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FINANCIAL SECTOR ASSESMENT PROGRAM

June 2024

TECHNICAL NOTE ON SYSTEMIC RISK ANALYSIS

This paper on the Kingdom of the Netherlands—The Netherlands was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on May 28, 2024.

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FINANCIAL SECTOR ASSESSMENT PROGRAM

May 28, 2024

TECHNICAL NOTE

SYSTEMIC RISK ANALYSIS

Prepared By
Monetary and Capital Markets Department

This Technical Note was prepared by IMF staff in the context of the Financial Sector Assessment Program in the Netherlands. It contains technical analysis and detailed information underpinning the FSAP's findings and recommendations. Further information on the FSAP can be found at http://www.imf.org/external/np/fsap/fssa.aspx

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Glossary

AC	Amortized Cost
AFM	Authority for Financial Markets (conduct supervisor)
APP	Asset Purchase Programme
ARS	Solo Prudential Reporting Annual Submission
BIS	Bank of International Settlements
BMA	Bayesian Model Averaging
BU	Bottom Up
CaR	Commercial Real Estate Price at Risk
CBS	Statistics Netherlands (*Central Bureau voor de Statistiek*)
CCyB	Countercyclical Capital Buffer
CET1	Common Equity Tier 1
COREP	Common Reporting
CPB	*Centraal Planbureau*
CPI	Consumer Price Index
CRE	Commercial Real Estate
CRI	Credit Research Initiative
CSD	Central Securities Depository
DB	Defined Benefit
DC	Direct Contribution
DGF	Deposit Guarantee Fund
DNB	*De Nederlandsche Bank*
DSGE	Dynamic Stochastic General Equilibrium
DSTI	Debt Service to Income
DTI	Debt to Income
EA	Euro Area
EBIT	Earnings Before Interest and Taxes
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
ECB	European Central Bank
EIOPA	European Insurance and Occupational Pensions Authority
EM	Emerging Market
EMDEs	Emerging Markets and Developing Economies
EMIR	European Market Infrastructure Regulation
EOF	Eligible Own Funds
ESMA	European Securities and Markets Authority
ESRB	European Systemic Risk Board
EU	European Union
FDI	Foreign Direct Investment
FICO	Financial Conglomerates
FINREP	Financial Reporting
FMIs	Financial Market Infrastructures
FSAP	Financial Sector Assessment Program
FSB	Financial Stability Board
FSC	Financial Stability Committee

FSR	Financial Stability Report
FX	Foreign Exchange
FVOCI	Fair Value through Other Comprehensive Income
FVPL	Fair Value through Profit and Loss
FTK	Financial Assessment Framework
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GMM	Global Macrofinancial Model
GRAM	Global Risk Assessment Matrix
HP	Hodrick-Prescott
HTM	Held-to-Maturity
HQLA	High-quality Liquid Assets
IAIS	International Association of Insurance Supervisors
ICP	Insurance Core Principles
ICR	Interest Rate Coverage Ratio
IF	Investment Fund
IFRS	International Financial Reporting Standard
IMF	International Monetary Fund
IO	Interest-Only
IOL	Interest-Only Loan
IPCC	Intergovernmental Panel on Climate Change
IRB	Internal Rating-based
IRRBB	Interest Rate Risk for the Banking Book
LCR	Liquidity Coverage Ratio
LGD	Loss Given Default
LLD	Loan-Level Data
LSI	Less Significant Institution
LST	Liquidity Stress Test
LTI	Lon to Income
LTV	Loan to Value
LTG	Long-Term Guarantee
KNMI	Royal Netherlands Meteorological Institute
MMF	Money Market Fund
MoF	Ministry of Finance
MSR	Monthly Securities Reporting
NBFI	Non-Bank Financial Institutions
NFC	Non-financial Corporate
NHG	*Nationale Hypotheek Garantie*
NIBUD	*Nationaal Instituut voor Budgetvoorlichting*
NII	Net Interest Income
NPL	Non-performing Loan
NSFR	Net Stable Funding Ratio
OCR	Overall Capital Requirement
OFI	Other Financial Institutions

O-SII	Other Systemically Important Institutions
P&C	Property & Casualty (insurer)
PD	Probability of Default
QRT	Quantitative Reporting Template
RAM	Risk Assessment Matrix
RIVM	Dutch National Institute for Public Health and the Environment
RRE	Residential Real Estate
ROW	Rest of the World
RWA	Risk Weighted Assets
SCR	Solvency Capital Requirement
SHSG	Securities Holdings Statistics Group
SI	Significant Institution
SREP	Supervisory Review
SME	Small-to-medium Enterprise
SSM	Single Supervisory Mechanism
STE	Short-term Exercise
STA	Standardized
STeM	Stress Test Matrix
TD	Top Down
TLTRO	Targeted Longer-term Refinancing Operation
TTF	Title Transfer Facility
VA	Volatility Adjustment
WEO	World Economic Outlook

EXECUTIVE SUMMARY[1]

The Netherlands has a large financial system. The system's assets are roughly eight times the Gross Domestic Product (GDP) of the Netherlands. Banks account for about one third of the financial system and 253 percent of GDP as of 2023Q2. Occupational pension funds are among the largest globally, at 142 percent of GDP. The insurance sector, in particular life insurance, has been undergoing consolidation, and stands at about 43 percent of GDP. Other financial institutions have grown significantly to surpass banks in size, reflecting responses to Brexit and financial innovation. The Dutch financial system is deeply interconnected domestically and with the rest of the world.

The FSAP conducted a quantitative analysis of selected segments of the Dutch financial system. Four main risks were considered as part of the macrofinancial scenario analysis—an abrupt slowdown in growth, persistently high inflation, continued tightening of financial conditions, and a severe correction in the housing market. The analysis covered banks, insurers, and pension funds, and was complemented by an analysis of household and corporate vulnerabilities, including commercial real estate price-at-risk. Banks were subject to solvency and liquidity stress tests, integrated solvency and liquidity tests, and sensitivity analysis. Solvency and liquidity stress tests, and sensitivity analysis were carried out for insurers and pension funds. Contagion analysis considered a fire sale channel across institutions and sectors, and an interconnectedness analysis of cross-border banking sector exposures was conducted.

The banking sector appears resilient to adverse macrofinancial shocks assuming no policy reactions, but some vulnerabilities exist. A solvency stress test on SIs reveals that the sector would remain sufficiently capitalized even if all the main risk factors materialize simultaneously. However, some SIs might see their capital buffers erode since earnings weaken over several years in the adverse scenario. Furthermore, an institution-level cross-sector contagion analysis shows that bank capital losses could lead to substantial additional losses in the banking, insurance, and pension fund sectors. Liquidity stress tests on SIs show that the sector would also be able to withstand severe funding pressures. Dutch banks could be susceptible to shocks from U.S. and German banking systems.

The insurance solvency stress test evidenced a broad resilience of the Dutch insurance sector, particularly for property & casualty (P&C) and health insurers, while vulnerabilities exist for some life insurers. While large Dutch life insurers strive for a rather close match of their assets and liabilities through the cycle, in times of rising interest rates they benefit less than many of their European peers. Aggregated interest rate effects on assets and liabilities are almost balanced, and hence the other asset-side shocks cause a significant decline in own funds. P&C insurers as well as health insurers are less sensitive to market and credit risks and are therefore more resilient in the adverse scenario.

[1] This Technical Note was prepared by Wei Sun, Max Sebastian Dovì, Romain Bouis, Junghwan Mok (all IMF MCM), and Timo Broszeit (external expert).

Life insurers are broadly resilient to liquidity shocks despite large interest rate swap positions. Assuming a euro interest rate increase of 100 basis points, margin calls are sizable, but the sampled entities apply heterogenous strategies and draw on a variety of different sources for their liquidity, including cash and deposits, uncommitted repo facilities, and the sale of money-market funds.

Pension funds' solvency positions are strong, and the sector appears resilient to liquidity risks, including from margin calls.

- Pension funds are benefiting from rising interest rates, after considerable improvements in their funding ratios already since 2021. Higher interest rates lower the value of (long-dated) pension fund liabilities substantially, which compensates for the decline in asset values. As a result, funding ratios improve for the large majority of pension funds in the sample.

- Bottom-up (BU) analyses conducted by De Nederlandsche Bank (DNB) show resilience of pension funds to liquidity risks from margin calls, even when restricting access to the repo market. Margin calls are even more sizable than for insurers, but a larger share of the call could be met in kind. For smaller pension funds which do not fall under the clearing obligations, many still make use of bilateral swap transactions which allow for a settlement in kind, thereby lowering liquidity risks.

The FSAP team also carried out an analysis of household and corporate sector resilience, and of the commercial real estate (CRE) market. Households and nonfinancial corporations (NFC) were subject to the same macrofinancial adverse scenario as banks. The analysis found the following:

- For households, young, low-income borrowers, as well as borrowers with high loan-to-value (LTV) and debt-to-income (DTI) ratios, are the most impacted, with the proportion of these latter almost tripling in the adverse scenario compared to the baseline. The loan-level data analysis, conducted in collaboration with DNB, assessed the impact of income, interest rate, and housing price shocks on borrowers' debt-service-to-income (DSTI) and LTV ratios.

- The nonfinancial corporate sector is susceptible to the adverse effects of lower growth and tighter financial conditions, particularly firms with shorter debt maturity profiles.

- A CRE price at risk analysis suggests the downside risks in the CRE market remain elevated.

The FSAP recommendations aim to address observed gaps and further strengthen the Netherlands' systemic risk analysis framework (Table 1).

Table 1. The Netherlands: Key Recommendations

Recommendation	Addressee	Timing*	Priority**
Bank Stress Testing			
Tap alternative data sources, e.g., Securities Holdings Statistics Group (SHSG) and trade repository of derivatives required by the European Market Infrastructure Regulation (EMIR), to complement the ongoing efforts to develop market risk analyses based on bank-reported sensitivities.	DNB	ST	M
Adopt the Interest Rate Risk for the Banking Book (IRRBB) template to conduct the interest rate analysis as it becomes available in Common Reporting (COREP) IN 2024.	DNB	ST	M
Continue efforts in collecting additional risk parameters and conducting granular credit-risk analyses for LSIs.	DNB	ST	M
Develop system-wide stress-testing methodologies to assess the contagion effects of price and funding shocks across banks and non-bank financial institutions (NBFIs).	DNB	MT	M
Insurer and Pension Fund Stress Testing			
Closely monitor pension funds' repo transactions, amend supervisory reporting where necessary, and perform liquidity stress tests which incorporate a drying-up of repo markets.	DNB	C	H
Continue efforts to improve the quality of supervisory reporting of insurers and pension funds, and prioritize data items relevant for systemic risk analysis.	DNB	C	M
Household Sector			
Refine the household stress test model by calibrating some of its equations by group of borrowers and by using alternative DSTI thresholds to identify borrowers at risk, complemented by some sensitivity analyses.	DNB	ST	M
Corporate and Commercial Real Estate Sectors			
Develop risk assessment models for both the corporate sector and CRE sector using more granular bank-firm level loan data and more accurately measured data on the CRE.	DNB	ST	M

* Timing: C = Continuous; I = Immediate (within one year); ST = Short Term (within 1-3 years); MT = Medium Term (within 3-5 years).
** Priority: H = High; M = Medium; L = Low.

INTRODUCTION

A. Macrofinancial Setting

1. The Dutch economy was resilient through a succession of global shocks, but growth slowed in 2023 while core inflation remained elevated. GDP growth has held up well to the effects of the war in Ukraine, following the post-pandemic recovery, but turned negative in mid-2023 as external demand wanes and consumption growth slows (Table 2). Inflation has fallen from double digit levels as energy price shocks subsided, with headline inflation approaching target. However, elevated core inflation has persisted amid a still-tight labor market.

2. Financial conditions have tightened, and lending growth has slowed (Figure 1)**.** The European Central Bank (ECB) has increased its policy rates by 4.5 percentage points since July 2022. The ECB has ended reinvestment in its Asset Purchase Programme (APP). Banks are repaying the amounts borrowed under the targeted longer-term refinancing operations (TLTROs). Financial conditions have tightened, though at a decelerating pace and even easing somewhat recently. Bank lending to households and nonfinancial corporations has slowed in 2023. The financial cycle has turned. DNB has increased the Countercyclical Capital Buffer (CCyB) to 2 percent (effective May 2024), a level it considers neutral.

3. The housing market cooled on tighter financial conditions but seems to be recovering. House prices had fallen 6 percent through mid-2023 from their July 2022 peak, before recovering lately. Mortgage rates have risen, and home sales have been stable recently. DNB imposed a macroprudential floor on risk weights on Dutch mortgages in 2022.

4. The banking system has remained stable through a succession of shocks. Bank profitability improved as increases in lending rates outpaced those of deposit rates (Figure 2). Bank capitalization has improved since 2017 but saw some decline in 2022 due to the introduction of a floor on risk weights on Dutch mortgages, with Core Equity Tier 1 (CET1) at 16.5 percent in 2023Q3 (Table 4). The systemwide NPLs stayed low, and the Liquidity Coverage Ratio (LCR) was adequate during this period, in line with peers (Figure 2).

5. Higher interest rates have improved occupational pension funds' funding ratios, and insurers solvency coverage ratios have been stable. Since 2021, rising interest rates have eased pressures on pensions' funding ratios as liability values declined (Figure 3). The new collective defined contribution (DC) regime will shift investment risks to pension fund members and beneficiaries. Solvency ratios of life insurers were stable over the last two years, though below the European Union (EU) average.

6. Households' debt burden has been declining since 2010, but some segments remain vulnerable (Figure 4). Household debt as a share of disposable income peaked in the early 2010s and has declined since then, partly reflecting: (i) higher voluntary debt repayments thanks to a decline in interest-only (IO) loans and to a tax exemption for gifts used for housing, and (ii) strong nominal income growth. The deleveraging has accelerated since 2022 on the back of strong nominal disposable income growth. Meanwhile, house prices increased sharply, despite tightening borrower-based measures since 2013. Notwithstanding, banks' real estate exposures, housing valuations, and household debt are high relative to peers (Figure 4). While household assets are also high, these are mainly illiquid and tied up in pension savings. The boom in housing prices has increased vulnerabilities for the most recent borrowers (see ¶16 and Household Sector Analysis below).

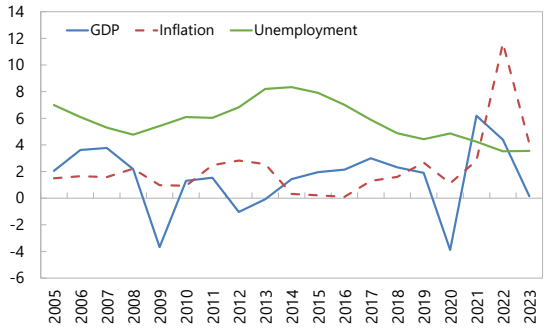
7. Corporate sector debt has fallen relative to GDP, but the sector may face difficulties in paying down debt if tight financial conditions persist (Figure 5). Nonfinancial corporate debt increased with the recovery from the pandemic, while the debt-to-GDP ratio declined. Bankruptcies have increased but remain below pre-pandemic levels. Within the Euro Area (EA), the Netherlands

ranks the fourth highest in debt-to-surplus ratio, suggesting a need to sustain profitability (see Corporate Sector Analysis section below).

Figure 1. The Netherlands: Macrofinancial Developments

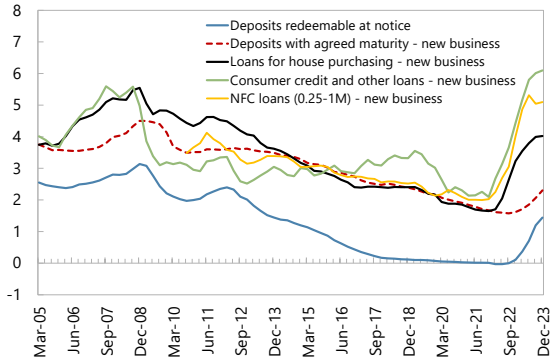
Growth has slowed, while inflation has come down and unemployment remains low.

Real GDP, Prices, and Unemployment Rate
(percent change y-y, percent unemployment)



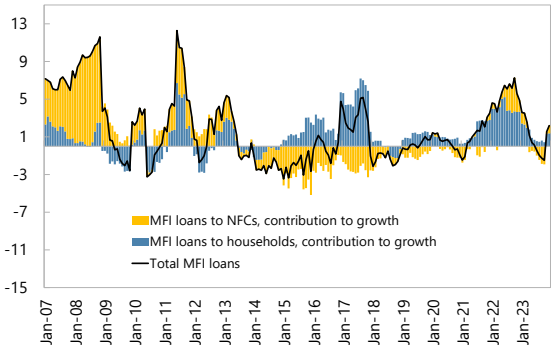
Lending rates have responded to policy rates hikes, even as deposit rates have lagged.

Interest Rates
(percent)

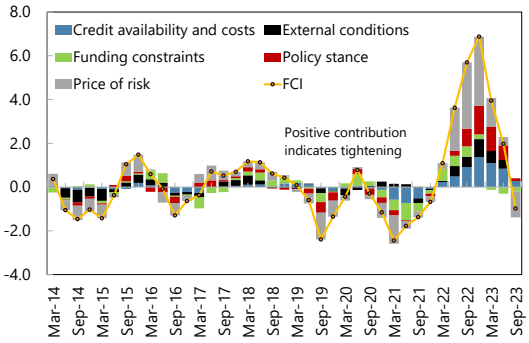


Loan growth has reversed itself, and financial conditions are easing somewhat after 1½ years of tightening.

Lending by Monetary Financial Institutions (MFIs)
(percent change y-y)



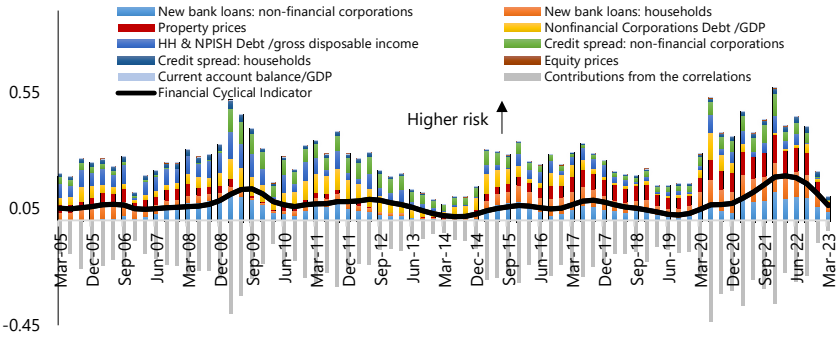
Changes in Financial Conditions Index [1]
(percent contribution to quarter-over-quarter first difference)



Note: 2023Q2 and 2023Q3 are forecasts.

The financial cycle has turned from its peak in early 2022; the recent decline in this indicator can be attributed to a drop in property prices, a reduction in new loans to both households and corporations, a decrease in household debt, and an increase in the interest rate spread for corporate loans.

Financial Cyclical Indicator [2]



Sources: IMF, Haver analytics, CBS, DNB, ECB, and IMF staff calculations.

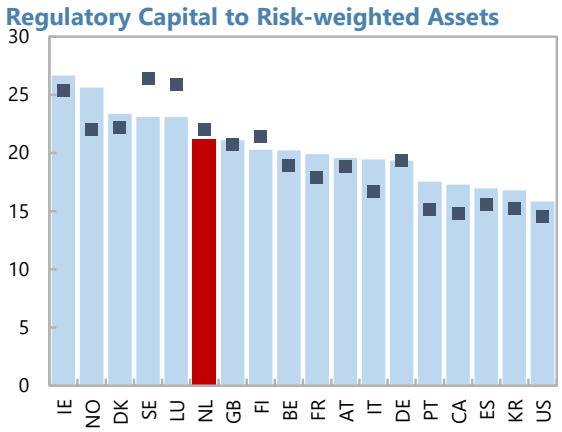
[1]See Borraccia et al (2023), "Financial Conditions in Europe: Dynamics, Drivers, and Macroeconomic Implications."

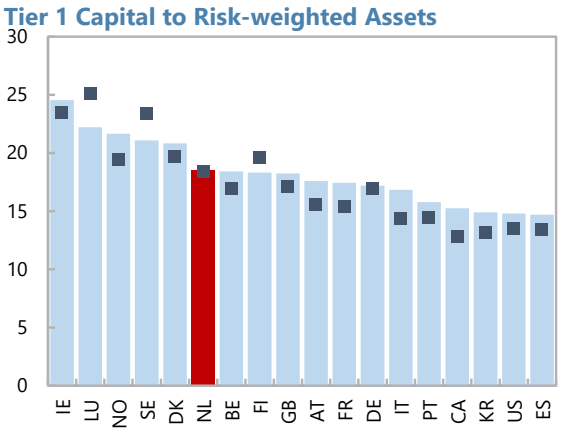
[2]The Indicator warns of a potential materialization of risks six quarters ahead. Ranging between 0 and 1, it covers demand and supply factors characterizing the cyclical swings in financial risk (see 2023 Iceland FSSA, Box 1).

Figure 2. The Netherlands: Financial Soundness Indicators of Selected Banking Systems

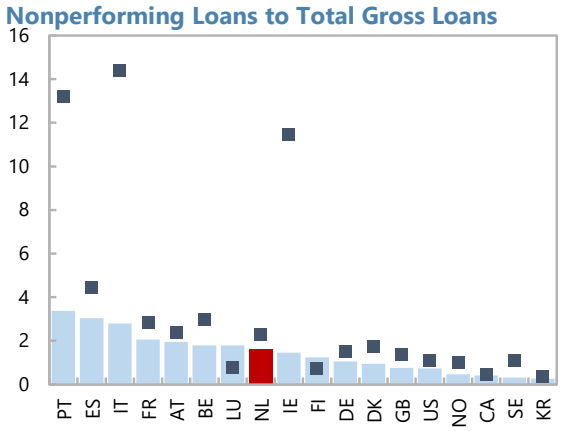
(Percent, September 2023 or latest available as bars, and end 2017 as squares)

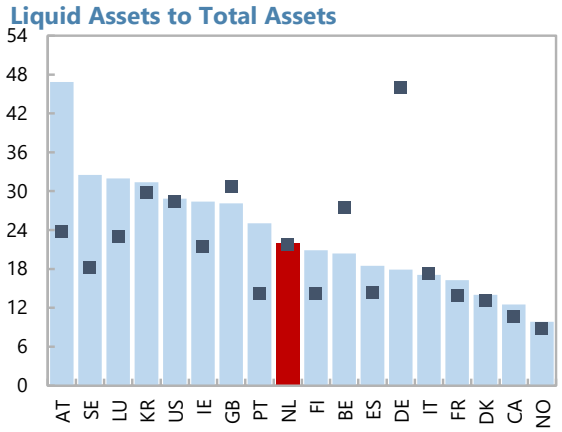
Capital ratios in Dutch banks are in the mid-to-high range relative to peers



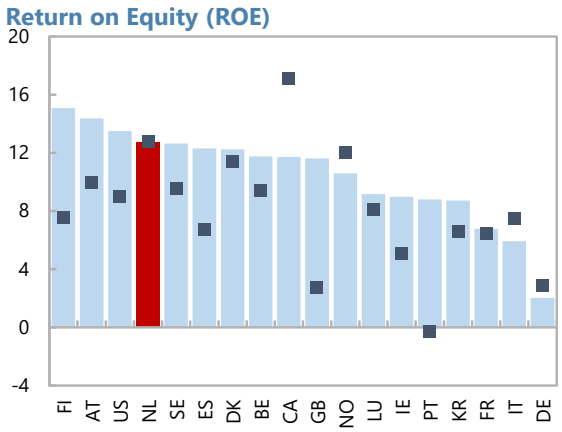


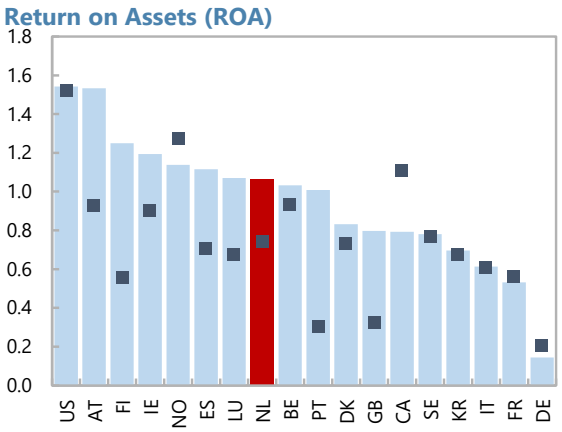
Asset quality and liquidity are in comfortable ranges ….





… while profitability is also in the mid-to-high range relative to peers.



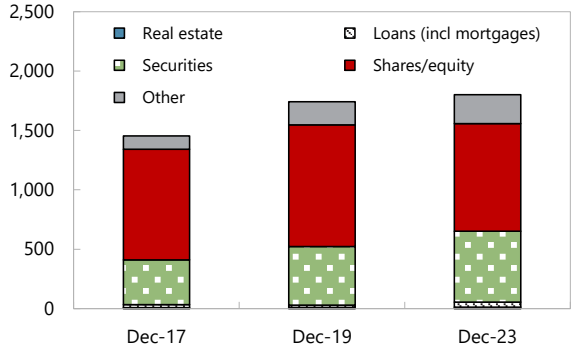


Source: IMF.

Figure 3. The Netherlands: Pension Funds and Insurers

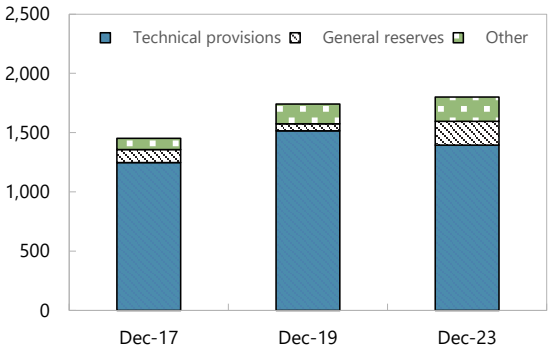
Pension funds' total assets at end 2023 are somewhat higher than those at end 2019 …

Assets of Pension Funds
(billions of euro)



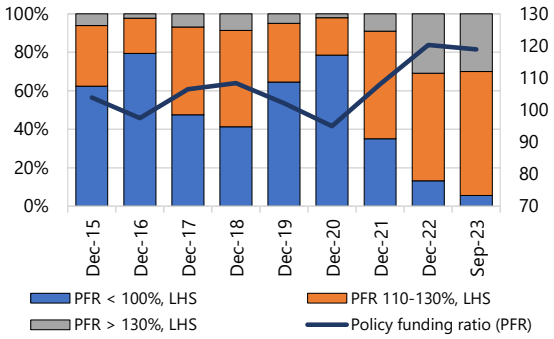
… while their general reserves have increased, translating into higher funding ratios …

Liabilities of Pension Funds
(billions of euro)



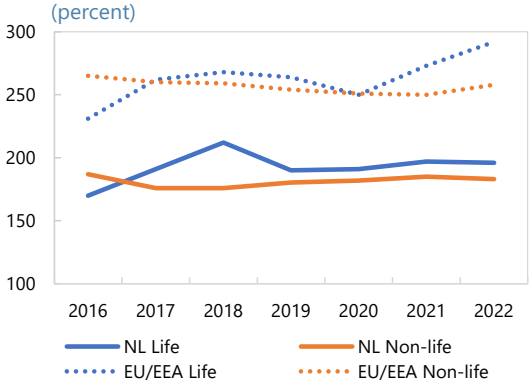
… leaving only a very small number of pension funds with a funding ratio below 100 percent.

Pension Funds' Policy Funding Ratios
(percent)



Insurers' Solvency Capital Requirement (SCR) has been stable, but lower than the average for peers in the region.

Insurers' SCR Coverage Ratios
(percent)

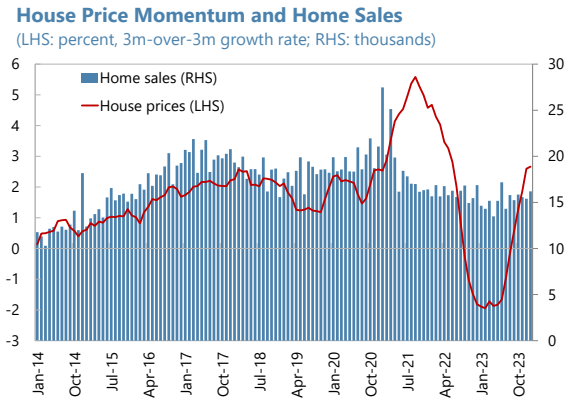


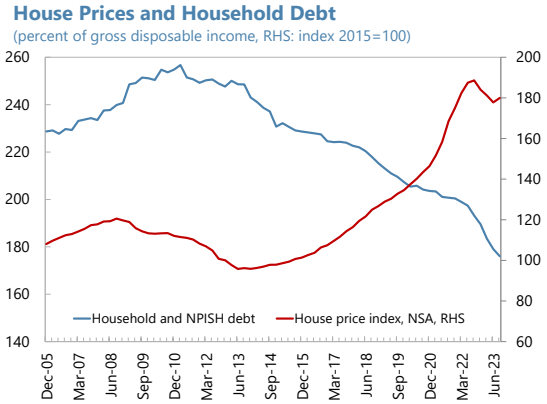
Source: DNB.

Figure 4. The Netherlands: Housing Market and Household Debt

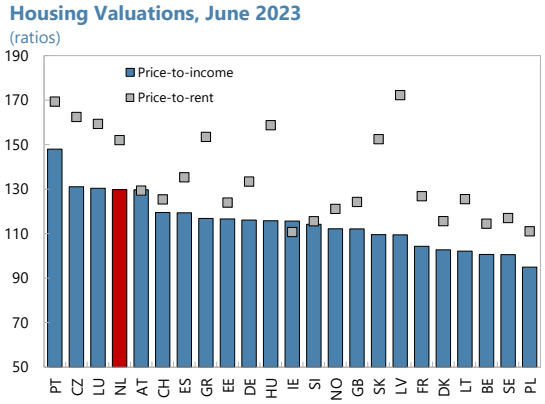
House price growth has been recovering recently, with home sales stable.

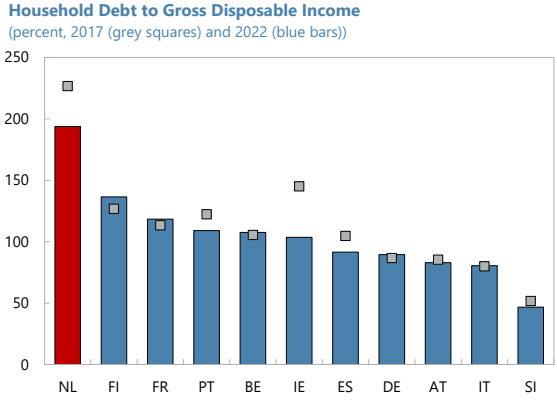
Household debt has declined after a peak in 2010 despite a concurrent house price boom.



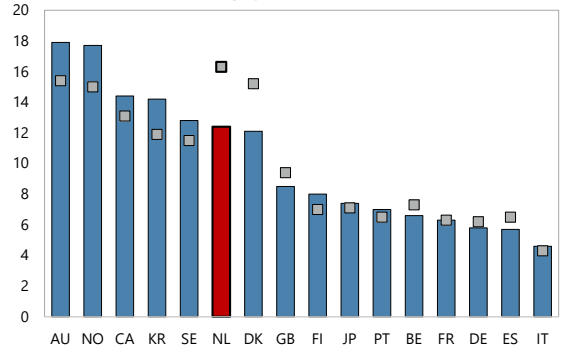


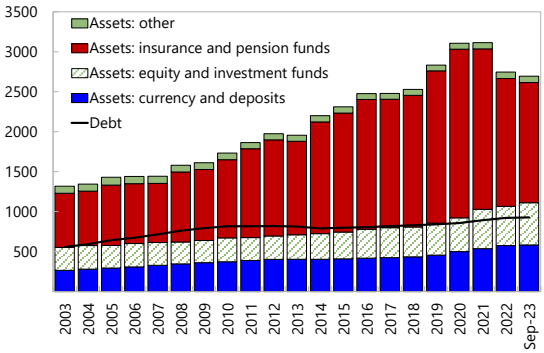
Dutch housing prices are quite elevated compared to peers, and households have high debt relative to disposable income…





… though debt service ratios have come down since 2017, and households have large holdings of pension assets.

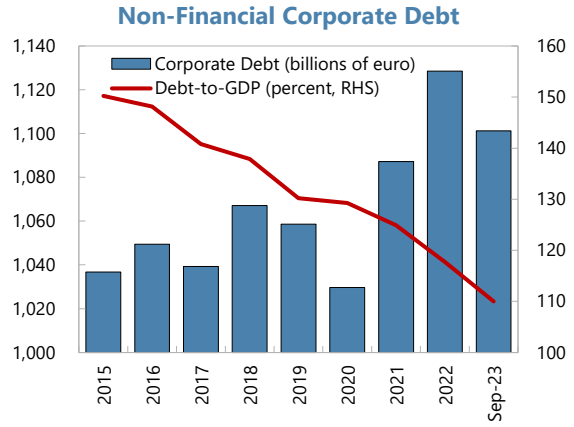




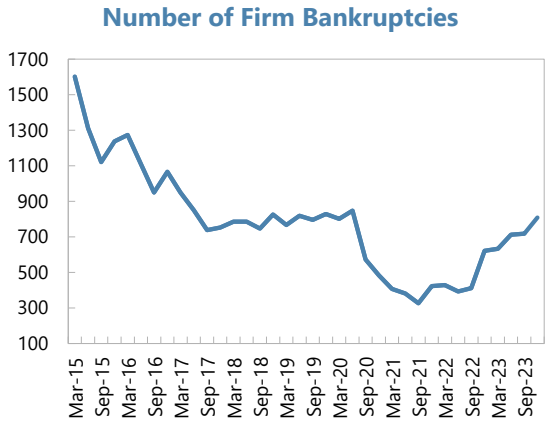
Sources: BIS, CBS (Statistics Netherlands), European Banking Authority (EBA), ECB, Eurostat, IFS, OECD, and IMF staff calculations.
NPISH: Non-profit Institutions Serving Households.

Figure 5. The Netherlands: Nonfinancial Corporate Sector

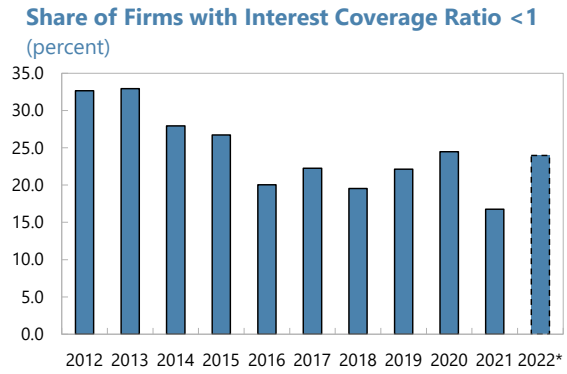
NFC debt levels fell in the wake of the pandemic and rebounded quickly. They declined relative to GDP.



Firm bankruptcies have increased and are approaching pre-pandemic levels.

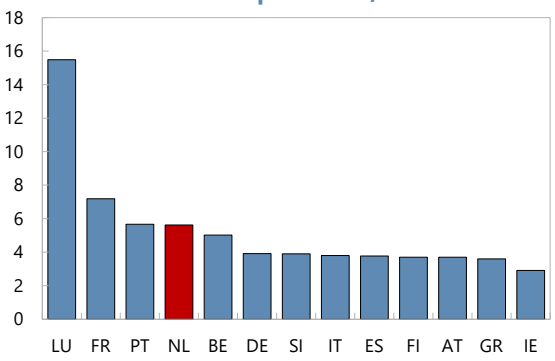


The share of firms with low interest payment coverage remains high….



*The number of observations drops in 2022 due to reporting lags.

…with debt-to-surplus ratios higher than some EU peers.



Sources: CBS, OECD, Orbis, IMF staff calculations. The Orbis set of firms in panel 3 covers 72 percent of total NFC assets.

B. Financial System Landscape

8. The financial sector relative to GDP has shrunk somewhat since the last FSAP, though it remains large. Total system assets are roughly eight times GDP, with banks accounting for one third of the system as of 2023Q2 (Table 3, Figure 6). The banking sector is highly concentrated. The four largest commercial banks (ING, Rabo, AMRO, and de Volksbank) account for 76 percent of the banking system. The two policy banks (BNG and Nederlandse Waterschapsbank) are state-owned and AAA-rated.

9. Dutch SIs have a loan-dominant business model funded mostly by deposits (Figure 6). The two policy banks mainly lend to corporate borrowers. De Volksbank specializes in domestic mortgages. The other three banks are active in international markets, including Australia, Belgium, Germany, UK, and U.S. These banks' lending to corporates, governments, households, and institutions are more diversified. The policy banks issue securities to fund their operations, while the commercial banks fund themselves through deposits, in particular sight deposits. The SIs as a group

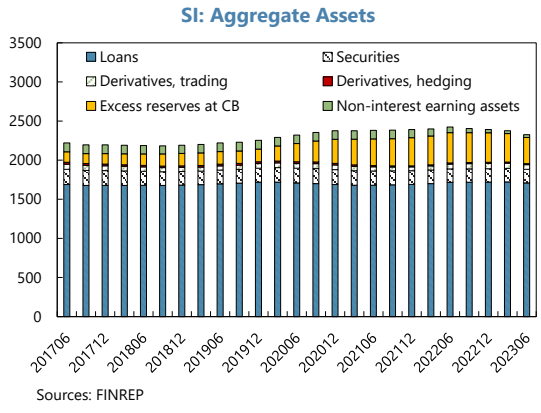
have been reducing their holdings of non-interest-earning assets and excess reserves at the central bank as financial conditions tightened. They have also experienced some outflows of sight deposits, which were partially offset by inflows into term deposits. They are repaying the TLTROs, reducing their outstanding balance to the ECB.

10. Dutch LSIs are small and have diverse business models (Figure 7). The 23 LSIs hold about 8 percent of total banking assets. Financial conglomerates (FICO) and universal banks conduct loan business domestically and in neighboring countries. Some corporate and emerging market (EM) banks are subsidiaries of foreign banks and serve international clients. Most of the custodian and specialized banks focus on payment, securities, and fee-based business.

11. Nonbanks have grown more than banks and securities market trading has shifted from London to Amsterdam. Occupational pension funds are among the largest globally, at 142 percent of GDP. Leverage is considerably lower than UK peers. A pension reform was adopted by Parliament in 2023, moving the system from defined benefit (DB) toward a defined contribution (DC) system, due for completion by 2028. The insurance sector, particularly life insurance, has been undergoing consolidation, but remains sizeable (43 percent of GDP). Several large new trading platforms have established themselves in the Netherlands since Brexit, increasing Dutch platforms' share of European trading (including UK) to over 30 percent from 5-10 percent pre-Brexit, with daily turnover volumes of EU-listed shares exceeding those in London. Amsterdam now hosts significant fixed-income trading venues, including repo trading venues, in addition to the existing venue which is a significant hub for trading Title Transfer Facility (TTF) gas futures.

Figure 6. The Netherlands: SIs, Aggregate Assets and Liabilities

(Billions of Euro)



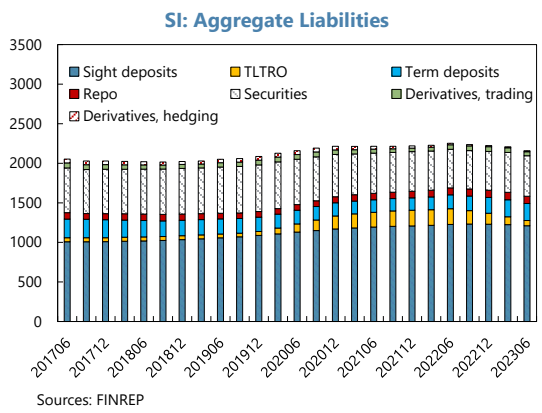
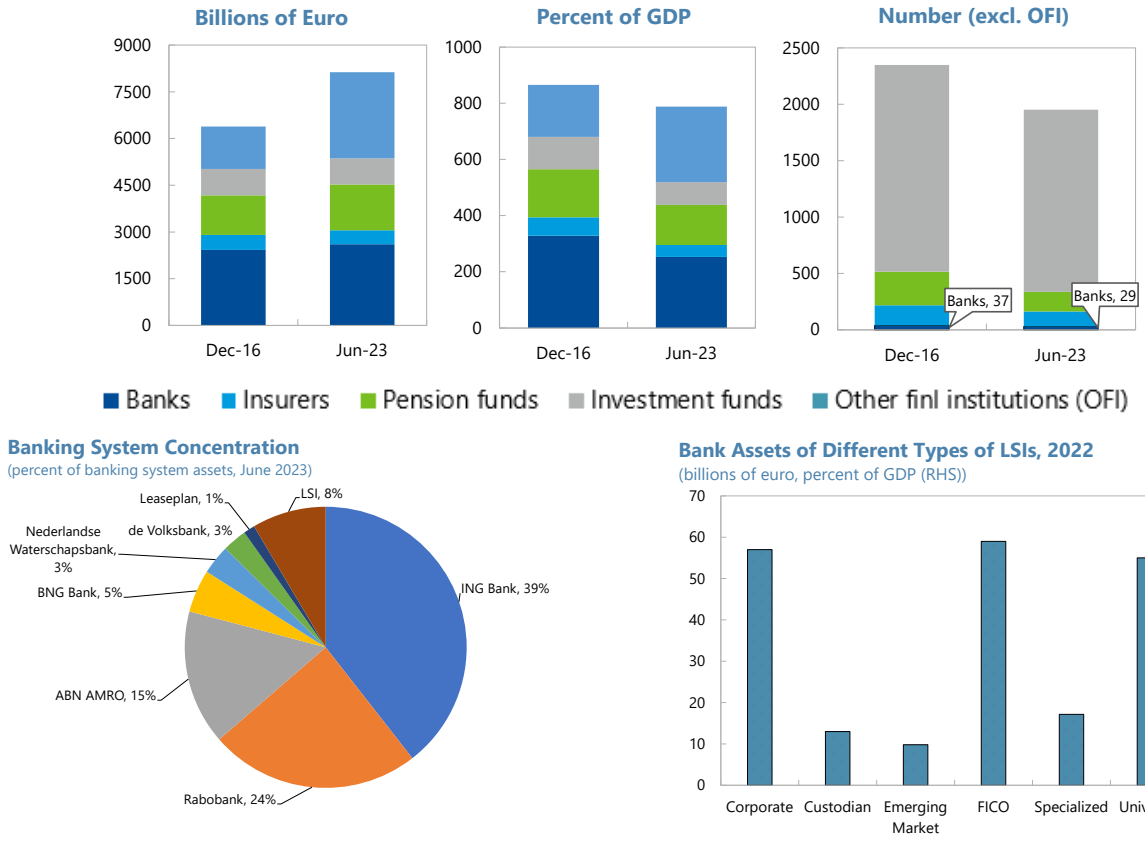


Figure 7. The Netherlands: Financial Sector Structure



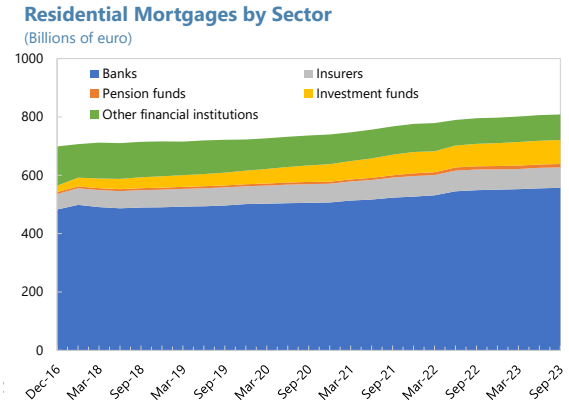
Sources: DNB, Haver, IMF staff calculations.
FICO: Financial conglomerate.

VULNERABILITIES AND RISKS

12. Certain features of the financial system can make it vulnerable to and potentially amplify specific types of shocks. The high concentration in mortgage lending subjects banks to higher credit losses when economic activity slows down, financial conditions tighten, and housing prices decline. Banks holding significant marketable securities are susceptible to valuation losses when market conditions shift quickly, if they do not hedge such risks sufficiently. The interconnected nature of the Dutch financial system makes it possible for idiosyncratic shocks to propagate through the system and cause collateral damage. The Dutch financial system is also prone to material climate-related risks, which are discussed in a separate Technical Note.

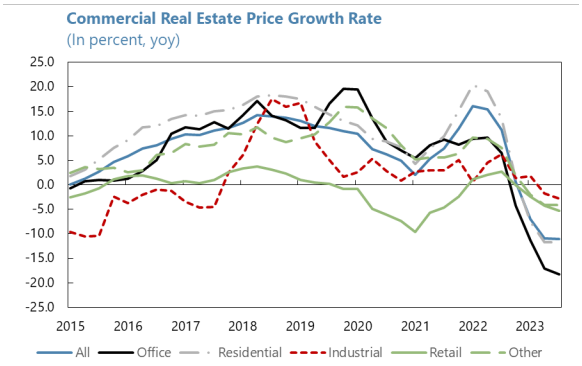
A. Vulnerabilities

13. Banks and NBFIs are significantly exposed to real estate. Mortgages constitute more than half of banks' domestic loan book. RRE exposures have risen from around 27 percent of total loans in 2017 to over 40 percent. Most mortgages are fixed-rate, with around 45 percent of these being interest-only. Insurers are also active in mortgage lending, accounting for 15 percent of their assets. Banks' commercial real estate (CRE) loans make up 7 percent of assets, while investments in CRE account for 7 percent and 8 percent of the balance sheets of pension funds and insurers, respectively.



14. LSI performance varies and could be vulnerable to more diverse macrofinancial shocks. LSIs have more diverse business models relative to SIs. Their capital, asset quality, liquidity, and profitability metrics exhibit more variability (Figure 8, Table 5). LSIs with large lending portfolios, especially those serving clients concentrated in certain foreign countries, could be more susceptible to credit risk driven by domestic conditions in those countries. LSIs that hold large securities portfolios could be adversely affected by higher interest rates and lower asset valuations. Banks that rely significantly on foreign or wholesale funding could be subject to liquidity strains during funding markets dislocations.

15. CRE prices in the Netherlands doubled in value between 2015Q1 and 2022Q2, with significant declines thereafter. While the pandemic temporarily slowed the growth rate, particularly in the retail sector, CRE price growth rebounded quickly. However, this upward trend was abruptly reversed in the second half of 2022, with substantial price declines under tightened financial conditions. A sudden drop in CRE prices can pose credit risks to banks and other financial institutions, as many companies use their CRE as collateral for borrowing.



Sources: MSCI Real Estate and IMF staff Calculation.

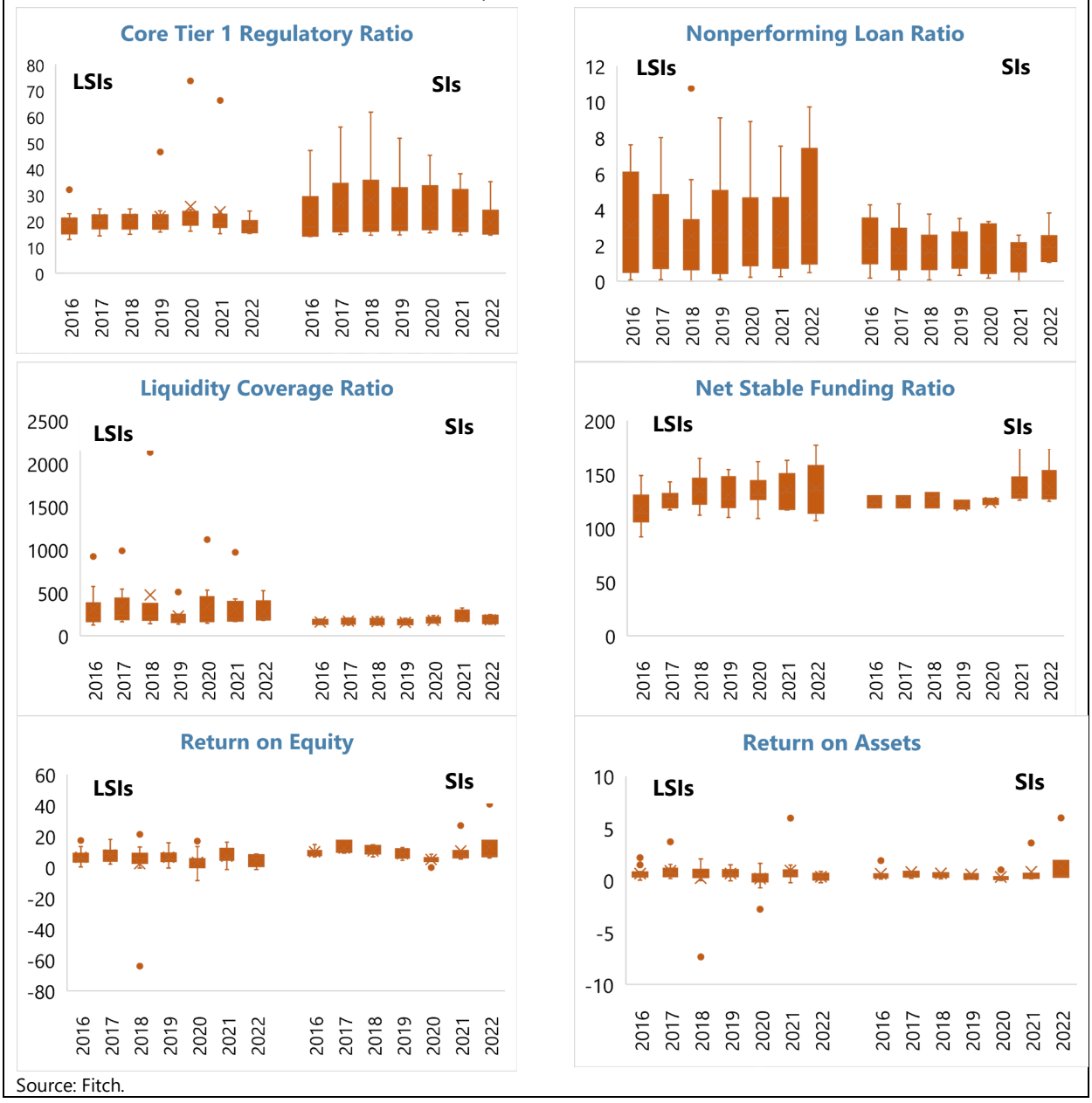
16. The boom in housing prices has increased vulnerabilities for the most recent borrowers. Higher housing prices have led to a decrease in the average LTV ratios, though they also increased the proportion of households at the borrowing limits, leading to an increase in debt-to-income ratios of new mortgagors, especially among younger borrowers. Around 60 percent of households under 36, and 45 percent of older households have a debt-to-income ratio above 450 percent. The stock of IO mortgages has declined in the past decade but remains high, and applications for IO mortgages recently resurged. A large volume of IO mortgages will mature between 2034 and 2039, though the authorities' analysis indicates that this will not pose any

systemic risk. In response to the Authority for Financial Markets (AFM) multi-year campaign launched in 2018 to monitor vulnerabilities from IO mortgages, banks have been taking actions to address the financial concerns associated with maturing IO mortgages of some of their customers.

Figure 8. The Netherlands: SI and LSI Financial Soundness Indicators

(Percent)

LSIs' financial soundness indicators exhibit wider dispersion than SIs'.



Source: Fitch.

B. Risks

17. The main risks stem from an abrupt slowdown in growth, combined with persistently high inflation that could lead to a continued tightening of financial conditions, as well as a severe correction in the housing market. Such a scenario could be accompanied by lower external

demand and financial spillovers affecting liquidity and funding conditions of certain financial institutions (Risk Assessment Matrix (RAM), Table 6). The FSAP's analysis focused on the following:

- *Housing*. Banks are vulnerable to higher interest rates, which, combined with a severe house price correction, could create macrofinancial feedback effects. House prices show signs of overvaluation.[2] Despite mitigating factors—including a full legal recourse of mortgage lenders and a mortgage guarantee scheme—and historically low mortgage default rates, an increase in interest rates combined with a severe drop in house prices and higher unemployment could increase borrowers' default rates and bank loan losses. Even if mortgage loan losses are limited and banks have sufficient buffers, lower household wealth could negatively affect consumer spending and growth, with possible second-round effects on banks' balance sheets.

- *NBFIs*. Occupational pension funds and life insurers face market and liquidity risk, while P&C insurers face higher inflation risk. Higher interest rates have exposed vulnerabilities associated with margin calls for interest-rate derivatives. Together with the pension reform, pension funds may shift investment strategies, though likely in a gradual manner during the transition period. Higher inflation poses a risk for insurers, specifically in the health and non-life sectors. Claims inflation, related to higher building costs, wages and medical costs, strain insurers' profitability.

BANK RISK ANALYSIS

A. Overview

18. The team performed a range of stress tests to assess the resilience of six SIs against the main macrofinancial risks.[3] The solvency analysis compared banks' scenario-conditional capital ratios with the minimum CET1 and various buffer requirements. On liquidity, the team assessed banks' resilience against prescribed cash outflows over various horizons and funding market dislocations by calculating LCRs, net stable funding ratios (NSFRs), and conducting cash-flow analyses. The contagion analysis estimated how losses in the banking sector can propagate to insurers and pension funds through fire sales. An interconnectedness analysis of cross-border banking sector exposures was also conducted.

19. The mission complemented the standard bank stress test with additional analyses on LSIs. The team assessed to what extent the worsening global macrofinancial conditions affect default risk of foreign corporate exposures. The contagion analysis included a representative sample of LSIs and found that their failure could cause significant damage to the wider financial system.

[2] The European Systemic Risk Board (ESRB) finds some evidence of overvaluation of Dutch housing prices, ranging from about 10 to more than 20 percent as of 2023Q2 (ESRB, 2023).

[3] Leaseplan Corporation NV is excluded from the analysis due to its special car rental business model. It was merged and is now consolidated under the French lender Société Générale S.A.

B. SI Solvency Stress Test

20. The bank solvency stress test assessed banks' capital adequacy against macrofinancial shocks. A baseline and an "extreme but plausible" adverse scenario underpin this "what-if" analysis. Both scenarios span a three-year horizon from 2023 to 2025. The team used the supervisory statistics as of June 2023 sourced from common reporting (COREP), financial reporting (FINREP), and the short-term exercise (STE). They are complemented by key historical series provided directly by the authorities.

21. The stress test projected the main elements of banks' balance sheets, income statements, and risk weighted assets (RWAs). The exercise adopted a dynamic balance sheet approach, while assuming that banks keep their business model unchanged. The growth rate of the balance sheets is determined jointly with other variables in the scenario generating model. This is to ensure that the balance sheets reflect the scenario-specific macrofinancial conditions and are consistent with the banking sector's performance. A combination of econometric and accounting models was used to assess the impacts of the materialization of credit, market, and interest rate risks on banks' incomes and expenses. The credit RWAs are projected separately for standardized and internal rating-based (IRB) portfolios, while other types of RWAs follow a pre-determined path. The stress test did not incorporate any extraordinary management action, policy support, or change of business models.

22. The stress test explicitly considers banks' foreign exposures where possible. Dutch Sis hold debt securities issued by foreign sovereigns, financial institutions, and corporates. They hold foreign currency positions due to funding and hedging needs. The three internationally active banks also have significant overseas credit exposures. Where granular data is available, this stress test analyzed the impact of materialization of interest rate, market, and credit risks by country of exposure.

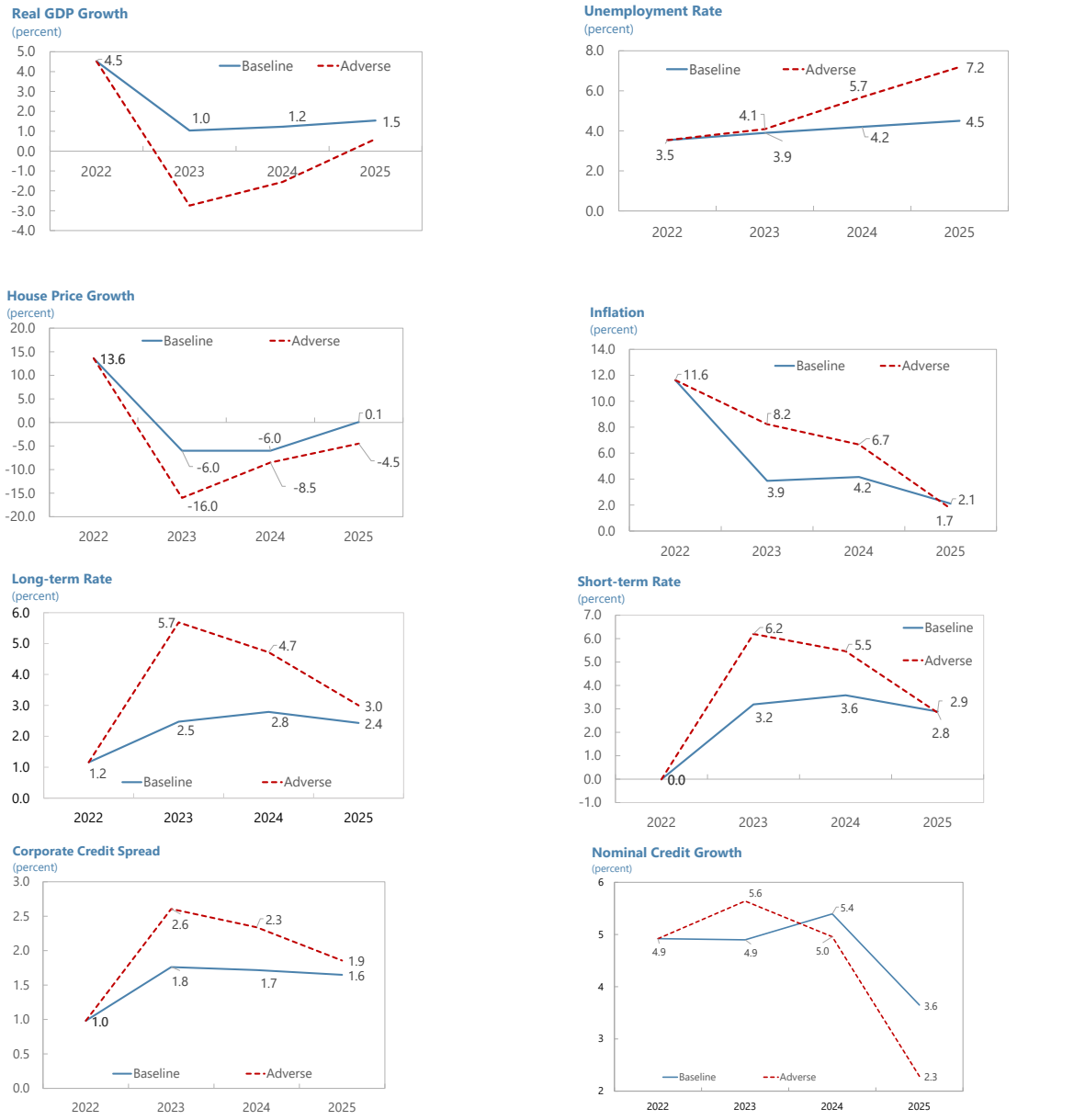
Scenario

23. The baseline scenario reflected World Economic Outlook (WEO) projections of the world economy and global financial conditions. The baseline scenario is in line with the April 2023 WEO publication. In addition to key macroeconomic variables, the scenario captures future dynamics of housing price, wage growth, credit growth, and corporate credit spread (Figure 9), which affect bank profitability and RWA through various channels.

24. The adverse scenario is generated by the IMF's Global Macrofinancial Model (GMM, Vitek 2018) to ensure consistency of key economic dynamics. GMM is a dynamic stochastic general equilibrium (DSGE) model. It covers 40 major advanced and EM economies and their interlinkages through trade and financial markets. The household, construction, production, banking, and trading sectors maximize their utilities subject to budget constraints. Monetary, macroprudential, and fiscal authorities respond to business cycles by using standard policy tools. However, no extraordinary policy, e.g., quantitative easing/tightening, is available in this model.

25. The adverse scenario for the Netherlands captures a simultaneous materialization of the macrofinancial risks (Figure 9). The adverse scenario reflects both global and domestic risks in the RAM (Table 6). It features stagflation due to supply disruptions and higher energy prices in Europe. These factors de-anchor inflation expectations and lead to a further increase in interest rates. Bank credit grows faster in nominal terms under the adverse scenario along with higher inflation in 2023. The credit spread for the corporate sector increases consistent with the general macroeconomic conditions. A large housing price correction is prescribed as a country-specific shock.

Figure 9. The Netherlands: Macrofinancial Scenarios



Source: IMF staff estimates.

26. A range of auxiliary scenarios are prescribed for Australia, Belgium, Germany, UK, and U.S. The generation of these scenarios follow the same approach. They support the credit and market risk analyses for Dutch banks' foreign exposures.

Methodology

27. The credit risk module projects credit impairment of banks' loan portfolios under the baseline and adverse scenarios. It is built on the future trajectories of probability of default (PD), loss given default (LGD), and provisioning rules prescribed by International Financial Reporting Standard 9 (IFRS 9). The authorities provided the historical PD and LGD data of the banking system by portfolio and country of exposure. Staff did not consider the credit losses of securities at amortized cost. The team analyzed the mark-to-market losses due to market risk in one sensitivity analysis to avoid double counting.

28. A suite of "satellite models" projected 216 future PD paths for six banks, six portfolios, and six economies (Annex A). The team started with a panel regression model with system-wide PDs by portfolio and country of exposure. For each of the four portfolios—mortgage, other retail, qualifying revolving, and corporate—the model uncovers the historical relationship between PDs and macrofinancial variables with country fixed effects. It subsequently projects six future PD paths conditional on scenario prescriptions for Australia, Belgium, Germany, the Netherlands, UK, and U.S. A structural model applies to government and institutional portfolios given the low occurrence of default events and the significant influence of idiosyncratic factors. The PDs by bank are finally inferred from the portfolio-level estimates, assuming constant distances in distance-to-default between individuals and the system aggregate (see Annex A for details).

29. The team estimated LGDs using two structural models. For the secured portfolio, it derived the LGD trajectories with bank-specific LTV projections and several other cost factors (Gross et al., 2020). For the unsecured loans, the LGDs were modelled as a function of future PDs (Frye and Jacobs, 2012; Frye, 2013).

30. The IFRS 9 accounting rule requires banks to set up provisions for expected credit losses by loan stage. The team first estimated the bank-specific transition matrices by sector, i.e., household, corporate, government and institution, using historical information on loan movements across stages supplemented by statistics directly provided by the authorities. It then adjusted the transition probabilities with scenario-conditional PDs from the "satellite models" ("beta-linking", Gross et al., 2020) and inferred the outstanding loan amount by stage over the stress-testing horizon. It finally computed the 12-month provision for stage 1 loans, and lifelong provision for stage 2 and 3 loans. The write-off rate is assumed to be zero.

31. The interest rate risk module estimated how soon banks' assets and liabilities are repriced and to what degree a shift in monetary policy "passes through" to lending and funding rates. For the former, the team leveraged the data submission to the IRRBB in the STE. This dataset categorizes the repricing schedules of loans, deposits, securities, and hedging derivatives into eight time-buckets. The team traced how these instruments move from one bucket to another

over time and computed the interest income and expense by allowing them to earn or pay new interests from the midpoint of each bucket. For the latter, the team estimated the historical relationships between the risk-free rates and sight deposit, term deposit, corporate, and mortgage loan rates in a suite of "satellite models", respectively (Annex A). For market-based instruments such as debt securities and derivatives, the team assumed a 100 percent "pass-through". For TLTRO deposits, the team assumed banks issue debt securities to cover any lost funding due to repayment. This exercise also accounted for credit risk results dynamically– nonperforming loans no longer generate interest income in future periods.

32. The interest risk module also considered the net interest income (NII) from the trading book. In addition to the NII from the banking book, the team allowed the trading book income/expense to grow with the balance sheet. This treatment is consistent with the underlying assumption that the composition of the balance sheet stays unchanged throughout the stress testing horizon (i.e., banks do not change their business model). Once a bank sells or buys some of these tradable instruments, it must replace them with something similar in market value. The NII, which is the product of principal and interest rate, should stay by and large the same.

33. The market risk analysis combined bank-specific market risk sensitivities with the scenario-specific macrofinancial shocks. The analysis deviates from the standard modified duration approach due to data limitations. Instead, it multiplied the scenario-conditional shocks to interest rate, spread, foreign exchange rate, equity, and commodity price by the bank-reported "delta" in the STE. "Delta" represents the gains/losses in euro caused by one unit of shock to the risk factors. Finer groups by tenor, currency, counterparty, country of exposure, and type of commodity are available for some risk factors. The "delta" is presented separately for the trading and banking books, and the team further decomposed the gains/losses across the fair value through profit and loss (FVPL), fair value through other comprehensive income (FVOCI), and at amortized cost accounts.[4] The total valuation change for each bank is the sum of gains/losses from all individual risk factors.

34. This approach for market risk analysis has several advantages, but the results should be interpreted with caution. Each "delta" in the STE is a net sensitivity between assets and liabilities, instruments, and their hedges. Therefore, it provides a very convenient way to compute the Euro impact once the magnitude of shock to a risk factor is known. However, the "deltas" represent the marginal change in valuation due to one factor, holding all other factors constant, and the valuation changes due to a confluence of shocks are not necessarily additive. It is hence unclear whether this approach over- or understates the total valuation changes. Some extreme "deltas" also appeared in the reported template. Given the netting nature of the metric, one needs additional information to validate whether they reflect banks' underlying vulnerability or data reporting quality.

35. Some auxiliary assumptions underpin the treatments for other components of the income statement. Fees and commissions, other income, and non-interest expense grow as the

[4] The split among the three accounts is in market value. It is estimated by combining the balance sheet with asset encumbrance data, and assuming the same share of asset encumbrance across accounts.

balance sheet, supported by historical observations. Banks pay the effective tax rate as of 2022 on future income. Banks pay out 50 percent of their net income as dividends as long as their total comprehensive income stays positive post payment and banks continue to meet the overall capital requirement (OCR), which comprises pillar I capital, pillar II capital add-ons, and various buffer prescriptions[5].

36. The RWAs were projected separately for credit, market, and operational risks. The team estimated the credit RWAs for the standardized (STA) and IRB portfolios separately and by country of exposure. For the former, the team divided the credit RWA over total standardized exposure net of provision as of 2022 to derive the density. It then applied the same density to the evolving size of STA exposures over the stress-testing horizon to get their future RWAs. For the latter, the team used both supervisory and projected PDs over an eight-year moving window to compute the through-the-cycle PD. It then applied the Asymptotic Single Risk Factor model with Basel III risk weight specifications to various portfolios. It made special adjustments to the mortgages according to the newly introduced macroprudential rule on minimum risk weights. Specifically, it extracted the bank-specific LTV distribution from STE as of 2022, and projected its future distribution based on scenario-prescribed housing prices. The risk weight of a mortgage portfolio is the weighted average of two components—a 12 percent weight was applied to the portion of the distribution with LTV under 55 percent, and a 45 percent weight was applied to the portion exceeding that. The declining housing prices in both the baseline and adverse scenarios increase the LTV and therefore the credit RWA. Market, operational, and other RWAs are assumed to grow at the same rate as the balance sheet.

Results

37. The Sis as a group appear resilient to severe macrofinancial shocks, but some might need additional resources to maintain a comfortable buffer position. Consecutive years of weak earnings under the adverse scenario and the increase in countercyclical capital buffer (CcyB) to 2.0 percent from 2024 both contribute to this result. The stress test assumes the buffer requirement (including the CcyB of 2 percent in both baseline and adverse scenarios) and the mortgage RWA floor to stay the same over the horizon, which may not be the case if the adverse scenario materializes.

- In the baseline scenario, Sis' CET1 ratio drops by 1.0, 2.0, and 2.4 percentage points in 2023, 2024 and 2025, respectively. Credit impairment drives this dynamic (Figure 10, Panels 1, 3, and 4). The increase in RWA, both due to a dynamic balance sheet and mortgage risk weight adjustment, also contributes to this result. Some Sis need to restrict dividend payouts to stay above the OCR.

- In the adverse scenario, Sis' CET1 ratio falls to 12.5 in 2024, the trough of the recession, from 15.7 in 2022 (Figure 10, Panels 3 and 4). The increase in net interest income is offset by the higher credit impairment, RWA, and lower other comprehensive income. The group as whole maintains

[5] The capital buffers include a 2.5 percent capital conservation buffer, 1 percent CCyB that will increase to 2 percent from 2024, and a bank-specific buffer for other systemically important institutions (O-SII).

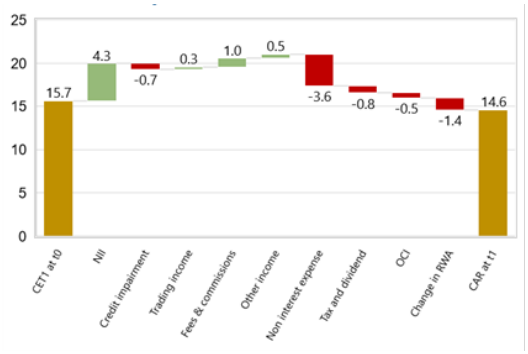
a solid buffer position, but some Sis need to draw down buffers of about 4.3 billion in 2024 and 9.7 billion in 2025 to weather the severe shocks.

- The solvency analysis results on the two banks could be prone to uncertainties in part due to data-reporting issues. Reported prudential parameters for credit risk are sporadic, which renders a full-fledged analysis impossible. Some extreme values are reported for market risk sensitivities and large exposures. As a result, one bank fails to meet the minimum CET1 capital requirement in the adverse scenario. Additional information is needed to verify whether these results are cause for fiscal concern given the special nature of these banks.

Figure 10. The Netherlands: Solvency Stress Test Results, Capital

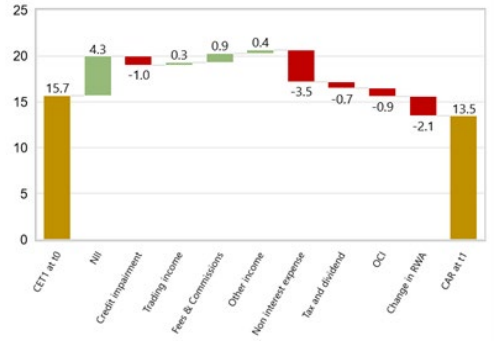
Higher credit impairment and risk weighted assets (RWA) contribute to weakening capital positions…

Baseline: Capital Evolution from 2022 to 2023



…more so in the adverse scenario in 2023 when economic growth declines the most. Total losses due to market risk are generally low.

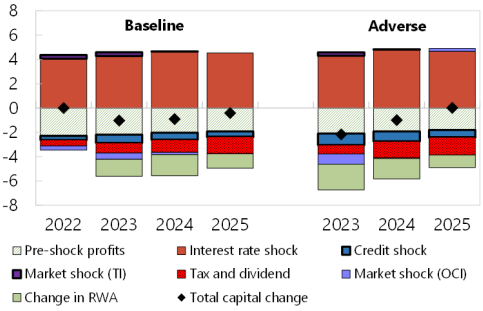
Adverse: Capital Evolution from 2022 to 2023



Capital ratios only start to stabilize in 2025.

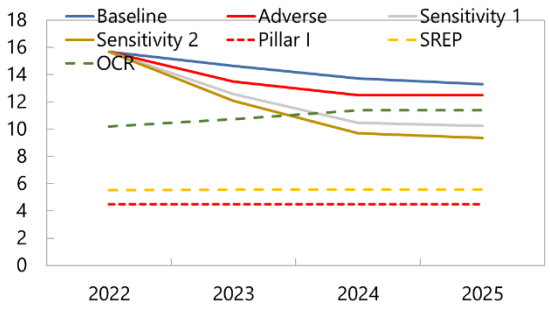
Contribution to CET1 Change, Sis

(percent)



More banks need to draw down capital buffers in more significant amounts if shocks in sensitivity analyses materialize

CET1 Ratio



Sources: DNB and IMF staff estimates.
Notes: OCI=other comprehensive income; TI=trading income; SREP=supervisory review; OCR=overall capital requirement. The Sensitivity 1 and 2 represent two exercises incorporating additional stress from solvency-liquidity interactions. See section E for details.

38. Rising interest rates support bank profitability through higher NII (Figure 11, Panels 1 and 2). Many forces affect the amount of interest earning/bearing principal and the evolving interest rates they are subject to. In general, banks reprice deposits faster than loans given their role in

maturity transformation. This nature of the business implies lower NII when deposit and loan rates rise in tandem. However, the team's empirical analysis shows that the change in reference rate "passes through" to the term deposit rates incompletely, which reflects the "deposit channel" of monetary policy (Drechsler et al., 2017). The transmission is even slower to sight deposits after years of near-zero interest rates, but faster to the lending rates. This widened loan-deposit rate differential leads to a higher NII (Annex A). In addition, cash positions at the ECB's deposit facility,[6] short-term corporate loans, floating rate mortgages by internationally active banks, and interest rate hedges allow the Dutch Sis to reduce the maturity gap and benefit from higher lending rates and profitability relatively fast. Other factors are also at play: Sis as a group would see some income losses from the securities positions, as they hold more securities for funding than investing purposes. Several Sis would have to pay a higher funding cost to replace the expiring TLTROs, but such expenses are limited given the insignificant outstanding TLTRO due for repayment. Higher interest rates affect the paying and receiving legs of the hedging derivatives simultaneously. As a result, banks incur a relatively stable net hedging cost over time. All factors considered, the NII of the banking book appears higher in the adverse scenario. The NII of the trading book does not change much given the balance sheet assumption (¶32).

39. Higher credit impairment and RWAs reduce bank capital ratios (Figure 11, Panels 3 and 4). PDs increase as the economy slows down, debt servicing cost rises, housing prices decline, and wage growth fails to catch up with price inflation. LGDs for secured and unsecured portfolios generally follow the same pattern given these portfolios' structural relationships with housing prices and PDs, respectively. The aggregate LTV increases as housing prices decline. This dynamic increases the credit RWA as more mortgage loans are subject to a higher risk weight.

40. The losses due to market risk factors are generally low (Figure 11, Panels 5 and 6). Sis as a group do not seem to hold significant positions subject to interest rate, spread, foreign exchange, equity, and commodity price shocks. They also appear to hedge these risks very well. The team found insignificant valuation gains/losses particularly for the trading book. The materialization of spread risk tends to have a larger impact for the banking book. However, the result is dominated by one bank, which could be due to incorrectly reported data.

C. LSI Credit Risk Analysis

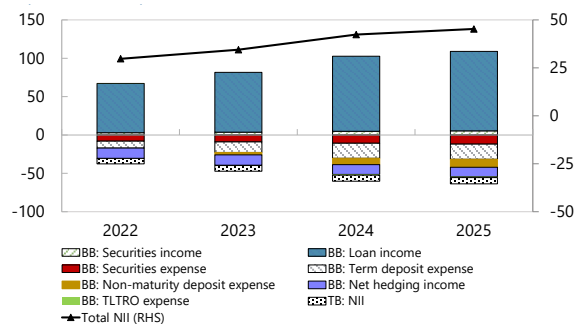
41. The team analyzed the credit risk of five corporate and four EM LSIs. The Dutch corporate and EM banks have significant loan businesses. About 65 percent of their corporate exposures are outside of the EA and distributed across Africa, Asia, non-EA Europe, Japan, Latin America, Turkey, UK, and U.S. These banks are exposed to credit risk influenced by macrofinancial factors globally and in a wide range of host economies.

[6] This is included in the "loans and advances" category in the IRRBB template.

Figure 11. The Netherlands: Solvency Stress Test Results, Income

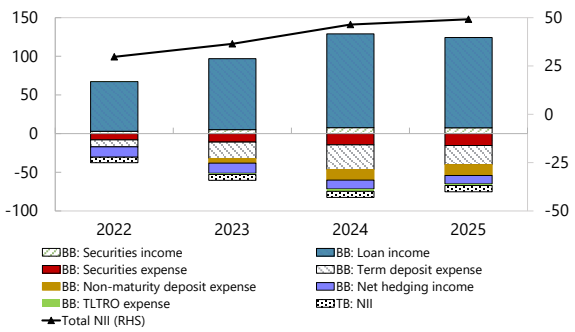
Interest income grows with higher interest rates…1/

Baseline: Net Interest Income (NII)
(Billions of Euro)



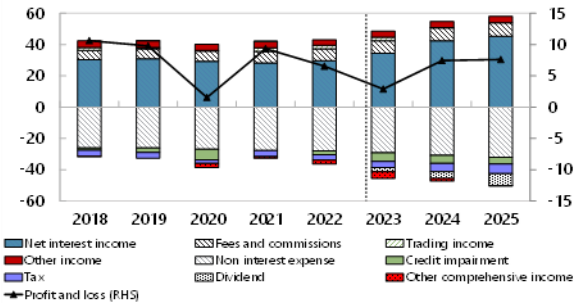
…which is partially offset by higher expense on deposits.

Adverse: Net Interest Income
(Billions of Euro)



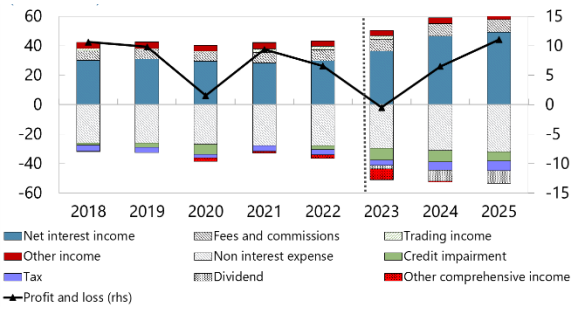
Credit impairment increases as economy slows down; wage growth does not keep with inflation…

Baseline: Income Statement
(Billions of Euro)



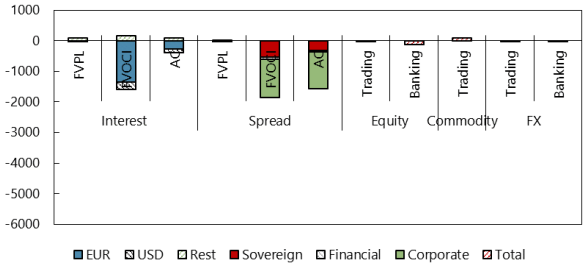
…and housing prices decline

Adverse: Income Statement, Sis
(Billions of Euro)



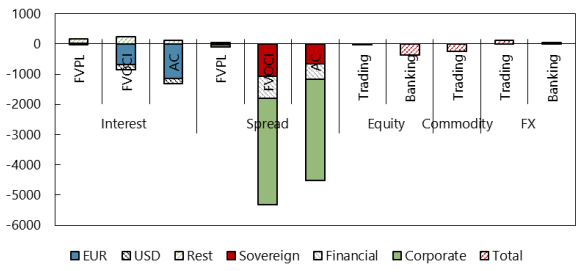
Gains/losses due to market risk factors are generally low…2/

Baseline: Market Risk Gains/Losses, H2 2023
(Millions of Euro)



…the significant impact from spread risk is driven by one bank only.

Adverse: Market Risk Gains/Losses, H2 2023
(Millions of Euro)

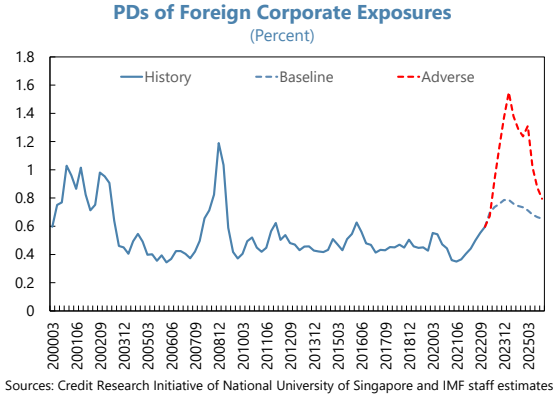


Sources: DNB and staff estimates.
1/TLTRO=Targeted long-term refinancing operations; BB=banking book; TB=trading book.
2/The observed trading and other comprehensive income in H1 2023 entered the total comprehensivce income directly.

42. The team stress tested the creditworthiness of these LSIs' foreign corporate borrowers against baseline and adverse global scenarios represented by 40 major advanced and emerging market economies. Given limited information on bank borrowers, the team leveraged a

PD database of 92,000 publicly listed companies to proxy for their credit risk.[7] These PDs are grouped into nine economic groups, i.e., U.S., UK, EA, non-EA Europe, Turkey, Japan, Asia excluding Japan, Africa, and Latin America, corresponding to the LSIs' main destinations of exposure. An econometric model is then used to establish the historical relationship between the average PD of each group and selected macrofinancial variables. These explanatory variables include the usual macro variables of the major members to reflect their significant influence on corporate sectors. The explanatory variables also include interest rates of major advanced economies to account for the global financial conditions and economic growth of the group's major trading partners. The team applied a Bayesian Model Averaging (BMA) methodology (Gross and Población, 2019) to estimate coefficients. This approach can select a small number of statistically significant variables from a large number of candidates. It also has the option to impose sign constraints on variables of interest. With the BMA-estimated coefficients, the team simulated the future PDs based on the prescribed trajectories of the macrofinancial variables under the baseline and adverse global scenarios.

43. The LSIs could experience rising default probabilities under severe global macrofinancial conditions. The econometric model reveals that the default probabilities of corporate borrowers in advanced markets is more vulnerable to interest rate rises, while those in Ems are more sensitive to economic slowdowns and foreign exchange rate fluctuations. The stagflationary global scenarios feature slow growth and high interest rates. They result in a sharp increase in corporates' credit risk, which even surpasses the level during the global financial crisis. This finding implies that the corporate and EM banks could suffer significant credit losses if the slow-growth-high-interest-rate scenario materializes. Once some bank-specific PDs become available, this analysis can be used to infer the PD levels of the bank borrowers and their expected credit losses in a more precise way (Annex A)



Sources: Credit Research Initiative of National University of Singapore and IMF staff estimates

D. SI Liquidity Stress Test

Methodology

44. Liquidity stress tests were conducted to assess the six Sis' capacities to withstand funding pressures. First, LCRs were evaluated to assess whether banks' stocks of high-quality liquid assets (HQLAs) are sufficient to cover their net outflows over a thirty-day horizon. Second, NSFRs were evaluated to analyze whether banks' available stable funding is sufficient to cover their required stable funding over a one-year period. Third, cash-flow analyses were conducted based on banks'

[7] Credit Research Initiative (CRI), National University of Singapore. The CRI PDs are for public companies, and their magnitude can be different from that of the actual bank borrowers. To make the best use of the LSI analysis, one can re-anchor the CRI PD estimates to the bank-specific corporate PDs once detailed economy-specific supervisory PDs become available. Effectively, this treatment assumes that default probabilities of public companies and actual bank borrower react similarly to macrofinancial changes. See Annex A Figure 1 for an illustration.

maturity ladders to analyze funding pressures over varying horizons, ranging from overnight to up to a year. June 2023 data was used in all analyses.

45. The sensitivity of LCRs and NSFRs to scenarios similar to—yet distinct from—the scenarios specified by regulators was assessed through a Monte Carlo exercise. The LCR and NSFR parameter values specified by regulators reflect plausible liquidity-stress scenarios. Nevertheless, the precise values of the parameters are somewhat arbitrary.[8] Banks may adjust their balance sheets as a function of these values, which could imply that regulatory LCRs and NSFRs overestimate the resilience of banks to liquidity stress similar to—yet distinct from—the one specified by regulators. To assess whether this is a concern, LCRs and NSFRs were calculated using parameter values drawn from a uniform distribution centered at the parameters' regulatory values, with upper and lower bounds given by ± 25 percent of the respective regulatory values.[9] Distributions of the LCRs and NSFRs centered to the left of the regulatory LCRs and NSFRs indicate that the regulatory LCRs and NSFRs overestimate the resilience of banks to scenarios similar to, yet distinct from, the baseline regulatory scenario.[10]

46. The resilience of banks to large retail deposit outflows was assessed through a targeted LCR-based reverse-stress-testing exercise. In particular, a fine grid of values between zero and one was specified for the deposit runoff rate, and the LCR was computed for each bank at each of these different values.[11]

47. The sensitivity of LCRs and NSFRs to extreme scenarios was assessed through a reverse-stress-testing exercise. In this exercise, the severity of all parameters is increased by a scalar factor that represents a multiple of the baseline (subject to a cap for all parameters at zero and one). In this approach, rather than specifying a limited set of plausible scenarios under which to calculate LCRs and NSFRs, the goal is to systematically identify scenarios relative to the regulatory baseline that would result in a bank's failure to meet its LCR and NSFR requirements.

48. The cash-flow analysis captures banks' ability to convert maturing assets into cash in each maturity bucket. Banks are allowed to counterbalance negative funding gaps using their existing cash, as well as the cash value of the securities they hold (after applying scenario-specific valuation adjustments). In every maturity bucket, the cash-value of collateral from run-off maturing

[8] For example, there is no clear reason why the run-off rate for stable deposits should be 5 percent, and not 4.75 percent or 5.25 percent.

[9] While this setup does not exclude the possibility that, say, factors on Level 1 assets are lower than factors on Level 2 assets, these draws occur with low probability given that the distributions they are drawn from are centered around their regulatory values. Parameter values for coins, bank notes, and central bank reserves were left unchanged at their regulatory value.

[10] A caveat of this analysis is that the changes to the parameter values are assumed to be independent, whereas in real-world liquidity stress, some correlation is expected (e.g., higher retail deposit outflows are expected to be correlated with higher wholesale deposit outflows).

[11] Retail deposits include: 'retail deposits exempted from the calculation of outflows'; 'retail deposits where the payout has been agreed within the following 30 days'; 'retail deposits subject to higher outflows, category 1'; 'retail deposits subject to higher outflows, category 2'; 'stable deposits', 'derogated stable deposits'; 'other retail deposits'.

repos (net of the cash-value of the collateral in rolled-off maturing reverse repos) is included in the counterbalancing capacity.

49. A baseline and a severe scenario were considered for the cash-flow analysis. The baseline scenario calibrations are similar to those of the regulatory LCR. The severe scenario calibrations include a moderate-to-severe run on deposits, as well as more severe valuation effects on Level 1 and Level 2 assets in the counterbalancing capacity. Throughout, run-off rates on wholesale and unsecured funding sources are higher than those on retail and secured funding sources, and run-off rates on stable retail deposits are higher than those on other deposits. Details on the calibrations for the cash-flow exercise are found in Annex B.

50. The sensitivity of the cash-flow analysis was assessed through a reverse-stress-testing exercise. In this exercise, the severity of all parameters is increased by a scalar factor that represents a multiple of the baseline (subject to a cap for all parameters at zero and one).

51. The cash-flow analysis was used to assess solvency risks originating from the sale of held-to-maturity (HTM) assets during liquidity stress. The number of banks having to sell HTM assets due to liquidity stress was computed as a function of the hypothesized shares of HTM assets in banks' counterbalancing capacities. This was done by assuming that banks resort to selling HTM assets only if the market value of other assets is insufficient to cover negative funding gaps. The solvency risks originating from the sale of HTM assets are then assessed using estimates of the share of HTM assets in banks' counterbalancing capacity.

Results

52. Banks' all-currencies LCRs and NSFRs are strong. All banks have regulatory LCRs and NSFRs well above 100 (Figure 12, Panels 1 and 2). Banks' LCRs and NSFRs stay above 100 for a wide range of stress scenarios (Figure 12, Panels 1 and 2). The Monte Carlo exercise suggests that, on aggregate, regulatory calibrations do not overestimate the resilience of banks to LCR scenarios that are similar to the regulatory ones (i.e., the distribution of simulated LCRs is roughly centered around the regulatory LCR, Figure 12, Panel 3). There is some evidence that the regulatory NSFRs overestimate the resilience of banks to NSFR scenarios that are similar to the regulatory ones (i.e., the distribution of simulated NSFRs is centered to the left of the regulatory NSFR, Figure 12, Panel 4). Nevertheless, all simulated values are still well above the regulatory cutoff. The results from bank-level Monte Carlo exercises are similar.

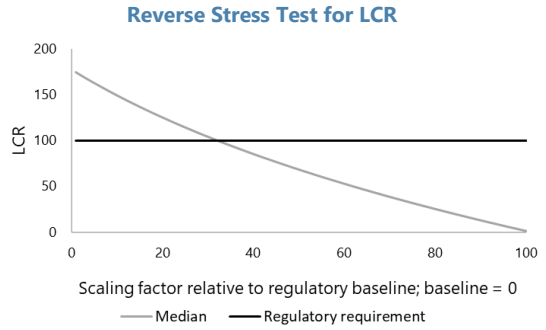
53. Banks' LCRs are robust to substantial retail deposit outflows. All banks have an LCR above 100 if retail deposit runoff rates are below 0.2, and all banks but two have an LCR below 100 if retail deposit runoff rates are above 0.28 (Figure 13) over a 30-day horizon.

54. The all-currencies cash-flow analyses confirm that banks have generally strong liquidity positions. On aggregate, banks stay liquid in both the baseline and the severe scenario (Figure 14, Panels 1 and 2). Nevertheless, in the severe scenario, one bank becomes illiquid at a horizon of three months or more, and two banks become illiquid at a horizon of nine months or more (Figure 17).

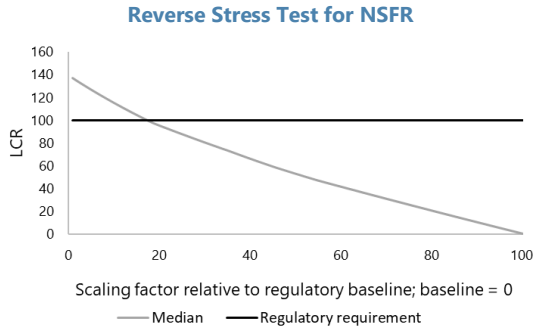
Several banks remain liquid under substantially more severe liquidity scenarios relative to the baseline (Figure 14, Panel 3). These results confirm the strong liquidity positions of the banks considered.

Figure 12. The Netherlands: LCRs and NSFRs

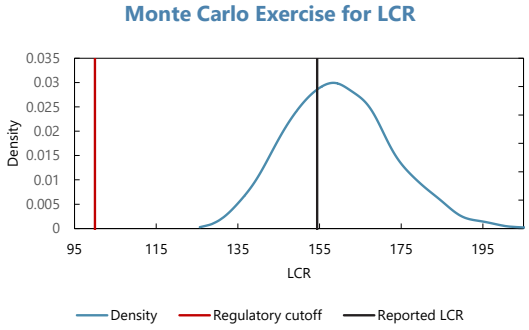
Banks satisfy regulatory LCR…



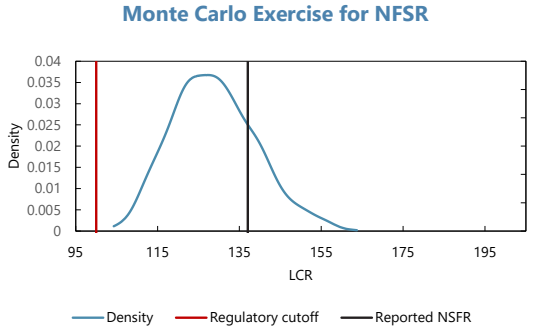
and NSFR requirements.



No evidence that regulatory LCRs overestimate robustness to liquidity stress…

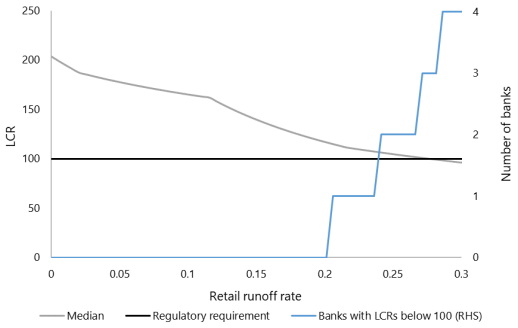


but some evidence that regulatory NSFR overestimate funding resilience of banks.



Source: COREP.

Figure 13. The Netherlands: Sensitivity of LCRs to Deposit Run-off Rates

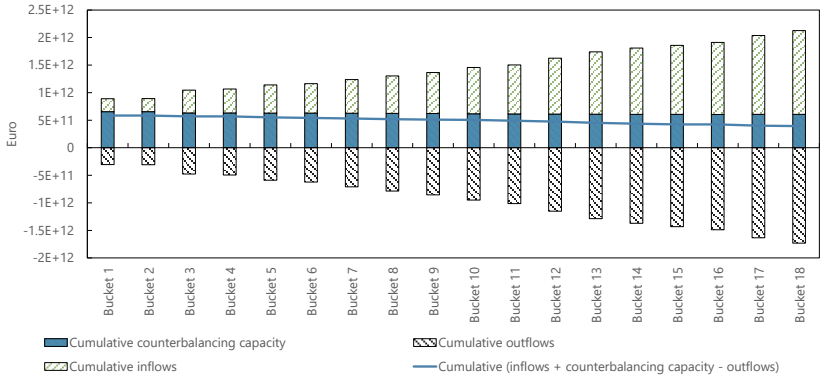


Sources: COREP and Fund staff calculations.

Figure 14. The Netherlands: Cash-flow Analysis

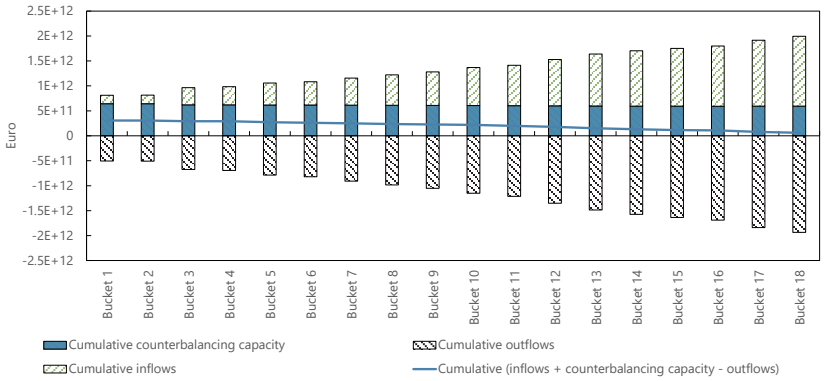
Aggregate cash-flow results show banks remain liquid in baseline scenario…

Baseline Aggregate Cash-flow Results



As well as the severe scenario.

Adverse Aggregate Cash-flow Results



Banks remain liquid in scenarios that are substantially more severe than the baseline (for example, Level 1 CQS1 assets would be revalued by the scaling factor indicated on the left-hand side below).

Number of Illiquid Banks

Scaling factor increase relative to baseline	Bucket 1	Bucket 2	Bucket 3	Bucket 4	Bucket 5	Bucket 6	Bucket 7	Bucket 8	Bucket 9	Bucket 10	Bucket 11	Bucket 12	Bucket 13	Bucket 14	Bucket 15	Bucket 16	Bucket 17	Bucket 18
10%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
15%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2
20%	0	0	0	0	0	0	0	0	0	0	0	1	2	3	3	3	3	3
25%	0	0	0	0	0	0	0	1	1	1	2	3	3	3	3	3	3	3
30%	0	0	0	0	1	1	2	2	2	3	3	3	3	3	3	3	3	4
35%	0	0	1	1	2	2	3	3	3	3	3	4	4	4	4	4	5	6
40%	0	0	2	2	2	2	3	3	3	3	4	4	4	4	4	4	5	6
45%	1	1	3	3	3	3	3	3	4	4	4	4	4	4	4	5	6	6
50%	2	2	3	3	3	3	3	4	4	4	4	4	4	4	5	5	6	6

Source: COREP.

Notes: Bucket 1: overnight. Bucket 2: greater than overnight up to 2 days. Bucket 3: Greater than 2 days up to 3 days. Bucket 4: Greater than 3 days up to 4 days. Bucket 5: Greater than 4 days up to 5 days. Bucket 6: Greater than 5 days up to 6 days. Bucket 7: Greater than 6 days up to 7 days. Bucket 8: Greater than 7 days up to 2 weeks. Bucket 9: Greater than 2 weeks up to 3 weeks. Bucket 10: Greater than 3 weeks up to 30 days. Bucket 11: Greater than 30 days up to 5 weeks. Bucket 12: Greater than 5 weeks up to 2 months. Bucket 13: Greater than 2 months up to 3 months. Bucket 14: Greater than 3 months up to 4 months. Bucket 15: Greater than 4 months up to 5 months. Bucket 16: Greater than 5 months up to 6 months. Bucket 17: Greater than 6 months up to 9 months. Bucket 18: Greater than 9 months up to 12 months.

55. Some banks would need to sell HTM assets in the scenarios considered. The FSAP team estimated the median share of HTM assets in the counterbalancing capacity to be around 50 percent. This suggests that banks would need to sell HTM assets, at horizons as short as a week (Figure 15).

56. Several banks have relatively large short-term unsecured wholesale USD liabilities but relatively small USD counterbalancing capacities. Some banks have a USD LCR and NSFR below 100 (Figure 16, Panels 1 and 2). Some of these low LCRs are due to hedging strategies of banks combined with the mechanics of the LCR formula, which automatically caps inflows at 75 percent of outflows. However, even in the cash-flow analysis (which does not impose caps on inflows), some banks would need to liquidate parts of their non-USD counterbalancing capacity and exchange the proceeds for USD to meet funding gaps in both the baseline and severe scenario (Figure 17). This is due to the large share of unsecured wholesale funding in those banks' USD-denominated liabilities, as well as the relatively low share of USD-denominated assets in their counterbalancing capacities. The largest funding gap across banks and all scenarios is approximately 10 percent of the total counterbalancing capacity (using the average USD-Euro exchange rate in June 2023). This suggests that even during severe USD-funding distress and in the absence of additional liquidity facilities, banks would only have to liquidate a relatively small part of their non-USD-denominated counterbalancing capacity. Nevertheless, USD funding shortfalls could materialize early, which may cause operational challenges when accessing liquidity facilities or liquidating and converting the proceeds of non-USD denominated assets.

Figure 15. The Netherlands: Sale of HTM Assets in Cash-flow Analysis

Banks are likely to have to sell HTM assets to meet funding shortfalls, as the share of HTM assets in the counterbalancing capacity is estimated to be around 50 percent.

Number of Banks Selling HTM Assets (Baseline)

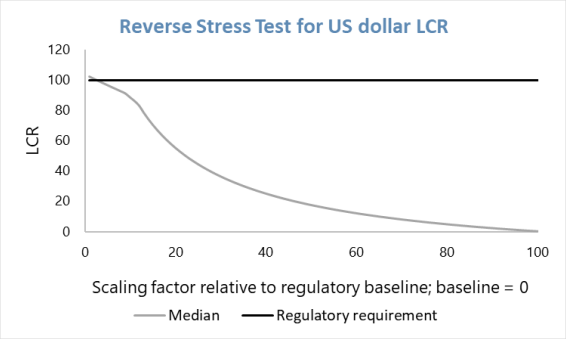
Share of HTM assets	Bucket 1	Bucket 2	Bucket 3	Bucket 4	Bucket 5	Bucket 6	Bucket 7	Bucket 8	Bucket 9	Bucket 10	Bucket 11	Bucket 12	Bucket 13	Bucket 14	Bucket 15	Bucket 16	Bucket 17	Bucket 18
0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
50%	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	2	2
60%	0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2
70%	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
80%	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
90%	2	2	2	2	2	2	2	2	2	2	3	3	3	4	4	4	4	5
100%	3	3	4	4	4	4	4	4	4	4	5	5	4	4	4	4	5	5

Source: COREP.

Notes: Bucket 1: overnight. Bucket 2: greater than overnight up to 2 days. Bucket 3: Greater than 2 days up to 3 days. Bucket 4: Greater than 3 days up to 4 days. Bucket 5: Greater than 4 days up to 5 days. Bucket 6: Greater than 5 days up to 6 days. Bucket 7: Greater than 6 days up to 7 days. Bucket 8: Greater than 7 days up to 2 weeks. Bucket 9: Greater than 2 weeks up to 3 weeks. Bucket 10: Greater than 3 weeks up to 30 days. Bucket 11: Greater than 30 days up to 5 weeks. Bucket 12: Greater than 5 weeks up to 2 months. Bucket 13: Greater than 2 months up to 3 months. Bucket 14: Greater than 3 months up to 4 months. Bucket 15: Greater than 4 months up to 5 months. Bucket 16: Greater than 5 months up to 6 months. Bucket 17: Greater than 6 months up to 9 months. Bucket 18: Greater than 9 months up to 12 months.

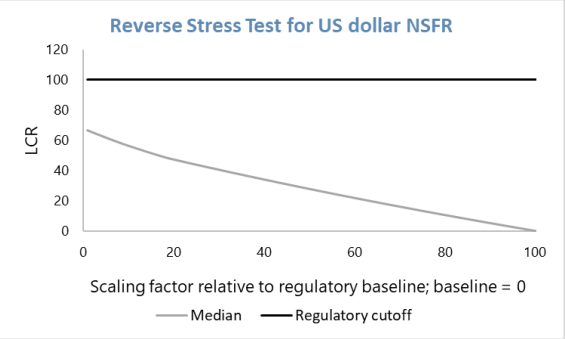
Figure 16. The Netherlands: USD LCRs and NSFRs

Some banks' USD LCR is below 100…



Source: COREP.

and some banks' USD NSFR is below 100.



Source: COREP.

Figure 17. The Netherlands: Cash-flow Analysis Summary

Two banks are unable to close their funding gaps in the severe scenario, and several banks face funding pressure in USD in both the baseline and the severe scenario.

Number of Illiquid Banks Across Scenarios

Scenario	Bucket 1	Bucket 2	Bucket 3	Bucket 4	Bucket 5	Bucket 6	Bucket 7	Bucket 8	Bucket 9	Bucket 10	Bucket 11	Bucket 12	Bucket 13	Bucket 14	Bucket 15	Bucket 16	Bucket 17	Bucket 18
Baseline all currencies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baseline EUR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baseline USD	0	0	1	1	2	2	2	2	2	2	2	1	2	2	3	4	4	4
Severe all currencies	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2
Severe EUR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Severe USD	0	0	2	2	3	3	3	3	2	2	3	3	4	5	5	5	5	5

Notes: Bucket 1: overnight. Bucket 2: greater than overnight up to 2 days. Bucket 3: Greater than 2 days up to 3 days. Bucket 4: Greater than 3 days up to 4 days. Bucket 5: Greater than 4 days up to 5 days. Bucket 6: Greater than 5 days up to 6 days. Bucket 7: Greater than 6 days up to 7 days. Bucket 8: Greater than 7 days up to 2 weeks. Bucket 9: Greater than 2 weeks up to 3 weeks. Bucket 10: Greater than 3 weeks up to 30 days. Bucket 11: Greater than 30 days up to 5 weeks. Bucket 12: Greater than 5 weeks up to 2 months. Bucket 13: Greater than 2 months up to 3 months. Bucket 14: Greater than 3 months up to 4 months. Bucket 15: Greater than 4 months up to 5 months. Bucket 16: Greater than 5 months up to 6 months. Bucket 17: Greater than 6 months up to 9 months. Bucket 18: Greater than 9 months up to 12 months.

E. Integrated Solvency-Liquidity Analysis

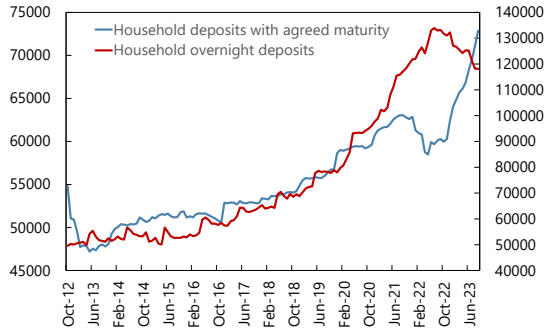
57. The FSAP team conducted two sensitivity analyses to assess the additional impact on SIs' capital due to solvency-liquidity interactions. In addition to the shocks specified in the adverse scenario, the first sensitivity analysis assumes a shift in depositor behavior motivated by the sight deposit outflow from Dutch banks over the past year (Figure 18, Panels 1 and 2). Assuming the rate of outflow to persist throughout 2023, about 60 percent of the sight deposits would remain in the sight account, 20 percent move to the term account, and another 20 percent flow out of the banking system. The loss in deposits would require SIs to issue securities at a higher cost to fund a growing balance sheet. The interest expense sharply increases as a result, more so for banks with a large sight deposit base (Figure 18, Panel 3). SIs' capital positions would further deteriorate from the adverse scenario (Figure 10, Panel 4, "Sensitivity 1").

58. The second sensitivity analysis considers two additional forms of liquidity-solvency interaction in addition to the previous exercise. Firstly, banks are assumed to sell HTM securities and realize the associated loss whenever the funding gaps in the cash-flow scenario cannot be closed using other parts of the counterbalancing capacity (Figure 18, Panel 4).[12] Banks are assumed to sell HTM securities at the prices specified in the cash-flow scenario. Secondly, a regression analysis reveals that banks'CET1 ratios explain some of the variation of the term deposit rates. With lower CET1 ratios under the main adverse scenario, banks having larger term deposit base need to finance their operations with an even higher expense. These two forms of additional costs make more banks draw down their capital (Figure 10, Panel 4, "Sensitivity 2").

Figure 18. The Netherlands: Solvency-Liquidity Interaction

Households have moved sight deposits to term accounts …

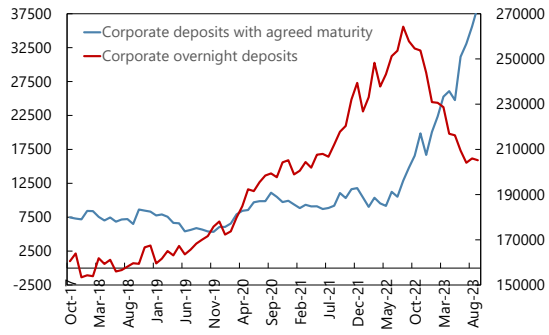
Household Deposits
(Millions of Euro)



Sources: DNB, Haver.

… banks lost about 60 billion corporate sight deposits, but only saw 20 billion increase in corporate term deposits.

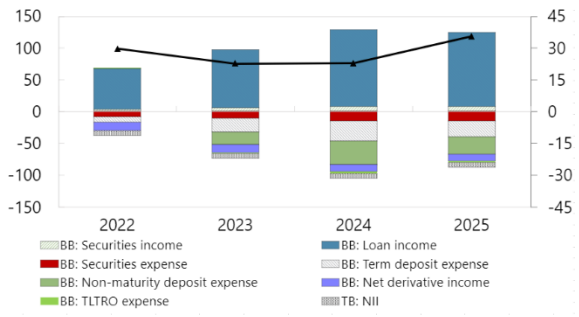
Corporate Deposits
(Millions of Euro)



Sources: DNB, Haver.

Banks' funding cost increases dramatically if sight depositors move their saving to term account or out of the banking system…

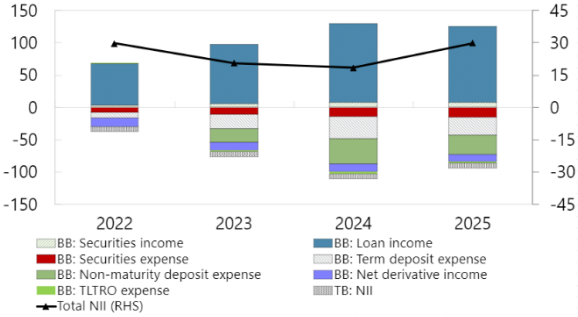
Sensitivity 1: Net Interest Income
(Billions of Euro)



Sources: DNB and staff estimates.

…a weakening capital position will cost banks even more in attracting deposits.

Sensitivity 2: Net Interest Income
(Billions of Euro)



Sources: DNB and staff estimates.

[12] Since the SIs considered are likely able to use HTM securities to obtain liquidity from the ECB, this is a somewhat improbable scenario, unless a bank is not operationally ready to do so.

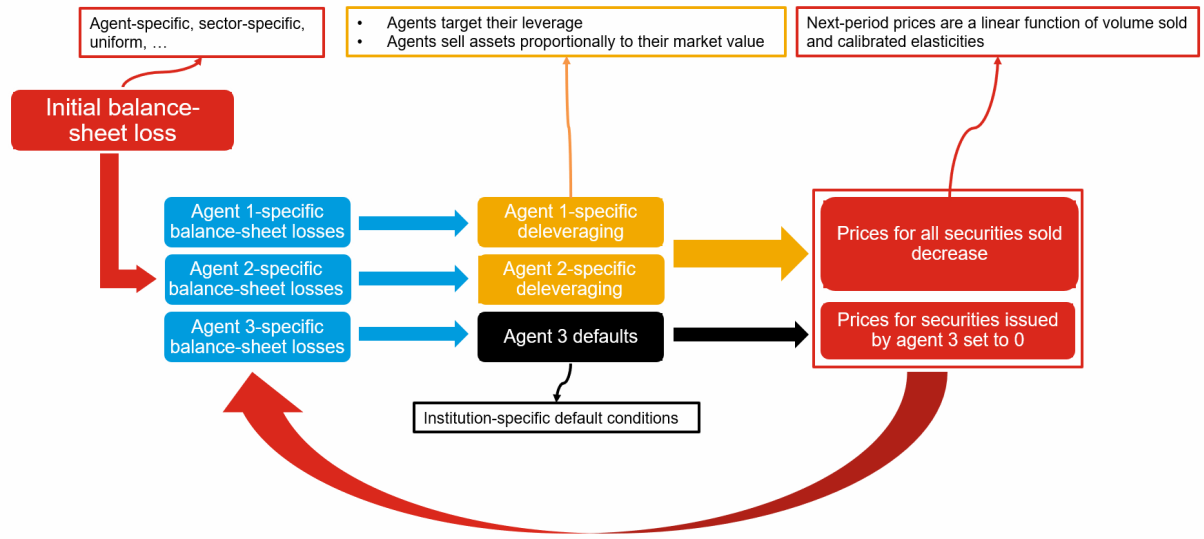
F. Contagion

Methodology

59. A fire-sale systemic stress test was conducted to assess the contagion effects of balance-sheet shocks in banks, insurers, and pension funds.[13] December 2022 balance-sheet data for 88 agents consisting of 14 banks, 27 insurers, and 47 pension funds was collated from FINREP, COREP, the Financial Assessment Framework (FTK), and Solo Prudential Reporting Annual Submission (ARS). For each institution, this balance-sheet data was combined with Monthly Securities Reporting (MSR) data on their holdings of 3,590 marketable securities.

60. The methodology of Cetorelli et al. (2023) was adapted to allow for institution-specific selling decisions and default conditions. The stress test starts by having one or more agents experience a balance-sheet loss. Agents are assumed to want to keep their leverage ratio constant, so that balance-sheet losses translate into sales of securities.[14] Agents sell assets proportionally to their market value. Agents are only allowed to sell assets, and buyers are assumed to be 'the rest of the world' (e.g., financial institutions in other Euro Area countries). Security-specific prices depend on the quantity sold of the corresponding security, as well as a security-specific elasticity parameter. Nonlinearities in price movements are introduced by setting the prices of securities issued by agents in default equal to zero. Figure 19 provides an overview of the methodology. Details on the methodology, as well as on the calibration of the parameters, are given in Annex C.

Figure 19. The Netherlands: Overview of Contagion Methodology



Source: IMF staff.

[13] Investment funds were omitted from the analysis, since no institutional-level data on their securities holdings was available.

[14] It is implicitly assumed that agents can only deleverage by selling marketable securities.

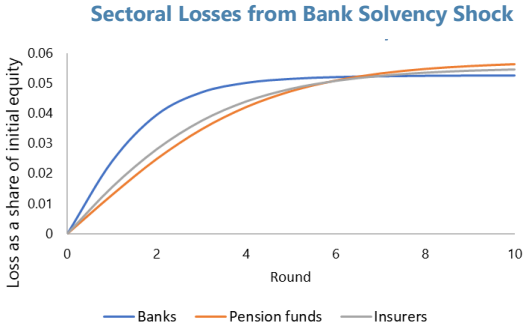
61. Two types of initial balance-sheet losses were considered. The first set of balance-sheet losses are the losses of the six SIs in the adverse scenario of the solvency bank stress test (which are considered jointly). The second set of balance-sheet losses are the ones generated when each securities-issuing agent defaults in turn.

Results

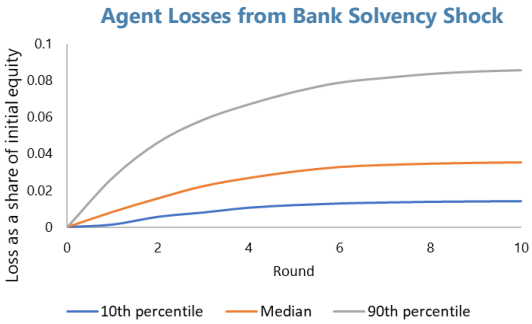
62. Losses from the bank solvency stress-test exercise lead to fire-sale induced losses of about 5 percent of initial equity. In early rounds, the losses are concentrated in the banking sector, but they spread to the insurance and pension sectors in later rounds (Figure 20, Panel 1). The losses can be as high as 10 percent of initial equity (Figure 20, Panel 2), and more than 60 percent of losses occur in second- and higher-order rounds (Figure 20, Panel 3). These results suggest that fire sales are an important transmission channel of contagion across institutions and sectors.

Figure 20. The Netherlands: Contagion Analysis

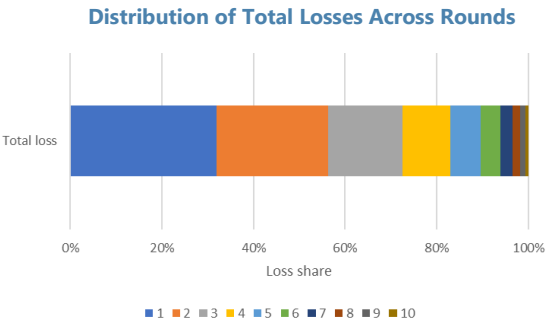
Bank solvency stress in the adverse scenario can lead to substantial fire-sale induced losses across sectors…



…with some agents suffering substantial losses as a share of their initial equity.



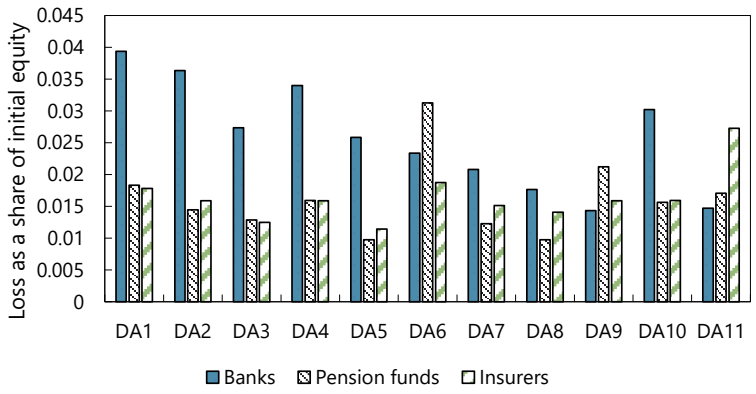
More than 60% of losses occur in second- and higher-order rounds.



Source: ARS, COREP, FINREP, FTK, MSR.

63. Individual-agent defaults can cause substantial losses that are amplified through fire-sale channels, but no agent's default leads to defaults of other agents. Banks suffer the highest total loss as a share of initial equity following the defaults of securities-issuing agents (Figure 21). The securities-issuing agents causing the five largest losses are not SIs. This suggests that contagion can be caused by the default of relatively small agents.

Figure 21. The Netherlands: Losses Caused by Defaulting Agents



Source: ARS, COREP, FINREP, FTK, MSR.

G. Interconnectedness[15]

64. This section presents a network-based analysis that uses foreign claims from the Bank of International Settlements (BIS) consolidated banking statistics as input. The analysis studies interconnectedness of banking systems across various countries. In doing so, it illustrates how disruptions in one country's banking system can spread to other countries' banking systems through credit and funding channels.

65. According to BIS data on foreign claims of banks as of end-June 2023, Dutch banks' asset and liability linkages are primarily against counterparts in the U.S. and Europe, with limited direct linkages to EMs.[16] As of end-June 2023, foreign claims of Dutch banks amount to USD 1,531 billion (Figure 22, top left). The major portion of these foreign claims are made against the non-financial private sector (including non-bank financial institutions), followed by the foreign official sector and banks.

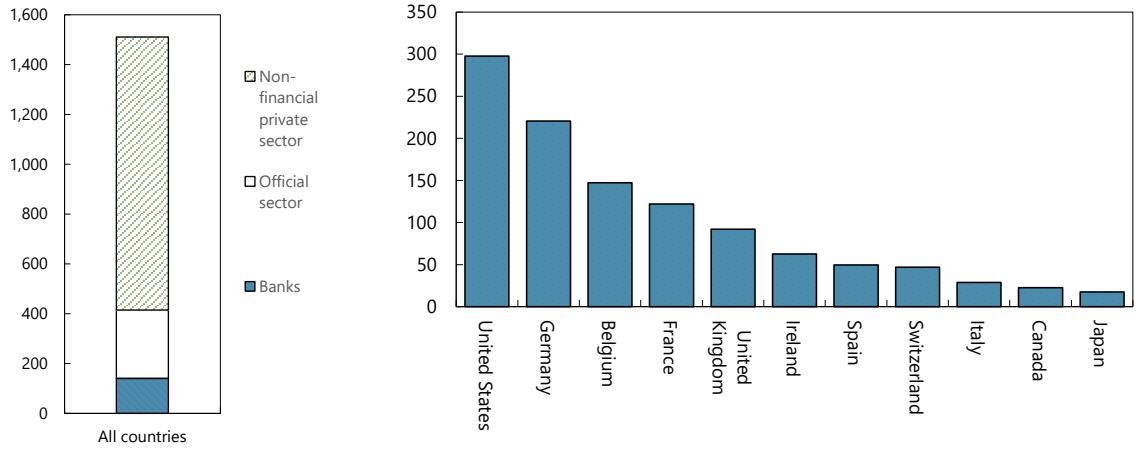
[15] This section was prepared by Mohamad Nassar (MCM).

[16] Foreign claims comprise cross-border claims and local claims of banks' foreign affiliates on residents of respective host countries. The data are sourced from BIS consolidated banking statistics (Guarantor basis).

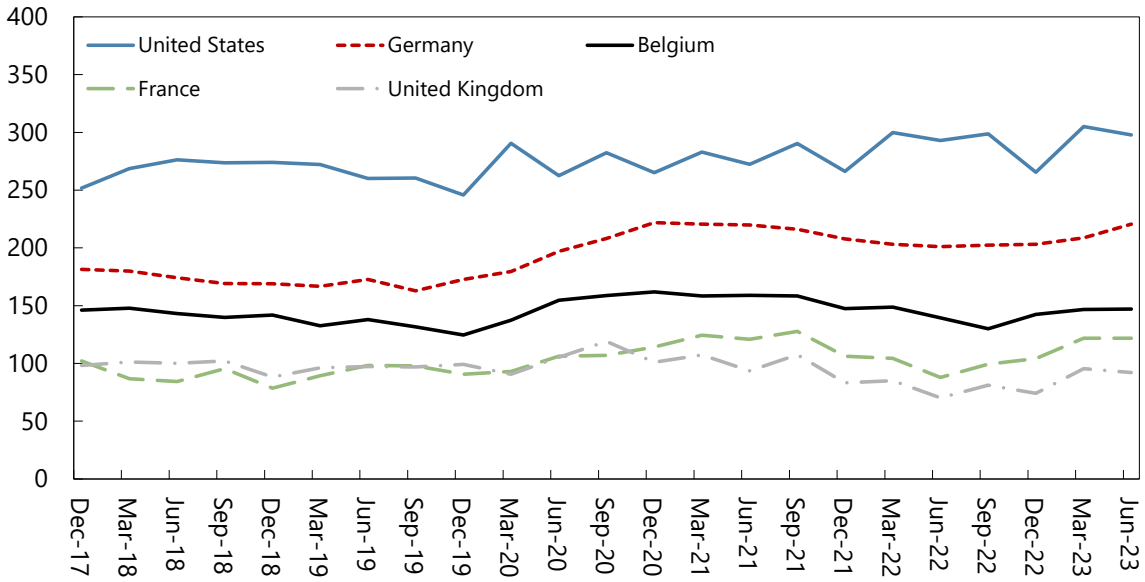
Figure 22. The Netherlands: Dutch Banks' Foreign Claims

(Billions of U.S. Dollars)

The largest foreign exposures are to the non-financial private sector, and to other advanced economies.



The top five remain the same as during the last FSAP, with France outpacing the UK in more recent years.



Source: BIS, DNB.

66. Network-based analysis is utilized to evaluate the potential for "failures" in the banking systems of specific countries to propagate globally, leading to knock-on effects in other jurisdictions. The approach devised by Espinosa-Vega and Solé (2010) is employed in examining the BIS data on foreign claims as of end-June 2023. The analysis explores the potential transmission of a banking system failure across 12 countries, including Belgium, Canada, France, Germany, Ireland, Italy, Japan, Netherlands, Spain, Switzerland, UK, and U.S. The study considers both credit and funding risks in cross-border lending and conducts 12 simulations to examine how the

failure of a single country's banking system could trigger subsequent failures in other countries. While a complete banking system failure in any single country is a coarse and highly unlikely assumption and the findings must be interpreted with caution, the analysis will help to gauge the degree of interconnectedness between Dutch banks and other banking systems. The simulations operate under the following assumptions:

- A country's banking system fails when the losses incurred from the effects of credit and funding shocks (explained below) surpass the initial (aggregate) level of bank capital.[17]

- In a creditor country, credit risk emerges when a borrower country experiences a failure (defaults). In the baseline, the creditor country would incur a loss equivalent to half of its exposure to the failed borrower.

- Funding risk materializes for a borrower country when a creditor country's banking system fails. The analysis assumes at baseline that only a portion of the funding withdrawn from the creditor will be replenished by other creditors (50 percent). Consequently, the borrower will be compelled to sell some of its assets in a fire-sale. Based on these considerations, the analysis assumes that the borrower country will incur a loss equivalent to 25 percent of the initial amount borrowed from a failed creditor.[18]

- In the bank system failure path analysis, distinct simulations were conducted at each assumed LGD level. Countries with the highest score on the contagion index[19] were assumed to fail first, generating knock on effects to other systems depending on the effect of failure on the latter's capital levels, which could then propagate in further rounds if the shock is large enough.

67. The simulation suggests that the Dutch banking system is susceptible to shocks originating from other financial centers, in particular from the U.S. and Germany, and to a lesser extent the UK:

- The findings suggest that capital levels in the Dutch system would be depleted following the collapse of the U.S. banking system, highlighting Dutch banks' substantial U.S. exposures.

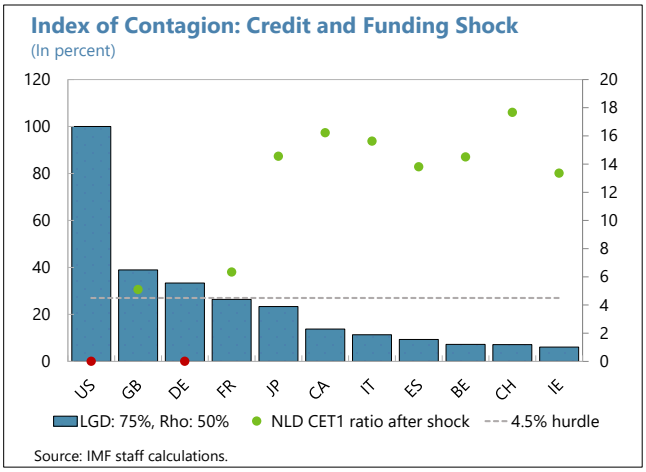
- The path simulation exercises show a susceptibility of the Netherlands to the failure of the banking systems of the U.S. and Germany.

[17] Data on bank capital for each banking system is obtained from the IMF's Financial Soundness Indicators database.

[18] For example, suppose only $\boldsymbol{\rho}$= 50 percent of the funding provided by a failed creditor will be replaced with other funding sources, and assets must be sold at a $\boldsymbol{\delta}$= 33 percent valuation discount in a fire-sale. In this case, 25 percent $(= \rho * \delta/(1-\delta))$ of the amount originally borrowed from a failed creditor will be realized as the borrower's losses.

[19] The Index of Contagion represents the total capital impairment in other banking systems due to the failure of the banking system in each country (percentage of the original total capital in other banking systems).

68. This susceptibility is evident as the Dutch banking system faces an immediate failure following the collapse of the U.S. banking system at an LGD assumption of 50 percent. Similarly, the Dutch banking system experiences an immediate failure following the collapse of the German and/or U.S. banking systems at an LGD assumption of 75 percent or higher. Additionally, the Dutch banking system demonstrates vulnerability in the second round of iterations after the failure of the UK banking system.



H. Recommendations

69. The authorities can strengthen their bank solvency stress test by incorporating the following components:

- Continue to develop the market risk analysis based on sensitivities, or "deltas", which banks report to the Single Supervisory Mechanism (SSM). Given that these sensitivities are a net between assets and liabilities, instruments, and their hedges, it is not straightforward to pinpoint the underlying vulnerability when extreme values are reported. It is recommended to complement this "delta"-based analysis with alternative data sources with more granular information. Examples include SHSG and trade repository of derivatives recorded by the EMIR. The former covers the holding and issuance of securities by the banking group. The latter documents derivatives transactions, which Dutch banks use frequently for trading and hedging purposes.

- Adopt the IRRBB template in the interest rate risk analysis. Currently, the authorities leverage the COREP 66 form on maturity ladder to conduct this analysis. While this template documents the maturity schedule of various assets and liabilities, one needs additional assumptions to capture the positions to be repriced over time, such as floating rate loans. The IRRBB template has the repricing information ready and is expected to be integrated into COREP in early 2024. It can be a more desirable data source for analyzing net interest income, the main source of Dutch banks' profitability.

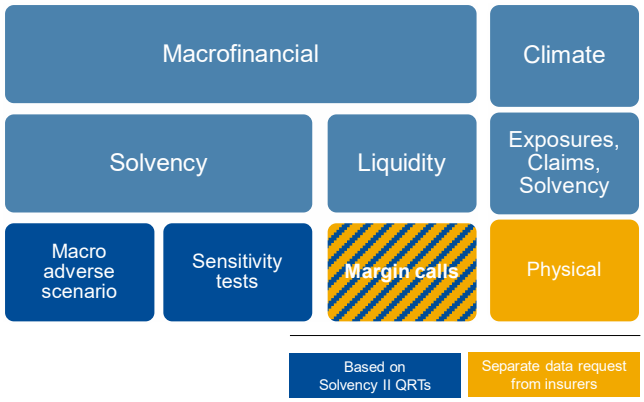
- Continue efforts to develop the credit risk analysis for LSIs. The authorities have made significant progress in requiring LSIs to report additional risk parameters, such as PDs by portfolio and country of exposure. Given LSIs' diverse exposures to advanced and EM economies, this effort will allow the authorities to better understand the risk profiles of LSIs' borrowers. It will also support authorities in developing tools to analyze LSI resilience to abrupt changes in macrofinancial conditions.

70. The authorities can strengthen their system-wide stress testing by developing methodologies to assess the contagion effects of price and funding shocks across banks and NBFIs.

INSURANCE SECTOR RISK ANALYSIS

71. The FSAP team conducted a solvency stress test as well as a liquidity risk analysis and an analysis of physical climate risks in the insurance sector, covering up to 16 insurers (Figure 23). The top-down solvency stress test utilized the macrofinancial adverse scenario also used in the banking stress test, with some granularity added for the market and interest rate shocks. Sensitivity analyses, covering interest rate and currency shocks and the default of the largest banking counterparty, complemented the solvency analysis. The liquidity risk analysis focused on the impact of variation margin calls for interest rate swaps held by life insurers. The climate risk analysis covered a bottom-up exercise on flood risks and parametric increases in the severity and frequency of weather-related loss events, and results are described in a separate Technical Note.[20]

Figure 23. The Netherlands: Components of Insurance Risk Analysis



QRT: Quantitative Reporting Template.
Source: IMF staff.

A. Scope and Sample of the Solvency Stress Test

72. A top-down (TD) solvency stress test was performed for 16 large insurers, on a solo-entity basis.[21] The sample was composed of five life insurers—resulting in a coverage of around 93 percent of assets in this highly concentrated market—as well as five P&C insurers and six health insurers, with a market coverage in these two sectors of around 70 percent. The participants' aggregated balance sheet assets amount to EUR 390bn, of which 340bn can be attributed to life insurers.

[20] See Technical Note on Climate Risk Analysis.

[21] For a summary of the stress testing approach see Table 8.

73. All 16 participants record before-stress solvency ratios above the regulatory threshold of 100 percent, but the use of internal models and the impact of certain regulatory measures complicate a direct comparison. Five insurers in the sample calculate their Solvency Capital Requirement (SCR) with a partial internal model. Sector-wide, Dutch insurers hold high-quality capital, with 91 percent of eligible own funds being unrestricted Tier 1 capital, while only 3 percent is comprised of Tier 3. The Long-Term Guarantee (LTG) measures, an integral part of Solvency II, have a significant effect in the Netherlands: 27 insurers have a permission to use the Volatility Adjustment (VA),[22] making it the most relevant LTG measure. For VA users (mainly life insurers), the SCR at the end of 2022 would have been around 70 percentage points lower without this measure, but still above the regulatory threshold of 100 percent.

B. Scenarios for the Solvency Stress Test

74. The macrofinancial adverse scenario specified by the FSAP team for the banking sector stress test was adjusted for the purpose of the insurance stress test. The scenario, which features significant supply shocks, a synchronized growth slow-down, a de-anchoring of inflation expectations, and globally a sharp rise in interest rates, together with a domestic house price decline, is highly relevant for the insurance sector. Nevertheless, some adjustments were made to make the scenario directly applicable to an insurer's balance sheet. While the scenario includes a projection of macro and market variables for the next five years, for the insurance stress test all shocks were assumed to occur at the beginning of the first year (instantaneous shock). Market shocks, such as declines in equity and property prices, have therefore been front-loaded so that the maximum drawdown during the projection horizon of the macrofinancial scenario is realized immediately after the reference date (30 June 2023).

75. To cover the most relevant risk factors for an insurer's balance sheet, specifically the market risk, shocks have been defined more granularly. The scenario includes shocks to the risk-free interest rate, equity and property prices, as well as credit spreads of corporate and sovereign bonds, and spreads of mortgage loans (Table 10). The interest rate shock also applies to the interest rate swap portfolio, which is relatively large compared to other European peers, with a notional value of more than EUR 300bn. Given the increase of credit spreads in the scenario, the VA also increases, following the Solvency II calculation method. For insurers using the VA measure, the result is a higher discount rate which partially offsets the negative impact of the credit spread shock.

76. Despite differences in individual asset classes, the overall severity of the adverse scenario is roughly comparable to a stress test run by the European Insurance and Occupational Pensions Authority (EIOPA) in 2018. The "Yield Curve Up" scenario in the EIOPA 2018 stress test[23] assumed 10-year EUR swap rates to increase by 86 bps and equity prices to drop by 39 percent (EU average); spreads of 10-year Dutch government bonds were to increase by 42 bps

[22] The VA is a measure by which (re)insurers are allowed to adjust the risk-free discount rate used to value liabilities to mitigate the effect of short-term volatility of bond spreads on their solvency position. In that way, the VA reduces procyclical investment behavior of (re)insurers, particularly in a downturn.

[23] Three Dutch insurance groups participated in the 2018 round of the EIOPA stress test.

and those of A-rated EU financials by 164 bps; the shock for Dutch commercial real estate amounted to -35 percent.

77. Additional sensitivity tests, which assumed single-factor shocks, were utilized to complement the stress test.

- Interest rates: parallel downward shift of the EUR risk-free term structure (liquid part only, followed by an extrapolation towards the ultimate forward rate) by 100 basis points.
- Currencies: increase (depreciation) of the Euro external value by 10 percent.
- Counterparty risk: default of the largest banking counterparty. The largest counterparty was determined based on investment asset data in the Quantitative Reporting Template (QRT) S.06.02, at the level of the issuer group. It was assumed that equity exposures and subordinated bonds need to be fully written off (i.e., a 100 percent haircut). Furthermore, an LGD of 10 percent was applied to secured bonds, and an LGD of 70 percent to other on-balance sheet exposures including unsecured bonds, uncollateralized loans, and deposits.

C. Capital Standard and Modeling Assumptions

78. Solvency II[24] was implemented in the EU in 2016 and forms the basis of the insurance stress test. As a general principle of Solvency II, assets and liabilities are valued mark-to-market. However, Solvency II also allows for some notable deviations from the market-consistent framework in the valuation of insurance liabilities, especially for the discount rate which can incorporate LTG measures and transitional measures.

79. The main output of the FSAP stress test calculations is the effect on own funds eligible for the coverage of the SCR. As the stress also affects the capital requirement, the SCR was partially recalculated after stress.

80. Data for the TD solvency stress test was gathered from the Solvency II QRTs. Solvency II has introduced a very granular supervisory reporting specifically on the asset side. Reported data must meet several automated validation checks, while DNB also has undertaken initiatives to improve the quality and consistency of data. Still, a few inconsistencies and remaining data gaps pose limitations to a TD stress test. For the stress test, the following QRTs were used:

- Balance sheet (S.02.01),
- Asset-by-asset investment holdings (S.06.02),
- Derivative positions (S.08.01),

[24] Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance.

- Cash-flow projections (S.13.01, S.18.01),
- Impact of LTGs measures and transitionals (S.22.01),
- Own funds (S.23.01),
- Calculation of the SCR (S.25.01, S.25.02, S.25.03),
- Calculation of the SCR for market risks and life underwriting risks (S.26.01, S.26.03).

81. For the TD stress test, the shocks specified in the scenario were applied to the investment assets and insurance liabilities. Haircuts in line with the adverse scenario were applied to the market value of directly-held assets. A look-through to the level of individual securities held through an investment fund was not applied, so investment fund holdings were stressed with the corresponding shocks for the underlying asset classes. Fixed-income assets were re-valued with the stressed term structure (for each major currency). Similarly, technical provisions (except for unit-linked business) after stress were approximated with the stressed term structure including the VA where applicable.[25] For unit-linked business, the decline in liabilities mirrored the market value loss of underlying assets.

82. The re-calculation of the SCR after stress was limited to selected risk modules. In the market risk module, the capital charges for equity risk, spread risk and property risk were proportionately adjusted in line with the change in exposures due to the stress. Furthermore, the equity risk capital charge was corrected for the symmetric equity adjustment which changes from +1.2 to -10.0 percentage points after the fall in equity prices in the adverse scenario. The capital charge for life underwriting risk was assumed to change proportionately with the technical provisions after the application of the stressed discount curve. All other components of the basic SCR, including the capital charge for counterparty default risk, non-life underwriting risk and operational risk were assumed unchanged. For internal model users, the relative change in the SCR including the aggregation and resulting diversification effects was approximated through a simplified approach building on the standard formula. In a last step, the loss-absorbing capacity of deferred taxes was re-calculated based on the modeled valuation losses in the excess of assets over liabilities.

83. Insurance stress tests, particularly when conducted as part of an FSAP, should not be seen as pass-fail exercises nor as implying additional regulatory capital requirements for individual insurers. As a macrofinancial stress test, the ambition is to detect sector-wide and potentially systemic vulnerabilities.

84. Insurance companies have a broad range of risk-mitigating mechanisms in place which cannot be fully captured in a TD stress test, and potential reactive management actions were not modeled in the stress test. Data granularity of the supervisory reporting does not allow for a comprehensive recognition of financial hedges, stop-loss arrangements, or financial reinsurance. In

[25] Due to data limitations, not all product features could be fully incorporated in the approximation.

times of financial stress, insurers have several options to restore their capital adequacy or their profitability, including implementing changes in underwriting standards and in the reinsurance program or by withholding profits. An even more effective way to improve the solvency position relatively quickly is a de-risking of the balance sheet, e.g., by selling equity or high-yield corporate bonds and buying sovereign bonds instead—this change in the asset allocation can significantly reduce required capital. For solo entities, there would also be a possibility of receiving capital as group support from the parent. As the stress test assumed a static balance sheet, these types of management actions were not modeled. Therefore, the results of the stress test would probably be less severe with management actions being included.

D. Results of the Solvency Stress Test

85. The valuation impact on assets and liabilities is very different across sub-sectors, but for each sub-sector (life, P&C, and health) the value of assets declines more than the value of liabilities (Figure 24). Asset values decline by 19 percent for the median life insurer, and by 11 and 3 percent for the median P&C and health insurer, respectively. These declines are not fully compensated for by lower liabilities (mainly through higher discount rates), hence the asset-liability ratio for almost all firms in the sample declines. For the median life insurer, this decline amounts to 5.0 percentage points (down to 102.7 percent), while for the median P&C and health insurer the ratio declines by 0.6 and 2.8 percentage points, to 126.3 and 151.2 percent, respectively.

86. Most of the decline in asset values of life insurers stems from higher interest rates, while all other asset-side shocks have a relatively muted impact. Higher interest rates reduce the value of fixed-income instruments and interest rate swaps. Considering the almost equal amount in the reduction in liabilities due to the higher discount rate, it underlines the approach of most of the large Dutch life insurers to match assets and liabilities closely and thereby reduce the interest rate risk. The depreciation of the Euro partially offsets other adverse shocks as most insurers in the sample hold more foreign-denominated assets compared to their liabilities, resulting in a net valuation gain.

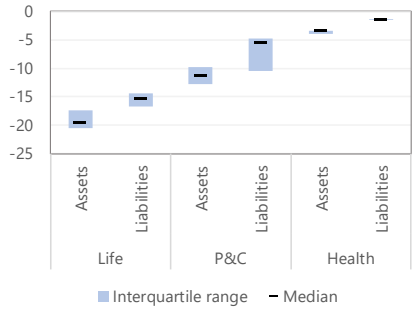
87. In terms of solvency levels, Dutch insurers are broadly resilient under the adverse scenario, but pockets of vulnerabilities exist for some of the life insurers (Figure 25). Eligible own funds (EOF) to meet the solvency capital requirement decline by 62 percent for the median life insurer which can only be partially compensated by a reduction in the SCR of 25 percent. The median life insurer records coverage of their SCR after stress of 100 percent, down from 189 percent prior to the stress—results are however very heterogenous across the sample, as shown in the distributions of post-stress SCR ratios in Figure 25. The aggregate capital shortfall for two life insurers falling below the regulatory threshold of 100 percent amounts to EUR 2.9bn, equivalent to about 0.3 percent of GDP.

88. P&C insurers as well as health insurers exhibit lower sensitivities to market and credit risks and are therefore more resilient in the adverse scenario. The median SCRs after stress in the P&C and the health insurance sample amount to 128 and 126 percent, down from 158 and 134 percent, respectively.

Figure 24. The Netherlands: Insurance Solvency Stress Test—Valuation Impact

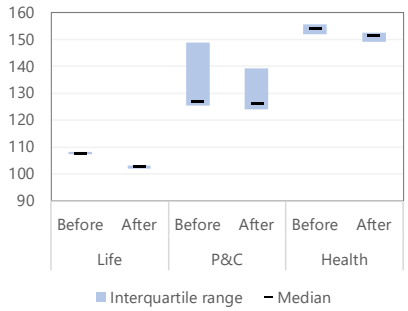
Asset values across all sectors decline by more than the respective liability values, most pronounced though in the life insurance sector with longer durations on both sides of the balance sheet…

Change in Value of Assets and Liabilities
(in percent)



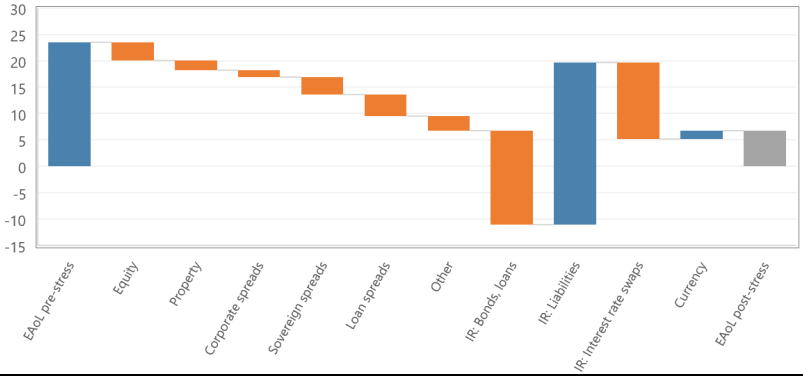
…the median asset-liability ratio therefore declines from 108 to 103 percent. In the P&C and health sectors, the ratio declines by 1 and 3 percentage points, respectively, also starting from higher levels.

Assets to Liabilities
(in percent)



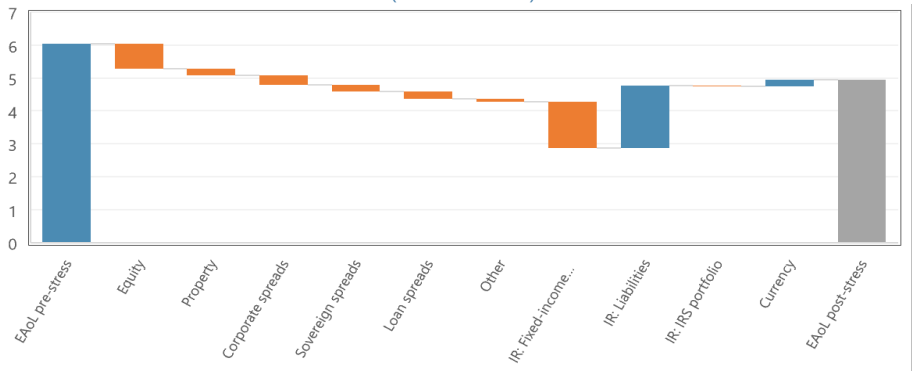
In the life sector, aggregated interest-rate effects on assets (fixed-income instruments, interest rate swaps) and liabilities (technical provisions) are almost balanced but come on top of other asset-side risks. The currency effect of a depreciating Euro on FX-denominated assets is minor.

Contribution of Individual Shocks: Life
(in EUR Billions)



In the P&C sector, the total decline in the excess of assets over liabilities amounts to only EUR 1.1bn (-18 percent). The largest decline stems from the equity shock, while the combined interest rate effect offsets other market shocks.

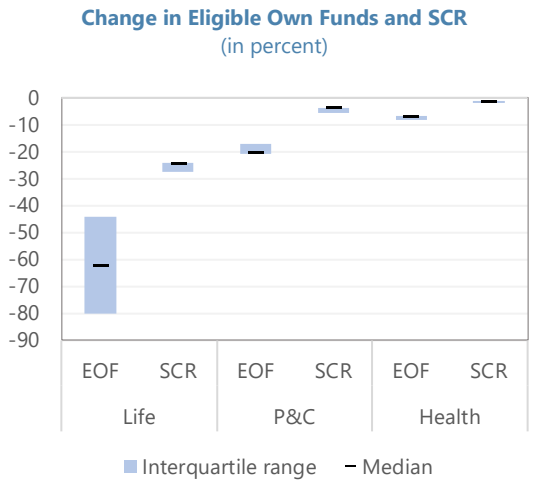
Contribution of Individual Shocks: P&C
(in EUR Billions)



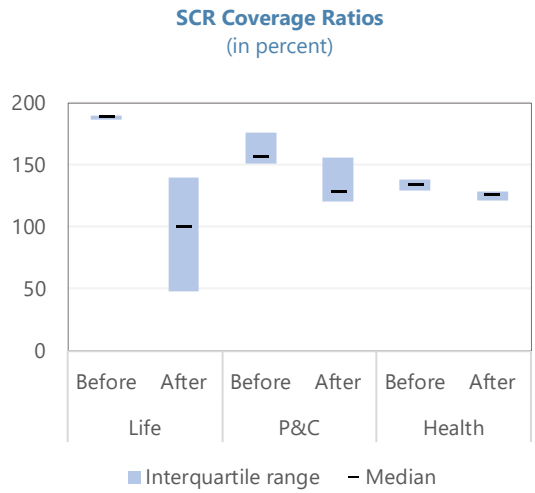
EAoL: Excess of Assets over Liabilities.
Source: IMF staff calculations based on DNB data.

Figure 25. The Netherlands: Insurance Solvency Stress Test—Solvency Impact

The decline in EOF cannot be compensated by the decline in the SCR which stems mainly from lower investment exposures post stress.



The life sector is impacted very heterogeneously, while P&C insurers remain largely resilient. Health insurers are insensitive to market and credit risk shocks.



Source: IMF staff calculations based on DNB data.

E. Sensitivity Analyses

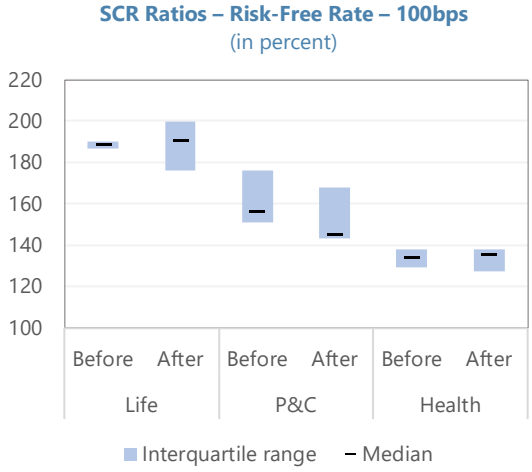
89. The results of the sensitivity analyses underline the resilience of Dutch insurers to a number of different single-factor shocks (Figure 26). For this analysis, the same data and methodology were used as for the solvency stress test, including a recalculation of the SCR after stress. With EUR interest rates being 100 bps lower, the effect on insurers' solvency would be very heterogenous in the life sector, effectively opposite to the adverse macrofinancial scenario—overall, the median SCR coverage changes only marginally (+2 percentage points), largely due to the close duration matching, but differences exist across firms. An appreciation of the Euro by 10 percent would have a slightly negative impact, most pronounced in the life sector where most of the foreign-denominated assets are held—the median SCR would decline by 12 percent. Individual bank defaults would not have a significant direct impact on the insurance sector as a whole. A few insurers have slightly concentrated exposures to individual banking groups, but a default would not cause any solvency shortfalls.

F. Approach and Scope for the Liquidity Risk Analysis

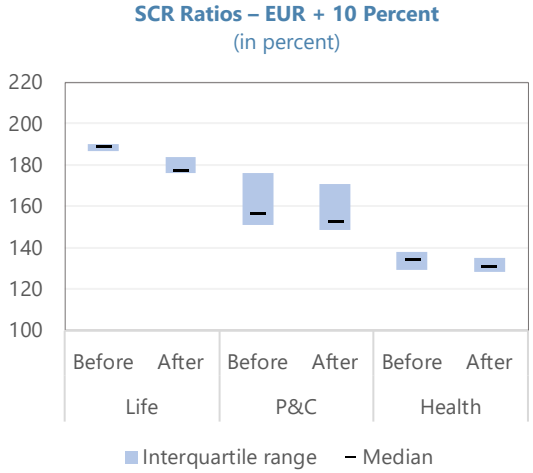
90. Dutch insurers hedge large parts of their interest-rate risk with derivatives, in particular interest rate swaps. For the sector as a whole, the market value of asset-side derivatives amounts to 6.3 percent of assets, while liability-side derivatives constitute 8.4 percent of total liabilities. Interest rate swaps are the largest derivative type with a total notional value of around EUR 360bn as of end-2022—these are almost exclusively used by life insurers.

Figure 26. The Netherlands: Insurance Solvency Stress Test—Sensitivity Analyses

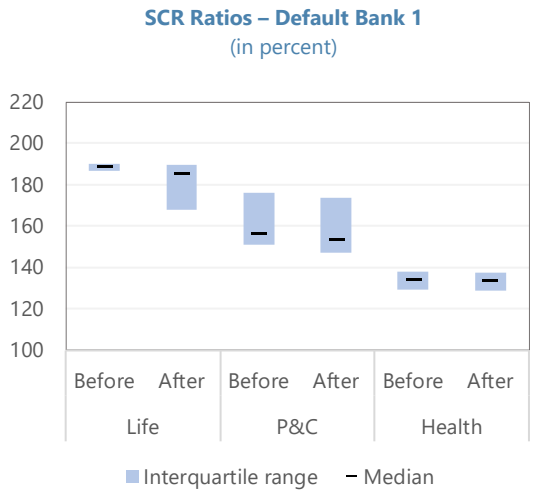
With lower interest rates, post-stress SCRs are again very dispersed for life insurers, depending on their interest rate risk management practices. For the median life insurer, the SCR increases by 2 percentage points.



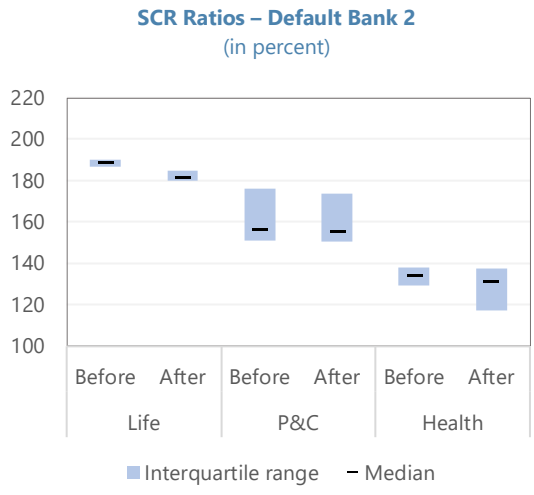
An appreciation of the Euro would mostly affect life insurers which hold the largest relative share in FX-denominated assets; however, the median SCR declines by only 12 percentage points.



If the largest banking counterparty defaults, median SCRs in each sector would decline only marginally, but individual firms in the life sector would be more affected.



Assuming a default of the second-largest banking counterparty, results are more homogeneous in the life sector, but outliers can be seen in the health sector.



Source: IMF staff calculations based on DNB data.

91. The FSAP team carried out a BU and TD analysis of potential liquidity risks from variation margin calls for interest rate swaps, using a methodology recently employed by EIOPA and in the 2021 UK FSAP. The scenario for the analysis assumes a substantial one-day interest-rate increase of 100 basis points. Life insurers were requested to report the margin call they would have to meet in the scenario, split into cash calls and collateral that could be provided in kind, and spread over the first two days after the interest-rate shock. In addition, information was requested on how insurers planned to meet the cash collateral call, drawing on different sources like

cash, repo facilities, or the liquidation of different types of assets. These assets had to be re-valued with the shocked interest rate. A top-down analysis was performed to cross-check the amount of the margin calls reported by the insurers. This analysis drew on the S.08.01 template of the Solvency II reporting.

92. Data quality in the QRTs was sufficient to re-value almost all interest rate swap positions reported by the life insurers in the sample. The overall quality of supervisory reporting has improved since the implementation of Solvency II in 2016. Still, as insurers have additional reporting requirements under the EMIR,[26] a cross-check between both data sources might enable further analysis, in particular as data would be available on a daily instead of a quarterly basis as in the QRTs.

G. Results of the Liquidity Risk Analysis

93. Life insurers are broadly resilient to liquidity shocks despite large interest rate swap positions. The margin call reported by insurers in the BU analysis is sizable (EUR 10.1bn) and 94 percent would need to be met in cash. Of the total cash amount, EUR 8.4bn are due within one day, and another EUR 1.1bn on Day 2.

94. The sampled entities apply rather heterogenous strategies in their collateral management and draw on a variety of different sources for their liquidity (Figure 27). On Day 1, the five insurers plan to raise a total liquidity of EUR 10.2 bn, drawing mainly on cash and deposits (22 percent) and repo facilities (53 percent). A liquidation of assets is likely to be used to a limited extent only. Money-market funds (16 percent) and high-quality government bonds with a short remaining maturity (7 percent) would be the only relevant asset classes in which divestments could be expected. As liquidity sourced on Day 1 exceeds the size of the margin calls due on that day, remaining liquidity is used for subsequent margin calls on Day 2. Still, some further divestments in government bonds could be expected on that day, too, likely to re-establish the targeted cash position.

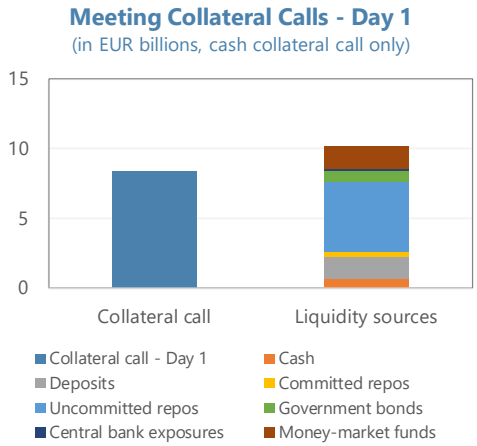
95. The sources of liquidity differ substantially across the sample, thereby reducing the systemic risk of an excessive reliance on just one source. Nevertheless, the amounts to be raised on the repo market would need to be assessed together with simultaneous liquidity needs by other market participants.

96. The BU results reported by life insurers were confirmed in the TD analysis. While the margin call turned out to be slightly higher in the TD analysis than in the BU analysis (10.3bn vs. 10.1bn), differences are within expected modeling uncertainty and confirm the overall good reporting quality of interest rate swap positions.

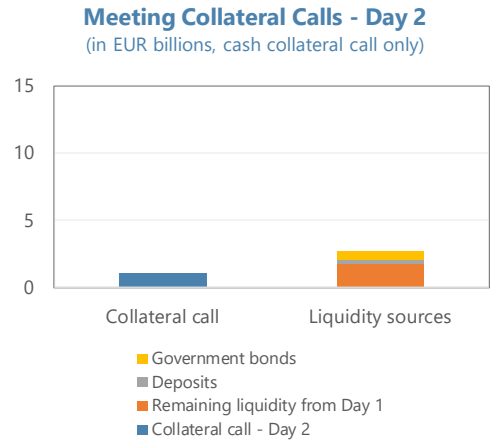
[26] Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories.

Figure 27. The Netherlands: Insurers' Variation Margin Calls

Cash collateral calls on Day 1 (EUR 8.4bn) could be met, mainly by uncommitted repos.



On day 2, collateral calls of EUR 1.1bn are met by remaining liquidity sourced on Day 1.



Source: IMF staff calculations based on company submissions.

H. Recommendations

97. Close monitoring of repo market conditions remains warranted. Even though the stress test showed that insurers are relatively resilient to liquidity shocks, the amounts they would need to raise on the repo market would need to be assessed together with simultaneous liquidity needs by other market participants including Dutch pension funds (see below), calling for a close monitoring of repo market conditions.

PENSION FUND RISK ANALYSIS

A. Approach and Scope of the Pension Fund Risk Analysis

98. For the large Dutch pension fund sector, both a solvency analysis and a liquidity risk analysis were conducted. The TD solvency analysis comprised the ten largest pension funds, covering 70 percent of the market in assets. While the Dutch pension fund sector is transitioning towards a DC regime, the risk analysis was based on the current DB regime, and the funding ratio was taken as the relevant performance metric.[27] The adverse scenario followed the one used in the insurance sector, and the approach to the modeling of asset valuations was also very similar.[28] Only for the application of the interest rate shock, a more approximative duration-based approach was used due to the absence of detailed reporting data on future expected cash flows and—for some pension funds—on details regarding their interest rate swap positions.

[27] For details, see the Technical Note on Insurance and Pension Fund Oversight.

[28] See Table 9.

99. For the liquidity analysis, DNB surveyed the five largest pension funds in a BU approach, requesting data on potential margin calls and sources of liquidity. Information was requested on how those pension funds (which cover about 60 percent of the market) planned to meet the cash collateral call, drawing on different sources like cash, repo facilities, or the liquidation of different types of assets. These assets had to be re-valued with the shocked interest rate. Four different scenarios were used, of which only the most severe one is presented here—it assumed a 36-bps increase in EUR interest rates,[29] combined with a 4.4 percent appreciation of the Euro against the U.S. dollar. While the interest-rate shock used for this analysis is lower than in the insurance risk analysis, the additional inclusion of an FX shock, as well as the choice to limit the access of pension funds to repo markets, added an extra level of prudence.

B. Results of the Solvency Analysis

100. Pension funds are benefiting from rising interest rates, after considerable improvements in their funding ratios already over the last two years. Higher interest rates lower the value of pension fund liabilities by 27 percent on average, which compensates for the decline in asset values (-23 percent). Pension funds' own funds—the difference between assets and liabilities—increase on average by 7 percent, from EUR 136bn to 145bn. As a result, funding ratios improve for the large majority of pension funds in the sample—on average, the ratio increases by 7 percentage points to 122 percent, while for some the improvements are even greater than 10 percentage points, in particular for those funds with a larger duration gap between assets and liabilities (Figure 28).

101. A large effect on own funds stems from the shock to share prices in the adverse scenario. Given pension funds' large allocations to the stock market, the assumed valuation loss is almost equal to the pre-stress own funds. Adding the remaining asset-side shocks, including the effect of higher interest rates on the value of fixed-income instruments and the interest swap portfolio, results in a very substantial reduction in asset values, which is compensated by both the interest-rate effect on the value of liabilities and the impact of the Euro depreciation on the value of foreign-denominated assets.

C. Results of the Liquidity Risk Analysis

102. Pension funds appear resilient to liquidity risks from margin calls, even when restricting their access to the repo market (Figure 29). In the scenario, the pension funds in the sample had to meet a variation margin call in total of EUR 25.0bn, of which 14.5bn stem from the interest rate swap portfolio. The share of margin calls which is met in kind instead of cash is higher among pension funds (36 percent) than in the insurance sector (6 percent), so that the cash collateral call amounts to EUR 18.4bn, of which 60 percent are due within one day ("Day 1") and the remainder the day after ("Day 2"). For smaller pension funds which do not fall under the clearing obligations, many still make use of bilateral swap transactions which allow for a settlement in kind, thereby

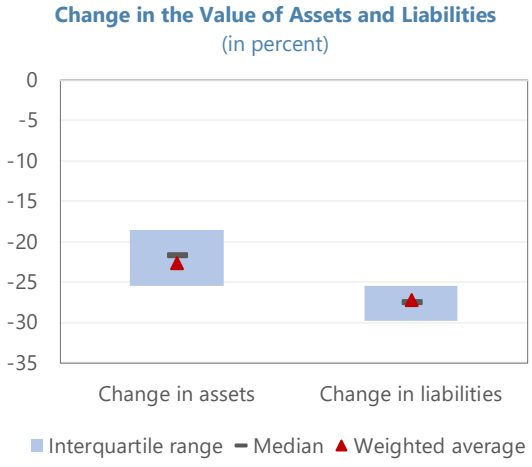
[29] In addition to further currency-specific interest rate shocks, e.g., 44 bps for USD and 77 bps for GBP.

lowering liquidity risks. At the same time, the clearing obligation for larger pension funds results in a further gradual increase of liquidity risk with every new swap or other derivative transaction.

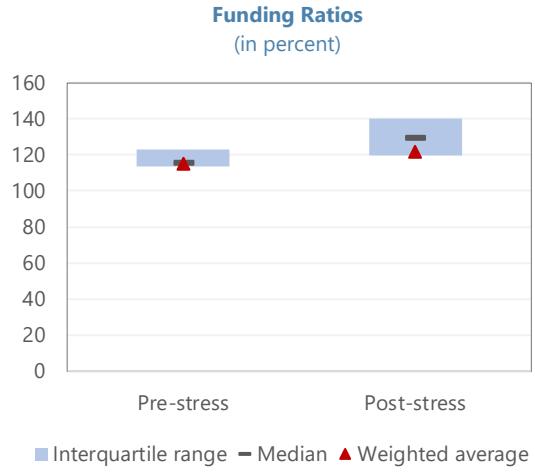
103. While funding sources are diversified, repo markets remain important sources of liquidity especially for the largest pension funds, so that a close monitoring of market conditions and liquidity risk management practices remains crucial. Pension funds would first draw on cash and deposits which contribute 18 percent of the sourced liquidity on Day 1. Reverse repos and uncommitted repo lines contribute another 34 percent, and 12 percent stems from the liquidation of money-market funds and short-term high-quality bonds. On Day 2, a further sale of money-market funds is the most relevant liquidity source, followed closely by further transactions on the repo market (39 percent each).

Figure 28. The Netherlands: Pension Fund Solvency Analysis

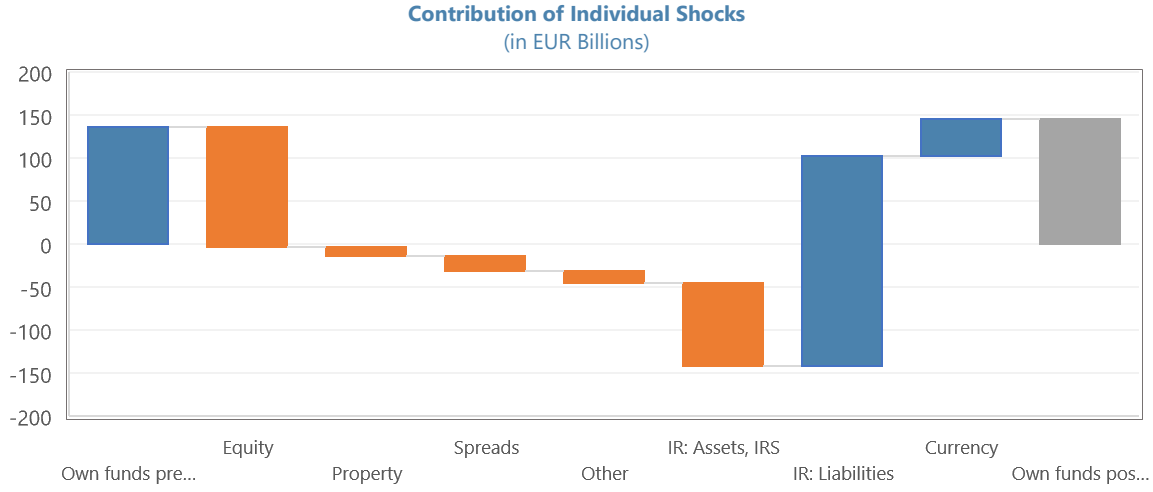
Asset values decline by 23 percent (EUR -235bn for the sample) but are overcompensated by a decline in liabilities by EUR 245bn.



The average funding ratio increases from 115 to 122 percent, with several pension funds recording even larger increases.



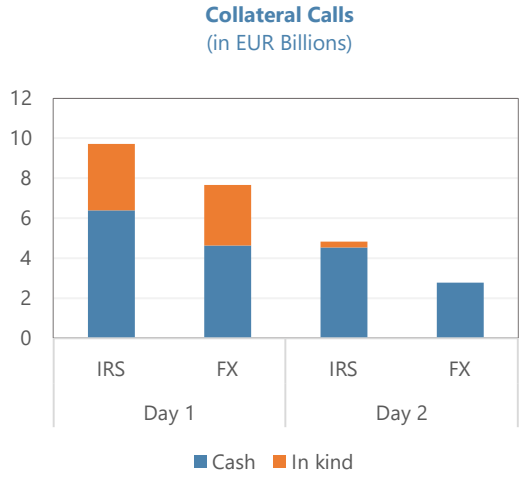
The effect of the interest-rate shock on liability values compensates for almost all asset-side shock effects, especially those on stocks and fixed-income assets.



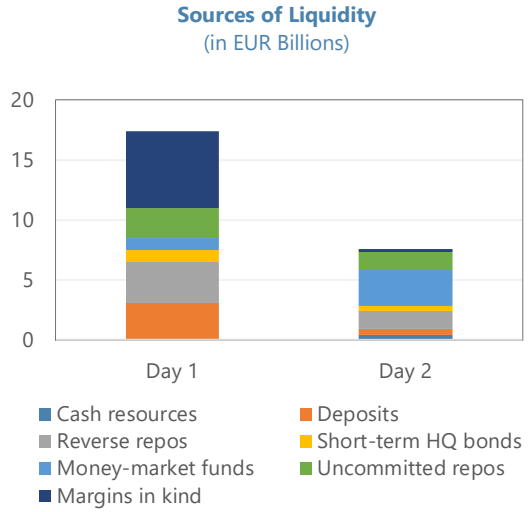
Source: IMF staff calculations based on DNB data.

Figure 29. The Netherlands: Pension Fund Liquidity Risk Analysis

Total collateral calls amount to EUR 25bn, of which 14.5bn are related to interest rate swaps. 36 percent of the total margin calls can be met in kind.



Collateral calls could be met by tapping different sources, even when assuming limited repo market access.



Source: IMF staff calculations based on DNB data.

D. Recommendations

104. Close monitoring of market conditions and pension funds' liquidity risk management practices remains crucial. Despite stress test results indicating resilience to liquidity shocks from margin calls and the pension funds' diversified funding sources, repo markets remain important sources of liquidity especially for the largest pension funds, and a close monitoring of market conditions and liquidity risk management practices remains crucial, especially in a context of a relatively shallow repo market where large transactions can be difficult to absorb.

HOUSEHOLD SECTOR ANALYSIS

105. Household debt has significantly declined despite the 2013-2022 boom in housing prices. The household debt-to-income ratio has kept declining, reflecting active deleveraging with larger voluntary debt repayments but also a robust growth in disposable income and a tightening of borrower-based measures over the period (see Caloia, 2022). However, more than 40 percent of mortgages contain an interest-only loan (IOL) element, exposing many households to a refinancing risk that could become systemic around 2036 when a large volume of loans will mature.

106. Average LTV ratios are relatively low following the housing price boom, but some vulnerabilities could materialize with higher interest rates and declining housing prices. Interest rates increased sharply in the past two years and housing prices started to decrease, by 6 percent from their peak of mid-2022 to mid-2023. The financial situation of borrowers is stronger

than it was during the house price downturn following the global financial crisis (GFC), notably with lower LTV ratios, but averages could hide heterogeneity across groups of borrowers, while some borrowers have pushed borrowing limits in recent years, given higher housing prices.

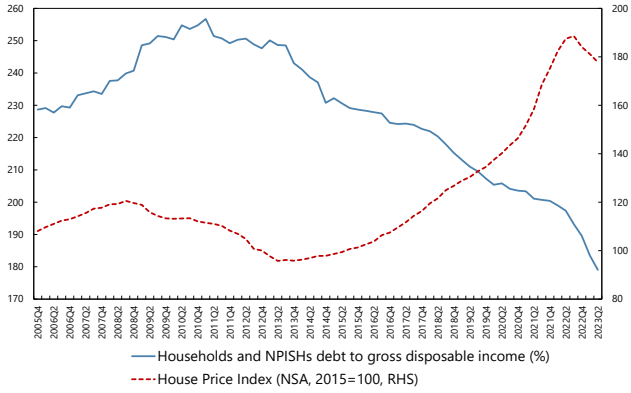
A. Recent Developments in Household Indebtedness and Vulnerabilities

107. Households have been deleveraging significantly, but debt remains high. Household debt to income decreased by almost 80 percentage points from the peak of 2011Q1 to 2023Q2 (Figure 30, left panel). Part of this deleveraging reflects larger debt repayments in the earlier phase over 2013-2015 (active deleveraging) and high growth of disposable income (passive deleveraging) in the more recent period.[30] Despite this significant decrease, the Dutch debt-to-income ratio remains one of the highest among advanced economies (Figure 30, right panel).

Figure 30. The Netherlands: Housing Prices and Household Debt to Income

Household debt has declined despite booming housing prices over 2023-2022…

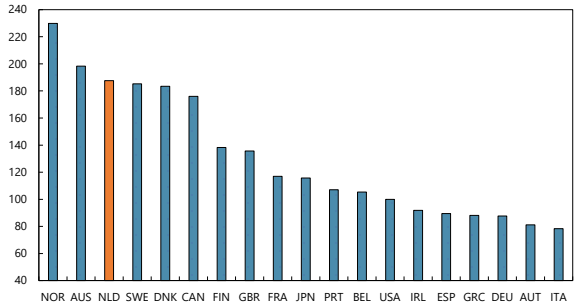
Household Debt to Income and Housing Prices



Sources: Centraal Bureau voor de Statistiek/Haver Analytics and IMF staff calculations and IMF staff calculations.

…but remains high by international standards.

Household Debt to Income Ratio as of 2023Q1, except otherwise indicated (percent)

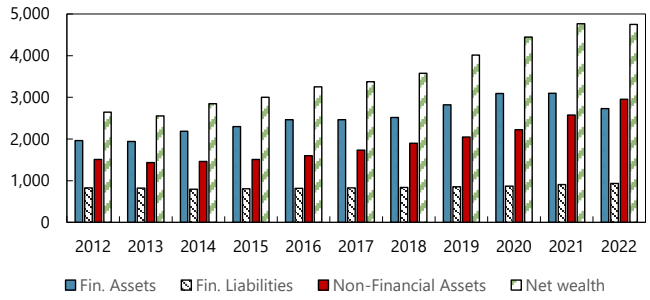


Source: OECD.
Note: Debt ratios as of 2023Q1, except for Greece (2021Q3), Japan (2022Q1), and Norway (2021Q4).

108. Households' wealth has improved but is mostly illiquid, being dominated by pension entitlements and real estate assets. Households are net lenders on aggregate and have improved their net wealth position over the years (Figure 31), on the back of higher pension entitlements and higher real estate assets (dwellings, non-residential buildings, and lands), which represent, respectively, 25 and 50 percent of households' total assets as of end-2022. These two categories of assets are however largely illiquid, and their value can vary significantly over time. Pension entitlements have for instance dropped by almost 25 percent from 2020 to 2022, while the value of real estate assets could experience a sharp correction after having more than doubled from 2013 to 2022.

[30] See Technical Note on Macroprudential Policy for details.

Figure 31. The Netherlands: Households' Assets, Liabilities, and Net Wealth

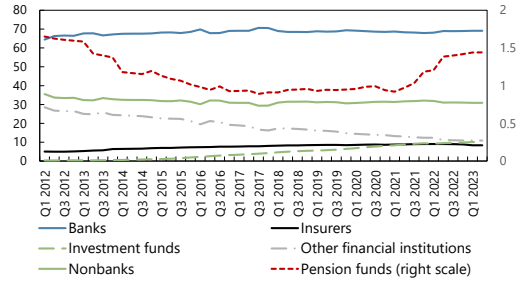


Sources: CBS and IMF staff calculations.

109. The pickup of inflation in the wake of the Covid-19 crisis has put low-income households under pressure. With wages lagging behind inflation in some sectors, households with low and middle incomes and small financial buffers have been struggling in the face of increased prices of basic necessities such as energy and food. A *Centraal Planbureau* (CPB) cost-of-living stress test suggests that between 540,000 and 860,000 Dutch households face affordability problems due to high inflation (CPB, 2022). Higher expenses imply that households have less disposable income left to meet their mortgage costs. Accordingly, reports of household defaults have been increasing for several months.

110. Banks are the main providers of mortgages and have maintained their market share over time despite increased activity by insurers, investment funds, and pension funds. Banks provide 69 percent of mortgages, or more than 550 billion euros of outstanding loans, as of 2023Q2. Mortgages offered by insurers and investment funds significantly increased in the last decade. At the same time, activity by other financial institutions (OFIs) – which consist mainly of finance companies and securitization vehicles – declined in the context of a drop of mortgage securitization, implying that the mortgage market share of NBFIs has been stable over time.

Residential mortgages by banks and by non-banks (in percent of total residential mortgages)

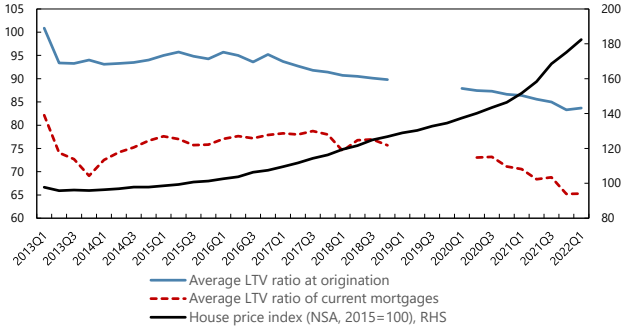


Source: DNB.

111. The LTV ratio has further decreased in recent years on the back of rising housing prices, but risks have increased for younger first-time buyers. The LTV ratio has declined from 82 percent in 2013Q1 to 65.3 percent in 2022Q1 following the introduction and tightening of the LTV

cap in 2013, as well as the housing price boom, implying that compared to the post-GFC period, fewer households would fall into negative equity should house prices drop significantly (Text Figure). However, a DNB analysis (Eijsink and van Dijk, 2022) indicates the presence of pockets of vulnerability among younger first-time buyers, who purchased proportionally more houses at the end of the boom than other households, and therefore had to push borrowing limits (see sub-Section B). The analysis shows that if house prices dropped by 20 percent, 13 percent of homeowners would see their LTV ratio rising to over 90 percent, and 8 percent of homeowners would fall into negative equity.

Average LTV Ratios at Origination and of Current Mortgages (percent) and House Prices (index 2015 = 100)

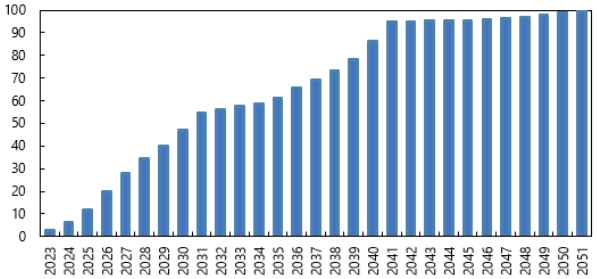


Sources: CBS and DNB.

112. Mortgage defaults are very low on aggregate, but loans with higher LTV and loan-to-income (LTI) ratios at origination, higher DSTI ratios, and with an IO status, are more likely to underperform. The default rate on banks' mortgages in the Netherlands is particularly low by international standards, standing at only 0.7 percent as of 2022Q1, versus an average of 0.5 percent over 2013-2021. This reflects several factors, including the presence of a guarantee scheme, the *Nationale Hypotheek Garantie* (NHG), which applies to a quarter of the total mortgage market, as well as a full recourse of lenders on borrowers' income and assets, reducing incentives to default (see the Technical Note on Macroprudential Policy). Still, Dutch mortgages with high LTV and LTI ratios at origination (Table 11), a higher current DSTI ratio, and an IO status, have been historically more fragile, as found empirically by de Haan and Mastrogiacomo (2020).

113. With 75 percent of outstanding mortgages having rates fixed for more than 5 years, the pass-through of the interbank rate to the average interest rate of outstanding mortgages has been weak so far. The interbank market rate sharply increased in the wake of the Covid-19 crisis, as central banks have been fighting inflation. The impact of this increase on borrowers' debt service burden varies significantly across countries and sectors, reflecting the prevalence of fixed versus flexible interest rates on loans. In general, loans to corporates are more likely to be flexible rate and thereby to adjust quickly to an increase in the interbank rate. In contrast, interest rates' arrangements on mortgages show much more heterogeneity across time (a growing number of households opted for fixed-rate mortgages in the wake of the GFC as interest rates were very low) and countries. Less than 3 percent of Dutch mortgages have interest rates which are flexible in 2023 and 25 percent within the next 5 years (Text Figure). As a result, compared to some

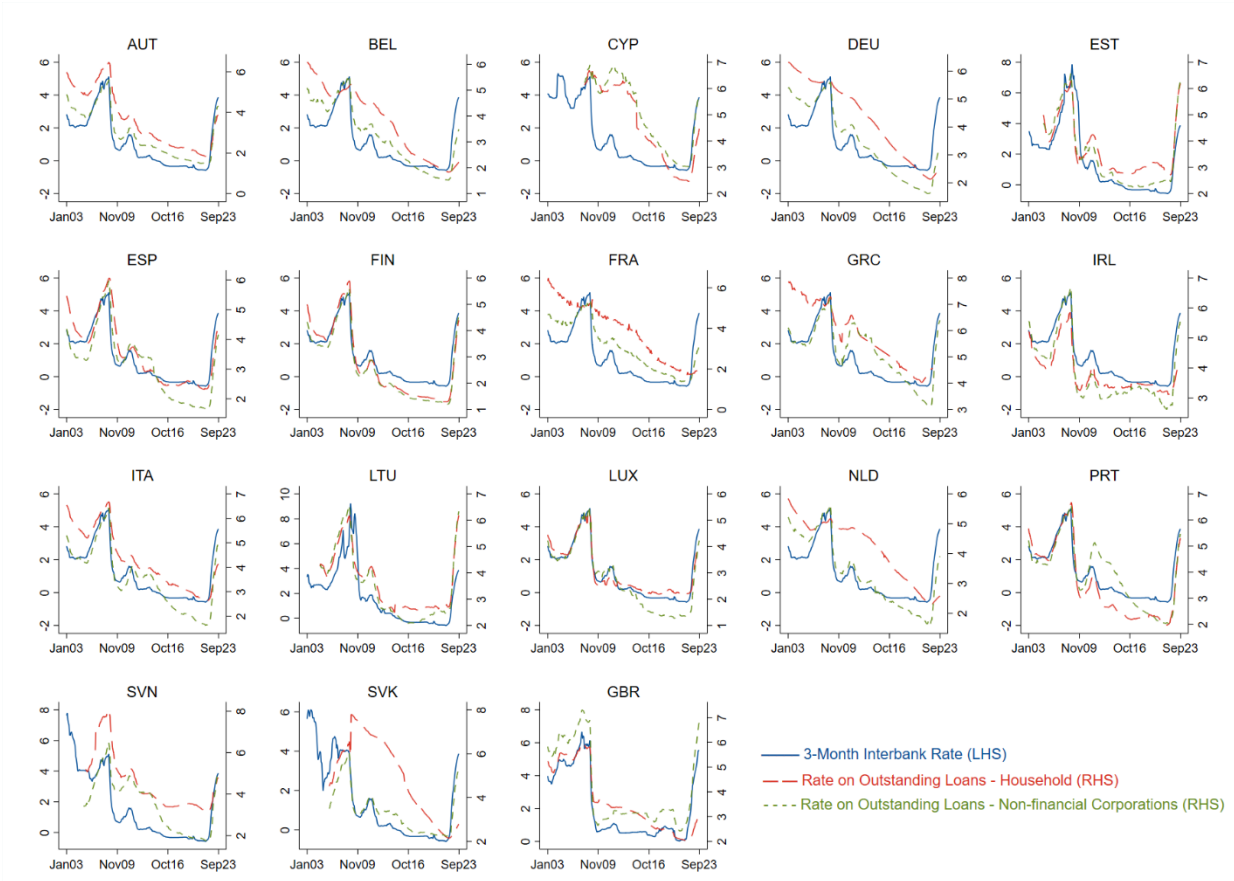
Cumulative proportion of mortgage debt with expiring fixed-interest period
(in percent of total mortgages)



Source: DNB.

other European countries (notably Austria, Estonia, Finland, Lithuania, Luxembourg, or Spain), the average interest rate of outstanding mortgages has moderately increased in the Netherlands so far (Figure 32). Still, a scenario analysis carried out by DNB reported in its Autumn 2022 Financial Stability Report (FSR) indicated that following a 3-percentage-point increase in interest rates, the average DSTI ratio of homeowners whose fixed-interest period expires in the short term would increase from 12 to 17 percent, and that the proportion of households spending more than a quarter of their disposable income on monthly mortgage payments would rise from 12 to 26 percent.

Figure 32. The Netherlands: Evolution of Interbank Rates and of Average Rates on Outstanding Loans (in percent)



Sources: ECB and IMF staff calculations.
Note: This figure shows the evolution of the average rates on outstanding loans to households, on outstanding loans to non-financial corporations, and of the 3-month interbank rate for a selected sample of European economies.

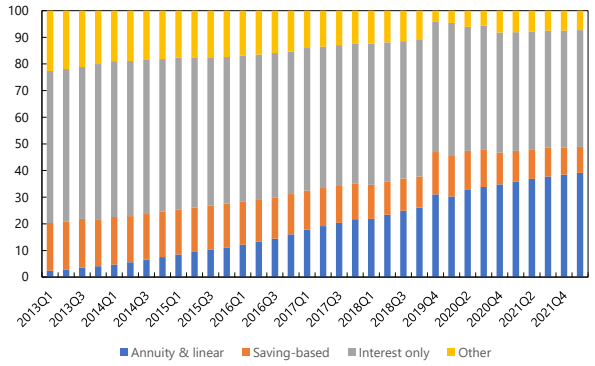
114. The stock of IO mortgages has declined in the past decade but remains high, and these loans have lately experienced a revival of popularity. Following the 50-percent limit of the value of the dwelling imposed on the share of IOLs at origination in 2011 and other measures reducing incentives for IOLs such as the end of mortgage interest deductibility, IO mortgages have become less popular, representing less than 44 percent of the total stock of mortgages in 2022Q1, versus more than 57 percent in 2013Q1 (Figure 33, left panel). However, the decline in the popularity of IO

mortgages has halted lately, as these loans are still subscribed by older homeowners (who still benefit from mortgage interest relief when refinancing their mortgage or purchase a more expensive house if their original IOL was taken out before 2013), while younger buyers have shown increased interest in IO mortgages in the wake of the Covid-19 crisis (Table 12).[31] Overall, however, IOLs remain much more common among older borrowers.

Figure 33. The Netherlands: Interest-only Mortgages

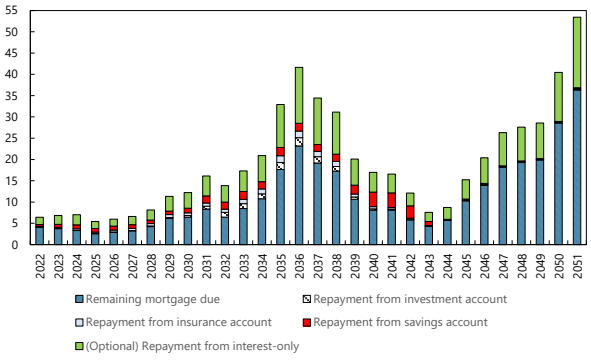
Interest-only mortgages have declined in proportion but remain important…

Composition of Mortgage Loans by Type of Payment
(Percent of Total Mortgage Loans)



…and a large volume of these loans are due to expire around 2034-2039

Maturity Schedule of Non-Amortizing Mortgages
(Billions of Euros)



Source: DNB.

115. A large volume of IO loans is going to mature in 2034-2039. Overall, about 2.78 million households (out of 3.82 million households with mortgage debt) still have either a partial IO mortgage or a 100-percent IO mortgage, while 29 percent of the stock of IO debt matures between 2034-2039 (Figure 33). Due to early repayment, refinancing, and conversion into amortizing loans, this maturity peak has significantly decreased in recent years but remains high. Mortgage providers have never experienced such a large-scale maturity of IOLs and have therefore hardly any data on the related credit and refinancing risk. Depending on the evolution of housing prices by the 2030s, some households could fall into negative equity, while simultaneously facing higher interest rates for the refinancing of their loan and receiving a lower income as they retire, implying that they may not qualify for a new mortgage. As a result, the Financial Stability Committee (FSC) called on banks to take further steps to reduce the risks of interest-only mortgages in November 2021, and DNB has repeatedly called on mortgage lenders to inform customers about the risks of interest-only loans, and to strengthen their risk management.

116. The authorities do not see any systemic risk stemming from the large number of maturing IOLs. The AFM has conducted an analysis on refinancing risks of maturing IOLs (AFM, 2021). Many of the IO mortgages will expire around 2036 at a time when most of the borrowers, who

[31] 24 percent of households under the age of 36 took out a partly interest-only mortgage in 2021Q4 versus 14 percent in 2020Q1.

will have to repay these loans or refinance them, will have retired and may not easily qualify for a new mortgage, thereby being possibly forced to sell their home. The AFM study finds that under a basic scenario where most variables evolve according to their long-term averages (in particular, property values increase by 2.5 percent annually and the interest rate is at 3 percent), an estimated 78,000 households out of the 3 million households with an IO mortgage (2.6 percent) are at risk of having to sell their home.[32] Almost one quarter of them (18,000 households) will not be able to use the sale to pay off their mortgage debt in full and will therefore be left with residual debt.[33] Also, DNB has carried out an internal analysis to evaluate the cumulated losses incurred by mortgage providers (banks and nonbanks), for borrowers who would not be able to refinance their IOLs at maturity (or would die) while the value of their house would fall below the value of residual debt. Results of this analysis indicate that losses would be largely manageable according to authorities, and do not imply any systemic risk. A back-of-the-envelope calculation carried out by IMF also suggests that cumulated losses implied by a similar scenario would remain well below banks' capital. A drop of house prices of 35 percent today, followed by an annual increase of 2 percent in the subsequent years, would translate indeed into a drop of 18 percent by mid-2030, that is of 72.000 euros in the average value of houses. With 18,000 households that could be forced to sell their house and still left with residual debt (as estimated by AFM, 2021), the total loss could amount to 1.3 billion euros (compared to 110 billion euros of Tier 1 capital held by the four largest Dutch banks at end-2022). The sale of houses by mortgage providers could trigger second-round effects on prices, which are however expected to be limited given the structural shortage of housing supply.

117. In response to an AFM campaign launched to monitor vulnerabilities from IOLs, banks have started to take action to address the financial concerns from maturing IOLs of some of their customers. In line with the 2017 FSAP recommendation to "enforce an industry-wide standard approach to informing interest-only mortgage borrowers of their estimated repayment shortfalls", since 2016, the AFM has been encouraging mortgage providers to develop an approach for potentially financially vulnerable customers with an IO mortgage or part IO mortgage. All mortgage providers have rolled out tailor-made approaches for these customers, adopting a proactive management policy, enabling customers to take timely actions to avoid problems at the maturity of loan. Since the rollout of the AFM approach in 2019, mortgage providers have contacted a total of 1.68 million customers with an IO mortgage or part IO mortgage, of which 370,000 have tested whether they would still be able to afford the IO mortgage loan in the future. 744,000 customers have taken action to improve their financial situation by making incidental or periodic mortgage repayments, by converting to a type of part repayment mortgage, or by means of additional savings.

[32] This number is estimated for the 2020-2050 period and can be compared to an average annual number of residential real estate transactions of 190,000 over 1995-2022 (source: Kadaster data).

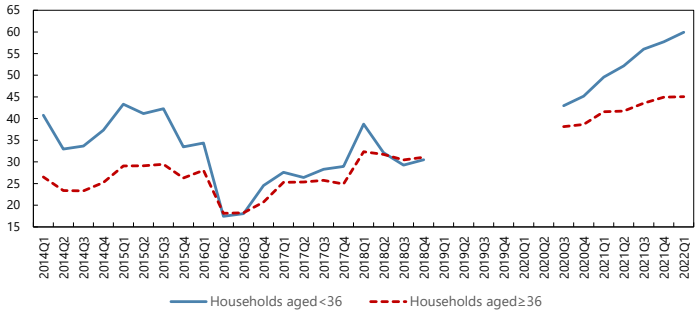
[33] In case of more adverse scenarios – that is a drop in housing prices (-22.6 percent in 5 years) or an increase in interest rates (+2 percentage points, to 5 percent in 5 years) – 44,000 households would be left with residual debt (147,000 in the event of a residential market crisis with housing prices decreasing by -34.7 percent over 5 years). The AFM study however does not consider the effects from a simultaneous increase in the interest rate and a drop in housing prices, which should translate into a larger number of households left with residual debt. As the interest rate increases from 3 to 5 percent over 5 years, housing prices are still assumed to increase by 21.7 percent over the period, or when housing prices drop, the interest rate is supposed to remain at 3 percent.

The number of customers at increased risk has dropped by 63 percent during this process, partly due to actions taken by customers, partly reflecting the increase in house prices.[34]

B. Simulation Analysis of Risks of Mortgage Loans

118. Vulnerabilities have emerged among some borrowers on the back of high housing prices, rising interest rates, and inflation. Housing prices have almost doubled during the 2013-2022 boom with some signs of overvaluation, as suggested by high price-to-income and price-to-rent ratios (see Technical Note on Macroprudential Policy). Some borrowers are more vulnerable than others to a housing price correction. Risks to debt sustainability – that is loans having an LTV>90 percent or a DTI>4.5 – may affect the most recent buyers (who had to purchase houses at higher prices than previous cohorts), buyers with bridge loans, young first-time buyers, and lower-income households. Households have indeed increasingly pushed the borrowing limits for house purchases in recent years, implying higher debt-to-income ratios, especially for young borrowers: around 60 percent of households under the age of 36 and 45 percent of older households have a debt-to-income ratio above 450 percent (Text Figure).[35] Risks to debt-servicing capacity increased with higher interest rates, and higher inflation, since part of consumption (in particular, of basic necessities) cannot be adjusted downward, thereby reducing income available to service debt. These risks are somewhat mitigated in aggregate as the share of mortgages with flexible interest rates in the short term is low, while wages have recorded high nominal growth reaching 10 percent in annual terms in some sectors of the Dutch economy. Still, reports of household defaults have been increasing for several months and, according to the *Nationaal Instituut voor Budgetvoorlichting* NIBUD, a rising proportion of households are facing financial difficulties. This increases the risk that households will be unable to continue meeting their mortgage obligations, potentially leading to growing losses on lenders' mortgage portfolios over time. Against this background, this section investigates the presence of pockets of vulnerabilities among borrowers which could materialize under the FSAP adverse stress test scenario.

Percentage of new mortgages with a debt-to-income ratio over 450 percent



Source: DNB.
Note: data for 2019Q1-2020Q2 are missing due to data quality issues in the transition from the Residential Real Estate (RRE) data to Loan Level Data (LLD).

[34] The risk profile of customers is based on their LTV ratio at maturity and the number of years until the end of the mortgage term, retirement, or the lapse of the mortgage interest relief.

[35] EBA (2022) also notes higher risk-taking borrowing in recent years. "Firstly, loan-to-income ratios of new loans have gradually increased over the past years and an increasing share of new contracts is close to the regulatory Debt-Service-to-Income (DSTI) limit. As a result, half of first-time buyers and 40 percent of home-movers were taking out mortgages exceeding 450 percent of their gross annual income at the end of 2021, compared to 31 percent of both groups at the end of 2018. Secondly, although loan-to-value ratios of new loans have been decreasing due to materializing home equity as a result of the price growth, still nearly half of the mortgages to first-time buyers have an LTV-ratio at or above 90 percent which makes them vulnerable to price declines."

Methodology and Data

119. This subsection describes the data and the approach used by DNB to assess the impact of the FSAP adverse scenario on Dutch borrowers' fragilities. Given confidentiality issues surrounding DNB loan level data (LLD), simulations have been carried out by DNB using its Real Estate Vulnerability Assessment model. This model considers the impact of shocks to the nominal interest rate, nominal wage growth, inflation, unemployment, and housing prices, on borrowers' DSTI and LTV ratios, as well as their implication for the PDs and the expected LGD of banks' mortgage portfolios (see Box 1 for details). Given the current limitations of the model, PDs and LGDs are only reported at the aggregate level. For more granular analysis by groups of borrowers (e.g., based on LTV and DTI ratios, age, or income), only the changes in the shares of the borrowers are reported. In particular, high-risk borrowers are defined as borrowers with current DSTI ratios breaching 90 percent of the DSTI limits defined by NIBUD.[36] For simplicity, 2023 DSTI limits are applied to define high-risk borrowers, providing conservative results, as limits have been tightened over time. Also, rather than directly using the DSTI limits, the simulations consider equivalent LTI limits corresponding to the DSTI limits under a 30-year amortization period.

120. The LLD contains a large sample of Dutch mortgages with detailed information. The LLD is a quarterly administrative panel dataset, collecting information on six million loans and three million borrowers (as a mortgage typically consists of multiple loans). The dataset has low measurement error thanks to its administrative nature while it is checked annually by households who must approve or correct the pre-loaded information when posting their tax forms. The LLD contains about 75 variables related to the loans, such as the mortgage provider and borrower, the loan types, interest rates, borrowers' participation in the NHG, origination and maturity, current property evaluation, as well as some information about the borrowers at origination (e.g., income, type of employment, age, and area code). Due to current legal issues in collecting information for the LLD, the latest version used for the simulations is from 2022Q1.

121. Almost three quarters of mortgages of the LLD sample are held by borrowers older than 45, and 97 percent of the loans are outside Amsterdam. The bulk of borrowers in the LLD are older than 45, with the age buckets 45-55 and 55-65 each representing 23 percent. Almost 96 percent of the loans have an LTV ratio under 90 percent, much more than the 50 percent reported in the 2013 sample used in the 2017 FSAP, reflecting the fact that many borrowers have benefited from booming prices in the past decade.[37] In contrast, and because of higher housing prices, the distribution of LTI ratios has shifted to the right compared to the sample of the 2017 FSAP, with 87 percent of mortgages having LTI ratios above 3, as opposed to 34.5 percent for the 2013 sample (Table 13).

[36] For setting the DSTI ratios, the MoF uses input from an independent organization (without any required commitment), the NIBUD. The maximum allowed DSTI ratios are set each year by NIBUD, taking a microprudential perspective primarily based on the available income for individual households. DSTI limits are increasing with the income level and with the interest rate paid (see the Technical Note on Macroprudential Policy Framework for additional details). These income-specific limits are those applying to borrowers in practice and are therefore more relevant for a stress test analysis than a flat DSTI limit.

[37] See Table 6 of IMF (2017).

Box 1. The Netherlands: DNB Real Estate Vulnerability Assessment Model

DNB's Real Estate Vulnerability Assessment Model is a scenario-based tool assessing the impact of income, interest rate, and housing price shocks on borrowers' DSTI and LTV ratios over a 3-year horizon.

Changes in interest rate, inflation, nominal wage growth, and unemployment, affect the DSTI ratio through their impact on debt and disposable income according to:

$$DSTI_t\ (shock) = \frac{Instalment\ due_t\ (\Delta r_t)}{Disp.\ income(\Delta \pi_t, \Delta w_t, \Delta U_t)},$$

where installment due depends positively on the change in the nominal interest rate *r*, and nominal disposable income depends negatively on the changes in inflation π and unemployment *U*, and positively on the change in nominal wage growth *w*. The negative relationship between inflation and the nominal income available to service debt reflects the assumption that consumption remains fixed in real terms, implying an increase in nominal consumption as inflation increases. This is clearly a conservative assumption neglecting possible consumption cuts by households to service their debt and transmitting all the inflation risk to financial institutions.[1] When applying the interest shock to the DSTI ratio in a given quarter, mortgages are divided into three groups: variable rates, fixed rates, and loans with an interest rate reset.

The LTV ratio depends negatively on the change in housing prices according to:

$$LTV_t\ (shock) = \frac{Outstanding\ debt_t}{Property\ value(\Delta HP_t)},$$

The changes in DSTI and LTV ratios are then used to compute changes in the PD and the expected loss (EL) given default of banks' mortgage portfolios, according to:

$\Delta PD_t = \varepsilon_{DSTI} DSTI_t\ (shock) + \varepsilon_{LTV} LTV_t\ (shock)$, and

$\Delta EL_t = \Delta PD_t(LTV_t) \cdot \Delta LGD_t(LTV_t)$.

Where the elasticities of the probability of default to the change in the DSTI ratio and to the change in the LTV ratio, respectively ε_{DSTI} and ε_{LTV}, are estimated using the loan-level data sample over the years 2012-2018 and the loss given default is the difference between the value of the loan and the value of the real estate property at the time of the default, net of the NHG.

Additional assumptions of the model include:

- The absence of new loans over the simulation horizon. Existing exposures decline over the horizon due to amortization (for amortizing loans only) while new mortgage issuances are not considered over the scenario, so that only existing exposures are in scope. There is no endogenous behavior of borrowers, for example in the form of pre-payments;
- A fixed net replacement rate. The net replacement rate for unemployment is fixed at 73 percent of income, based on OECD estimates, implying that when households move from employment to unemployment, they face a 27-percent negative income shock, independently of inflation and wage growth dynamics;
- An absorbing state of unemployment. Unemployment follows a Bernoulli distribution, with the probability of getting unemployed equal to the difference in the unemployment rate between *t* and *t*-1. Once unemployed, the agent remains unemployed for the rest of the stress test horizon, which is a conservative assumption.

1/ The debt overhang assumption has two opposite implications for households' defaults: (i) a smaller increase in defaults, as households prioritize debt servicing over consumption; (ii) a more severe slowdown in activity, increase in unemployment, increase in the number of households in distress. Because the first effect is likely to dominate, not including the debt overhang in the analysis provides conservative results with respect to the stress of the household sector.

Results

122. In aggregate, the proportion of borrowers at risk increases moderately in the adverse scenario compared to the baseline. The proportion of borrowers with a high LTV is almost 11 percentage points higher in the adverse scenario than in the baseline, as the LTV ratio increases significantly in the adverse scenario due to the large drop in housing prices over the three years (-29 percent in cumulative terms). However, for all types of households considered, the proportion of borrowers with a high DTI or with a high DSTI ratio increased less sharply, being respectively only 4 and 3 percentage points higher compared to the baseline (Figure 34). These results, however, hide significant heterogeneity across borrower groups.

123. Lower-income borrowers are the most vulnerable according to the high-DTI and high-DSTI ratios criteria, but the proportions of those households at risk increase only moderately under the adverse scenario. The lowest-income households have a higher proportion of borrowers with a DSTI ratio above 25 percent, as these households are more likely to borrow at the limit. Likewise, low-income households show a high proportion of borrowers with a high DTI ratio. In contrast, those households do not show a high proportion of borrowers with high LTV ratios compared to low-income households (Figure 35).

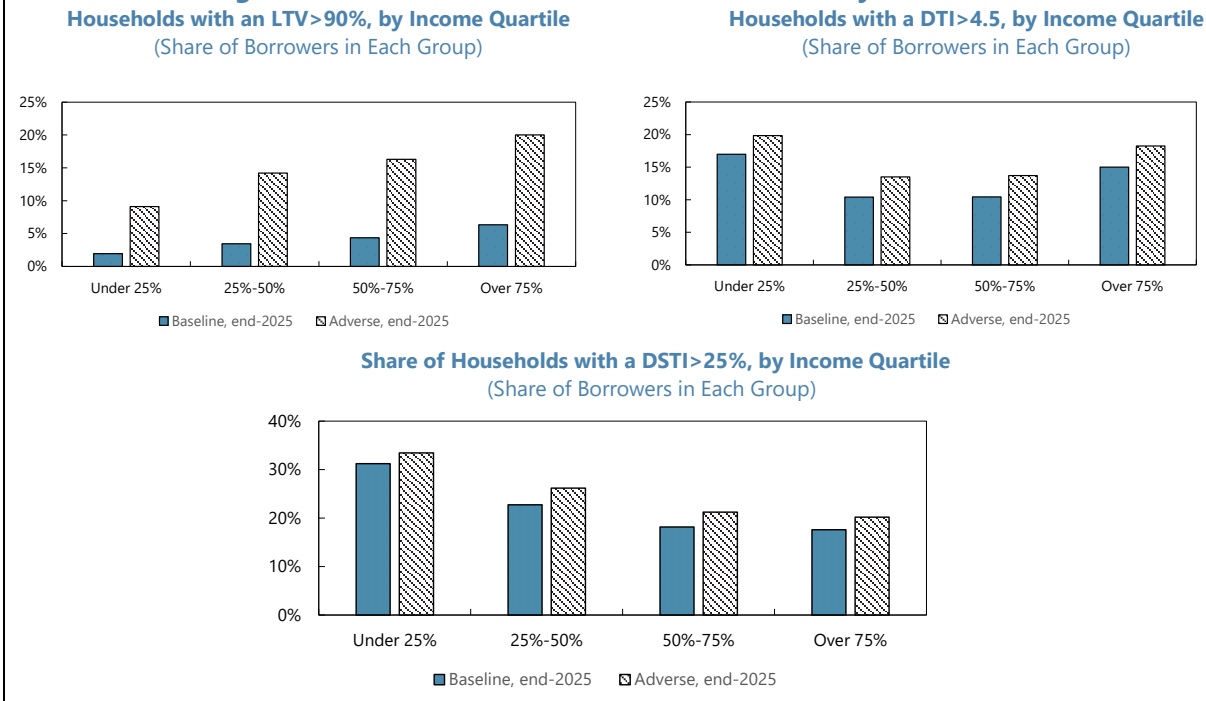
124. The proportion of borrowers at risk almost triples in the adverse scenario compared to the baseline, while safer borrowers become less numerous. The proportion of borrowers considered at risk based on the joint LTV and DTI distribution (that is borrowers with an LTV above 80 and a DTI above 4), increases from 4.3 percent in the baseline scenario to 11 percent in the adverse scenario. In contrast, the safest borrowers see their proportion decreasing from 73.6 percent in the baseline to 58.5 percent in the adverse scenario as the distribution of risky loans shifts to the right (Figure 36).

125. Young borrowers are more likely to be at risk according to the high-DSTI and high-LTV criteria, but not with respect to the high-DTI criterion, thanks to a lower proportion of IOLs. Differentiating the various groups of borrowers by age indicates that the youngest households are those with the highest proportion of borrowers with a high LTV ratio, as young borrowers are more likely to have purchased houses at high valuations than older ones (Figure 37, Panel 1). In contrast, young households are not those with the highest proportion of high DTI ratios in the adverse scenario (Figure 37, Panel 2). This is because IOLs are much more common among old households than among young ones (Table 13), while IOLs are associated with more debt given the absence of debt repayment over the life of the loan. Finally, young borrowers are more likely to have a high proportion of individuals with a high DSTI as they tend to borrow at the limit (Figure 37, Panel 3). Interestingly, the proportion of households at risk according to the DSTI limit barely changes in the adverse scenario for older borrowers, reflecting the fact that older borrowers are relatively shielded from the negative shock on income stemming from higher unemployment, since most of them are retired.

Figure 34. The Netherlands: Evolution of Financial Vulnerability Variables Over the Stress Test Horizon

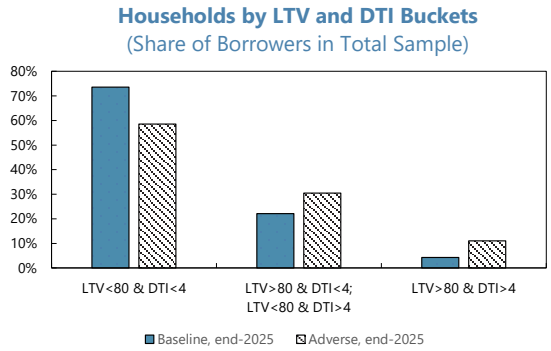
Source: DNB Real Estate Vulnerability Assessment Model based on 2022Q1 LLD.

Figure 35. The Netherlands: Households at Risk by Income Quartile



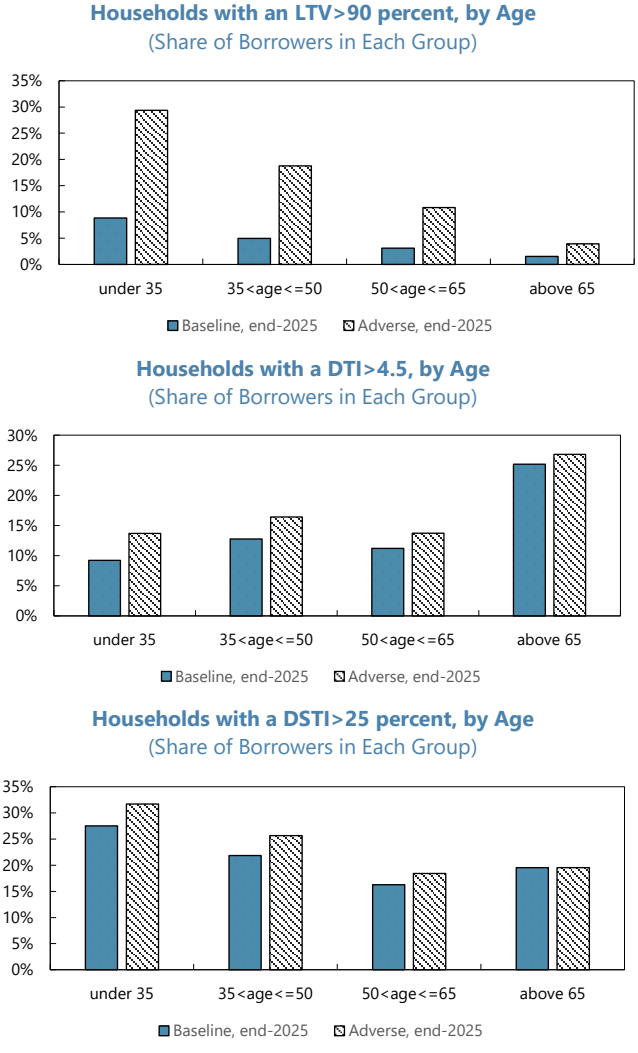
Source: DNB Real Estate Vulnerability Assessment Model based on 2022Q1 LLD.

Figure 36. The Netherlands: Households at Risk by LTV and DTI Joint Distribution



Source: DNB Real Estate Vulnerability Assessment Model based on 2022Q1 LLD.

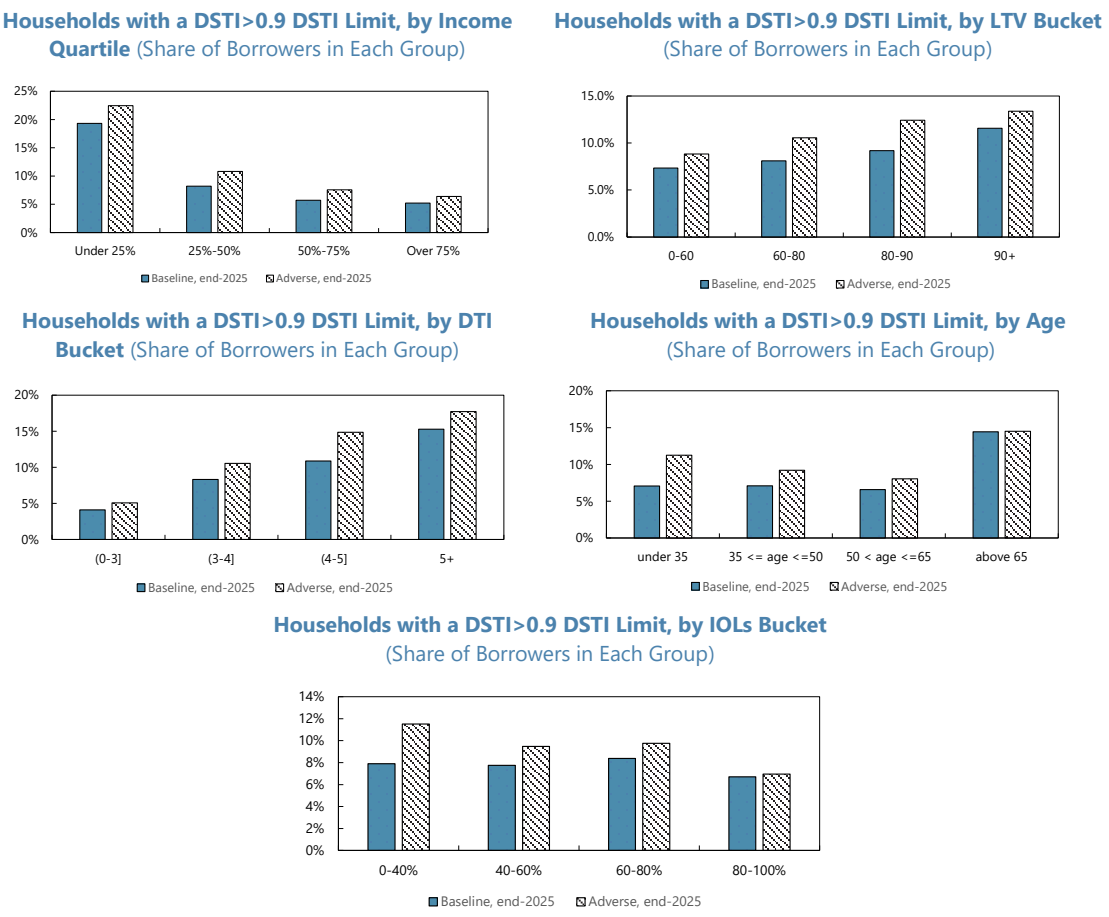
Figure 37. The Netherlands: Households at Risk by Age Groups



Source: DNB Real Estate Vulnerability Assessment Model based on 2022Q1 LLD.

126. The analysis based on the breaching of the NIBUD DSTI limit confirms that young, low-income households, and households with high LTV and high LTI ratios tend to be hit harder by the shock. Results from simulations using the breach of the 90-percent of the DSTI limit set by NIBUD to define high-risk borrowers confirm that young and lower-income households are those seeing the largest increase in the proportion of high-risk borrowers under the stressed scenario (Figure 38). At the aggregate level, the proportion of high-risk borrowers increases moderately in the adverse scenario (from a starting point of 6.6 percent to 8.2 percent three years later). This proportion increases much more among borrowers with the lowest incomes (from 19.3 to 22.5 percent), as well for younger borrowers under 35 (from 7.1 to 11.3 percent). Likewise, high-risk borrowers with initially high LTV and DTI ratios see the largest increase in their proportion under the stress. In contrast, the proportion of high-risk households with a large share of IOLs is barely increasing. This result reflects again the fact that households with a high share of IOLs are older than other households (as very large shares of IOLs are mainly observed among older loans) and are therefore barely impacted by the income shock coming from higher unemployment, since they have already retired.

Figure 38. The Netherlands: Risky Borrowers (with DSTI Ratio > 0.9 DSTI Limit)



Source: DNB Real Estate Vulnerability Assessment Model based on 2022Q1 LLD.

C. Recommendations

127. The household stress test model could be refined by calibrating some of its equations by group of borrowers and by using alternative DSTI thresholds to identify borrowers at risk, complemented by some sensitivity analysis. DNB's stress test approach of households' mortgages analyses the evolutions of the proportions of borrowers considered at risk (that is borrowers with financial vulnerability metrics such as the LTV or the DTI ratios above given thresholds) under various scenarios but does not use the estimated PDs and LGDs from the Real Estate Vulnerability Assessment Model. The reason is that the probability of default in the model is related to the DSTI and the LTV shocks through elasticities which have been estimated over a sample comprising all types of borrowers, while these elasticities probably differ across groups of borrowers and types of loans. DNB would then need to estimate elasticities of the PD to the DSTI and the LTV shocks for various sub-groups of borrowers, to be able to fully use the output from the Real Estate Vulnerability Assessment Model. In addition, the model could also consider DSTI thresholds that would better reflect the probability of distress of borrowers (and not only a 25-percent limit applying to all types of borrowers).

CORPORATE SECTOR ANALYSIS

A. Overview of Corporate Sector

128. The non-financial corporate (NFC) sector in the Netherlands appears to have recovered from the downturn caused by the Covid-19 pandemic. The sector experienced a significant decline in value-added during the first two quarters of 2020, primarily due to lower demand, especially in service industries like transportation, accommodation, and food service. Nevertheless, there has been a rapid recovery in the sector's value-added, constituting 93.4 percent of total value-added as of the third quarter of 2023 (Figure 39).

129. Despite signs of recovery, bankruptcies have risen due to the tightened financial conditions, and are approaching pre-pandemic levels. The favorable financial conditions that followed the pandemic helped ease the debt burden on firms, preventing them from filing for bankruptcy. However, as monetary policy tightens, bankruptcies have increased, with a noticeable surge in the construction and service sectors. Nevertheless, the unemployment rate remains at historically low levels due to high levels of labor participation.

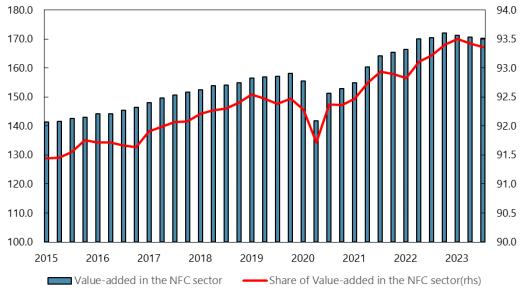
130. Corporate sector debt has fallen relative to GDP, but the sector may face difficulties in paying down debt if tight financial conditions persist. While the debt-to-GDP ratio has declined, NFC debt, which encompasses debt securities and loans, increased with the recovery from the pandemic and remains elevated compared to pre-pandemic levels. In particular, the corporate sector's dependence on short-term securities and loans has increased since 2021, suggesting that rising interest rates could strain debt servicing capabilities. NFCs tend to rely on CRE/RRE as collateral for funding their activities.

131. Within the EA, the Netherlands ranks the fourth highest in debt-to-surplus ratio, suggesting a need to sustain profitability. Despite having high debt-to-surplus ratios, Dutch firms demonstrate resilience, maintaining gross profit rates above 45 percent for the past decade, reaching 48.3 percent in 2022, surpassing the EA average.

Figure 39. The Netherlands: Stylized Facts in Corporate Sector

The non-financial corporate sector in the Netherlands has recovered from the pandemic …

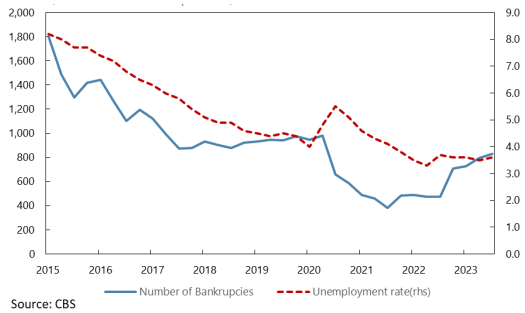
Value-added and Share of Value-add in the NFC Sector
(in mil. Euros; in percent)



Source: CBS

… but bankruptcies have risen due to the tightened financial conditions.

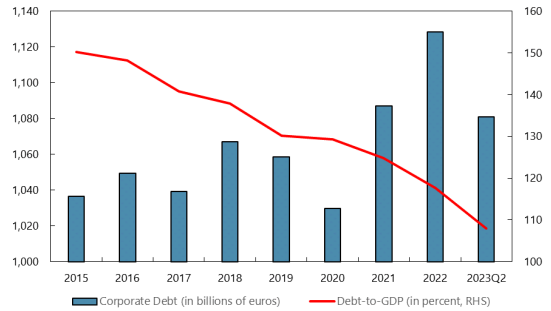
Bankruptcies and Unemployment Rate
(Number of Firms; in percent)



Source: CBS

Corporate sector debt has fallen relative to GDP, but the level of debt increased with the recovery from the pandemic.

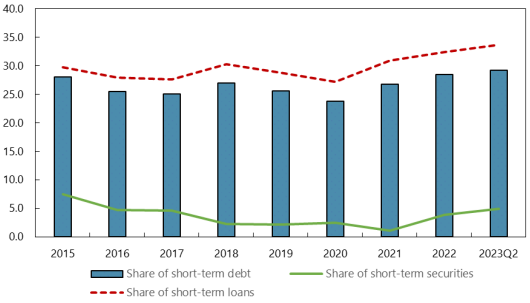
Non-Financial Corporate Debt



Source: CBS and IMF Staff Calculation

The corporate sector's dependence on short-term debt has increased since 2021.

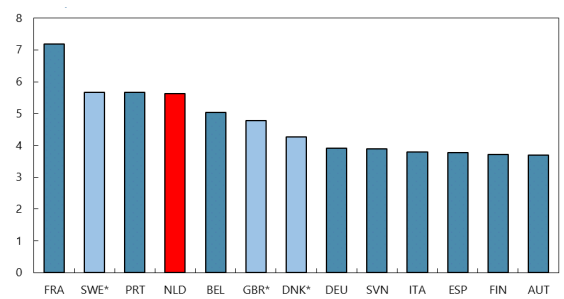
NFC Sector's Dependence on Short-term Debt



Source: CBS and IMF Staff Calculation

Dutch firms have high debt-to-surplus ratio within the EA …

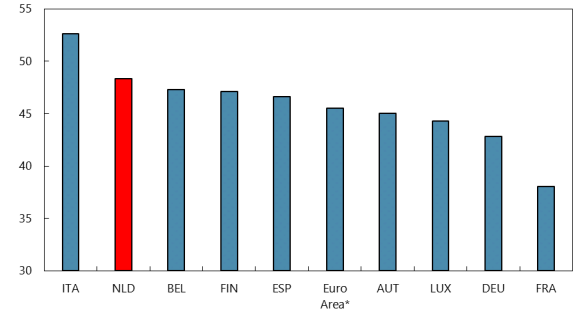
NFC Debt-to-Surplus Ratio
(in percent, 2022)



Note: Luxembourg, being an outlier, is omitted despite its top ranking.
Source: OECD * indicates non-EA Countries

… but they have sustained profitability, surpassing the EA average.

Gross Operating Surplus to Gross Value Added
(in percent)



Source: OECD * indicates 2020 data

B. Corporate Sector Vulnerabilities with Firm-level Data

132. The FSAP team used NFC data from the Orbis database, encompassing balance-sheet information for both private and publicly listed companies, over the period 2001-2022. The Orbis database, maintained by Bureau Van Dijk, provides comprehensive financial data on both private and listed firms, enabling a breakdown by economic sector (using the NACE Rev. 2 classification).[38] For analytical purposes, the FSAP team narrowed its focus to non-financial corporations by excluding financial firms classified under the NACE K section. Additionally, the sample was restricted to firms with data available from 2019 to 2021.

133. Data limitations prevent the utilization of all observations. Excluding financial corporations and restricting the sample to firms with recent data reduces the number of firms from over 750,000 to approximately 338,000. The lack of interest payment or financial expenses data further diminishes the sample size to 3,369 (Table 14). While the sample represents 72 percent of total NFC assets, the sample may not be representative of the Dutch NFC sector. Compared to the sectoral distribution of firms reported by *Central Bureau voor de Statistiek* (CBS), sectors such as mining (BDE), manufacturing (C), and wholesale and accommodation (GHI) are overrepresented, while professional (MN), public (OPQ), and other (RSTU) service sectors are underrepresented.

134. The team used two financial indicators to evaluate the financial vulnerability of Dutch firms: the interest coverage ratio (ICR) and cash balance. The ICR for a given period measures a firm's ability to service its debt obligations using current earnings without resorting to asset sales. It is calculated by dividing earnings before interest and taxes (EBIT)[39] by interest payments expenses payable on liabilities. Generally, a firm's debt-serving capability is considered weak when its ICR falls below 1. The cash balance serves as another indicator measuring a firm's financial needs. It is defined as the sum of initial cash balance and EBIT net of interest payments and taxes. A negative cash balance suggests that a firm needs to liquidate its assets or borrow funds.

135. After years of decline, the proportion of firms having trouble in repaying debt has shown signs of reversal since 2018. The favorable financial conditions during the pandemic period eased debt-servicing burdens. However, with rising interest rates, an increasing number of firms are anticipated to encounter debt-repayment difficulties. In particular, the number of firms with ICRs lower than 1 exhibited a consistent upward trend in the wholesale, transportation, and accommodation (GHI), real estate service (L), and professional service (M) sectors.

136. The need for external financing has generally decreased over the past decade, possibly due to larger companies' tendency to accumulate cash reserves. However, as debt repayment pressures intensify due to rising interest rates, some firms may be forced to increase their leverage to

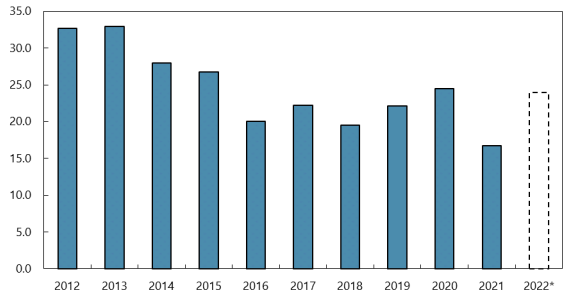
[38] NACE (Nomenclature of Economic Activities; nomenclature statistique des activités économiques dans la Communauté européenne) is the European statistical classification of economic activities.

[39] Although earnings before interest, taxes, depreciation, and amortization (EBITDA) offers a more comprehensive measure of profitability, EBIT is employed in this analysis due to the limited availability of EBITDA data. However, it is worth noting that for many firms, EBIT and EBITDA are identical, indicating that the selection of metric is not critical.

meet their financial obligations. Despite the overall decline in the proportion of firms with negative cash balances in 2021, the vulnerable sectors with low ICRs continue to exhibit lower cash balances compared to other sectors. These findings are broadly aligned with DNB and the CPB's research on the effect of Covid-19 on small-to-medium enterprises' (SMEs') liquidity needs, which showed that the greatest need for liquidity is in accommodation and transportation sectors.

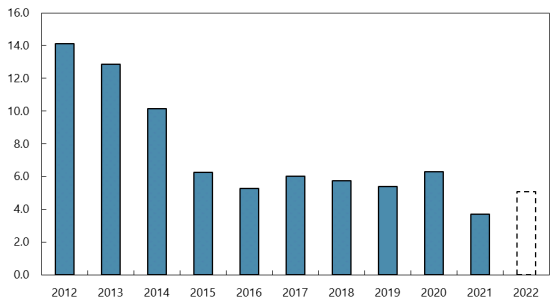
Figure 40. The Netherlands: Firms with Low ICR and Cash Balances

Share of Firms with ICR < 1
(in percent)



Note: The number of observations drops markedly for year 2022 due to reporting lags.
Source: Orbis, IMF staff calculation.

Share of Firms with Cash Balance < 0
(in percent)



Note: The number of observations drops markedly for year 2022 due to reporting lags.
Source: Orbis, IMF staff calculation.

C. Dynamic Scenario-based Stress Test

137. This analysis employs a dynamic scenario-based approach, developed by Tressel and Ding (2021), to evaluate the impact of both baseline and adverse scenarios[40] on firms' debt-servicing capabilities and borrowing needs. The methodology relates firm-level financial indicators to past structural and cyclical characteristics, industry fixed effects, and macro-financial conditions, using a firm-level panel regression over the period 2001-2021. Under each scenario over the period 2022-2025, shocks to macro-financial variables such as GDP growth and short- and long-term interest rates affect firms' ICRs and cash balances through accounting identities and regression projections (See Annex D).

138. As described in the section of bank solvency stress tests, short- and long-term interest rates increase and remain elevated in both scenarios, while GDP experiences negative growth rates in the adverse scenario. The adverse effects are most pronounced in 2023, with a gradual recovery towards the steady state. Nevertheless, even in 2025, GDP growth rates remain below 2022 levels, and both interest rates exceed 2022 levels.

139. Both scenarios trigger a substantial increase in the proportion of firms facing debt-servicing difficulties and borrowing needs, with the adverse scenario having significantly more severe repercussions. The share of firms with ICR below 1 shoots up from 8.2 percent in 2022 to 31.5 percent in 2023 under the adverse scenario, while it rises by only 5.3 percentage points under

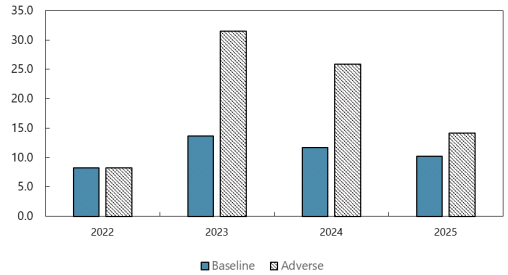
[40] The adverse scenario used in this analysis is the same as the one used for the bank solvency stress test.

the baseline scenario (Figure 41). Similarly, under the adverse scenario, the proportion of firms with negative cash balances doubles from 2022 to 2023, reaching a peak of 20.6 percent in 2024. In the baseline scenario, the proportion of firms with negative cash balances is higher than in 2022, hovering around 10 percent.

Figure 41. The Netherlands: Corporate Stress Test

The adverse scenario triggers a significant spike in the proportion of firms facing debt repayment difficulties …

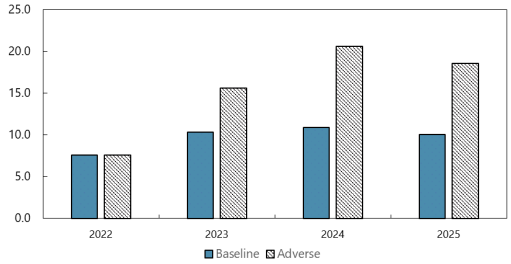
Share of Firms Facing Debt Serving Problem (ICR<1)
(in percent)



Source: Orbis, IMF Staff Calculation.

… coupled with a substantial increase in the proportion of firms with borrowing needs.

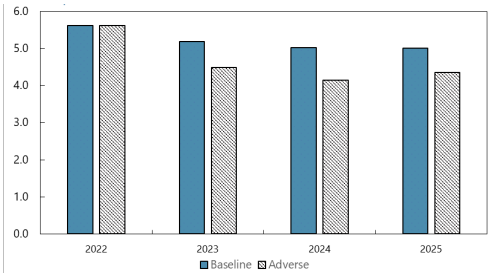
Share of Firms with Borrowing Needs (Cash<0)
(in percent)



Source: Orbis, IMF Staff Calculation.

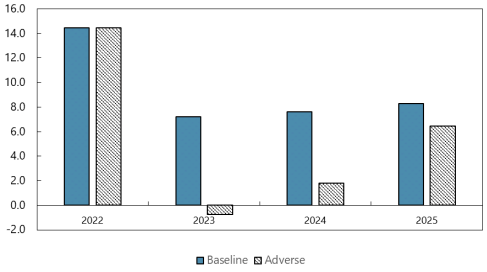
The subdued GDP growth weakens firms' earnings and hinders sales growth

Return on Assets
(in percent, median)



Source: Orbis, IMF Staff Calculation.

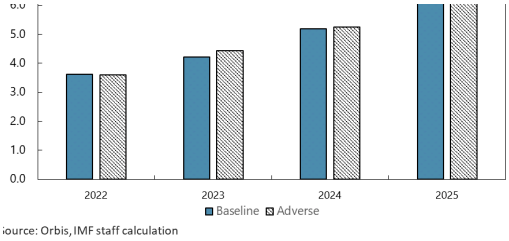
Sales Growth Rate
(in percent, median)



Source: Orbis, IMF Staff Calculation.

Lower earnings coupled with high interest rates increase external finance needs.

Debt Increase
(in percent of total assets, median)



Source: Orbis, IMF Staff Calculation.

Regression results are presented below.

	ROA	Leverage	Sales Growth
ROA(-1)	0.581***	-0.086***	-0.267***
	(0.020)	(0.026)	(0.059)
Leverage(-1)	-0.000	0.904***	0.007
	(0.006)	(0.008)	(0.019)
Sales Growth(-1)	-0.007**	-0.001	0.019
	(0.002)	(0.002)	(0.017)
Asset Tangiblity Ratio (-1)	0.009**	0.001	-0.035**
	(0.003)	(0.003)	(0.017)
Cash Flow Generation Ratio (-1)	0.004***	0.004***	-0.023***
	(0.001)	(0.001)	(0.003)
Size (-1)	0.052	0.172	-1.471***
	(0.077)	(0.135)	(0.428)
Real GDP Growth (-1)	0.187***	-0.008	2.102***
	(0.061)	(0.043)	(0.192)
Sector FE	YES	YES	YES
Observations	18,056	16,472	18,047
R-squared	0.387	0.966	0.084

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

140. The findings are primarily driven by the combination of weakened earnings and elevated debt burdens under the scenario of economic contraction coupled with higher interest rates. The subdued or negative GDP growth rate impedes sales growth, leading to lower earnings. Furthermore, the increase in both short- and long-term interest rates exacerbates the debt burden of firms. This compounding effect prolongs the recovery process, making it significantly slower under the adverse scenario.

D. Recommendations

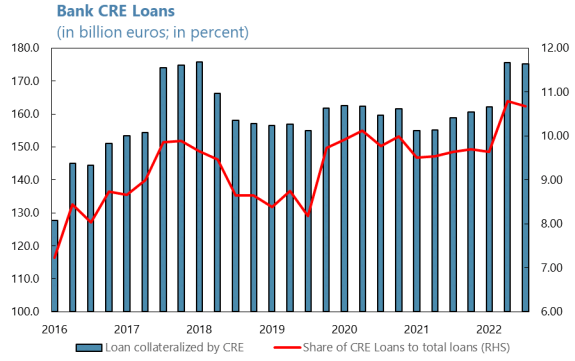
141. Emerging from the pandemic's shadow, the Dutch NFC sector exhibits signs of sustained profitability, albeit with a caveat – the elevated debt burden raises concerns under the prevailing high-interest rate environment. Stress test results indicate that the NFC sector is susceptible to the adverse effects of lower growth and tighter financial conditions. Given the current elevated interest rates, these adverse impacts could persist for an extended period.

142. These findings underscore the importance of vigilant monitoring of the corporate sector, particularly firms with shorter maturity profiles. A more granular examination of corporate balance sheets and financial conditions is warranted. Additionally, since NFCs tend to rely on RRE and CRE as collateral for funding, access to bank loan-level data would provide a clearer understanding of the borrowing terms and maturities faced by individual firms.

COMMERCIAL REAL ESTATE ANALYSIS

A. The Commercial Real Estate Market in the Netherlands

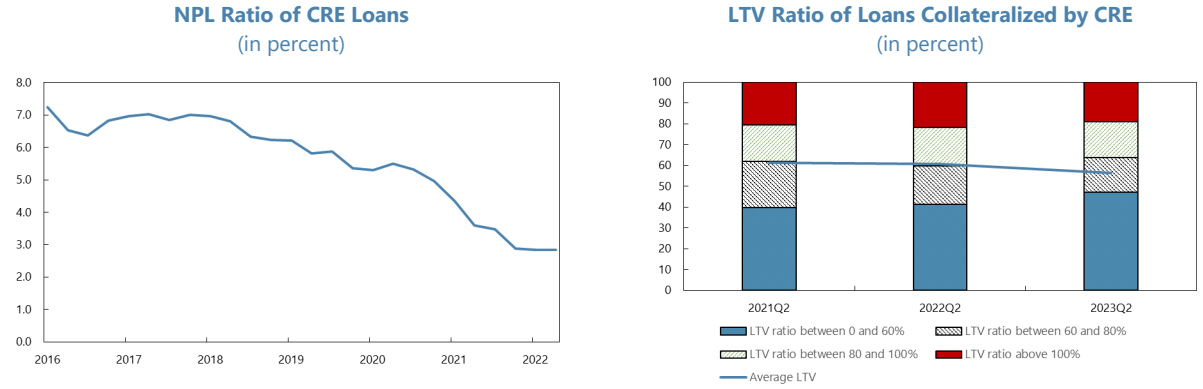
143. Dutch financial institutions hold significant investments in CRE. The total CRE exposures of Dutch banks, pension funds and insurers stand at approximately 360 billion euros, both domestically and internationally. Bank loans to the CRE sector account for 7 percent of the balance sheet and 10.7 percent of total loans.



Source: DNB

144. Dutch banks do not face significant credit risks in their CRE exposures. The NPL ratio for CRE loans has consistently decreased, reaching a historically low level of 2.8 percent in 2022Q4 (Figure 42). Moreover, the average LTV ratio of CRE loans remains below 60 percent in 2023Q2, lower than the average recovery rate of 70 percent for foreclosed CRE. Additionally, there has been a recent growth in the proportion of CRE loans with LTV ratios below 60 percent, indicating banks' capacity to absorb losses by selling the underlying collateral in case of defaults. However, financial conditions and CRE price growth will continue to affect prospects for these exposures (Figure 42).

Figure 42. The Netherlands: NPL Ratio and LTV Ratio of CRE Loans

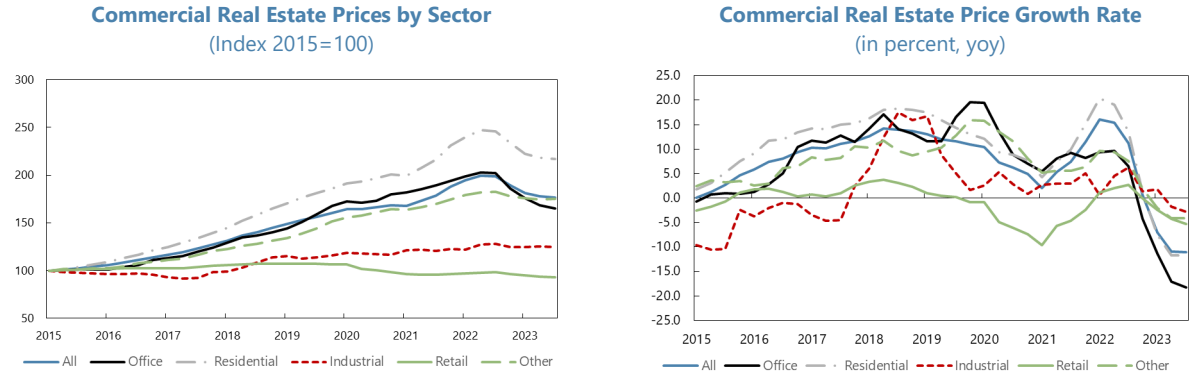


Source: DNB.

Source: DNB.

145. CRE prices in the Netherlands doubled in value between 2015Q1 and 2022Q2, with significant declines thereafter. While the pandemic temporarily slowed this growth rate, particularly in the retail sector,[41] overall CRE price growth rebounded quickly (Figure 43). However, this upward trend was abruptly reversed in the second half of 2022, with substantial price declines under tightened financial conditions. Notably, residential[42] and office properties, which experienced the most substantial price increase until early 2022, have recently undergone a pronounced downturn.

Figure 43. The Netherlands: Commercial Real Estate Prices



Sources: MSCI Real Estate and IMF Staff Calculation.

Sources: MSCI Real Estate and IMF Staff Calculation.

146. A sudden drop in CRE prices can pose credit risks to banks and other financial institutions as many companies use their CRE as collateral for borrowing. To assess credit risks effectively, granular loan-level data for CRE bank loans is crucial. However, due to limited access, the

[41] This classification follows MSCI's sector level classification, which includes retail, office, industrial, residential, and others. Others include properties for leisure, education, healthcare, land, parking lots, etc.

[42] The residential segment within CRE sector refers to professionally managed residential real estate portfolios, held by institutional investors such as insurers and pension funds.

following sections will focus on CRE prices in isolation, examining potential downside risks of CRE prices using the CRE price at risk (CaR) approach (IMF, 2021).

B. CRE Price-at-Risk Analysis

147. Price misalignment serves as a crucial indicator for assessing the vulnerability of the CRE sector. When market prices deviate from fundamental values, a price correction in the opposite direction becomes more probable. A significant disparity between market prices and fundamentals may result in a swifter correction once the associated risks materialize. This hypothesis could extend beyond the CRE sector and apply to various other asset markets.

148. Due to constraints on data availability, this analysis uses the capitalization rate to estimate price misalignment. CRE price, valuation, and net operating income data are sourced from MSCI Real Estate Database. Capitalization rate, calculated as the ratio of net operating income to CRE valuation, gauges profitability and associated risks in CRE investments. The capitalization rate is proxied by net operating income yield, computed as the ratio of net income over the preceding 12 months to the capital value at the period's end date. A higher capitalization rate implies a higher potential return, while a lower rate signifies a higher valuation.

149. The capitalization rate has been on a downward trend since the GFC, signaling elevated valuations in the CRE market, particularly within the office sector. The upward trend in office prices leading up to the pandemic coincided with a decline in the capitalization rate, dropping from 6.5 percent in 2008Q4 to 3.4 percent in 2019Q4. Although CRE prices continued to rise until early 2022, the impact of reduced rental income due to remote working or mobility restriction, has driven up the capitalization rate. Moreover, with recent CRE price growth turning negative, there has been a corresponding shift in the trend of capitalization rates.

150. Price misalignment can be calculated by applying the Hodrick-Prescott (HP) filter to the capitalization rate, which separates the trend component of the time series from its cyclical component. The trend component represents the long-term growth of CRE prices, while the cyclical component represents their short-term fluctuations. A prolonged deviation from the long-term trend indicates an accumulation of vulnerabilities, increasing the likelihood of a future price correction. Defined in this way, CRE price misalignment in the Netherlands has been positive from 2016Q4 to 2022Q3, making the CRE sector vulnerable to adverse shocks, such as higher interest rates.

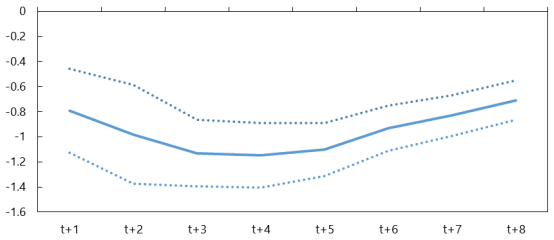
151. The CaR methodology is used to assess downside risks to CRE prices over different horizons and to identify the impact of CRE price misalignment on future price corrections. The estimated effect of price misalignment over different horizons allows us to establish a term-structure of CRE price risks, reflecting short-term and medium-term responses to a given factor. The estimation methodology follows previous studies (e.g., Deghi et al. (2021), IMF (2021), and Canay (2011)), but uses the panel quantile estimation methodology of Machado and Santos Silva (2019).

Due to the limited length of Dutch CRE price time series, we employ a cross-country panel sample encompassing 12 European countries (See Annex E).[43]

152. An increase in CRE price misalignment is associated with higher downside risks in CRE price growth over time. In this analysis, CaR is defined as the 5th percentile of the conditional distribution of future CRE price growth. A one-standard deviation increase in CRE price misalignment, which is equivalent to 24 basis points, is associated with a cumulative 3.4 percentage point increase in downside risks to CRE prices (or decrease in CaR value) over four quarters. The association between current price misalignment and future price correction demonstrates a prolonged impact (Figure 44).

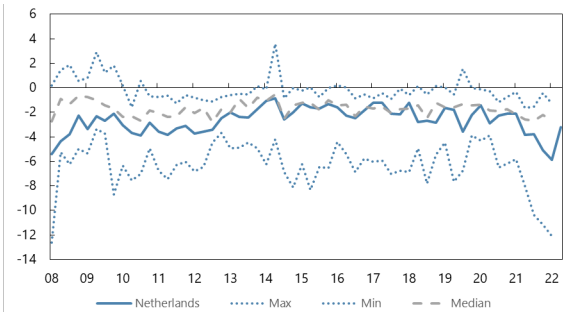
Figure 44. The Netherlands: CRE Price Misalignment and CRE Price-at-Risk

Effect of CRE Price Misalignment on CaR
(in percent, average q-o-q growth)



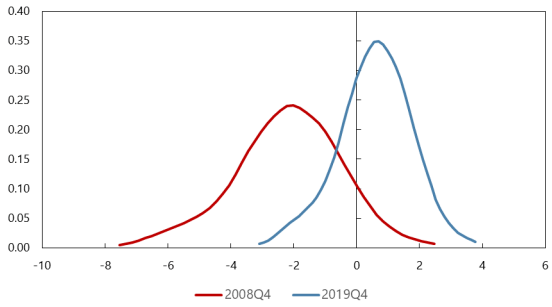
Note: The solid line denotes the association between one standard deviation increase in CRE price misalignment and downside risk to CRE prices growth (CaR), defined as the 5th percentile of the CRE prices growth distribution, at different horizons. The dotted lines show the confidence internal for a one-standard deviation.
Sources: MSCI Real Estate and IMF Staff Calculation.

CRE Price at Risk across Sample Countries
(in percent, average q-o-q growth)



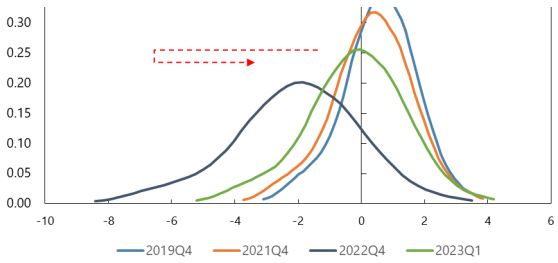
Sources: MSCI Real Estate and IMF Staff Calculation.

4 Quarter-ahead CRE Price Growth Distribution
(density, average q-o-q growth)



Sources: IMF Staff Calculation.

CRE Price Growth Distributions
(density, average q-o-q growth)



Sources: IMF Staff Calculation.

153. CaRs in the Netherlands have stayed below the median of its peers, indicating elevated downside risks in the CRE sector. These CaR values significantly vary across countries and fluctuate over time. In case of the Netherlands, CaR has hovered around -2 percent since 2012, recovering

[43] The sample includes Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, and the UK.

from the GFC and European debt crisis. Notably, CaR increased from -5.4 percent in 2008Q4 to -1.6 percent in 2019Q4 before the onset of the pandemic.

154. The downside risks to CRE price growth increased after the pandemic, partly reflected in the sharp price drop in 2022, and continued to remain elevated. Throughout the pandemic, the distributions of future CRE price growth rates shifted to the left, indicating higher downside risk. The consistently high valuation of CRE before the pandemic made the sector vulnerable to adverse shocks, such as higher interest rates. The risks materialized in the second half of 2022, leading to a substantial decline in CRE prices amid tightened financial conditions. Following a temporary shift further to the left, the distribution returned closer to historical levels. However, the low CaR value in 2023Q1 indicates that downside risks remain elevated compared to pre-pandemic levels.

	2019Q4	2020Q4	2021Q4	2022Q4	2023Q1*
Realized Average Growth Rate	1.53	1.82	2.71	-2.89	-2.24
CaR_5	-1.63	-1.45	-2.11	-5.88	-3.21
*All values are the quarterly average over future four quarters, except for 2023Q1 which is the averaged value over recent three quarters.					

C. Recommendations

155. As the downside risks in the CRE market remain elevated, close monitoring of CRE market development is warranted. Compared to the RRE sector, public data on the CRE market is limited. CBS provides a CRE price index based on the transaction data from the Land Registry (*Basis Registratie Kadaster*) and the registry data of addresses and buildings (*Basisregistraties Adressen en Gebouwen*). However, there is a significant discrepancy between the price index and market data from private vendors. Given the ample granular data sources available to authorities, some exploration of how to close the gap between market and the CBS price is warranted.

156. As the CRE market is closely linked to both corporate and financial sectors, stress testing exercises with granular loan level CRE data could be also considered. One caveat of this analysis is the absence of a connection between CRE prices and the financial sector's exposure to CRE sector. Access to bank loan-level data, coupled with detailed information on properties, could enhance the efficiency of the credit risk assessment.

Table 2. The Netherlands: Selected Economic Indicators, 2019-29

(percent change, unless otherwise indicated)

	2019	2020	2021	2022	2023 Est.	2024 Proj.	2025 Proj.	2026 Proj.	2027 Proj.	2028 Proj.	2029 Proj.
National Accounts											
Real GDP	2.0	-3.9	6.2	4.3	0.1	0.6	1.3	1.9	1.9	1.8	1.6
Domestic demand	3.0	-4.2	4.6	3.7	0.8	1.2	1.7	2.0	1.9	1.9	1.8
Private consumption	0.9	-6.4	4.3	6.5	0.4	0.5	1.3	2.3	2.3	2.2	1.9
Public Consumption	2.8	1.6	5.0	1.6	3.1	2.8	2.0	1.6	1.5	1.6	1.5
Gross fixed investment (total)	6.2	-2.6	2.9	1.8	1.5	-1.1	1.5	1.8	1.8	1.8	1.8
Public	1.9	4.6	-1.1	-4.7	1.2	2.7	2.0	2.0	1.0	1.0	1.0
Private	7.0	-4.0	3.7	3.1	1.5	-1.9	1.4	1.8	2.0	2.0	2.0
Residential	3.4	-0.7	5.7	1.1	-1.4	-2.0	0.7	1.8	2.0	2.0	2.0
Business	8.5	-5.3	3.0	3.8	2.7	-1.8	1.7	1.8	1.9	1.9	1.9
Stocks (contribution to GDP growth)	0.4	-0.8	0.3	-0.2	-0.6	0.4	0.1	0.0	0.0	0.0	0.0
Exports goods and services	2.0	-4.3	8.1	4.5	-1.3	0.2	2.3	3.4	3.4	3.2	3.2
Imports goods and services	3.3	-4.7	6.4	3.8	-0.8	0.8	3.0	3.7	3.6	3.6	3.6
Domestic demand (contribution to GDP growth)	2.7	-3.8	4.1	3.3	0.7	1.1	1.5	1.8	1.7	1.7	1.6
External demand (contribution to GDP growth)	-0.8	-0.1	2.1	1.0	-0.6	-0.5	-0.2	0.1	0.2	0.0	0.0
Output gap	1.5	-4.2	-0.2	2.0	0.4	-0.4	-0.6	-0.2	0.1	0.0	0.0
Potential output growth	1.8	1.8	2.0	2.0	1.7	1.5	1.5	1.5	1.6	1.8	1.6
Gross investment (percent of GDP)	22.1	21.8	21.5	21.2	20.1	20.1	20.2	20.2	20.1	20.1	20.1
Gross national saving (percent of GDP) 1/	29.0	26.9	33.6	30.5	30.2	29.2	29.0	28.9	28.9	28.7	28.7
Prices and Employment											
Consumer price index (headline, period avg.)	2.7	1.1	2.8	11.6	4.1	2.7	2.1	2.0	2.0	2.0	2.0
Consumer price index (headline, eop.)	2.7	0.9	6.4	11.0	1.0	2.5	2.0	2.0	2.0	2.0	2.0
Consumer price index (core, period avg.)	2.2	2.1	1.6	5.5	7.3	3.3	2.6	2.0	2.0	2.0	2.0
Consumer price index (core, eop.)	2.3	2.0	2.4	8.5	3.8	3.1	2.0	2.0	2.0	2.0	2.0
GDP deflator	3.0	1.9	2.9	5.5	7.7	1.9	2.2	2.0	2.0	2.1	2.1
Employment	2.0	0.0	1.5	3.2	2.0	-0.1	-0.2	-0.3	-0.3	-0.3	-0.4
Unemployment rate (percent) 2/	4.4	4.9	4.2	3.5	3.6	3.9	4.2	4.5	4.7	4.8	5.0
External											
Current account balance (percent of GDP)	6.9	5.1	12.1	9.3	10.2	9.1	8.8	8.7	8.7	8.7	8.7
Public Sector Accounts (Percent of GDP)											
Revenue	43.9	44.1	43.8	43.4	43.0	43.0	43.2	43.3	43.4	43.3	43.4
Expenditure	42.1	47.8	46.1	43.5	44.1	45.0	45.3	45.9	46.2	46.6	46.7
General government balance	1.8	-3.7	-2.2	-0.1	-1.1	-2.0	-2.2	-2.7	-2.8	-3.3	-3.3
Structural balance (percent of potential GDP) 3/	0.6	2.1	1.5	0.6	-0.7	-1.7	-1.8	-2.5	-2.9	-3.3	-3.3
Cyclically-adjusted balance (percent of potential GDP)	0.6	-1.2	-2.1	-1.3	-1.4	-1.7	-1.8	-2.5	-2.9	-3.3	-3.3
General government debt	48.5	54.7	51.6	50.1	47.2	47.7	48.2	48.9	49.8	51.1	52.6

Sources: Dutch official publications, International Monetary Fund, International Financial Statistics, and IMF staff calculations.

1/ Value implied by investment and current account data.

2/ ILO definition.

3/ Structural balance excludes one-offs such as pandemic support and the price-cap measures.

Table 3. The Netherlands: Financial Sector Structure

	Dec-16				Dec-19				Jun-23			
		Assets				Assets				Assets		
	Number	(billions of euro)	(percent of financial system)	(percent of GDP)	Number	(billions of euro)	(percent of financial system)	(percent of GDP)	Number	(billions of euro)	(percent of financial system)	(percent of GDP)
Banks	37	2,421	37.9	341.8	34	2,397	33.6	294.8	29	2,608	32.1	252.5
Globally systemic institutions	1	845	13.2	119.3	1	892	12.5	109.7	1	1,029	12.7	99.6
Significant institutions (non-GSIBs)	5	1,364	21.4	192.5	5	1,275	17.9	156.8	5	1,357	16.7	131.4
Less Significant institutions	31	212	3.3	30.0	28	230	3.2	28.3	23	221	2.7	21.4
Memo: Branches of foreign banks (excluded from above)	41	112	1.8	15.8	44	89	1.2	11.0	42	134	1.6	12.9
Insurers	181	486	7.6	68.7	150	515	7.2	63.3	134	445	5.5	43.1
Life and funeral insurers	40	411	6.4	58.1	29	440	6.2	54.2	20	369	4.5	35.7
Non-life insurers	132	69	1.1	9.8	113	69	1.0	8.5	107	72	0.9	7.0
Reinsurers	9	6	0.1	0.8	8	5	0.1	0.6	7	4	0.1	0.4
Pension funds	297	1,266	19.8	178.7	220	1,554	21.8	191.2	173	1,469	18.1	142.3
Investment funds	1832	849	13.3	119.8	1761	984	13.8	121.0	1616	838	10.3	81.1
Other financial institutions (excl SPEs)*	...	1,364	21.4	192.6	...	1,687	23.6	207.4	...	2,772	34.1	268.4
Total Financial System (excl branches)	2347	6,386	100	902	2165	7,137	100	878	2015	8,133	100	787
Memo: Financial System (incl branches)	2388	6,498	102	917	2209	7,226	101	889	1994	8,266	102	800

Source: DNB and staff estimates. *June 2023 figure for "Other financial institutions (excluding SPEs)" is for end 2022.

Table 4. The Netherlands: Financial Soundness Indicators of the Banking System

(In percent unless otherwise indicated)

	2017	2018	2019	2020	2021	2022	2023Q3
Core FSIs							
Regulatory Capital to Risk-Weighted Assets	22.0	22.3	22.9	22.8	22.4	21.0	21.2
Regulatory Tier 1 Capital to Risk-Weighted Assets	18.4	18.8	18.9	19.3	19.3	18.0	18.5
Common Equity Tier 1 Capital to Risk-Weighted Assets	...	...	16.8	17.4	17.4	16.1	16.5
Nonperforming loans net of provisions to capital	...	...	14.3	14.5	10.9	9.8	10.5
Nonperforming loans to total gross loans	2.3	2.0	1.8	1.9	1.7	1.6	1.6
Return on Assets	0.7	0.7	0.6	0.3	0.7	0.6	1.1
Return on Equity	12.8	11.7	7.6	3.3	8.8	8.0	12.8
Interest Margin to Gross Income	73.5	54.8	54.9	54.1	47.7	49.6	55.6
Non-interest Expenses to Gross Income	71.7	72.2	68.5	71.6	70.5	69.4	60.1
Liquidity Coverage Ratio	...	...	138.6	169.1	163.3	153.6	159.9
Net Stable Funding Ratio	...	...	168.6	150.2	135.6	133.6	135.7
Additional FSIs							
Large exposures to capital	...	...	14.6	18.8	20.6	21.7	23.5
Gross asset position in financial derivatives to capital	54.2	43.6	42.0	50.7	35.6	48.9	47.5
Gross liability position in financial derivatives to capital	67.3	53.7	55.4	67.0	43.5	42.7	39.7
Spread between reference lending and deposit rates (base points)	...	...	8.3	38.4	103.5	91.2	3.7
Customer deposits to total (non interbank) loans	...	...	62.3	62.2	74.0	75.6	75.3
Residential real estate loans to total gross loans	27.3	24.4	37.5	35.8	43.2	44.1	43.3
Commercial real estate loans to total gross loans	...	...	8.1	8.0	9.0	10.1	9.9

Source: IMF.

Table 5. The Netherlands: Financial Soundness Indicators for SIs and LSIs

(In percent)

		2018	2019	2020	2021	2022
Return on equity	SI	8.71	7.62	3.27	8.35	8.00
	LSI	4.63	9.08	1.97	8.24	5.80
Return on assets	SI	0.52	0.46	0.19	0.49	0.48
	LSI	0.54	0.93	0.22	0.92	0.63
Net interest margin	SI	1.44	1.42	1.28	1.23	1.34
	LSI	1.26	1.15	1.05	0.96	1.08
Cost-to-income ratio	SI	53.70	50.32	49.39	49.74	49.12
	LSI	53.57	49.51	58.03	48.38	52.41
CET1 to RWA	SI	16.45	16.48	17.03	16.97	15.68
	LSI	21.36	20.08	25.20	24.99	23.35
Leverage ratio	SI	4.61	4.88	5.23	6.54	5.80
	LSI	9.87	8.53	10.25	10.34	9.18
NPL ratio	SI	1.95	1.86	2.24	1.73	1.60
	LSI	1.88	1.63	2.29	1.98	1.80
RWA density	SI	30.46	31.19	28.68	29.76	33.23
	LSI	48.06	44.30	38.79	38.99	40.16
Loan to deposit ratio	SI	123.45	124.52	106.46	104.01	108.04
	LSI	104.27	102.76	97.46	94.09	95.04

Source: DNB.

Table 6. The Netherlands: Risk Assessment Matrix[1]

Source of Risks	Likelihood of Realization in Next 1-3 years	Expected Impact on Financial Stability if Threat is Realized
Global Conjunctural Risks		
Abrupt global slowdown or recession. Global and idiosyncratic risk factors cause a synchronized sharp growth slowdown, with recessions in some countries, adverse spillovers through trade and financial channels, and market fragmentation causing sudden stops in Emerging Markets and Developing Economies. **Europe:** Intensifying fallout from the war in Ukraine, supply disruptions, tight financial conditions, and real estate market corrections exacerbate the downturn.	Medium Medium	A sharp drop in economic activity, as well as domestic and external demand. Energy dependence on Russia and *direct* trade and financial links with Russia and Ukraine are limited. However, *indirect* links and spillovers are important; depressed activity in key trading partners (e.g., Germany) would have spillover effects to the Netherlands and exacerbate credit risks.
Intensification of regional conflict(s). Escalation or spread of the conflict in Gaza and Israel, Russia's war in Ukraine, and/or other regional conflicts or terrorism disrupt trade (e.g., energy, food, tourism, supply chains), remittances, foreign direct investment (FDI) and financial flows, payment systems, and increase refugee flows.	High	
Monetary policy miscalibration. Amid high economic uncertainty, some major central banks may loosen their policy stance prematurely, causing abrupt adjustments in financial markets and potentially weakening the credibility of central banks.	Medium	Miscalibration may require a reversal, i.e., a resumption in policy tightening, possibly leading to demand cooling, house price declines and pressures on borrowers, given elevated private debt. This would exacerbate credit risks (see house price risk below). Tightened conditions could also reduce the value of marked-to-market securities.
Systemic financial instability. High interest rates and risk premia and asset repricing amid economic slowdowns and policy uncertainty trigger market dislocations, with cross-border spillovers and an adverse macro-financial feedback loop affecting weak banks and NBFIs.	Medium	Sharp swings in asset prices and risk premia driven by global systemic instability could affect capital positions of institutions holding similar asset classes. Individual banks/NBFIs may fail as a result. Fire sales may ensue and worsen the downward price spiral even more.
Structural Risks		
Deepening geo-economic fragmentation. Broader conflicts, inward-oriented populist policies, and weakened international cooperation result in a less efficient configuration of trade and FDI, supply disruptions, protectionism, technological and payments systems fragmentation, rising input costs, financial instability, a fracturing of international monetary and financial systems, and lower growth.	High	The Netherlands is vulnerable to supply disruptions and weaker investor confidence, due to strong cross-border real and financial linkages and the presence of large multi-national corporations and financial institutions. Such disruptions could impact both bank asset quality and non-bank investment asset valuations.

Table 6. Netherlands: Risk Assessment Matrix (Concluded)

Source of Risks	Likelihood of Realization in Next 1-3 years	Expected Impact on Financial Stability if Threat is Realized
Structural Risks (Concluded)		
Extreme climate events. Extreme climate events driven by rising temperatures cause loss of human lives, severe damage to infrastructure, supply disruptions, lower growth, and financial instability. The Netherlands is vulnerable to sea level rise, particularly over the longer term. In addition, efforts to reduce nitrogen depositions may need to be redoubled, with adverse macroeconomic effects.	Medium Medium High	Most physical infrastructure would be at risk from flooding if sea levels rise or other weather events overwhelm existing coping mechanisms. Forceful actions to curtail nitrogen depositions to meet EU commitments could disrupt economic activity, including in agriculture and construction. Droughts would also threaten housing infrastructure.
The Netherlands-Specific Risks		
A rapid correction of house prices	Medium	Dutch banks are highly exposed to highly indebted households, and vulnerable to a downward correction in the housing market. Continued high inflation and a cooling economy could impact borrowers' ability to repay, worsening asset quality. Second-round effects on growth through households cutting consumption to service their debts would be likely.
An adverse change in the direction of economic and climate policies in the context of political fragmentation.	Medium	Economic and climate policy uncertainties (including nitrogen policies) raise the risk of supply disruptions, stranded assets, affecting investment and growth.

[1] The RAM shows events that could materially alter the baseline path. The relative likelihood is the staff's subjective assessment of the risks surrounding the baseline ("low" is meant to indicate a probability below 10 percent, "medium" a probability between 10 and 30 percent, and "high" a probability between 30 and 50 percent). The RAM reflects staff views on the source of risks and overall level of concern as of the time of discussions with the authorities. Non-mutually exclusive risks may interact and materialize jointly. The conjunctural shocks and scenarios highlight risks that may materialize over a shorter horizon (between 12 to 18 months) given the current baseline. Structural risks are those that are likely to remain salient over a longer horizon.

Table 7. The Netherlands: Stress Testing Approach for Banks	
Domain	Stress Test Approach
Bank Solvency Stress Test	
Institutional perimeter	6 significant institutions—over 90 percent of the banking system.
Methodology and risk drivers	• Scenario-conditional simulation of various drivers of P&L were assessed, including credit risk (through credit impairment), interest rate risk (through interest income and expense), and market risk (through mark-to-market revaluation of marketable securities); • Credit risk model linking macrofinancial shocks with default probabilities of loan portfolios by country of exposure; • Interest rate models linking risk free rates to lending and borrowing rates; • Market to market valuation of banking and trading books linking sensitivity factors, or "delta", with shocks to interest rate, spread, foreign exchange rate, equity, and commodity prices.
Scenarios	• Baseline scenario aligned with April 2023 IMF WEO; • Bespoke adverse scenarios based on RAM (Table 6) addressing the most relevant risks confronting the Dutch financial system.
Sensitivity analysis on alternative interest rate paths	Simulation exercise on bank capital through interest income and expense as interest rate follow different paths, assuming sight deposits move to term accounts and flow out of the banking system.
Sensitivity analysis on liquidation of HTM securities	Estimation of losses when banks are forced to liquidate held-to-maturity securities to cover cash shortfalls as funding runs off under stress scenario.
LSI Analysis	
Credit risk analysis on foreign credit exposures of corporate and EM banks	Using publicly available default probabilities as proxy to stress test creditworthiness of foreign corporate exposures against macrofinancial scenarios of 40 economies.
Bank Liquidity Stress Test	
Institutional perimeter	6 significant institutions—over 90 percent of the banking system.
Methodology	• Regulatory liquidity stress test: evaluation of LCRs and NSFRs;

Table 7. The Netherlands: Stress Testing Approach for Banks (Concluded)	
	• Cash-flow-based liquidity stress test. Evaluates the ability of banks to withstand a sequence of liquidity shocks in different maturity buckets; • Sensitivity analysis. Exploration of the sensitivity of regulatory and cash-flow-based liquidity stress tests to model assumptions.
Interconnectedness and Contagion Analysis	
Institutional perimeter	14 banks, 27 insurers, 47 pension funds, 3,590 different marketable securities making up more than 50 percent of total assets for the median institution.
Methodology	Institution-level contagion analysis based on a fire-sale channel: the selling of assets by institutions in distress affects other institutions' balance sheet through the price channel.
Banking Sector Climate Risk Analysis	
Institutional perimeter	The six Dutch banks designated as systemically important.
Methodology and risk drivers	• Physical risk from floods mapped into economic damage; • Flood damages to impact banks' credit risk (domestic and international loans); • Macro approach mapping climate scenarios into macrofinancial scenarios. Standard stress testing methodologies to assess the implications of climate risks for the banking system's resiliency.
Scenarios	• Multiple flood scenarios designed with the consideration of various regions, different climate conditions under different return periods, • Extreme flood scenarios and floods in both unembanked and embanked areas were also considered. • Macrofinancial scenarios including the impact of floods on Dutch economy and other neighboring countries (Belgium and Germany) to which the banking sector is exposed.

Table 8. The Netherlands: Stress Testing Approach for Insurers		
Insurers Solvency Stress Test		
Top-down		
1. Institutional Perimeter	Number of institutions	5 life insurers 5 P&C insurers 6 health insurers
	Market Share	Life: 93 percent, based on balance sheet assets P&C: around 70 percent Health: around 70 percent
	Consolidation level	Unconsolidated
	Data	Statutory returns
	Reference Date	June 30, 2023
2. Channels of Risk propagation	Methodology	• Investment assets: market value changes of assets after price shocks; • Liabilities: valuation change due to interest rate shock; • Impact on available capital (net assets as the difference between stressed assets and liabs); • Recalculation of the SCR.
	Time horizon	Instantaneous shock
3. Scenario Analysis	Tail shocks	Adverse scenario: aligned with the macrofinancial scenario, but with more granularity on market and interest rate risks, e.g.: • Risk-free rate: full Solvency II term structure incl. extrapolation towards the ultimate forward rate, EUR +147 bps (1y) and +158 bps (10y); USD +5 bps (1y) and +203 bps (10y) • Equity: -40.7 percent (Netherlands), -42.4 percent (Euro Area), -42.1 percent (U.S.), -41.2 percent (other advanced economies)
		• Property: -13.0 percent (domestic RRE), -15.0 percent (domestic CRE), -10.0 percent (foreign RRE), -12.0 percent (foreign CRE) • Sovereign bond spreads: +55 bps (Netherlands), +60 bps (Euro Area, United States) • Corporate bond spreads: ranging from +45 bps (AAA, non-financials) and +50 bps (AAA, financials) to 400 bps (CCC and lower) • Mortgage loan spreads: +45 bps • Currency: -10.7 percent depreciation of the EUR external value

Table 8. The Netherlands: Stress Testing Approach for Insurers (Concluded)		
4.	Sensitivity analysis	• Parallel decline of the EUR interest term structure: -100 bps • Appreciation of the EUR external value: +10 percent • Default of largest banking counterparty.
5. Risk factors assessed		• Market risks (equity, property); • Interest rate risks; • Credit risks (bond spreads, (mortgage) loan spreads, default of largest banking counterparty).
6. Regulatory/accounting standards		Solvency II, National GAAP
7. Reporting Formats for results	Output presentation	• Change in valuation of assets and liabilities • Solvency ratios; • Aggregated capital shortfall; • Dispersion across companies; • Contribution of individual shocks.
Insurer: Liquidity Stress Test		
Bottom-up and Top-down		
1. Institutional perimeter	Number of institutions	5 life insurers
	Market share	Life: 93 percent, based on balance sheet assets
	Consolidation level	Unconsolidated
	Data	Company submissions and statutory returns
	Reference date	June 30, 2023
2. Channels of risk propagation	Methodology	Variation margin call on interest rate swap positions after a sudden increase in interest rate
	Time horizon	Two days
3. Scenario analysis	Tail shocks	Increase in short-term EUR interest rates by 100 bps
4. Risk factors assessed		Liquidity risks
5. Regulatory/accounting standards		Solvency II, National GAAP
6. Reporting formats for results	Output presentation	• Amount of margin call (per day) • Share of margin calls which could be met in kind • Liquid assets • Sources of liquidity to meet margin calls

Table 9. The Netherlands: Stress Testing Approach for Pension Funds		
Pension Funds: Solvency Stress Test		
		Top-down
8. Institutional perimeter	Number of institutions	10 occupational pension funds (defined benefit)
	Market share	70 percent of assets
	Data	Statutory returns
	Reference date	June 30, 2023
9. Channels of risk propagation	Methodology	• Investment assets: market value changes of assets after price shocks • Liabilities: valuation change due to interest rate shock • Impact on own funds (net assets as the difference between stressed assets and liabilities)
	Time horizon	Instantaneous shock
10. Scenario analysis	Tail shocks	Adverse scenario: aligned with the macrofinancial scenario, but with more granularity on market and interest rate risks, e.g.: • Risk-free rate: full Solvency II term structure incl. extrapolation towards the ultimate forward rate, EUR +147 bps (1y) and +158 bps (10y); USD +5 bps (1y) and +203 bps (10y) • Equity: -40.7 percent (Netherlands), -42.4 percent (Euro Area), -42.1 percent (United States), -41.2 percent (other advanced economies) • Property: -13.0 percent (domestic RRE), -15.0 percent (domestic CRE), -10.0 percent (foreign RRE), -12.0 percent (foreign CRE) • Sovereign bond spreads: +55 bps (Netherlands), +60 bps (Euro Area, United States) • Corporate bond spreads: ranging from +45 bps (AAA, non-financials) and +50 bps (AAA, financials) to 400 bps (CCC and lower) • Mortgage loan spreads: +45 bps • Currency: -10.7 percent depreciation of the EUR external value
	Sensitivity analysis	• Parallel decline of the EUR interest term structure: -100 bps • Appreciation of the EUR external value: +10 percent

Table 9. The Netherlands: Stress Testing Approach for Pension Funds (Concluded)		
		• Default of largest banking counterparty
11. Risk factors assessed		• Market risks (equity, property) • Interest rate risks • Credit risks: bond spreads, (mortgage) loan spreads, default of largest banking counterparty
12. Regulatory/accounting standards		National GAAP
13. Reporting formats for results	Output presentation	• Change in values of assets and liabilities • Funding ratios • Dispersion across companies • Contribution of individual shocks
Pension Funds: Liquidity Risk		
Bottom-up (Conducted by DNB)		
1. Institutional Perimeter	Number of institutions	5 occupational pension funds (defined benefit)
	Market Share	~60 percent of assets
	Data	Statutory returns
	Reference Date	December 31, 2022
2. Channels of Risk propagation	Methodology	Combination of interest rate (EA, U.S., UK, JP) and FX shocks (USD, GBP, JPY) leading to margin calls on pension funds' derivative positions
	Time horizon	Two days
3. Scenario Analysis	Tail shocks	Four adverse scenarios: 1. Parallel interest rate shock between 17 and 38 bps; EUR appreciation between 2.2 and 3.8 percent 2. As scenario 1, with limited access to the repo market 3. Parallel interest rate shock between 33 and 77 bps; EUR appreciation between 4.4 and 7.5 percent 4. As scenario 3, with limited access to the repo market
4. Risk factors assessed		Liquidity risks
5. Regulatory/accounting standards		National GAAP
6. Reporting Formats for results	Output presentation	• Aggregated margin calls (absolute amount, relative to liquid assets) • Cashflows and liquidity position • Dispersion across companies

Table 10. The Netherlands: Insurance Stress Test Specification

Equity	
Netherlands	-40.7%
Euro Area	-42.4%
United States	-42.1%
Other advanced economies	-41.2%
Emerging economies	-33.6%
Unlisted	-12.0%
Property	
RRE, domestic	-13.0%
CRE, domestic	-15.0%
RRE, other countries	-10.0%
CRE, other countries	-12.0%
Currencies	
EUR external value	-10.7%
Corporate bonds (financials, in bps)	
Credit Quality Step 0	+50
Credit Quality Step 1	+70
Credit Quality Step 2	+90
Credit Quality Step 3	+120
Credit Quality Step 4	+180
Credit Quality Step 5	+300
Credit Quality Step 6	+400
Unrated	+120
Corporate bonds (non-financials, in bps)	
Credit Quality Step 0	+45
Credit Quality Step 1	+65
Credit Quality Step 2	+85
Credit Quality Step 3	+120
Credit Quality Step 4	+180
Credit Quality Step 5	+300
Credit Quality Step 6	+400
Unrated	+120
Investment funds	
Equity	-42.0%
Debt	***
Money-market	-0.5%
Asset allocation	***
Real estate	-12.0%
Alternative	-8.0%
Private equity	-12.0%
Infrastructure	-4.0%
Other	-8.0%
Structured notes and collateralised securities	
Structured notes	-6.0%
Collateralised securities	-4.0%
Other investments	-8.0%
Sovereign bonds (in bps)	
Netherlands	+55
Euro Area	+60
United States	+60
Other advanced economies	+65
Emerging economies	+100
Supranational	+/-0
Loans and mortgages (in bps)	
Mortgages	+45
Other collateralized loans	+60
Uncollateralized loans	+100
Interest rates (in bps)	
EUR 1Y	+147
EUR 10Y	+158
USD 1Y	+5
USD 10Y	+203

*** company-specific shock based on rating breakdown and duration of direct holdings

Source: IMF staff.

Table 11. The Netherlands: Share of Mortgages in Arrears by Originating LTV and LTI Ratios

(In percent, based on latest available loan-level database of 2022Q1)

All loans

		Originating LTV ratios								
		<60	60-70	70-80	80-90	90-100	100-110	110-120	>120	unknown
Originating LTI ratios	0-2	1.0	0.6	0.9	1.1	1.5	1.0	2.4	1.3	2.3
	2-3	1.0	0.9	0.8	0.8	1.0	0.9	1.4	0.8	1.9
	3-4	1.3	1.1	1.1	1.0	1.0	1.2	1.2	1.0	2.2
	4-5	1.8	1.5	1.3	1.3	1.2	1.6	1.4	1.1	2.9
	5-6	2.0	1.9	1.7	1.6	1.3	1.7	1.7	1.4	2.4
	>6	3.0	2.0	2.0	2.7	2.3	2.5	2.3	2.1	3.2
	unknown	2.4	1.6	1.6	1.8	1.5	1.8	1.9	2.1	4.1

Interest-only loans

		Originating LTV ratios								
		<60	60-70	70-80	80-90	90-100	100-110	110-120	>120	unknown
Originating LTI ratios	0-2	0.9	0.7	0.8	1.1	1.6	1.1	1.8	0.9	2.7
	2-3	0.9	0.9	0.8	0.8	1.0	0.8	1.5	0.7	2.2
	3-4	1.2	1.0	1.0	1.1	1.0	1.1	1.2	1.0	2.6
	4-5	1.6	1.3	1.3	1.3	1.3	1.7	1.5	1.1	3.4
	5-6	1.8	1.9	1.6	1.7	1.3	1.9	2.2	1.5	2.2
	>6	3.2	2.1	2.1	3.0	2.5	3.1	2.5	2.1	3.3
	unknown	2.1	1.5	1.6	2.0	1.5	1.9	1.9	2.3	5.3

Amortizing loans

		Originating LTV ratios								
		<60	60-70	70-80	80-90	90-100	100-110	110-120	>120	unknown
Originating LTI ratios	0-2	1.1	0.5	0.9	1.4	1.6	0.8	3.4	1.4	2.5
	2-3	1.4	0.8	0.8	0.7	1.0	0.9	1.4	0.8	2.3
	3-4	1.8	1.2	1.2	1.0	1.0	1.2	1.0	1.0	2.3
	4-5	2.1	1.6	1.3	1.2	1.1	1.4	1.1	1.1	3.1
	5-6	2.6	2.1	1.6	1.5	1.1	1.2	1.1	1.2	2.9
	>6	2.2	2.1	1.5	2.7	1.8	1.9	1.9	2.2	4.3
	unknown	3.7	3.3	2.3	2.2	1.4	2.2	3.1	2.0	4.6

Source: DNB.

Table 12. The Netherlands: Proportion of Interest-only Loans by Age Bracket

(in percent of mortgage loan production)

	2013Q4	2018Q4	2021Q1	2021Q2	2021Q3	2021Q4	2022Q1
18-25	2.2	0.4	1.7	1.6	2.6	4.1	4.5
26-35	20.4	8.1	9.5	9.8	12.0	14.2	14.7
36-45	41.8	26.2	26.5	27.6	29.2	31.7	31.1
46-55	56.1	38.5	42.0	43.8	44.8	47.8	47.6
56-65	74.3	59.0	61.3	63.7	65.0	67.7	67.9
66+	90.5	81.8	82.8	83.8	83.6	85.4	85.9

Source : DNB.

Table 13. The Netherlands: Composition of Residential Mortgages
(In percent, except otherwise indicated, based on latest available loan-level database of 2022Q1)

Groups	Percent	Groups	Percent
Location		**Current LTV ratio**	
Amsterdam	3.0	LTV under 60	61.9
Non-Amsterdam	97.0	LTV 60-70	16.9
Age of the oldest in a household		LTV 70-80	11.2
Age Under 35	10.0	LTV 80-90	5.8
Age 35-45	16.9	LTV 90-100	3.0
Age 45-55	23.0	LTV 100-110	0.7
Age 55-65	23.4	LTV 110-120	0.2
Age 65-75	16.4	LTV 120+	0.3
Age 75+	10.3	**Current LTI ratio**	
Gross Income (threshold in euros)		LTI 0-2 times	8.3
Income under 20-percentile	29,372	LTI 2-3 times	14.7
Income 20-40-percentile	43,673	LTI 3-4 times	38.3
Income 40-60-percentile	59,218	LTI 4-5 times	30.2
Income 60-80-percentile	81,871	LTI 5-6 times	11.5
Income 80-100-percentile	221,788	LTI over 6 times	7.0

Source: DNB.

Table 14. The Netherlands: Sample Coverage by Sector

NACE	Description	Number of Firms (in 2021)
A	Agriculture, Forestry and Fishing	40
BDE	Mining, Quarrying and Other Industry	154
C	Manufacturing	577
F	Construction	207
GHI	Wholesale and retail trade, transportation and storage, accommodation, and food service	1,046
J	Information and communication	143
L	Real estate activities	185
MN	Professional, scientific, technical, administration and support service	665
OPQ	Public administration, defense, education, human health, and social work	283
RSTU	Other services	69
Total		3,369

Source: Orbis and IMF Staff Calculation.

Appendix I. Technical Annex

A. "Satellite Models" for Bank Solvency Stress Test

1. The team employed a suite of econometrics and structural models to project the key parameters in the bank solvency analysis. These "satellite models" help quantify the impacts of credit and interest rate risks on bank income and expense.

Credit Risk: Scenario-conditional PD Trajectories

2. The team estimated the historical relationship between PDs and macrofinancial variables by portfolio and country of exposure. It then projected the future PD paths conditional on the macroeconomic evolution (Appendix I. Figure 2). Portfolios in this exercise include mortgage, other retail, qualifying revolving, corporate, government, and financial institution. Countries of exposure include the Netherlands, Germany, Belgium, UK, United States, Australia, and the rest of the world. For mortgage, other retail, qualifying revolving, and corporate portfolios, a Panel Autoregressive Distributed Lag (ARDL) model in equation (1) is deployed. The logit-transformed probability of default (I) is explained by its 1-period lag, a group of exogenous variables and their lags (z_{t-s}). z_t include the standard explanatory variables, e.g., economic growth, interest rate, housing price growth, and real wage growth underpinning the scenarios. A fixed effect i captures the unobserved country-specific characteristics. The selection of explanatory variables may differ across portfolios depending on statistical performance and economic intuition.

$$\ln\left(\frac{PD_{i,t}}{1-PD_{i,t}}\right) = \alpha_i + \lambda \cdot \ln\left(\frac{PD_{i,t-1}}{1-PD_{i,t-1}}\right) + \sum_{s=0}^{P} \beta_{i,s} \cdot z_{t-s} + u_{i,t} \quad (1)$$

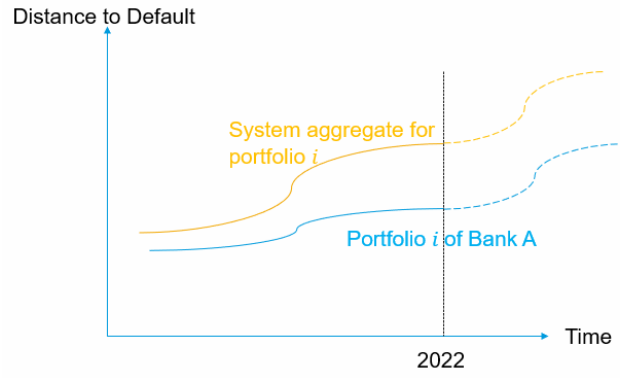
3. The econometric analyses reveal that economic growth is an important factor to explain the PD variation. Housing price growth affects mortgage portfolios and to some extent the retail portfolios through wealth effect. Interest rate rises are only felt with a lag, more so for mortgage loans which tend to be long-term and with fixed rates in the Netherlands. Wage growth is a positive for sustaining retail borrowers' credit quality, but CPI inflation erodes their purchasing power. CPI inflation outpaces wage growth in the adverse scenario, thus eroding household's debt service capability. Corporate portfolio benefits from positive export growth. Credit spread is a significant predictor for corporate creditworthiness.

4. The PDs of government and financial institution are computed by equation (2). The choice of this structural model is due to the low occurrence of default events and significant impact by idiosyncratic factors in the two sectors.

$$PD_{i,t} = \left(\frac{\text{CIedit Spread}_{i,t}}{1-\text{Recovery Rate}}\right) \quad (2)$$

5. The PD projections from the "satellite models" are by portfolio and economy. We transform them to bank-specific level by assuming constant differential of riskiness between the system aggregate and a bank holding the same portfolio. Specifically, we computed the distance-to-default of both aggregate (from "satellite models") and bank-specific PDs (from credit risk module, STE) as of 2022 (Appendix I. Figure 1). This is done by taking the inverse normal of the two values. We then took the difference of the two and assumed it to stay unchanged throughout the stress testing horizon. The bank-level can be implied accordingly.

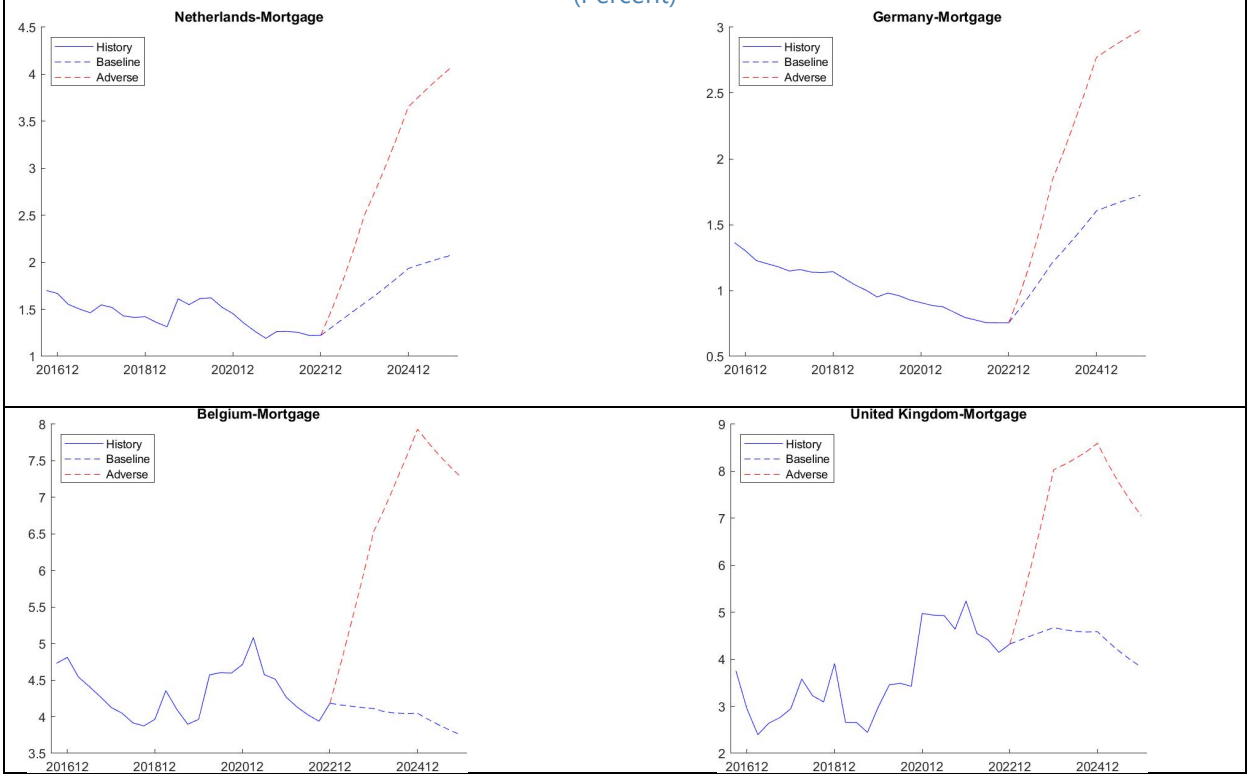
Appendix I. Figure 1. The Netherlands: Anchoring Bank Specific PDs



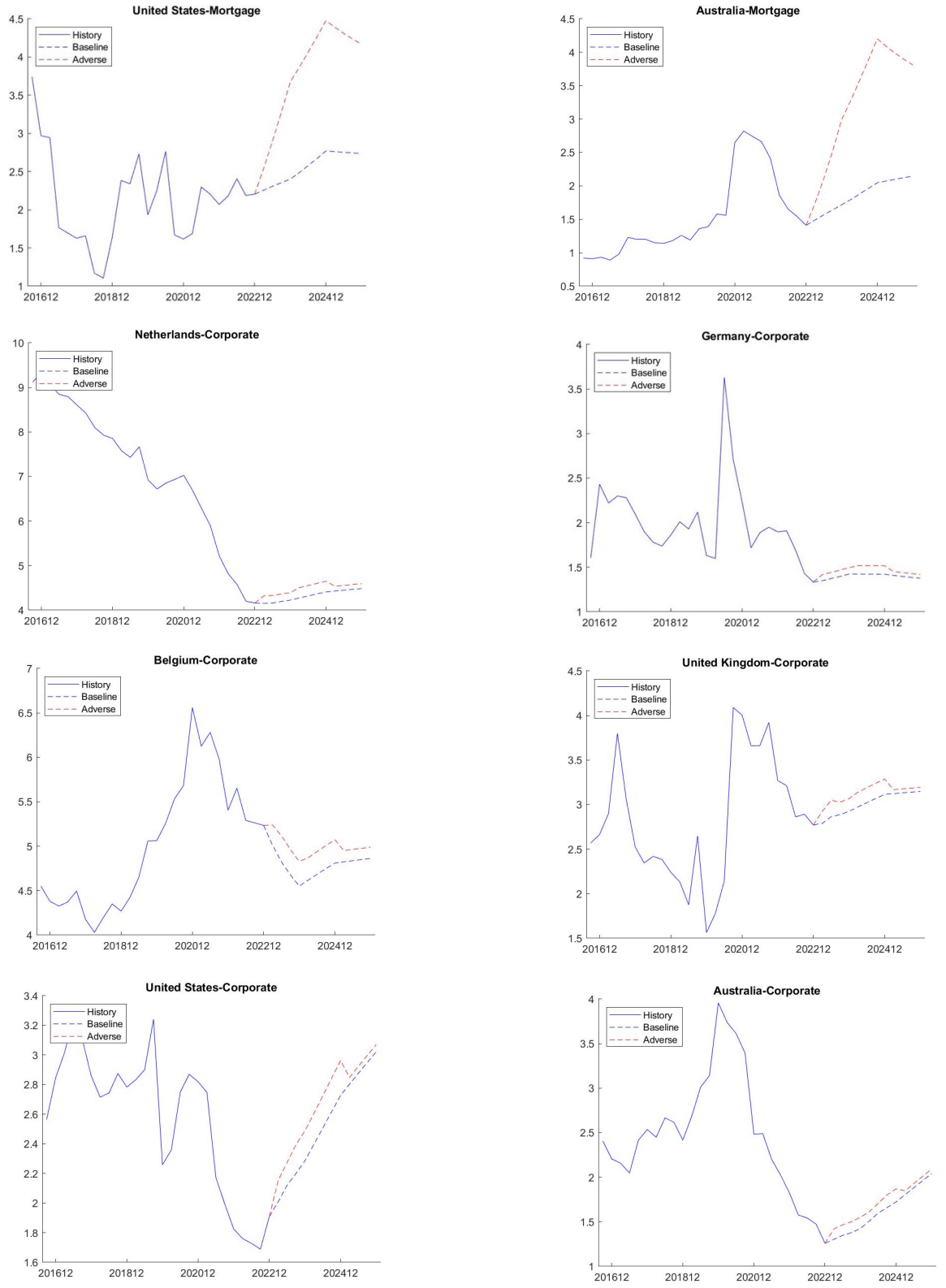
Source: IMF staff

Appendix I. Figure 2. The Netherlands: PD Trajectories of Selected Portfolios

(Percent)



Appendix I. Figure 2. The Netherlands: PD Trajectories of Selected Portfolios (Concluded)



Sources: DNB and IMF Staff estimates

Interest Rate Risk: "Pass-through" Coefficients

6. The interest rate risk analysis comprises two parts. First, the team estimated how fast monetary condition shift "passes through" to lending and funding rates of various instruments. Second, the team computed the interest income and expense based on the repricing schedule, according to which these instruments start earning or paying the new rates.

7. The first part relies on a suite of "satellite models", which estimate the historical relationship between the risk-free rates and a range of deposit and loan rates:

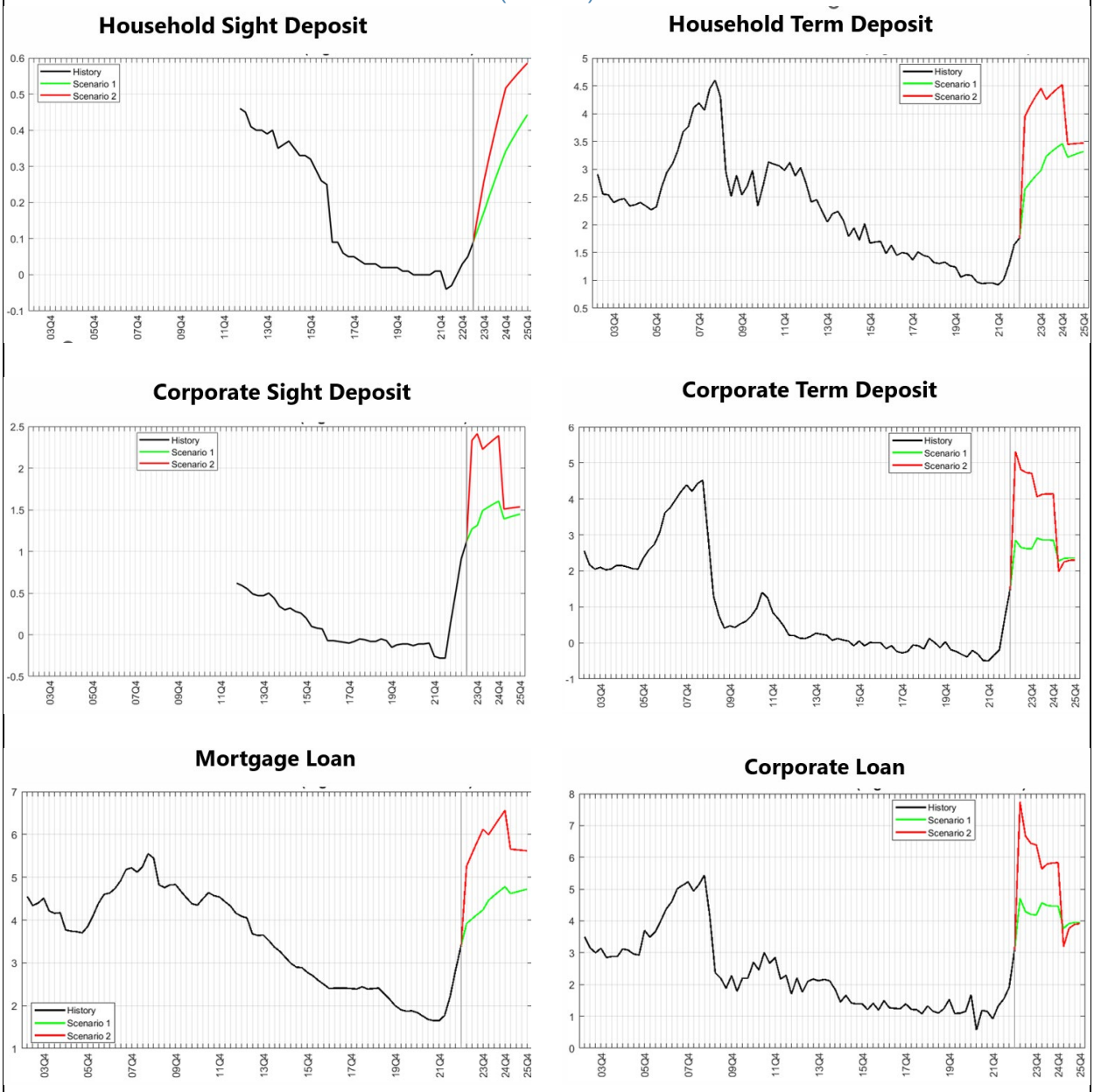
$$i_t = \alpha_i + \lambda \cdot i_{t-1} + \sum_{s=0}^{P} \beta_{i,s} \cdot z_{t-s} + u_t \quad (3)$$

8. It then projects the interest rate trajectories based on the "pass-through" coefficients (Appendix I. Figure 3). Here, i_t denotes the nominal interest of one of the following liabilities/assets: household sight deposit, corporate sight deposit, household term deposit, corporate term deposit, mortgage loan, consumer loan, and corporate loan rates. z_{t-s} includes the short-term risk-free rates and several macrofinancial variables such as inflation and GDP growth. For regressions on loan rates, long-term risk-free rates are also present to capture the effect of term premium. Given the inverted yield curve in the prescribed scenarios, the inclusion of this variable puts downward pressure on the loan rates over the projection horizon.

9. The team employed a Bayesian Model Averaging (BMA) approach to estimating these time series models. The approach accounts for modeling uncertainty and offers the option to impose sign constraints. For market-based instruments such as debt securities and derivatives, the team assumed a 100 percent "pass-through". For TLTRO deposits, the team assumed banks to issue debt securities to cover any repayment amount. As a result, interest expenses increase as banks move from paying negative to positive rates on the outstanding TLTRO amount.

Appendix I. Figure 3. The Netherlands: Deposit and Loan Rates of Selected Instruments

(Percent)



Sources: DNB, Haver, and IMF Staff estimates

B. Liquidity Stress Test

Appendix I. Table 1. Netherlands: Calibration for Cash-flow Analyses

	Baseline	Severe
OUTFLOWS		
Unsecured bonds due	100%	100%
Requlated covered bonds	100%	100%
Securitisations due	100%	100%
Other	100%	100%
Level 1 central bank	0%	100%
Level 1 (CQS1)	0%	100%
Level 1 (CQS2-3)	0%	100%
Level 1 (CWS4+)	0%	100%
Level 1 covered bonds (CQS1)	0%	100%
Level 2A corporate bonds (CQS1)	15%	100%
Level 2A corporate bonds (CQS1)	15%	100%
Level 2A public sector (CQS1-2)	15%	100%
Level 2B ABS (CQS1)	50%	100%
Level 2B covered bonds (CQS1-6)	50%	100%
Level 2B: corporate bonds (CQS1-3)	50%	100%
Level 2B shares	50%	100%
Level 2B public sector (CQS 3-5)	50%	100%
Other tradeable assets	100%	100%
Other assets	100%	100%
Stable retail deposits	5%	20%
Other retail deposits	10%	30%
Operational deposits	25%	40%
Non-operational deposits from credit institutions	100%	100%
Non-operational deposits from other financial customers	100%	100%
Non-operational deposits from central banks	40%	40%
Non-operational deposits from non-financial corporates	40%	75%
INFLOWS		
Level 1 central bank	0%	100%
Level 1 (CQS1)	0%	100%
Level 1 (CQS2-3)	0%	100%
Level 1 (CWS4+)	0%	100%
Level 1 covered bonds (CQS1)	0%	100%
Level 2A corporate bonds (CQS1)	15%	100%
Level 2A corporate bonds (CQS1)	15%	100%
Level 2A public sector (CQS1-2)	15%	100%
Level 2B ABS (CQS1)	50%	100%
Level 2B covered bonds (CQS1-6)	50%	100%
Level 2B: corporate bonds (CQS1-3)	50%	100%
Level 2B shares	50%	100%
Level 2B public sector (CQS 3-5)	50%	100%
Other tradeable assets	100%	100%
Other assets	100%	100%
Retail customers	50%	25%
Non-financial corporates	50%	25%
Credit institutions	100%	100%
Other financial customers	100%	100%
Central banks	100%	100%
Other counterparties	50%	25%
FX-swaps maturing	100%	100%
Derivatives amount receivables	100%	100%
Paper in own portfolio maturing	100%	100%
Other inflows	100%	100%
COUNTERBALANCING CAPACITY		
Coins and banknotes	100%	100%
Withdrawable central bank reserves	100%	100%
Level 1 central bank	100%	93%
Level 1 (CQS1)	100%	93%
Level 1 (CQS2-3)	100%	93%
Level 1 (CWS4+)	100%	93%
Level 1 covered bonds (CQS1)	100%	93%
Level 2A corporate bonds (CQS1)	85%	80%
Level 2A corporate bonds (CQS1)	85%	80%
Level 2A public sector (CQS1-2)	85%	80%
Level 2B ABS (CQS1)	50%	50%
Level 2B covered bonds (CQS1-6)	50%	50%
Level 2B: corporate bonds (CQS1-3)	50%	50%
Level 2B shares	50%	50%
Level 2B public sector (CQS 3-5)	50%	50%
Level 1 facilities	100%	100%
Level 2B restricted use facilities	100%	100%
Level 2B IPS facilities	100%	100%
Other facilities	100%	100%
CONTINGENCIES		
Considered as Level 2B by the receiver	6%	6%
Other	6%	6%
Liquidity facilities	38%	38%
Outflows due to downgrade triggers	100%	100%

C. Contagion

10. This annex describes the methodology used in the FSAP's contagion analysis.

11. N, M, T are the number of agents, assets, and stress-testing rounds, respectively. p_t is the $M \times 1$ vector of asset prices in round t. p_0 is normalized to be an $M \times 1$ vector of ones. $p_{j,t}$ is entry j of vector p_t. $q_{i,t,j}$ is the (non-negative) number of assets j owned by agent i in round t. $x_{i,t,j}$ is the (non-negative) number of asset j sold by agent i in round t. $A_{i,t}$ and $L_{i,t}$ are total assets and liabilities, respectively, of agent i in round t.

12. Banks, insurers, and pension funds have different default conditions. Banks and insurers are assumed to be in default if their capital is negative, while pension funds do not default.

13. As in Cetorelli and others (2023), agent i sells assets of value R_i Euros for every Euro of market-value losses, where

$$R_i = \frac{1}{LR_i} - 1,$$

and $LR_i = (A_{i,0} - L_{i,0})/A_{i,0}$. Furthermore, as in Cetorelli and others (2023), agent i sells assets proportionally to the value of their holdings, and market prices develop according to

$$p_{j,t+1} = p_{j,t}\left(1 - \delta_{j,t}^{-1}\sum_{i=1}^{N} x_{i,t,j}\right),$$

where $\delta_{j,t}^{-1}$ is an elasticity measure for asset j in round t. All agents are assumed to sell at the price in the display above (i.e., they are assumed to sell at the worst-possible price). Non-linearities are introduced by assuming that the price of securities issued by agents in default is zero.

14. The elasticities $\delta_{j,t}^{-1}$ are given by

$$\delta_{j,t}^{-1} = \delta_j^{-1} = \frac{1-\gamma}{\sum_{i=1}^{N} q_{i,0,j}},$$

where $\gamma \in (0,1)$ can be interpreted as measuring the (inverse of the) degree to which the agents in the model matter in the market at large.[1] Since $\delta_{j,t}^{-1}$ depends inversely on $\sum_{i=1}^{N} q_{i,0,j}$, this approach captures the interpretation of elasticities as measures of market depth: if very few agents own a given security, it seems reasonable to assume that it is traded in shallow markets, such that even small sales of that security lead to large changes in its price (i.e., large $\delta_{j,t}^{-1}$).

[1] To see this, suppose that all agents sell all their initial marketable securities, and that as a result, the price of each security j is given by $p_{j,1} = \gamma p_{j,0}$. The larger is γ, the less the prices of the securities will change as a result of this sale. Using this expression, the equation for the evolution of security prices, as well as the fact that in this thought experiment $x_{i,0,j} = q_{i,0,j}$ yields the expression for δ_j^{-1} above.

D. Dynamic Scenario-based Stress Test Methodology

15. This annex outlines the methodology employed in the dynamic scenario-based stress test of the corporate sector, based on Tressel and Ding (2021). The analysis utilizes Orbis firm-level data spanning from 2001 to 2022, with the exclusion of financial firms.

16. The stress test models in a scenario-based framework encompass a series of firm-level regressions integrated with accounting identities. This approach enables the derivation of remaining firm-level variables in a consistent manner, particularly when they are not directly predicted from the firm-level regressions.

17. Dynamic OLS regression including a set of industry level fixed effects is estimated as follows:

$$Y_{i,s,t} = \alpha Y_{i,s,t-1} + \Gamma \cdot X_{i,s,t-1} + \Phi \cdot Z_t + \delta_s + \epsilon_{i,s,t}$$

where $Y_{i,s,t}$ is the variable to be projected for firm i in the industry s at year t. $X_{i,s,t-1}$ is a set of firm-specific explanatory variables, Z_t is a real GDP growth rate reflecting macro conditions, δ_s is a sector (industry) fixed effect, and $\epsilon_{i,s,t}$ is a residual which is clustered at the country-year level.

18. The dependent variables include ROA, leverage (debt-to-asset ratio), and sales growth. The firm-level variables include one period lagged variables of ROA, leverage, size (measured by total assets, relative to the average of all firms each year), asset tangibility (the ratio of fixed assets to total assets), cashflow generation ratio (the ratio of sales to total assets), and growth opportunities (the sales growth rate).

19. The dependent variables are projected dynamically from firm level variables in the previous year, including both time-varying and time-invariant structural characteristics, and macro-financial variables. We assume some of the explanatory variables reflect structural characteristics of firms and be time-invariant. In particular, we consider the size, asset tangibility, and cashflow generation ratio as structural and set them at their 2021 value. Following accounting identities are also used for the projections:

$$\text{Cash} = \text{Initial Cash and eq.} + \text{EBIT} - \text{Taxes} - \text{Interest Expense}$$

$$\text{Debt Increase} = -\text{Cash}, \qquad \text{if Cash} < 0$$

$$\text{Interest Expense}_t = \left[\text{Interest Rate}_{t-1} + \left\{ \frac{\text{LTD}}{\text{TD}} \times \Delta\text{LT Rate}_t + \left(1 - \frac{\text{LTD}}{\text{TD}}\right) \times \Delta\text{ST Rate}_t \right\} \right] \times \text{TD}_{t-1}$$

where $\text{Interest Rate}_{t-1}$ is the interest rate paid on its debt of the last year, LTD/TD is the ratio of long-term debt to total debt, TD_{t-1} is the total debt in the last year, and $\Delta\text{LT Rate}_t$ and $\Delta\text{ST Rate}_t$ are the changes in the long-term and short-term rate, respectively. We assume LTD/TD is constant over time. Real GDP growth rate, $\Delta\text{LT Rate}_t$, and $\Delta\text{ST Rate}_t$ are provided by the macro baseline and adverse scenarios.

E. CRE Price-at-Risk Analysis Methodology

20. This annex describes the methodology used in the CaR analysis. This analysis uses cross-country unbalanced panel data for 12 European economies from 2000Q1 to 2023Q1.

21. To estimate the downside risks of CRE price growth, a panel quantile regression model, following Canay (2011), is used to assess the impacts of CRE price misalignment and other macro-financial variables on the 5th percentile of the future distribution of changes in CRE prices. The baseline panel quantile model to be estimated is as follows:

$$\Delta_h Y_{i,t+h,\tau} = \alpha^h_{i,\tau} + \beta^h_\tau X_{i,t} + \epsilon^h_{i,t,\tau}$$

where $\Delta_h Y_{i,t+h,\tau}$ denotes the quarterly average percentage change in real CRE prices in country i from the base time t to $t+h$ $(h = 1, 2, \dots, H)$, at a specific quantile $\tau \in (0,1)$. $X_{i,t}$ is a $k \times 1$ vector of control variables including lagged real CRE price growth, CRE price misalignment, financial condition index purged of residential real estate price, changes in credit-to-GDP ratio, real GDP growth rate, capital inflows to GDP ratio, and $\alpha^h_{i,\tau}$ are country fixed effects. All control variables except for lagged real CRE price growth rate are normalized by their standard deviation for the purpose of comparison of the size of coefficients across variables. In this setting, quantile local projections can be estimated based on:

$$\hat{\beta}^h_\tau \equiv \underset{\beta^h_\tau \in R^k}{\operatorname{argmin}} \sum_{t=1}^{T} \Big[\tau \times I\big(\Delta_h Y_{i,t+h,\tau} \geq X_{i,t}\beta^h_\tau\big) \times \big|\Delta_h Y_{i,t+h,\tau} - X_{i,t}\beta^h_\tau\big| + (1-\tau) \times I\big(\Delta_h Y_{i,t+h,\tau} < X_{i,t}\beta^h_\tau\big) \times \big|\Delta_h Y_{i,t+h,\tau} - X_{i,t}\beta^h_\tau\big|\Big]$$

where $I(\cdot)$ denotes the indicator function. The estimated coefficient $\hat{\beta}^h_\tau$ measures the effect of $X_{i,t}$ on the τ-th quantile of the conditional distribution of $\Delta_h Y_{i,t+h,\tau}$.

22. Future projections of CRE price growth at a given quantile τ capture downside risks to future CRE price growth and are defined as CaR. That is, CaR value on τ-th quantile in country i over the next h periods is defined as the τ-th quantile of $\Delta_h Y_{i,t+h}$ conditional on $X_{i,t}$:

$$\mathrm{CaR}^h_{i,\tau} \equiv Q_\tau\big(\Delta_h Y_{i,t+h} | X_{i,t}\big) = X_{i,t}\,\hat{\beta}^h_\tau$$

Both $\hat{\beta}^h_\tau$ and $\mathrm{CaR}^h_{i,\tau}$ depend on the quantile τ and the horizon h. For this analysis, we mainly focus on the 5th percentile and the 4-quarter horizon.

23. We also smooth the estimated quantile distribution every quarter by interpolating between the estimated quantiles using kernel density estimation. This allows us to transform the empirical quantile distribution into an estimated conditional distribution of CRE price growth.

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