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Security through stability.

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The OeNB's semiannual Financial Stability Report provides regular analyses of Austrian and international developments with an impact on financial stability. In addition, it includes studies offering in-depth insights into specific topics related to financial stability.

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Financial stability means that the financial system – financial intermediaries, financial markets and financial infrastructures – is capable of ensuring the efficient allocation of financial resources and fulfilling its key macroeconomic functions even if financial imbalances and shocks occur. Under conditions of financial stability, economic agents have confidence in the banking system and have ready access to financial services, such as payments, lending, deposits and hedging.

Recent developments and macroprudential policy update

Austrian economy experiences second year of recession in 2024

Austria's economy has been in recession almost continuously for two years. Economic output contracted by a total of 2.1% from its peak in the second quarter of 2022 to the second quarter of 2024. This downturn has been primarily driven by two factors: an industrial recession and a notable decline in consumer spending. The industrial sector has been particularly affected by the global economic slowdown, with the downturn in Germany – Austria's key trading partner – having a significant impact on Austrian industry. In addition to weak foreign demand, domestic demand has underperformed across various sectors. The OeNB's September 2024 Interim Economic Outlook highlights that energy-intensive and construction-related industries have been the main drivers of the industrial recession. Despite strong income growth, consumer spending has fallen short of expectations due to persistently low consumer confidence, which has led to a sharp increase in the saving rate. In light of the OeNB's revised outlook for the second half of the year, the forecast for real GDP growth in 2024 has been downgraded by one percentage point to –0.7%, and by 0.8 percentage points to 1.0% for 2025. As a result of the weaker economic activity, the unemployment rate is projected to rise to 7.1% in 2024 and 7.5% in 2025.

The inflation shock is coming to an end, and HICP inflation is to fall below 3% in 2024. HICP inflation peaked at 11.6% in January 2023 and has since steadily declined, reaching 1.8% in September – a level last seen in early 2021. The drop in HICP inflation from 2023 to 2024 has been driven by all major components of the index, particularly industrial goods (excluding energy), energy and food. According to the OeNB's latest forecasts, the annual average HICP inflation rate is expected to fall from 7.7% in 2023 to 2.9% in 2024. However, disinflation is anticipated to slow in subsequent years due to the expiration of fiscal measures in the energy sector. The OeNB projects HICP inflation to be 2.3% in 2025 and 2.2% in 2026.

Austria's budget deficit will be higher than 3%, which is why the country is likely to face an excessive deficit procedure. The ongoing recession, coupled with declining inflation, is causing a further worsening of public finances. Without additional corrective measures, the budget deficit will exceed

Table 1

OeNB September 2024 outlook for Austria – main results

	2023	2024	2025	2026
	Annual change in % (real)			
Gross domestic product (GDP)	–0.7	–0.7	1.0	1.5
Harmonised Index of Consumer Prices (HICP)	7.7	2.9	2.3	2.2
HICP excluding energy	7.8	3.8	2.6	2.2
	%			
Unemployment rate (national definition)	6.4	7.1	7.5	7.3

Source: 2023: Statistics Austria; 2024 to 2026: OeNB September 2024 outlook.

the 3% target in 2024 and in the coming years. This increases the likelihood of the European Commission initiating an excessive deficit procedure against Austria.

The ECB lowered its deposit rate to 3.25% in October 2024. Inflation in the euro area has fallen more quickly than anticipated at the start of the year. According to the ECB's September forecast, inflation is projected to reach 2.2% in 2025 and 1.9% in 2026. In response, the ECB Governing Council decided to lower interest rates in June, September and October by 25 basis points each, marking the start of an easing cycle.

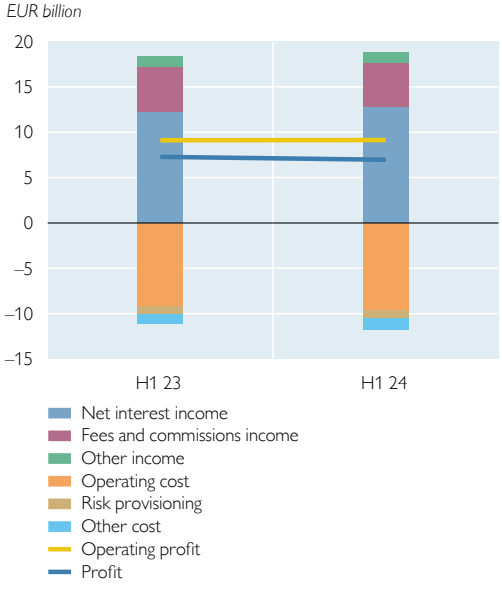
The Austrian banking sector's profitability and capitalization remain strong, but risks from commercial real estate loans intensify

The consolidation of the Austrian banking sector continued in the first half of 2024, while the sector's total assets registered moderate growth. The number of banks in Austria fell only marginally, as mergers typically take place in the second half of a year. However, total assets continued to grow moderately, reaching EUR 1,243 billion at the end of June 2024. On the asset side, loans and debt securities contributed to the increase, while banks slightly reduced their cash balances. On the liability side, growth was driven by both interbank and customer deposits.

Despite ongoing quantitative tightening, the liquidity position of the Austrian banking sector has improved and remained comfortable. Recent trends in Austrian banks' funding and liquidity positions have continued in the first half of 2024. Banks have responded to the continued reduction of excess reserves in the Eurosystem (quantitative tightening) by further substituting their cash and reserve holdings with government and covered bond holdings. The banking sector managed to keep its overall liquidity risk metrics fairly constant: The liquidity coverage ratio, for instance, which measures the amount of high-quality liquid assets – like reserves or government bonds – that banks hold against expected short-term outflows in a liquidity stress scenario, stood at 174% on a consolidated level as of mid-2024, up 1.1 percentage points from end-2023 and up 9.2 percentage points year on year. On the liability side, the relative importance of sight deposits, which markedly decreased as interest rate hikes started in mid-2022, has stabilized in the first half of 2024. This could be a consequence of the narrowing interest rate differential between term and sight deposits due to recent interest rate cuts.

Chart 1

Austrian banking sector: profit and loss statement



Source: OeNB.

The Austrian banking system earned a EUR 7.0 billion profit in the first half of 2024, which is only

slightly below the record set in the same period of 2023. Net interest income, which makes up around two-thirds of all income, was up by 4%, while fees and commissions recorded only a marginal decline. Consequently, operating income increased to EUR 18.8 billion in the first half of 2024. As operating costs rose in line with income – with noticeable reductions in contributions to resolution and deposit guarantee funds but higher impairments on participations – the operating profit stayed flat at EUR 9.1 billion. The cost-to-income ratio was almost unchanged at 51%. As risk provisioning rose by 12% to EUR 0.9 billion, and tax payments increased by 13% to EUR 1.7 billion, the profit of the Austrian banking system fell slightly to EUR 7.0 billion. This translated into a return on assets of 1.2%, some 8 basis points lower than in the first half of 2023, but still highlighting banks' strong profitability.

The Austrian banking sector's capitalization further increased in the first half of 2024, and large Austrian banking groups improved their capitalization compared to their competitors in the SSM. With the tailwind of high profitability, Austrian banks further increased their capitalization in the first half of 2024. Although risk-weighted assets grew by EUR 14 billion, the retention of profits raised the common equity tier 1 (CET1) ratio by a further 10 basis points to 17.7%. The leverage ratio – which is not risk-weighted – improved to 8.5%. Compared to the EU banking sector, the Austrian banking sector is well capitalized with a CET1 ratio 130 basis points above the average. Besides, the CET1 ratio of large Austrian banking groups in the SSM increased to 16.3%, some 50 basis points above the average of their SSM peers.

As for macroprudential capital requirements, the buffer for other systemically important institutions (O-SII) addresses risks that large systemic banks pose to the financial system.[1] The buffer requires systemic banks in Austria to hold additional CET1 capital and thereby lowers their probability of failure. On an annual basis, the OeNB identifies banks that are systemically important and thus have to hold more capital. In October 2024, Austria's Financial Market Stability Board (FMSB) recommended removing a temporary limit on O-SII buffer rates that had been in place since 2022 due to uncertainty over Russia's war against Ukraine, increased energy prices and high inflation. As a result of this final phase-in step, four large banks will see their buffer requirements increase slightly.

In order to create a stronger link between systemic importance and buffer rates, the FMSB recommended increasing the number of buckets in the O-SII assessment methodology.[2] Banks that are systemically important but at the lower end of the distribution will be required to hold a buffer of 0.45% (after taking the overlap with the systemic risk buffer (SyRB) into account). Currently, two banks fall into this category and will see a slight reduction in their O-SII buffers. At the other end of the spectrum, banks exceeding a high threshold will need to hold a buffer of 2.2% (after taking the overlap with the SyRB into account). This bucket is deliberately left empty and ensures that if the largest banks

[1] *https://www.oenb.at/finanzmarkt/makroprudenzielle-aufsicht/massnahmen_und_methoden/der_andere_systemrelevante_institute-puffer.html (in German only)*

[2] *https://www.fmsg.at/en/publications/warnings-and-recommendations/2024/recommendation-fmsb-4-2024.html*

Table 2

Allocation of scores to buffer levels

Previously				New			
Bucket	O-SII buffer (pre-overlap)	O-SII buffer (post-overlap)	Scores	Bucket	O-SII buffer (pre-overlap)	O-SII buffer (post-overlap)	Scores
	% of CET1 capital				*% of CET1 capital*		
				Bucket 1	**0.5**	**0.45**	**Only additional indicators and <275**
Bucket 1	1.0	0.90	275–636	Bucket **2**	1.0	0.90	275–636
Bucket 2	1.5	1.30	637–999	Bucket **3**	1.5	1.30	637–999
Bucket 3	2.0	1.75	≥1,000	Bucket **4**	2.0	1.75	1,000–3,399
				Bucket 5	**2.5**	**2.20**	**≥3,400**

Source: OeNB.

Note: Changes in bold. "Pre-overlap" means prior to adjusting for overlap with systemic risk buffer; "post-overlap" means after adjustment.

further increase their systemic importance, they do so with a commensurate increase in resilience.

Box 1

Results of the OeNB's 2024 solvency stress test

Background

The OeNB conducts annual stress tests for all Austrian banks under its dual mandate for banking supervision and financial stability. *The solvency stress test is designed to assess banks' resilience to adverse macroeconomic shocks and provides insights on both bank-specific and system-wide vulnerabilities. Conducted in a top-down fashion, it relies on the OeNB's ARNIE stress testing framework, which is well-established and continuously improved. The stress test covers both significant and less significant institutions at the highest consolidated level. It focuses on risks faced by the Austrian banking sector, including spillover effects among banks, which are particularly relevant to the decentralized sector. The most recent stress test is based on data as of year-end 2023 and covers the period from 2024 to 2026.*

Scenario

The adverse scenario assumes a severe macroeconomic downturn combined with a decline in inflation and interest rates. *The baseline scenario projects a cumulative GDP growth of 3.6% for the Austrian economy over the stress test horizon (2024–26). In the adverse scenario, characterized by spillover effects of a credit bust in China, euro area GDP contracts by a cumulative 6.0% (–5.0% in Austria). Further escalation of Russia's war against Ukraine leads to an idiosyncratic shock on energy prices in Austria, Hungary and Slovakia, triggering prolonged inflationary effects in these countries reliant on Russian gas. Austrian inflation falls from 7.7% in 2023 to 3.1% in 2026, while euro area inflation declines to 1.9% in 2026, leading to interest rate cuts. Short-term rates (3M EUR Swap) fall from 3.4% in 2023 to 2.1% in 2026, sharper and further than in the baseline scenario (2.7% in 2026).*

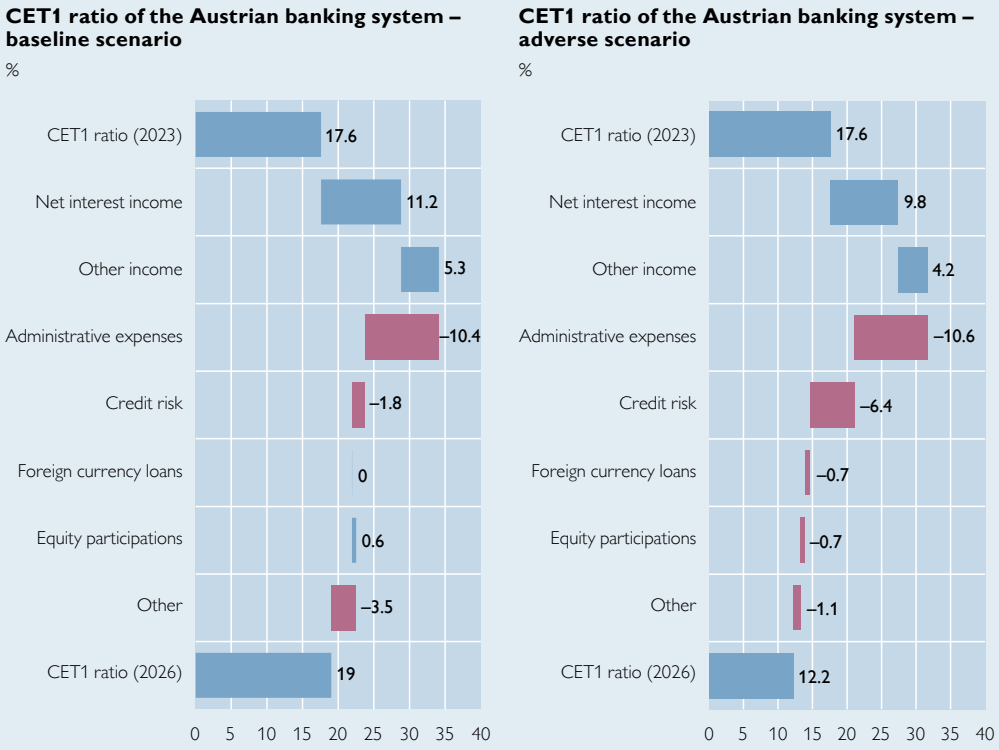
Results and risk drivers

While the aggregate CET1 ratio increases by 1.4 percentage points in the baseline scenario, it declines by 5.4 percentage points in the adverse scenario, landing at 12.2% at year-end 2026. *The following waterfall charts show the most important risk*

drivers and their contribution to changes in the capital ratio for both the baseline and the adverse scenario.

Chart 2

Austrian stress test – results and risk drivers



Source: OeNB.

Credit risk remains the main risk driver and reduces capital by 6.4 percentage points in the adverse scenario (baseline: –1.8 percentage points). *Approximately one-tenth of these credit risk losses is attributable to Austrian commercial real estate (CRE) exposures, which were specifically subjected to a shock in this year's exercise. Moreover, the contribution of net interest income drops from 11.2 percentage points in the baseline to 9.8 percentage points in the adverse scenario. Net interest margins face a double compression: With falling interest rates, banks' loan book income declines, while interest paid on deposits does not. During the recent period of rising interest rates, banks could keep deposit rates at comparably low levels, so that current rates are still below those assumed to materialize in the adverse scenario. Interest expenses are therefore modeled to increase slightly, and net interest margins return to levels seen around 2020. Finally, gains and losses from equity participations remain significant. In the baseline scenario, banks participate in the profits of entities they are invested in and build up capital (+0.6 percentage points), but the picture reverses in the adverse scenario (–0.7 percentage points), reflecting reduced dividend income and write-downs of equity participations. On aggregate, the difference between gains and losses in the baseline and in the adverse scenario is less pronounced than in previous years due to methodological improvements, while for some banks the impact is now more material.*

Compared to last year's exercise, the 2024 OeNB stress test projects a greater impact (–5.4 vs. –4.2 percentage points in 2023). *This reflects higher credit risk (–6.4 percentage points vs. –5.6 percentage points in 2023), with exposures linked to CRE being especially hard hit, and lower net interest income (9.8 percentage points vs. 10.3 percentage points in 2023). At the same time, record profits allowed Austrian banks to increase*

capital by 1.2 percentage points in 2023. Therefore, the final CET1 ratio after stress remains practically unchanged from last year's stress test.

Conclusions

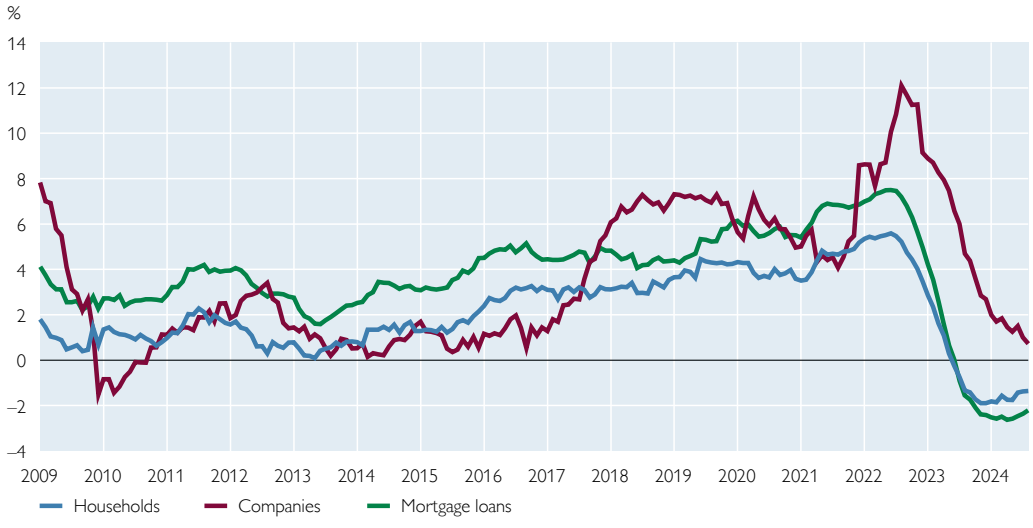
Overall, the stress test indicates that the Austrian banking system is well placed to withstand substantial macroeconomic shocks. *Banks were able to build up capital and now have a greater cushion against potential losses. However, results are heterogeneous across the Austrian banking sector. With credit risk costs rising across the board, banks with a larger share of CRE exposures relative to their total loans are especially vulnerable to higher losses. Falling interest rates will compress interest margins, adding to downward pressure on capital.*

The stress test underlines the importance of a well-capitalized banking sector. *Even though capital ratios have increased significantly in recent years, overall uncertainty remains high. Given the speed of recent interest rate movements and rising credit risk costs, banks might face substantial headwinds in the years to come. Therefore, it is important that Austrian banks be forward looking and prudent with profit distributions. These conclusions are confirmed by a special topic in this report entitled "Results of the first dynamic balance sheet stress test in the ARNIE framework." It simulates banks' reactions to the same macroeconomic scenarios used in this stress test and finds that better capitalized banks are able to grow even in the adverse scenario, providing credit to the real economy in times of crisis.*

While mortgage lending seems to have bottomed out, corporate lending growth has been slowing down. Demand for corporate loans has been falling since 2022, with a persistent weakness particularly in the demand for long-term loans to finance investments. This subdued demand and the restrictive lending policies of banks mean that corporate investment activity has not been contributing to economic growth in Austria, which is reflected in the current weak economic outlook. In contrast, housing loans have seen a moderate recovery in demand since the first quarter of 2024, starting from a historic low after sharp declines in the previous one and a half years. The moderate rebound is due to improvements in

Chart 3

Annual loan growth in Austria



Source: ECB.

Note: Data up to and including August 2024.

affordability driven by rising real incomes and slightly falling financing costs. That said, the annual growth rate for domestic loans remains low. As of August 2024, loans to Austrian companies grew by 0.7% and loans to households contracted by 1.4% year on year. However, the bottom for the latter seems to have been reached.

The share of lending at variable interest rates continued to decline. In the first half of 2024, new borrowers in Austria sought low interest rate risk. Consequently, the share of variable rate loans in total new loans continued to decline to around 40% for households and three-quarters for companies. The decline was especially pronounced in mortgage lending, where only one in five new loans had a variable interest rate. However, the overall share of variable rate loans in Austria is still above the European average. Supervisors therefore continue to closely monitor further developments.

The deterioration of credit quality continued in the first half of 2024, albeit at a noticeably slower pace. Triggered by major bankruptcies in the construction and CRE sector, Austrian banks' overall loan quality started to deteriorate in late 2023. This trend continued in the first half of 2024, albeit at a noticeably slower pace. In recent quarters, the decline in banks' credit quality was more pronounced in Austria than in other European countries.

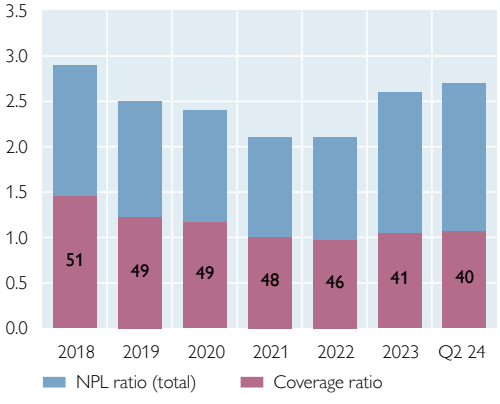
As of mid-2024, the consolidated nonperforming loan (NPL) ratio of the Austrian banking sector stood at 2.7%, well above the all-time low of around 2% marked two years ago. Banks' risk provisioning in the first half of 2024 did not, however, keep up with the increase in NPLs. This means that the NPL coverage ratio, i.e. the ratio of loan loss provisions to NPLs, fell to 40%, as old NPLs with higher coverage were written off and the volume of new NPLs still continues to grow. Compared to Austrian banks' peak NPL ratio of nearly 7% in 2015, however, the current level is still moderate.

A further increase in forbearance points to a continued deterioration in credit quality. Forbearance involves granting concessions to borrowers who are unlikely to repay their loans under the current terms and conditions, with the aim to return borrowers to a sustainable repayment path. It can take the form of refinancing or restructuring the loan or modifying the terms and conditions. Forborne loans are a leading indicator of future credit quality. In Austria, the share of forborne loans in total loans increased from 1.7% at the end of 2022 to 2.3% as of mid-2024.

Chart 4

Consolidated NPL ratio of the Austrian banking sector

% at end of period



Source: OeNB.

Borrower-based measures for residential real estate (RRE) lending in Austria (the KIM-V) are effective.[3] Data for the first half of 2024 show a further increase in the

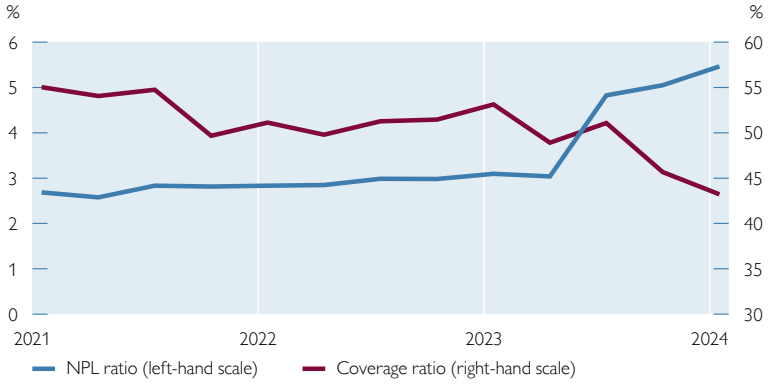
[3] *KIM-V is the regulation for sustainable loan origination standards for residential real estate financing (in German: Kreditinstitute-Immobilienfinanzierungsmaßnahmen-Verordnung).*

share of sustainable loans[4], from 80% to 84%. Moreover, a difference-in-differences estimation shows that the introduction of the KIM-V is associated with a reduction of the NPL ratio for RRE loans, thus effectively contributing to financial stability (see the special topic in this report entitled "From part of the problem to part of the solution: evaluating the effectiveness of borrower-based measures in Austria"). This contributed to a relatively stable credit quality of RRE lending, where NPL ratios remain at 1.1%.[5] In the interest of administrative simplification, the KIM-V was amended for a second time in July 2024. The indicator-specific exemptions were abolished and only the 20% institution-related exemption remains in place. The key role of the KIM-V has also been emphasized internationally: S&P Global Ratings positively highlighted the regulation in their Banking Industry Country Risk Assessment for Austria[6] and acknowledged that exemptions remained largely unused. The rating agency also confirmed that the decline in new lending was the result of increased financing costs, and not brought about by the KIM-V. This remained true throughout the first half of 2024, as close to EUR 500 million in exemption volume continued to be available. The share of banks that used less than half of their available exemption volume increased from 46% in the second half of 2023 to 62% in the first half of 2024. Given that the KIM-V has its legal sunset date on June 30, 2025, the OeNB is currently evaluating if borrower-based measures remain necessary to address systemic risks from the RRE sector.

CRE loan woes have intensified in the course of 2024. CRE loans have been under scrutiny by Austrian and international supervisors for several years now. Since interest rates started to increase in 2022, the vulnerabilities of this sector's funding, which rested on increasing real estate values and low interest rates, have come to the fore. The number of defaults of real estate companies[7] has increased, as have nonperforming CRE loans on banks' balance sheets (see chart 5). CRE loan loss provisions have increased as well, but to a lesser extent. Accordingly, CRE loans' coverage ratios have decreased, while real estate values – another cushion to protect banks from losses in the event of defaults – have been under pressure as well.

Chart 5

NPL and coverage ratio of CRE loans of the Austrian banking sector



Source: FINREP, OeNB.

This report features a special topic on systemic risks from CRE loans in Austria. It finds that a further deterioration of the economy and of real estate valuations, as experienced in past crises, could lead to CRE

[4] *Sustainable loans are all loans with a debt service-to-income ratio of up to 40%, a maturity of up to 35 years and a loan-to-collateral ratio of up to 90%. Loans that are not clearly assignable are classified as sustainable.*

[5] *The special topic uses the median corrected NPL ratio on an unconsolidated level for significant institutions in Austria to ensure comparability to the control group. The consolidated NPL ratio in Austria stands at 1.4% in mid-2024.*

[6] *S&P Global Ratings (August 2024) Banking Industry Country Risk Assessment: Austria.*

[7] *ÖNACE sectors "F construction" and "L (as of 2025 M) real estate related activities."*

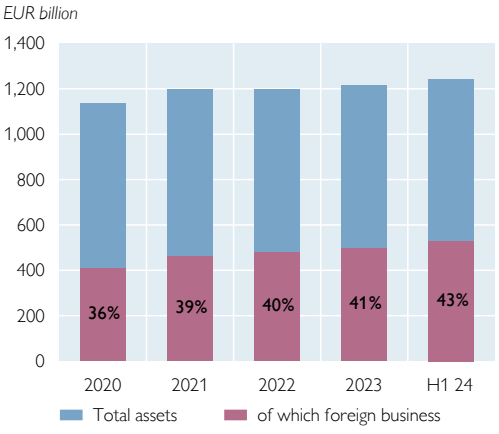
loan losses that are not covered by regulatory ("pillar 1") and microprudential ("pillar 2") requirements. The FMSB has concurred with this assessment and found that potential losses from CRE loans, in the event of a further deterioration of the economic environment, can pose an increased risk to financial stability in Austria. After its 42nd meeting, the FMSB therefore recommended that Austria's Financial Market Authority (FMA) set a sectoral SyRB of initially 1% for risk-weighted exposures to domestic nonfinancial corporations of the ÖNACE 2025 sectors "M.68 real estate activities," "F.41 construction of buildings" and "F.43 specialised construction activities" as of July 1, 2025. As limited-profit housing associations do not pose a systemic risk due, among other things, to their markedly lower probabilities of default, the FMSB recommended excluding them from the scope of the sectoral SyRB.

The importance of Austrian banks' foreign business continued to grow. With EUR 530 billion in foreign assets as of June 2024, 43% of Austrian banks' business was located abroad (see chart 6), mainly within the EU. The most important foreign markets are Czechia, Germany and Slovakia, accounting for 40% of all foreign business. While most banks' business is done locally, either in Austria or via subsidiaries in host countries, one-fifth of all business occurs across borders.

The total assets of Austrian banking subsidiaries in Central, Eastern and Southeastern Europe (CESEE) surpassed EUR 300 billion in mid-2024,[8] with more than 80% located in EU member states. Six countries continue to be dominant, as Czechia accounts for 38%, Slovakia and Romania make up 15% and 12%, respectively, followed by Hungary, Russia and Croatia with shares of less than 10% each. As shown in chart 7, growth was strong during the COVID-19 pandemic but lost steam over the last two years. One of the reasons was tighter monetary policy, but as inflationary pressures are decreasing in the region and central banks start cutting rates, it will be important to monitor loan growth.

Chart 6

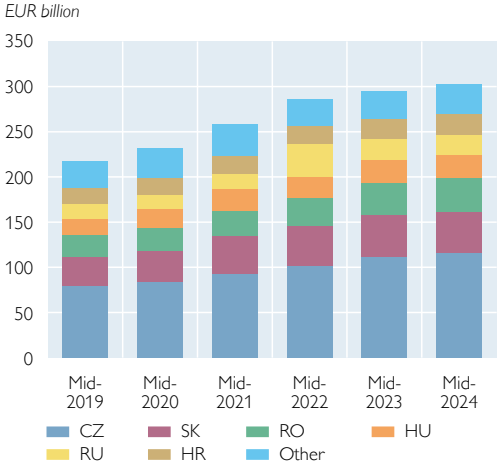
Total assets of the Austrian banking sector



Source: OeNB.

Chart 7

Austrian banking subsidiaries in CESEE: total assets by country

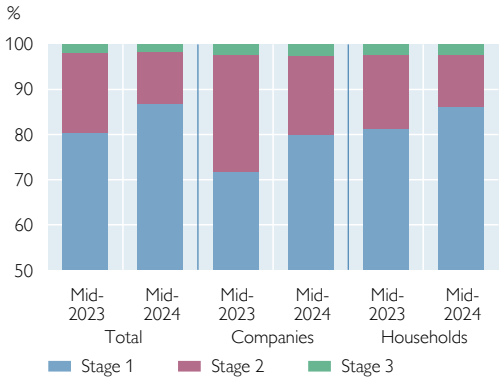


Source: OeNB.

[8] *A first since UniCredit Bank Austria transferred its CESEE subsidiaries to its Italian parent in 2016.*

Chart 8

Austrian banking subsidiaries in CESEE: credit risk according to IFRS 9 stages



Source: OeNB.

Note: For information on IFRS 9 loan stages, see https://www.bis.org/fsi/fsisummaries/ifrs9.pdf.

Profits of Austrian banking subsidiaries in CESEE reached a new high of EUR 3.1 billion in the first half of 2024, driven by higher net interest income and a marginal provision release. Net interest income of Austrian subsidiaries in CESEE rose to EUR 4.5 billion (+11% year on year), boosted by moderate asset growth (+3%) and an expansion of the net interest margin to 3.1% (+22 basis points). At the same time, fees and commissions income fell by 13% to EUR 1.8 billion. Consequently, operating income rose by 2% to EUR 6.6 billion.[9] As operating costs declined by 3%, driven by staff cost that fell despite ongoing wage pressures, the subsidiaries' operating profit reached EUR 3.8 billion (+6% year on year). Risk costs were very benign in the first half of 2024, as EUR 26 million of credit risk provisions were released, compared to a buildup of more than EUR 300 million in the same period of 2023.

Credit quality of Austrian banking subsidiaries in CESEE remains at historically good levels, as reflected in an NPL ratio for total loans of just 1.9%, a 65% coverage of NPLs (both stable year on year) and a noticeable increase in the share of stage 1 loans, i.e. loans with no significant increase in credit risk since initial recognition (see chart 8). All these trends resulted in a half-year profit of EUR 3.1 billion, up 15% from last year. As of mid-2024, the aggregate CET1 ratio of Austrian banks' CESEE subsidiaries stood at 20% and their loan-to-deposit ratio was 71%. These solid levels reflect past efforts by banks and supervisors to make local banking systems more resilient by increasing the subsidiaries' risk-bearing capacity and ensuring a balanced refinancing structure.[10]

As for macroprudential capital requirements, the SyRB addresses structural systemic risks, such as the domestic banking sector's specific ownership structures and its high exposure to emerging economies in Europe.[11] Disruptions in the whole or in parts of the Austrian financial system may entail severe negative consequences for the entire financial system and the real economy. In 2024, the SyRB was evaluated according to a biennial assessment plan. As it was found that the major structural systemic risks identified in the previous assessment from 2022 continue to exist, the FMSB recommended keeping SyRB rates unchanged. All previously identified banks will have to maintain a SyRB of

[9] *Changes in trading and valuation income cancelled each other out.*

[10] *For more details, refer to box 4 entitled "Success of the Austrian Sustainability Package" in the Financial Stability Report 47.*

[11] *For more details, refer to https://www.oenb.at/finanzmarkt/makroprudenzielle-aufsicht/massnahmen_und_methoden/systemrisikopuffer.html (in German only).*

0.5% to 1.0%. Additionally, one institution was identified as a SyRB bank for the first time (with a rate of 0.5%).[12]

Recommendations by the OeNB

The profitability and capitalization of the Austrian banking sector remained strong in the first half of 2024. Nevertheless, a geopolitical polycrisis, two years of domestic recession in 2023 and 2024 as well as the forecast rise in the Austrian unemployment rate mark a challenging economic backdrop for financial stability.[13] Rising pressures, including weakening domestic corporate credit quality, are likely to challenge earnings over time, while less restrictive monetary policy will take time to stimulate loan growth. The OeNB recommends that banks further strengthen financial stability by taking the following measures:

- Continue to safeguard or, where appropriate, further strengthen their capital position by exercising restraint regarding profit distributions.
- Adhere to sustainable lending standards for residential as well as commercial real estate (CRE) financing and prepare for stricter supervisory requirements for CRE loans.
- Ensure adequate risk management practices, especially a commensurate coverage of NPLs by risk provisions and a conservative valuation of collateral.
- Ensure sustainable profitability by maintaining cost discipline while investing in information technologies as well as in protection against cyber risks and the impact of climate change.

Box 2

"Never waste a good crisis" – The OeNB's Crisis Simulation Tool

Background

The OeNB has developed a Crisis Simulation Tool[14] that allows supervisors to run macroeconomic crisis scenarios for all Austrian banks and provides timely and accurate information in times of a global polycrisis. *Indeed, the COVID-19 pandemic, Russia's war against Ukraine, the ensuing period of high inflation, the disruption of global supply chains and energy markets, as well as the end of zero interest-rate policies have entailed new and complex challenges for bank supervisors. The volatile business environment and emergence of novel and very different shocks require swift supervisory action and a flexible toolkit that allows for real-time evaluations.*

Introducing the tool

Supervisors can use the Crisis Simulation Tool to run both standardized and customized shock scenarios, based on economic sectors and countries, on the profits, capital positions and leverage ratios of individual banks and groups of banks. *The tool requires that supervisors take two main decisions: first, whether they want to*

[12] *For more details on the decision, refer to https://fmsg.at/en/publications/warnings-and-recommendations/2024/recommendation-fmsb-4-2024.html*

[13] *For the latest OeNB outlook, refer to OeNB Report 2024/17: Austrian economy remains in recession, inflation shock comes to an end*

[14] *The tool's conception and implementation were led by Thomas Kögler and Thomas Resch, who are both members of the Expert Pool for Business Model Assessment, ESG and Digitalization within the Off-Site Supervision Division – Less Significant Institutions. They also authored this box. A joint team of off-site supervisors and the Financial Stability and Macroprudential Supervision Division leads the future development of the tool.*

run a predefined macroeconomic scenario or create a custom scenario; second, whether the chosen scenario should be applied to an individual bank or a group of banks. Both predefined and custom scenarios are based on economic sectors (based on NACE codes[15]) and countries, which subsequently act as filters on the banks' credit portfolio. Having picked a scenario and a bank or group of banks, analysts can set the rate of default on the banks' unsecured credit exposure in the countries and sectors included in the scenario. In addition, supervisors can determine a specific haircut on the existing collateral and allow for mitigating factors such as the bank's expected profits, retained earnings or hidden reserves. Based on the settings, the Crisis Simulation Tool calculates additional impairments and their effects on profits, capital position and leverage ratio, and flags potential breaches of supervisory capital requirements in real time. For individual banks, the tool provides an in-depth analysis of the scenario's impact, while at the banking group level, a more abstract, aggregated view is available.

Applications

The Crisis Simulation Tool is utilized both in micro- and macroprudential supervision, and its results have been reported to senior management and external stakeholders. *Within microprudential supervision, the tool has been used to swiftly identify vulnerable banks in times of crisis, assess potential breaches of regulatory capital requirements, challenge banks' assumptions and statements, and complement analytical assessments and reports with macroeconomic shock simulations. The results, including the identification of vulnerable banks with significant commercial real estate exposures and an impact study of the energy crisis on Austrian banks, have regularly been reported and presented to senior management and external stakeholders, such as Austria's Financial Market Authority (FMA) and the ECB. Moreover, supervisors employed the Crisis Simulation Tool to run reverse scenarios to identify individual danger thresholds and determine specific risk potentials for Austrian SIs (significant institutions) and LSIs (less significant institutions).*

The tool has been recently extended to macroprudential applications. *It is used there to quickly assess the exposure to and the potential capital losses from macroeconomic shocks or crisis events from an aggregate banking-sector perspective to detect systemic vulnerabilities from banks' credit exposure and to assess the robustness of current profitability and credit quality trends. After potential systemic risks have been identified in specific sectors, these preliminary results are sometimes utilized as the basis for a more detailed analysis, e.g. in the special topic in this report entitled "Systemic risks from commercial real estate lending of Austrian banks." In all these applications, the tool's focus on credit risk shocks rather than a gradual worsening of the macroeconomic environment as well as its time horizon, which is limited to the current year, makes it a complement to, and in no way a substitute for, supervisory stress tests.*

Database and technical details

The Crisis Simulation Tool is based on well-established regulatory reporting data and macroeconomic crisis scenarios defined by OeNB economists and macroprudential supervisors. *The tool's most important data sources are the granular credit data and credit risk data, which are aggregated for each bank based on the countries and sectors of the economy included in the chosen scenario. They are complemented by capital adequacy, leverage, profitability and balance sheet data, which are necessary to calculate the additional impairments and subsequently the impact of the chosen scenario on profits, capital position and leverage ratio. All regulatory data are retrieved on a quarterly basis. The predefined macroeconomic scenarios have been designed by OeNB economists and macroprudential supervisors. The tool itself is a web-based R Shiny solution.*

[15] *The tool utilizes NACE (Nomenclature statistique des activités économiques dans la Communauté européenne = Statistical Classification of Economic Activities in the European Community) levels 1 (containing 21 sections of the economy) and 2 (containing 88 subdivisions).*

Conclusion

Overall, the Crisis Simulation Tool has proven to be a timely and cutting-edge addition to the OeNB's existing analytical toolkit. *Indeed, the Crisis Simulation Tool has filled a void between regular analytical reports and the annual supervisory stress tests by allowing for rapid initial assessments of shock scenarios. For example, the tool has enabled supervisors to swiftly identify vulnerable banks with significant commercial real estate exposures or to conduct an impact study of the energy crisis on Austrian banks. Since it can be easily adapted and extended to cover new emerging crisis scenarios and provides easily accessible real-time evaluations with high user convenience and satisfaction, it enables supervisors to conduct informed assessments and stay ahead of the curve even during the current polycrisis.*

Special topics

The impact of the digital euro on Austrian banks from a financial stability perspective

Manuel Gruber, Christoph Siebenbrunner, Alexander Trachta, Christian Wipf[1]

We study the impact the introduction of the digital euro might have on Austrian banks from a financial stability perspective. The premise is that the digital euro will not bear interest and will be subject to a holding limit. More specifically, we analyze (1) the impact on Austrian banks' liquidity positions in a liquidity stress scenario and (2) long-run profitability effects on banks' net interest income and income from payment services. With respect to liquidity risk, we find substantial effects only for extreme scenarios and high holding limits. For instance, at a holding limit of 3,000, the most extreme stress scenario we consider results in outflows of 9.0% of total retail deposits into the digital euro. Besides, 7.4% of banks (accounting for 4.2% of the sample's total assets) would breach the regulatory liquidity coverage ratio (LCR) threshold of 100%. Smaller banks are disproportionately affected because they have a larger share of retail funding, which leads to higher outflows. The picture is similar with respect to the long-run effects on banks' net interest income. In a similarly extreme scenario as above, we estimate that the digital euro would cause interest income losses and a drop in the aggregate sample return on equity (RoE) of 51 basis points – the aggregate sample RoE is 14.9% – at a holding limit of 3,000. Smaller banks and less capitalized banks would be affected more strongly. In a more realistic scenario, the effects are substantially lower, with 1.0% of total retail deposits outflowing and the aggregate sample RoE dropping by 5 basis points. Lower holding limits effectively contain adverse outcomes both with respect to interest income losses and liquidity risk. As to the effect on payment services income, it is harder to arrive at reliable estimates given a lack of suitable bank-level data and high uncertainty about the digital euro's impact on transaction volumes and fees of retail current accounts and about how digital euro transactions and account management will be remunerated. In a tentative estimation, we find an aggregate sample RoE effect of around 26 basis points. By determining the remuneration of the digital euro, the central bank can effectively control the magnitude of this effect. Overall, we conclude that the introduction of a digital euro would not pose a threat to the stability of the Austrian banking system provided the digital euro is subject to a carefully designed holding limit and remuneration model. From a purely financial stability perspective, low holding limits would be preferable to higher ones.

JEL classification: E42, G21
Keywords: central bank digital currencies, digital euro, financial stability, substitution of bank deposits, liquidity, profitability, business models

Central banks worldwide are investigating the issuance of central bank digital currencies (CBDCs). In October 2023, the Eurosystem finalized the two-year investigation phase for a euro area CBDC, i.e. the digital euro. We are now one year into the preparation phase scheduled to last until October 2025. After that, the Governing Council of the European Central Bank (ECB) will decide whether the digital euro project will progress toward potential development and rollout (ECB, 2024). With the digital euro, the Eurosystem aims for the euro to evolve alongside the general public's digital payment preferences and to facilitate electronic payments in the euro area. The digital euro is also meant to strengthen Europe's

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monetary infrastructure and sovereignty by reducing Europe's dependence on non-European private payment providers that currently dominate the European payments landscape. At the same time, a widely accepted CBDC might generate systemic repercussions for bank intermediation, which might have negative effects on financial stability. If households substitute CBDC for bank deposits, which are a relatively stable and cheap funding source for banks, this might have adverse consequences for banks' liquidity and profitability. Ultimately, this might also impact the overall resilience of the banking sector and its intermediation function for the real economy.

We study these concerns, using bank-level data from Austrian banks.[2] We first analyze the impact the digital euro would have on Austrian banks' liquidity risk in a stress scenario in section 1. Then, in section 2, we assess the long-run profitability effects of the digital euro, in particular on banks' net interest income and income from payment services, abstracting from initial implementation costs. A particular emphasis lies on bank heterogeneity because the impact of the digital euro most likely depends on a bank's business model, e.g. on its share of financing from retail deposits.

Consistent with the current proposals of the ECB,[3] we model the digital euro as a digital alternative to cash, which does not bear interest and can be held by households only. Households can hold digital euro up to a certain holding limit set by the ECB. Their digital euro accounts are directly linked with their other payment accounts to automatically top up the digital euro account up to the holding limit. This "(reverse) waterfall approach" allows households to transact any amount in digital euro, independent of the holding limit.

In the following sections, we focus on a baseline scenario characterizing the most likely outcome and a maximal scenario that captures the extreme but very unlikely upper bound for outcomes. The baseline scenario is mainly calibrated by using the Deutsche Bundesbank's Survey on Consumer Expectations of 6,000 households in Germany presented in Bidder et al. (2024). This survey contains information on how households plan to use the digital euro both in normal and in crisis times.

1 Liquidity effects

To assess the financial stability impact of the digital euro on Austrian banks' liquidity positions, we use a sample of 393 Austrian banks at the unconsolidated level, which reported household salary and pension accounts in the second quarter of 2023.[4] Table 1 presents some descriptive statistics of the sample.

Table 1

Descriptive sample statistics

Total assets, EUR billion	Household sight deposits, EUR billion	Salary/pension accounts, EUR million	Accounts per bank (median)	Account size (mean), EUR
727.3	191.9	5.75	5,200	33,400

Source: OeNB.

[2] *Similar papers include Auer et al. (2024), Bellina and Cales (2023), Bidder et al. (2024) and Meller and Soons (2023).*

[3] *See https://www.ecb.europa.eu/euro/digital_euro/html/index.en.html.*

[4] *The total bank sample at the unconsolidated level consists of 452 banks, of which 59 report no salary or pension accounts. As the reporting standards for 49 banks of the Sparkassen sector have changed, the most recent data for these banks are from the fourth quarter of 2022. The study sample covers 74% of the total sample in terms of total assets and 95% of household sight deposits.*

Table 2

Calibration of the baseline and the maximal scenario liquidity effects

	Baseline	Maximal	Description/Source
d€uptake_crisis	0.6	1	Bidder et al. (2024)
holding limit	(200, 5,000)	(200, 5,000)	
d€holdings	1,000	0	

Source: OeNB.

We consider a systemic liquidity stress scenario, where e.g. due to a sudden loss of confidence in the banking sector, Austrian salary and pension account holders abruptly transfer deposits up to the holding limit from their deposit accounts to a digital euro wallet. We model the deposit outflow for bank i in such a liquidity crisis as follows

$$out_{i,crisis} = d€uptake_{crisis} * \#accounts_i * (holding\ limit - d€holdings) \quad (1)$$

where $d€uptake_{crisis}$ is the average ratio of account holders that adopt the digital euro in a liquidity crisis, $\#accounts_i$ is the number of salary and pension accounts of bank i, *holding limit* is the holding limit set by the central bank and *d€holdings* are the average intended digital euro holdings of a digital euro adopter before the crisis. If *d€holdings* > *holding limit*, digital euro adopters just hold the holding limit. Note that (1) assumes that the share of account holders that adopt the digital euro is uniformly distributed across banks and all digital euro adopters have enough deposits to withdraw up to the holding limit. We now calibrate the baseline and the maximal scenario as follows (table 2).

In the baseline scenario, $d€uptake_{crisis}$ is the upper bound of Bidder et al. (2024), who find that in a crisis event 56% of respondents would adopt the digital euro. In the maximal scenario, we assume that all account holders adopt the digital euro. We also assume that digital euro adopters intend to hold EUR 1,000 in digital euro in the baseline scenario before the crisis, while in the maximal scenario they hold no digital euro. We motivate the low intended digital euro holdings with the "reverse waterfall approach" explained above and the unremunerated nature of the digital euro. Note that the maximal scenario means that households hold no digital euro before the crisis but in the crisis they all transfer deposits up to the holding limit into the digital euro.

Table 3

Deposit outflows under liquidity stress: baseline vs. maximal scenario

	Baseline scenario			Maximal scenario		
Holding limit	Deposit outflow, EUR billion	% of total assets	% of deposits	Deposit outflow, EUR billion	% of total assets	% of deposits
200	0.0	0.0	0.0	1.1	0.2	0.6
1,000	0.0	0.0	0.0	5.7	0.8	3.0
3,000	6.9	0.9	3.6	17.2	2.4	9.0
5,000	13.8	1.9	7.2	28.7	4.0	15.0

Source: OeNB.

Table 3 shows deposit outflows in the two scenarios. In the baseline scenario, deposit outflows increase linearly from holding limits above 1,000 (since households already hold 1,000 digital euro before the crisis) to EUR 13.8 billion or 7.2% of total sight deposits at a 5,000 holding limit. In the maximal scenario, deposit outflows increase linearly to EUR 28.7 billion or 15% of total sight deposits at a holding limit of 5,000.

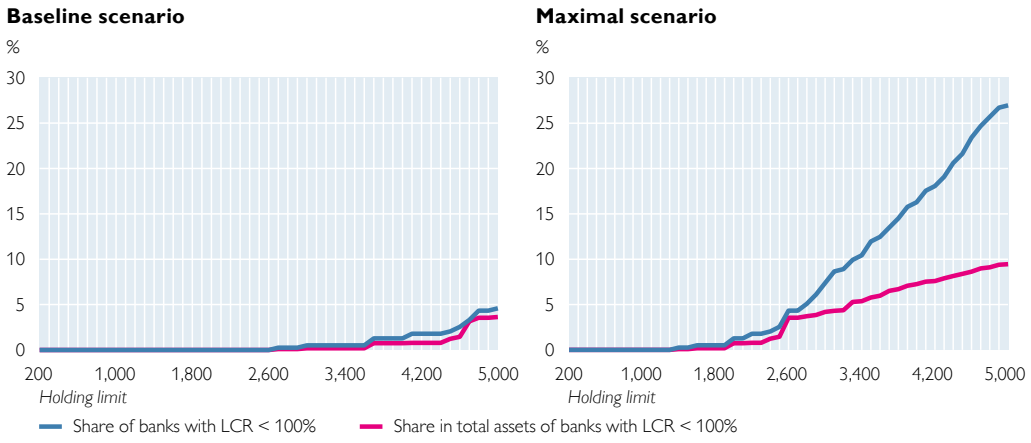
Do banks have enough liquid assets to withstand these outflows? To answer this question, we calculate banks' liquidity coverage ratios (LCR). In other words, we compare the high-quality liquid assets (HQLA) banks hold to their outflows due to the liquidity crisis $out_{i,crisis}$ plus their other net liquidity outflows (NLO).[5]

$$LCR_i = \frac{HQLA_i}{NLO_i + 0.95 * out_{i,crisis}} \quad (2)$$

Chart 1 shows how many banks have an LCR below 100% due to these outflows as well as their share in total assets. In the baseline scenario, we only see material effects for high holding limits. At a holding limit of 5,000, 4.6% of banks (3.6% of the sample's total assets) have an LCR below 100%. In the maximal scenario, the effects are more substantial. At a holding limit of 3,000, 7.4% of banks (4.2% of the sample's total assets) have an LCR below 100%; at a holding limit of 5,000, this is the case for 27% (9.5% of the sample's total assets). The divergence between the share of banks and their share of total assets indicates that it is mostly smaller banks that are affected. The reason is that, compared to large and medium-sized banks, smaller banks tend to have more accounts and more retail financing relative to their assets (see table A1 in the annex). Overall, the effects of the liquidity stress scenario are substantial only for high holding limits. Thus, a careful calibration of

Chart 1

Liquidity effects: baseline vs. maximal scenario



Source: OeNB.

[5] *We subtract 5% of outflows from the other liquidity outflows in the denominator because the outflows from these retail deposits are already contained in the outflows due to the crisis. 5% is the usual outflow rate applied to retail deposits in the calculation of the LCR. The HQLA and the liquidity outflows of the Raiffeisen banks in Lower Austria, Vienna, Upper Austria, Styria and Vorarlberg as well as the Volksbanken banks are aggregated to a sector level due to special liquidity reporting requirements that apply to these banks. In the baseline scenario, we also adjust* $HQLA_i$ *for pre-crisis outflows per bank into the digital euro* $out_{i,normal}$ *derived in section 2.1 on net interest rate income losses below.*

the holding limit can contain the adverse effects of such a scenario even in the extreme and very unlikely maximal scenario.

2 Profitability effects

To assess the financial stability impact of the digital euro on Austrian banks' solvency, this section first analyzes the effects on banks' net interest income (NII) and then the effects on banks' net payment services income (NPI). In contrast to the crisis focus in the liquidity part, we now concentrate on the digital euro's profitability effects in "normal times." This steady state perspective also abstracts from initial introduction costs.

2.1 Net interest income (NII)

Banks might suffer NII losses due to deposit outflows into the digital euro either because banks must replace deposits with more expensive funding or because they shrink their assets. As shown in (3) we model average deposit outflows of bank i $out_{i,normal}$ as a product of the average share of account holders that adopt the digital euro in normal times $d€uptake_{normal}$ and the number of accounts of bank i $\#accounts_i$, the average intended digital euro holdings of digital euro adopters and the fraction of digital euro holdings which digital euro adopters substitute for sight deposits (and not for cash) $deposit\_sub$:

$$out_{i,normal} = d€uptake_{normal} * \#accounts_i * d€holdings * deposit\_sub \quad (3)$$

The NII loss is then the product of $out_{i,normal}$ and the funding advantage of sight deposits, $funding\_advantage$.

$$NII\_loss_i = out_{i,normal} * funding\_advantage \quad (4)$$

We calibrate the baseline and the maximal scenario as shown in table 4.

In the digital euro survey of the Deutsche Bundesbank (Bidder et al., 2024), 46% of households responded they would adopt the digital euro in normal times. We take the upper bound of this and – similar to the liquidity part – assume 100% adoption in the maximal scenario. *d€holdings* are calibrated as in the liquidity section. However, note that high digital euro holdings map into high outflows here, while in the liquidity section high digital euro holdings implied low outflows. Thus, we choose EUR 5,000 for the maximal scenario here (and as a robustness exercise we also consider 3,000 or 5,000 intended digital euro holdings in the

Table 4

Calibration of the baseline and the maximal scenario NII effects

	Baseline	Maximal	Description/Source
d€uptake_normal	0.5	1	Bidder et al. (2024)
d€holdings	1,000	5,000	
deposit_sub	0.64	1	Bidder et al. (2024)
funding_advantage			Average interest spread between new term deposits and household sight deposits in Austria 2003–2008
	1.61%	1.61%	

Source: OeNB.

baseline scenario). The substitution parameter is derived as follows: In Bidder et al. (2024), digital euro adopters project to hold 21.1% of their liquid portfolio in digital euro (a share similar to cash) while reducing their deposit share by 13.4 percentage points to this end. Thus, *deposit_sub* is 0.134/0.21=0.64. Note that NII losses are zero if digital euro holders completely substitute digital euro holdings for cash, i.e. *deposit_sub* is zero. Finally, the funding advantage banks lose with deposit outflows is calibrated to the period before the very low or negative interest rate period with deposit rates stuck at the zero lower bound. The value is close to Austrian banks' average net interest margin in 2023 (1.53%).

Table 5 shows the deposit outflows and NII losses in the two scenarios. We also express NII losses relative to tier 1 bank capital, thus capturing the effect on the return on equity (RoE). In the baseline scenario, the aggregate deposit outflows amount to EUR 1.8 billion, which results in an NII loss of EUR 29 million and an RoE effect of 5 basis points, which is very small compared to the aggregate RoE (14.9%) in the sample.[6] In the maximal scenario, the effects are more material. Deposit outflows here exactly correspond to the outflows in the maximal crisis scenario above. This is because, with intended digital euro holdings of 5,000, the holding limit always binds and deposit outflows equal the holding limit, as was the case in the liquidity crisis scenario. Also note that the holding limit effectively contains the more material effects in the maximal scenario. Choosing a 3,000 holding limit instead of a 5,000 holding limit reduces the RoE effect from 86 basis points to 51 basis points.

Chart 2 identifies banks that are particularly affected by NII losses. In the baseline scenario, no bank has an RoE effect above 100 basis points. We only have significant effects in the maximal scenario, where the share of banks with an RoE effect above 100 basis points increases approximately linearly from a holding limit around 1,500. At a 3,000 holding limit, 23.1% of banks (22.6% of the sample's total assets) have an RoE effect above 100 basis points, while at a 5,000 holding limit, 59.3% of banks (37.3% of the sample's total assets) have an RoE effect above 100 basis points. As in the liquidity section, the NII losses rather affect small banks but not as strongly as was the case with effects on the LCR above.

Table 5

Deposit outflows and NII losses: baseline vs. maximal scenario

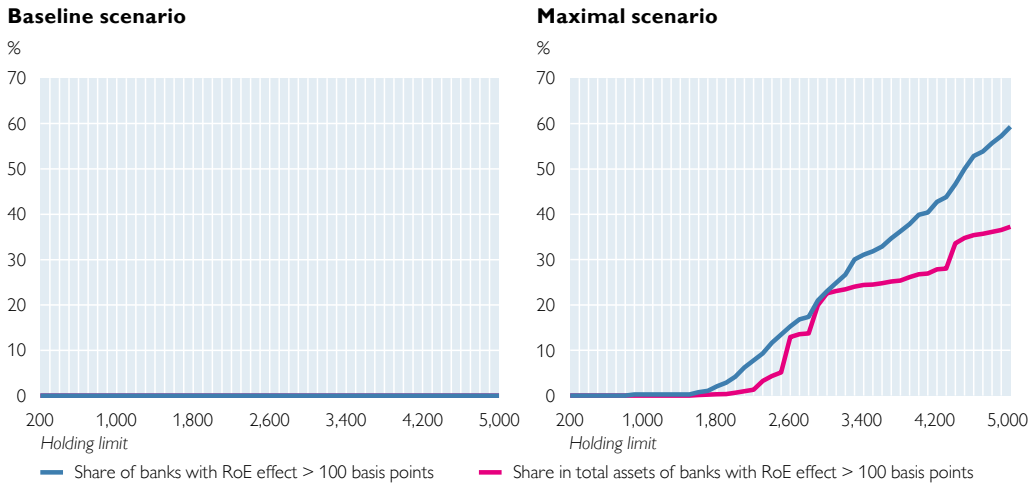
	Baseline scenario			Maximal scenario		
Holding limit, EUR	Deposit outflow, EUR billion	NII loss, EUR million	RoE effect, basis points	Deposit outflow, EUR billion	NII loss, EUR million	RoE effect, basis points
200	0.4	6	1	1.1	19	3
1,000	1.8	29	5	5.7	93	17
3,000	1.8	29	5	17.2	278	51
5,000	1.8	29	5	28.7	463	86

Source: OeNB.

[6] *For intended digital euro holdings of 3,000 (5,000), the RoE effects are only slightly higher at 16 (28) basis points.*

Chart 2

RoE effects from NII losses: baseline vs. maximal scenario



Source: OeNB.

2.2 Net payment services income (NPI)

Due to data limitations[7] and the high uncertainty about the digital euro's impact on banks' NPI, we restrict the analysis to the Austrian banking sector as a whole in this section. We model aggregate NPI as a linear function of the number of transactions T and the return per transaction with sight deposits R_D, i.e. $NPI=T*R_D$. After the introduction of the digital euro, NPI changes to $NPI'=(1-x)T*R_D'+xT*R_{d€}$ where x is the share of transactions transferred into the digital euro and $R_{d€}$ is the return per transaction with digital euro. Note that this NPI definition assumes that the income from digital euro transactions remains within the banking sector. Thus, the NPI loss is calculated as follows:

$$NPI_{loss} = NPI - NPI' = NPI * \left[1 - (1-x)\frac{R'_D}{R_D} - x\frac{R_{d€}}{R_D}\right] \quad (5)$$

where R_D'/R_D and $R_{d€}/R_D$ denote the change in the return of transactions with sight deposits and digital euro relative to the current return. $R_{d€}/R_D$ can thus be interpreted as a parameter measuring how the central bank remunerates digital euro transactions. We calibrate the baseline and the maximal scenario as shown in table 6.

Table 6

Calibration of the baseline and the maximal scenario NPI effects

	Baseline	Maximal	Description
NPI	1.1	1.1	Aggregate NPI of sample banks in EUR billion
x	0.16	0.32	16% (32%) of transactions move to the digital euro
R'_D/R_D	0.95	0.90	Profitability of transactions with sight deposits decreases by 5% (10%)

Source: OeNB.

[7] *NPI data for Austrian banks are only available for a different bank sample.*

To estimate the *NPI*, we proceed as follows: We use the average end-of-year 2020–2023 NPI of the banks for which NPI data are available (EUR 2.16 billion) and set this number in relation to the average end-of-year sum of sight deposits from households, nonfinancial firms and the government from 2020 to 2023.[8] This yields 0.57, which means that Austrian banks on average earn 0.57 cent per euro of (transactional) sight deposits. Assuming this also holds for the household deposits of the banks in our sample, we arrive at an aggregate NPI of EUR 1.1 billion. To define how many transactions move into the digital euro (x), we follow up on the reasoning in the NII section. There, we assumed in the baseline scenario that 50% of account holders adopt the digital euro. We further assume that the share of deposit substitutions we assumed there (64%) also holds for transactions and, finally, we assume that holders of a digital euro wallet split their transactions 50-50 between sight deposits and digital euro, which yields 0.16. For the maximal scenario, we double this to 32% outflows. Finally, the decrease in the profitability of transactions with sight deposits of 5% (10%) reflects the idea that the introduction of the digital euro also increases competition in the conventional NPI business with sight deposits and puts these margins under pressure.

Chart 3 shows the NPI losses for different digital euro remuneration levels $R_{d€}/R_D$. Values like 0.5 mean that transactions in digital euro are remunerated at 50% of the current return on sight deposits. In table 7 we provide reasonable parameters for the remuneration of digital euro transactions, following the idea that the remuneration of digital euro transactions should target the return of the most efficient providers of transactions.[9] This yields NPI losses ranging from EUR 140 to 173 million (EUR 262 to 329 million) and RoE effects of 26 to 32 basis points (49 to 61 basis points) in the baseline (maximal) scenario. As with holding limits, carefully calibrating the digital euro remuneration prevents extreme profitability effects for the banking sector.

Table 7

NPI losses: baseline vs. maximal scenario

	Baseline scenario		Maximal scenario	
Digital euro remuneration	NPI loss, EUR million	RoE effect, basis points	NPI loss, EUR million	RoE effect, basis points
0.47	140	26	262	49
0.28	173	32	329	61

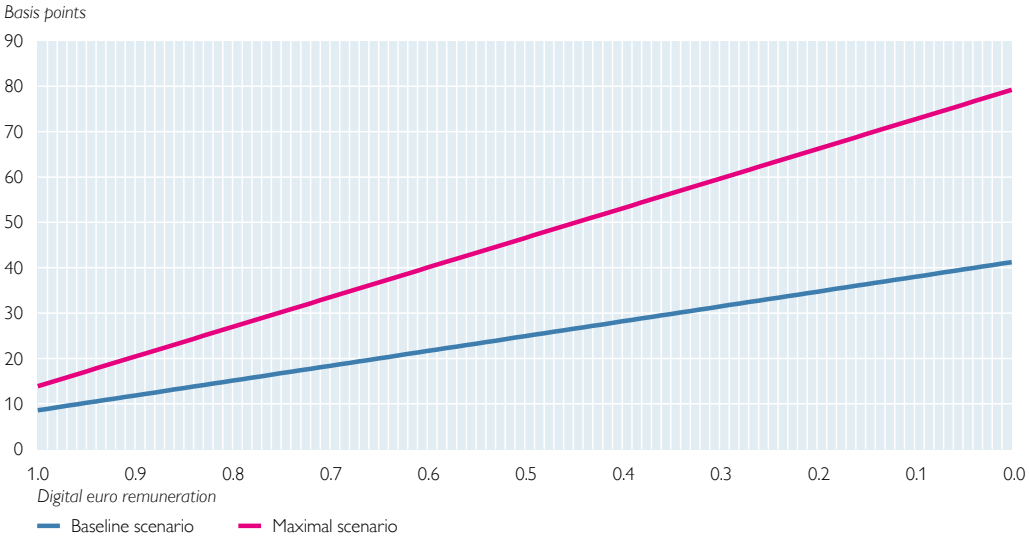
Source: OeNB.

[8] *The idea here is that sight deposits from these agents are mainly used for transactional purposes, while the sight deposits of financial firms and central banks do not serve this function.*

[9] *The first (second) value, 0.47 (0.28), relates the NPI return of Austrian banks from sight deposits derived above (0.57) to the 25th (10th) percentile of the same NPI return of a sample of European SSM banks, 0.27 (0.16). The 25th percentile corresponds to the NPI return of Dutch banks in the SSM sample (0.28), where the payment system is often considered one of the most efficient and innovative in Europe.*

Chart 3

RoE effect from NPI losses



Source: OeNB.

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Annex

Table A1

Sample statistics for small, medium-sized and large banks

	Small banks	Medium-sized banks	Large banks
Share of banks, %	79.9	16.5	3.6
Share of total assets, %	15.6	25.0	59.4
Share of accounts, %	27.6	27.4	45.0
Share of deposits, %	22.3	27.9	49.8
Accounts per total assets, EUR million	14.0	8.7	6.0
Share of household deposits in total assets, %	37.9	29.6	22.1

Source: OeNB.

Note: Small banks are defined as banks with total assets up to EUR 1 billion, medium-sized banks' total assets range from EUR 1 billion to EUR 10 billion, while large banks' total assets amount to more than EUR 10 billion.

Systemic risks from commercial real estate lending of Austrian banks

Marcel Barmeier, David Liebeg[1], Sebastian Rötzer[2, 3]

The commercial real estate (CRE) market in Austria – and many other countries – has been under stress at least since interest rate increases began in 2022. Consequently, the evaluation of financial stability risks in the CRE segment is of high relevance for supervisory authorities and policymakers. This study contributes to this goal by providing an integrated approach to gauge systemic risks associated with CRE financing. Combining macroeconomic information with data on the loan, firm and bank level, we estimate the effect of adverse macroeconomic conditions on CRE loan portfolios of Austrian banks. We find that in an adverse scenario, nonperforming loan (NPL) ratios could increase to levels seen in international historical crises and a sizable share of bank capital could be depleted. Thus, we conclude that CRE loans, in the event of a further deterioration of the economic environment, pose an increased risk to financial stability in Austria. This is in line with the assessment that Austria's Financial Market Stability Board (FMSB) made in its 41st meeting.

JEL classification: G01, G21, G28, R33
Keywords: commercial real estate, systemic risk, financial stability

Commercial real estate (CRE) funding has been at the forefront of worries of financial journalists, analysts, policymakers and investors since the start of interest rate increases in 2022 and even earlier. In the macroprudential sphere, the European Systemic Risk Board (ESRB) has issued a warning on vulnerabilities in CRE markets in Europe, following its recommendations on closing data gaps in 2016 and 2019 (ESRB, 2016, 2019, 2023). Austria's Financial Market Stability Board (FMSB) has regularly warned about risks of CRE funding in Austria, as have the Financial Market Authority (FMA) and the OeNB nationally, as well as the ESRB, the European Central Bank (ECB) and the International Monetary Fund (IMF) internationally. In its 41st meeting, the FMSB concluded that "potential losses from commercial real estate loans, in the event of a further deterioration of the economic environment, can pose an increased risk to financial stability in Austria." This paper constitutes a follow-up to the work of Liebeg and Liegler (2022).

We start our paper with a short introduction on insights from past CRE crises, then present the data available for our systemic risk assessment, describe our empirical strategy, lay out the scenarios we use and the results we obtain, and finally conclude.

1 Insights from CRE crises of the past

CRE crises occur with some regularity and are usually part of a wider real estate crisis or downturn in the economy as the CRE segment is strongly interconnected with both the real economy and the financial system (ESRB, 2023). A crisis in the

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CRE segment has both been a trigger (Deghi et al., 2021) and a consequence (Davis and Zhu, 2011) of a wider economic downturn. For our assessment, we have analyzed 12 CRE-specific crises since the early 1980s from the literature, some of which transcended national borders and affected a wider region.

Crowe et al. (2013), while concluding that CRE crises are difficult to pin down due to their interweaving with residential real estate (RRE) crises, find that CRE played an important role in the savings and loans crisis in the US in the early 1980s, in Japan from the late 1980s onward, in the Nordic crisis and in Australia in the early 1990s, in the Asian crisis in the late 1990s, and in Ireland and Spain in the late 2000s. Davis and Zhu (2011) employ a similar sample but add France, the UK, and the United States in the late 1980s and early 1990s to the list of property crisis episodes. Ellis and Naughtin (2010) add Australia, the UK and the US to the list of countries with CRE crises during the global financial crisis of the late 2000s. Herring and Wachter (1999) offer deeper insights into the CRE crises of the early 1980s in the US, the early 1990s in Japan and Sweden, and the late 1990s in Thailand. The Danish Systemic Risk Council (2023) finds that in the crisis of the late 2000s, lending to the corporate sector "real estate activities" has given rise to significant impairment charges for credit institutions.

While international CRE price data are comparably more widely available, data for CRE credit risk indicators, such as nonperforming loans (NPLs) and loan loss provisions from historical CRE crises, are scarce. In their overview, Deghi et al. (2021) show that CRE prices tend to reach their troughs roughly two years after their peaks, dropping by 20% to 56% in that time span. Some price drops last longer and are deeper – Ireland saw a decline by about two-thirds over five years. Ellis and Naughtin (2010) demonstrate that CRE price drops are usually larger than RRE price drops. As for risk indicators, the US Federal Deposit Insurance Corporation (FDIC) offers time series data on loan portfolio performance that are available for all FDIC-insured institutions from 1984 onward and for various aggregates of real estate loans.[4] Noncurrent rates[5] of US real estate loans increased from 0.9% in Q1 2007 to 7.6% in Q1 2010. In construction and development loans, there was an increase from 1% to 16.8% in the same time span. Banco de Espana's BIEST[6] dataset offers time series data on real estate loan quality from 1992 onward. The NPL ratio in Spain increased from 0.7% in Q4 2007 to 34.3% in Q4 2013 for loans to the construction sector. In loans to the real estate activities sector, the ratio rose from 0.7% to 38% in the same period of time. The loan loss provisions ratio for loans to the construction sector increased from 0.3% to 18% during this six-year period. Finally, Danmarks Nationalbank has provided us with data on loan loss provisions for real estate activities loans: They grew from 0.5% in 2007 to 9.4% in 2013.

2 Data

Defining CRE loans from a risk perspective is a challenging task. Depending on the scope, data sources and the applied perspective, the size of banks' CRE exposure may vary significantly. For our systemic risk assessment, we use a sectoral perspective

[4] *https://www.fdic.gov/analysis/quarterly-banking-profile/index.html*

[5] *According to the FDIC, noncurrent loans are those that are 90 or more days past due or are on nonaccrual status. The noncurrent rate is the sum of noncurrent loans to total loans.*

[6] *https://app.bde.es/bie_www/faces/bie_wwwias/jsp/op/Home/pHome.jsp*

that includes all loans to domestic non-financial corporations in the "real estate activities" (ÖNACE 2008 sector L.68), "construction of buildings" (ÖNACE 2008 sector F.41) and "specialised construction activities" (ÖNACE 2008 sector F.43) sectors.[7] The interconnectedness of these sectors is shown by the high correlation of NPL ratios as well as the mutual reliance on intermediate consumption of goods from the sectors L "real estate activities" and F "construction" in the gross value added in the Austrian economy.[8] Furthermore, this definition of CRE loans allows us to focus on a homogenous group of corporations and thereby follow a targeted approach in modeling sensitivities of corporates to macroeconomic shocks. Recently, the European Central Bank (Ryan et al., 2023; ECB, 2024) and Danmarks Nationalbank (Danish Systemic Risk Council, 2023) have used a similar approach to assess risks from CRE financing. Following this definition, the total loans associated with CRE amount to EUR 127 billion as of December 2023, of which the majority (EUR 102 billion, 80%) fall under the "real estate activities" sector (see chart 1).

Chart 1

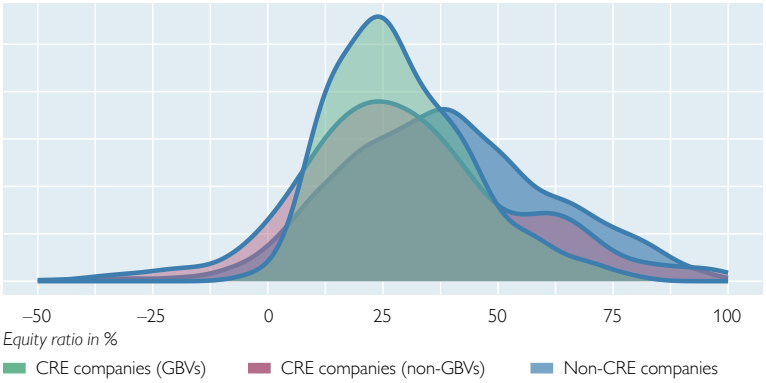
Domestic CRE exposure by economic sectors

Source: OeNB.

Note: Data as at December 31, 2023.

Chart 2

Equity ratio distribution of CRE companies



Source: SABINA database, OeNB.

Note: Data as at December 31, 2021.

One particularity of the Austrian CRE segment is the importance of limited-profit housing associations (GBVs).[9] GBVs account for 22% of domestic CRE loans, and the largest share is in the "real estate activities" sector. The risk structure of GBVs differs significantly from profit-oriented debtors (non-GBVs). As of year-end 2023, the NPL ratio stood at 3.7% for profit-oriented debtors, whereas it was 0% for GBVs.[10] Furthermore, we also use information from the Bureau van Dijk SABINA database

[7] *Note that for the monitoring of CRE-related risks, we focus on domestic and foreign loans to legal persons (including nonfinancial corporations) in the sectors L.68, F.41 and F.43 as well as loans that fund the constructing, developing or acquiring of (commercial or residential) properties. For an overview of the exposure and risk structure based on this definition, see Financial Stability Report 47.*

[8] *Statistics Austria: input-output statistics.*

[9] *In German: gemeinnützige Bauvereinigungen.*

[10] *Note that the NPL ratio is based on data from AnaCredit and uses a sectoral perspective to define CRE. This differs from the CRE definition based on FINREP data.*

to investigate the balance sheet structure of CRE companies. As of year-end 2021, CRE companies had on average a lower capitalization than companies from other sectors irrespective of profit orientation (see chart 2).[11] However, compared to profit-oriented debtors in the CRE sector, the number of GBVs with negative equity is much lower and close to zero. Moreover, with respect to the availability of liquid assets, we find that GBVs generally have stronger liquidity positions (cash and bank balances) than non-GBVs. Since better capitalization and liquidity as well as legal provisions effectively shield GBVs from market stress, we treat them separately in our assessment of systemic risks in the CRE segment.

3 Empirical strategy

Our systemic risk assessment follows a two-step approach. First, we estimate the sensitivity of individual borrowers' probability of financial distress to a selection of macroeconomic drivers, which we then use to project expected probabilities of stress for a given set of macroeconomic scenarios. Second, we employ the projected probabilities and a dataset of lender-borrower interlinkages to conduct a simulation exercise to map simulated balance sheet stress of borrowers into banks' portfolio losses. Our simulation approach follows the methodologies in Harrison and Mathew (2008) and Górnicka and Valderrama (2020), adapted to the distinct requirements of CRE lending, and allows us to track default probabilities (PDs) and losses given default (LGDs) for individual banks as well as the aggregate banking system.[12] Figure 1 illustrates the two main steps and their respective substeps, with a more detailed description given below.

3.1 Step I – Projecting CRE companies' probability of financial distress

Earlier studies on systemic risks from real estate financing have primarily focused on households. However, CRE companies are fundamentally different: Their debt servicing capacity depends, at least to some degree, on price developments in real estate markets. That is, both the first and second lines of defense of the banking system's loan book depend on the same macroeconomic drivers. Therefore, and due to the gap in the existing literature, the modeling of borrowers' probability of financial distress conditional on macroeconomic states is a key contribution of our study.

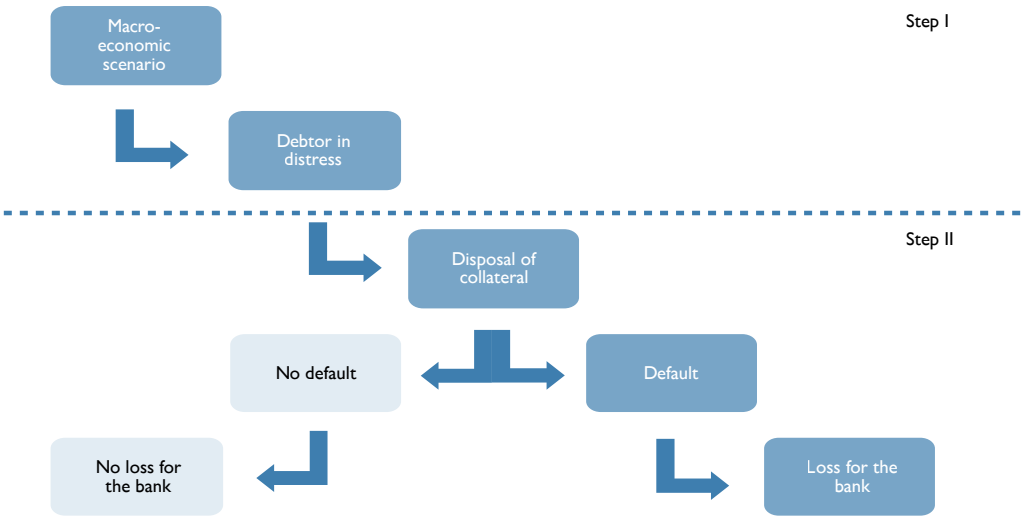
We use a two-step approach to map changes in macroeconomic state variables into shifts in probabilities of firm balance sheet stress. First, using data from the Banque de France's BACH database, we estimate the impact of changes in macroeconomic variables on within-country aggregate revenue changes in the construction and real estate sectors. In the second step, following the micro-simulation approach of Ryan et al. (2023), we employ Bureau van Dijk SABINA data on firm-level balance sheets in the construction and real estate sectors to assess liquidity and solvency stress for a large number of historically plausible shocks to revenues and interest rates. In determining the thresholds for a corporation to fail, we rely on

[11] *Unfortunately, balance sheet information in Bureau van Dijk SABINA database is available with a significant time lag. Thus, we rely on data as of year-end 2021.*

[12] *CRE lending differs from RRE insofar as both lenders and borrowers are heterogeneous and the latter may have multiple loans outstanding. Therefore, we depart from the representative bank approach employed in prior literature and instead simulate and resolve borrower defaults for the entire network of CRE loans in the Austrian banking system.*

Figure 1

Steps in systemic risk assessment



Source: Authors' compilation based on Harrison and Mathew (2008) and Górnicka and Valderrame (2020).

Guth et al. (2020) and Puhr and Schneider (2021): A firm is insolvent when either its cash and bank reserves are below –10% (e.g. bank lines are overdrawn) or its equity ratio is below –30%.[13] Taken together, the combined sensitivities obtained from these two exercises allow us to project any macroeconomic scenario, be it historical or hypothetical, into a shift of borrowers' probabilities of solvency or liquidity stress.[14] To ensure that our projection method returns only real probabilities, we constrain output values of stressed borrower PDs, i.e. base PDs from the lender-borrower level data plus shifts, to the interval of [0.05%, 100%].

Taken together, let β_{NACE} denote a vector of sectoral sensitivities to the vector of macroeconomic changes, ΔZ, including the particular element $\Delta NFCrate$ for the change in corporate lending rates. Let α_S and α_R be the sensitivities obtained from the micro-simulation in the second step and let PSS_i and $ShareVariable_i$ be the ex ante probability of stressed sales by firm i and its share of variable rate loans. Then the projected probabilities of CRE companies' financial distress in our model are given by

$$PSS_i^* = \max\{\min\{PSS_i + \alpha_S \times \Delta Sales_i(\boldsymbol{\beta}_{NACE}, \Delta \mathbf{Z}) + \alpha_R \times ShareVariable_i \times \Delta NFCrate, 100\%\}, 0.05\%\},$$

where the lower bound of projected stress probabilities of 5 basis points is aligned with the lower bound guidance in the capital requirement regulation (CRR) version III.

[13] *The overindebtedness threshold is justified by cross-country empirical studies that show that the equity ratio commonly associated with insolvency ranges from –30% to –35% (see Davydenko, 2007). The foundation for the illiquidity threshold is weaker. As by Puhr and Schneider (2021), we use a negative liquidity threshold to account for the firms' possibility to rely on undrawn credit lines from banks.*

[14] *A firm experiencing solvency and/or liquidity stress will attempt to rebalance its accounts by selling assets. If the proceeds from a sale are deemed insufficient to cover the firm's needs, it will default on its obligations, thereby appearing as default in the lending bank's loan books.*

3.2 Step II – Simulation of banks' portfolio losses from real estate financing

Using our projection method for borrowers' probabilities of financial distress and the macroeconomic scenarios detailed below, we conduct a simulation exercise to gauge the conditional loss distributions of Austrian banks' CRE credit portfolios. To this end, we construct a large sample of lender-borrower relationships where we track the total exposure amount, the loan's conditional net present value (NPV), the risk premium and the available loan collateral in the form of residential and commercial real estate as well as other, non-real estate, assets. For each out of a sample of $S = 2000$ simulations, we draw a vector of financial distress indicator variables for the population of borrowers, where an outcome of 1 indicates financial distress and the probability of such an event is governed by the projection method detailed in step I above.

For each borrower in distress, the process of distress resolution, as illustrated in step II of figure 1, may lead to economic default if the proceeds from a collateral sale cannot cover the cost of debt following Harrison and Mathew (2008) and Górnicka and Valderrama (2020). Any resulting losses are then collected at the bank portfolio level. This approach allows us to track measures like probability of economic default, loss given default and NPL ratios not only on the individual bank-level but also for within-bank subportfolios, such as lending to each of the individual economic sectors considered, as well as to distinguish between profit-oriented debtors and GBVs.

In the implementation of our simulation methodology, we place particular emphasis on the consistency of the macroeconomic channels between the projection method in step I and the resolution of credit risk in step II. That is, the same shocks that drive up distress probabilities of firms in the broader real estate sector also reduce collateral value and increase ex ante loan NPVs. This is to maintain the intuitive perspective on how this sector accumulates a systemic risk to financial stability: It is the twofold dependency of debt servicing capacity and collateral value on real estate prices and interest rates that makes the real estate sector, and thereby its lenders, particularly vulnerable to adverse shifts in the macroeconomic environment.

4 Macroeconomic scenarios

For our systemic risk assessment, we need macroeconomic scenarios for the paths of domestic GDP and property prices (both residential and commercial) as well as that of interest rates. Our macroeconomic scenarios for GDP and real estate prices[15] draw from the OeNB 2024 banking stress test exercise (see box 1 "Results of the OeNB's 2024 solvency stress test" in this report's "Recent developments and macropru-

Table 1

Macroeconomic scenarios: cumulative change over three years

	Baseline	Adverse
	%	
Real GDP	+4.1	–5.0
Risk free and corporate rate	Unchanged from YE 2023	Unchanged from YE 2023
CRE prices	+2.4	–28.4
RRE prices	+4.1	–33.2

Source: OeNB, ESRB, authors' compilation.

[15] *The underlying scenarios are based on the methodology of the European Central Bank that takes overvaluations in real estate markets into account.*

dential policy update"), while we keep the risk free and corporate interest rates at the level as of year-end 2023.

Following the usual approach in stress testing, we use a three-year horizon, which is also backed by the experiences made in historic CRE crises that roughly lasted from two to six years peak to trough. In line with the static balance sheet assumption, we assume that the banks' balance sheets do not change over time. The adverse scenario of our stress simulation assumes a severe stagflation: a period of negative GDP growth associated with elevated levels of inflation that hinders central banks from lowering their policy rates and a materialization of accumulated risks in the real estate sector that leads to an extended fall in property prices.

Cumulative GDP growth from 2024 to 2026 is 4.1% in the baseline scenario and –5.0% in the adverse scenario. CRE property prices rise by 2.4% in the baseline scenario and fall by 28.4% in the adverse scenario; RRE property prices increase by 4.1% and decline by 33.2%, respectively.[16]

5 Results

Applying the discussed methodology and the baseline as well as the adverse macroeconomic scenario to the Austrian banking system according to year-end 2023 data, we observe that CRE financing poses a heightened systemic risk to financial stability. We come to this conclusion by investigating the changes in the estimated PDs and LGDs as well as the impact on the NPL ratio and capitalization of Austrian banks.

In the adverse macroeconomic scenario, the estimated PDs and LGDs for CRE loans increase significantly. While the PD is 0.3% is the baseline scenario, it increases to 16.4% in the adverse scenario. LGDs triple from 12% in the baseline scenario to 35.3% in the adverse scenario (see chart 3).

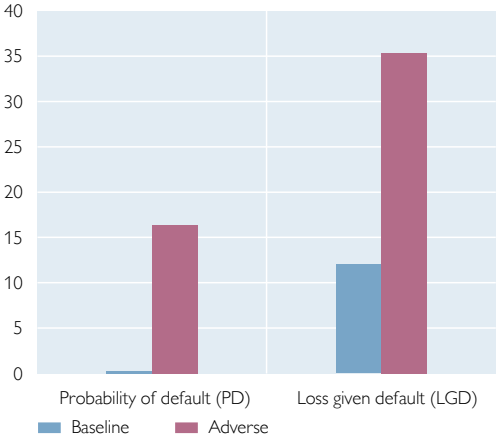
Consequently, the increase in PDs also leads to a higher share of NPLs. We find that our estimated NPL ratios in the adverse scenario are in the range of historical CRE crises: During those crisis periods, the NPL ratio stood at 8%–17% in the United States[17] and 34%–38% in Spain.[18]

Increases in PDs and LGDs subsequently also increase banks' expected credit losses. In total, bank losses are

Chart 3

Estimated PDs and LGDs by scenario

Weighted average PDs and LGDs in %



Source: Authors' compilation, OeNB.

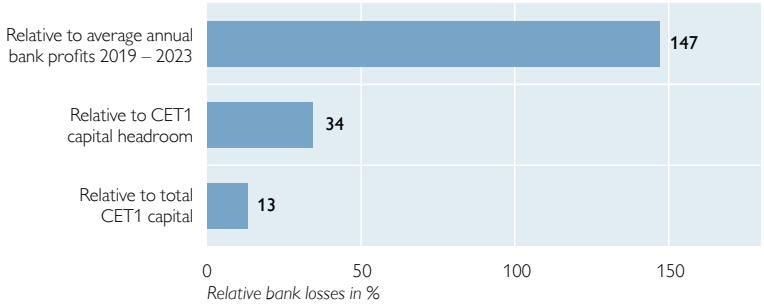
[16] *Note that the ESRB (2024) scenario allows for more severe assumptions about risk-free rates (+119 basis points for ten-year Austrian government bond yields) and corporate shocks (+288 basis points for BBB rated exposures and +435 basis points for BB rated exposures) as well as property prices (–33.1% for RRE and –43.6% for CRE over a three-year horizon). In the global financial crisis, Ireland experienced an RRE price drop of 34.2% and a CRE price drop of 56.3% within two years (Ellis and Naughtin, 2010).*

[17] *Total real estate loans and loans for construction and development loans, respectively.*

[18] *Loans to the NACE sectors "construction" and "real estate-related activities," respectively.*

Chart 4

Estimated bank losses in the adverse scenario



Source: Authors' compilation, OeNB.

estimated to amount to 13% of total CET1 capital in the adverse scenario. One third of capital headroom, i.e. the difference between CET1 capital and the required CET1 capital for fulfilling the overall capital demand (OCD),[19] could be depleted in the adverse scenario. To put the number in another perspective, estimated bank losses could be larger than the average annual bank profits between 2019 and 2023 (see chart 4). Virtually all losses (98%) stem from profit-oriented debtors (non-GBVs), thus confirming the risk-mitigating character of limited-profit housing associations in Austria. This observation is supported by the distribution of losses across banks. Banks with a high share of GBV financing have lower average losses.

In a systemwide CRE crisis, various factors that are not incorporated in our model would influence the severity of the crisis. While banks' operating profits could mitigate some effects, various aspects could amplify the impact of the crisis. These include an increase in bank funding costs, interbank contagion effects as well as negative spillovers to other industries. In our view, these observations confirm the systemic nature of risks associated with CRE financing.

6 Conclusions

Losses from commercial real estate (CRE) loans, in the event of a further deterioration of the economic environment, pose an increased risk to financial stability in Austria. We come to this conclusion by extending the approaches used by, among others, the European Central Bank and the International Monetary Fund to identify systemic risks in real estate markets. We show that in the event of an adverse macroeconomic development, a sizeable number of loans could become non-performing and a significant share of available capital in the Austrian banking sector could be depleted. Our results therefore support the view of Austria's Financial Market Stability Board (FMSB) that macroprudential measures are necessary to address systemic risks stemming from CRE loans. Accordingly, the FMSB recommended that the Financial Market Authority set a sectoral systemic risk buffer of initially 1% of risk-weighted CRE assets.[20]

[19] *OCD is calculated as the sum of the overall capital requirement (Total SREP capital requirement + combined buffer requirements) and the Pillar 2 guidance.*

[20] *For details, refer to the FMSB website.*

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From part of the problem to part of the solution: evaluating the effectiveness of borrower-based measures in Austria

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Evaluating macroprudential policies is key to ensuring that measures are implemented effectively. Borrower-based measures were introduced in Austria in August 2022 via the so-called KIM-V regulation that defines sustainable lending standards for residential real estate (RRE) financing. In our evaluation, we provide evidence on how effective these measures have been so far in addressing systemic risks in Austria's RRE sector. Based on data for lending standards, we find that the KIM-V has halved the share of new lending with a debt service-to-income ratio (DSTI) above 40%. In addition, by applying estimations in a difference-in-differences setting, we find that the ratio of nonperforming loans (NPLs) of RRE loans has decreased by up to 0.5 percentage points since mid-2022. Our findings support the literature, which shows that borrower-based measures effectively reduce systemic risks in the housing sector.

JEL classification: G21, G28, R31
Keywords: borrower-based measures, KIM-V, financial stability, residential real estate

From 2016 onward, the Austrian Financial Market Stability Board repeatedly highlighted the importance of adhering to sustainable standards in real estate lending. When these recommendations did not have the intended effects and systemic risks from residential real estate (RRE) financing kept building up, it was decided to implement legally binding borrower-based measures (BBMs) in August 2022, known as the KIM-V regulation ("Kreditinstitute-Immobilienfinanzierungsmaßnahmen-Verordnung"). The KIM-V sets standards for credit institutions' new lending by limiting (1) the loan-to-collateral ratio (LTC) to 90%, (2) the debt service-to-income ratio (DSTI) to 40% and (3) the maturity to 35 years.[2] Given that BBMs have been in place for over two years now, the question arises how effective they have been so far in mitigating risks to financial stability. To provide an answer, we draw on national and international bank-level data in a difference-in-differences framework. The study is structured as follows: In section 1, we discuss the link between BBMs and financial stability, section 2 includes a short literature review, section 3 provides an empirical approach to estimating the effectiveness of the KIM-V and section 4 concludes.

1 Borrower-based measures and financial stability

Poor lending standards in RRE financing increase the likelihood and severity of disruptions to financial stability, i.e. systemic banking crises, as underlined e.g. by

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[2] *Bridge loans and small loans (up to 2%) are exempted from the KIM-V. Furthermore, banks can exempt 20% of the new lending volume from the KIM-V. The minimum exemption volume per bank is EUR 1 million.*

Aikman et al. (2021) and Muellbauer (2022). The quality of new loans trickles down to the quality of a bank's RRE portfolio, which constitutes a significant share of banks' domestic credit exposure; in Austria approximately 30%.[3] Given that mortgages play such an important role for banks, housing market turmoil and banking crises often go hand in hand (Jordà et al., 2016). Two-thirds of 46 systemic banking crises for which house price data are available were preceded by housing boom-bust cycles (Crowe et al., 2013; Roy, 2022). Systemic banking crises imply high social and economic costs: the public sector on average pays 6.7% of GDP to fight such crises, public debt rises by 21% of GDP and output losses are roughly 35% of GDP (Laeven and Valencia, 2018).[4] To reduce the risks of a real estate-related banking crisis, BBMs became the most commonly used macroprudential policy tool in Europe: 22 out of 30 countries in the European Economic Area deploy BBMs. The most common BBMs are income- and collateral-based measures. Income-based measures, such as limits to the DSTI or the debt-to-income ratio (DTI), aim at increasing household resilience to income and interest rate shocks. In times of crisis, borrowers have more income at their disposal to cover their regular expenses, which lowers the household's probability of default (PD). Collateral-based measures, like the LTC, aim at improving lender resilience during real estate downturns by requiring higher down payments. If a household defaults on its debt, the bank's loss given default (LGD) is reduced (Lo Duca et al., 2023).

2 Literature review

A major challenge in evaluating BBMs is how to define the target variable for measuring effectiveness. Financial stability is difficult to define in an implementable way (BIS, 2023). Thus, policymakers commonly target specific intermediate objectives, which can be broken down into (1) maintaining borrower resilience, (2) maintaining lender resilience, (3) dampening the housing credit cycle and (4) promoting sustainable house price growth (BIS, 2023). Since many authorities mandated with assessing systemic risks, including the Oesterreichische Nationalbank, focus on the first two objectives, the following literature review covers the impact of BBMs on borrower and lender resilience.

To measure borrower resilience, the target variable is often a single credit risk indicator, e.g. the PD, which is regressed on loan and borrower characteristics. Examples include de Haan and Mastrogiacomo (2020), who find that in Denmark limits to the loan-to-value ratio (LTV) and DSTI reduce the probability of non-performance of loans, which encompasses arrears, foreclosures and defaults. If the LTV (DSTI) is 10 percentage points higher, the probability of nonperformance of loans increases by 0.19 (0.75) percentage points. Galán and Lamas (2019) corroborate the main insights for Spain, emphasizing that income-based measures are more robust determinants of mortgage default than LTV limits. Nier et al. (2019) show for Romania that if the DSTI limit of 40% had been implemented earlier, the PD would have been lowered by approximately 23% in comparison to the case without BBMs. Catapeno et al. (2021) rely on an agent-based model to assess the effectiveness of potential BBMs in Italy. They acknowledge that BBMs

[3] *The share of RRE loans of banks' total assets is approximately 16%. Source: ECB, Balance Sheet Items data, Consolidated Banking Data.*

[4] *Data for high-income countries.*

reduce the probability of mortgage default but find negligible effects for the Italian market. The TUI[5]-model developed by Górnicka and Valderrama (2020) is another method to estimate effects on credit risk indicators. It was for instance applied to Switzerland (Maslova et al., 2022) and Austria (Górnicka and Valderrama, 2020) to measure the effectiveness of various theoretical DSTI, DTI and LTV limits. For Austria, the PD decreased from 3.9% to 2.2% in an adverse macroeconomic scenario thanks to a DSTI limit of 40% combined with an LTV limit of 80%.

With respect to lender resilience, the literature directs attention to risk measures on the level of individual institutions. Gross and Población (2017) developed a structural micro-macro model which combines household information of the Household Finance and Consumption Survey with macroeconomic and bank-level data. Household resilience is indicated by PD, LGD as well as the expected loss. Any change in these variables subsequently affects banks' capital position via the mortgage portfolios. The model has been applied in a cross-country context, e.g. by Giannoulakis et al. (2023) or Ampudia et al. (2021), but also for individual countries, e.g. Slovakia (Jurča et al., 2020). Giannoulakis et al. (2023) find that the median capital ratio across countries implementing BBMs increases by up to 1 percentage point compared to no policy intervention. Some researchers construct their own bank-level risk measures to evaluate the impact of BBMs. The target variables are typically based on data from stock markets as well as banks' financial statements. Meuleman and Vander Vennet (2020) distinguish between individual bank risk and risk from the linkage with the financial system. They find that BBMs are most effective in lowering banks' individual risk. In other words, a unit increase (tightening) of their self-constructed index for BBMs on average reduces risk by 4.2 percentage points. They do not find a statistically significant effect on the linkage component. Belkhir et al. (2023) add that DSTI and LTV limits are effective in reducing banks' expected capital shortage in a crisis – but only in combination with an inflation-targeting regime. Altunbas et al. (2018) find that asset class measures, which encompass DSTI, LTV and credit growth limits and limits on the exposure to the housing sector, reduce (increase) the expected default frequency[6] for the average bank by 0.15 (0.66) percentage points when tightened (eased).

To summarize, the literature finds support for the effectiveness of BBMs in addressing systemic risks, measured by indicators evaluating borrower and lender resilience. This gives authorities well-founded arguments to apply BBMs. However, as national specificities play an important role for the effectiveness of BBMs, national characteristics should be considered.

3 Effectiveness of BBMs in Austria

To add to the understanding of BBMs in Austria, we evaluate their effectiveness in a two-step approach. First, we present descriptive statistics for the development of lending standards and the NPL ratio for RRE financing. Second, we use these data in a difference-in-differences setting to estimate the effect of the introduction of the KIM-V on the NPL ratio. Regarding the target variable, we contribute to the

[5] *Tool for Unobserved-event Investigation.*

[6] *A forward-looking risk measure computed by Moody's considering Moody's default database, stock market information and banks' financial statements.*

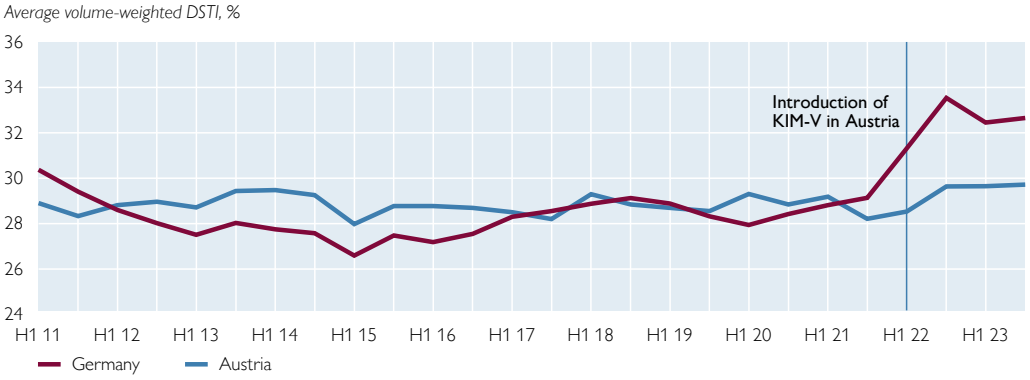
literature on the effectiveness of BBMs with respect to borrower resilience.[7] De Haan and Mastrogiacomo (2020) as well as Galán and Lamas (2019) are the papers which bear the most resemblance to ours.

3.1 Data

To conduct our analysis, we compare Austrian and German bank-level data on lending standards and the quality of the RRE loan portfolio, i.e. the NPL ratio.

Chart 1

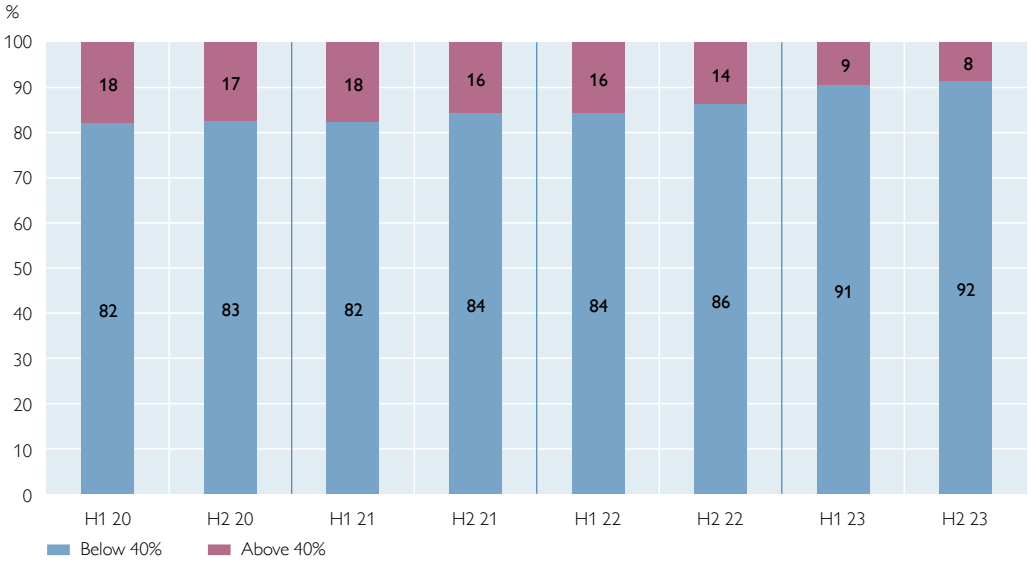
Average debt service-to-income (DSTI) ratio in Austria and Germany, new lending



Source: OeNB, Deutsche Bundesbank.

Chart 2

Austria: debt service-to-income (DSTI) ratio, new lending



Source: OeNB.

Note: Loans that are not clearly assignable are classified as sustainable.

[7] *In addition to the effect of the KIM-V on borrower resilience, the limit on LTC may also have a positive effect on lender resilience. However, this is not quantified in our approach.*

In Austria, data on lending standards, i.e. on DSTI, DTI, LTV, LTC and maturity, are available from 2011 onward. From 2011 until 2020, banks reported their lending standards as part of the "Hypothekarkreditumfrage" (HKU)[8]. Starting from 2020, reporting standards were amended and reporting via "VERA H – Private Wohnimmobilienfinanzierung" (VERA-H)[9] related to RRE lending became legally binding. For Germany, we rely on data that are provided by a loan brokerage platform to the Deutsche Bundesbank (Ausschuss für Finanzstabilität, 2024). As the DSTI is the most relevant indicator for debtors' ability to repay their loans, we discuss its development in more detail.[10]

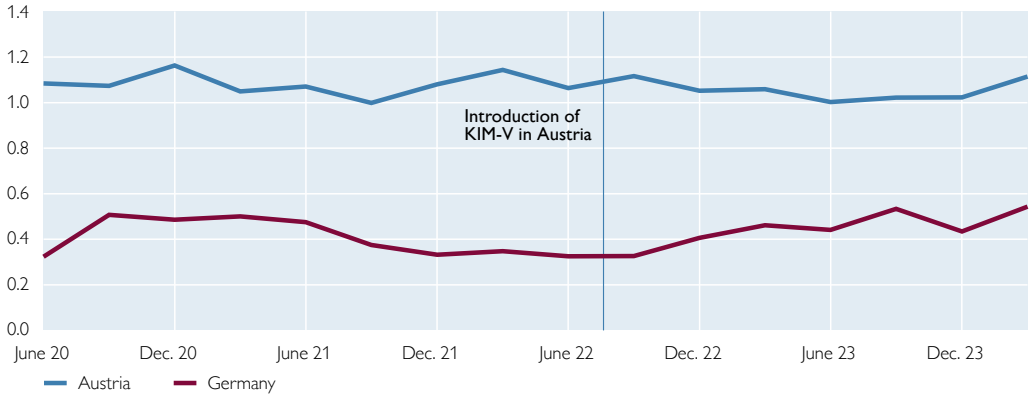
Chart 1 shows the average volume-weighted DSTI for new lending in Germany and Austria. Although interest rates increased gradually from July 2022, the average DSTI for new lending in Austria remained below 30%, whereas in Germany the DSTI peaked at 33.5% in the first half of 2022. While the average DSTI in Austria also increased slightly between the first half of 2022 and the second half of 2023, the reduction in the share of loans with a DSTI above 40% dampened the overall increase in the DSTI (chart 2). In the first half of 2022, 16% of the new lending volume was issued with a DSTI above 40%; in the second half of 2023, this percentage dropped to 8%. The improvement of the DSTI and other lending standards (see the annex) is a first indication of the effectiveness of the KIM-V.

To gauge the loan quality of banks' RRE portfolio, we consider the NPL ratio for RRE loans. The NPL ratio is corrected for loans that are past due more than one year.[11] Chart 3 shows the development of the median corrected NPL ratio on an unconsolidated level for significant institutions from Germany and Austria

Chart 3

NPL ratio of RRE loans in Austria and Germany

Median NPL ratio, %



Source: ECB, OeNB.

Note: Only nonperforming loans with past due ≤ 1 year are considered.

[8] *Up to 11 banks took part in HKU mortgage reporting. The banks' lending volume added up to at least one-third of the total new lending volume.*

[9] *Neue Erhebung Vera H – Private Wohnimmobilienfinanzierung unkonsolidiert ab BT 30.6.2020 - Oesterreichische Nationalbank (OeNB).*

[10] *See chart A1 in the annex for the evolution of LTV ratios in Austria and Germany.*

[11] *The correction of the NPL ratio is conducted to exclude the effect of loans that were nonperforming already before the KIM-V was introduced.*

since June 2020.[12] While in Austria and Germany the NPL ratio remained relatively constant up to the introduction of the KIM-V, the NPL ratio increased in Germany from mid-2022 onward, namely from 0.3% to 0.5% in March 2024. In Austria, the NPL ratio stood at 1.1% in June 2022 and March 2024.

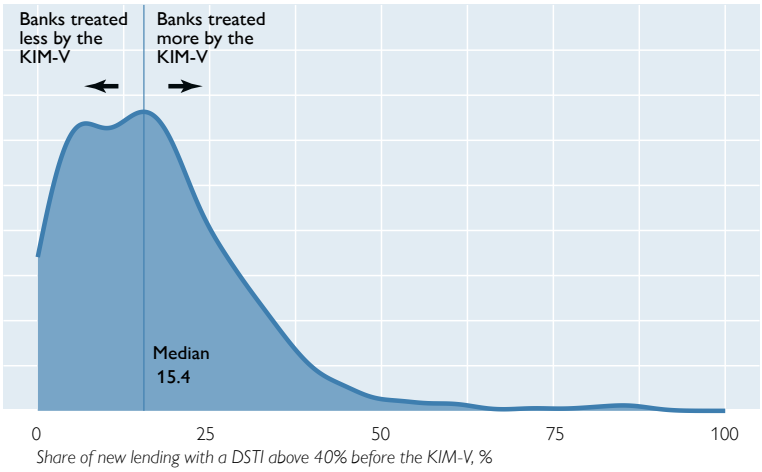
When evaluating the effect of the KIM-V on the NPL ratio, we need to consider that improved lending standards do not immediately reduce defaults in the stock.[13] Thus, the direct increase in the NPL ratio recorded by German vs. Austrian banks should be considered as part of general fluctuations. Only the persistent increase in the NPL ratio in Germany relative to Austria might be attributable to the KIM-V. Since other confounding factors might have played a role, we continue our analysis with an econometric approach to estimate the causal relationship between the introduction of the KIM-V in Austria and the evolution of non-performing loans.

3.2 Empirical strategy

Estimating the causal effect of the introduction of BBMs in Austria is challenging. Ideally, we would randomly allocate banks to a group that has to fulfill the requirements for new lending according to the KIM-V (treatment group) and a group that does not have to fulfill the requirements (control group). However, as the KIM-V targets all banks in Austria, we need to find other methods for estimating the impact. Thus, we rely on a difference-in-differences approach, where we compare the NPL ratio of banks that are treated by the KIM-V and banks that are not treated by it.

Chart 4

Distribution of banks: new lending with a DSTI above 40% before the KIM-V



Source: OeNB (VERA-H reports).

Since the assignment of banks into a treatment or control group is crucial, we rely on two alternative approaches. First, as the KIM-V was introduced only in Austria, we draw on bank-level data from Germany to build a control group (baseline specification).[14] As the banking sectors in Austria and Germany are alike (e.g. high degree of bank competition, large number of banks), German banks are most suitable to serve as a control group when we estimate the effects of the implementation of the KIM-V in Austria.

Second, we classify Austrian banks into a treatment and a control group based on their standards for new lending

[12] *As of the first quarter of 2024, data are available for 84 significant institutions, of which 59 banks are from Austria and 25 banks from Germany, representing a significant share of each market.*

[13] *Improved lending standards resulting from the KIM-V lead to lower probabilities of default. Thus, the NPL ratio is reduced. However, given the timespan that needs to be considered in this transmission mechanism, the effect of the KIM-V materializes only with a time lag.*

[14] *As data for banks from Germany are only available for significant institutions, we only compare the NPL ratio of significant institutions in Austria and Germany.*

prior to the introduction of the KIM-V (robustness specification).[15] Chart 4 shows the distribution of Austrian banks with respect to their share of new lending with a DSTI above 40% in 2020 and 2021, i.e. before the KIM-V was introduced. The control group comprises banks that had a below-median share of new lending with a DSTI above 40%, while banks with an above-median share of new lending with a DSTI above 40% make up the treatment group.[16] Given the numerous exemptions to the KIM-V, banks with a low share of new lending with a DSTI above 40% did not need to change their lending standards significantly once BBMs were introduced.[17]

The econometric validity of the difference-in-differences approach rests on critical assumptions. Most importantly, the method assumes that the NPL ratios of treated and non-treated banks have parallel trends in the absence of the KIM-V ("parallel trends assumption"). While this is generally not testable, the pre-KIM-V trends provide an indication. Chart 3 shows for the baseline specification that the evolution of the median NPL ratios were fairly parallel for banks from Austria and Germany before the treatment. In June 2020 and June 2022, the median NPL ratios corresponded for banks in both countries, with the German NPL ratio standing at 0.3% and the Austrian one at 1.1%. As a further assumption for the difference-in-differences approach, the composition of the control and the treatment group should not change over time ("time-invariant composition assumption"). This assumption would be violated in the baseline specification if banks endogenously changed their headquarters between Austria and Germany in response to the introduction of the KIM-V. However, this has not been observed in the Austrian and German banking markets.

To estimate the effects of BBMs on the credit quality in Austria, the following two-way fixed effects model in its baseline specification will be estimated:[18]

$$NPL\ ratio_{i,j,t} = \beta_1\ BBM_i \times Time_t + \gamma X_{i,t-1} + \delta_t + \eta_j + \varepsilon_{i,j,t} \qquad (1)$$

where $NPL\ ratio_{i,j,t}$ is the corrected NPL ratio for RRE loans[19] of bank i in country j at time t, BBM_i is a dummy variable that is 1 if the bank is in the treatment group and 0 otherwise, $Time_t$ is a dummy variable that is 0 before the introduction of the KIM-V and 1 afterward and $X_{i,t-1}$ refers to lagged control variables on the bank level. As suggested by Manz (2019), we include the common equity tier 1 (CET1) ratio, the return on assets (ROA) ratio and the overall NPL ratio in the estimation.[20] Bank variables are lagged by one quarter to control for potential endogeneity between control variables and the NPL ratio. δ_t and η_j are time- and country-fixed

[15] *For this approach, we use data from significant and less significant institutions in Austria.*

[16] *In 2020 and 2021, the median share of new lending with a DSTI above 40% stood at 15.4%. Thus, half of the Austrian banks had a share of new lending with a DSTI above 40% above 15.4%, while the other half had a share below 15.4%.*

[17] *As a further check, we exclude banks in the first and fourth quartile of the distribution of new lending with a DSTI above 40% prior to the KIM-V. This is to control for bank heterogeneity at the extremes of the distribution and to ensure that the treatment and the control group are more comparable. The estimation results do not change significantly compared to the robustness specification.*

[18] *For the robustness specification, the estimation equation remains the same, except that we do not have country-fixed effects but group-fixed effects.*

[19] *The corrected NPL ratio is defined in section 3.1. To focus on new nonperforming loans, NPLs with past due > 1 year are excluded.*

[20] *Information on the CET1, ROA and overall NPL ratios is sourced from regulatory reporting (COREP, FINREP).*

effects, respectively. Ideally, we would also control for heterogeneity on the bank level by applying bank-fixed effects. In addition, we would control for bank-specific reactions to changes in macroeconomic variables (e.g. interest rate) via bank-time fixed effects. However, given the small sample size, either is infeasible.[21] The estimated coefficient of interest is $\hat{\beta}_1$. $\hat{\beta}_1 < 0$ would indicate that the introduction of the KIM-V in Austria reduced the NPL ratio compared to the case where no BBMs were in place.

3.3 Results

Estimation results for evaluating the effectiveness of BBMs with respect to their impact on NPLs are shown in table 1. As discussed in section 3.2, two alternative empirical strategies are executed with respect to assigning banks to a treatment and a control group.

Columns (1) and (2) show that the introduction of BBMs in Austria is associated with a 0.5-percentage-point decrease in the NPL ratio of Austrian banks compared to German banks. With respect to the robustness specification, we find that the KIM-V reduced the NPL ratio of Austrian banks that were relatively more exposed to the regulation by 0.1 percentage points compared to Austrian banks that were relatively less exposed (columns (3) and (4)). The results are confirmed when we consider bank control variables.

The results need to be interpreted with caution. While we are confident that the KIM-V reduced the NPL ratio for RRE loans, the magnitude is of greater uncertainty. This is shown by the relatively large difference between the estimated coefficients in the baseline and robustness specifications, which indicates the importance of choosing an appropriate control group. Furthermore, a reduction of the NPL ratio in the range of 0.1 to 0.5 percentage points may appear small. However, given that the KIM-V has only addressed a portion of the RRE loan volume currently outstanding[22], this would translate into a significantly lower NPL ratio

Table 1

Estimation results for the effectiveness of the KIM-V

	Baseline specification		Robustness specification	
Dependent variable	*NPL ratio*		*NPL ratio*	
	(1)	*(2)*	*(3)*	*(4)*
BBM x Time	−0.0046**	−0.0045**	−0.0008**	−0.0013*
	(0.00002)	(0.00006)	(0.00001)	(0.00010)
Bank controls	No	Yes	No	Yes
Time-fixed effects	Yes	Yes	Yes	Yes
Country-/group-fixed effects	Yes	Yes	Yes	Yes
Observations	1,472	1,371	1,222	1,083
R2	0.05263	0.17945	0.04423	0.31703

Source: OeNB.

*Note: Clustered standard errors are in parentheses. Significance codes: *** = 0.01, ** = 0.05, * = 0.1.*

[21] *Data consist of quarterly data between June 2020 and March 2024. In the baseline specification, the sample consists of 84 significant institutions, of which 59 banks from Austria and 25 banks from Germany.*

[22] *In June 2024, approximately 17% of the outstanding RRE loan volume had been granted since the introduction of the KIM-V.*

for loans granted since August 2022. When we factor in the unfavorable macroeconomic developments since then (e.g. rising interest rates), it could seem unrealistic for RRE loans granted since mid-2022 to have a very low NPL ratio.

4 Concluding remarks

Borrower-based measures in Austria have been effective. Combining evidence from descriptive statistics on the development of lending standards with an empirical approach to estimate the effect on borrower resilience, we find that the BBMs have reduced systemic risks in the residential real estate market. Standards for new RRE loans have improved significantly since the KIM-V was introduced in mid-2022, while NPL ratios for RRE lending have remained relatively stable. Deploying a difference-in-differences approach to empirically evaluate the effectiveness of BBMs, we find that the introduction of the KIM-V reduced the NPL ratio of Austrian banks by up to 0.5 percentage points compared to a control group.

Given that BBMs such as the KIM-V address only the new lending volume, it can take many years for their full effect to unfold with respect to borrower and lender resilience. Many member countries in the Single Supervisory Mechanism therefore regard BBMs as a structural measure in the nature of a backstop (Lang et al., 2022).

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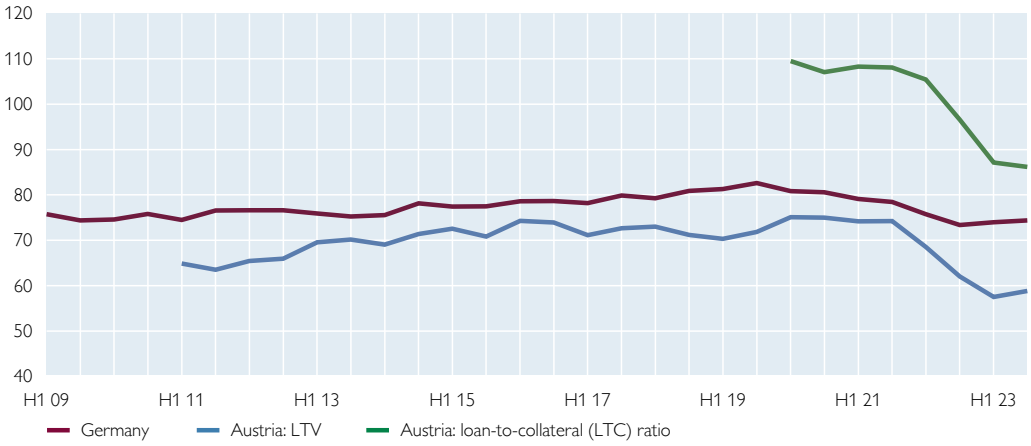
Annex

Chart A1

Average loan-to-value (LTV) ratio in Austria and Germany, new lending

Average volume-weighted LTV, %

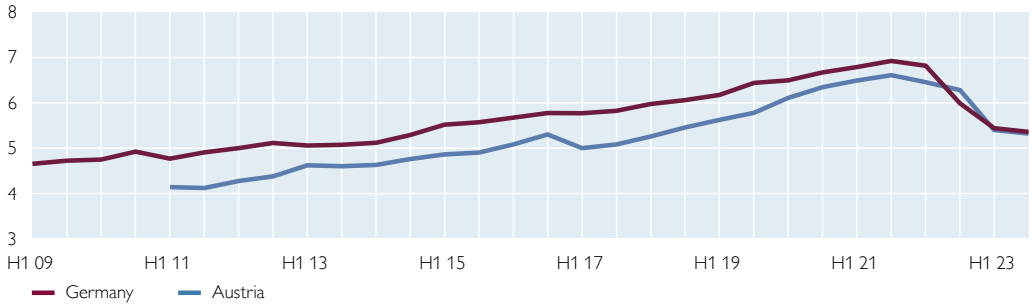


Source: OeNB, Deutsche Bundesbank.

Chart A2

Average debt-to-income (DTI) ratio in Austria and Germany, new lending

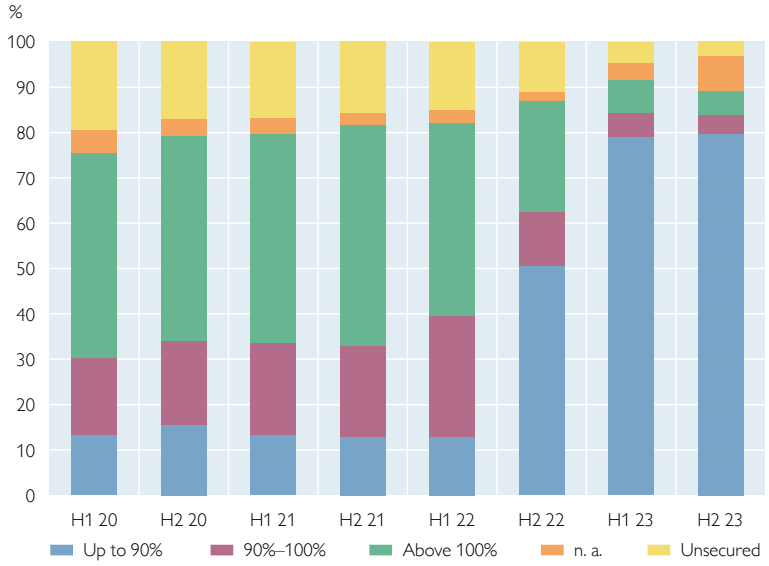
Average volume-weighted DTI, %



Source: OeNB, Deutsche Bundesbank.

Chart A3

Austria: loan-to-collateral (LTC) ratio by bucket, new lending

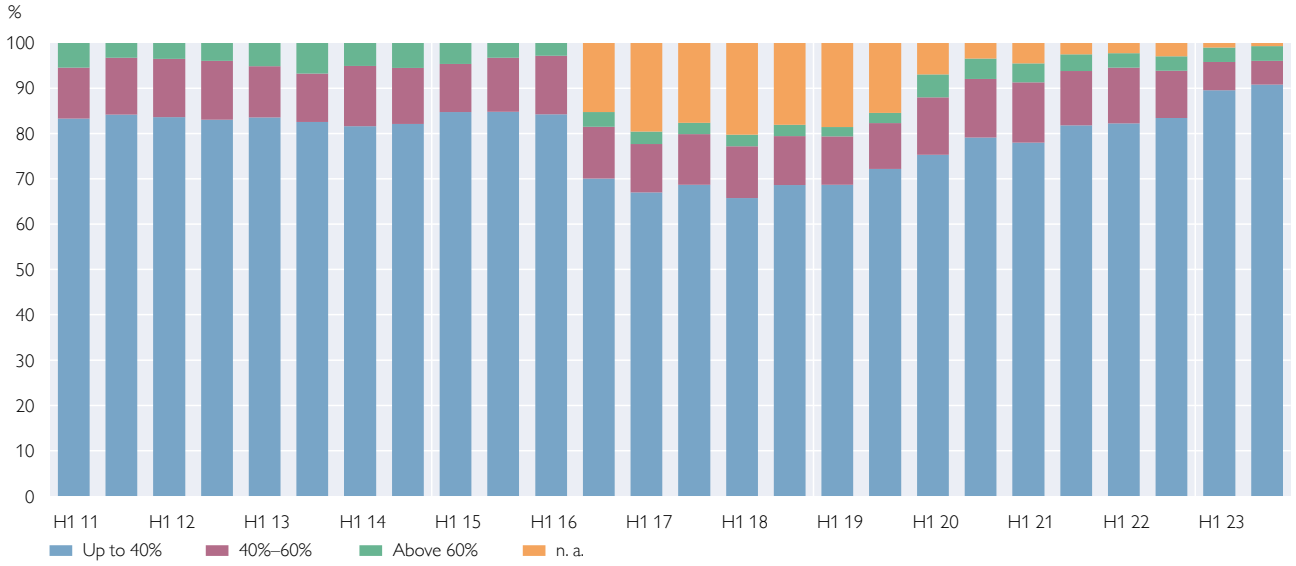


Source: OeNB.

Note: Up to Q4 19: HKU mortgage reporting by up to 11 banks accounting for at least one-third of the new lending volume. From Q2 20: VERA-H reporting by all Austrian banks.

Chart A4

Austria: debt service-to-income (DSTI) ratio by bucket, new lending

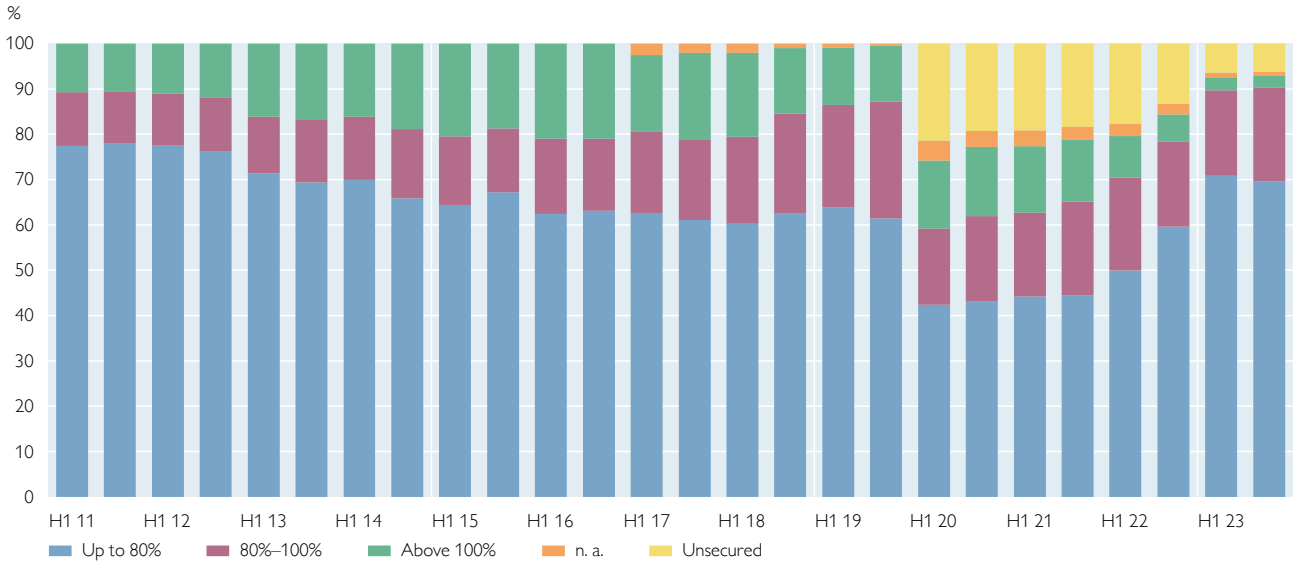


Source: OeNB.

Note: Up to Q4 19: HKU mortgage reporting by up to 11 banks accounting for at least one-third of the new lending volume. From Q2 20: VERA-H reporting by all Austrian banks.

Chart A5

Austria: loan-to-value (LTV) ratio by bucket, new lending

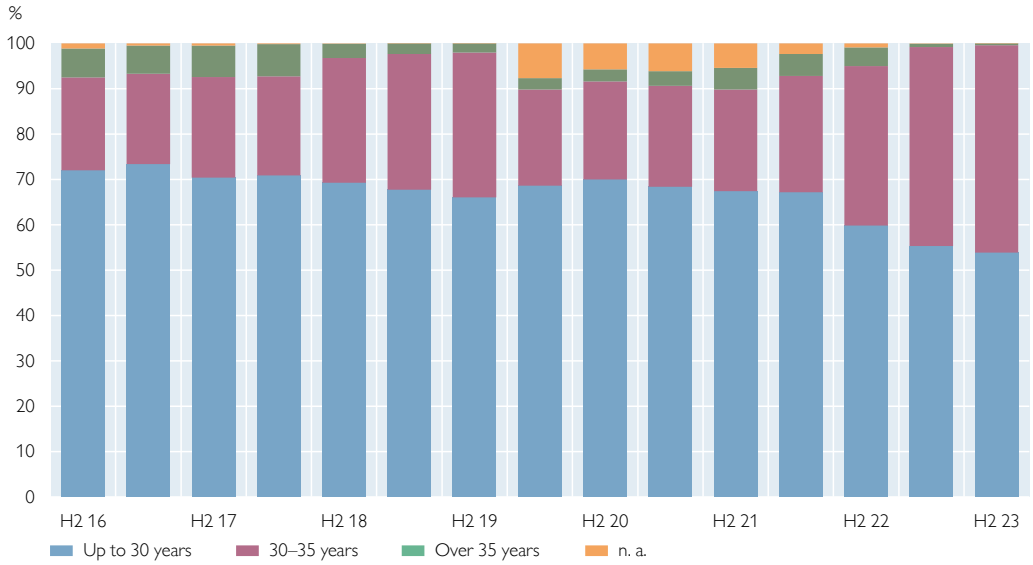


Source: OeNB.

Note: Up to Q4 19: HKU mortgage reporting by up to 11 banks accounting for at least one-third of the new lending volume. From Q2 20: VERA-H reporting by all Austrian banks.

Chart A6

Austria: maturity by bucket, new lending

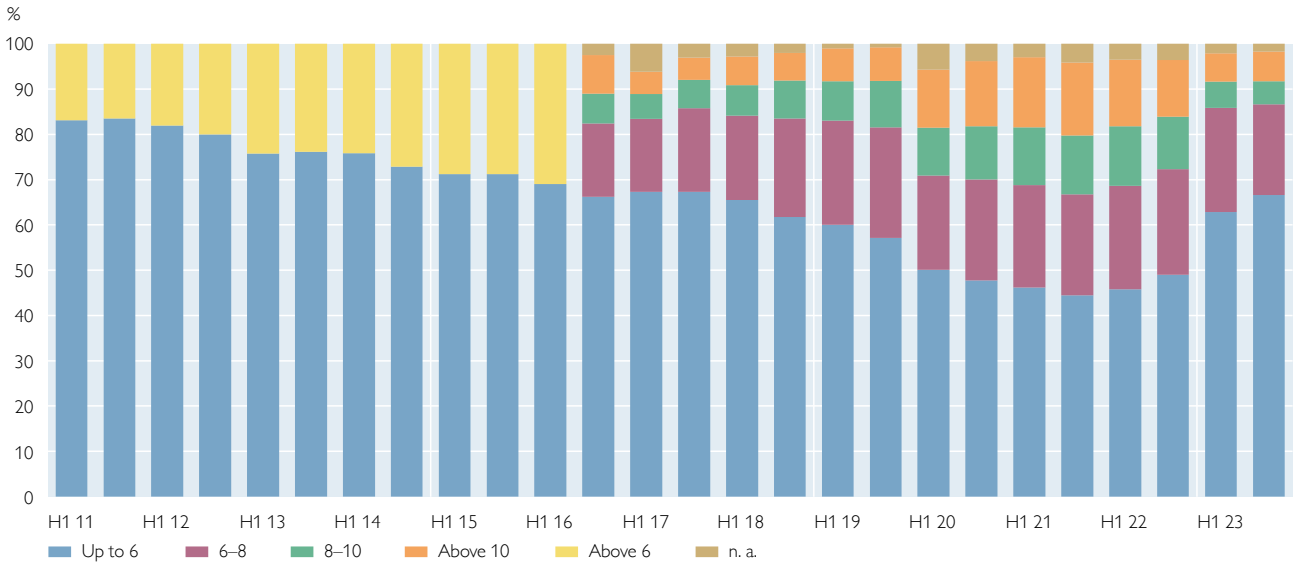


Source: OeNB.

Note: Up to Q4 19: HKU mortgage reporting by up to 11 banks accounting for at least one-third of the new lending volume. From Q2 20: VERA-H reporting by all Austrian banks.

Chart A7

Austria: debt-to-income (DTI) ratio by bucket, new lending



Source: OeNB.

Note: Up to Q4 19: HKU mortgage reporting by up to 11 banks accounting for at least one-third of the new lending volume. From Q2 20: VERA-H reporting by all Austrian banks.

Results of the first dynamic balance sheet stress test in the ARNIE framework

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Stress tests have become an important element of the supervisory review process for banks and an important tool for financial stability analysis. Including balance sheet dynamics substantially improves stress tests by reducing the need for implicit assumptions, thereby making them more realistic and enabling more flexible analyses. After years of work on the dynamic balance sheet stress testing model and its integration into the larger OeNB stress testing infrastructure (ARNIE), this paper presents the first dynamic balance sheet exercise by the OeNB, conducted in parallel with the annual static balance sheet stress testing exercise. The dynamic balance sheet model predicts that, in the baseline scenario, capital ratios stay relatively flat, showing that banks grow their balance sheets instead of hoarding capital. The aggregate CET1 ratio in the baseline scenario increases from 17.6% to 18%, with average annualized credit growth of 3.8%, compared to an increase to 19% in the static exercise. In the adverse scenario, credit growth at the system level slows down to practically zero over the course of the scenario horizon, but it does not turn negative because well-capitalized banks grow their balance sheets, gaining market share from capital-constrained banks that have to engage in deleveraging. The result is that growth of better-capitalized banks effectively compensates for deleveraging pressures from undercapitalized banks. The average annualized credit growth in the adverse scenario is 1.1%, leading to a CET1 ratio that is 0.4 percentage points lower than in the static exercise. This lower CET1 ratio is only true in the aggregate; granular results show a clear difference between undercapitalized banks, which undergo substantial deleveraging, and well-capitalized banks, which continue growing their balance sheets. We discuss these results and present an outlook for the future development of our dynamic balance sheet model.

JEL classification: G21, G28
Keywords: stress test, financial stability

In the aftermath of the global financial crisis, banking supervisors around the world, including the European Banking Authority and the US Federal Reserve, started conducting stress testing exercises with an explicit focus on their use as a supervisory tool. In the EU, for example, Article 100 of the Credit Requirements Directive, as amended 2024, mandates competent authorities to carry out, at least annually, supervisory stress tests on institutions they supervise. Despite the efforts to provide unified guidance for the development of stress testing frameworks in line with best practices summarized in the BCBS stress testing principles (BCBS, 2018), no single stress testing approach has emerged, as different objectives lead to conflicting priorities (Drehmann, 2008). Supervisory stress tests typically have a stand-alone perspective at their core, without dynamics, second-order effects and interbank linkages (Borio et al., 2012). Especially in bottom-up settings, where

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banks calculate results, simplified methodologies and strict guidance help enforce conservatism.

The static balance sheet (SBS) assumption implies that banks cannot change their business model in reaction to shocks, and no additional steps are taken by banks to offset the adverse macroeconomic developments. In practice, it means that the size and composition of the balance sheet remains unchanged throughout the exercises' horizon – assets and liabilities maturing over time are replaced with instruments similar to those at the start of the exercise. While such a simplification helps to ensure that individual banks will generate results that are roughly consistent and comparable to one another, it comes with numerous drawbacks. The simplifying approach does not take into account management interventions to respond to the shocks, thus preventing banks from reacting to adverse market conditions, most notably by deleveraging.

To address these weaknesses, supervisory authorities have sought to add dynamic elements to their stress tests for nearly a decade, longer in some cases. According to a survey of 31 authorities and 54 banks conducted by the Basel Committee on Banking Supervision, nearly half of supervisors use an SBS approach, but only one in five banks used this approach for their internal risk management (BCBS, 2017). Furthermore, top-down stress tests conducted by all major supervisory authorities, including the ECB, Fed, SNB, BoE and BoJ, already use some form of dynamic balance sheet (DBS) approach in their stress testing methodologies. This ranges from a simple proportional credit growth in line with projected industry-wide loan and asset growth to more elaborate modeling of optimized portfolio structure and allowing for management actions (Baudino et al., 2018).

At the OeNB, top-down stress tests were initially inspired by early works of Elsinger et al. (2006) on risk assessment in banks. They initially focused on financial stability with an aim to quantify systemic risk rather than to assess individual institutions (Boss et al., 2006). Due to the short observation period of one quarter, the implicit SBS assumption played a minor role. But even the subsequent multiperiod extensions of the approach used by the OeNB that resulted in the development of the Applied Risk, Network and Impact assessment Engine (ARNIE) and incorporated contagion analysis and solvency-liquidity feedback still relied on the SBS assumption (Feldkircher et al., 2013). In line with the aforementioned international efforts to consider more dynamic elements in stress tests and a more general push to make stress tests more macroprudential, while further enhancing the usefulness of stress tests for microprudential purposes, creating a DBS extension for ARNIE has become a priority of stress test development work at the OeNB.

In this paper, we present the first results of this ongoing work. First, we describe the scenario and results of the OeNB's first DBS stress test. Second, we compare the results to those of an SBS calculation given the same underlying scenario. Then we discuss the impact on results and its implications for our analyses. We conclude by providing a brief outlook on our next steps.

1 Scenarios and results

In this section, we present the scenario and the main results of the 2024 OeNB DBS stress testing exercise as well as the results of the SBS exercise. The results were computed using our ARNIE framework (Feldkircher et al., 2013), which has two different configuration options for DBS and SBS stress tests. The stress test

covers both significant and less significant institutions at the highest consolidated level. Bank-level data are obtained from the regulatory reporting system. The methodology of our DBS model focuses on credit growth as the banks' main adaptation mechanism. The credit growth model considers macroeconomic conditions as well as bank-level profitability and capitalization/growth constraints. Growth constraints are considered in both directions, i.e. there are limits to both how fast a bank can grow and shrink its credit portfolio in a given amount of time. These limits move dynamically with the evolution of the bank's balance sheet. Due to space constraints, the present article focuses on presenting the results of our first DBS stress test exercise; a separate publication with details on the methodology will follow.

1.1 Scenarios

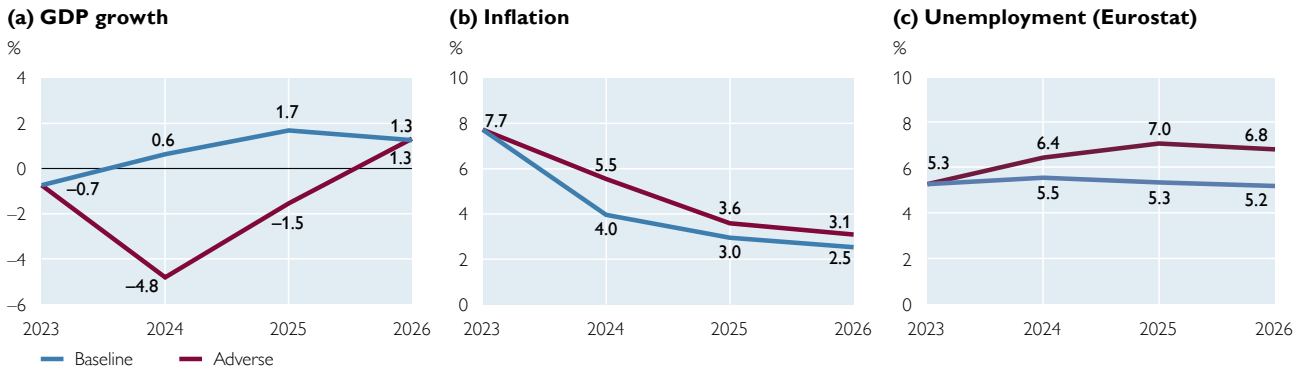
We consider two scenarios, a baseline scenario based on the OeNB's December 2023 Economic Outlook for Austria and an adverse scenario. The scenario horizon covers the period 2024–2026; chart 1 shows the evolution of GDP, inflation and unemployment in both scenarios. The *adverse scenario assumes a severe macroeconomic downturn* marked by a sharp decline in output, increase in unemployment and a slow decline of inflation. The baseline scenario projects a slow recovery of output and inflation. *Cumulative GDP growth* is 3.6% in the baseline scenario and *–5.0% in the adverse scenario.* Inflation drops from 7.7% to 2.5% in 2026 in the baseline scenario and declines to 3.1% in the adverse scenario, staying well above historical averages in both scenarios. Unemployment (Eurostat definition) grows from 5.3% to 6.8% in the adverse scenario and remains relatively flat in the baseline scenario, falling to 5.2%.

1.2 Results

Results for both the DBS and SBS configurations were computed based on the same baseline and adverse scenarios. Chart 2a shows the evolution of the aggregate common equity tier 1 (CET1) ratio for the Austrian banking system in both scenarios for both the DBS and SBS configurations. The aggregate CET1 ratio grows from 17.6% to 18.0% (DBS, +0.4 percentage points) and 19.0% (SBS,

Chart 1

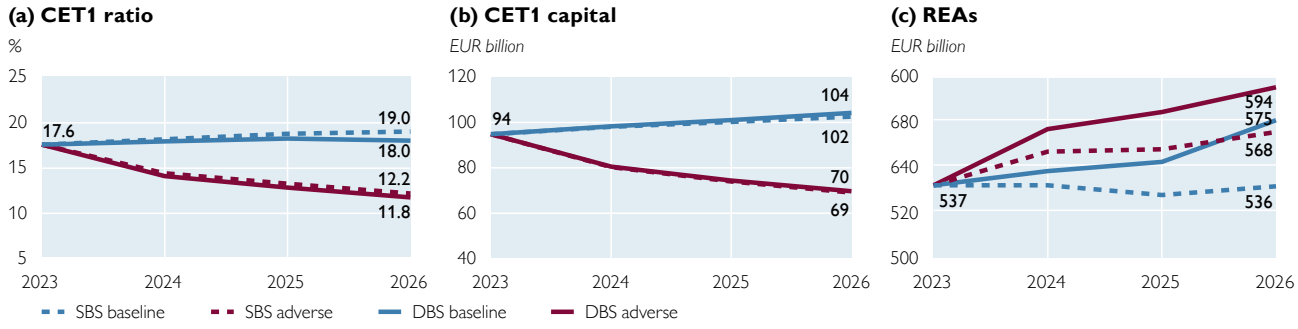
Scenario paths for Austria



Source: OeNB.

Chart 2

Comparison of results between DBS and SBS



Source: OeNB.

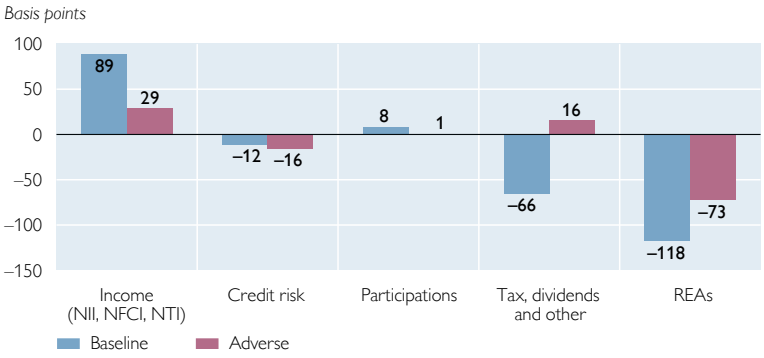
+1.4 percentage points) in the baseline scenario. In the adverse scenario, the aggregate *CET1 ratio decreases by 5.8 percentage points to 11.8% in the DBS* configuration and by 5.4 percentage points to 12.2% in the SBS configuration. Charts 2b and 2c show the breakdown of the CET1 and risk exposure amount (REA) components of the CET1 ratio.

Moving from SBS to DBS has a substantially larger impact on REAs than on CET1 capital: In the adverse scenario, REAs are 10.6% higher in 2026 than the starting value in the DBS configuration, compared to an increase of 5.8% in the SBS configuration, a delta of 4.8 percentage points. In the baseline scenario, REAs are practically flat in the SBS configuration at –0.1% compared to +7.0% for DBS, a delta of 7.2 percentage points (numbers do not add up due to rounding). By comparison, the delta for CET1 capital is only 1.7 percentage points in the baseline scenario and 0.6 percentage points in the adverse scenario. A stronger reaction of REAs than CET1 capital to credit growth is to be expected, as REAs directly increase when new loans are granted, whereas capital only grows over time, through the positive P&L contribution of profitable businesses.

Chart 3 shows a breakdown of various drivers explaining the overall difference in the aggregate CET1 ratio between the DBS and SBS configurations. In line with the above discussion, *REAs are the most important driver of differences between the results of the DBS and SBS exercises:* REA changes drive the aggregate CET1 ratios by 118 basis points lower in the DBS configuration than in the SBS configuration in the baseline scenario, and by 73 basis points lower in the adverse scenario. These changes are partly offset by changes to income components, which – considered in isolation – increase the CET1 ratio in the DBS configuration by 89 basis points in the baseline scenario and by 29 basis points in the adverse scenario, as compared to the SBS configuration. Among those income components, net interest income (NII) is the most important driver. This is not a surprise, given that credit growth directly affects interest income. Taxes, dividends and other effects are another important driver in the baseline scenario, with an impact of –66 basis points. These are primarily driven by higher tax and dividend payments, which are both direct results of the higher income. With regard to credit risk provisions and participation income, the difference between the DBS and SBS configurations is comparatively small.

Chart 3

Differences in the main drivers – DBS compared to SBS

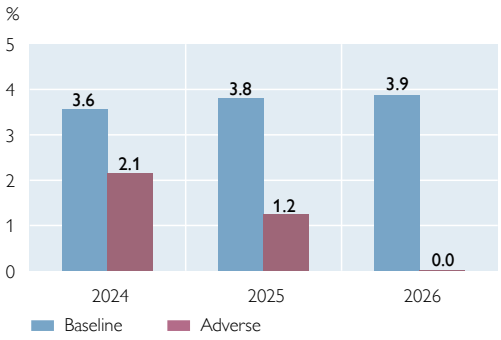


Source: OeNB.

Note: A positive value indicates a positive contribution to the CET1 ratio (measured in basis points) in the dynamic balance sheet (DBS) stress test compared to the static balance sheet (SBS) stress test, and vice versa for negative values.

Chart 4

System credit growth over the stress test horizon



Source: OeNB.

Chart 4 shows aggregate credit growth in the Austrian banking system for both scenarios. Credit growth is an output of the DBS model and hence only applies in the DBS configuration. Projections for credit growth take into account historical growth rates, macroeconomic influences as well as bank-level profitability and capitalization constraints. *Credit growth* is relatively consistent in the baseline scenario, with an average annualized growth rate of 3.8%, and *drops substantially over time in the adverse scenario,* with an average *growth rate of 1.1%*. These credit growth projections are somewhat high compared to recent credit growth rates due to two main reasons: First, credit growth in Austria has historically been high, which is still reflected in the model. Second, the baseline projection, which dates from 2023, is generally too optimistic compared to actual outcomes in 2024 – for credit growth and other variables as well. The decline in credit growth in the adverse scenario is driven both by macroeconomic variables as well as higher bank losses due to the stress scenario, which limit system-wide growth capacity due to capitalization constraints. Without these capitalization constraints, average annual credit growth would have been 1 percentage point higher in the adverse scenario. In the baseline scenario, capitalization constraints were not binding at the aggregate level but for some banks because shortfalls by capitalization constraints were compensated by other well-capitalized, profitable banks which could benefit by increasing their market shares. The same effect of *well-capitalized, profitable banks growing their market share at the expense of capital-constrained, loss-making banks* was also observed in the adverse scenario.

Table 1 shows average values for selected result drivers in the baseline and adverse scenarios for both configurations as well as the 2023 starting values for comparison. Variables are based on definitions developed explicitly for the stress tests, which may differ from other definitions used in this report. We see that the net interest margin (NIM) decreases in all scenarios compared to 2023. This is not surprising given the very benign environment for banks and is due to the asymmetric response of interest income and expenses to the interest rate increases throughout 2022 and 2023. A lower NIM in both scenarios reflects both a normalization, as interest expenses catch up with higher interest rate levels compared to pre-2022,

Table 1

Selected results of the static and dynamic balance sheet stress tests

	2023	SBS		DBS	
		Baseline	Adverse	Baseline	Adverse
	%				
Net interest margin	2.15	1.73	1.52	1.70	1.52
Cost of risk	–0.27	–0.40	–1.55	–0.39	–1.54
Cost-to-income ratio	48	61	75	58	73
	EUR billion				
Loan stock	1,307	1,307	1,307	1,406	1,346

Source: Authors' calculations.

and a decline in interest rates. The higher cost of risk in the baseline scenario is driven by an expected uptick in insolvencies, following low default rates in the (post)-COVID era. These changing circumstances are also reflected in higher cost-to-income ratios in both scenarios. Dynamic bank reactions partially offset this development, but only slightly.

2 Discussion and outlook

The addition of the DBS module makes the projections substantially more realistic by removing the restrictive SBS assumption and *allowing for banks to adapt to the evolution of their balance sheets and macroeconomic developments*. This is particularly evident in the results for the baseline scenario, where aggregate CET1 ratios grow only modestly by 0.4 percentage points in the DBS configuration, compared to a substantial increase of 1.4 percentage points in the SBS configuration. This is consistent with *banks making use of profitable opportunities to grow their businesses instead of hoarding capital.* We consider the former to be more realistic and stress that this behavior emerged endogenously from the model and was not an input or a target.

We observe that the decline in credit growth in the adverse scenario is less marked compared to other exercises. We focus on the exercise of Cappeletti et al. (2024) in our comparison because it is the most relevant benchmark in our opinion, being a relatively recent exercise by the European Central Bank covering the euro area banking system with a scenario horizon from 2023 to 2025. They project an annualized aggregate credit growth of –3.4% in the adverse scenario, compared to +1.1% in our results. These differences can be explained by various factors, including:

1. Different scope of the data: Our exercise only covers the Austrian banking market, and the credit growth model has been calibrated on historical data stretching back to 1998. Credit growth in the Austrian banking sector has been substantially positive over the whole 1998–2023 period, leading to generally high estimates. It seems likely that the difference between the Austrian market and the whole euro area, as well as potentially different time frames used in the model calibration will explain part of this observed difference.
2. Different scenarios: The exercise by Cappeletti et al. (2024) is based on data up to 2022 with a scenario horizon from 2023 to 2025, i.e. starting one year before our scenario. Different scenarios may account for some differences but given the overall comparable magnitude of the economic shock in both scenarios, this seems likely a less important contributor.
3. Model differences: The analysis of Cappeletti et al. (2024) is based on the BEAST model by Budnik et al. (2023), while our DBS exercise is based on our own OeNB DBS model, for which a publication will follow later. Compared to the BEAST model, *our model emphasizes the ability of the banking system to compensate for the deleveraging needs of some banks,* through the channel of other

banks growing faster, capitalizing on the opportunity to gain market share. These compensation effects mean that credit growth slows down to effectively zero in the adverse scenario, but it does not turn negative. Combined with slower, but still positive, growth at the beginning of the scenario horizon, this leads to a slightly positive average credit growth rate of 1.1% in the adverse scenario. This positive credit growth is also responsible for the lower aggregate CET1 ratio in the adverse scenario. We stress that this lower CET1 ratio is only true in the aggregate. The granular picture shows a clear differentiation between well-capitalized banks, which grow faster and gain market share, and undercapitalized banks, for which we observe deleveraging at a scale comparable to, or exceeding, the results of the exercise of Cappeletti et al. (2024). These compensating effects seem likely to be the most important driver explaining the differences between our results and those of Cappeletti et al. (2024).

In conclusion, we see that the DBS model provides a richer set of results that make economic sense and that provide additional insights compared to the SBS analysis, especially regarding banks' individual reactions and the resulting behavior of the overall banking system. One development goal of our DBS model was that it should be able to replace the SBS model when called for and not serve as a mere "add-on" exercise. In our view, *dynamic bank reactions make stress tests substantially more realistic and should generally be considered for use,* unless other requirements explicitly call for an SBS approach. For this reason, the DBS model was tightly integrated with the existing ARNIE framework, where it is now one module among many and can be turned on or off (to switch back to an SBS approach) through a simple configuration parameter. This article is the first publication of results using the new DBS model, which we are still actively improving and refining. One important caveat for the current version of the model is that the aforementioned 1 percentage point reduction in credit growth compared to the macroeconomic projection, due to bank capitalization constraints, is not fed back into the macro model. Such a negative credit growth feedback would likely lead to an additional worsening of the adverse macroeconomic scenario, which may in turn drive down future credit growth as banks become even more capital-constrained due to increased losses. We are actively working on including these feedback effects, and a publication of our full DBS model will follow.

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Interconnections between the Austrian banking sector and debt securities markets

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Banks use debt securities markets to finance and refinance their activities and to manage liquidity. Debt securities offer many advantages regarding liquidity management, earnings stability and regulatory compliance. Yet, they also harbor risks in times of economic stress, as seen in the past in connection with bank collapses in the USA. Effective risk management and supervision are important to ensure that interconnected relationships do not compromise financial stability. It is therefore of great benefit if the requirements for issuing and holding financial instruments rest on a harmonized regulatory environment such as that provided by the European Union (EU). At the end of 2023, the majority of debt instruments issued by the Austrian banking sector were held by counterparties from the EU and the euro area. The securities on the banks' books were also predominantly issued by counterparties from these regions. Refinancing from the EU and the euro area is crucial for the Austrian banking sector, as the strict European regulatory framework effectively reduces banks' risk profiles. We use empirical data to show the most important trends over recent years (2017–2023). Austrian banks' debt instruments grew significantly, with the volume of debt securities holdings increasing by 12.3% and that of debt securities issues surging by 50.6%. The counterparty composition shifted on both sides of the balance sheet. For one thing, debt securities issued by monetary financial institutions (MFIs) grew in prominence. For another, Austrian counterparties reduced their holdings, which was offset by a rise in EU and euro area counterparties. The changes highlight the deepening interconnection of banks with debt securities markets. This is addressed by both microprudential and macroprudential supervisory measures. In addition, the greater geographical diversity of counterparties, which are mainly from the EU and the euro area, contributes to a broader distribution of risk.

JEL classification: G11, G15, G20, G21, G23
Keywords: securities holdings statistics, banks securities holdings, bank securities portfolios, portfolio investment, debt securities, banking statistics, Eurosystem

In this study, we analyze the interconnectedness of the Austrian banking system and debt securities markets from 2017 to 2023[2]. We explore various aspects of debt securities held and issued by Austrian banks, including shifts in the regional composition, types of holders and issuers, and the main components of these portfolios. We start by giving an overview of the size, relevance and recent developments of Austrian banks' balance sheets and the Austrian bond market. After that, we analyze debt securities on the asset and liability sides of Austrian banks, revealing key changes over the last few years. We find that several measures mitigate the implications for financial stability, namely micro- and macroprudential supervisory measures like the supervisory review and evaluation process (SREP) and capital buffers for structural systemic risks.

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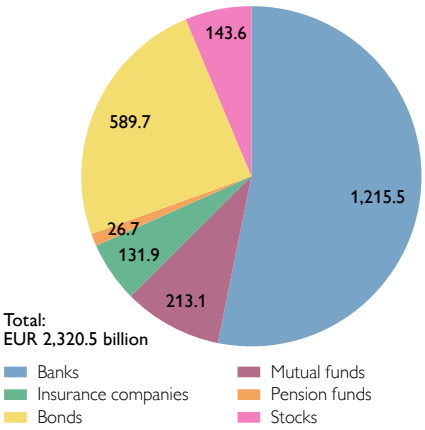
[2] *Data of the ECB's securities holdings statistics became available in 2017.*

Chart 1

Components[1] of the Austrian financial system

EUR billion



Source: OeNB.

[1] As measured by total assets, debt outstanding, assets under management and market capitalization.

Note: Data as at Q4 23.

1 Size, relevance and recent developments of the Austrian banking sector and the Austrian bond market

From 2008 to 2017, the consolidated total assets of the Austrian banking sector declined by 19.2%, from EUR 1,175.6 billion to EUR 949.3 billion. However, starting in 2017, the sector's balance sheet began to grow steadily, reaching EUR 1,215.5 billion at the end of 2023, which equals an increase of 28%. During the same period, debt market financing surged notably, with the total volume reaching EUR 589.7 billion in 2023 (chart 1).[3] The growth of Austrian banks' balance sheets and bond markets between 2017 and 2023 was driven by a combination of macroeconomic, financial and policy factors. Key among these was the prolonged low interest rate environment, a response by the ECB to the euro area debt crisis and to persistently low inflation. Coupled with significant ECB interventions, this environment facilitated the issuance of bonds by both banks and corporates. The ECB interventions included the asset purchase programme (APP)[4] and targeted longer-term refinancing operations (TLTROs)[5]. The COVID-19 pandemic resulted in further support provided by governments and ECB measures like the pandemic emergency purchase programme (PEPP), which helped stabilize the economy and the banking sector. Additionally, government borrowing surged in the aftermath of the global financial crisis and during the pandemic, with government bond issuance increasing notably. Corporates, seeking liquidity for expansion or refinancing, also contributed to the growing bond market. And so did investors searching for higher yields in a low interest environment. Moreover, starting from 2017, regulatory reforms were implemented that aimed at increasing market transparency, enhancing investor protection and promoting sustainable finance. They further boosted the attractiveness of bond markets, encouraging growth in bond financing.

[3] *The figures are available on the OeNB's website at https://www.oenb.at/en/Statistics/Standardized-Tables/Securities/Debt-Securities.html. However, note that double counting may not be ruled out due to bond issuances by banks with a volume of EUR 183.2 billion at end-2023.*

[4] *The APP consists of the corporate sector purchase programme (CSPP), the public sector purchase programme (PSPP), the asset-backed securities purchase programme (ABSPP) and the third covered bond purchase programme (CBPP3). For further information, see https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html.*

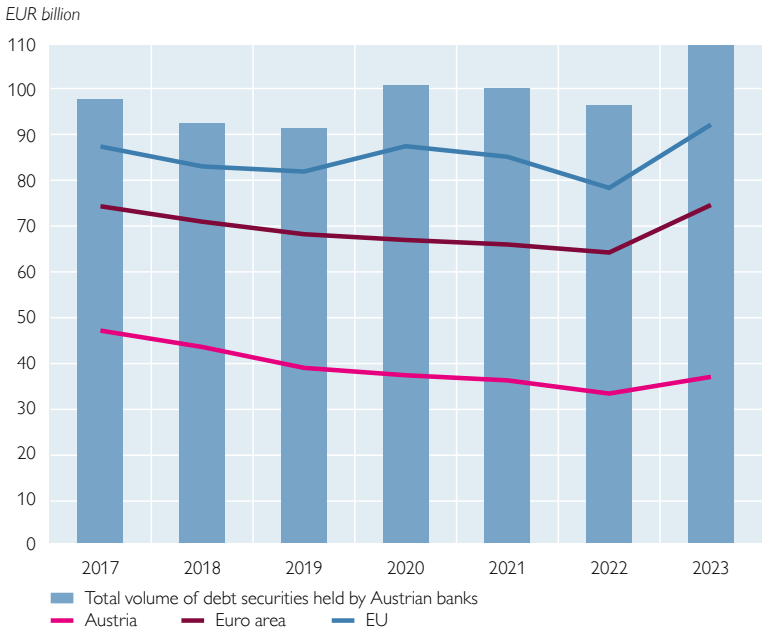
[5] *Targeted longer-term refinancing operations, like the third series of such operations (TLTROs III), aimed to provide banks with long-term funding at attractive conditions to stimulate bank lending to the real economy.*

2 Developments relating to debt securities on the asset side of the Austrian banking sector since 2017

Banks hold debt securities for several important reasons, with regulatory liquidity requirements playing a significant role. High-quality liquid assets[6] are essential for meeting the liquidity coverage ratio (LCR). They ensure that banks have sufficient liquid assets to handle short-term cash outflows during periods of stress. Additionally, bonds contribute to long-term balance sheet stability by helping banks meet the net stable funding ratio (NSFR). That ratio requires more stable funding sources over a one-year horizon.

Chart 2

Total volume of debt securities held by Austrian banks



Source: OeNB.

Note: The lines reflect volumes in EUR billion.

At the end of 2017, Austrian banks held EUR 97.9 billion in debt securities[7], which accounted for around 80% of banks' entire securities portfolio[8]. By end-2023, banks' bond holdings had increased by 12.4% since 2017, to EUR 109.9 billion. However, this growth was not linear, with fluctuations throughout the years. Notable increases occurred in 2020 and 2023, while other years saw declines. Especially by year-end 2019, the total volume of debt securities had declined to EUR 91.6 billion (chart 2). The decrease was largely driven by low bond yields, as during that period many bonds carried fixed interest rates[9], and matured bonds were often not replaced. Besides, the reduction was ascribable to a shift toward more profitable lending opportunities, spurred by the low interest rate environment. Another factor were cautious investment strategies in response to global and EU market uncertainties such as the upcoming Brexit in 2020. Regulatory considerations likewise contributed to the decline. Moreover, government and corporate debt securities offered lower yields, which had an impact on risk-weighted assets. In 2020, the COVID-19 pandemic led to a significant economic shift. Price slumps on international financial markets and the economic downturn both in the EU and in Austria prompted comprehensive monetary and fiscal measures. The ECB measures, like the TLTROs and the PEPP, played a pivotal role as they included large-scale purchases of government and corporate bonds. The PEPP increased market liquidity, incentivizing banks to hold more bonds to use as collateral. Consequently, Austrian banks increased their holdings of debt securities to EUR 101 billion in 2020, and that level remained almost stable

[6] *For instance government bonds issued by countries with a strong credit rating.*

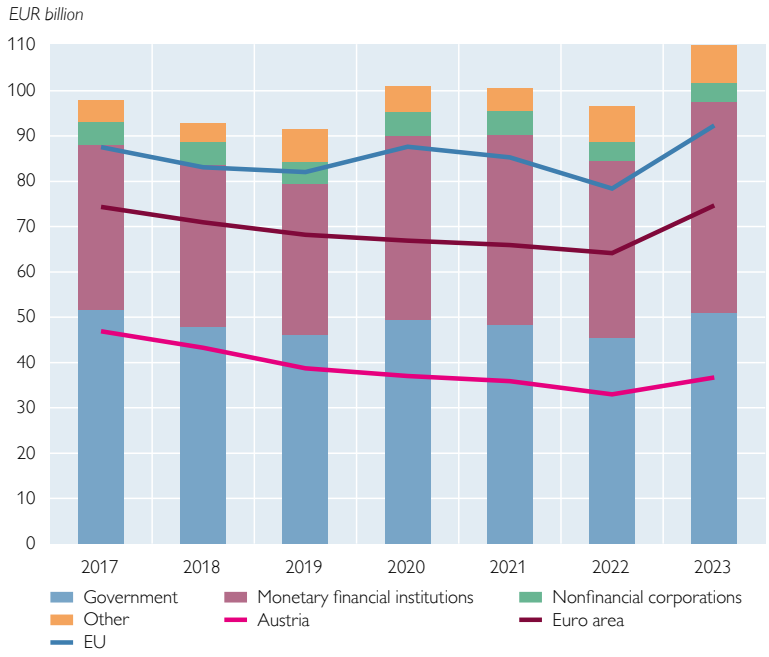
[7] *Values are based on market values, unless otherwise stated in the text.*

[8] *Around 20% of banks' portfolios are equities like stocks, mutual fund shares, money market fund shares, etc.*

[9] *Approximately 75% of debt securities.*

Chart 3

Total volume of debt securities by sector



Source: OeNB.

Note: The lines reflect volumes in EUR billion.

throughout 2021. In 2022, when interest rates began to rise and the COVID-19 crisis subsided, the market volume fell to EUR 96.7 billion. Yet in 2023, bond volumes reached a new high of nearly EUR 110 billion, driven by improved yields and banks' strategic responses to rising borrowing costs and tighter liquidity conditions.

Analyzing the composition of Austrian banks' portfolios reveals the following: Throughout the 2017–2023 period, government bonds and bonds issued by monetary financial institutions (MFIs)[10] played a prominent role. They accounted for 90% of the total volume of debt securities in 2017, and for 88.7% in 2023, thus staying almost stable. As evident in chart 3, their respective relevance shifted somewhat over time. While the total volume of government bonds (around EUR 51 billion) remained relatively stable, their share in the portfolio declined from 52.8% to 46.4%. By contrast, MFI bonds rose from EUR 36.4 billion in 2017 to EUR 46.4 billion in 2023, with their share in the portfolio increasing from 37.2% to 42.3%. The reduction in government bonds was primarily driven by a continuous decline in the volume of Austrian government bonds between 2017 and 2022 (–48.5%), caused mainly by the search for higher yields in a low interest rate environment (chart 4). During this period, Austrian government bonds offered lower yields compared to those of other euro area countries, such as Spain, which prompted investors to seek more attractive alternatives. In 2022, Austrian government bonds plunged by 20.3%, as the termination of the ECB's APP and PEPP reduced demand for government debt securities.[11] The ECB's key interest rate hikes in 2022 and 2023 led to a sharp drop in the market value of all types of bonds, especially those with longer maturities. Despite these reductions, 2023 saw a 13.8% increase in total debt securities holdings, driven largely by banks' need to maintain liquidity buffers. Non-EU government bonds, particularly from the USA, also gained prominence, growing by 18.5% in 2023.[12]

By the end of 2023, Austrian banks' securities portfolios largely consisted of debt securities issued by governments (46.4%) and MFIs (42.3%). EU issuers

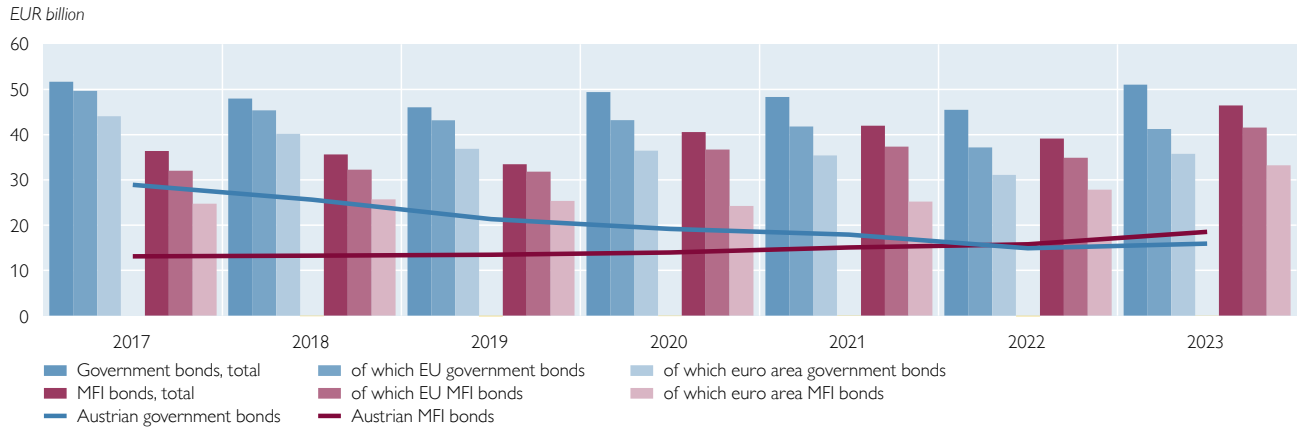
[10] *According to the European System of Accounts (ESA), MFIs include central banks and deposit-taking corporations such as commercial banks. In the context of this study, the term "MFI" is used for credit institutions and other licensed deposit-taking corporations.*

[11] *For further information, see the ECB's Annual Reports 2017–2023 at https://www.ecb.europa.eu/press/annual-reports-financial-statements/annual/html/index.en.html.*

[12] *US and Japanese government bonds were the largest non-EU securities positions at end-2023, each amounting to EUR 1.3 billion.*

Chart 4

Debt securities of Austrian banks by main sectors



Source: OeNB.

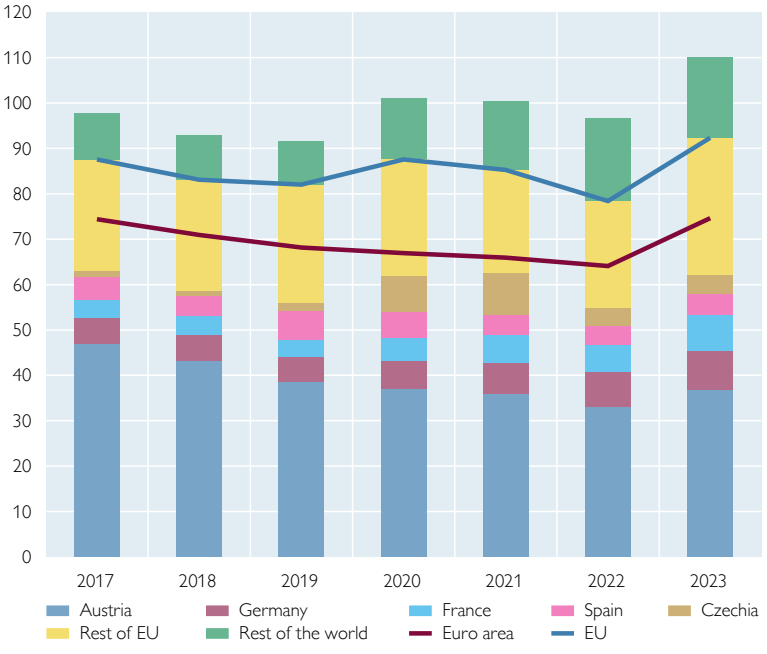
Note: The lines reflect volumes in EUR billion.

accounted for over 84% and euro area issuers for 67.9% of the portfolios. Euro area government bonds accounted for 32.5% and euro area MFIs accounted for 30.2%, while EU government bonds and EU MFIs each reached 38%[13].

As can be seen in chart 5, in 2023, the most important countries of origin were Austria (33.4%), followed by Germany (8.1%), France (7.1%) and Spain (4.2%). The share of Austrian debt securities, while still the largest component of banks' securities portfolios, declined significantly from 2017 to 2023, namely from 48% to 33.4%. This reduction is primarily linked to the substantial decrease in Austrian government bond holdings, which dropped from EUR 28.9 billion in 2017 to EUR 15.9 billion by end-2023. Moreover, the importance of MFI bonds grew considerably during the same period, rising by 27.5%. Notably, the increase in Austrian MFI bonds,

Chart 5

Total volume of debt securities by region



Source: OeNB.

Note: The lines reflect volumes in EUR billion.

[13] *Debt securities issued by EU MFIs in Austrian banks' portfolios totaled EUR 41.6 billion. They were mainly issued by MFI counterparties in Austria (EUR 18.5 billion), Germany (EUR 4.9 billion), France (EUR 4.7 billion), Czechia (EUR 3.0 billion). Overall, Austrian banks held MFI securities worth EUR 46.5 billion.*

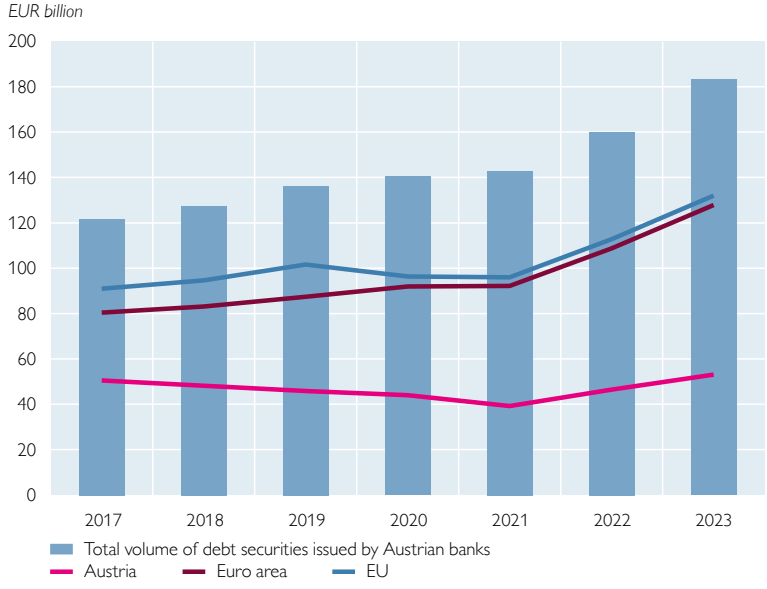
from EUR 13.1 billion to EUR 18.5 billion (+41.2%), partially offset the decline in government bonds. The rise in MFI bonds highlights the growing interconnectedness between Austrian banks and their EU counterparts through debt securities, which reinforces contagion risk. This risk is mitigated by macroprudential measures such as the capital buffer regime. Additionally, the reduction in Austrian government bonds points to a broader trend of regional diversification. The share of EU and euro area (excluding Austria) debt securities in Austrian banks' portfolios increased from 41.6% and 28.1% in 2017 to 50.6% and 34.5% in 2023, respectively.

3 Developments relating to debt securities issued by Austrian banks since 2017

At the end of 2017, the total volume of debt securities issued by Austrian banks stood at EUR 121.7 billion. By end-2023, this figure had surged to EUR 183.2 billion, which represents a 50.6% increase between 2017 and 2023 (chart 6). This underscores the growing importance of bonds as a financing tool for Austrian banks. Notably, the total volume of issued bonds significantly exceeds the volume of bonds held by banks (EUR 109.9 billion) in 2023. Over the same period, the rate of growth in banks' financing through debt issuance (50.6%) vastly outpaced the growth of bond investments held by banks (12.3%). From 2017 to 2019, the volume of debt securities issued by Austrian banks grew moderately. This was due to the relatively stable economic environment until the end of 2019, characterized by low interest rates and the ECB's accommodative monetary policy. The ECB's TLTRO programs also meant that demand for debt instruments issued by banks was lower, as the long-term financing options via the ECB were more attractive for banks than market-based funding (Barbiero et al., 2021). In 2020, the COVID-19 pandemic created significant uncertainty. However, the ECB's extensive stimulus measures, such as the PEPP, provided vital liquidity and supported the bond markets. Debt issuance thus recovered throughout 2020 and 2021, despite the uncertain environment. Beginning with 2022, TLTRO III repayments led to higher refinancing needs through debt securities. Banks increased their issuance of debt securities to capitalize on still low interest rates while also meeting regulatory requirements. The latter included liquidity requirements like the liquidity coverage ratio (LCR), the net stable funding ratio (NSFR) and the minimum requirement for own funds and eligible liabilities (MREL) under the EU's Bank Recovery and Resolution

Chart 6

Total volume of debt securities issued by Austrian banks



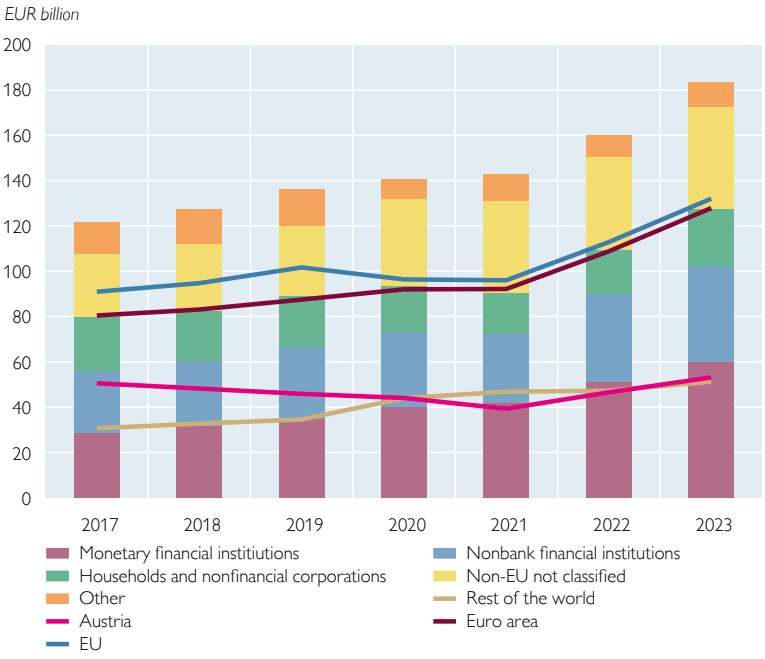
Source: OeNB.

Note: The lines reflect volumes in EUR billion.

Directive.[14] This regulatory framework compelled banks to issue MREL-eligible securities to fulfill supervisory standards and enhance their financial resilience. In response to inflation, the ECB began to tighten its policy in 2022, and started to reduce the ample supply of liquidity via TLTROs. Thus, Austrian banks resumed issuing debt securities, which substantially increased issuance volumes, by 12% in 2022 and 14.5% in 2023.

Chart 7

Holders of Austrian bank debt securities by sector



Source: OeNB.

Note: The lines reflect volumes in EUR billion.

The sectoral analysis (chart 7) revealed that in 2017 MFIs held the largest share of Austrian banks' debt securities (23.7%), followed closely by nonbank financial institutions (22.3%) and households and nonfinancial corporations (19.9%). Notably, one-quarter of Austrian bank bonds was held by investors outside the EU, which led to data gaps concerning most of those positions.[15] As a result, in 2017, for 22.6% of the bonds no detailed information regarding the counterparty was available beyond the country of origin. An additional 11.5% were held by other counterparties, such as governments. From 2017 to 2023, the composition shifted consistently toward a higher share of MFI holders, which had reached nearly one-third (32.7%) by end-2023. The distribution became more distinct, with 24.6% unclassified, 23.2% held by nonbank financial institutions, 13.7% by households and nonfinancial corporations and 5.8% by other counterparties. Especially from 2017 to 2019, households significantly reduced their holdings of bank debt securities (–21.9%). At the same time, MFIs increased their holdings of bank debt securities by 19.4%, while the holdings of nonfinancial corporations remained almost stable. This general trend persisted until the end of 2023. The "other" section also saw a decline, which was offset by MFIs.

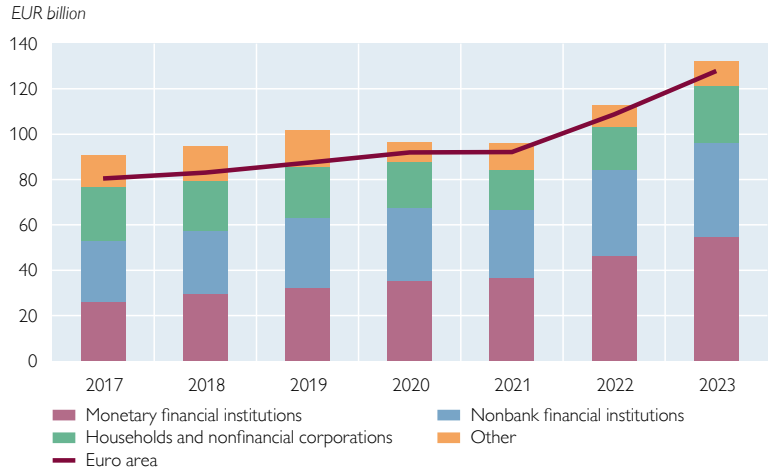
A closer look at the EU holders of Austrian bank debt securities reveals that in 2017 counterparties within the EU and the euro area held a substantial portion of Austrian banks' debt securities. EU holders accounted for 74.8% or EUR 90.9 billion and euro area holders for 66.1% or EUR 80.5 billion (chart 8). Over time, this composition shifted slightly, with the shares of EU and euro area counterparties adjusting to 72.1% and 69.8% in 2023. This change is partly attributable to the Brexit in 2020. The UK's withdrawal from the EU reduced the proportion of

[14] *The MREL is a regulatory standard established under the EU's Bank Recovery and Resolution Directive. It requires banks to maintain a sufficient level of capital and eligible liabilities to absorb losses during financial distress. Compliance with regulatory requirements is ensured by issuing debt, particularly MREL-eligible securities such as subordinated or senior unsecured bonds.*

[15] *The security holdings statistics do not include data outside the euro area.*

Chart 8

EU holders of Austrian bank debt securities by sector

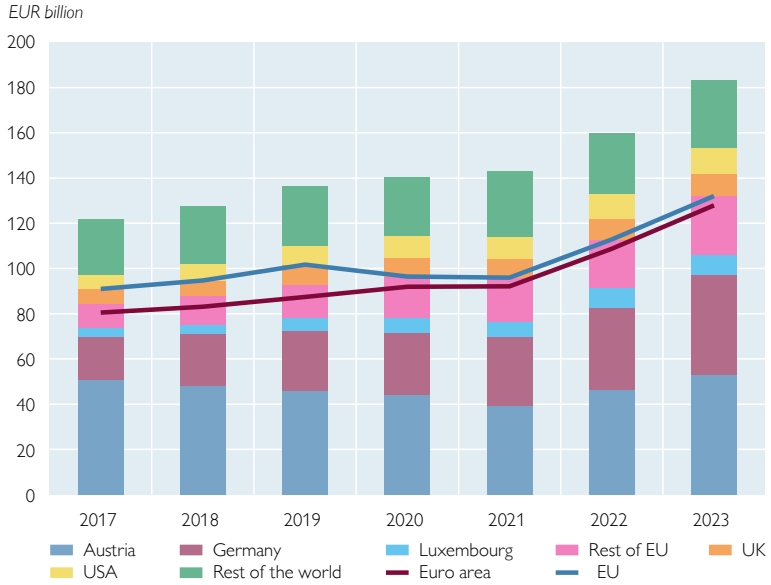


Source: OeNB.

Note: The line reflects volumes in EUR billion.

Chart 9

Holders of Austrian bank debt securities by region



Source: OeNB.

Note: The lines reflect volumes in EUR billion.

EU-based holders. Nevertheless, the EU – particularly the euro area – remains the most significant region in terms of holders of Austrian debt securities.

As to the debt securities issued by Austrian banks (chart 9), a breakdown of holders by region was as follows in 2017: Austria (41.5%), followed by Germany (15.9%), the UK (5.3%), the USA (4.9%) and Luxembourg (3.2%). Over time, this regional composition shifted notably, with the share of Austrian holders shrinking significantly. In 2023, Austrian counterparties held just 29%, while Germany's share had increased to 24%, that of the USA to 6.5%, that of the UK to 5.2% and that of Luxembourg to 5%. The 12.5 percentage point decline in Austrian holders was nearly offset by an 8.1 percentage point rise in German holders, which reflected a notable redistribution of bond holdings across regions.

In summary, between 2017 and 2023, the volume of debt securities issued by Austrian banks surged by 50.6%, reaching an impressive EUR 183.2 billion, which underscored banks' increasing reliance on bonds as a financing tool. This growth was accompanied by a significant shift in counterparty composition, with MFIs rising in prominence to account for nearly one-third of holders in 2023. This trend highlights the deepening interconnection among banks via debt securities markets, mirroring developments on the asset side. Furthermore, the data illustrate the ongoing integration of the Austrian banking sector into the euro area and broader EU financial system, which is evident on both sides of the balance sheet. Austrian counterparties' declining importance on the liability side mirrors trends on the asset side. But from 2017 to 2023, the shares of EU and euro area holders (excluding Austria) rose from 33.2% and 24.6% to 43.1% and 40.8%, respectively.

4 Risks and regulatory environment relating to banks' debt securities

Effective risk management is critical in the context of bonds: they can expose banks to significant challenges, particularly during periods of economic volatility. Main risks are:

1. Interest rate risk, which is the risk that changing interest rates will negatively affect the market value of bonds. This effect is more pronounced, the longer the bond maturity is.
2. Credit risk, which is the risk that the issuer of a bond will default and fail to make interest rate payments or repay the principal. If the creditworthiness of the issuer is deteriorating, losses can occur. Credit risk is typically higher for corporate bonds than for government bonds.
3. Liquidity risk arises when bonds cannot be sold quickly in periods of market stress. If a bank faced sudden withdrawals, bonds could be sold with losses amid unfavorable market conditions.
4. Contagion risk, which refers to the risk that one bank's financial distress may spread to other institutions. Such transmission can occur through debt securities, particularly if counterparty risks arise among financial institutions.

In the case of recent bank failures in the USA, such as Silicon Valley Bank, both interest rate and liquidity risks materialized, which ultimately led to the bank's collapse. Sharp declines in the market value of its bond portfolio triggered a liquidity crisis, and the bank could no longer meet depositor demands. To prevent such outcomes, the EU has established a comprehensive regulatory framework to address the risks associated with bonds in banks' portfolios. This framework, including regulations like the CRD, CRR, EMIR, BRRD,[16] along with the supervisory review and evaluation process (SREP),[17] enforces strict risk management rules designed to strengthen financial stability. These regulations impose extensive requirements on banks for managing credit, liquidity, interest rate and contagion risks, including micro- and macroprudential measures like capital buffers and stress testing. Effective supervision is ensured by the ECB and national competent authorities, based on a legal framework that guarantees consistent enforcement of harmonized supervision standards across the EU. As a result, the Austrian banking sector has improved its capitalization and liquidity position, which has significantly reduced financial stability risks. The EU's stringent regulatory approach to managing risks in banks' bond portfolios has also proven effective during recent stress periods. It was supported by both micro- and macroprudential measures and the dominance of EU and euro area counterparties in Austrian banks' debt security portfolios.

[16] *CRD: Capital Requirements Directive – EU legislation setting out the rules on capital, liquidity and governance for banks. CRR: Capital Requirements Regulation – a regulation that complements the CRD, providing the detailed rules on how banks should calculate their capital requirements. EMIR: European Market Infrastructure Regulation – EU regulation that enhances transparency and reduces risk in the over-the-counter (OTC) derivatives market. BRRD: Bank Recovery and Resolution Directive – EU legislation that establishes a framework for the recovery and resolution of failing banks to protect financial stability and minimize taxpayer exposure.*

[17] *The SREP is conducted by the ECB and the national regulators aiming to assess banks' risk management practices and determine additional capital requirements to enhance banks' resilience.*

5 Summary and concluding remarks

The period from 2017 to 2023 was characterized by significant economic fluctuations, namely the COVID-19 pandemic, Russia's invasion of Ukraine, the energy crisis and the transition from a low interest rate environment to rising interest rates aimed at reducing inflation. Austrian banks expanded their portfolios of debt instruments despite the challenges presented by valuation losses and liquidity constraints during crises. To mitigate the difficult situation, the ECB took proactive measures, such as the asset purchase programme (APP) and targeted longer-term refinancing operations (TLTROs). These measures affected both the asset and liability sides of Austrian banks. From 2017 to 2023, the total volume of debt securities held by Austrian banks increased by 12.4%, reaching EUR 109.9 billion, while debt securities issued grew by 50.6%, to EUR 183.2 billion. This underscores the critical role that bond refinancing plays in meeting regulatory standards such as the minimum requirement for own funds and eligible liabilities (MREL) and liquidity requirements. Austrian counterparties, however, saw a decline in significance. Dropping by 15 percentage points since 2017, the share of Austrian debt securities in banks' portfolios only made up one-third of the portfolio in 2023, which was largely due to a EUR 13 billion reduction in Austrian government bonds. Similarly, on the liability side, the share of Austrian counterparties shrank by 12.5 percentage points, which reduced their stake to 29% in 2023. This decline was almost fully offset by an increase in EU and euro area counterparties. Given the well-developed and harmonized regulatory regime and supervision in the EU, the large share of EU counterparties on both sides of the balance sheet is considered to be a risk-mitigating factor. Moreover, the growing diversification of counterparties distributes risk across a broader range of countries. From 2017 to 2023, the counterparty composition shifted notably on both sides of the balance sheet. On the asset side, the share of MFI debt securities increased by 5.1 percentage points, reaching 42.3% of Austrian banks' portfolios. On the liability side, MFIs accounted for 32.7% of Austrian banks' debt securities in 2023, reflecting a 9% rise since 2017. This trend highlights a growing interconnection of banks with debt securities markets, which has important implications for financial stability as contagion risk intensifies. This risk is, however, mitigated by effective micro- and macroprudential supervisory measures like the supervisory review and evaluation process (SREP) and capital buffers for structural systemic risks.

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Annex

Main changes of the EU regulatory environment relating to the bond market since 2017

Since 2017, the regulatory environment relating to the bond market has changed significantly. In the following, we summarize the main drivers: EU directives, global financial stability initiatives and national regulations.

1. MIFID II (implemented in January 2018)

At the beginning of 2018, the EU directive on markets in financial instruments, known as MIFID II, was transferred into Austrian law,[18] which led to stricter transparency requirements for bond trading and trade transparency for bond transactions. The aim was to enhance market efficiency and investor confidence.

2. Prospectus Regulation (effective since July 2019)[19]

The EU Prospectus Regulation, which replaced the former prospectus directive, became applicable in July 2019. It simplified the prospectus requirements for bond issuances, especially for small and medium-sized enterprises (SMEs) by standardizing disclosure requirements. This made it easier for undertakings to access bond markets and therefore increased bond issuances.

3. Benchmark Regulation (effective since January 2018)[20]

The regulation governs the use of benchmarks in financial instruments like bonds. Benchmarks used in bond contracts must meet certain standards, which prevents manipulation. Benchmarks are crucial for properly calculating financial metrics, e.g. interest rates. The regulation has contributed to investor confidence in bonds.

4. Sustainable Finance Disclosure Regulation (effective since 2021)[21]

This EU regulation requires financial market participants to disclose how they integrate environmental, social, and governance (ESG) factors into their investment decisions. It aims to influence the development of the green bond market in Austria. Issuers are required to provide detailed disclosures on the sustainability of their bonds, which increases transparency and encourages more green bond issuances.

[18] *Securities Supervision Act 2018 (Wertpapieraufsichtsgesetz 2018 – WAG 2018; Federal Law Gazette I No. 237/2022).*

[19] *Regulation (EU) 2017/1129 of the European Parliament and of the Council of 14 June 2017 on the prospectus to be published when securities are offered to the public or admitted to trading on a regulated market, and repealing Directive 2003/71/EC.*

[20] *Regulation (EU) 2016/1011 of the European Parliament and of the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds and amending Directives 2008/48/EC and 2014/17/EU and Regulation (EU) No 596/2014.*

[21] *Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector.*

5. Implementation of the EU Green Bond Standard (2023)[22]

The EU implemented an EU-wide standard, which is voluntary, to open up new opportunities for issuers and investors and to tackle greenwashing. The standard is aimed to set up clear criteria for bonds to qualify as "green." While not fully implemented yet, this standard is expected to develop the green bond market in Austria further by providing a trusted label for green investments. Austrian issuers are preparing to align with this standard with a view to ensuring that their bonds meet stringent environmental criteria. Anticipating and gradually implementing this standard already encourages higher standards for green bonds, which fosters growth of sustainable finance in Austria.

These regulatory improvements have made Austria's bond market more transparent, sustainable and accessible, aligning it with broader European and global financial standards. All these enhancements aiming at investor protection, market integrity and sustainable finance have contributed to the Austrian bond market's growth and resilience, which are key in the face of global and economic challenges.

[22] *Regulation (EU) 2023/2631 of the European Parliament and of the Council of 22 November 2023 on European Green Bonds and optional disclosures for bonds marketed as environmentally sustainable and for sustainability-linked bonds.*

Key financial indicators and macroprudential stance

Macroeconomic indicators for Austria

Economic indicators

https://www.oenb.at/en/Statistics/Standardized-Tables/Economic-and-Industry-Indicators/economic-indicators.html

Selected economic measures

https://www.oenb.at/isaweb/report.do?lang=EN&report=7.1

Interest rates and exchange rates

https://www.oenb.at/en/Statistics/Standardized-Tables/interest-rates-and-exchange-rates.html

Consumer prices

https://www.oenb.at/en/Statistics/Standardized-Tables/Prices--Competitiveness/Consumer-Prices.html

Economic sector breakdown of households

https://www.oenb.at/isaweb/report.do?lang=EN&report=801.1.2

Economic sector breakdown of nonfinancial corporations

https://www.oenb.at/isaweb/report.do?lang=EN&report=801.1.1

Property market

https://oenb.shinyapps.io/Immobiliendashboard_en/
https://www.oenb.at/en/Publications/Economics/reports.html?category=-63df104a-6070-41fe-ab54-90c4ee84344a&year=

Table A1

Bank lending

	2019	2020	2021	2022	2023	H1 23	H1 24
	%						
Loan growth (year on year): households	4.2	3.6	5.3	3.5	–1.9	–0.3	–1.4
Loan growth (year on year): residential real estate	6.1	5.5	6.9	5.0	–2.4	0.0	–2.5
Loan growth (year on year): corporations	6.2	5.0	8.7	9.2	2.7	6.6	1.5
	% of total loans						
Share of variable rate loans (outstanding): households	65	60	57	51	45	57	39
Share of variable rate loans (outstanding): corporations	70	69	67	67	66	87	77
Share of variable rate loans (new lending): households	51	46	47	59	51	50	40
Share of variable rate loans (new lending): corporations	82	77	86	85	78	82	75

Source: OeNB.

Table A2

Debt ratios

	2019	2020	2021	2022	2023	H1 23	H1 24
	%						
Household debt (relative to net disposable income)	92	95	94	89	81	83	77
Corporate debt[1] (relative to gross operating surplus[2])	471	466	476	457	473	447	536

Source: OeNB.

[1] *Short- and long-term loans, money and capital market instruments.*
[2] *Including mixed income of the self-employed.*

Indicators for the Austrian banking sector

Structural indicators

https://www.oenb.at/en/Statistics/Standardized-Tables/Financial-Institutions/banks/Number-of-Banks.html
https://www.oenb.at/en/Statistics/Standardized-Tables/Financial-Institutions/banks/banks-business-structure.html

Table A3

Consolidated banking data

	2019	2020	2021	2022	2023	H1 23	H1 24
	EUR billion						
Total assets	1,032	1,136	1,197	1,200	1,216	1,232	1,243
Loans	744	752	787	814	819	836	844
Shares and debt instruments	137	143	147	155	173	170	181
Cash balance and deposits at central banks	75	164	186	161	152	157	148
Deposits by nonbanks	615	656	686	709	717	717	734
Deposits by credit institutions	101	102	106	106	113	131	129
Debt instruments issued	150	153	152	163	195	186	204
Profit	6.7	3.7	6.1	9.8	12.6	7.3	7.0
Operating income	25.0	24.8	25.8	31.7	37.0	18.3	18.8
Operating costs	16.7	16.5	16.8	18.9	18.1	9.2	9.6
Operating profit	8.3	8.2	9.0	12.8	18.9	9.1	9.1
Risk costs	1.0	3.7	1.4	2.9	3.9	0.8	0.9
Key ratios	%						
Common equity tier 1 (CET1) ratio	15.6	16.1	16.0	16.5	17.6	16.6	17.7
Leverage ratio	7.6	7.4	7.7	8.0	8.4	7.9	8.5
Return on assets (annualized)	0.7	0.4	0.6	0.9	1.1	1.3	1.2
Cost-to-income ratio	67	67	65	60	49	50	51
Nonperforming loan (NPL) ratio[1]	2.2	2.4	2.1	2.1	2.6	2.0	2.7
Coverage ratio	49	49	48	46	40	45	40
Liquidity coverage ratio (LCR)[2]	146	181	176	163	173	164	174
Net stable funding ratio (NSFR)[2]	n.a.	n.a.	135	131	134	134	136

Source: OeNB.

[1] *As of 2020, the NPL ratio excludes cash balances at central banks and other demand deposits.*
[2] *Historical data calculated using the March 2024 banking sample at the highest consolidation level.*

Table A4

Unconsolidated banking data[1]

	2019	2020	2021	2022	2023	H1 23	H1 24
	EUR billion						
Total assets	885	974	1.024	1.014	1.011	1.023	1.026
Loans	654	669	700	730	704	716	717
Shares and debt instruments	94	95	93	104	130	126	133
Cash balance and deposits at central banks	50	123	141	102	97	104	98
Deposits by nonbanks	444	474	496	505	516	510	523
Deposits by credit institutions	166	217	240	213	174	201	173
Debt instruments issued	137	140	140	160	190	184	197
Profit	4.8	2.7	6.5	5.0	12.3	6.6	5.4
Operating income	19.7	19.3	21.2	23.7	26.2	12.9	14.1
Operating costs	14.2	13.6	14.2	14.0	11.6	5.8	7.3
Operating profit	5.5	5.7	6.9	9.7	14.6	7.1	6.8
Risk costs	0.23	2.47	–0.42	3.63	1.1	–0.1	0.7
Key ratios	%						
Return on assets (annualized)	0.6	0.3	0.7	0.5	1.2	1.3	1.1
Cost-to-income ratio	72	71	67	59	44	45	52
Nonperforming loan (NPL) ratio (Austria)	2.2	2.0	1.8	1.7	2.4	1.8	2.6
Coverage ratio (Austria)[2]	61	68	70	74	62	71	60
Liquidity coverage ratio (LCR)	142	174	171	155	168	158	166
Net stable funding ratio (NSFR)	n.a.	n.a.	129	124	127	127	129

Source: OeNB.

[1] As of 2023 and due to reporting changes, comparability to previous years' data is limited.
[2] Total loan loss provisions as a percentage of NPLs in domestic business.

Table A5

CESEE subsidiaries

	2019	2020	2021	2022	2023	H1 23	H1 24
	EUR billion						
Total assets	223	234	271	279	288	294	303
Loans	161	165	186	184	188	196	202
Shares and debt instruments	38	42	48	49	55	55	59
Cash balance and deposits at central banks	18	22	30	39	39	36	35
Deposits by nonbanks	167	178	205	211	214	220	223
Deposits by credit institutions	22	16	18	18	17	22	21
Debt instruments issued	5	11	15	12	19	16	18
Profit	2.8	1.9	3.0	5.2	5.5	2.7	3.1
Operating income	8.4	8.2	8.9	12.8	12.7	6.5	6.6
Operating costs	4.4	4.4	4.6	5.1	5.5	2.9	2.8
Operating profit	4.1	3.8	4.3	7.7	7.2	3.6	3.8
Risk costs	0.5	1.3	0.5	1.0	0.3	0.3	–0.0
Key ratios	%						
Return on assets (annualized)	1.3	0.8	1.2	1.9	1.9	1.9	1.9
Cost-to-income ratio	52	54	52	40	43	44	42
Nonperforming loan (NPL) ratio[1]	2.4	2.6	2.2	2.1	2.0	1.9	1.9
Coverage ratio	67	67	64	64	64	63	65

Source: OeNB.

[1] As of 2020, the NPL ratio excludes cash balances at central banks and other demand deposits.

Table A6

Financial stress indicators

	2019	2020	2021	2022	2023	H1 23	H1 24
	Indicator value						
Austrian financial stress indicator (AFSI)	–0.72	–0.57	–0.66	0.67	–0.29	0.02	–0.46
Composite indicator of systemic stress (CISS)	0.02	0.10	0.05	0.33	0.06	0.26	0.05

Source: OeNB, ECB.

Indicators for other financial intermediaries in Austria

Mutual funds

https://www.oenb.at/en/Statistics/Standardized-Tables/Financial-Institutions/Mutual-Funds.html

Pension funds

https://www.oenb.at/en/Statistics/Standardized-Tables/Financial-Institutions/pension-funds.html

Insurance corporations

https://www.oenb.at/en/Statistics/Standardized-Tables/Financial-Institutions/insurance_corporations.html

Overview of the macroprudential stance in Austria

The primary goal of macroprudential supervision in Austria is to reduce systemic risks in the Austrian financial system. The OeNB pursues this goal in a proportional manner by using the most appropriate tool available. The measures applied consist of borrower-based measures to mitigate the buildup of systemic risk as well as other macroprudential instruments, such as capital buffers and moral suasion to strengthen banks' resilience. In its analyses to the Financial Market Stability Board (FMSB), the OeNB recommends measures in line with a steady-hand policy, allowing banks sufficient time to adapt. The consistent implementation of macroprudential policy supported capital buildup and helped Austrian banks keep top ratings throughout the COVID-19 pandemic and even shielded them from potential negative impacts resulting from Russia's war of aggression against Ukraine. In August 2024, the rating agency Standard & Poor's confirmed the Austrian banking sector's rating as one of the highest worldwide. Strong capitalization and top ratings reduce banks' refinancing costs and provides households and firms with more stable financing conditions. For an overview of the currently applicable risk warnings and recommendations by the FMSB, see table A7 and the FMSB's website.

Table A7

Overview of the macroprudential stance in Austria

As of January 1, 2025	CCoB	CCyB	O-SII buffer	SyRB	Borrower-based measures (residential real estate)
Calibration in %	2.5	0	0.45–1.75	0.5–1.0	90% LTC, 40% DSTI, max. maturity of 35 years, 20% exemption bucket
Number of banks	All banks	n.a.	7 (consolidated) 8 (unconsolidated)	12 (consolidated) 11 (unconsolidated)	All banks
As of July 1, 2025				Sectoral SyRB	
Calibration in %				1.0 on CRE exposure	
Number of banks				All banks	

Source: OeNB.

Note: Based on the FMSB's recommendations of October 3, 2024. CCoB = capital conservation buffer; CCyB = countercyclical capital buffer; O-SII buffer = capital buffer for other systemically important institutions; SyRB = systemic risk buffer; LTC = loan-to-collateral ratio; DSTI = debt service-to-income ratio; CRE = commercial real estate.