulated virtual asset market in Korea. As most virtual asset users in the domestic market could store their virtual assets in custodial wallets rather than on trading platforms, the transmission of the impact of the FTX collapse was low. More precisely, the crash of FTX was triggered by the withdrawal of deposited money from the platform, which is unlikely to occur in Korea's virtual asset market as the Act on Reporting and Using Specified Financial Transaction Information strictly stipulates the management of customer deposits separately from its own assets and management of customer's transaction separately on an individual basis." The Act also sets out entry barriers to the business which virtual asset service providers (VASPs) need to report in advance to Korea Financial Intelligence Unit (KoFIU) on the required business information including the name of the company and its representative, location, and virtual asset business to be conducted.

More recently, the government has tightened oversight of the virtual asset market by enforcing regulatory requirements and taxation to safeguard investors, ensure financial stability, boost anti-money laundering (AML) efforts, and curb tax evasion. In particular, the government amended the Act on Reporting and Using Specified Financial Transaction Information requiring all VASPs to comply with information security management systems, anti-money laundering requirements, and travel rule[31] and to properly report to KoFIU. In addition, the amended Financial Investment Income Tax was to levy 20 percent on capital gains from virtual asset transactions over the amount of KRW2.5 million; however, the Yoon government has recently postponed implementation of this amendment till the end of 2023. **As a result of these tightened regulatory requirements, arbitrage trading and financial misconduct in the virtual asset market should continue to diminish.**

Going forward, the right mix of rules will balance the need to spur innovation and create value-added for the Korean economy against the need to protect investors and safeguard financial stability. The emergence of the virtual asset market will generate socio-economic benefits for Korea. According to the Boston Consulting Group's projection, capitalization of the Korean virtual asset market capitalization will reach KRW1,000 trillion, and about 42,000 jobs will be created by 2026. Therefore, Korea should consider embracing benefits from this market while safeguarding investors and financial stability. Against this background, the newly drafted regulatory framework, Digital Asset Basic Act, will likely generate optimism for both virtual asset market development and investor protection.

37 The government should continue its efforts to reduce carbon emissions while managing the impacts during the transition. AMRO commends the government's plan

[31] Travel rule required all VASPs to provide the beneficiary with information about virtual asset transfer.

to achieve carbon neutrality by 2050 and reduce carbon emissions by 40 percent below 2018 levels by 2030. To reach the intermediate target by 2030, which implies an average reduction rate of 4.2 percent per year, the new administration plans to raise the share of nuclear power to a minimum of 30 percent in 2030 from 27.4 percent in 2021. Whole doing so, the scenarios[32] to achieve the intermediate target should be reviewed and implemented flexibly while considering the progress of carbon emission reduction and technological developments. That said, challenges could exist during the transition. To protect the vulnerable, targeted climate funds and/or fiscal revenues generated from a future carbon tax could be used to expedite green transition such as green investments and technology, and/or to temporarily support workers and businesses in those severely affected sectors. Moreover, the government, in partnership with the private sector, should continue developing a deep green bond market to finance green investments without an overreliance on fiscal resources.

Authorities' Views

38 The government's plan is not to focus on nuclear energy, but to reduce fossil fuel usage by forming reasonable energy mix. The government views the increase in nuclear energy's share as a more realistic approach to eventually achieve carbon neutrality. According to the energy mix plan released on January 2023, the share of renewable energy will triple from 7.5 percent in 2021 to 21.6 percent in 2030.

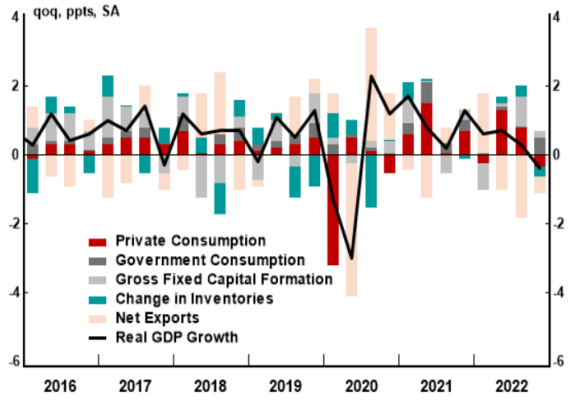
[32] Currently, there are two scenarios. Scenario A entails the complete elimination of thermal power generation, Scenario B actively utilizes various technologies, such as Carbon capture, utilization and storage.

Appendices

Appendix 1. Selected Figures for Major Economic Indicators

Figure 1.1. Real Sector

The Korean economy rebounded in 2021 and 2022, mainly on strong export growth and recovering private consumption...

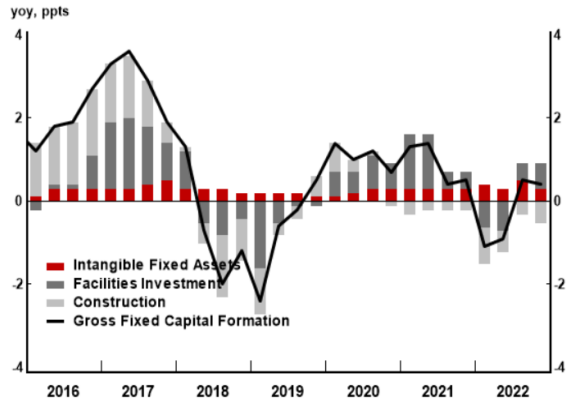


Source: Bank of Korea; Haver Analytics

… however, the growth outlook in the near-term growth in Korea and its major trading partners has deteriorated.

Source: S&P Global Purchasing Managers Survey; JP Morgan; Caixin; Haver Analytics

Investment has been weak and is expected to remain sluggish in 2023



Source: BOK; Haver Analytics

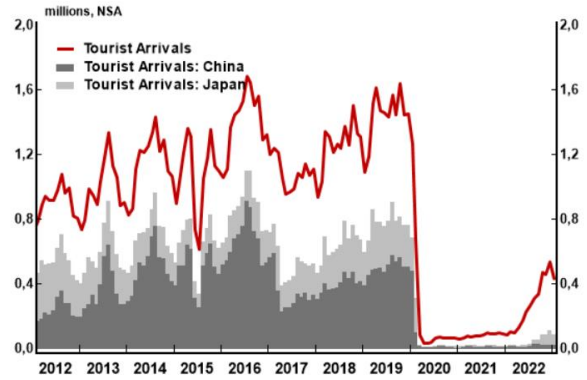
Non-regular labor, especially daily workers, suffered more during the pandemic

Source: Statistics Korea; Haver Analytics

Short-term inflation expectations appeared to have peaked following a similar trend to the headline inflation

Source: BOK; Haver Analytics

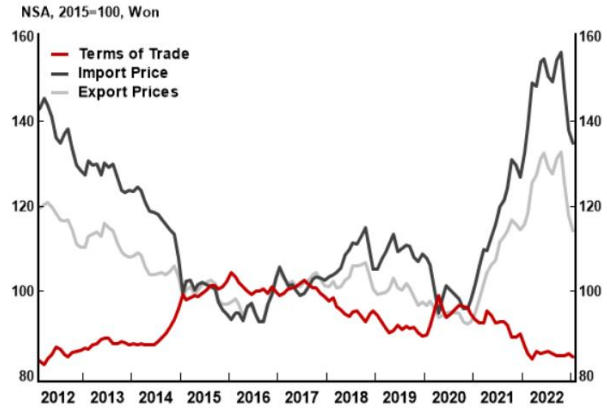
The recovery of inbound tourism has been gradual and moderate



Source: Korea National Tourism Organization; Haver Analytics

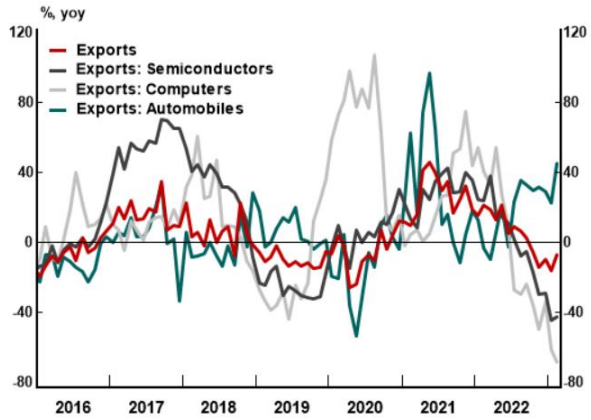
Figure 1.2. External Sector

A sharp rise in import prices led to a deterioration of the terms of trade



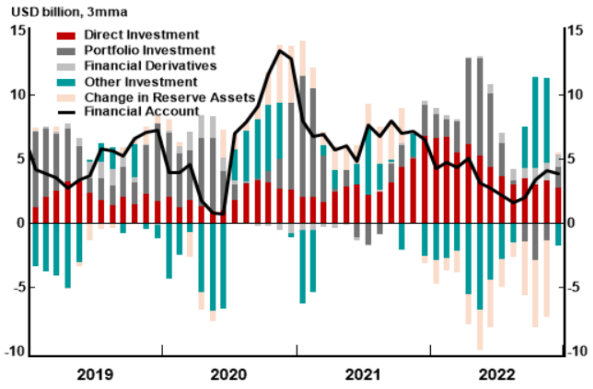
Source: BOK; Haver Analytics

Key manufacturing exports trended down in 2022 yoy, except for automobiles



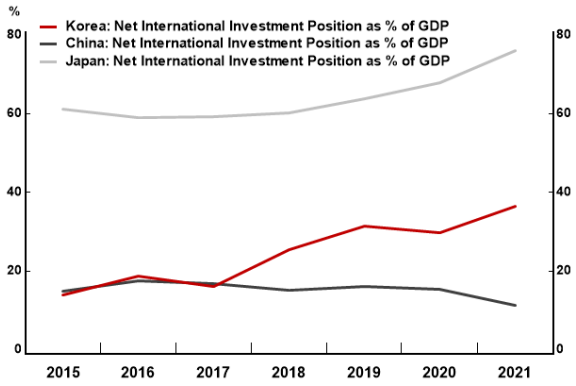
Source: Korea Customs Service; Korea International Trade Association; Haver Analytics

Capital outflows continued in 2022, reflecting residents' interest in overseas investments and financial assets



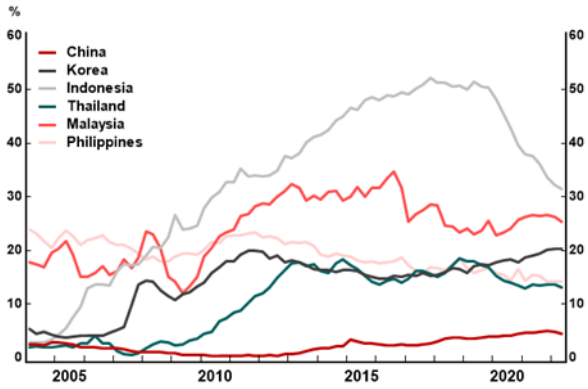
Source: BOK; Haver Analytics; AMRO calculations

Korea's net international investment position steadily improved



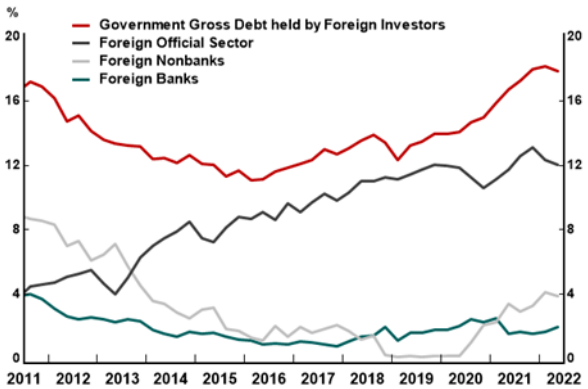
Source: International Monetary Fund; Haver Analytics

Foreign holdings of Korean gross government debt have steadily increased since 2016…



Source: IMF; Haver Analytics

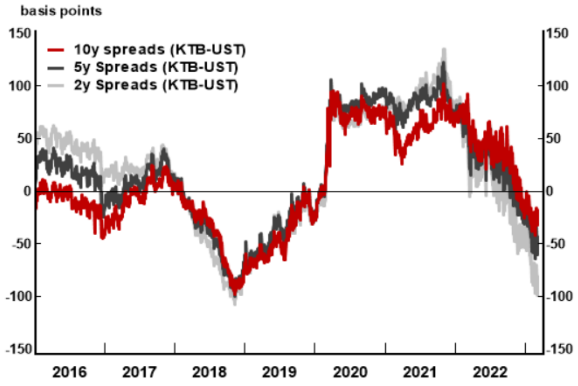
… especially during the pandemic, led by foreign non-bank institutions



Source: IMF; Haver Analytics

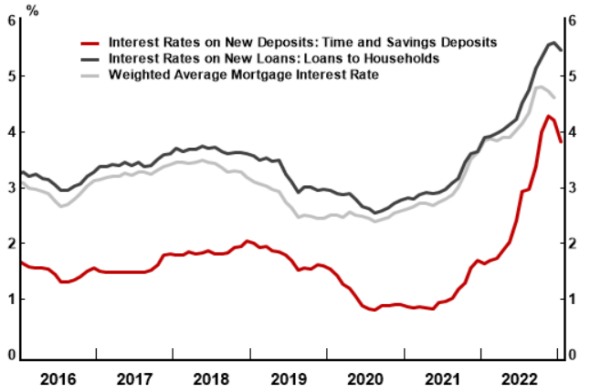
Figure 1.3. Monetary and Financial Sector

Yield spreads of Korean government bonds to their U.S. counterparts fell in 2022 amid aggressive Fed policy hikes



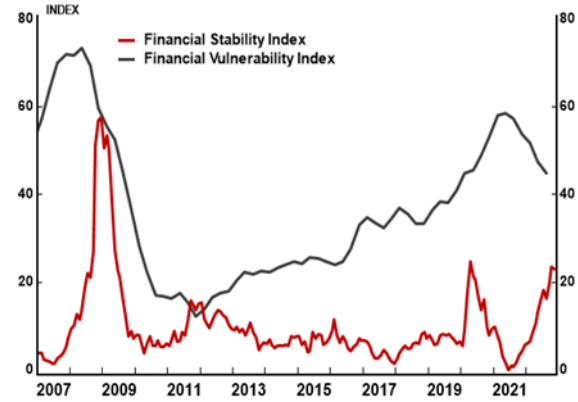
Source: Haver Analytics

The BOK's policy hikes led to increased funding and financing costs



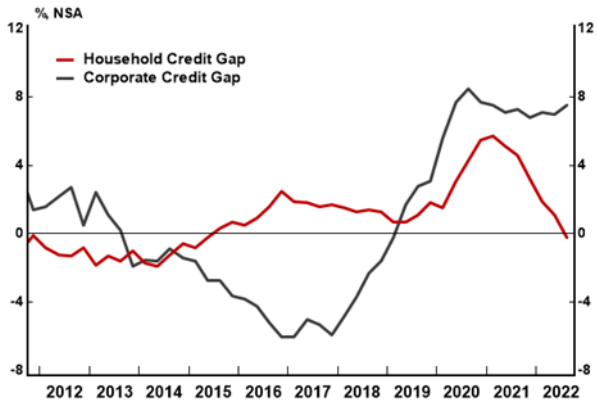
Source: BOK; Kookmin Bank; Haver Analytics

The levels of instability(1) and vulnerability(2) in the financial system have increased



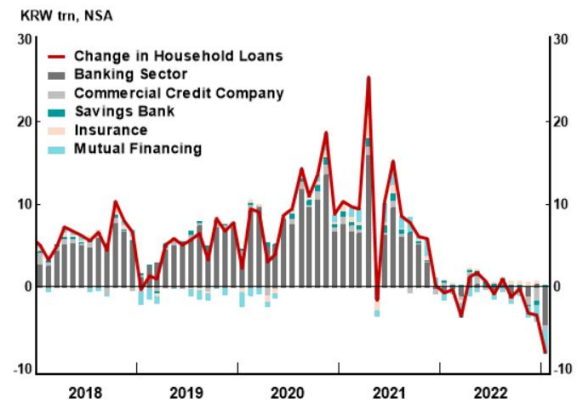
Note: (1) A composite index (0-100) calculated by standardizing 20 monthly real and financial sector indicators related to financial instability. The warning and crisis stage thresholds are set at 8 and 22 respectively, using the "noise-to-signal" ratio method. (2) A composite index (0-100) calculated by standardizing 39 quarterly indicators concerning three criteria for assessment (asset prices, credit accumulation and financial system resilience).
Source: BOK; Haver Analytics

Lending to households slowed down compared to corporate lending…



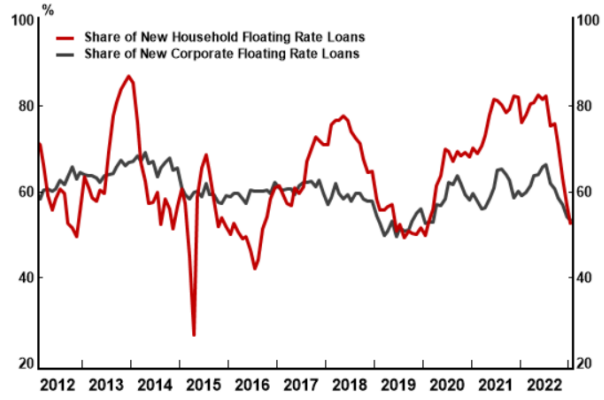
Source: BOK; Haver Analytics

…as the banking sector reduced exposure amid a tightening monetary environment



Source: Financial Supervisory Service; Haver Analytics

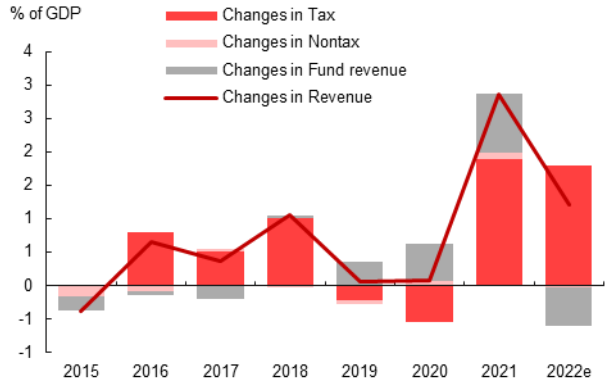
The high share of household and corporate loans with a floating rate could be challenging for vulnerable groups



Source: BOK; Haver Analytics

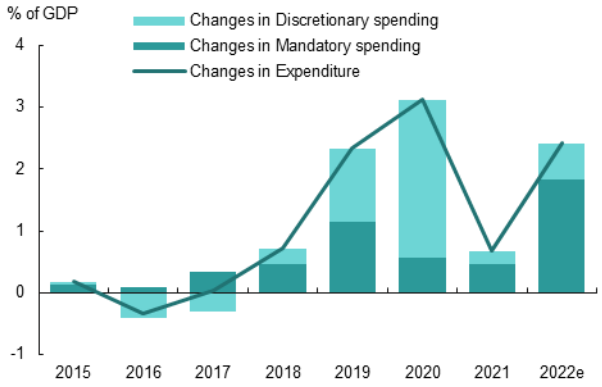
Figure 1.4. Fiscal Sector

In 2022, revenue continued to grow robustly, backed by a strong economic recovery and buoyant asset markets, …



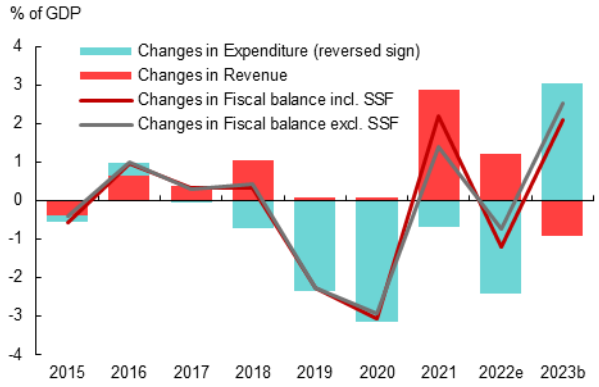
Source: Ministry of Economy and Finance; AMRO staff estimates

… while expenditure increased sharply to support small merchants and vulnerable groups, leading to the rise in fiscal deficit.



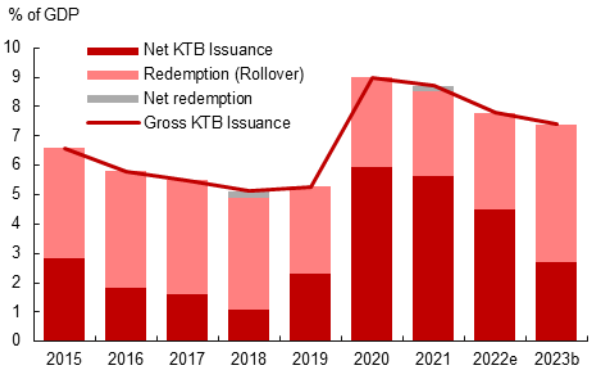
Source: MOEF; AMRO staff estimates

The fiscal deficit in 2023 is budgeted to narrow by cutting expenditure amid sluggish forecast revenue growth.



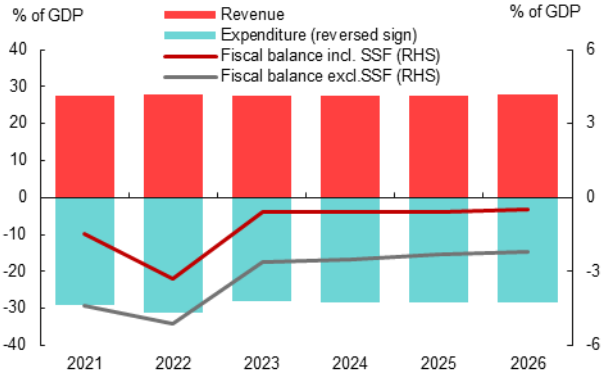
Source: MOEF; AMRO staff estimates

Despite the reduced fiscal deficit, KTB issuances are expected to remain high as bonds that were massively issued during the pandemic are nearing maturity.



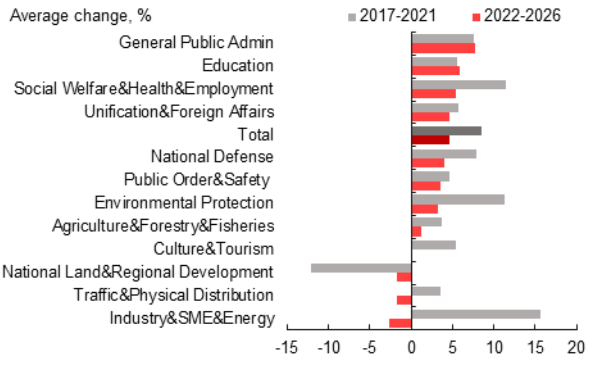
Source: MOEF; AMRO staff estimates

The government is committed to fiscal consolidation by maintaining the fiscal deficit excluding SSFs at mid-2 percent of GDP …



Source: MOEF

… by tightly managing spending programs across all sectors and functions.



Source: MOEF

Appendix 2. Selected Economic Indicators for Korea

	2018	2019	2020	2021	2022e	2023p
National income and prices	(In percent change unless specified)					
Real GDP	2.9	2.2	-0.7	4.1	2.6	1.7
Final consumption	3.7	3.2	-2.2	4.2	4.3	1.7
Private sector	3.2	2.1	-4.8	3.7	4.3	1.6
Public sector	5.3	6.4	5.1	5.6	4.1	1.7
Gross capital formation	-1.3	-1.9	0.9	2.3	-0.4	2.5
Construction	-4.6	-1.7	1.5	-1.6	-3.5	0.9
Facilities investment	-2.3	-6.6	7.2	9.0	-0.5	-0.2
Intellectual property products	4.4	3.1	3.4	4.4	4.7	4.3
Exports	4.0	0.2	-1.7	10.8	3.2	1.7
Exports of goods	3.3	-1.1	-0.2	10.5	3.4	1.5
Exports of services	9.4	9.7	-11.1	13.2	2.3	3.5
Imports	1.7	-1.9	-3.1	10.1	3.7	2.4
Imports of goods	2.0	-2.5	0.3	12.8	4.7	2.3
Imports of services	0.5	0.5	-16.3	-1.8	-1.2	2.7
Labor Market						
Unemployment rate (in percent, period average)	3.8	3.8	4.0	3.7	2.9	3.3
Labor force participation rate (in percent, period average)	63.1	63.3	62.5	62.8	63.9	63.5
Prices						
Consumer price inflation (period average)	1.5	0.4	0.5	2.5	5.1	3.3
Core inflation, excluding food and energy (period average)	1.2	0.7	0.4	1.4	3.6	3.6
External sector	(In billions of US dollars unless specified)					
Current account balance	77.5	59.7	75.9	85.2	29.8	28.5
(In percent of GDP)	4.5	3.6	4.6	4.7	1.8	1.5
Trade balance	110.1	79.8	80.6	75.7	15.1	34.5
(In percent of GDP)	6.4	4.8	4.9	4.2	0.9	1.9
Services, net	-29.4	-26.8	-14.7	-5.3	-5.5	-20.0
Primary income, net	4.9	12.9	13.5	19.4	22.9	18.0
Secondary income, net	-8.2	-6.1	-3.5	-4.7	-2.6	-4.0
Financial account balance	59.0	57.6	64.0	63.6	66.7	53.0
(In percent of GDP)	3.4	3.5	3.9	3.5	4.0	2.9
Overall balance	17.5	1.5	17.4	14.8	-27.9	-24.5
(In percent of GDP)	1.0	0.1	1.1	0.8	-1.7	-1.3
Gross official reserves	403.7	408.8	443.1	463.1	423.2	403.6
(In months of imports of goods & services)	7.2	7.7	9.3	7.5	6.0	5.7
Total external debt (USD bn)	441.2	470.7	550.6	632.4	664.5	562.5
Short-term external debt (% of international reserves)	31.1	33.1	36.1	35.6	39.4	42.7
Fiscal Sector	(In percent of GDP)					
Total Revenue	24.5	24.6	24.7	27.7	28.7	28.4
Total Expenditure	22.9	25.2	28.3	29.2	31.4	28.9
Overall balance including Social Security Funds	1.6	-0.6	-3.7	-1.5	-2.7	-0.5
Managed balance	-0.6	-2.8	-5.8	-4.4	-5.1	-2.6
Central and local government debt	35.9	37.6	43.6	46.9	49.7	50.4
Monetary and financial sector	(In percent unless specified)					
Domestic credit (in percentage change)	6.4	6.6	10.2	9.9	8.1	…
(In percent of GDP)	224.1	235.6	257.4	265.0	267.5	…
Broad money (KRW trillion)	2,700	2,914	3,200	3,614	3,739	…
Substandard-and-below loan ratio (in percent) 1/ 2/	0.5	0.4	0.3	0.2	0.2	…
Capital adequacy ratio (in percent) 1/ 2/	15.9	16.0	17.2	18.2	16.2	…
Memorandum items:						
Exchange rate (KRW per US$, average) 3/	1,100	1,166	1,180	1,144	1,291	1,220
Exchange rate (KRW per US$, end of period) 3/	1,118	1,158	1,088	1,186	1,267	1,220
10-year government bond yield (in percent, end of period) 3/	2.0	1.7	1.7	2.2	3.5	3.4
3-month Koribor yield (in percent, end of period) 3/	1.7	1.3	0.7	1.4	3.8	3.5
Nominal GDP (in KRW trillion)	1,898	1,924	1,941	2,072	2,151	2,252
Nominal GDP (in US$ billion)	1,725	1,651	1,645	1,810	1,665	1,846

Data: Korean authorities; Bank for International Settlements, CEIC, Haver Analytics, and AMRO staff estimates (e) and projections (p)
Note: numbers in dark grey denote AMRO estimates or projections.
1/ Commercial banks only
2/ Latest values
3/ Market Consensus based on Bloomberg

Appendix 3. Balance of Payments

	2018	2019	2020	2021	2022	2023p
	(in billions of U.S. dollars unless specified)					
Current account balance (I)	**77.5**	**59.7**	**75.9**	**85.2**	**29.8**	**28.5**
Trade balance	110.1	79.8	80.6	75.7	15.1	34.5
Exports, f.o.b.	626.3	556.7	517.9	649.5	690.5	714.6
Imports, f.o.b.	516.2	476.9	437.3	573.7	675.4	680.1
Services, net	-29.4	-26.8	-14.7	-5.3	-5.5	-20.0
Receipts	103.7	103.8	89.6	119.9	130.2	140.1
Payments	133.0	130.7	104.3	125.2	135.7	132.9
Primary income, net	4.9	12.9	13.5	19.4	22.9	18.0
Secondary income, net	-8.2	-6.1	-3.5	-4.7	-2.6	-4.0
Capital account (II)	**0.3**	**-0.2**	**-0.4**	**-0.2**	**0.0**	**0.0**
Financial account (III) (+ indicates net outflows) 1/	**59.0**	**57.6**	**64.0**	**63.6**	**66.7**	**53.0**
Direct investment (net)	26.0	25.6	26.1	43.9	48.4	30.0
Portfolio investment (net)	47.4	42.4	41.7	19.4	25.4	25.0
Financial derivatives (net)	-1.5	6.2	4.9	-0.1	7.6	0.0
Other investment (net)	-13.0	-16.7	-8.7	0.4	-14.7	-2.0
Errors and omissions (IV)	**-1.3**	**-0.5**	**5.9**	**-6.6**	**9.0**	**0.0**
Overall balance (=I + II - III + IV)	**17.5**	**1.5**	**17.4**	**14.8**	**-27.9**	**-24.5**
Reserve assets (+ indicates increases)	**17.5**	**1.5**	**17.4**	**14.8**	**-27.9**	**-24.5**
Memorandum items:						
Current account balance (In percent of GDP)	4.5	3.6	4.6	4.7	1.8	1.5
Gross reserves (USD billion)	403.7	408.8	443.1	463.1	423.2	403.6
(In months of imports of goods and services)	7.2	7.7	9.3	7.5	6.0	5.7
(In percent of short-term debt at remaining maturity)	…	…	…	…		
Changes in gross reserves (USD billion)	14.4	5.1	34.3	20.0	-39.9	-19.6
Nominal GDP (USD billion) 2/	1,725.2	1,650.9	1,644.5	1,810.0	1,665.2	1,846.3

Note: 1/ Excludes changes in reserve assets.
2/ Based on AMRO staff calculations using the yearly averages of USD/KRW exchange rates.

Source: Korean authorities; AMRO staff projections.

Appendix 4. Statement of Government Operations

	2018	2019	2020	2021	2022e	2023p
	(In percent of GDP unless specified)					
Revenue	24.5	24.6	24.7	27.7	28.7	28.4
Tax	15.5	15.3	14.7	16.6	18.4	17.8
Personal Income Tax	4.5	4.3	4.8	5.5	6.0	5.9
Corporate Income Tax	3.7	3.8	2.9	3.4	4.8	4.7
Value-added Tax	3.7	3.7	3.3	3.4	3.8	3.7
Transportation Tax	0.8	0.8	0.7	0.8	0.5	0.5
Customs Duty	0.5	0.4	0.4	0.4	0.5	0.5
Other tax	2.3	2.3	2.6	3.1	2.8	2.6
Nontax	1.4	1.3	1.4	1.5	1.2	1.2
Fund revenue	7.6	8.0	8.6	9.5	9.1	9.4
Expenditure	22.9	25.2	28.3	29.2	31.4	28.9
Mandatory spending (excl. Interest)	10.5	11.7	12.3	12.7	14.5	14.4
Interest payments	0.8	0.7	0.7	0.8	0.9	1.0
Domestic	0.8	0.7	0.7	0.8	0.9	1.0
External	0.0	0.0	0.0	0.0	0.0	0.0
Discretionary spending	11.2	12.2	15.3	15.4	16.1	13.4
Fiscal Balance						
Fiscal Balance incl. SSF	1.6	-0.6	-3.7	-1.5	-2.7	-0.5
Primary Balance incl. SSF	2.4	0.1	-2.9	-0.7	-1.8	0.5
Fiscal Balance excl. SSF	-0.6	-2.8	-5.8	-4.4	-5.1	-2.6
Primary Balance excl. SSF	0.2	-2.1	-5.0	-3.6	-4.3	-1.5
Public debt	35.9	37.6	43.6	46.9	49.7	50.4
Domestic debt	35.4	37.1	43.1	46.3	49.1	49.9
External debt	0.4	0.4	0.5	0.5	0.6	0.5

Source: Korea Ministry of Economy and Finance; AMRO staff estimates and projections

Appendix 5. Debt Sustainability Analysis[33] [34]

After a sharp rise during the pandemic, the public debt-to-GDP ratio is projected to increase modestly, while gross financing needs (GFNs) are expected to drop in line with the reduced fiscal deficit (Table 5.1). The projected average economic growth rate during 2023-2027 is 2.0 percent, in line with the potential growth path. The effective interest rate is expected to rise gradually, reflecting policy rate hikes since 2021. The fiscal deficit excluding social security funds (SSFs) is projected to remain at mid-2 percent of GDP, without tighter fiscal consolidation, given a rising share of hard-to-adjust mandatory spending. The primary deficit and real interest rate will continue to raise the debt ratio, offsetting the negative contribution from real growth (Figure 5.1). Despite a sizable reduction in the primary balance, GFNs will remain higher than pre-pandemic levels as the treasury bonds that were issued in large amounts during the pandemic are scheduled to mature after 2023 (Figure 5.1).

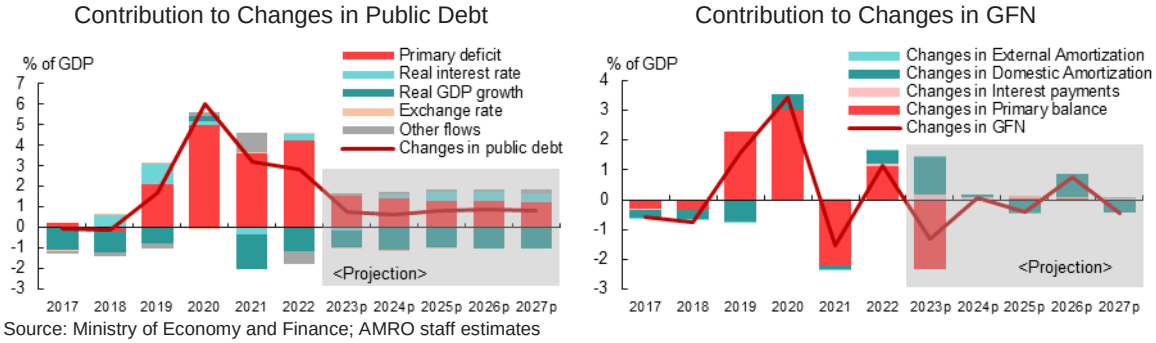
The standard Debt Sustainability Analysis (DSA) results find the overall risk of public debt sustainability to be low (Figure 5.4). The public debt-to-GDP ratio and the GFN as a percentage of GDP have remained below their corresponding thresholds in the past five years and are projected to stay lower than the thresholds in the baseline and all stress test scenarios over the projection period (Figure 5.2). Even under a combined macro-fiscal shock, the debt ratio will likely remain below 60 percent, and the GFN will rise at most to 8 percent of GDP. Moreover, market perception of sovereign risk continues to be low, as indicated by the bond yield spread, and the public debt structure, including external and short-term shares, remains sound (Figure 5.3).

Table 5.1. Macroeconomic and Fiscal Indicators

	2018	2019	2020	2021	2022	2023p	2024p	2025p	2026p	2027p
Macroeconomic indicators (Percent)										
Real GDP growth	2.9	2.2	-0.7	4.1	2.6	1.7	2.3	2.0	2.0	2.0
GDP deflator	0.5	-0.8	1.6	2.5	1.2	2.4	1.9	1.7	1.7	1.7
Effective interest rate	2.2	2.0	2.0	1.8	1.9	2.2	2.4	2.5	2.6	2.7
Fiscal indicators (Percent of GDP)										
Revenue	24.5	24.6	24.7	27.7	28.7	28.4	28.5	28.6	28.7	28.9
Expenditure	22.9	25.2	28.3	29.2	31.4	28.9	29.1	29.4	29.6	29.8
Fiscal balance excluding SSF	-0.6	-2.8	-5.8	-4.4	-5.1	-2.6	-2.5	-2.6	-2.6	-2.6
Primary balance excluding SSF	0.2	-2.1	-5.0	-3.6	-4.3	-1.5	-1.4	-1.3	-1.3	-1.2
Public debt	35.9	37.6	43.6	46.9	49.7	50.4	51.1	51.9	52.8	53.6
Gross financing needs	3.1	4.7	8.1	6.6	7.7	6.4	6.5	6.1	6.8	6.4

Source: Ministry of Economy and Finance; AMRO staff estimates

Figure 5.1. Public Debt and GFN Dynamics

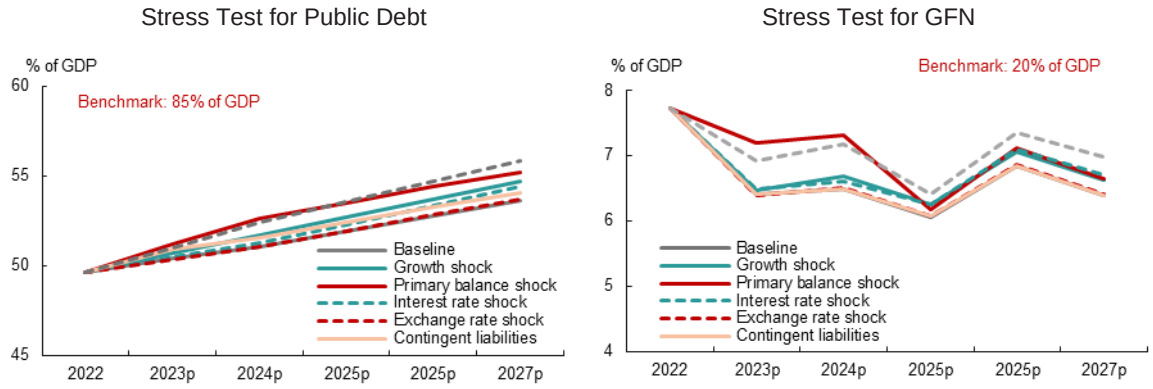


Source: Ministry of Economy and Finance; AMRO staff estimates

[33] Prepared by Byunghoon Nam, Senior Economist

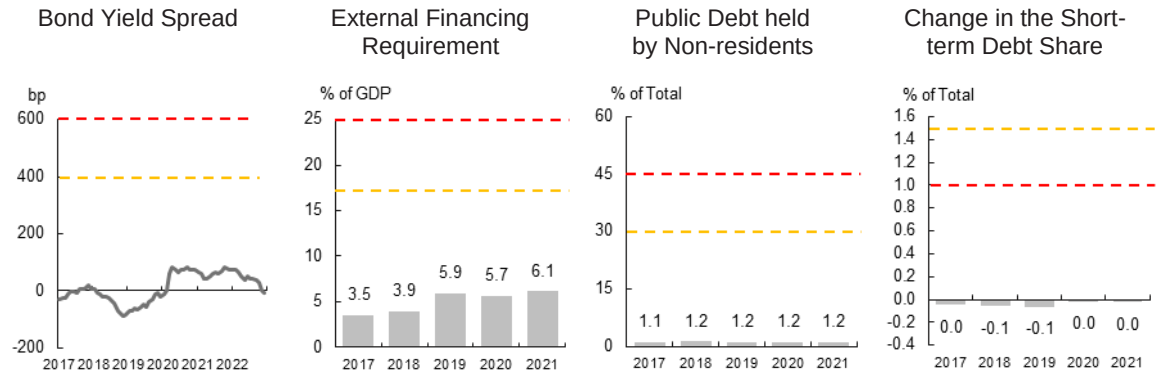
[34] Public DSA for Korea covers national government debt (central and local government) excluding SSFs. As of end-2021, general government debt was at 51.5 percent of GDP on an accrual basis, according to the Public Sector Debt Statistics, while national government debt amounted to 46.9 percent of GDP on a cash basis.

Figure 5.2. Macro-Fiscal Stress Test



Note: The scenarios for the stress test are as follows: 1) Real GDP growth shock: one standard deviation or –0.5 percentage points shock to 2023 and 2024; 2) Primary balance shock: one standard deviation or –1 percent of GDP shock to 2023 and 2024; 3) Interest rate shock: +1 percentage points shock from 2023; 4) Exchange rate shock: one-time +5 percentage points shock in 2023; 5) Contingent liability shock: one-time 0.5 percent of GDP shock in 2023, by recognizing the government guaranteed debt as of end-2021; 6) Combined shock: a combination of growth (half size), primary balance (half size), interest rate, and exchange rate shocks.
Source: Ministry of Economy and Finance; AMRO staff estimates

Figure 5.3. Debt Profile Vulnerabilities



Note: 1) – – – Lower early warning (50 percent of the benchmark), – – – upper early warning (75 percent of the benchmark); 2) Bond yield spreads are computed using the difference between KTBs and U.S. Treasury notes at 10-year maturities; 3) External financing requirements = current account deficit + amortization of public external debt + amortization of private external debt; 4) Public debt held by nonresidents is based on the jurisdiction of issuance; 4) Short-term debt is based on the original maturity.

Source: Ministry of Economy and Finance, AMRO staff estimates Source: Ministry of Economy and Finance; AMRO staff estimates

Figure 5.4. Heatmap of Public Debt Sustainability

		2017	2018	2019	2020	2021	2022	2023p	2024p	2025p	2026p	2027p
Public Debt												
Gross Financing Needs												
Debt Profile	Market Perception of Sovereign Risk											
	External Financing Requirement											
	Public Debt Held by Non-residents											
	Change in Short-term Debt Share											

Note For Public Debt and Gross Financing Needs, the cell is highlighted in green if the benchmark is not exceeded under all shocks or the baseline, yellow if exceeded under any specific shock but not the baseline, and red if exceeded under the baseline; 2) For Debt Profile, the cell is highlighted in green if the country value is less than the lower early warning benchmark, red if it exceeds the upper early warning benchmark, and yellow if it lies between the lower and upper early warning benchmarks.

Sources: AMRO staff estimates

Appendix 6. Data Adequacy for Surveillance Purposes: a Preliminary Assessment

Criteria/Key Indicators for Surveillance	Data Availability[(i)]	Reporting Frequency/Timeliness[(ii)]	Data Quality[(iii)]	Consistency[(iv)]	Others, if Any[(v)]
National Account	Yearly data for the income approach, and quarterly data for the expenditure and production approach are available.	Quarterly data are released within one month after the reference quarter ends (for the first preliminary estimate).	-	-	-
Balance of Payments (BOP) and External Position	Monthly BOP data is available in detail.	Monthly BOP data are released about two months after the reference period, while quarterly IIP data are released within two months after the reference period.	-	-	-
Central Government Budget/External Debt	Monthly data on central government public finance are available, while quarterly external debt data are available in detail.	Monthly data on central government public finance are released within four months after the reference period, while quarterly data on external debt are released within two months after the reference period.	-	-	-
Inflation, Money Supply and Credit Growth	Data on monthly inflation, money supply and credit growth are available.	Monthly inflation data are released within one month after the reference period, while data on money supply and credit growth are released within two months of the end of the reference period.	-	-	-
Financial Sector Soundness Indicators	Available	Monthly data are released within one to two months after the reference period, while quarterly data are available three months after the reference period.	-	-	-
Housing Market Indicators	Available	Monthly data are released within one month after the reference period.	-	-	-

Notes:
(i) Data availability refers to whether the official data is available for public access by any means.
(ii) Reporting frequency refers to the periodicity with which the available data is published. Timeliness refers to how up to date the published data is relative to the publication date.
(iii) Data quality refers to the accuracy and reliability of the available taking into account the data methodologies.
(iv) Consistency refers to both internal consistency within the data series itself and its horizontal consistency with other data series of either the same or different categories.
(v) Other criteria might also apply, if relevant. Examples include but are not limited to potential areas of improvement for data adequacy.

Source: AMRO staff compilation. This preliminary assessment will form the “Supplementary Data Adequacy Assessment" in the EPRD Matrix.

Annexes: Selected Issues

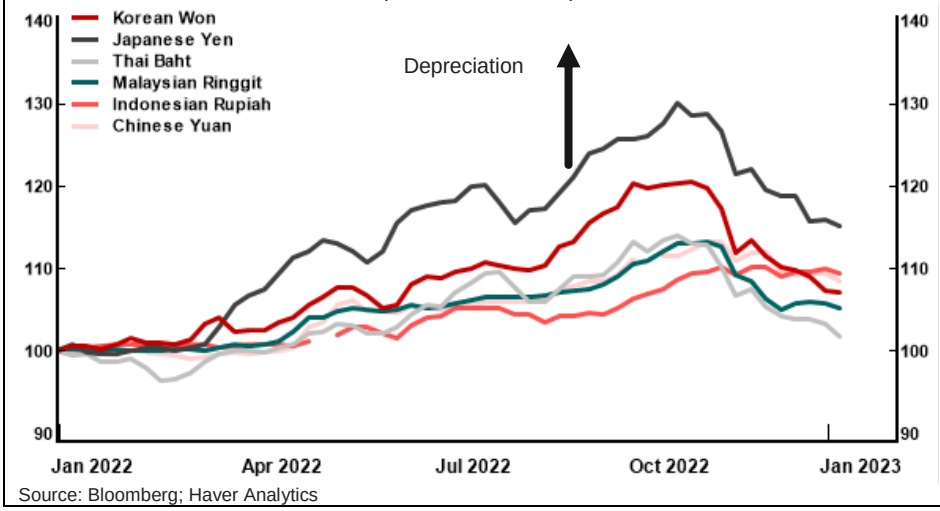
1. The Drivers of the Korean Won[35]

As an open economy with deep integration into the global supply chains and a high degree of free flow of capital, avoiding excessive foreign exchange rate volatility is of vital importance to the Korean economy. Right after the pandemic and during 2022, the USD/KRW exchange rate exhibited significant volatility. Against this backdrop, the analysis intends to assess the economic drivers of the USD/KRW exchange rate over a long horizon. Overall, our analysis suggests that interest rate differentials, changes in risk perception, and the performance of the Korean equity market have more significant impacts on the USD/KRW than net portfolio flows and current account balance. Moreover, the impacts of these drivers vary over time.

1. **In an export and open economy like Korea, the exchange rate plays a significant role in the stability of the economy.** As the U.S. economy emerged from the pandemic, the strength of the U.S. dollar following the hawkish policy stance of the U.S. Federal Reserve was the main theme in financial markets in 2022. The U.S. dollar was able to exert such a dominant effect because the dollar market is the largest among global foreign exchange markets and the dollar is the largest payment currency in international trade (Yoon, 2019).

2. **The strong dollar had led to a significant depreciation of the Korean won and increased volatility in the foreign exchange market since early 2022, a common issue for many currencies in the region (Figure A1.1)**. The won had depreciated against the dollar by 17.4 percent in late October 2022 at the peak and 6.0 percent for the whole of 2022, compared with the end of 2021. Apart from the strength of the dollar, other factors could have played a role, too, in the weakness of the won in 2022:

Figure A1.1. Performance of USD/KRW in 2022
(2021 Dec. 31 =100)



Source: Bloomberg; Haver Analytics

- **Rapid increases in the Fed's policy rate led to a widening of interest rate differentials between Korea and the U.S., and deteriorating investor sentiment.** These developments in part contributed negatively to portfolio flows by nonresidents in 2022. In particular, Korean government bonds received fewer inflows from

[35] Prepared by Trung Thanh Vu, Associate Economist; and Kimi Xu Jiang, Economist

nonresident investors who, in the meantime, continued to sell Korean equities mostly during the first half of the year.

- **The deterioration of the current account could be another contributor to the won's weakness.** Increased energy imports due to higher energy commodity prices, along with a fall in exports, particularly some key manufacturing products such as semiconductors and computers, were the primary reasons behind the deterioration of the trade balance.

3. **The sharp depreciation of the won resulted in FX authorities' market stabilization measures and increased monitoring of the foreign exchange market.** According to data published by the Bank of Korea (BOK), the FX authorities' net purchase of the dollar amounted to USD -41.3 billion in the first three quarters of 2022. Among other measures to reduce demand for the USD, FX authorities agreed with the National Pension Services (NPS) on a FX swap arrangement[36] up to USD10 billion to fund its overseas investments.

4. **The rapid depreciation of the won against the dollar and the importance of the exchange rate to the economy call for a better understanding of the underlying drivers of the exchange rate movements.** Against this backdrop, this selected issue aims to analyze which factors drive foreign exchange movements and how these factors affect the exchange rate. These fundamental drivers can be categorized as the following: (i) interest rate differentials reflecting shifts in the monetary policy stance, (ii) changes in risk perception, and (iii) current account balance, equity market conditions and capital flows.[37]

5. **Following Brunnermeier and others (2008) and Han and Westelius (2019), a VAR model and a historical decomposition are employed to estimate the impact and contribution of each factor on the movements of the won against the dollar, respectively.** Drivers include changes in risk perception, current account balance, Korean equity market conditions, portfolio investment flows and monetary policy shifts. The VAR model can be written as

$$Y_t = \beta_0 + \sum_{j=1}^{J} A_j Z_{t-j} + \varepsilon_t,$$

in which Y_t is a vector of endogenous variables, including proxies for the abovementioned economic drivers, such as changes in the logarithm of the CBOE's volatility index (VIX), Korea's current account as a percentage of GDP, net portfolio flows[38] as a percentage of GDP, changes in the logarithm of the KOSPI, changes in three-year[39] interest rate differentials between the U.S. and Korea[40], and changes in the logarithm of the won-dollar exchange rate. The sample includes monthly data from February 1999 to October 2022,

[36] The currency swap in September 2022 allowed the NPS to borrow from foreign reserves held by the BOK in exchange for its local currency holdings. The temporary deal would help the NPS to secure necessary funds for its overseas investment, while obviating NPS's need to obtain the dollar inthe local spot market. All the dollar withdrawals will be redeemed on expiration dates, and there will be no rollover.

[37] See Habib and Stracca (2011), Han and Westelius (2019), and Masujima (2019).

[38] This is based on the financial account from the monthly balance of payments published by the BOK.

[39] We have also estimated the model using two-year, five-year and 10-year interest rate differentials and decided to use the three-year interest rate differentials for a better fit.

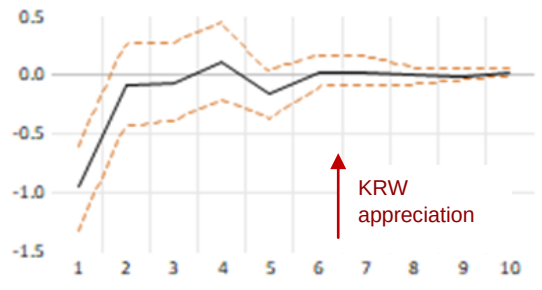
[40] The interest rate differential is defined as the U.S.'s interest rate minus Korea's interest rate.

sourced from Bloomberg, Haver Analytics and national authorities.[41] The dataset cannot be extended to cover the Asian financial crisis period in 1997-1998 as government bond yields are not available in Bloomberg. All the data series are stationary, and the lag-length criteria are selected based on the Akaike Information Criterion.

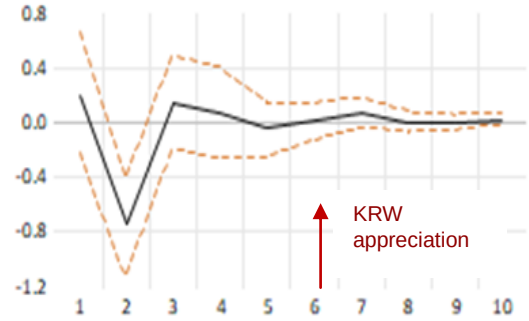
6. **Impulse response functions are plotted to gauge the dynamic impacts on won-dollar movements from each driver.** These impulse response functions can show the magnitude, time lags and persistence of such impacts. Overall, interest rate differentials, changes in risk perception, and the performance of the Korean equity market have significant impacts on the won-dollar rate, while the effects of current account and net portfolio investments are insignificant and smaller, respectively (Figure A1.2).

Figure A1.2. Korea: Impulse Response Functions
(full sample from February 1999 to October 2022)

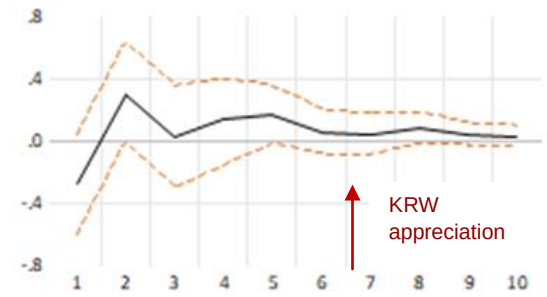
Response of USD/KRW to an increase in the VIX



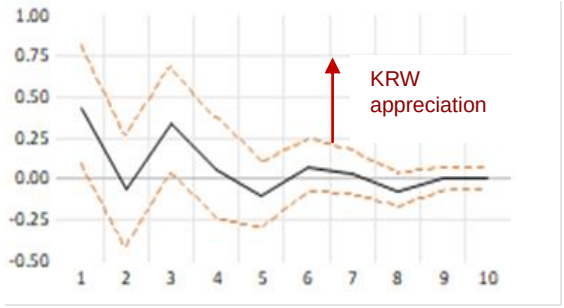
Response of USD/KRW to a widening of three-year interest rate differential



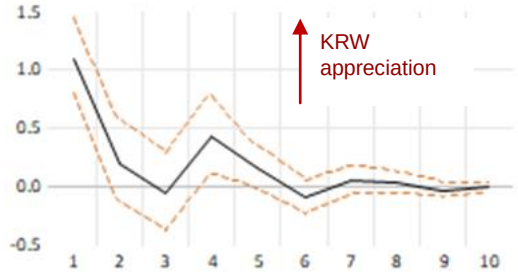
Response of USD/KRW to an improvement in current account balance



Response of USD/KRW to net portfolio inflows



Response of USD/KRW to an increase in KOSPI



Source: Bloomberg; Haver Analytics; national authorities; AMRO staff estimates

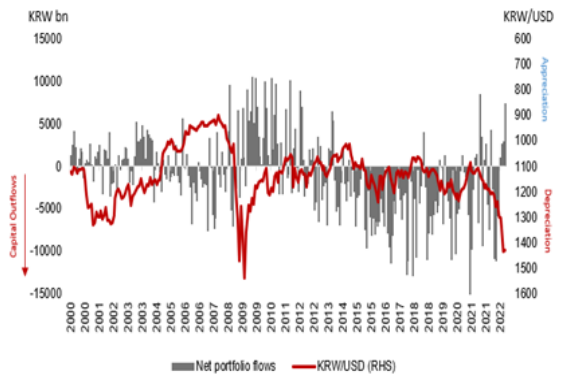
Note: The sample includes monthly data from February 2000 to October 2022. The x-axis represents the months and the y-axis represents percentage changes of the won in response to one standard deviation shock of each driver. The estimate is based on a generalized impulse response with a 95% confidence interval using Hall's percentile bootstrap with 9,999 bootstrap repetitions.

[41] Data on investor positioning, such as the speculative positioning provided by the CFTC, are not available. In addition, the selected drivers do not include peer currencies, such as the Chinese renminbi and the Japanese yen, both currency pairs are mostly linked via the trade channel and merchandised trades are part of the current account.

7. **When the three-year interest rate differential between Korea and the U.S. widens, the won-dollar rate tends to depreciate with a one-month lag (Figure A1.3).** Widening interest rate differentials prompted investors to move money to U.S. markets in search of safe assets and higher yields. This could heighten pressures on capital outflows, especially after the Korean capital market started gradually liberalizing in the 1990s. Capital outflows would then have implications for the exchange rate. The one-month lag could be explained by investors' portfolio adjustments.

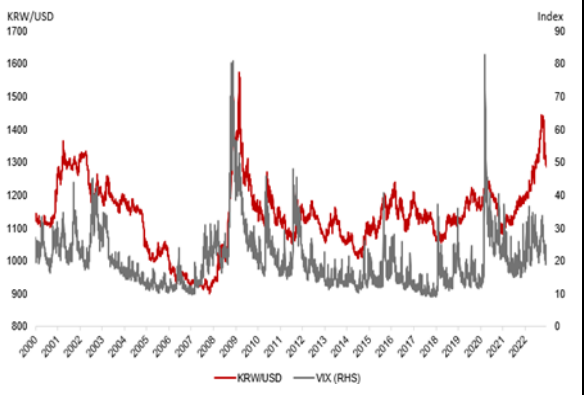
8. **The Korean won is sensitive to changes in global investor sentiment.** In particular, an increase of one standard deviation in the change in VIX, which represents heightened risk aversion, could lead to a depreciation of the won against the dollar in the first month.[42] Since the market generally sees the Korean won as a global currency in view of Korea's strong exports and deep integration into the global supply chain, the won could be quite sensitive to the dynamic shifting of investor sentiment (Figure A1.4). This contrasts with the Japanese yen in the region, which is generally viewed as a safe-haven currency and moves in the opposite direction to investor sentiment (Choi, et al, 2022).

Figure A1.3. USD/KRW and Net Portfolio Flows



Source: Bloomberg; Haver Analytics

Figure A1.4. USD/KRW and VIX



Source: Bloomberg

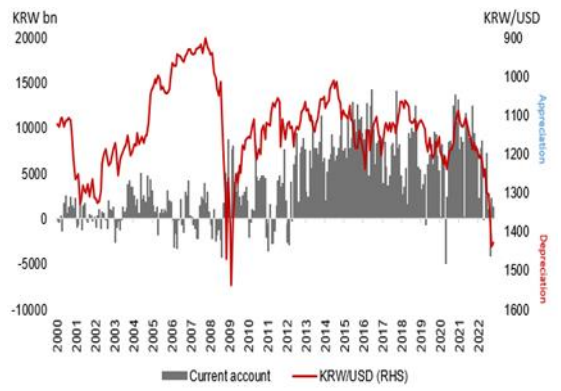
9. **Improvements in the current account can lead to an appreciation of the won with a one-month lag although the impact dampens quickly and is only marginally statistically significant (Figure A1.5).** This finding is in line with the observation that despite a long-running current account surplus and consequent increase in foreign exchange reserves, the won's gains against the dollar have been marginal (Yoon, 2019). With the increased openness of capital movements, the impact of the current account, especially the trade balance, could dwindle over time. In addition, as Korean companies become more global over time, revenues from exports may stay overseas instead of being repatriated home.

10. **The won is highly responsive to changes in the equity index, KOSPI (Figure A1.6).** Foreign investors owned more than 30 percent of Korean stocks in 2022, according

[42] Following Masujima (2019), we also conducted an additional exercise by estimating a safe-haven index based on the hypothesis that the violation of the uncovered interest rate parity condition makes the carry trade profitable on average. The model is specified as: $dln\left(\frac{KRW}{USD}\right)_t = \alpha + \beta_1(\Delta di_{USDKRW})_t + \beta_2 dln(VIX)_t + \varepsilon_t$. Daily data from 1990 is obtained with rolling samples of 250 days. The coefficient β_2 of the VIX is defined as the safe-haven index, in which $\beta_2 < 0$: "safe-haven" tendency, $\beta_2 > 0$: "vulnerable" tendency, $\beta_2 = 0$: fx movement does not follow a specific tendency. Consistent with the VAR model, the estimated results also suggest a vulnerable tendency of the KRW, in which the KRW often depreciates against the dollar when the VIX rises.

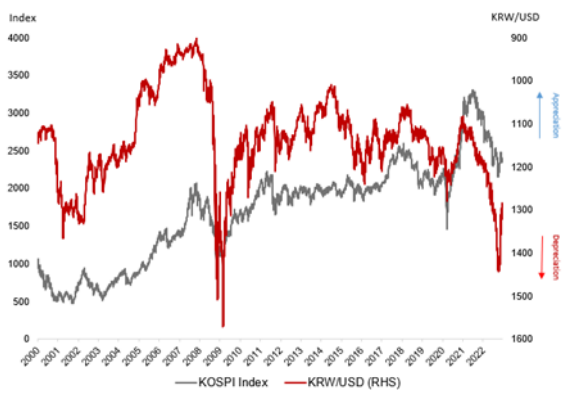
to data from the Korea Exchange. As they buy and sell equities in the Korean market and reallocate money in and out of the country, the exchange rate would be affected.

Figure A1.5. USD/KRW and Current Account



Source: Bloomberg; Haver Analytics

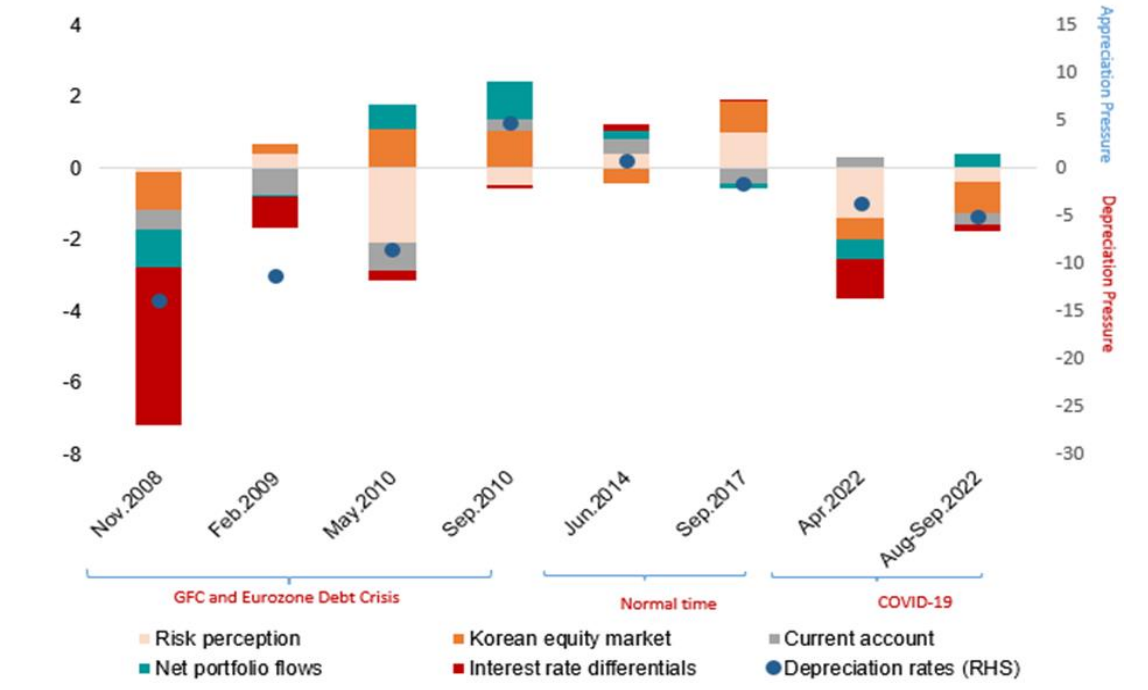
Figure A1.6. USD/KRW and Equity Index



Source: Bloomberg

11. **However, drivers of won-dollar movements change over time.** A historical decomposition is used to examine the contributions of each factor to won-dollar movements in each month. Figure A1.7 compares factors that caused exchange rate movements in selected periods during the pandemic, the Global Financial Crisis in 2008-2009, the early phase of the European Debt Crisis in 2010, and normal times. In the figure, a positive sign indicates appreciation pressure on the won, and vice versa.[43] Key findings include:

Figure A1.7. Drivers of Won-dollar Rate in Selected Months



Note: The selection of episodes is based on those months when the won rose or fell sharply against the dollar. The blue dots denote the actual monthly depreciation or appreciation. The cumulative impacts of these factors do not add up to the actual monthly depreciation or appreciation as, due to data limitations, the model does not capture some of the depreciation or appreciation pressure, such as intervention by the authorities and investor positioning.

Source: Bloomberg; Haver Analytics; national authorities; AMRO staff estimates

[43] The sign of the factor only provides information about the direction and magnitude of impacts.

a. The depreciation of the won in November 2008 during the Global Financial Crisis was broad-based, including widening interest rate differentials, deterioration in the current account balance, the equity market downturn and portfolio outflows. Comparatively, depreciation in the selected months during the pandemic was mostly due to increased risk aversion and a weak domestic equity market.

b. Likewise, during periods of appreciation pressure on the won, portfolio inflows and an increase in the equity index were the main drivers behind the appreciation in September 2010, while improvements in risk sentiment and the booming equity market drove up the currency in September 2017.

12. **The near-term outlook for the won-dollar exchange rate remains highly uncertain.** Interest rate differentials between the USTs and KTBs and the resultant concerns over capital flows would likely continue to be the main drivers behind near-term developments of the Korean currency. However, uncertainties surrounding monetary policy paths in Korea and the U.S. are expected to remain high in 2023. Risks to a weaker won could also come from the softening trade balance, which would in turn be due to high import prices and subdued external demand, a rebound of residents' overseas direct investments or portfolio investments, and worsening global investor sentiment triggered by, for instance, a deterioration of China-U.S. relations.

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2. Retail CBDC: What Can We Learn from the Bank of Korea's and Riksbank's Pilot Studies?[44]

Although payment systems of Korea and Sweden are already quite efficient, the changes in the payment landscape have driven authorities to explore the possibility of issuing its own retail digital currencies. Among advanced economies, these two countries focus primarily on issuing a retail Central Bank Digital Currency (CBDC) and have conducted pilot experiments. In this regard, this selected issue explores and draws lessons from their experiences of the CBDC pilot projects. We find that the distributed ledger technology has the limitation of scalability in supporting a high number of retail transactions. Moreover, both central banks still face challenges in protecting users' privacy, while pursuing effective AML/CFT enforcement.

Background of Bank of Korea's and Riksbank's Pilots

1. **The issuance of a CBDC is not urgent in Korea or Sweden, due to their high degree of financial inclusion and advanced digital payment systems.** In many countries, the primary objectives of issuing or exploring a CBDC are to enhance financial inclusion and to improve the efficiency and timeliness of payment services. However, these are not the main reasons in Korea or Sweden, where more than 95 percent of the population have access to banking (Figure A2.1). Moreover, Korea has a more than 90 percent of smartphone penetration rate. She is also the first country to launch a fifth-generation mobile network and ranks fourth in the world for mobile broadband[45], while Stockholm has the fastest growing number of tech startups and unicorns (Sokolnicki, 2022). With advanced digital infrastructure and financial technology, the payment systems of Korea and Sweden are also well developed and provide a wide range of services to serve the growing sophistication of economic activities.

2. **That said, due to various developments in the financial landscapes of Korea and Sweden and many central banks' growing interest in CBDCs, the Bank of Korea (BOK) and the Riksbank have stepped up efforts during the past few years to explore their own digital currencies.**

- Both countries have moved toward a cashless society. Digital finance has grown very fast in tandem with smartphone penetration and e-commerce, especially during the pandemic. More than 80 percent of Korean and Swedish people actively use internet banking in their daily transactions.46 As point-of-sale (POS) terminals are available in all retail stores and restaurants, more shops are refusing cash payment.
- Big tech firms and non-banks dominate the market of retail payment services in both countries. In Korea, tech firms such as KakaoPay, NPay and SamsungPay are among prominent players the digital payment market.[47] The growing role of

[44] Prepared by Wanwisa May Vorranikulkij, Senior Economist.

[45] The speeds are up to 125.17 Mbps, according to Speedtest Global Index.

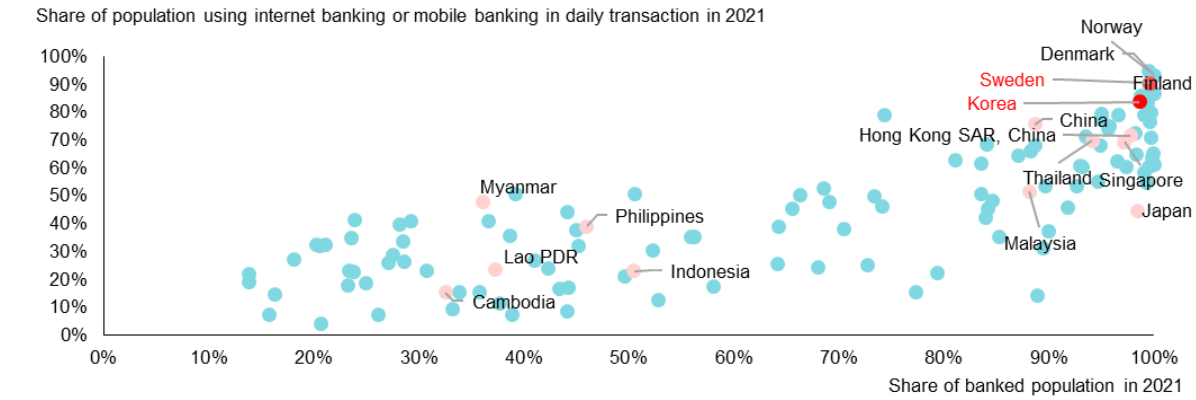
[46] The World Bank's Global Findex Database 2010.

[47] Based on a 2020 survey on preferred payments method among Koreans, conducted by Rapyd Financial Network (2016) Ltd.

these tech firms and private-sector players poses concerns about their control over market competition and the possible misuse of the data of individual consumers.

- In Korea, the digital asset market has evolved very rapidly. Young people invested actively in cryptocurrencies before the collapse of Terra-Luna and FTX in 2022.
- While financial technology is advancing, the Korean and Swedish financial systems are exposed to rising cases of money laundering and intensifying cyber security threats, such as private data breaches and cryptojacking.
- Many central banks are embracing a digital currency. To date, 114 central banks are exploring having their own CBDC, up from 35 countries in 2020.[48] Six economies in the ASEAN+3 region are conducting pilot experiments, while most OECD members have reached the development stage. (Table A2.1)

Figure A2.1. Banking and Digital Banking Penetration



Source: World Bank

Table A2.1. CBDC Research in ASEAN+3 Region and OECD Countries

Economy	Use case[1/]	Status				Architecture [2/]	Underlying technology [3/]	Cross-border project
		Research	Development	Pilot	Inactive			
ASEAN+3 Region								
Korea	Retail			●		Intermediated	DLT	
Cambodia	Retail		●			Intermediated	DLT	
China	Both			●		Intermediated	Both	mCBDC bridge
Hong Kong, China	Both			●		Intermediated	Undecided	mCBDC bridge
Indonesia	Both		●			Undecided	Undecided	
Japan	Both		●			Intermediated	Undecided	Project Stella
Lao PDR	Both	●				Undecided	Undecided	
Malaysia	Wholesale			●		Undecided	Undecided	Project Dunbar
Myanmar	Undecided	●				Undecided	Undecided	
The Philippines	Retail	●				Undecided	Undecided	
Singapore	Wholesale			●		Undecided	Undecided	Project Dunbar
Thailand	Both			●		Intermediated	Both	mCBDC bridge
Vietnam	Undecided	●				Undecided	Undecided	
OECD members								
Australia	Both		●			Undecided	Undecided	Project Dunbar
Austria	Wholesale		●			Undecided	DLT	
Canada	Both		●			Intermediated	Undecided	Project Jasper

[48] Atlantic Council

Economy	Use case[1/]	Status				Architecture [2/]	Underlying technology [3/]	Cross-border project
		Research	Development	Pilot	Inactive			
Chile	Retail	●				Undecided	Undecided	
Colombia	Undecided	●				Intermediated	Undecided	
Czech Republic	Undecided	●				Undecided	Undecided	
Denmark					●			
Estonia	Retail		●			Intermediated	DLT	Digital Euro
Finland	Retail		●			Intermediated	Both	Digital Euro
France	Both		●			Undecided	Undecided	Digital Euro
Germany	Undecided		●			Intermediated	Both	Digital Euro
Hungary	Retail	●				Undecided	Undecided	
Iceland					●			
Israel	Retail		●			Intermediated	Both	
Italy	Undecided		●			Intermediated	Both	Digital Euro
Lithuania	Retail		●			Undecided	Undecided	
Mexico	Retail	●				Undecided	Undecided	
Netherlands	Retail		●			Intermediated	Both	Digital Euro
New Zealand	Retail	●				Undecided	Undecided	
Norway	Retail		●			Undecided	Undecided	Project Icebreaker
Sweden	Retail			●		Intermediated	DLT	Project Icebreaker
Switzerland	Wholesale		●			Undecided	Undecided	Project Helvetia, Project Jura, Project Mariana
Turkey	Retail		●			Undecided	DLT	
United Kingdom	Both		●			Intermediated	Undecided	
United States	Both		●			Intermediated	Undecided	

Note: 1/ Uasge or purpose of CBDC is categorized into retail and wholesale CBDC.
2/ Architecture is categorized into: (i) direct CBDC, which a CBDC is a direct claim to a central bank and the central bank is directly in charge of the retail transactions; (ii) intermediate CBDC, which a CBDC is a direct claim to a central bank, while payments and transactions are managed by financial institutions; and (iii) synthetic CBDC, whose claims are not directed to a central bank, but become a liability of financial institutions instead.
3/ Underlying technology refers to either conventional centrally controlled infrastructure or distributed ledger technology (DLT).

Source: Atlantic Council (December 2022); AMRO staff

BOK's and Riksbank's Pilot Projects: Similarities and Differences

3. **The BOK and Riksbank started conducting CBDC research in early 2020.** The Riksbank began its e-krona pilot project in February 2020 and concluded the second phase in April 2022. The BOK set up the CBDC unit in 2020, then conducted its pilot experiment from August 2021 to June 2022.[49] Both projects focused on developing a retail CBDC based on distributed ledger technology (DLT)[50] Local commercial banks and tech firms were selected to participate in the experiments. Although both central banks are continuing research to investigate the technical and legal details of a retail CBDC, they have not yet decided to issue a digital currency, nor adopted a specific technology or changed any laws and regulations.

[49] The pilot experiment lasted 10 months, and was composed of two phases. The first phase was done during August 23–December 22, 2021. The second phase was done from December 23, 2021 to June 22, 2022.

[50] In Korea's project, the technology and infrastructure are developed by the BOK in collaboration with Samsung, Ground X (as an executor) and local commercial banks. For Sweden's experiment, Riksbank built the e-krona network in the Corda platform, which is a tokenized DLT platform used for transferring digital assets and is not specifically designed to manage CBDC. A special platform – called the 'e-krona engine' with the specifications and configuration of a CBDC – would be developed later if Riksbank issued its own digital currency.

4. **The pilot studies thus far have mainly focused on two-tier retail CBDC.** Both central banks chose a two-tier distribution model that replicates physical cash transactions (Box A2. Architecture Designs of CBDC). Under this framework, the central bank keeps wholesale ledgers and independently operates distributed ledger network. It also manufactures and distributes a digital currency to participating intermediaries in the central bank's payment and settlement network. Meanwhile, intermediaries, namely financial institutions and payment service providers, deal with the public who are the end-users, with intermediaries in charge of creating digital wallets and conducting know –your-customer (KYC) checks (Figure A2.2). In this model, CBDC remains a liability of the central bank, but the bank does not have to record the balance of retail transactions. An end-user can exchange his/her CBDC with his/her intermediary, which can then redeem the digital currency at the central bank. In particular, the BOK's pilot recorded all transactions in a single distributed ledger (a hybrid distribution model).

5. **Both pilot projects simulated basic and extended functions, with some variations (Table A2.2).** Both central banks simulated basic functions of CBDC, including manufacturing, issuance, distribution, redemption and verification, in the first phase of their pilot studies. Riksbank also conducted a legal analysis on the legal status of the e-krona and anti-money laundering and counter-terrorism financing (AML/CFT) regulations. In the second phase, the BOK extended the functions of leasing to offline transactions, cross-border remittance, the purchase of non-fungible tokens, interest-bearing functions, compliance with AML/CFT regulations, and zero-knowledge proof (ZKP) technology.[51] Meanwhile, Riksbank tested offline transactions, aliases, integration with POS terminals, and integration of the e-krona network with participating intermediaries' internal systems. Both pilot projects found that basic functions and offline transactions could operate successfully, but some extended functions had limitations, which will be discussed in the next section.

Table A2.2. Summary of BOK's and Riksbank's Pilot Projects

CBDC	Scope of Research		Participants
	Phase 1	Phase 2	
BOK	**Technical work: testing basic functions** • Manufacturing • Issuance • Distribution • Disposal/redemption • Adjustment of participating financial institutions' balance and reserves at BOK • Validation and verification of e-won authenticity Digital wallet management by participating intermediaries	**Technical work: testing extended functions** • Performance test • Offline transaction • Cross-border remittance • Digital asset transaction • Personal information protection using zero-knowledge proof technology • Monetary policy support comprising interest payment and deduction • Support for court enforcement such as account seizure	• 15 financial institutions[52] • Ground X (main operator) • Other non-bank firms including tech firms, private payment service providers and business consultancies.[53]
Riksbank	**Technical work: testing basic functions** • Manufacturing • Issuance	**Technical work: testing extended functions** • Performance test • Offline transaction	• Handelsbanken • Tietoevry

[51] ZKP technology can verify the owner of a CBDC without revealing the person's identity.

[52] Kookmin Bank, Shinhan Bank, Woori Bank, Hana Bank, Nonghyup Bank, Industrial Bank of Korea, Suhyup Bank, Busan Bank, Gyeongnam Bank, Daegu Bank, Gwangju Bank, Jeonbuk Bank, Kakao Bank, K Bank, and Korea Financial Telecommunications and Clearings Institute (KFTC)

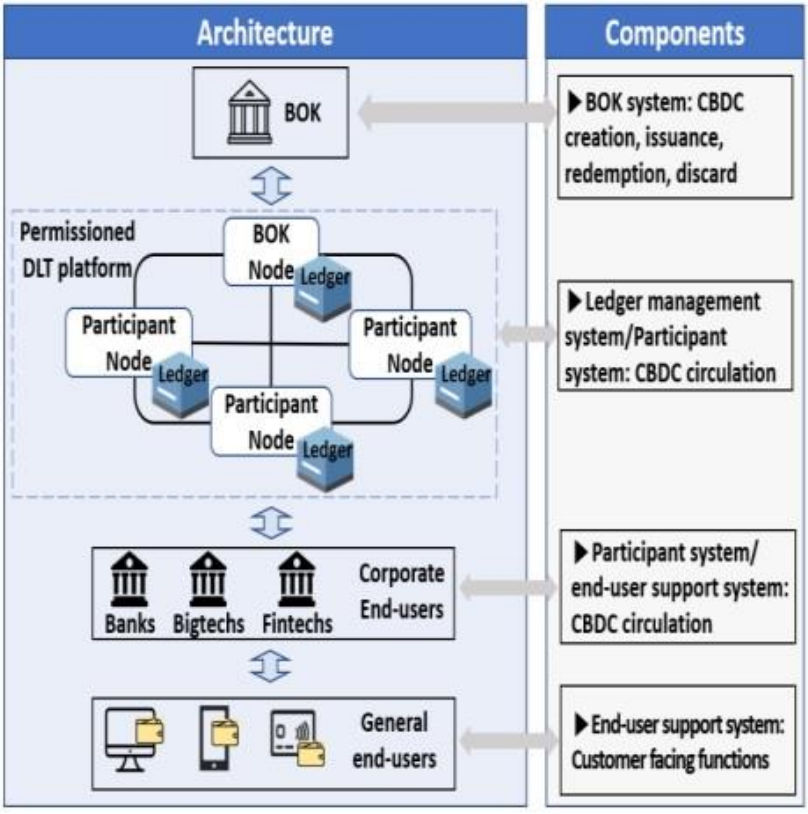
[53] Samsung Electronics, KPMG, Kakao Bank, Kakao Pay, S-core, Konai, Dream Security, Zcrypto, Onther, Ngle, and Consensus

	• Distribution • Disposal/redemption • Adjustment of participating financial institutions' balance and reserves at Riksbank • Validation and verification of e-krona authenticity • e-kronar storage in either payment instrument or participating intermediary's node. • Monetary policy support comprising interest payment and deduction **Legal analysis** • Legal status of e-krona as means of payment • Legal basis to conduct AML/KYC	• Integration between e-krona network and participating intermediaries' internal customer, account, payment, and AML systems • Alias for addressing e-krona wallets • Interoperability with POS terminal **Legal analysis** • Formation of legal principles for e-krona as electronic form of cash • Further investigation on how existing laws and regulations about financial confidentiality and data protection relate to DLT/blockchain technology	

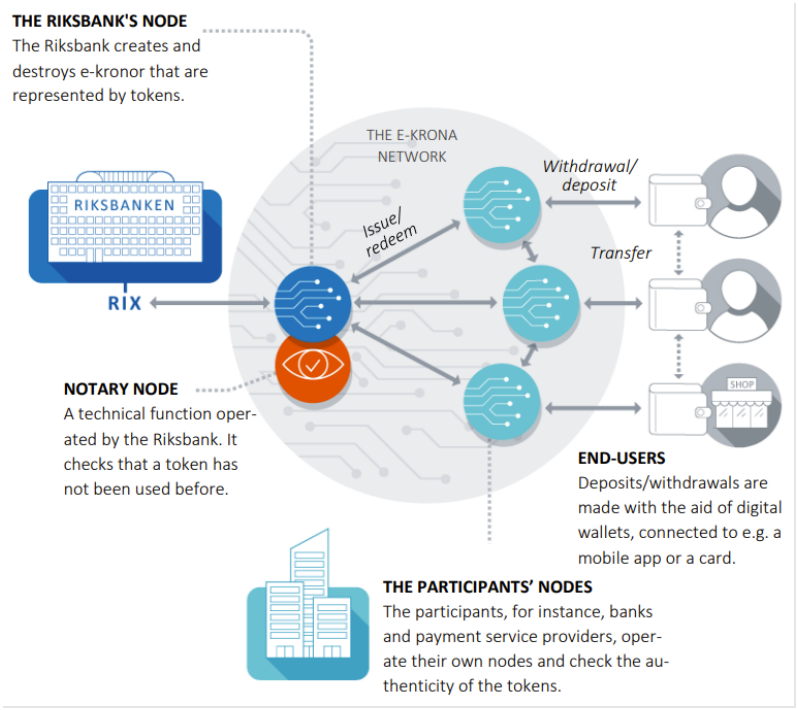
Source: Bank of Korea; Riksbank of Sweden; AMRO staff

Figure A2.2. Distribution Models

[Bank of Korea]



[Riksbank]



Source: Bank of Korea; Riksbank of Sweden

Key Takeaways from Both Pilot Projects

6. **The technical solutions based on DLT has the limitation in their scalability to perform retail payments.** Both pilot projects found that DLT technology worked well when the transactions were simple and involved small amounts. But, when the tests became more complex and closer to real-world payments in terms of the sophistication of the transactions and volume, the systems took a long time to complete the transactions. The BOK pilot project found that the simulation test took up to one minute more in processing time under a peak-period scenario, while existing payment systems took only 1-2 seconds.[54] Meanwhile, Riksbank found that the system took significantly longer to finalize the wallet balance when the test simulated situations of many tokens being used simultaneously, long transaction chains, or many tokens coexisting in a single wallet.

7. **It remains challenging to strike a balance between protecting users' financial confidentiality while complying with AML/CFT regulations and allowing for effective law enforcement.**

- In the BOK's pilot project, the ZKP technology prolonged the processing time of each individual transaction. Moreover, the encryption technology is not yet certified by Korea's National Cyber Security Center.
- As far as identity and privacy are concerned, the BOK test allowed anonymous wallets, available only in offline transactions, to contain small sums. The test found

[54] Test performance decreased by 10 percent and response time increased when the number of users rose from 500,000 to 10 million, or when the number of nodes rose from four to 30.

it was hard to conduct certain functionalities that were by court orders such as account freezing and asset seizure

- Meanwhile, Riksbank recommended restricting the size of offline transactions and using offline transactions with authorized payments only or linking a CBDC wallet with a bank account.

8. **Using CBDC in retail commerce requires preparation.** The Riksbank simulation could physically integrate e-krona payments with POS terminals. However, to implement this in the real world, the central bank must develop its own software and security solution that can link CBDC payments with all payment instruments, which all have different technological and IT standards. The complexity would increase in the case of cross-border remittances and payments. The central bank must also collaborate with retail trade operators, besides banks and payment service providers, the preparation for the use of a CBDC.

9. **In-depth legal analysis should be done before issuing a CBDC.**

- *Legal status of a CBDC.* If a token is regarded as a means of payment with an independent value, the e-krona may adopt the same legal principles as cash. However, if the CBDC is interest-bearing, it could be considered as a claim in the legal sense, which is subject to statutory limitation provisions. Different designs would have different legal implications and would thus lead to the amendment of different regulations.

- *Data protection.* Riksbank's legal analysis found that it was unclear how existing laws and regulations on financial confidentiality and personal data protection would apply to DLT/blockchain technology. For example, the data relevant to a transaction chain might or might not be considered as data that is subject to data protection regulations.

Policy Recommendation and Consideration

10. **It is worthwhile exploring synthetic CBDC in the next phase of the pilot studies.** As the hybrid distribution model with DLT/blockchain technology is limited in its ability to support retail payments, the experiments may consider testing CBDC-backed e-money. Relative to other two-tier models, a central bank does not have to handle retail transactions or safeguard users' financial confidentiality (HKMA, 2021). Moreover, a synthetic CBDC offers users more safety, stability and consumer protection, compared with privately issued stablecoins.

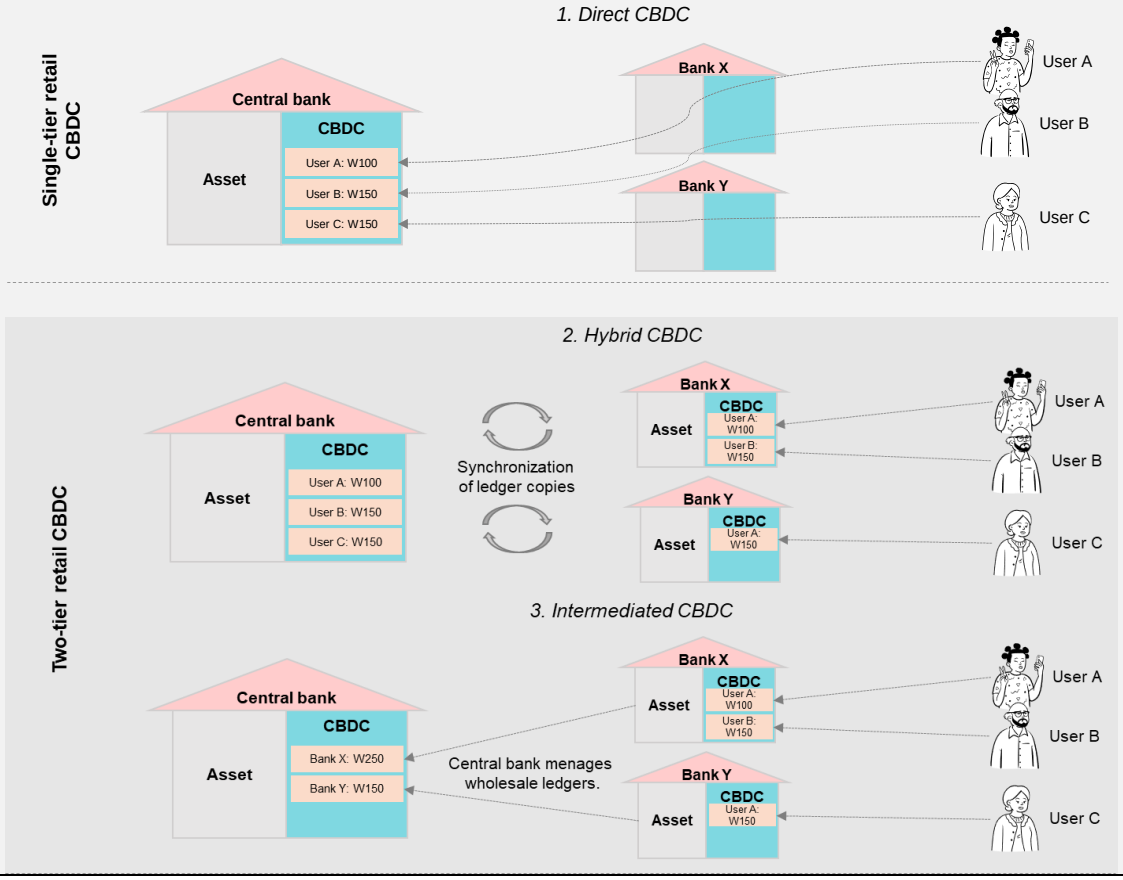
Box A2. Architecture Designs of A CBDC

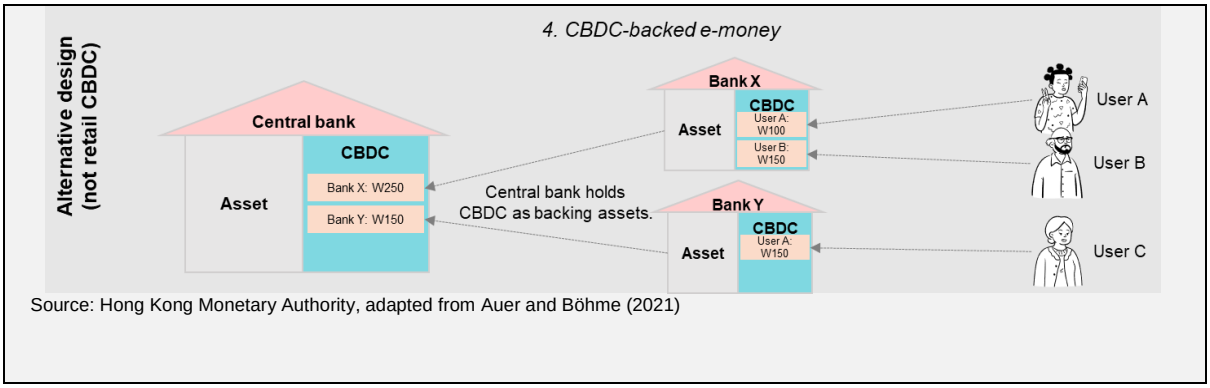
The CBDC architecture consists of two designs – direct and indirect – based on the structure of legal claims, and the data recorded by the central bank (HMKA, 2021). In a direct or one-tier CBDC model, the CBDC is a direct claim on the central bank. The central bank is in charge of operational tasks, including account opening, recording and updating balances of all retail users, account owner validation and authentication, and other day-to-day services. Meanwhile, in an indirect or two-tier CBDC model, users are making a claim on financial intermediaries, usually a commercial bank, while the central bank only maintains wholesale accounts. The central bank holds a wholesale ledger and focuses on infrastructure, while delegating most of the operational tasks to financial intermediaries.

According to Auer and Böhme (2021) and the HKMA (2021), four distribution models are:

1. *Direct CBDC* is the model in which the central bank operates the whole system itself by developing and maintaining infrastructure, at the same time handling retail transactions. The involvement of private intermediaries is marginal.
2. *Hybrid CBDC* is still a claim on the central bank. Private financial intermediaries process and handle retail transactions, while the central bank keeps records of retail balances for privacy and data security purposes.
3. *Intermediated CBDC* is also a claim on the central bank but it is an alternative to hybrid CBDC. The central bank does not record retail data, which are instead collected and maintained by financial intermediaries. The central bank maintains only records of wholesale transactions.
4. *CBDC-backed e-money* is not a direct liability of a central bank. It is a digital money issued by financial intermediaries and backed by CBDC. This model is also called synthetic CBDC.

Figure A3.1. Distribution Models





Source: Hong Kong Monetary Authority, adapted from Auer and Böhme (2021)

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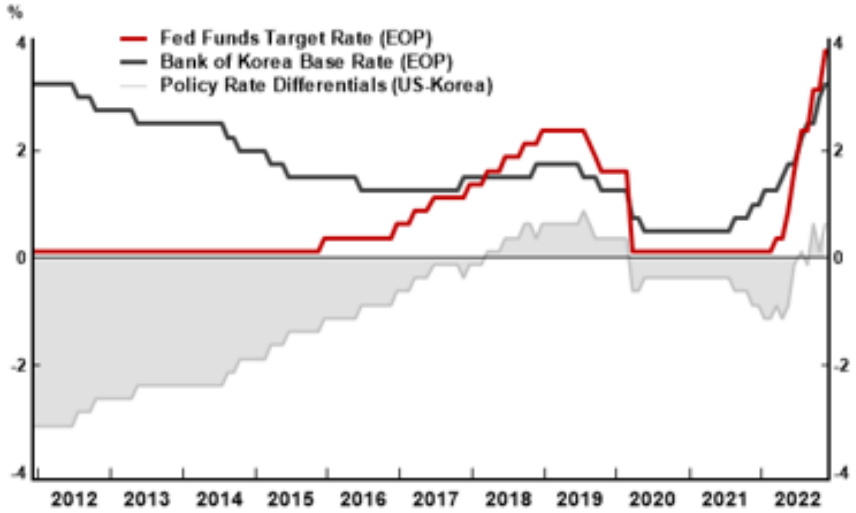
3. Impact of Fed Hikes on Korea and BOK's Optimal Policy Response[55]

As a small open economy, monetary tightening by the Fed could have negative impacts on the Korean economy through multiple channels including the real output, prices, and balance of payments. In this study, we employ the AMRO Global Macro-Financial (DSGE) Model to simulate the impact of Fed rate hikes on the Korean economy and further explore the optimal rule-based policy response by the BOK, taking into account trade-offs between policy objectives. The study shows that the BOK's monetary policy path is not independent of the Fed's. More aggressive Fed hikes would pressure the BOK to follow suit to prevent interest rate differentials from being too wide and would have larger impacts on real GDP and consumer price inflation.

1. **The Fed has been raising interest rates sharply to contain the rapid rise of inflation**. With unexpectedly high and persistent inflation in the U.S., the Fed increased the (mid) policy rate to 3.875 percent in November from 0.125 percent at the beginning of 2022, including four large increases of 75 basis points each (Figure A3.1). The quick shift in monetary policy stance and forward guidance led to heightened market volatilities, evidenced by a sharp repricing of global assets and a strong U.S. dollar as investors moved into safe USD-denominated assets amid a risk-off environment.

2. **As an open market economy, Korea is sensitive to unexpected shifts in the U.S. monetary policy stance.** The risk of significant capital outflows and an excessively weak currency in part pressured the BOK to follow the Fed's actions and accelerate monetary tightening domestically. According to Tan (2022), the strong dollar and rising U.S. government bond yields following the Fed's aggressive monetary tightening could exert non-trivial pressure on capital outflows from Korea. This contributed to the BOK's policy rate hikes of a total of 200 basis points in 2022, including two big increases of 50 basis points each in July and October (Figure A3.1). As a result, domestic financial conditions became tight and stress in some market segments started to appear. Moreover, the Fed's aggressive monetary tightening raised concerns over the risk of an economic recession in the U.S. and the European Union, as well as weaker demand from other major economies, thereby adversely affecting Korea's exports.

Figure A3.1 Monetary Policy Rates in Korea and U.S.



Note: EOP denotes end of period.
Source: U.S. Federal Reserve Board, BOK, Haver Analytics

[55] Prepared by Alex Liyang Tang, Economist, and Kimi Xu Jiang, Economist.

3. **Against this backdrop, the current selected issue studies the impacts of the Fed's monetary policy tightening on the Korean economy and the BOK's optimal rule-based policy responses under different policy paths taken by the Fed.**[56] A large-scale and micro-founded dynamic stochastic general equilibrium (DSGE), namely the AMRO Global Macro-Financial (DSGE) Model (the AGMFM), is employed to simulate the impact of Fed rate hikes on the Korean economy. As described in detail in Tang (2022), the AGMFM, which covers 48 economies including all 14 ASEAN+3 economies, contains a detailed characterization of global trade, international direct investment, and international interbank, money, bond and equity markets. It also models real economy and financial linkages across countries.

4. **The AGMFM includes economy-level parameters, industry-level parameters and other parameters, such as the discount factor, persistence of consumption habit, and elasticities.** The calibration or estimation of each parameter is briefly described as follows, as in Tang (2022): the calibration or estimation of most economy parameters mainly draws on information from national statistics via Haver Analytics or the CEIC database, and from international organizations' reports, statistics and tools, such as the AMRO Taylor rule tool and the IMF report on exchange arrangements (AMRO 2019; IMF 2022). Industry parameters are all calibrated or estimated based on the OECD Inter-Country Input-Output (ICIO) tables (OECD 2021). Other parameters derive their values mainly from literature on DSGE model design and estimation (Vitek 2018; Tang 2022).

5. **For each economy represented in this model, the economic sectors include households, labor supply, construction, production, banking, foreign exchange, exports, imports, balance of payments, government, and a virtual "absorption sector" to form a closed loop of national accounting**. See sections II and III in Tang (2022) for details. The dynamic cross-economy and cross-sector interaction mechanisms in the model are briefly described as follows:

- All sectors, except the government sector, of all economies in the AGMFM will determine their equilibrium prices and quantities under rational expectations in each quarter.
- The government sector of each economy, including the monetary, fiscal and macroprudential authorities, is going to make rule-based optimal policy responses, and the policy rules are different from economy to economy. Taking Korea as an example, the BOK uses a specific Taylor rule to determine its optimal policy response, taking into account current domestic inflation developments, the real GDP growth rate, and short-term interest rate adjustment pressure from the external world, such as from Fed rate hikes.
- In this simulation, all private and public sectors of all the economies make their optimal quantity, price and policy choices based on interaction with other domestic sectors. For example, the labor supply sector interacts only with other domestic sectors. Sometimes, sectors of other economies, for instance, the banking sector or the production sector, interact with both domestic and foreign sectors in an uncertain macroeconomic and financial environment mainly caused by Fed rate hikes.

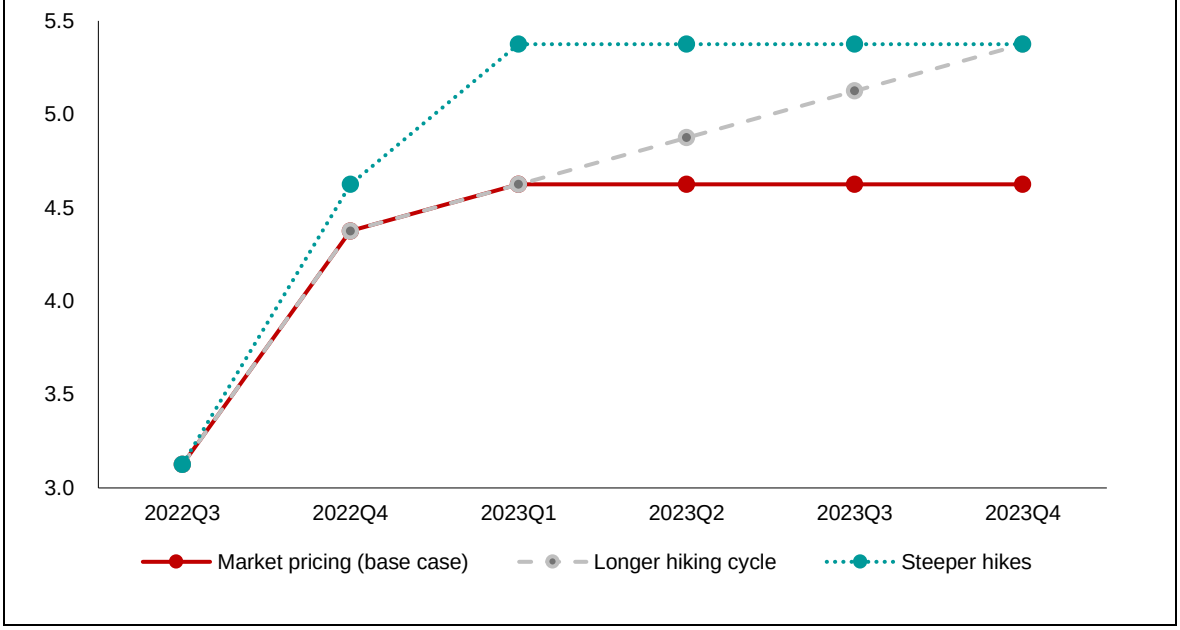
[56] Market expectations of the Fed's monetary policy path have been volatile. The current analysis is done based on information as of October 2022. As this study aims to obtain a theoretical understanding of the impacts (in relative terms, namely deviation from the benchmark of no more hikes) on the Korean economy and monetary policy under hypothetical scenarios, the actual and expected future monetary policy paths between the time of writing and the time of publication will differ.

A tree diagram shown in Tang, et al (2023) systematically and comprehensively describes how the impacts of Fed rate hikes are transmitted step by step to almost all major macroeconomic and financial variables in the Korean economy within the AGMFM.

6. **We extract the following three main transmission mechanisms** from the systematic and comprehensive transmission mechanism described in Tang, et al (2023). All three could be directly linked to specific policy objectives.

- **Real output transmission channel:** this channel transmits the impact of Fed rate hikes via numerous economic channels.[57] Since the overall loss can be understood as being concentrated on real GDP growth, we discuss the impact on the whole Korean economy through this real economy transmission mechanism by simply focusing on the policy objective of real GDP growth.
- **Price transmission channel:** in this channel, the impact of Fed rate hikes is transmitted to domestic interest rates and prices.[58] Since the ultimate losses are mainly reflected in increased inflation or deflation, the overall impact on Korea through this price transmission mechanism can be discussed simply by focusing on the policy objective of the expected consumer price inflation.
- **Balance of payments (BOP) transmission channel:** through this channel, Fed rate hikes would first lead to a depreciation of the Korean won against the U.S. dollar, then the trade balance, current account balance, capital and financial account balance, and finally net foreign asset position of the Korean economy. For this BOP transmission channel, we focus on the short-term interest rate gap between Korea and the U.S, as it is one of the key drivers for capital flows and the USD/KRW exchange rate.

Figure A3.2. Scenarios on Future Path of Fed Rate Hikes
(Percentage point, end of period)



[57] Including private and public consumption, private investment and capital stock for the production and construction sectors, public investment and capital stock, total imports and exports, total domestic demand, the housing stock, mortgage and corporate loans, bank retained earnings and bank balance sheet, the labor force and unemployment, real GDP and potential output, the fiscal balance and the government balance sheet, et al., of the entire Korean economy.

[58] Including the BOK's policy rate, short-term and long-term interest rates and bond yields, corporate equity prices, mortgage and corporate loan rates, portfolio and property returns, private capital and bank capital prices, housing and rental prices, export and import prices, output and consumption prices, core inflation, wage level, et al., of the Korean economy.

Note: Market pricing refers to policy rates implied from Federal Funds futures, based on data as of October 2022. The reason for not removing the uncertainty of the market's expectations of the Fed's 2022 year-end policy rate by October 2022, rather than adopting the actual policy rate at the end of 2022, is explained in detail in footnote 2. The two alternative scenarios assume a higher terminal rate of 5.375 percent, but with different paths leading to it. The "longer hiking cycle" scenario assumes a gradual increase of the mid-Federal Funds rate to reach the terminal rate, while the "steeper hikes" scenario assumes steeper policy rate hikes until Q1 2023 and then a pause in the hiking.

Source: U.S. Fed, AMRO staff estimates

7. **Three scenarios of Fed rate hikes are considered in Figure A3.2**. The base case considers market consensus pricing as of October 2022 as mentioned in footnote 65, which expects that the Fed hikes will pause for the remainder of 2023 after a final 25 basis point increase in Q1 2023, bringing the terminal rate to 4.625 percent. The two alternative scenarios both assume a higher terminal rate of 5.375 percent, but with different paths and thus varying economic impacts, potentially due to the different trajectories of U.S. inflation and employment developments. The first alternative scenario assumes a gradual increase of the mid-Federal Funds rate to reach the terminal rate, while the second alternative scenario assumes steeper policy rate hikes until Q1 2023 and then a pause in the hiking. These scenarios are considered as exogenous shocks that will simulate how far and how fast this multi-economy, multi-sector global macroeconomic and financial system within the AGMFM would be affected by the Fed's policy rate hikes, to which all other economies' rule-based policies respond accordingly in order to minimize losses on their various policy goals.

8. **The BOK is assumed to use the following Taylor Rule[59] developed by AMRO staff *(AMRO 2019)* to determine the policy interest rate for each quarter in response to Fed rate hikes through the above-mentioned main transmission channels:**

$$\hat{i}^{P}_{KR}(t) = 0.83 * \hat{i}^{P}_{KR}(t-1) + (1-0.83)\left[0.67 * E_t\hat{\pi}^{C}_{KR}(t+1) + (\frac{0.21}{4}) * \ln\hat{\hat{Y}}_{KR}(t) + 0.59 * \left(\hat{i}^{S}_{US}(t) - \hat{i}^{S}_{KR}(t)\right)\right] + \hat{v}^{i^P}_{KR}(t)$$

Here, $\hat{i}^{P}_{KR}(t)$ and $\hat{i}^{P}_{KR}(t-1)$ are the BOK's policy interest rates in the current and previous periods. $E_t\hat{\pi}^{C}_{KR}(t+1)$ is the expected consumer price inflation (namely inflation expectation), and based on the definition in the AGMFM, this consumer price inflation is closer to core inflation than headline inflation. $\ln\hat{\hat{Y}}_{KR}(t)$ is the contemporaneous output gap of the Korean economy, $\hat{i}^{S}_{US}(t)$ is the current-period three-month U.S. T-Bill yield, $\hat{i}^{S}_{KR}(t)$ is the current-period three-month Korean T-Bill yield, and $\hat{v}^{i^P}_{KR}(t)$ is the contemporaneous monetary policy exogenous shock. All variables in the above formula adopt their linear deviation form or logarithmic deviation form relative to their steady-state value, so the above formula does not need to consider the constant term. Using data from Q1 2003 to Q3 2022, AMRO estimates the weights[60] for the expected inflation, reflecting vulnerability to the price

[59] As a comparison, the standard Taylor rule which is used to guide policy rate determination from literature, and is typically used by economies that opt for a flexible inflation-targeting regime (Vitek 2018; IMF 2022), takes the following form: $\hat{i}^{P}_{i}(t) = \rho^{i}\hat{i}^{P}_{i}(t-1) + (1-\rho^{i})\left(\xi^{\pi}E_t\hat{\pi}^{C}_{i}(t+1) + \xi^{Y}\ln\hat{\hat{Y}}_{i}(t)\right) + \hat{v}^{i^P}_{i}(t)$. Here $\hat{i}^{P}_{i}(t)$ and $\hat{i}^{P}_{i}(t-1)$ are the policy interest rates in the current and previous periods, $E_t\hat{\pi}^{C}_{i}(t+1)$ is the expected future consumer price inflation, $\ln\hat{\hat{Y}}_{i}(t)$ is the contemporaneous output gap, and $\hat{v}^{i^P}_{i}(t)$ is the contemporaneous monetary policy exogenous shock. All variables in the above formula adopt their linear deviation form or logarithmic deviation from relative to their steady-state value, so the above formula does not need to consider the constant term. ρ^{i}, ξ^{π} and ξ^{Y} are, respectively, the weight before the previous-period policy rate, the weight before expected inflation, and the weight before the output gap.

[60] Weights before Various Policy Objectives Considered in the Rule-based Policy Response

transmission channel; the output gap, reflecting vulnerability to the real economy transmission channel, divided by four because the AGMFM does a quarterly simulation; and the short-term interest rate differentials, reflecting vulnerability to the BOP transmission channel.

9. **Based on the above rule-based policy responses to Fed rate hikes and the corresponding transmission channels, the AGMFM calculates the future paths of the BOK's policy rate paths, as well as the corresponding economic impacts** on real GDP growth, consumer price inflation (inflation expectation consistent with the real path of inflation), and short-term interest rate gap between Korea and the U.S., under various scenarios of Fed policy rate hikes. These impacts would be compared against the impacts under the case where the Fed would not make more policy rate hikes from Q4 2022 onwards.

10. **Under various scenarios of Fed rate hikes, the BOK's policy rate hike would partially follow the Fed's path, mainly to compromise between reducing the negative impact of the short-term interest rate gap between Korea and the U.S on the capital outflows, and maintaining GDP growth and controlling inflation in the Korean economy.** The range and speed of the BOK's rate hike in each stage are almost in proportion to the Fed's, as shown in Figure A3.3. In particular, further rate hikes by the Fed from Q4 2022 would prompt the BOK to opt for relatively smaller hikes under all scenarios. In addition, the BOK will start to lower the policy interest rate earlier when the Fed no longer raises policy rates to support the economy, under both the base case scenario and the steeper hikes scenario.

11. **As a result, the short-term interest rate gaps under different scenarios of Fed policy hikes are generally widening over time except for Q4 2023 under the base case scenario**, as shown in Figure A3.4.

- Under the base case scenario, the short-term interest rate gap between Korea and the U.S. would increase to 0.94 percentage point in Q3 2023 from 0.62 percentage points in Q4 2022, before narrowing to 0.85 percentage point in Q4 2023, as the Fed will not further raise policy rates.
- Under the scenario of a longer hiking cycle with gradual Fed policy hikes, the interest rate gap would monotonously peak at 1.39 percentage points in Q4 2023 from 0.62 percentage point in Q4 2022.
- Under the scenario of steeper hikes with the Fed rate rising most steeply at the beginning and then remaining unchanged, the short-term interest rate gap would peak at 1.42 percentage points in Q4 2023 from 0.72 percentage point in Q4 2022, similar in trend to the path under the longer hiking cycle scenario, but with a sharper increase from Q4 2022 to Q1 2023.

	Weight before output gap	Weight before inflation expectation	Weight before short-term interest rate gap
Standard	0.50	2.00	None
KR	0.21	0.67	0.59

Source: Vitek 2018, Tang 2022, AMRO staff estimates
Note: Standard = Standard Taylor rule typically used by economies that opt for flexible inflation-targeting regime, KR = Korea.

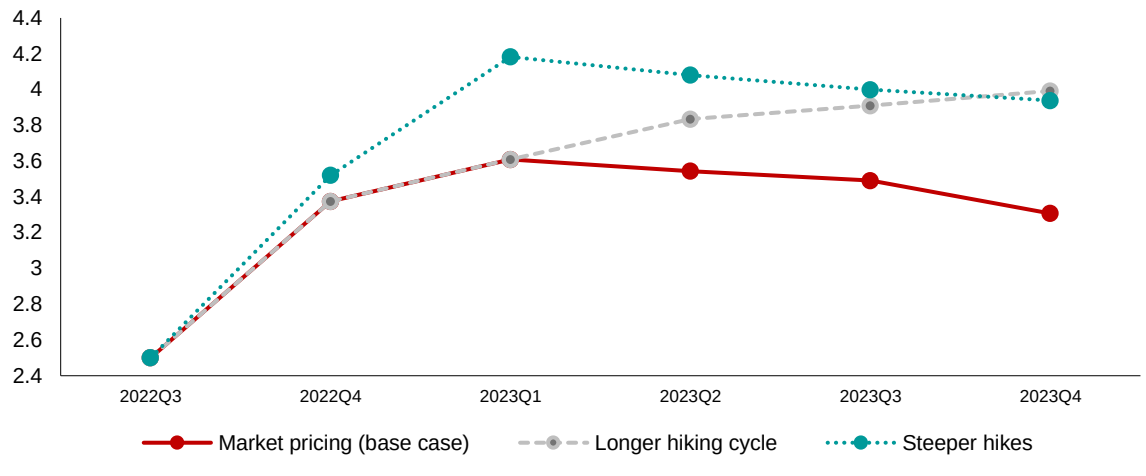
12. **The loss of real GDP growth will be bigger, when terminal rates in Korea and the U.S. are both higher in the alternative scenarios, especially when the Fed increases the pace to reach the terminal rate**[61], as shown in Figure A3.5. In particular:

- Under the base case scenario, further rate hikes by the Fed from Q4 2022 could reduce Korea's 2023 annual real GDP growth by as much as an average of -0.69 percentage point.
- In the second scenario, of a longer hiking cycle, where we assume a gradual increase of the policy rate to a higher terminal rate, the loss of Korea's real GDP growth in 2023 will rise to an average of -0.80 percentage point.
- In the third scenario, of steeper hikes, where we assume the hike to be steep initially, reaching a higher terminal rate and then stabilizing until Q4 2023, Korea's real GDP growth loss would be the largest, at an average of -0.99 percentage point in 2023.

13. **The additional Fed rate hikes would reduce the inflation expectation, since the BOK would follow the pace of the Fed, albeit only partially** (Figure A3.6). As in the case of real GDP, the impact on expected consumer price inflation would be bigger with a higher terminal rate, especially when the path to the higher terminal rate is steeper.

- Under the base case scenario, further rate hikes by the Fed and the BOK's optimal rule-based policy responses would reduce the expected consumer price inflation, by a total of -0.34 percentage point in Q4 2023.
- Under the scenario of a longer hiking cycle with larger rate hikes by the Fed, expected consumer price inflation in Korea will eventually be reduced by -0.39 percentage point, by Q4 2023.
- Under the scenario of steeper hikes, expected consumer price inflation in Korea will decline by -0.49 percentage point, in Q4 2023.

Figure A3.3. Future Paths of BOK's Optimal Rule-based Policy Responses
(Percentage point)



[61] Relative to the forecast for 2023 real GDP growth of 2.3 percent made in October 2022.

Figure A3.4. Future Paths of Short-term Interest Rate Gap under Various Scenarios of Fed Rate Hikes
(Percentage point)

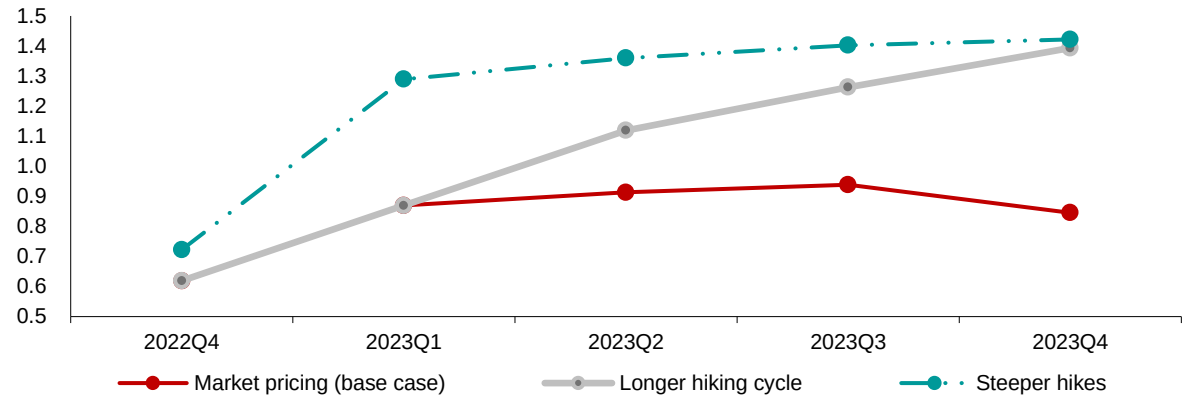


Figure A3.5. Future Paths of Real GDP Growth under Various Scenarios of Fed Rate Hikes
(Percentage point)

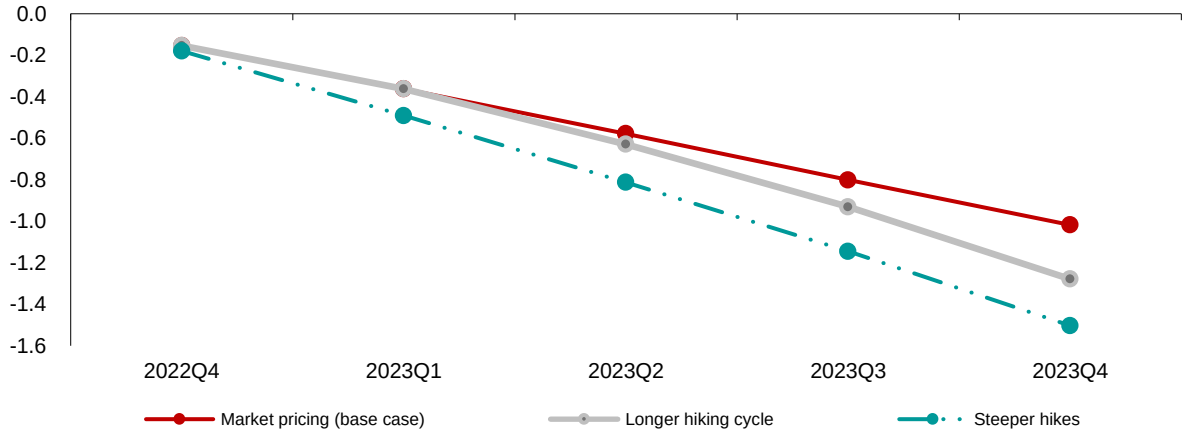
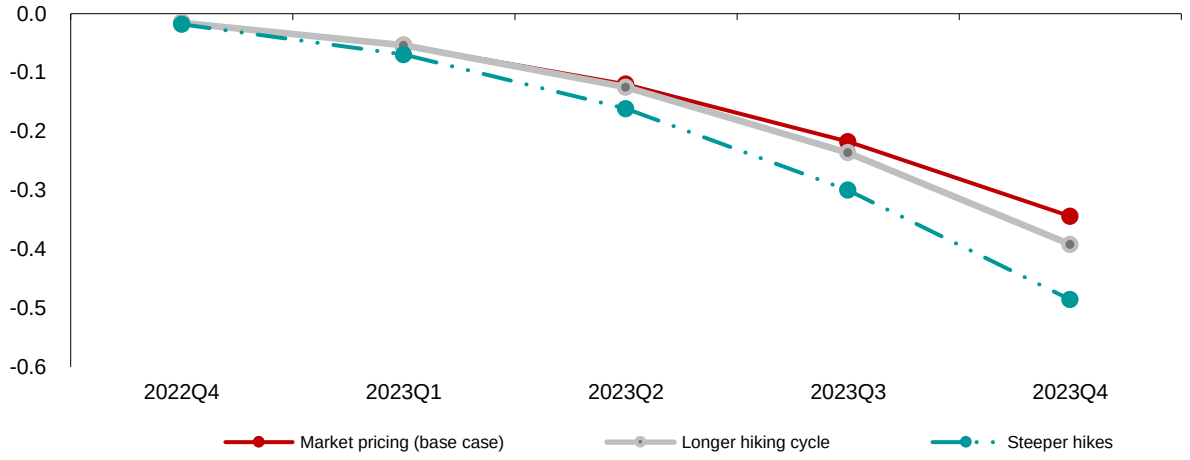


Figure A3.6. Future Paths of Expected Consumer Price Inflation under Various Scenarios of Fed Rate Hikes
(Percentage point)



Note: The future path of Korea's real GDP growth, assuming no more Fed rate hikes from Q4 2022, is projected in October 2022 ASEAN+3 Regional Economic Outlook Update (AMRO 2022). The future path of Korea's real GDP growth under additional Fed rate hikes from Q4 2022 is equal to the original path, which has/assumes no more Fed rate hikes from Q4 2022, plus the path difference calculated by the AGMFM. All the other future paths of other policy objectives, including expected consumer price inflation and the short-term interest rate gap with the U.S., come from the simulation results derived using the AGMFM.

Source: BOK, IMF, OECD, AMRO staff estimates

14. **The study shows that the BOK's monetary policy path is not independent of the Fed's and needs to be carefully calibrated.** More aggressive Fed hikes could pressure the BOK to follow suit to prevent interest rate differentials from being too wide and thus mitigate capital outflow pressure and risks to financial stability. That said, the pace of the monetary policy hike would need to be carefully calibrated, by actual-impact-assessment-based weighing the negative impacts on inflation versus the real economy.

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