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April 2017

TECHNICAL NOTE—FINANCIAL STABILITY AND STRESS TESTING OF THE BANKING, HOUSEHOLD, AND CORPORATE SECTORS

This Technical Note on Financial Stability and Stress Testing of the Banking, Household, and Corporate Sectors for the Kingdom of the Netherlands—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 in April 2017.

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FINANCIAL STABILITY AND STRESS TESTING OF THE BANKING, HOUSEHOLD, AND CORPORATE SECTORS

Prepared By
Monetary and Capital Markets Department

This Technical Note was prepared by IMF staff in the context of the Financial Sector Assessment Program (FSAP) 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

AFM	Authority for Financial Markets
AFS	Available for Sale
CET1	Common Equity Tier 1
CRD IV	Capital Requirement Directive IV
DNB	De Nederlandsche Bank
DSGE	Dynamic Stochastic General Equilibrium
DSTI	Debt-Service-to-Income
EBA	European Banking Authority
ECB	European Central Bank
EMs	Emerging Markets
EBITDA	Earnings Before Interest Taxation, Depreciation, and Amortization
FSAP	Financial Sector Assessment Program
FV	Fair-valued
FX	Foreign Exchange
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GFSR	Global Financial Stability Report
ICR	Interest Coverage Ratio
HFT	Held for Trading
IMF	International Monetary Fund
IPO	Income Panel Survey
IRB	Internal Risk-Based Approach
LCR	Liquidity Coverage Ratio
LGD	Loss Given Default
LSI	Less Significant Institution
LTI	Loan to Income
LTV	Loan to Value
MID	Mortgage Interest Deductibility
MOF	Ministry of Finance
NFC	Nonfinancial Corporation
NII	Net Interest Income
NPL	Nonperforming Loan
PD	Probability of Default
PIT	Point in Time
RWA	Risk-Weighted Assets
SMEs	Small- and Medium-sized Enterprises
SI	Significant Institution
SPVs	Special Purpose Vehicles
T1	Tier 1
WEO	World Economic Outlook

EXECUTIVE SUMMARY[1]

This analysis is conducted against a backdrop of a gradual domestic recovery, but still uncertain international context and remaining domestic vulnerabilities. Household debt is high and negative equity among young borrowers is prevalent. A substantial portion of households have a loan-to-value ratio above 100 percent. While bank capitalization has improved since the crisis, balance sheets have contracted, profitability is low, and banks remain significantly reliant on wholesale funding. Financial institutions also face challenges from the continuing low interest rate environment and slow credit growth.

The FSAP stress tests examined overall risks and vulnerabilities in the financial system, with a particular focus on the "triple threats" to financial stability. The tests assessed the resilience of the banking system to solvency and liquidity shocks, and contagion. The analysis focused on three main threats: low profitability due to a continuation/further decline in interest rates and low credit growth; high indebtedness of the household and nonfinancial corporate (NFC) sectors; and banks' reliance on wholesale funding and exposure to cross-border linkages.[2]

The Dutch banking system appears resilient in the face of these risks. The stress test results indicate that a severe scenario of *extreme* but *plausible* adverse macroeconomic conditions would have a significant negative impact on Basel III fully loaded (risk-weighted) capital ratios, but all banks maintain capital ratios above minimum regulatory requirements. The results in terms of the leverage ratio, however, indicate that a significant bank could fall just below the fully loaded minimum 3 percent hurdle—considered for the stress testing exercise, but not a minimum legal requirement. The extreme adverse scenario is characterized by a cumulative decline of GDP equal to two standard deviations relative to the baseline (6.9 percentage points and 8.7 percentage points over two years and three years, respectively). The scenario reflects downside external risks—including a significant recession and deflation in the Euro area, sovereign shocks and a tightening in global financial conditions—in addition to domestic shocks, which include a decline in house prices impacting private consumption and investment. The scenario also takes into account strains on funding markets, resulting in pressure on interest margins. Combined external and domestic shocks result in a V-shaped recession characterized by negative growth of 3.7 percent in 2017. The overall results of the tests indicate the following:

- **Under the baseline scenario, low interest rates are expected to weigh down bank profitability**. In view of the prolonged low interest rate environment, banks are projected to suffer a significant deterioration in net interest income. Overall profitability is projected to decline but remain positive. Banks' lending rates are set to decline further as fixed income assets mature and are repriced, with negative effects on net interest income. Net interest income for

[1] This Technical Note has been prepared by Mario Catalán, Fabian Lipinsky, Heedon Kang (IMF MCM), and Marc Gerard (IMF EUR).

[2] The analysis of interlinkages and contagion is presented in a separate Technical Note: "Linkages and Interconnectedness in the Netherlands Financial System."

the largest six banks is projected to decline gradually from 1.3 percent of assets in 2015 to 1.1 percent of assets in 2017–18. Overall profitability in the banking system would fall from 0.50 percent of assets in 2015 to about 0.15 percent in 2018—despite the mitigating effects of lower credit losses and taxes.

- **Under the adverse scenario, the shocks have a significant negative impact on (risk-weighted) capital ratios, but all banks maintain capital ratios above minimum regulatory requirements**. The stress scenario results in a significant decline in bank profitability and capitalization in the form of reduced net interest income and credit and market losses. The fully loaded common equity Tier 1 capital ratio (CET1) for the largest six banks declines from 13.5 percent in 2015 to 10.2 percent in 2018. As the capital ratio of every bank remains above the minimum hurdle rate of CET1 ratio of 7 percent over the period 2016–18, the system does not have any capital shortfall.

- **The results in terms of the leverage ratio, however, indicate that one significant bank could fall below the minimum 3 percent hurdle**. In the adverse scenario, the fully loaded leverage ratio in the system (6 largest banks) would decline from 3.8 percent to 3.2 percent, and the ratio for one of the largest banks would fall just below the minimum 3 percent hurdle. This outcome reflects the relative low risk-weight asset density (risk-weighted assets (RWAs) to total assets) in the Dutch banking system and implies a shortage of Tier 1 capital in the adverse scenario (equivalent to €3.8 billion or 0.6 percent of GDP).

Sensitivity analysis assessed vulnerabilities of the banking system to concentration risk and to the introduction of risk-weight floors on mortgage portfolios:

- **Concentration tests assessed the impact of default of the largest (one, three, and five) non-sovereign exposures on all banks (both significant institutions (SIs) and less significant institutions (LSIs)) under different assumptions for the recovery rate.** When no haircut is applied to collateral values, large banks would be able to withstand simultaneous defaults of up to four largest exposures without suffering undercapitalization (relative to an 8.5 percent Tier 1 hurdle rate). In an extreme and highly unlikely event, when 50 percent haircuts on collateral values are applied, one of the largest banks exhibits a shortfall of Tier 1 capital upon a simultaneous default of the three largest exposures; while other systemically important banks also exhibit undercapitalization in the presence of simultaneous default by the five largest exposures.

- **Sensitivity tests also reveal a significant impact of introducing RWA floors for mortgage exposures on overall capitalization levels (measured in terms of CET1)**.[3] The tests assessed the impact of increasing RWAs on internal risk-based approach (IRB) mortgage portfolios from current levels (15.4 percent on average for the largest banks in the system, with variation across banks) to 60, 80, and 90 percent of the risk-weight level corresponding to standardized

[3] This exercise is relevant given ongoing discussions aimed at introducing reforms to the Basel III regulatory framework (known as "Basel 3.5").

portfolios (35 percent). Thus, in different tests, the RWAs for mortgage portfolios increase to 21, 28, and 31.5 percent, respectively. The results show that, based on capital ratios corresponding to end-2015, the introduction of the floors would cause declines in CET1 ratios equivalent to 0.7, 1.4, and 1.8 percentage points, respectively.

Liquidity stress tests reveal that banks could handle significant withdrawals of funding. Cash flow-based liquidity stress tests assessed resilience to strong shocks characterized by run-off rates on funding sources calibrated by liability type, with haircuts on assets. The structure of contractual maturities and run-off rates resulted in withdrawals of funding equivalent to 15–20 percent of the initial stock within the first two to three months (with variation across banks). The results of these tests, based on maturity ladder analysis, revealed that, with the exception of a small institution, all banks could confront persistent and sizable withdrawals of funding without emergency liquidity assistance (ELA) from the European Central Bank (ECB) for periods longer than six months. The system exhibits heavy reliance on wholesale funding; however, liquidity risks appear contained because the term structure of this type of funding has sufficient average length.

Our analysis indicates that households with high LTV and LTI ratios are relatively more vulnerable to adverse shocks. Staff analyzed household sector vulnerabilities based on (i) micro-level data of incomes and indebtedness of borrowers (the analysis was done in conjunction with the De Nederlandsche Bank, DNB); and (ii) a macroeconomic general equilibrium model with a housing sector. The micro-level data analysis confirms that young low income households with high LTV and LTI ratios are the most vulnerable to adverse shocks. The general equilibrium model demonstrates that higher tax-deductibility encourages households to increase indebtedness (e.g., to seek a higher LTV ratio). Furthermore, households are more vulnerable to changes in the housing outlook the higher the LTV ratios are. Specifically, model simulations show that an increase in the variance of housing returns (i.e., higher risk associated to housing) leads to declining output, employment, and consumption; the decline, however, is small if the LTV ratio is below 80 percent. Also, the higher the LTV ratio, the earlier a household defaults. This analysis supports the financial stability role of the LTV and debt-service-to-income (DSTI) limits. The authorities are therefore encouraged to tighten these measures further to build the resilience of borrowers against future macrofinancial shocks.

While overall nonfinancial corporates have restored their profitability and strengthened their equity-to-debt ratios, there are pockets of vulnerabilities in certain segments. Corporate vulnerability analysis carried out by staff points to non-trivial heterogeneity across firm categories, which suggests that data gaps should be addressed quickly to allow a more a granular investigation of corporate balance sheets.

Table 1. Netherlands: Key Recommendations

Recommendations	Timeframe[1]	Authorities Responsible for Implementation
Risk analysis of the banking sector		
Enhance the DNB's top-down solvency stress testing framework: • Develop satellite models of credit risk for multiple countries. In view of the significant activities of large Dutch banks in foreign countries, a multi-country approach to scenario design and probability of default (PD)/loss given default (LGD) projection would allow a more refined estimation of credit losses under adverse scenarios. • Adjust the DNB's framework so as to exploit useful (more granular and detailed) data reported by banks in European Banking Authority (EBA) templates for calculation of net interest income, when stress testing exercises take place at the European level.	NT	DNB
Enhance the DNB's monitoring and stress testing framework for liquidity risk. • In the Netherlands and other EA countries, progress toward the development of adequate liquidity stress testing frameworks is underway. Refinements to the DNB framework could allow for differentiated analysis by currency, while ensuring adequate and consistent reporting of cash flows by banks, under the liquidity monitoring metrics framework (including flows from derivatives and off-balance sheet positions).	NT	DNB
Household sector		
Enforce an industry-wide standard approach to informing interest-only mortgage borrowers of their estimated repayment shortfalls.	NT	DNB, AFM
Corporate sector		
Fill data gaps on the nonfinancial corporate sector.	NT	DNB, CBS

[1] I (immediate): within one year; NT (near term): one–three years; MT (medium term): three–five years.

INTRODUCTION

1. **The FSAP financial stability analysis and stress testing exercise take place in a macroeconomic environment characterized by a gradual domestic recovery and an uncertain international context**. Since the last FSAP, the Dutch economy suffered a double-dip recession from which it only emerged in early 2014. The global financial crisis (GFC) resulted in severe strains for the financial and household sectors. Growth suffered as protracted deleveraging by households and falling house prices kept consumption demand weak, while banks underwent a balance sheet repair process. Since 2014, the economy has been gradually recovering due to strengthening consumption, investment and exports. The effects of Brexit are likely to be manageable, unless uncertainty is prolonged. In the short run, a slowdown in net exports and investment is expected to be partly mitigated by resilient private consumption, resulting in a growth shortfall of 0.2–0.4 percentage points. The impact over the medium term will depend upon the outcome of the Brexit negotiations.

2. **In addition, some features of the financial system and broader economy increase their vulnerability to shocks**. Household debt is high and negative equity among young borrowers is prevalent. A substantial portion of households have an LTV above 100 percent. While bank capitalization has improved since the crisis, balance sheets have contracted, profitability has only recently started to rebound from historically low levels, and banks remain significantly reliant on wholesale funding. Financial institutions also face challenges from the continuing low interest rate environment.

3. **The FSAP stress tests examined overall risks and vulnerabilities in the financial system, with a particular focus on the "triple threats" to financial stability:**

Box 1. "Triple Threats" to Financial Stability

Vulnerabilities	Risks
• Low profitability due to a continuation/further decline in interest rates and low credit growth.	May reduce net interest income for banks. Low interest rates may further impact the financial positions of insurance companies and pension funds.
• The indebtedness of the household and NFC sectors.	Increases probability of default of borrowers and exacerbates the impact of adverse shock to house and asset prices.
• Banks' reliance on wholesale funding and exposure to cross-border linkages.	Exacerbates the probability of an adverse funding shock and could negatively affect bank profitability.

4. In general, the objective of the FSAP stress testing exercise is to assess the capacity of the banking system to withstand *extreme* but *plausible* macroeconomic shocks. The tests are means to explore weaknesses in a financial system and the channels through which adverse shocks are transmitted. FSAP stress tests can help identify priorities for policy actions, such as those aimed at reducing specific exposures or building capital and liquidity buffers. The FSAP stress testing process can also help authorities identify informational and methodological gaps, and assess their preparedness to deal with situations of financial stress.

5. FSAP stress tests may differ from stress tests conducted by central banks, including those previously undertaken by the DNB and the ECB.[4] The authorities and the FSAP team estimated separate credit risk models and used different but complementary methodologies to assess transmission of macroeconomic shocks to banks' profitability and capitalization. The FSAP team carried out the tests in close cooperation with the DNB and ECB, and was given access to detailed supervisory data—both in a physical data room located at ECB premises, and electronically.

6. Although stress tests are useful to explore weaknesses in a financial system, results must be interpreted with caution. In all countries, the implementation of stress tests is conceptually challenging. Among other limitations, stress tests use macroeconomic and satellite models to calculate the impact of adverse scenarios or shocks on banks.[5] These models are estimated using historical data and are subject to estimation uncertainty. Choices must also be made regarding the severity of shocks. In adverse scenarios, the economy is typically affected by a combination of external and domestic shocks that (ex-ante) have a very low probability of realization.[6] Hence, by construction, adverse scenarios should not be (mis-) interpreted as macroeconomic "forecasts."

7. The stress tests examined the resilience of the banking system to *solvency*, *liquidity*, and *contagion* risks (Figure 1 and Appendix I). The solvency stress tests included Top-Down (TD) exercises based on macroeconomic scenarios and sensitivity analyses—the TD FSAP approach complements, but stands in contrast to the Bottom-Up (BU) approach of the 2016 European

[4] It is important to note that the stress tests conducted in the context of the Netherlands FSAP are not fully comparable to the EBA 2016 Stress Test. This relates to the use of a different scenario, significant differences in assumptions and main characteristics of the FSAP and EBA exercises (e.g., top-down versus bottom-up), which affect the results and their comparability.

[5] Satellite models map the variables projected in the macroeconomic scenarios into credit, market and other risk factors that determine individual banks' gains or losses.

[6] The selection of "relevant" historical episodes and the length of data series used to construct adverse scenarios are among the choices that must be made in the design of stress tests. There is often a temptation to dismiss the validity of historical episodes because structural changes alter the way in which economies function. Valid stress tests, however, should not fail to incorporate long history. As pointed out by Haldane (2009), stress testing exercises conducted before the GFC failed to play a useful "early warning" role (in part) due to reliance on short data series—the tests underestimated true macroeconomic and financial volatility by failing to incorporate information contained in long data series, which undermined their validity and usefulness.

Banking Authority (EBA)[7] Stress Test exercise. The tests based on macroeconomic scenarios assessed the impact of combined *external* and *domestic* shocks on the economy over a three-year horizon (2016–18), based on data available through December 2015. The effects of these shocks on individual bank's profitability and capitalization were assessed using satellite models and methodologies developed by the authorities and Fund staff. In addition, solvency stress tests based on sensitivity analysis assessed vulnerabilities of the banking system to individual shocks. The TD liquidity tests assessed the capacity of banks to confront large withdrawals of funding using a maturity ladder analysis (cash-flow analysis based on information corresponding to different maturity buckets) and supervisory information. The contagion tests covered domestic interbank exposures, interlinkages within the domestic financial system, and cross-border exposures between domestic institutions and foreign sectors.[8]

8. The main stress tests covered six banks that account for 87 percent of assets in the system.[9] The following six banks are under direct supervision of the ECB and were included in TD stress tests: ING Bank N.V.; Coöperatieve Rabobank U.A.; ABN AMRO Bank N.V.; Bank Nederlandse Gemeenten N.V.; Nederlandse Waterschapsbank N.V.; and SNS Bank N.V. In all cases, the perimeter of analysis was the consolidated group. Note that, in terms of institutions covered, the scope of the FSAP stress test exercise for the Netherlands is broader than that of the 2016 EBA Stress Test, which covered four banks representing 81 percent of assets in the system; these are ING Bank N.V., ABN Amro Bank N.V., Coöperatieve Rabobank U.A., and Bank Nederlandse Gemeenten N.V.

9. In addition, specific tests were implemented to analyze the nonfinancial corporate (NFC) and household sectors in greater detail and assess the resilience of the sectors to adverse shocks:

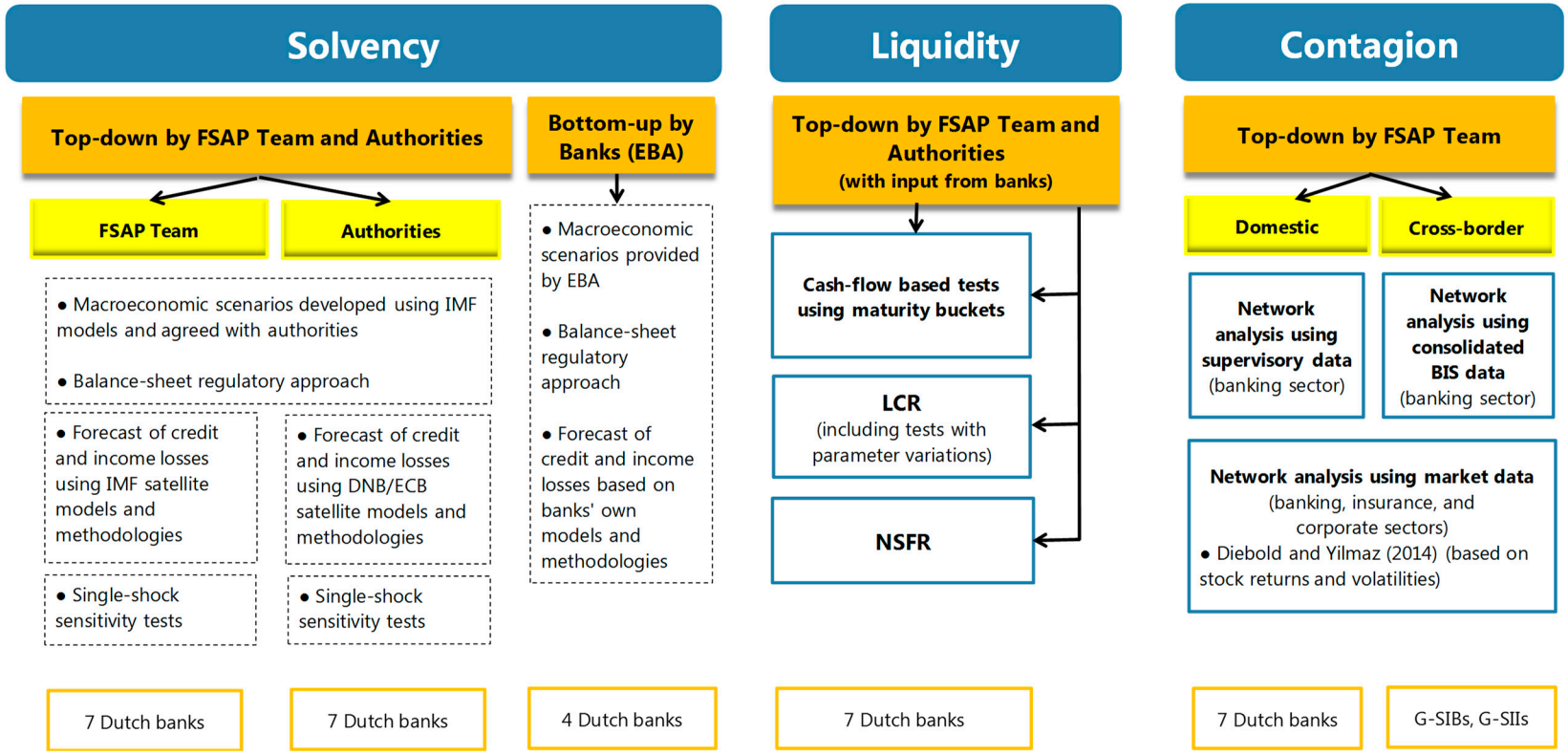
- **A multi-pronged approach was used in the household sector**. First, in close collaboration with the DNB, the central bank's stress test model and loan-level data were used to approximate the probability of default (PD) of mortgages under the FSAP baseline and adverse scenarios. The highly granular approach based on loan-level data allows a comparison of simulated PDs across groups of households with different characteristics (e.g., LTV ratios) to identify segments that are most vulnerable to negative shocks. Second, the FSAP team assessed the macrofinancial role of household indebtedness using a Dynamic Stochastic General Equilibrium (DSGE) model. The analysis evaluates the relationship between LTV ratios (and potential adjustments in future LTV regulations) on household consumption volatility and growth.

[7] It should be noted that the EBA is a "constrained BU stress test" as there is extensive supervisory quality assurance of the calculations submitted by banks.

[8] The analysis of interlinkages and contagion is presented in a separate Technical Note: "Linkages and Interconnectedness in the Netherlands Financial System." Similarly, the risk and vulnerability analysis of the insurance sector is presented separately, in the Note "Insurance and Pension Sectors."

[9] Some sensitivity tests also covered the following four banks under (direct) supervision of the DNB: NIBC Bank N.V.; LeasePlan Corporation N.V.; Achmea Bank N.V.; and F. van Lanschot Bankiers N.V. These banks account for 3 percent of the total assets in the banking system.

Figure 1. Summary of the Netherlands FSAP Stress Tests (Financial Sector)



Source: IMF staff.

- **And the risk and vulnerability analysis on the NFC sector used as input both macro- and micro-level data**. It took stock of recent developments, compared the Dutch NFC sector with those of its peers, and assessed firms' debt service capacity (e.g., interest coverage ratio) by firm size, sector, and ownership (domestic versus foreign). Also, the FSAP conducted balance-sheet sensitivity analyses to evaluate firms' sensitivities to an increase in borrowing cost and a decline in earnings—calibrated in line with the bank stress testing scenarios—and estimate the potential increase in the share of financially distressed firms (interest cover ratio (ICR) less than one). Using the Global Financial Stability Report (GFSR) methodology, the mission used stressed ICR ratios to evaluate potential bank losses on NFC exposure.

10. The remainder of this note is structured as follows. The second section presents the different components of the banking sector's solvency stress tests based on macroeconomic scenarios: their description, design, methodology for implementation, and results. The third section presents the banking sector's solvency stress tests based on sensitivity analysis. The fourth section presents the banking sector's stress tests of liquidity risk. The fifth section presents the analysis of the household sector, and the sixth section presents the analysis of the NFC sector.

BANKING SECTOR: TOP-DOWN SOLVENCY TESTS BASED ON MACRO SCENARIOS

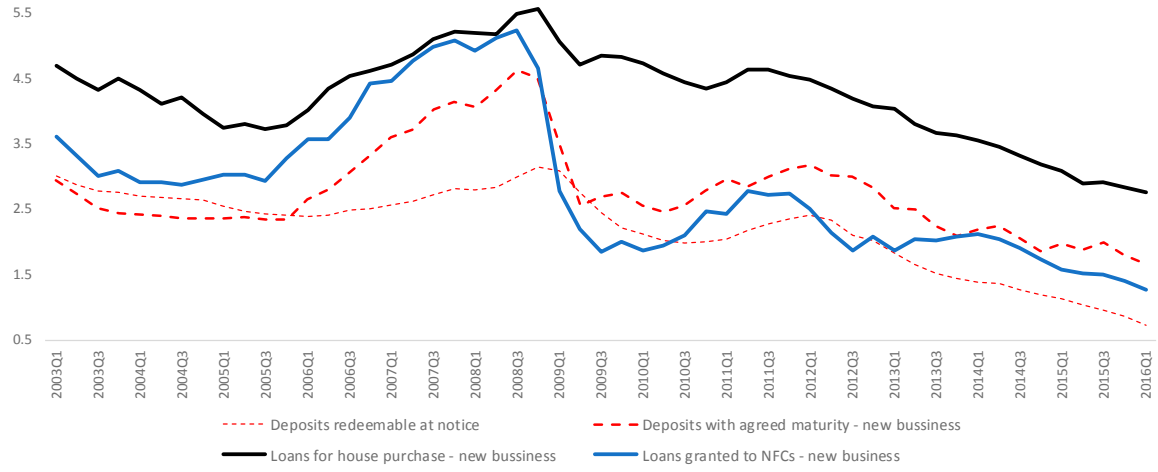
A. Microfinancial Risks

11. Under baseline conditions, bank profitability is likely to decline due to persistent low interest rates and weak credit growth. Interest rates on assets and liabilities of Dutch banks are for a significant part fixed, and adapt to lower rates only gradually. In the recent past, net interest income (NII) of Dutch banks was relatively resilient. As banks perform maturity transformation, they have reduced their funding costs in the low interest rates environment, while interest income from borrowers is declining only gradually. Figure 2 shows the evolution of selected deposit and lending rates; the environment with declining interest rates, however, has also affected non-deposit (securities) funding costs. More specifically, although lending rates on new corporate loans, which are mostly floating, declined sharply in tandem with short-term policy and market rates, mortgage rates, which are largely fixed, [10] started declining with a lag and gradually. If interest rates continue at their current low levels, the full impact on mortgage rates will materialize with time, further compressing net interest margins, with little room left for further funding cost reductions. It must be noted that stronger credit growth could sustain net interest margins in the future, despite low interest rates.

[10] The share of mortgages with fixed interest rates over five years is 73 percent.

Figure 2. Netherlands: Interest Rates on Deposits and Loans to Households (New Business), 2003–16

(In percent)



Source: DNB.

12. The Dutch financial sector operates in an uncertain global macroeconomic and financial environment and faces several *external* risks (Appendix II):

- **Reversion in international integration and policy coordination in large economies could weigh on global growth and exacerbate financial market volatility**. Protracted uncertainty associated with negotiating post-Brexit arrangements could weigh on confidence and investment more than expected—most prominently in the United Kingdom and the rest of Europe with possible knock-on effects elsewhere. Slower than anticipated external demand associated with diminished confidence and investment in Europe would negatively affect net exports, business confidence, and investment in the Netherlands. Lower domestic growth would exacerbate credit risks for the banking sector.

- **Fallout from global economic and political fragmentation could imply a sharp rise in risk premia with flight to safety**. Investors could withdraw from specific risk asset classes as they reassess underlying economic and financial risks in large economies—or respond to unanticipated U.S. Federal Reserve tightening and increases in U.S. term premia—with poor market liquidity amplifying volatility. A drop in stock and bond prices would affect the solvency of insurers and reduce coverage ratios in the pension sector; it would also reduce banks' capital ratios and could trigger redemptions in investment funds. Renewed stress in global wholesale funding markets would increase funding costs for Dutch banks, with adverse effects on their profitability and solvency; it could also trigger funding liquidity strains in a worst-case scenario.

- **Structurally weak growth in the Euro Area (EA) could affect demand for Dutch exports and its NFC sector, exacerbating credit risks and triggering deflation**. In the EA, weak demand, low productivity growth, and persistently low inflation from a failure to fully address crisis legacies and undertake structural reforms could lead to lower medium-term potential growth and exacerbate financial imbalances, especially among European banks (high likelihood). Such external conditions would weaken the demand for Dutch exports, affecting the profitability and solvency of NFCs, thereby increasing strains on banks' asset quality. They could also lead to broader deterioration in domestic consumer and business confidence, negatively affecting banks through weak credit demand and growth.

- **Global risks with potential indirect effects on the Dutch economy also arise from a potentially significant slowdown in China, while tighter financial conditions could undermine growth in emerging markets (EMs) more generally**. In China, a loss of investor confidence, disorderly corporate defaults, and/or a sharp fall in asset prices would impact commodity prices and could roil global financial markets, reducing global growth. Significant slowdown in other large EMs could be exacerbated by excessive household and corporate foreign exchange (FX) leverage. A withdrawal of international investors from EM corporate debt could generate disorderly deleveraging, with potential spillbacks to advanced economies. In these cases, financial and nonfinancial institutions in Netherlands could be particularly affected through trade and financial channels given their wide international exposure.

13. In addition to external risks, the Dutch economy faces *domestic* risks, notably those related to renewed weaknesses in housing markets. The housing market seems to have turned the corner, households have reduced their mortgage indebtedness through voluntary repayments, and low interest rates support their debt servicing capacity. However, a reversal of the recent recovery in house prices could weaken household balance sheets and dampen domestic demand once again. Dutch banks are highly exposed to households and NFCs. A halt or reversal of the ongoing domestic economic recovery would impact the ability of borrowers to service their loans, which could worsen banks' asset quality. It would also have implications on economic growth through macrofinancial linkages (lower consumption).

14. Some features of the Dutch economy and its financial system increase its vulnerability to adverse external and domestic shocks. Features that increase the probability of realization, as well as the conditional effects of adverse shocks include: (i) low bank profitability due to a continuation/further decline in interest rates and weak credit growth; (ii) the high indebtedness of the household and NFC sectors; and (iii) banks' reliance on wholesale funding and exposure to cross-border contagion.

B. Macroeconomic Scenarios

15. Given the risks and vulnerabilities described above, the stress tests examined a baseline macroeconomic scenario and an *extreme* but *plausible* adverse scenario (Table 2 and Figure 3). The baseline macroeconomic scenario is based on the World Economic Outlook (WEO) projections of IMF staff as of August 2016. It incorporates post-Brexit downward revisions to real GDP growth equivalent to 0.1 and 0.3 percentage points in 2016 and 2017, respectively; the mild slowdown in growth in 2016–17 is driven by weaker investment and external demand, while consumption remains resilient. Note that the IMF WEO baseline envisages slower growth in 2016–18 than the baseline scenario assumed in the EBA Stress Test. These differences reflect different vantage points in time: the EBA scenarios were announced in February 2016 and do not reflect post-Brexit revisions.

16. The *extreme* but *plausible* adverse macroeconomic scenario reflects the abovementioned downside external risks, and a domestic house price shock.

- The IMF adverse macroeconomic scenario has similar intensity (in terms of real GDP deviation from baseline projections) to the one used in the 2016 EBA Stress Test. The IMF adverse scenario was run through an MCM global macroeconomic model[11] and results in a cumulative decline of real GDP relative to the IMF WEO baseline equivalent to 2 standard deviations (6.9 percentage points, calculated based on data covering 1980–2015) over two years, and 1.9 standard deviations (or 8.7 percentage points) over three years.[12]

- As illustrated in Figure 3, however, growth rates under the IMF adverse scenario are lower than in the EBA scenario due to post-Brexit downward revisions in baseline projections. Also, the IMF adverse scenario exhibits a V shape—a sizable decline in the year 2017—while the EBA scenario is U-shaped.[13]

[11] Vitek, F. (2015), "Macrofinancial Analysis in the World Economy: A Panel Dynamic Stochastic General Equilibrium Approach," *International Monetary Fund Working Paper No. 15/*227.

[12] A standard deviation of (two-year cumulative) real GDP growth, calculated based on data for the period 1980–2015, is equal to 3.4 percentage points. The two-year cumulative growth rate in the baseline scenario is $g^{\text{Baseline}}_{2017-15} = \left(\text{Real GDP}^{\text{Baseline}}_{2017} / \text{Real GDP}_{2015}\right) - 1$. In the adverse scenario relative to the baseline, real GDP in 2017 ($\text{Real GDP}^{\text{Adverse}}_{2017}$) satisfies $g^{\text{Adverse}}_{2017-15} = g^{\text{Baseline}}_{2017-15} - 0.068 = \left(\text{Real GDP}^{\text{Adverse}}_{2017} / \text{Real GDP}_{2015}\right) - 1$.

[13] In a U-shaped scenario, deviations of real GDP growth rates from the baseline path are more evenly distributed over time—across the years that comprise the stress testing period—than those in a V-shaped scenario. In the latter type of scenario, economic activity exhibits a particularly intense (extreme) decline in a given year, and is then followed by a strong recovery.

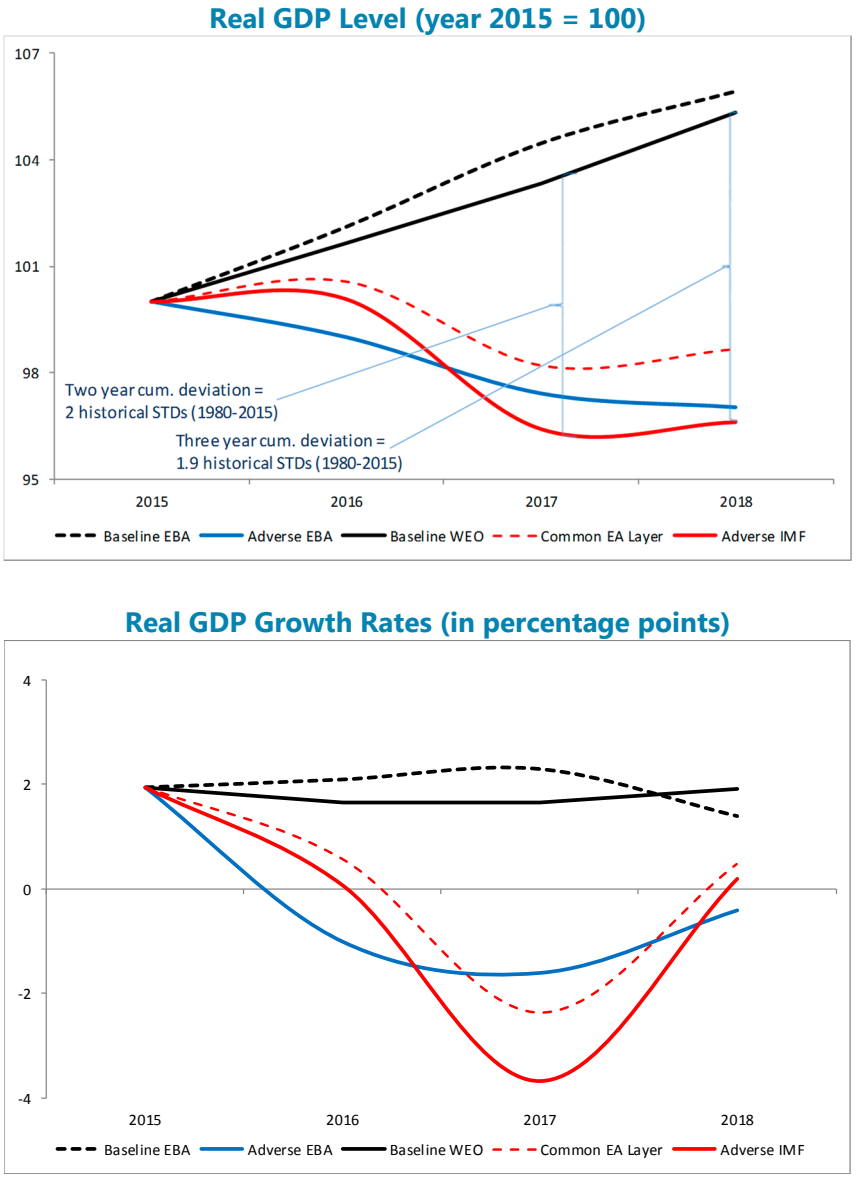
Table 2. Netherlands: Macroeconomic Baseline and Adverse Scenarios for Stress Tests

		Paths in Stress Period		
	2015	2016	2017	2018
Real GDP growth (in percent change)				
Baseline	**2.0**	**1.7**	**1.6**	**1.9**
Contribution of common EA layer		-1.1	-4.0	-1.4
Contribution of country-specific layer		-0.5	-1.3	-0.3
Adverse IMF	**2.0**	**0.1**	**-3.7**	**0.2**
Private consumption (in percent change)				
Baseline	**1.8**	**1.9**	**1.9**	**1.7**
Contribution of common EA layer		-0.8	-3.5	-1.8
Contribution of country-specific layer		-1.0	-2.8	-0.9
Adverse IMF	**1.8**	**0.1**	**-4.4**	**-1.0**
Private investment (in percent change)				
Baseline	**11.6**	**6.6**	**4.6**	**4.0**
Contribution of common EA layer		-1.6	-7.2	-5.6
Contribution of country-specific layer		-5.5	-14.3	-2.6
Adverse IMF	**11.6**	**-0.5**	**-16.9**	**-4.2**
Consumer price inflation rate (in percent)				
Baseline	**0.2**	**0.2**	**0.9**	**1.0**
Contribution of common EA layer		-0.2	-1.9	-3.0
Contribution of country-specific layer		0.0	-0.3	-0.5
Adverse IMF	**0.2**	**0.0**	**-1.4**	**-2.5**
Unemployment rate (in percent)				
Baseline	**6.9**	**6.6**	**6.4**	**6.1**
Contribution of common EA layer		0.4	1.8	2.0
Contribution of country-specific layer		0.2	0.5	0.5
Adverse IMF	**6.9**	**7.2**	**8.8**	**8.6**
Fiscal balance ratio (in percent)				
Baseline	**-1.8**	**-1.6**	**-1.0**	**-0.7**
Contribution of common EA layer		0.1	0.2	-0.1
Contribution of country-specific layer		-0.1	-0.6	-0.8
Adverse IMF	**-1.8**	**-1.7**	**-1.4**	**-1.5**

		Paths in Stress Period		
	2015	2016	2017	2018
Short term interest rate (in percent)				
Baseline	**0.0**	**-0.3**	**-0.4**	**-0.2**
Contribution of common EA layer		0.1	0.2	0.2
Contribution of country-specific layer		0.3	0.8	0.7
Adverse IMF	**0.0**	**0.1**	**0.7**	**0.7**
Long term interest rate (in percent)				
Baseline	**0.8**	**0.3**	**0.5**	**0.6**
Contribution of common EA layer		0.2	0.4	0.4
Contribution of country-specific layer		0.3	0.8	0.7
Adverse IMF	**0.8**	**0.8**	**1.6**	**1.7**
Mortgage interest rate (in percent)				
Baseline	**2.9**	**2.8**	**2.7**	**2.5**
Contribution of common EA layer		0.0	0.1	0.1
Contribution of country-specific layer		0.2	0.4	0.4
Adverse IMF	**2.9**	**3.0**	**3.2**	**3.0**
Interest rate on corporate loans (in percent)				
Baseline	**1.7**	**1.7**	**1.6**	**1.5**
Contribution of common EA layer		0.0	0.1	0.1
Contribution of country-specific layer		0.2	0.4	0.4
Adverse IMF	**1.7**	**1.9**	**2.2**	**2.0**

Sources: IMF staff calculations.

Figure 3. Netherlands: Macroeconomic Scenarios for Stress Testing: Real GDP



Sources: EBA; and IMF staff calculations.

17. Table 3 describes the different layers of numerical assumptions that underlie the construction of the adverse IMF scenario, divided into a common EA layer, and a country specific layer:

- *Common EA layer*. It is driven by a tightening of global financial conditions accompanied by credit-cycle downturns in EM economies. It features an abrupt decompression of risk asset premia, which is amplified by low secondary market liquidity. Within the EA, these tensions affect, with particularly intensity, high spread economies, and are reflected in higher money market interest rates—and banks' cost of short-term funding—and long-term government bond yields. Also, the realization of financial stability risks implies that monetary normalization in the systemic advanced economies fails to materialize in the stress testing period (2016–18).

- *Country-specific layer*. Weakness in economic activity (resulting from the combination of shocks envisaged under the common EA layer) has knock on effects on domestic housing markets. Housing prices decline by 15 percent, with adverse impact on domestic consumption and residential investment (see Appendix III for further details on real estate. In addition, heavy reliance on wholesale funding by Dutch banks makes them vulnerable to turmoil in international financial markets. Under the country-specific layer, the cost of short-term funding rises by 75 basis points. Overall, combining the impact of both layers, banks' cost of funding increases by 100 basis points.

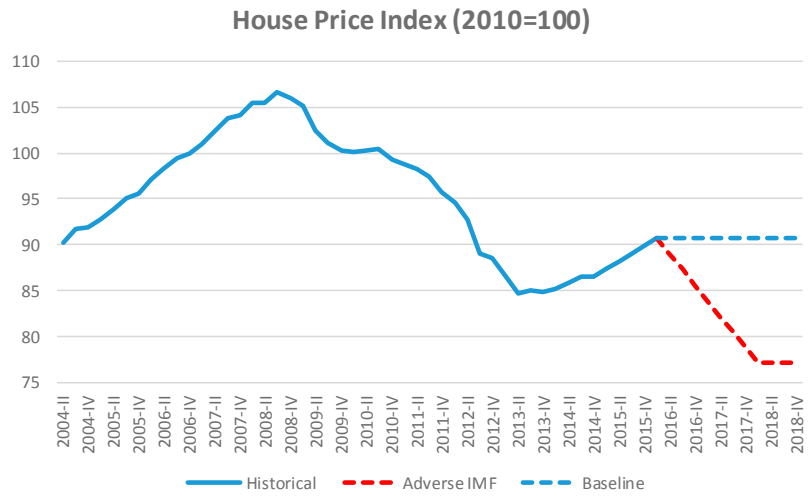
18. The scenario assumes differentiated impact of banks' cost of funding shocks across funding sources, and a 50 percent pass-through of these shocks to lending rates (Figures 5 and 6). Cost of funding shocks affect bank's net interest income in two ways. First, these shocks cannot be passed on to borrowers immediately, due to maturity transformation (e.g., loans have longer maturity and time to repricing than deposits). Second, when banks are able to reprice loans, they can only pass to borrowers 50 percent of the funding shocks. Differentiation of funding shocks across sources also implies differentiated impact across banks; more specifically, banks more heavily reliant on wholesale funding are affected by larger shocks, while banks relying on overnight or short-term deposits are affected by smaller shocks. *Note that a highly granular/disaggregated approach to project various interest rates is key to realistically assessing the evolution of bank profitability in a low interest rate (baseline) environment, or under a stress scenario*. (Sub-section C below describes how interest rate paths, combined with information of time-to-repricing of assets and liabilities, impact bank's net interest income and profitability.)

Table 3. Netherlands: Macroeconomic Scenarios: Shocks in the Common EA and Country-Specific Layers

	Common to the EA	Country-specific	Total
Layer 1: Tightening of financial conditions in systemic economies, 2016Q3 – 2017Q2			
Long term government bond yield; Duration risk premium shocks			
High Spread Euro Area Economies	+200 basis points		+200 basis points
Low Spread Euro Area Economies (excl. Netherlands)	+50 basis points		+50 basis points
Japan, United Kingdom, United States	+100 basis points		+100 basis points
Netherlands	**+50 basis points**	**+75 basis points**	**+125 basis points**
Real equity price; Equity risk premium shocks			
China, Euro Area, Japan, United Kingdom, United States	−20 percent		−20 percent
Money market interest rate spread; Credit risk premium shocks			
China, High Spread Euro Area Economies	+100 basis points	**+50 basis points**	+150 basis points
Low Spread Euro Area Economies (excl. Netherlands), Japan, United Kingdom, United States	+25 basis points	**+50 basis points**	+75 basis points
Netherlands	**+25 basis points**	**+75 basis points**	**+100 basis points**
Real bilateral exchange rate; Currency risk premium shocks			
Euro Area	+5.0 percent		+5.0 percent
Layer 2: Fiscal consolidation in the Euro Area, 2016Q3 – 2018Q2			
Primary fiscal balance ratio; Fiscal expenditure shocks			
High Spread Euro Area Economies	+2.0 percentage point		+2.0 percentage point
Low Spread Euro Area Economies (excl. Netherlands)	+1.0 percentage point		+1.0 percentage point
Netherlands	**+1.0 percentage point**		**+1.0 percentage point**
Layer 3: Credit cycle downturns in emerging market economies, 2016Q3 – 2018Q2			
Loan default rate shocks	+0.3 to +4.7 percentage points		+0.3 to +4.7 percentage points
Layer 4: Suppressed economic risk taking worldwide (excl. Germany and Netherlands), 2016Q3 – 2018Q2			
Private investment; Investment demand shocks	−4.0 percent		−4.0 percent
Private consumption; Consumption demand shocks	−1.0 percent		−1.0 percent
Germany			
Private investment; Investment demand shocks	−4.0 percent	**-8.0 percent**	−12.0 percent
Private consumption; Consumption demand shocks	−1.0 percent	**-2.0 percent**	−3.0 percent
Netherlands			
Private investment; Investment demand shocks	**−4.0 percent**	**−16.0 percent**	**−20.0 percent**
Private consumption; Consumption demand shocks	**−1.0 percent**	**−2.0 percent**	**−3.0 percent**

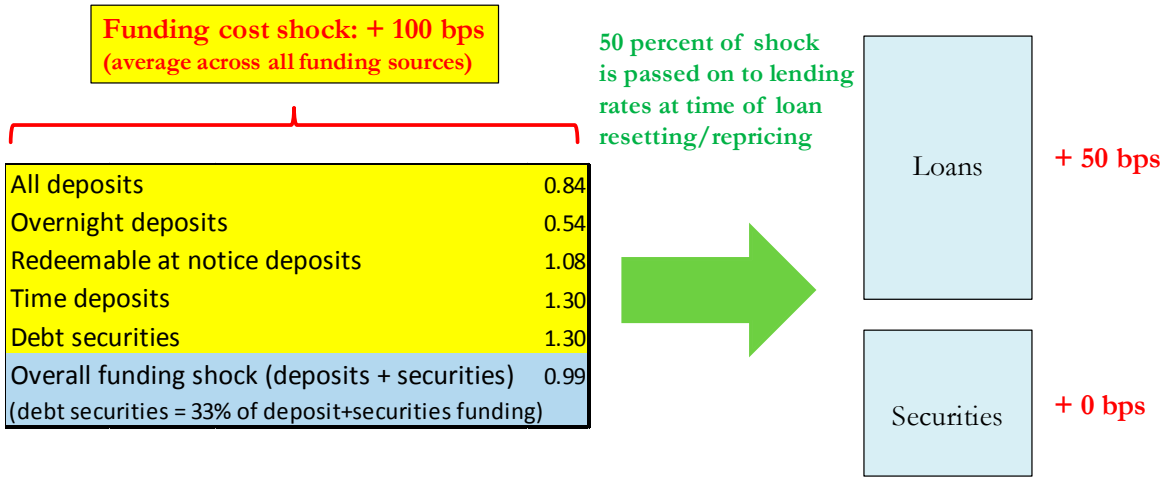
Sources: Authorities; and IMF staff.

Figure 4. Netherlands: Housing Prices in Adverse IMF Macroeconomic Scenario



Sources: DNB; and IMF staff calculations.

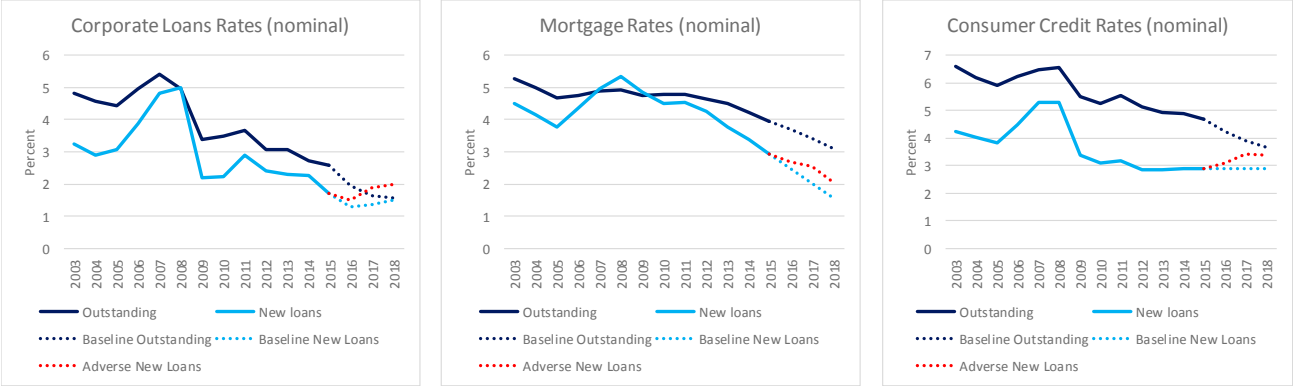
Figure 5. Netherlands: Pass-through of Funding Cost Shocks to Lending Rates



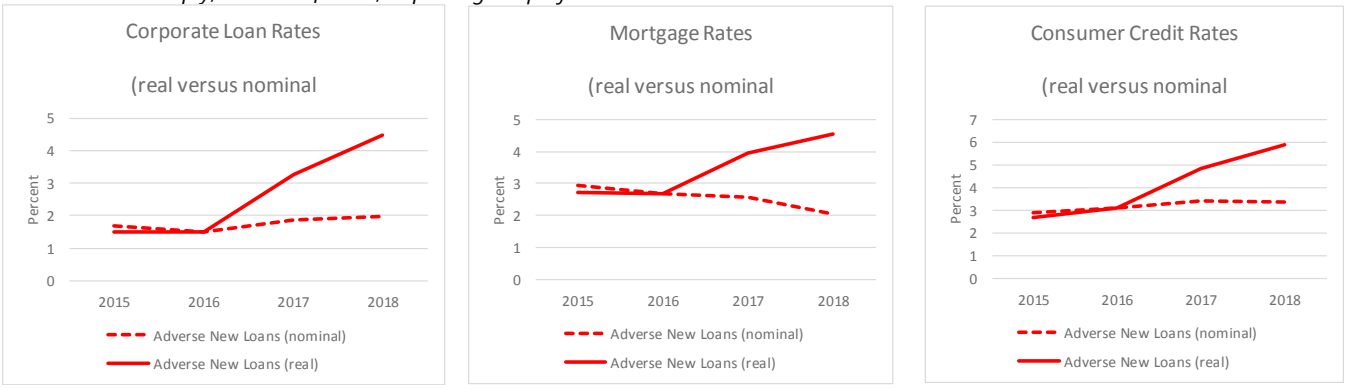
Source: IMF staff calculations.

Figure 6. Netherlands: Interest Rate Assumptions Underlying Net Interest Income Projections

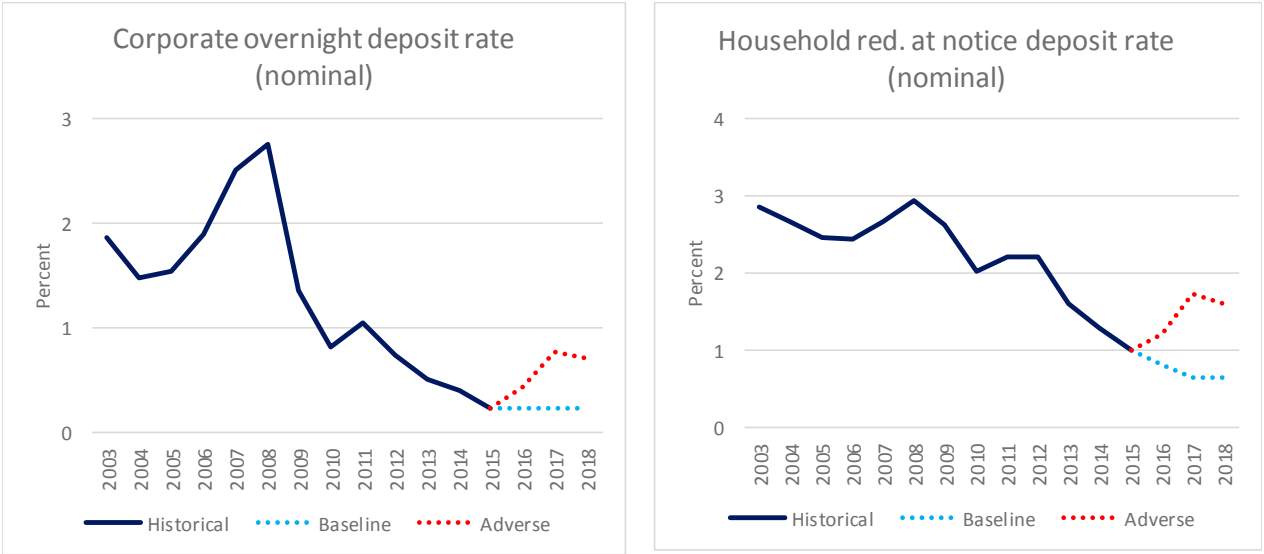
Nominal lending rates continue to decline in the baseline scenario …



… and modestly increase in the adverse scenario, due to the pass-through assumption of the cost-of-funding shock. However, real rates increase more sharply, due to deflation, impacting PD projections.



Deposit rates remain low or decline further in the baseline scenario, and increase in the adverse scenario.



Source: IMF staff calculations.

C. Banks' Balance Sheets, Profits, and Risk Exposures

19. Large banks have different business models, and hence, are exposed to different types of risks. The largest three banks, ING, ABN Amro and Rabobank, have invested about 70-75 percent of their balance sheets in loans, according to 2015 annual reports. The loan book consists mostly of mortgage loans to households (40–50 percent of the loan book) and corporate loans (30–40 percent of the loan book). These banks finance themselves mostly with deposits (50–70 percent of total assets) and securities (20–30 percent of total assets). In contrast, BNG and NWB are public, focus almost entirely on extending loans to the public sector, and fund themselves predominately with securities. BNG provides financing for (semi-) publicly owned organizations, such as public utilities, public housing and healthcare providers. NWB is a specialist financial institution, providing funding for water boards and local governments. Last, SNS has the largest deposit base and focuses almost entirely on providing mortgage loans.

20. The three largest banks have substantial international exposure. According to data of the 2016 EU-wide stress tests:

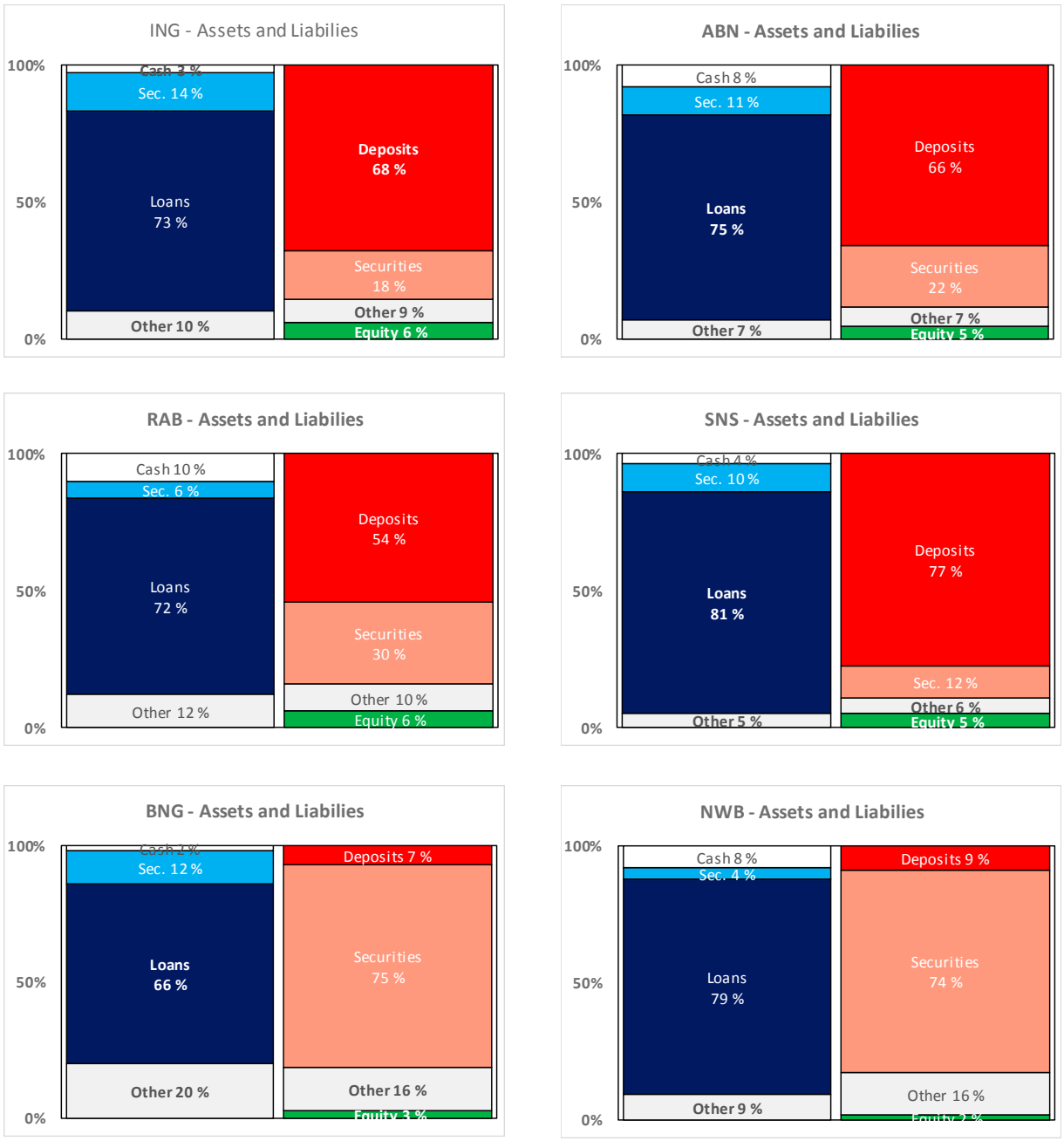
- ING holds only about 30 percent of its IRB portfolio in the Netherlands, lending 70 percent to clients outside the Netherlands. The five largest foreign counterparty countries are Germany (14.2 percent), Belgium (13 percent), the United States (5.8 percent), Australia (4.6 percent), and the United Kingdom (4.6 percent); 5.4 percent of ING's IRB portfolio is invested in Spain and Italy.

- Rabobank is holding about 68 percent of its IRB portfolio in the Netherlands. The five largest IRB foreign counterparty countries are the United States (11.6 percent), the United Kingdom (3.4 percent), Australia (2.1 percent), Switzerland (2.3 percent), and New Zealand (1.5 percent). Rabobank has invested 0.9 percent of its IRB portfolio in Brazil.

- ABN Amro is more domestically focused than ING and Rabobank, holding about 76 percent of its IRB portfolio in the Netherlands. The five largest IRB foreign counterparty countries are France (3.4 percent), the United States (3 percent), Germany (2.1 percent), Belgium (1.6 percent), and the United Kingdom (1.6 percent). ABN Amro is less exposed to Spain and Italy and has larger holdings in Singapore (1.4 percent), the Marshall Islands (0.9 percent) and Bermuda (0.7 percent) compared to ING and Rabobank.

21. Given the international nature of these banks, staff applied a cross-country credit risk model to capture differences in exposures.

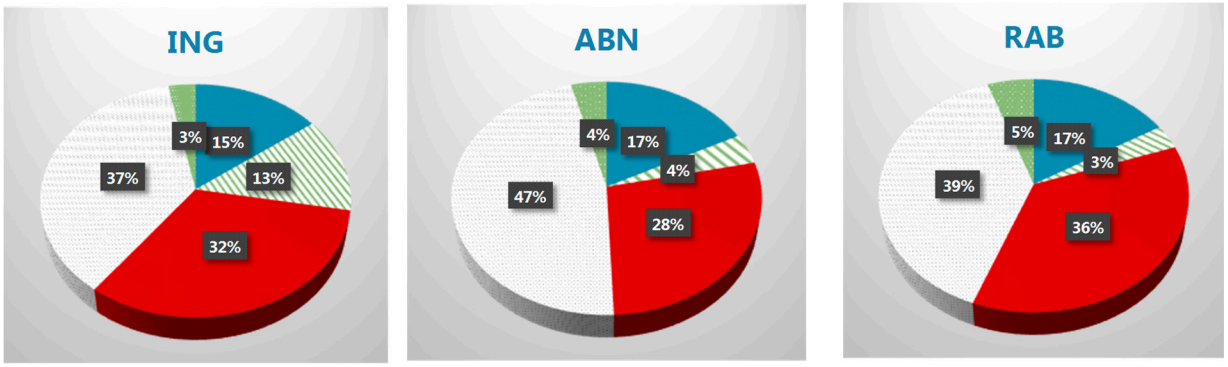
Figure 7. Netherlands: Bank's Assets and Liability Composition



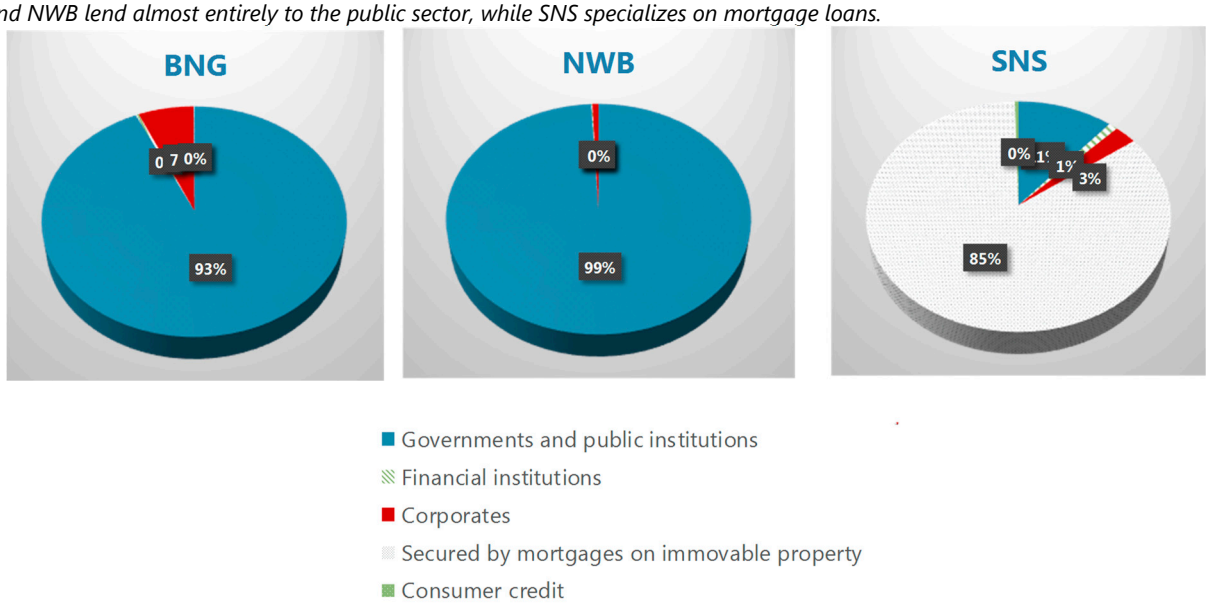
Sources: 2015 annual reports; and grouping of various accounting items into larger subgroups performed by staff.

Figure 8. Netherlands: Banks' Loan Books Composition

ING, ABN and Rabobank have about 40–50 % of their loan-book invested in mortgage loans and about 30–40% in corporate loans.



BNG and NWB lend almost entirely to the public sector, while SNS specializes on mortgage loans.



Sources: 2015 year-end data taken from 2016 EU-wide Stress Test results, and annual reports and investor presentations.

D. Macrofinancial Risk Transmission: Satellite Models and Methodologies

22. Satellite models and specific methodologies were used to assess the transmission of macroeconomic shocks to individual banks' profitability and capitalization. These models and methodologies were used to assess the transmission of macroeconomic conditions (summarized in sub-sections A and B, including assumptions on interest rates) to bank-specific losses associated with credit, market, and interest rate risks.

Credit losses

23. Given the international diversification of large banks' exposures, probabilities of default (PDs) under the adverse scenario were estimated for 11 different countries. A dynamic panel data econometric model was estimated to obtain PDs in the Netherlands and 10 other countries in which banks had significant credit exposures (see Appendix IV for further details). The list of countries includes: Australia, Belgium, France, Germany, Italy, the Netherlands, Poland, Spain, Switzerland, the United Kingdom, and the United States. In the model, bank- and country-specific PDs are determined by real GDP growth rates and real interest rates in a non-linear fashion.[14] Non-linear effects embedded in the estimated model (and consistent with observed data) imply the following:

- Larger subsequent increases in PDs for exposures that have higher PDs at the starting point; and
- PDs rise at an increasing rate as macroeconomic conditions deteriorate further and further.

24. Note that variation in macroeconomic conditions across countries—real GDP growth, deflation, and nominal interest rates—combined with differentiated bank exposures to foreign countries affect the rise in overall PDs of banks. For instance, banks exposed to countries subject to more extreme conditions under the adverse scenario (e.g., high-spread EA economies) would be affected more negatively.

25. Estimates from the credit risk models suggest that PDs would rise sharply in the adverse scenario. System-wide point-in-time (PIT) PDs in 2015 were lowest for portfolios of mortgage loans and credit to financial institutions, and higher for exposures to corporate counterparts and consumer credit. In the adverse scenario, overall the PIT PD multiplier is 2.4 times the starting level, but with significant variation across exposure types and countries:

[14] Non-linear effects are introduced in the model in two ways: first, the dependent variable is defined as the logistic transformation of the PD; and second, the square of real GDP growth is introduced as an explanatory variable.

- *Corporate and consumer credit exposures exhibit higher initial PDs and large multipliers*. Average multipliers (across all banks and countries) for corporate and consumer credit exposures are 2.8 and 2.5, respectively;

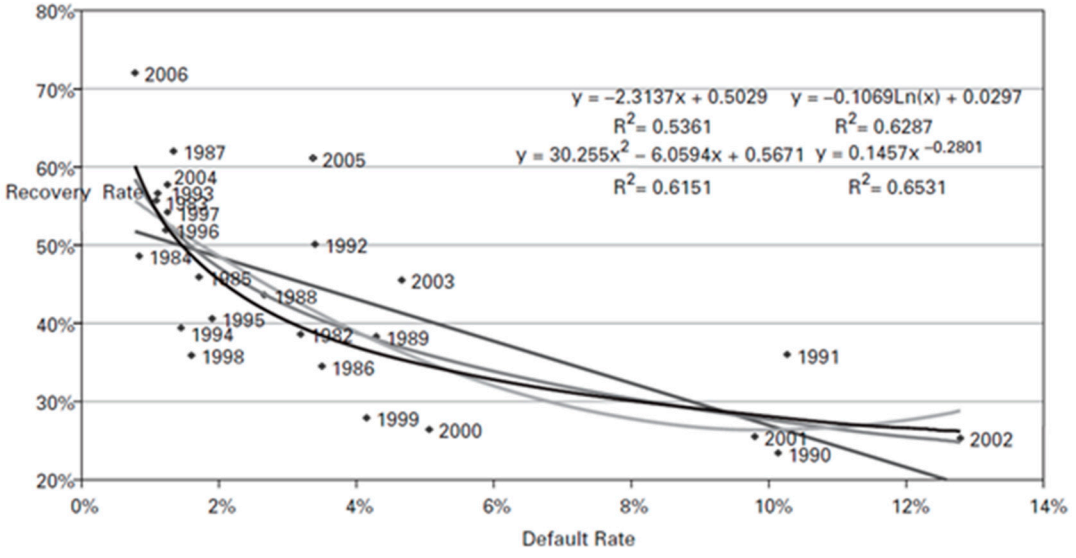
- *Mortgage loans exhibit lower initial PDs and smaller multipliers.* The average multiplier for mortgage loans is 1.7; and

- *As noted above, PD sensitivity and hence multipliers differ significantly by country due to variation in starting PDs and the severity of macroeconomic conditions in the adverse scenario*. For instance, multiplier values for corporate exposures range from 2.4 to 3 in low spread EA economies (Netherlands, Germany, Belgium) and from 5 to 6 in high spread EA economies.

26. Loss given default (LGDs) were adjusted to reflect past (international) empirical association between recovery and default rates, as well as the effect of housing price shocks. Empirical evidence indicates that when PDs rise from 1 to 2 percent, average recovery rates decline from 50 percent to 40 percent (Figure 9)—LGDs rise from 50 percent to 60 percent. In terms of "multipliers," a PD multiplier equal to 2 would be associated with an LGD multiplier equivalent to 1.2. To reflect these relations, LGDs were adjusted according to the following formula: $\Delta LGD = 0.6 \text{ x } \Delta PD$.

Figure 9. Netherlands: Recovery Rate/Default Rate Association

Dollar Weighted Average Recovery Rates to Dollar weighted Average Default Rates
(*1982-2009*)



Source: "Default Recovery Rates and LGD in Credit Risk Modeling and Practice: An Updated Review of the Literature and Empirical Evidence," Edward I. Altman.

Net interest income

27. A detailed and highly granular approach was used to project net interest income under baseline and adverse scenarios. The authorities provided to the FSAP team detailed information on the maturity structure and time to repricing of asset and liability items for individual banks. Based on these data, we calculated interest income and expenses under the different scenarios. Figure 10 shows a numerical example that illustrates the calculation method: "trees" that track the refinancing times and rates of each type of asset and liability item. Note that:

- As the stress tests were performed under the "constant balance sheet assumption," maturing loans were always renewed at the rates corresponding to "new business" (lending was not interrupted); and
- It was assumed that in the event of default of a given asset exposure, payments would be suspended. Thus, proceeds from interest payments under the "trees" were adjusted by PDs.

Market losses

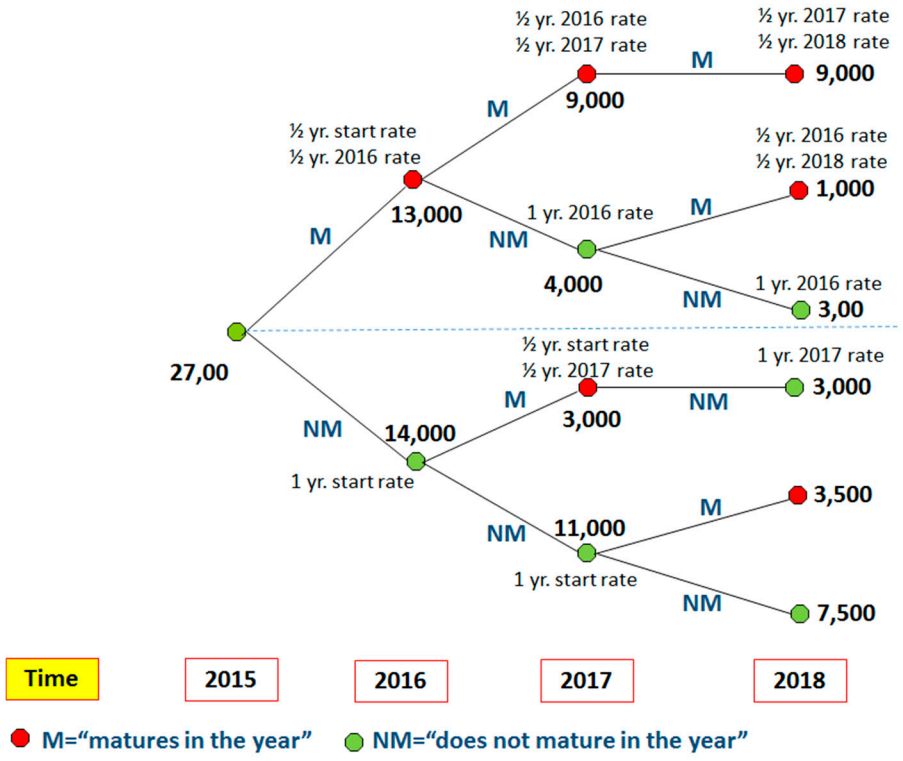
28. Market valuation losses corresponding to holdings of sovereign and non-sovereign debt securities were measured through changes in yields leading to re-pricing based on a modified duration approach. For every country and year, sovereign yield curves were constructed by linear interpolation of short- and long-term interest rates, as specified in the macroeconomic scenarios. By tracking the shifts in yield curves over time, changes in yields were obtained for any given (modified) duration, and these were applied to calculate haircuts and re-price bond portfolios in held for trading (HFT), available for sale (AFS), and fair-valued (FV) accounts (excluding floating rate securities), according to the following formula:

$$\frac{\partial \text{Valuation}}{\text{Valuation}} = -MD \cdot \partial y_{MD}$$

where MD is the modified duration of the portfolio, and ∂y_{MD} is the change in the yield caused by the shift in the yield curve (vis-à-vis the value prevailing in the previous year), and measured at a point in time that matches the modified duration of the portfolio.

Figure 10. Netherlands: Calculation of Interest Income in Stress Tests (Example)

Hypothetical example of maturity structure and rollover projection for one loan type:



E. Hurdle Rates

29. For the assessment of capital adequacy and determination of hurdle rates, the regulatory frameworks applied were Basel III (i.e., fully loaded), and the European Union and national frameworks, as defined by the Fourth Capital Requirements Directive (CRD IV), Regulation on Prudential Requirements, national law and DNB regulations. The hurdle rates for total capital, Tier 1 capital and Common Equity Tier 1 capital were set according to the current minimum requirements (Table 4). For the leverage ratio, there is no legal threshold; instead, the Basel 3 percent leverage ratio is used. The stress tests were based on the minimum capital ratios under Pillar 1 and did not take into account any individual requirements under Pillar 2. Every ratio was based on Basel III fully loaded definitions.

Table 4. Netherlands: Hurdle Rates for Solvency Stress Tests

(In percent)

	Total Capital ratio (total capital to RWAs)	Tier I Capital ratio (tier I capital to RWAs)	Common Equity Tier I Capital ratio (CET1 capital to RWAs)	Leverage ratio (Tier I capital to total assets)
Hurdle rate	10.5	8.5	7	3

F. Results

30. Results show that low interest rates are expected to weigh down on bank profitability under the baseline scenario (Box 2). In view of the prolonged low interest rate environment, banks are projected to suffer a significant deterioration in net interest income. Overall profitability is projected to decline but remain positive. Banks' lending rates are set to decline further as fixed income assets mature and are repriced, with negative effects on net interest income. Net interest income for the largest six banks is projected to decline gradually from €29.4 billion (1.3 percent of assets) in 2015 to €25 billion and €24 billion in 2017 and 2018, respectively (about 1.1 percent of assets). Due mainly to the dominant effect of declining net interest income, overall profitability in the banking system would fall from 0.50 percent of assets in 2015 to about 0.15 percent in 2018—despite the mitigating effects of lower credit losses and taxes.

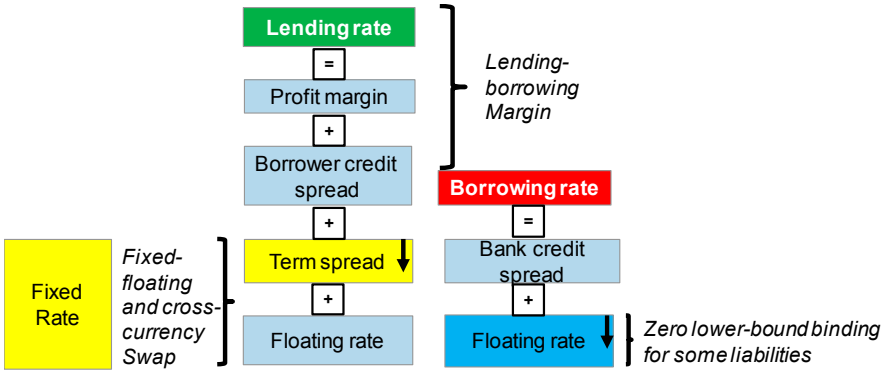
31. The Dutch banking system appears resilient in the face of the risks identified above (the triple "threats"). Stress tests of solvency risk suggest that banks are affected significantly by the realization of *extreme* but *plausible* adverse macroeconomic conditions, but all banks maintain capital ratios above the regulatory minimums. The overall results of the tests indicate the following (Figures 11 and 12):

- *The shocks have a significant negative impact on (risk-weighted) capital ratios, but all banks maintain capital ratios above minimum regulatory requirements.* The common equity Tier 1 capital ratio (CET1) for the largest six banks declines from 13.5 percent in 2015 to 10.2 percent in 2018. As the capital ratio of every bank remains above the minimum hurdle rate of CET1 ratio of 7 percent over the period 2016–18, the system does not have any capital shortfall.

- *The results in terms of the leverage ratio, however, indicate that a significant bank could fall below the minimum 3 percent hurdle.* In particular, in the adverse scenario, the leverage ratio in the system (six largest banks) would decline from 3.8 percent to 3.2 percent, and the ratio for one of the largest banks would fall below the minimum 3 percent hurdle. This outcome reflects the relative low risk-weighted asset (RWA) density (RWAs to total assets) in the Dutch banking system and implies a capital shortage of Tier 1 capital in the adverse scenario (equivalent to €3.8 billion or 0.6 percent of GDP).

Box 2. Effects of a Low Interest Rate Environment on Banks' Net Interest Income

Banks enter into fixed-to-floating swaps at the time of loan origination such that increases in short-term base rates don't affect net interest income. Hedging reduces banks' interest rate risk, as liabilities of banks have shorter maturities than loans.



However, banks might still be exposed to changes in interest rates. When interest rates are low and the yield curve flattens, maturity transformation will be less profitable, as swaps will be repriced at the time of rolling over the loan, and term spreads are lower. The figure below shows a decomposition of lending and borrowing rates into different components. After hedging, lending and borrowing rates move with the floating rate (in this simple example). However, an unexpected flattening of the yield curve will lead to lower lending rates and lower maturity transformation premium, here called "the term spread."[1] This implies a certain degree of financial market friction, as yield curve theory would imply no arbitrage on intermediating funding. Another reason for lower net interest income, e.g., lower lending-borrowing margins, is that borrowing rates of some liability categories may hit the zero lower bound, and cannot fall below zero.

The impact of flattening yield curves has a lagged effect on net interest income, as the loan portfolio only gradually is rolling over. The longer the maturity of loans, the longer it takes until long-term yield movements are priced-in. A detailed analysis of banks' interest income and interest expenses shows that new business loans have significantly lower interest rates than outstanding loans, implying that past yield curve shifts are still priced-in in the loan portfolio of banks.

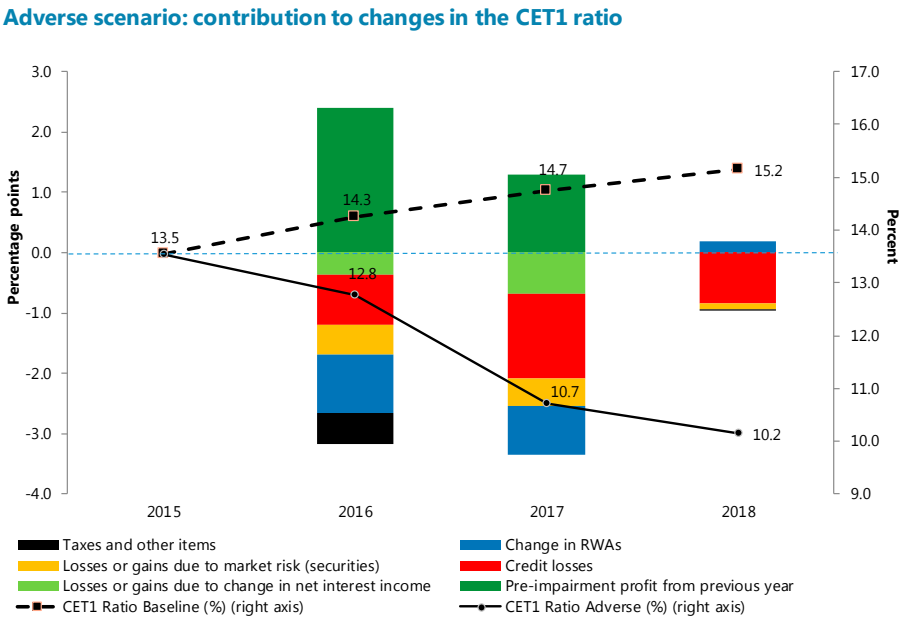
_____

Source: IMF staff.

[1] For a detailed discussion of the impact of changes in the slope of the yield on net interest income see Borio (2015).

Figure 11. Netherlands: Stress Tests Results: Evolution of Bank Capital and Its Drivers in the IMF Adverse Scenario

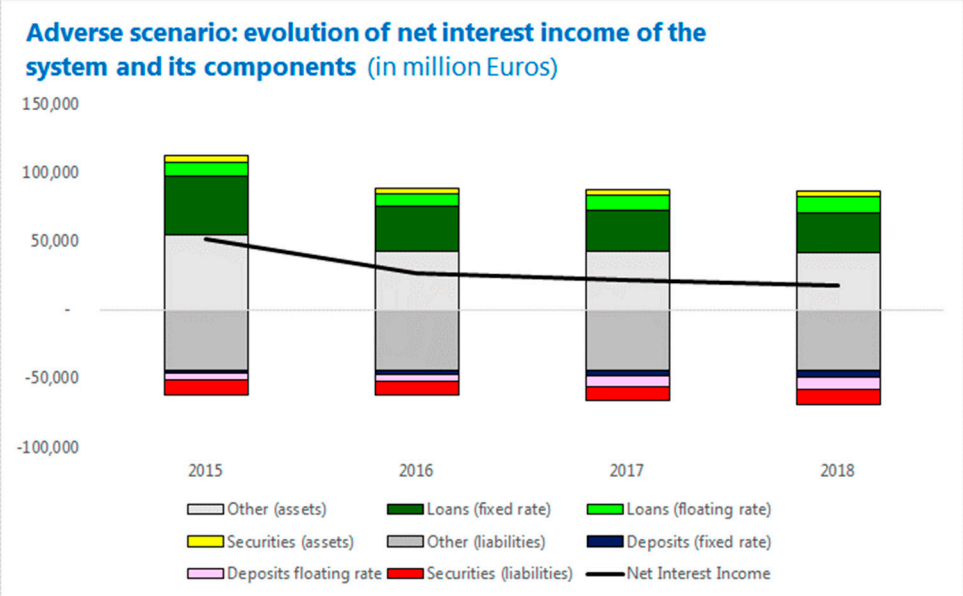
Deterioration in net interest income, credit and security losses as well as higher RWAs lead to lower capital ratios in adverse scenario.



Sources: IMF staff calculations.

Figure 12. Netherlands: Stress Tests Results: Evolution of Net Interest Income in IMF Adverse Scenario

Repricing of fixed-rate loans together with a cost-of-funding shock and 50% pass-through lead to decline in net interest income.



Sources: IMF staff calculations. Other assets and liabilties includes derivatives.

32. Each of the three main "threats" identified above contribute to a significant decline in bank profitability and capitalization under the stress scenario. The combination of extreme shocks triggers significant losses. Cost of funding shocks increase banks' interest expenses, reducing further net interest income (which as noted above, is set to decline even in the baseline scenario). A sharp slowdown in the domestic and foreign economies and rising real lending rates—driven by a partial pass-through from the cost of funding shocks as well as by deflation—trigger defaults that exacerbate banks' credit losses. These defaults, in turn, further reduce net interest income by failing to accrue interest. Sharp upward shifts in sovereign yield curves negatively impact the valuation of marked-to-market and FV securities portfolios.

33. More specifically, the stress test results reveal the following:

- *Overall profitability declines from 0.5 percent of assets in 2015 to -0.3 percent in 2017–18, with significant cumulative impact on capitalization levels*. Net interest income declines from 1.3 percent of assets in 2015 to 0.8 percent in 2018. Credit loss impairments rise from 0.2 percent of assets in 2015 to 0.5 percent of assets in 2015 (credit losses decline to 0.3 percent in 2018 as the economy starts recovering). The impact on gains or losses related to securities portfolios is also significant: a net gain of 0.2 percent of assets in 2015 turns into a 0.2 percent loss in 2017 due to sharp increase in sovereign bond yields in the adverse scenario (particularly in some foreign economies where high sovereign bond spreads materialize). Banks post losses on a pre-tax basis, and reduced tax payments partially mitigate the overall decline in bottom-line results.

- *Credit risk is a significant driver of overall losses*. In the adverse scenario, bank provisions rise with higher expected credit losses (driven by changes in PD and LGD rates). From a system-wide perspective, PIT PDs in 2015 were low for portfolios of mortgage loans and credit to financial institutions, and higher for exposures to corporate counterparts and consumer credit. In the adverse scenario, overall PIT PD rates rise sharply, reaching a peak level equivalent to 2.4 times the initial level, but with significant variation across exposure types and countries (as shown above, in Figure 9).[15]

- *Banks are also exposed to potential losses from market risk on sovereign and non-sovereign securities portfolios*. In the adverse scenario, banks are not only unable to repeat gains received in 2015 (equivalent 0.2 percent of assets), but also suffer from declining valuations as yield curves shift upwards. In the adverse macroeconomic scenarios, the duration-adjusted haircuts applied to all the securities in the held for trading, available for sale, and fair valued books cause

[15] Non-linear effects embedded in the estimated credit risk model (and consistent with observed data) imply larger subsequent increases in PDs for exposures that have higher PDs at the starting point; PDs also rise at an increasing rate as macroeconomic conditions deteriorate further and further. Average multipliers (across all banks and countries) for corporate and consumer credit exposures are 2.8 and 2.5, respectively, while average multipliers for mortgage loans are 1.7. Similarly, multipliers differ significantly by country due to the variation in starting PDs and severity of macroeconomic conditions in the adverse scenario; values for corporate exposures range from 2.4 to 3 in low-spread EA economies (Belgium, Germany, and the Netherlands) and from five to six in high-spread EA economies.

losses equivalent to 2 percent of the initial valuations. Potential losses are mitigated by the presence of floating rate securities (not stressed), large allocations to low-spread countries relative to high-spread countries, and short/intermediate average duration of portfolios.

BANKING SECTOR: TOP-DOWN SOLVENCY TESTS BASED ON SENSITIVITY ANALYSIS

34. Sensitivity tests assessed vulnerabilities of the banking system to concentration risk and to the introduction of risk-weight floors on mortgage portfolios. Unlike macroeconomic stress tests, sensitivity tests were *static*: they assessed the *instantaneous* impact of different shocks on the banks' balance sheets positions as of December 2015.

35. Concentration risk was tested by assessing the impact of default of the largest (one, three, and five) exposures.[16] The analysis was conducted for all banks (both SIs and LSIs) and excluded sovereign exposures. It used supervisory data as input, and calculated losses and impact on capitalization under different assumptions for the recovery rate.

- When no haircut is applied to collateral values, large banks would be able to withstand simultaneous defaults of up to four largest exposures without suffering undercapitalization (relative to an 8.5 percent Tier 1 hurdle rate). Only one small bank would be undercapitalized upon default of the single largest exposure, and one additional small bank would be undercapitalized in the event of simultaneous default of the three largest exposures.

- In an extreme and highly unlikely event, when 50 percent haircuts on collateral values are applied, one of the largest banks exhibits a shortfall of Tier 1 capital upon a simultaneous default of the three largest exposures; while other systemically important banks also exhibit undercapitalization in the presence of simultaneous default by the five largest exposures.

36. Sensitivity analysis also reveal a significant impact of introducing RWA floors for mortgage exposures on overall capitalization levels (measured in terms of CET1). The tests assessed the impact of increasing RWAs on (IRB-based) mortgage portfolios from current levels (15.4 percent on average for the largest banks in the system, with variation across banks)[17] to 60, 80, and 90 percent of the risk-weight level corresponding to standardized portfolios (35 percent). Thus, in different tests, the RWAs for mortgage portfolios increase to 21, 28, and 31.5 percent,

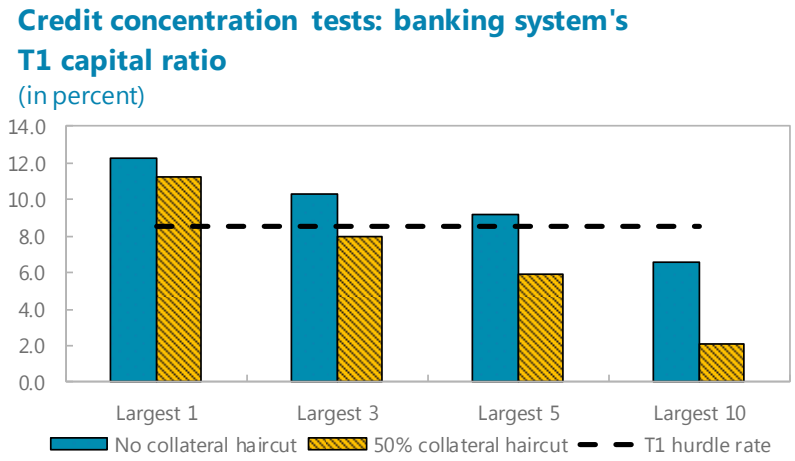
[16] In these tests, banks' RWAs were assumed to stay constant after the application of the shocks.

[17] This is the relevant ratio for the largest six banks in the system. The choice of floors is set relative to the 35 percent level corresponding to standardized portfolios. The sensitivity tests, however, do not take into consideration eligibility criteria of mortgage portfolios for preferential treatment. Revisions to the Basel III standardized approach for credit risk allow the introduction of a 20 to 100 percent range of standardized risk weights for residential mortgages, with specific weights determined based on LTV ratios and other features of the mortgages. Given the top-down nature of our exercise, we are unable to perform highly detailed calculations based on LTV ratios of individual mortgages, so a single risk-weight number (floor) is applied to overall loan portfolios.

respectively. The text figure below shows that, based on ratios corresponding to end-2015, the introduction of the floors would cause declines in CET1 equivalent to 0.7, 1.4, and 1.8 percentage points of CET1 respectively.[18]

Figure 13. Netherlands: Results Corresponding to Credit Concentration Stress Tests

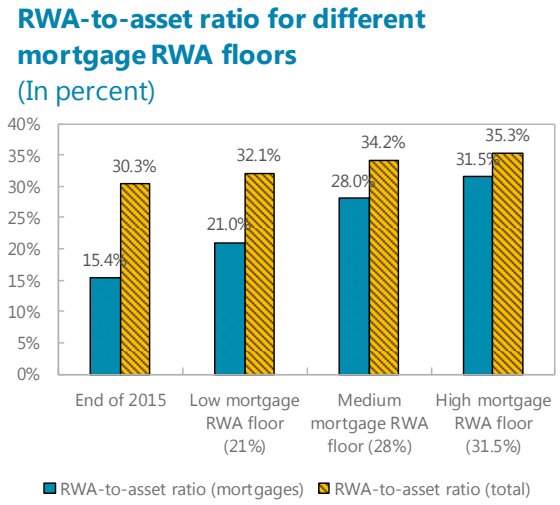
Concentration tests show that banks are vulnerable to default of 3 or more of the largest borrowers, if a 50% collateral haircut is assumed.



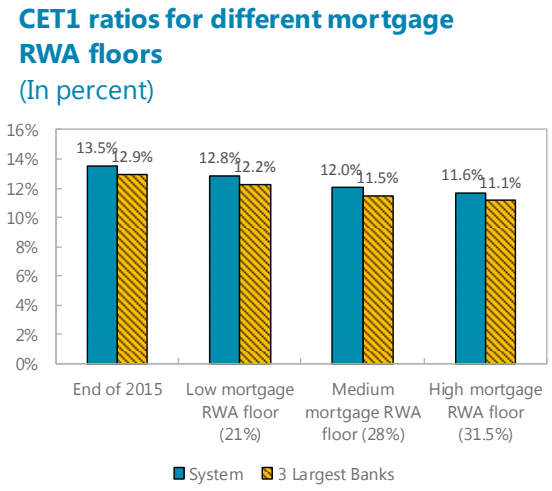
Source: IMF staff calculations.

Figure 14. Netherlands: Sensitivity Analysis: RWA Floors for Mortgage Portfolios

An introduction of a floor to RWA for mortgages increases RWA overall …



… and leads to reduction in capital ratios.



Source: IMF staff calculations.

[18] Note that the test is based on a simple "static" calculation; hence likely phase-in periods and potential dynamic behavioral responses of banks are not taken into account.

BANKING SECTOR: LIQUIDITY STRESS TESTS

37. Liquidity stress tests based on a maturity ladder analysis were undertaken to assess the capacity of banks to withstand severe funding pressures.[19] Cash-flow based liquidity stress tests were implemented through a TD approach, using information on the time structure of contractual cash flows generated by assets and liabilities. The tests assessed resilience to strong shocks characterized by run-off rates on funding sources calibrated by type, and liquidation of assets subject to valuation haircuts. Specifically, the exercise captured (i) a bank's liquidity needs derived from outflows; (ii) its available standby liquidity from inflows; and (iii) its buffers available to counterbalance liquidity gaps.

38. Funding pressures were captured through specific time profiles of run-off rates for different funding sources (Appendix V). A set of general principles, consistent with historical experience and empirical studies of depositor and investor behavior in extreme but plausible conditions, guided the choice of run-off rates. First, more informed and sophisticated depositors withdraw funding more rapidly than less informed depositors—run-off rates applied to wholesale funding sources are higher than those applied to retail funding sources. Second, run-off rates on secured funding sources are lower than those applied on unsecured funding sources. Third, under stress, sight deposits are/or deposits protected by deposit insurance are withdrawn at a slower pace than time deposits and/or those uninsured.[20] Fourth, regarding the intensity and persistence of the funding liquidity pressures, it is assumed that cash outflows would be protracted—lasting for up to two years. However, run-off rates are assumed to decline over time. The highest rates should correspond to short-term maturity buckets (0–30 days); medium-size rates are applied to intermediate maturity buckets (30–180 days); and the lowest rates correspond to longer-term time buckets (after 180 days).

39. For different assets and maturity buckets, specific roll-off rates were applied to convert maturing loans into cash proceeds (Appendix V). Specifically, 40–50 percent rates were applied to performing loans to retail and nonfinancial corporate customers, and 100 percent rates were applied to maturing loans to other entities (including financial institutions) and cash flows from debt securities. These represent the cash inflows that a bank can generate under the going concern assumption: its actions do not compromise banking relations with important borrowers and cause no significant business disruptions.

40. Banks can counterbalance negative funding gaps by using their cash holdings and the standing facilities of the ECB, or by drawing emergency liquidity assistance (ELA) from the ECB. In the tests, banks were allowed to cover negative balances of cash inflows relative to cash outflows by using their sovereign and non-sovereign securities. Banks could use securities as

[19] For methodological details, see IMF Guidance Note on Stress Testing, "Treatment of Liquidity Risks in Stress Tests," Number 11, November 2015.

[20] Sight deposits tend to be more stable, as they are usually held for transactional, operational, and cash management purposes.

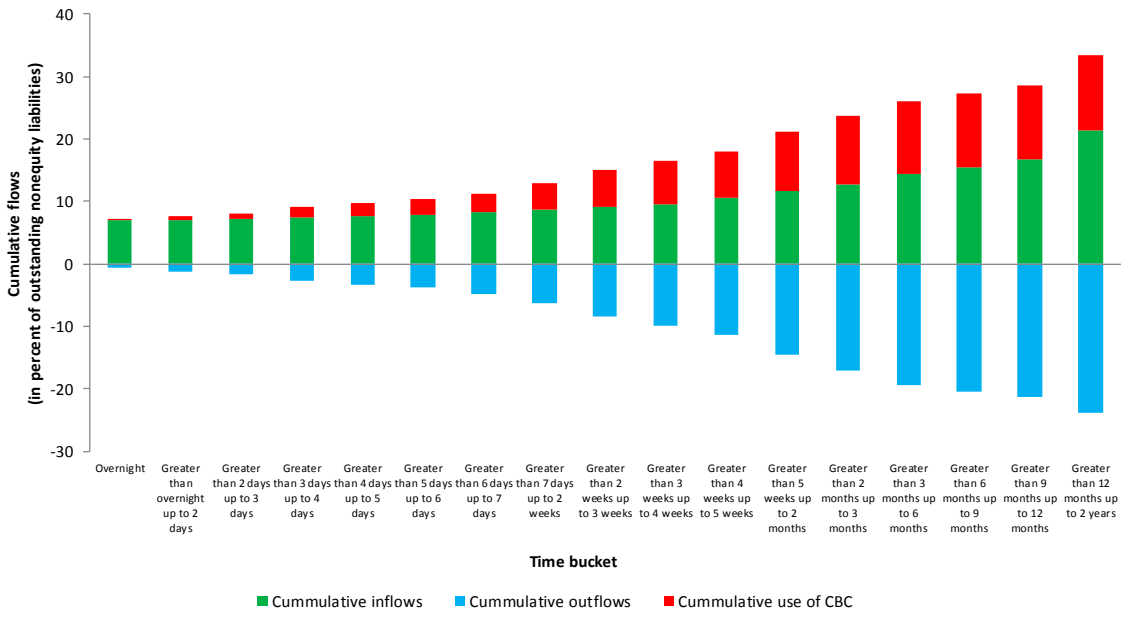
collateral to obtain liquidity through the standard liquidity facilities of the ECB. Banks could also obtain ELA from the ECB as a last resort and under more stringent conditions only when they had no eligible collateral to access the standard facilities. The pass-fail criterion is defined by the ELA provision: a bank that needs ELA to continue operating has failed the test.

41. In the tests, the combined contractual maturities reported by banks and the assumed run-off rates result in withdrawals of funding equivalent to 15-20 percent of the initial stock within the first two to three months (with variation across banks). Figure 15 shows the evolution of outflows in percent of outstanding non-equity liabilities, as well as the cumulative impact on asset sales for the system. However, as the tests were bank-specific, the cumulative outflows vary by bank: banks that extended the maturity structure of their liabilities would be more protected against runs, confronting les intense outflows in the test.

42. The results of the liquidity stress tests reveal that banks could handle significant withdrawals of funding. The results revealed that all banks could confront persistent and sizable withdrawals of funding without ELA from the ECB for periods longer than six months.

Figure 15. Netherlands: Bank Liquidity Stress Tests Cumulative Inflows, Outflows, and Use of Counter-Balancing Capacity

(In percent of outstanding non-equity liabilities)



Source: DNB; and IMF staff calculations.

43. An important conclusion of the exercise is that, despite banks' heavy reliance on wholesale funding, liquidity risks appear contained because the term structure of this type of funding has sufficient average length.

44. The FSAP team assessed the sensitivity of LCR calculations to alternative parameterizations leading to larger net liquidity outflows (denominators) over a 30-day period. All banks currently have LCR ratios that are comfortably above the 100 percent requirement. The sensitivity analysis assessed the impact of increasing numerical run-off rates on retail and wholesale deposits.[21] Specifically, run-off rates on stable retail deposits were increased from 5 to 10 percent, while those corresponding to deposits subject to higher outflows were increased from 12.5 to 20 percent (category 1) and from 17.5 to 25 percent (category 2). Withdrawal rates on wholesale deposits were also increased as follows: from 5 to 10 percent for operational deposits covered by deposit guarantees and from 25 to 40 percent for those unprotected by guarantees. The re-parameterization shows that LCR ratios for some banks (including some large ones) would decline below 100 percent but in all cases would remain above 85 percent.

A. Remarks on the Relation between Solvency and Liquidity Stress Test Results

- ***Is wholesale funding a "threat"?*** The most significant risk posed by banks' dependence on wholesale funding is revealed in the solvency tests: banks' cost of funding could rise sharply under adverse conditions, with adverse impact on net interest income and profitability. Sudden withdrawal of wholesale funding would not pose an imminent risk, as banks have been extending the maturity of this type of funding.

- ***Banks face a trade-off between strengthening resilience to changes in interest rates and improving resilience to funding liquidity shocks***. The process of extending the maturity of wholesale funding liabilities reduces roll-over (funding liquidity) risks. However, to the extent that banks raise wholesale funds at fixed rates, they also lock-in interest rate costs, reducing their ability to further lower costs when interest rates decline—as envisaged in the baseline scenario.

HOUSEHOLD SECTOR ANALYSIS

45. The housing boom-bust cycle and a double-dip recession have left a declining, but still highly indebted household sector in the Netherlands. The level of household debt and the share of mortgage arrears have maintained a downward trend in recent years, as the real economy experiences recovery and employment improves. However, about a quarter of residential mortgages are still underwater, especially among young households.

46. High private indebtedness implies that the household sector is exposed to negative shocks, which may lead to nontrivial credit losses and require banks extra provisioning, further deteriorating their low profitability. External macrofinancial risks are broadly on the downside with weak EA growth and a possible reversal of the global search for yield. Stresses—

[21] Most non-deposit funding tends to generate cash outflows at longer than 30-day horizons, so applying higher run-off rates to these funding sources would not alter LCR calculations in a significant manner.

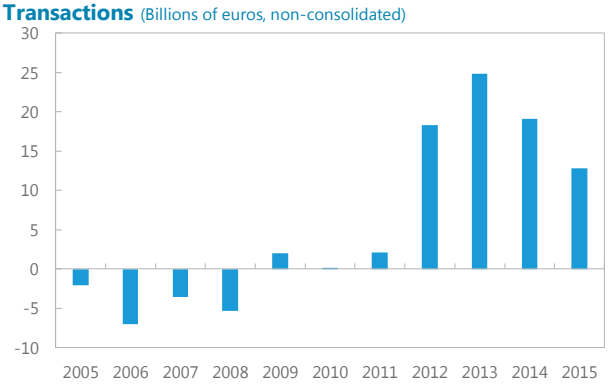
triggered by a sharp increase in interest rates, a halt of recovery in the real economy and labor market, a sharp decline in real estate prices, or a combination thereof—could have a significant impact on the financial sector via significant exposures to the household sector. Understanding how fragile the household sector would be against shocks is key to securing a robust recovery and financial stability in the Netherlands.

47. The rest of this section is outlined as follows. Sub-section A reviews the current state of household balance sheets using aggregate data. Sub-section B assesses the vulnerability of the Dutch household sector and its financial resilience to the FSAP stress test scenario, using loan-level data and a micro-simulation of household balance sheets developed by the DNB. Sub-section C concludes and considers policy options to address current and potential vulnerabilities.

A. Recent Developments in Household Indebtedness and Vulnerabilities

48. Households are improving their financial position, but are still highly indebted. Unlike the pre-crisis period, the household sector became a net lender in 2009 and has kept this status since then (text figure).[22] During 2010–2015, the outstanding balance of household financial assets increased by 23 percent from €1,772 to €2,181 billion, much faster than that of financial liabilities (6.3 percent).[23] Households' debt-to-net disposable income ratio also decreased from 294 percent in 2010 to 277 percent in 2015, supported by the economic recovery and employment growth. However, as shown in Figure 16, the household debt-to-disposable income ratio is one of the highest in Europe.

Netherlands: Household Financial Asset and Liability Transactions (Billions of euros, non-consolidated)

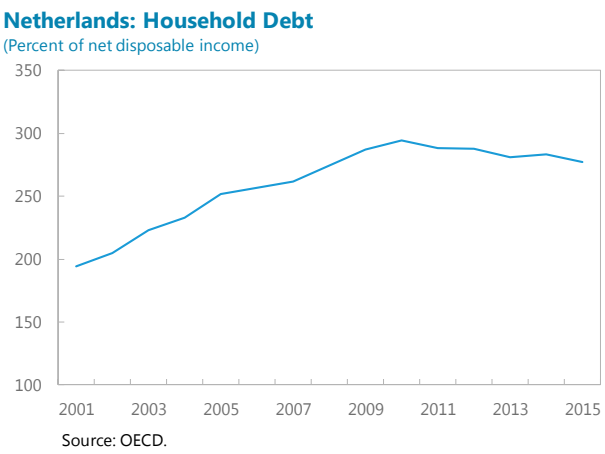


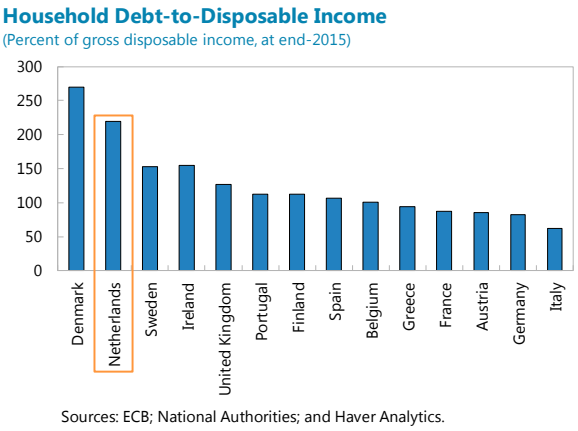
Sources: CBS; and IMF staff calculation.

[22] A sector is a net lender if the transaction of financial assets is larger than that of financial liabilities.

[23] To make a historical comparison, both the ESA 2010 and ESA 1995 quarterly financial account data are used.

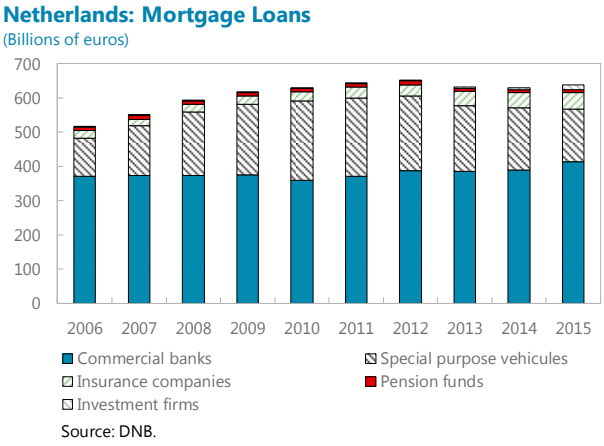
Figure 16. Netherlands: Household Debt-to-Income Ratio





49. The overall net wealth of households is strong, but their sizable asset holdings are mostly illiquid in the form of pension entitlements and housing assets. Debt-to-Total Assets stood at 25.7 percent at end-2014.[24] However, 80 percent of total assets comprises home equities (34 percent), life insurance (5 percent) and pension entitlements (41 percent), which are illiquid. Considering only financial assets, households had about minus €170 billion net worth at end-2014.

50. Mortgage loans have marginally decreased from the peak in 2012 (text figure). After reaching a peak at €652 billion in 2012, the outstanding balance of mortgages decreased to €639 billion by 2015. Its share in percent of GDP declined from 97 percent to 94 percent during 2013–2015. While securitization via Special Purpose Vehicles (SPVs) has declined significantly through the double-dip recession, insurance companies have doubled their market shares from 3.8 percent to 7.7 percent.



51. A sizable share of mortgage loans remains in negative equity.[25] Dutch housing markets were severely hit by the recent financial crisis. Through the double-dip recession, residential property prices fell by 21 percent. The share of underwater mortgages still accounts for a quarter of

[24] Total assets include currency and deposits, debt securities and loans, equities, financial derivatives, home equities, insurance and pension schemes, and other accounts receivables, according to the ESA 2010.

[25] Negative equity means that current LTV ratio is greater than 100.

the whole mortgages at end-2015, while it has been declining along a slow recovery in housing markets since 2013. Mortgage interest deductibility (MID), along with the absence of stringent LTV limits, has incentivized high LTV mortgages in the previous boom time which ended up as underwater mortgages afterwards.[26] Negative equity is a well-documented cause of default and/or depressed consumption (IMF, 2015). As Verbruggen and others (2015) points out, the large number of underwater mortgages is a latent risk for the Dutch economy, as underwater borrowers are less resilient to shocks and underwater mortgages may lead to higher credit losses in case of default. The share of underwater mortgages is particularly high among young borrowers (e.g., about 40 percent among borrowers at age 20–30, 55 percent among those at age 30–40), who bought houses at the end of the previous boom time with high originating LTV ratios.

52. Aggregate mortgage arrears have been low, but mortgages with higher LTV and loan-to-income (LTI) ratios have higher default rates. Despite sizable underwater mortgages, the aggregate share of mortgage arrears was 2.3 percent of total mortgages in 2013Q1 and has been decreasing in recent years, standing at 1.6 percent at end-2015. This phenomenon is driven by several factors, such as a full recourse mechanism, low and fixed lending rates, a strong social safety net, and a temporary tax exemption for intergenerational monetary gifts.[27] However, the share of mortgage loans with high LTV and LTI ratios continue to be very high and is a cause of concern in the Netherlands. Mortgages with originating LTV above 100 percent and originating LTI about four times account for 20 percent of total mortgages at end-2015, according to the DNB loan-level dataset. Even with a gradual reduction of official limits on LTV ratios, 37 and 50 percent of new mortgage loans have LTV and LTI ratios above 100 percent and four times at end-2015, respectively.[28] As shown in Table 5, mortgages with higher originating LTV and LTI ratios tend to fall

[26] The higher the mortgage balance, the higher the mortgage interest payment and the higher the mortgage interest deductability (MID). Even if a mortgage is not necessary due to a substantial wealth, it is beneficial to have one in order to maximize income tax deduction.

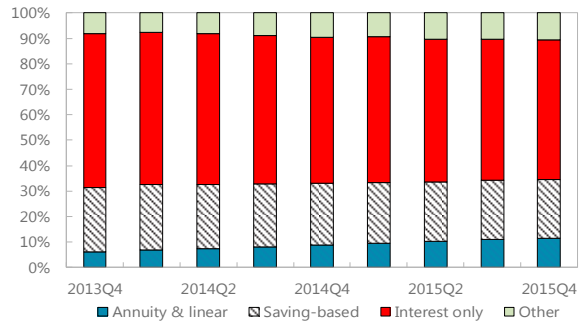
[27] Detailed information of these factors are as follows: (i) mortgage lending rates declined by about 120 basis points since October 2008, and the share of variable rate mortgages is low (12 percent) at end-2015; (ii) unemployment insurance is mandatory for all employees. The scheme grants generous benefits for a long period relative to other countries. It ensures a benefit payment of 70–75 percent of the last wage. The benefit duration is dependent on the employment history, but it can run up to 38 months. When the unemployment benefit term is expired, part of the unemployed can receive means-tested social assistance ('bijstandsuitkering') to ensure an absolute minimum standard of living; (iii) in 2014, the authorities introduced a temporary tax exemption for monetary gifts of up to €100,000 if the recipient used the proceeds to pay down debt on new or existing mortgages. More than 50,000 households signed up for the measure, which encouraged transfers between cash-rich elderly and young households and relieved liquidity constraints of the latter. It will be restored from January 2017; and (iv) the full recourse mechanism gives lenders the legal right to seize other assets and to have claims on the future income of borrowers who default on their mortgage loan, up to the full amount of the loan. It reduces the incentive of debtors to default even if they are underwater.

[28] The Ministry of Finance started to implement mandatory limits on LTV and debt-service-to-income (DSTI) ratios since 2013, respectively. They are imposed on all mortgages that are provided by all financial institutions in the Netherlands. See the Technical Note on Macroprudential Policy Framework for detailed information.

more frequently into arrears: while the share of arrears is only 0.4 percent among mortgages with LTV below 60 percent and LTI below two times, it is 4.9 percent among those with LTV above 120 percent and LTI six times at end-2015.

53. The stock of interest-only (IO) mortgages is a potential pocket of vulnerability in the Dutch mortgage market. The share of IO mortgages is about 55 percent of total mortgages at end-2015, the bulk of which will start to mature from 2030 onwards (text charts). Mortgage interest deductibility (MID) previously provided a strong incentive to maximize the loan amount and delay repayment of the principal until maturity by taking out IO mortgages. One quarter of mortgage borrowers fully rely on an IO mortgage, while about 60 percent of IO borrowers combine an IO with an amortizing mortgage.

Composition of Mortgage Loans by Type of Payment
(Percent of total mortgage loans)



Source: DNB based on loan-level data.

Table 5. Netherlands: Share of Mortgages in Arrears by Originating LTV and LTI Ratios

(In percent, as of 2015Q4, loan-level data)

Based on the latest loan-level survey		Originating LTV ratios							
		< 60	60-70	70-80	80-90	90-100	100-110	110-120	> 120
Originating LTI ratios	0-2	0.4	0.4	0.4	0.5	0.6	0.7	1.1	0.6
	2-3	0.4	0.5	0.6	0.8	0.9	1.2	1.6	1.5
	3-4	0.6	0.7	0.8	1.1	1.1	1.6	2.3	2.7
	4-5	0.8	1.0	1.3	1.5	1.8	2.1	3.1	4.4
	5-6	1.0	1.3	1.6	2.0	2.3	3.0	4.2	5.9
	> 6	1.4	1.4	1.6	2.0	2.4	2.9	3.7	4.9

Note: If the balance of mortgage loans, whose originating LTV and LTI are less than 60 percent and 0-2, amounts to €10 billions, and €1 billions out of €10 billions is in arrears, then the share of arrears in this group is 10 percent.

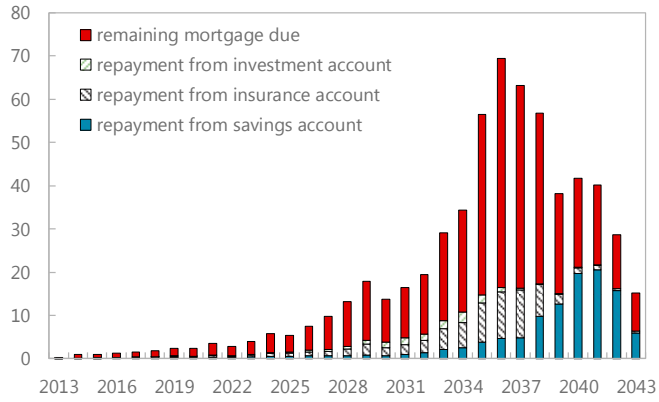
Source: DNB.

54. A large share of mortgage borrowers appears not to be accumulating sufficient financial assets to repay their mortgage loans by maturity. The DNB (2016) estimates that 60 percent of outstanding IO mortgages will not be fully covered by contractual payments or

pledged accounts at maturity.[29] Therefore, such households will need to negotiate with lenders to roll over a part of the mortgage or sell their homes at maturity, which could create a risk of fire sales or an increase in DSTI ratios, depending upon market conditions at the time.

B. Simulation Analysis of Risks of Mortgage Loans

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



Source: De Nederlandsche Bank.

55. The aggregate picture can mask large variations in financial soundness across households. Notwithstanding the resilience of mortgage borrowers during the double-dip recession, the effects of future macrofinancial shocks could transpire differently if unemployment rates were to rise or housing prices to drop again. Also, the impacts faced by individual borrowers varies substantially across different segments of households, according to current financial conditions. Therefore, policymakers need to know which segments of households are vulnerable to shocks and implement measures to enhance the resilience of the system as a whole as well as individual households.

Methodology and data

56. This subsection describes stress test results with micro-level data to assess the impact of the FSAP adverse scenario and identify the heterogeneity across segments of the Dutch households. Due to the confidentiality of the Income Panel Survey (IPO) data, simulations have been conducted by the DNB staff using its internal mortgage credit risk model for top-down stress tests. The stress test scenarios are reported in Table 2. Household characteristics and their balance sheet information in the dataset are explicitly used to measure the impacts of a stress scenario on the share of households with mortgage loans that become "highly risky," meaning that debt-service-to-income (DSTI) ratio increases to the level above the recommended limit.[30] Explicitly, the scenario inputs affect household income, mortgage characteristics, and each household's DSTI ratio.

57. The IPO dataset includes a representative sample of the Dutch population and builds on the tax returns households are required to submit. The refined sample of the IPO data covers about 4.5 million units after excluding some observations, such as early retirees, students, and those

[29] As part of the 2013 Housing Market Reform Agenda, new IO mortgages were no longer eligible for MID from January 2014. While maximizing tax deduction over time with the IO loans, the previous tax system allowed for untaxed accumulation of capital through dedicated savings accounts, investment accounts, or life insurance products, as long as they are used for principal repayment at maturity. Mortgages with these pledged accounts account for about 30 percent of total mortgage loans at end-2015.

[30] See the Technical Note on Macroprudential Policy Framework for detailed information.

who are not in the labor force. It has rich information on family size, income, interest payments, property value, mortgage loan, savings, debts, etc. In simulations, the 2010 data wave is used as a starting point for the top-down model, and the DNB loan level data is also used as supplementary information.

58. According to the IPO data, 97.5 percent of mortgage loans in the sample are outside Amsterdam. The most common age categories of the oldest in households are between 35-45 and 45-55 years old; about 50 percent of loans have LTV ratio of below 90 percent, with about 40 percent being in negative equity in the sample, which is slightly above the 2015 level; and borrowers with LTI ratio under four times represent about 86 percent of the sample, as opposed to six percent for those with LTI ratio above five times (Table 6).

59. In addition to the micro-study, staff used a general equilibrium model with a housing sector to simulate how uncertainty about house prices and household incomes would affect macroeconomic conditions for different LTV ratios (Box 3).

Table 6. Netherlands: Composition of Residential Mortgages

(In percent of the sample in the IPO 2013 data, about 55,000 households)

Groups	Percent	Groups	Percent
Location		**Current LTV Ratio**	
Amsterdam	2.5	LTV Under 60	29.4
Non-Amsterdam	97.5	LTV 60-70	6.2
Age of the oldest in a household		LTV 70-80	6.5
Age Under 35	13.5	LTV 80-90	6.8
Age 35-45	29.3	LTV 90-100	7.2
Age 45-55	30.0	LTV 100-110	8.4
Age 55-65	15.5	LTV 110-120	9.8
Age 65-75	8.8	LTV 120+	25.8
Age 75+	3.0	**Current LTI Ratio**	
Gross Income (threshold in euros)		LTI 0-2 times	36.0
Income Under 20 percentile	20 (49,220)	LTI 2-3 times	29.5
Income 20-40 percentile	20 (66,198)	LTI 3-4 times	20.8
Income 40-60 percentile	20 (83,560)	LTI 4-5 times	7.6
Income 60-80 percentile	20 (109,101)	LTI 5-6 times	2.7
Income 80-100 percentile	20 (277,522)	LTI over 6 times	3.4

Source: DNB.

Box 3. Effects of House Price Shocks on Economic Conditions Under Different LTV Ratios

Staff developed a DSGE model with a housing sector to analyze to which extent changes in the housing outlook affect macroeconomic conditions, conditional on three different LTV ratios—80 percent, 90 percent, and 100 percent. Staff calibrated the model to characteristics of the Dutch economy and simulated how an increase in the dispersion of housing values affects:

(i) **Variables governing home purchase decisions** including mortgage rates (the spread above the benchmark rate), mortgage lending, and residential investment; as well as

(ii) **Macroeconomic variables** that result from general equilibrium dynamics, including output, employment and consumption.

The model differentiates between households that serve their mortgage loan and households that default on their mortgage loan, and simulates changes in the distribution depending on financial and macroeconomic conditions. Of special interest are high-risk households that are on the verge of default. Households finance their housing purchase $p_{h,t}h_t$ with a mortgage loan l_t, subject to an LTV-constraint:

$$l_t \leq LTV_t p_{h,t} h_t$$

Next period, households receive a return $R_{h,t+1}$ on the house, which is equal to the rental rate[1] plus the increase in the value of the house ($R_{h,t+1} \equiv \vartheta_{i,t+1}(r_{h,t+1} + p_{h,t+1}(1-\delta))/p_h$), and pay the gross lending rate on loans equal to $R_{l,t} = 1 + i_{l,t}$. Housing returns vary across households due to idiosyncratic differences in housing values, represented by the shock $\vartheta_{i,t+1}$. Households discount future income at the stochastic discount factor M_{t+1} and choose housing and mortgage financing according to the following objective function:

$$\max_{h_t, l_t} \{-p_{h,t}h_t + l_t + E_t(M_{t+1} \int_{R^*_{h,t+1}}^{\infty} (R_{h,t+1} p_{h,t} h_t - R_{l,t} l_t) dG(R_{h,t+1}, \sigma_{h,t+1}))(1-\tau_H)\}$$

Households default if the value of their assets falls below the value of its liabilities, or the return on the house falls below a certain default threshold $R_{h,t+1} < R^*_{h,t+1}$:

$$R^*_{h,t+1} p_{h,t} h_t - R_{l,t} l_t = 0$$

Households borrow from banks that charge a spread on mortgage loans above the deposits rate to account for credit losses on the mortgage loan portfolio. Banks receive interest and principal on loans from households that serve their debt and take the house of defaulting households into possession, making a loss on defaulting loans. Banks set the lending rate to compensate for expected losses, such that the expected return on the mortgage loan portfolio is at least as high as the cost of funding, e.g., the deposit rate $R_{d,t}$:

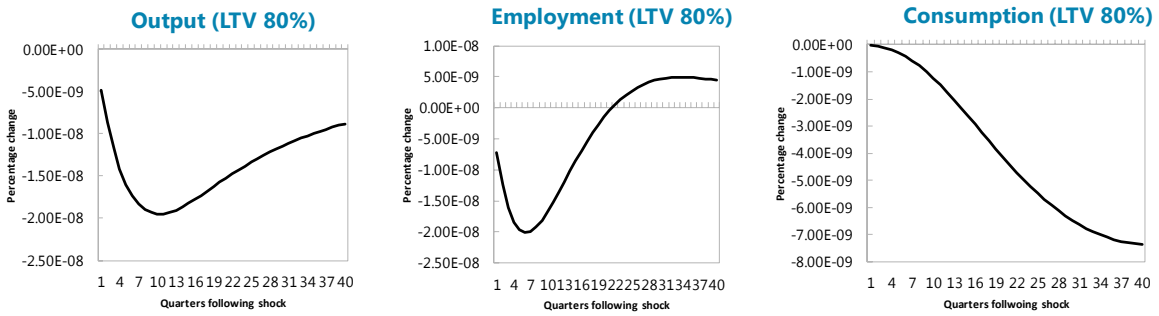
$$E_t\left(M_{t+1}\left(\int_{R^*_{h,t+1}}^{\infty} R_{l,t} l_t + \int_{0}^{R^*_{h,t+1}} R_{h,t+1} p_{h,t} h_t (1-\mu_H)\right) dG(R_{h,t+1}, \sigma_{h,t+1}) - R_{d,t} l_t\right) \geq 0$$

[1] Rental income is equal to a share of household income that is pledged for housing.

Box 3. Effects of House Price Shocks on Economic Conditions Under Different LTV Ratios (concluded)

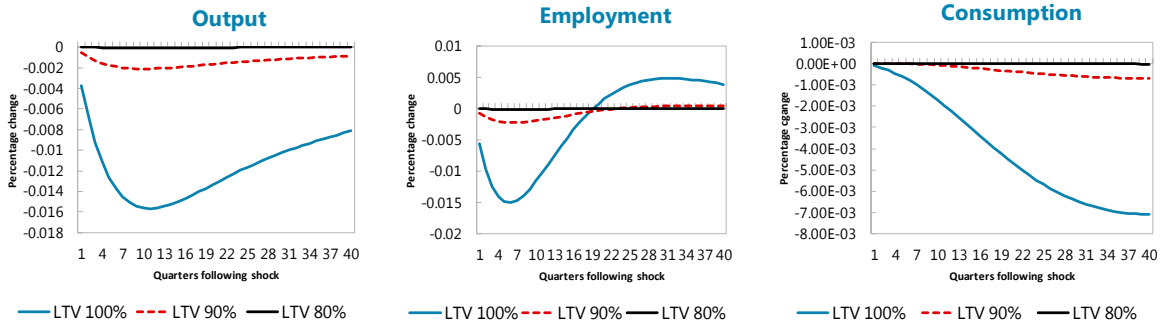
The model demonstrates that higher tax-deductibility encourages households to increase indebtedness, e.g., to seek a higher LTV ratio**.** According to Dutch tax laws, mortgage payments are tax-deductible ($\tau_h > 0$). In addition, banks suffer a loss ($\mu_h > 0$) upon default. Consequently, if households could choose their level of indebtedness freely (e.g., the LTV-ratio), they would increase their indebtedness until the expected cost of default offsets the expected value of tax-deductions. The higher the tax rate, the higher households' indebtedness.

Simulations show that higher risk associated to housing leads to declining output, employment and consumption; however, the decline is small if the LTV ratio is 80 percent. Staff simulated how an increase in the variance of housing returns that may be associated to increasing uncertainty about households' incomes and/or house prices, affects macroeconomic conditions. The figure below shows the response of output, employment and consumption to a one-standard deviation increase in the variance $\sigma_{h,t}$ of housing returns:



When housing return values are more dispersed, default becomes more likely, and banks' expected cost of default increases. Consequently, banks charge higher credit spreads, lending rates increase, and borrowers demand less credit. Residential investment, output and employment declines. As households invest less they have more liquid funds such that consumption only declines gradually with output and employment, owing to habits in consumption.

The higher the LTV ratio, the more vulnerable are households to changes in the housing outlook. The higher the LTV ratio, the earlier a household defaults. Consequently, the larger the LTV-ratio, the more households default in the aggregate. Staff repeated simulations with an LTV-ratio of 90 percent and 100 percent. The response of output, employment and consumption are significantly larger in that case.



Source: This box describes staff's simulations as well as the key part of staff's model pertaining to housing, borrowing households, and mortgage-providing banks, which extends standard New Keynesian models, such as the one presented in Smets and Wouters (2007).

Results

60. The analysis confirms that a young low income household with high LTV and LTI ratios tends to hit by the negative shock severely (Figure 17). Specifically,

- At an LTV ratio of over 120 percent, there is the largest increase in the share of high risk borrowers, even if the absolute level is fairly low at 2.4 percent given the historically low default rate (the upper left chart in Figure 17). At the LTI over six times, the share increases by 60 basis points from 3.7 percent to 4.3 percent (the upper right chart in Figure 17);

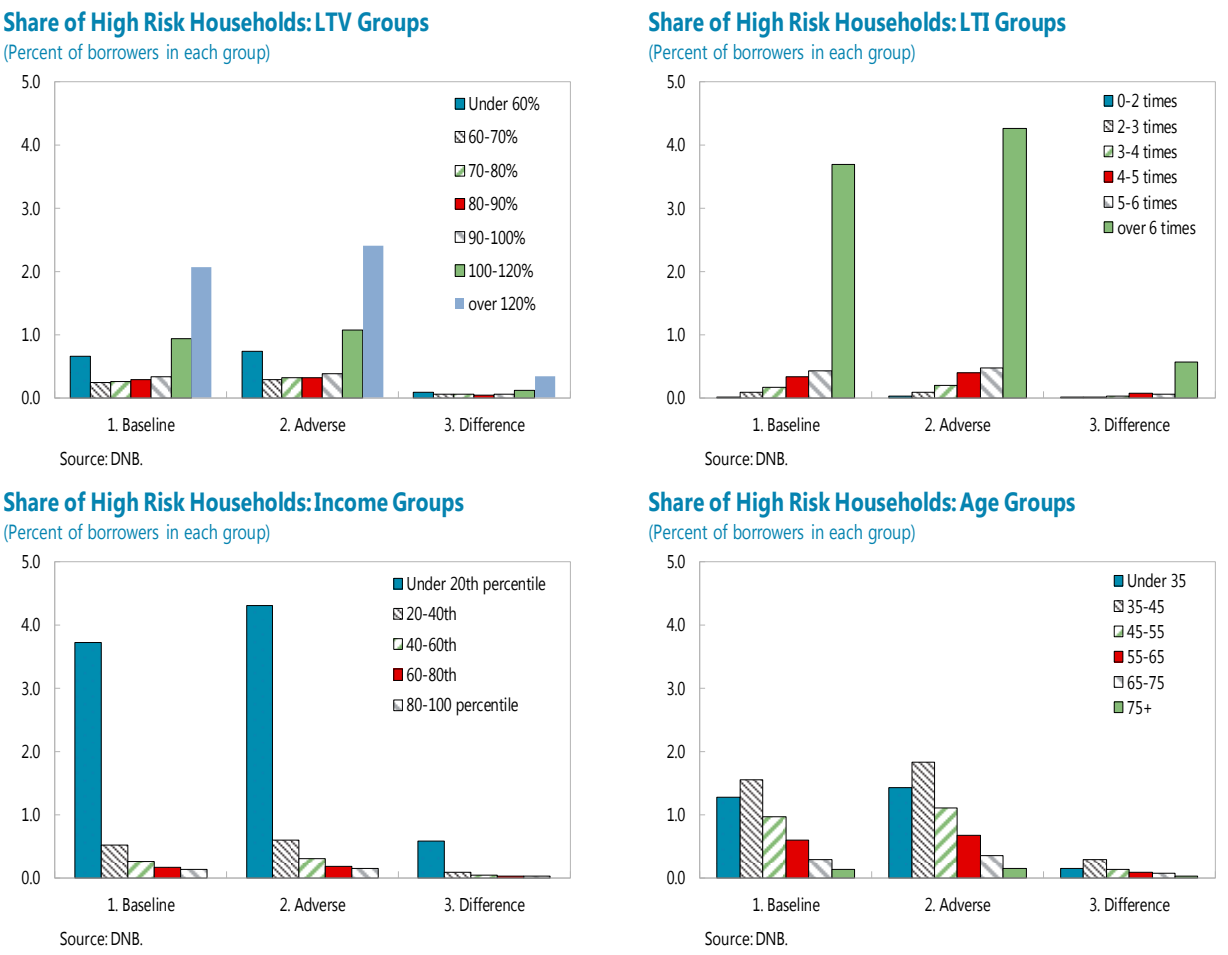
- When variation in the age of the head of a household is investigated, forward-looking vulnerabilities appear to decrease with age (the bottom left chart in Figure 17). Those under age 35 and age 35-45 are more likely to face an income shock, with those over 65 years of age being nearly unaffected. It must be noted that the forward-looking vulnerabilities are unconditional average estimates across the age groups. The current LTV distribution, which reflects a combination of many elements (originating LTV and DSTI, the housing cycle since origination, and location), may be a factor behind this pattern. Based on the DNB loan-level data at end-2015, the share of young borrowers (under 30 years old) with originating LTV and LTI ratios above 100 percent and 5 times was 54 percent and 64 percent, respectively, much higher than the analogous figures in the age over 70 group (4 percent and 24 percent). This largely reflects the higher originating LTV ratios that are prevalent among younger borrowers who bought their houses during the pre-crisis boom time;

- As expected, households with low income will suffer more under the adverse scenario than those with high income (the bottom right chart in Figure 17). Those in the other spectrum (under 20 percentile) would suffer the most with the share of high risk households increasing by about 60 basis points, whereas those in the 80-100 percentile income group are nearly unaffected by the shock due to the ample liquidity buffer; and

- Lastly, borrowers with mortgages outside Amsterdam are found to be more vulnerable than those with loans in Amsterdam under the adverse scenario. On average, borrowers in Amsterdam earn higher income, which functions as buffers against shocks.

61. Simulations based on the general equilibrium model suggest that the higher the LTV ratio, the more vulnerable are households to adverse changes in house prices and incomes. In a nutshell, the simulations showed that the higher the tax rate and mortgage payment deductibility, the higher is household indebtedness.

Figure 17. Netherlands: Share of High Risk Households against Adverse Shocks



C. Conclusion and Policy Implications

62. Segments of households that are particularly susceptible to economic shocks have been identified using aggregate and loan-level data. The analysis of household debt dynamics and the comparison of the simulated shares of high risk households across different groups reveals that borrowers with high LTV and LTI ratios are relatively more vulnerable to adverse shocks.

63. This analysis supports the role of limits to LTV and DSTI ratios; thus, the authorities should further tighten measures aimed at building the resilience of borrowers against future macrofinancial shocks. As shown in IMF (2014), the two tools will complement each other in reducing probabilities of defaults for borrowers and loss given defaults for lenders. LTV limits without a complementary role of DSTI limits could leave borrowers' capacity to service their

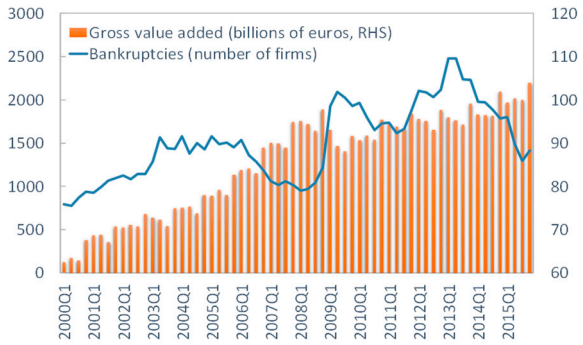
mortgages vulnerable to income shocks. DSTI caps without LTV measures could leave lenders highly exposed to severe house price shocks. Combining the Dutch experience during the crisis with results in this section supports the view that it is highly important to build the resilience of households and thus enhance the impacts on lenders' balance sheets.

64. To minimize the risks associated with a large share of IO loans, the industry and the authorities should act now in a concerted way in order to help borrowers with non-amortizing loans prepare for repayment. It can be done by strengthening the incentive to switch their loan types to annuity or linear mortgages, prepay the loans voluntarily, accumulate financial assets, or use equity release actively (e.g., for older borrowers). The authorities should work with the industry to develop a standardized approach to informing IO mortgage holders of their financial status vis-à-vis these loans and advise them on options for early remedial measures. In the United Kingdom, which faced a similar problem with high IO mortgages, insurers have been sending biennial color-coded letters since 2000 under an instruction from the supervisor. Endowment policyholders receive a red "traffic light" letter if the endowment is not expected to repay their mortgage, amber if it might, and green if it is likely, given prescribed annual growth rates. For example, an endowment in the red category would need to return above 8 percent per annum to meet the principal payment. The letters set out various options to policy holders and encourages them to increase savings or switch to a repayment mortgage at an early juncture.

CORPORATE SECTOR ANALYSIS

65. The Dutch nonfinancial corporate (NFC) sector seems to have broadly recovered from the global financial crisis. In the wake of the 2008 financial meltdown, overall turnover dropped sharply due to contracting demand, resulting in widespread firm bankruptcies, especially in the retail and construction sectors, shrinking value-added creation and rising unemployment. These trends have been reversed following the historical peak reached after the double-dip recession. The return to profitability has allowed for across-the-board strengthening of debt-to-equity ratios while the liquidity position of firms has improved.

Value added and bankruptcy trends in the NFC sector



Sources: DNB and CBS.

66. Continued tight lending standards, however, suggest that financial vulnerabilities persist in some segments of the NFC sector. Overall corporate sector debt remains elevated. Credit growth to the private sector has been lagging. Commercial real estate, used as collateral by many small businesses, remains depressed. As a result, small- and medium-sized enterprises (SMEs) tend to face higher interest rates and shorter loan maturities, whereas they are heavily dependent on bank financing (IMF, 2014).

67. The remainder of this section seeks to shed light on balance sheet developments in the NFC sector. Sub-section A briefly analyses the financial position of Dutch enterprises using macro-level data. Sub-section B investigates disaggregated developments across firm size and economic sectors using micro-level data. These are used in Sub-Section D to conduct sensitivity analyses aimed at assessing the resilience of Dutch firms to deteriorating macroeconomic and financial conditions. Section E concludes.

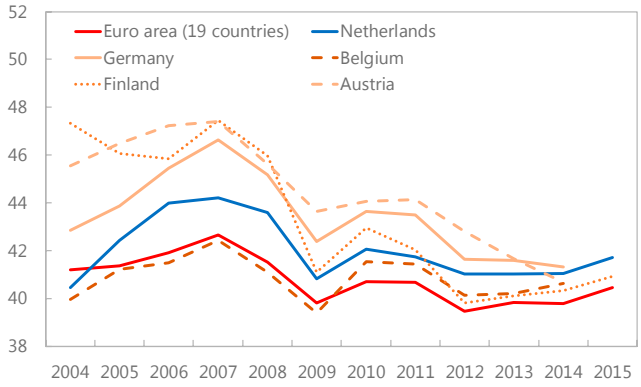
A. Stylized Facts on Overall Balance Sheet Developments

68. Corporate debt has stabilized at elevated levels in the Dutch corporate sector (Figure 18). After steadily decreasing against the backdrop of strong economic growth during the 2000s, overall gross corporate debt spiked from about 112 percent in 2008 to 127 percent of GDP in 2011, about 20 percent above the EU average.[31] Since then, total debt has stabilized at this level even as the recovery was gaining momentum. After sharply increasing from 26 percent in 2010 to 34.5 percent in 2014, the share of short-term debt has dropped to 30 percent recently.

69. However, the equity position of Dutch firms has markedly improved, improving leverage ratios. The share of equity in total firms' liabilities has been on an upward trend after bottoming up from the trough of 42 percent in 2008 to reach 50 percent in 2015, above pre-crisis levels. As a result, the average debt-to-equity ratio of the corporate sector as a whole has fallen below 100 percent since 2011. Overall, Dutch firms appear to experience moderate leverage ratios compared to EU country peers.

70. The strengthening of corporate balance sheets has been underpinned by sustained profitability. Throughout the crisis years, Dutch firms have been able to maintain gross profit rates of about 40 percent, above the EU average, while also gaining market shares in Europe. Since 2012, the change in net value added has accelerated to reach about 3 percent per year. These developments have helped Dutch firms preserve their debt servicing capacity in line with EU peers. The liquidity position of the overall corporate sector has been maintained, with the share of currency and deposits hovering over 15 percent of total financial assets.

Gross operating surplus to gross value added
(Percent)

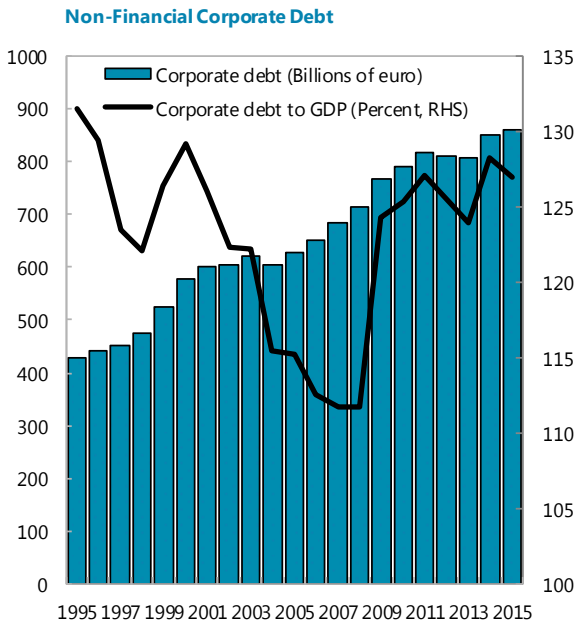


Source: Eurostat.

[31] Excluding inter-company lending, NFC sector debt increased from about 107 percent of GDP in 2008 to 111 percent in 2011, to actually peak at 116 percent of GDP in 2014. The breakdown of inter-company lending into its domestic and cross-border components is, however, not available.

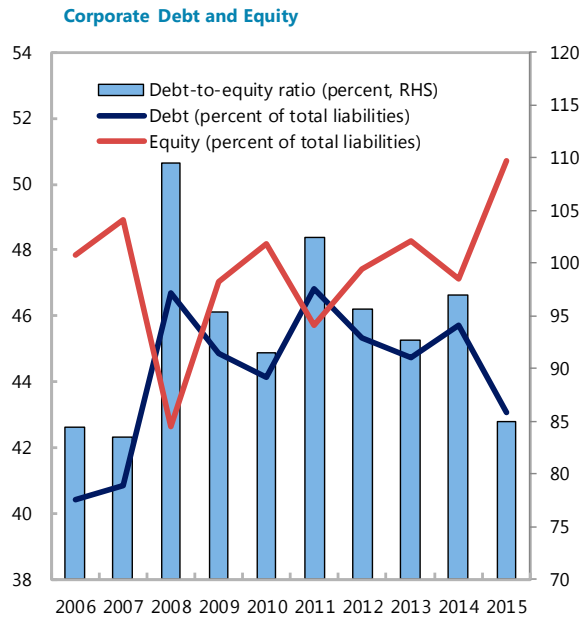
Figure 18. Netherlands: Balance Sheet Developments in the NFC

Corporate debt has stabilized at relatively high levels…



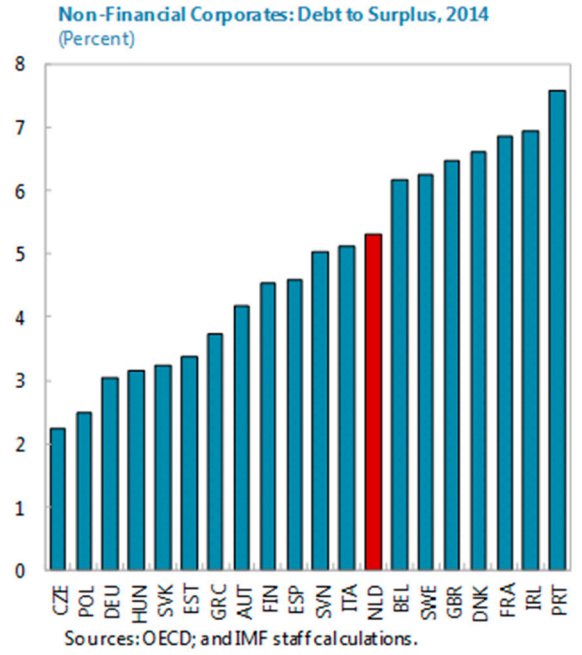
Sources: CBS and IMF staff calculations.

…but debt-to-equity ratios have improved in the aftermath of the financial crisis.



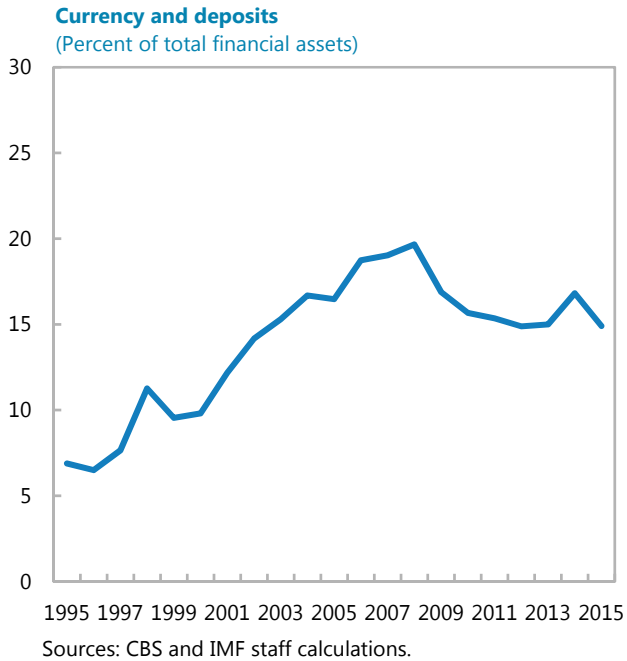
Sources: CBS and IMF staff calculations.

The debt-servicing capacity of Dutch firms is in line with EU peers…



Sources: OECD; and IMF staff calculations.

… while liquidity buffers have been preserved.



Sources: CBS and IMF staff calculations.

B. Insights on Dutch Firms' Financial Vulnerabilities using Micro-Level Data

Profitability, liquidity and leverage

71. The analysis relies on disaggregated balance sheet information on an average of 16,000 Dutch firms over the period 2008–2015. The ORBIS database, maintained by Bureau Van Dijk, comprises detailed financial information on each firm, also allowing for a breakdown by size, economic sector (using the NACE Rev. 2 decomposition) and shareholding structure (distinguishing between domestic and foreign ultimate owners). For the Netherlands, the sample obtained after retaining enterprises with sufficient records on operating turnover, liabilities and payroll mostly comprises domestic firms, 97 percent of which employ less than 50 employees or generate a turnover below €500,000 per year. In terms of sectoral decomposition, two-thirds of domestic firms provide financial services, about 20 percent other types of services, while 7 percent operate in the manufacturing and trade sectors.

Average Sample Coverage by Firm Size

Firm Size	Number of observations	Number of firms 1/
Domestic	74,004	16,237
Small	67,789	15,722
Medium	4,226	1,122
Large	1,990	535
Foreign	4,829	978
Small	2,951	801
Medium	957	241
Large	921	231
Total	78,833	17,215

Note: Small (1-49 employees), medium (50-249 employees), large (>249 employees).
1/ The sum of small, medium, and large firms tend to exceed their reported number due to some firms switching categories over the years.

Source: ORBIS.

72. While comprehensive, the ORBIS database is not exempt of limitations that should be borne in mind when interpreting results. First, the number and characteristics of firms vary over time. Further to limiting intertemporal analysis, this likely biases results towards overstating both profitability indicators (as the panel only includes surviving firms, whereas bankrupt ones get dropped) and indebtedness ratios (as these may be boosted by the inclusion of newly-created firms that have not broken even yet, especially among SMEs). Second, the number of observations drops markedly for year 2015 due to reporting lags, undermining the accuracy of forward-looking analyses, especially in a fast-changing environment. Finally, data restrictions emerge as the number of observations decreases when indicators are computed by firm categories. These caveats plead for focusing the interpretation of results on variations over time rather than absolute levels.

Sample Coverage by Firm Sectors
(percent)

	Share of observations			Share of firms		
Sector	Domestic	Foreign	Total	Domestic	Foreign	Total
Agriculture	0.8	1.7	0.9	0.6	1.3	0.6
Manufacturing	4.1	16.5	5.0	2.9	11.5	3.4
Trade	7.1	25.8	8.5	4.5	16.8	5.2
Information	2.4	5.4	2.6	1.4	3.5	1.6
Finance	56.6	33.4	55.0	66.5	51.3	65.6
Housing	3.7	1.3	3.5	3.2	1.7	3.1
Services	22.3	14.6	21.7	19.0	13.0	18.6
Other	3.0	1.3	2.9	1.9	0.9	1.9
Total	100	100	100	100	100	100

Source: ORBIS.

73. Dutch firms appear profitable, liquid and moderately leveraged in most sectors (Table 7). Disaggregated information reveals that *return on equity (ROE) ratios* have rebounded across all firm size categories after the 2011–2012 slump, with profit especially high for small and medium-sized domestic firms. However, relative profitability has been lagging behind in the housing industry and in services, and undergone a downward trend in the manufacturing and trade sectors, possibly on account of increased competition. Meanwhile, *liquidity buffers* have been continuously maintained, especially for small firms and in the finance and services sectors. Also consistent with macro-level data, *debt-to-equity ratios* have remained stable for all firm sizes and most sectors, although recent developments point to increasing leverage in the manufacturing and trade sectors. By contrast, the housing industry has undergone some continuous deleveraging, with debt-to-equity ratios brought down below 1 along the recovery that started in 2013.

74. Outstanding corporate sector debt is mostly concentrated in large firms and in the manufacturing sector. While 20 percent of total corporate debt was still held by SMEs in the aftermath of the financial crisis, this proportion drastically diminished since then and 92 percent of total debt was concentrated among large firms in 2015. By this time, more than 60 percent of corporate debt had been incurred in the manufacturing sector, followed by 15 percent in the trade sector.

Outstanding Debt of Domestic Non-Financial Corporations by Firm Size
(Percent of total)

	2009	2011	2013	2015
Total	100.0	100.0	100.0	100.0
Small	10.3	15.5	6.3	1.4
Medium	12.2	15.1	15.2	6.4
Large	77.3	69.5	78.5	92.3

Sources: ORBIS and IMF staff calculations.

Financial vulnerability

75. Interest cover ratios are used to assess the financial vulnerability of Dutch firms. For each enterprise, the interest cover ratio (ICR) corresponds to the ratio of earnings before interests, tax, depreciation and amortization (EBITDA) to interest payments due on liabilities for the same time period. Thus, the indicator measures the firm's ability to service its debt using current profits, i.e., without drawing down on its financial assets. A firm may be deemed financially vulnerable if its ICR is below 1– with the important disclaimer that it may draw down on other resources, or incur new liabilities, to repay interests due. In the Dutch case, EBITDA amounts could be computed exclusively using available information on the profit and loss account of firms from ORBIS, but given data shortages, interest payments had to be calculated by applying average corporate sector interest rates provided by the DNB for short-term (less than one year) and long-term (more than one year) interest rates to interest-generating components of current and non-current liabilities, respectively.

Interest Cover Ratios of Non-Financial Corporations by Firm Size
(median, in percent)

	2009	2011	2013	2015
Domestic firms	9.9	9.7	11.1	12.7
Small	10.8	9.7	12.3	13.8
Medium	9.9	9.8	10.5	13.8
Large	8.8	9.4	11.6	10.4
Foreign firms	13.0	16.3	16.9	14.2
Small	15.3	20.2	16.7	11.4
Medium	14.4	18.7	21.3	25.0
Large	9.4	10.9	11.9	9.5

Sources: ORBIS, and IMF staff calculations

Table 7. Netherlands: NFC Sector Balance Sheet and Profit and Loss Developments, 2009–15

Return on Equity (ROE) of Non-Financial Corporations by Firm Size
(median, percent)

	2009	2011	2013	2015
Domestic firms	13.4	12.9	11.0	16.4
Small	11.8	11.7	10.8	16.5
Medium	14.5	13.6	10.7	17.9
Large	13.4	13.7	12.2	14.4
Foreign firms	9.2	11.4	9.0	11.7
Small	5.0	6.9	4.2	7.3
Medium	12.4	14.7	11.7	14.3
Large	12.3	13.2	11.4	14.3

Return on Equity (ROE) of Domestic Non-Financial Corporations by Firm Sector
(median, percent)

	2009	2011	2013	2015
Total	12.6	12.6	10.6	15.3
Agriculture	11.5	13.8	9.7	15.8
Manufacturing	17.3	17.8	14.4	14.3
Trade	18.2	19.9	14.9	17.3
Information	24.7	22.5	15.4	17.3
Finance	13.1	11.7	10.9	18.5
Housing	7.0	6.2	4.8	9.0
Services	16.2	14.4	12.8	18.8
Other	12.6	12.5	7.6	9.1

Liquidity Ratio of Non-Financial Corporations by Firm Size 1/
(median, times)

	2009	2011	2013	2015
Domestic firms	2.1	2.3	2.4	2.0
Small	2.5	2.6	2.8	2.6
Medium	1.0	1.0	1.0	1.1
Large	1.0	1.0	1.0	1.0
Foreign firms	1.2	1.2	1.2	1.2
Small	1.2	1.3	1.3	1.4
Medium	1.2	1.1	1.2	1.2
Large	1.1	1.1	1.1	1.1

1/ (Current Assets - Stocks) / Current Liabilities

Liquidity Ratio of Domestic Non-Financial Corporations by Firm Sector 1/
(median, times)

	2009	2011	2013	2015
Total	2.1	2.2	2.2	1.9
Agriculture	1.3	1.4	1.2	1.2
Manufacturing	1.2	1.2	1.2	1.2
Trade	1.3	1.3	1.3	1.2
Information	1.8	1.7	1.8	1.4
Finance	2.4	2.6	2.7	2.6
Housing	1.5	1.6	1.7	1.5
Services	2.4	2.5	2.5	2.3
Other	1.5	1.7	1.8	1.5

1/ (Current Assets - Stocks) / Current Liabilities

Debt-to-Equity Ratio of Non-Financial Corporations by Firm Size
(median, times)

	2009	2011	2013	2015
Domestic firms	0.6	0.6	0.6	0.5
Small	0.7	0.8	0.7	0.7
Medium	0.6	0.6	0.5	0.4
Large	0.6	0.5	0.5	0.5
Foreign firms	0.4	0.4	0.4	0.5
Small	0.4	0.4	0.5	0.5
Medium	0.3	0.4	0.4	0.4
Large	0.5	0.4	0.5	0.5

Debt-to-Equity Ratio of Domestic Non-Financial Corporations by Firm Sector
(median, times)

	2009	2011	2013	2015
Total	0.6	0.5	0.5	0.5
Agriculture	1.1	1.1	1.3	1.2
Manufacturing	0.5	0.4	0.4	1.2
Trade	0.3	0.3	0.3	1.2
Information	0.3	0.3	0.2	0.4
Finance	0.6	0.6	0.5	0.5
Housing	1.8	1.9	1.1	0.5
Services	0.6	0.4	0.6	0.4
Other	0.6	0.8	0.9	1.1

Sources: ORBIS; and IMF staff calculations.

76. ICRs have been hovering at elevated levels for all categories of Dutch firms. The median ICR has improved to reach high levels by international standards across all firm sizes, despite rising indebtedness. Also featuring a high degree of financial resilience in general, developments by sectors appear more contrasted, with limited evidence pointing to downward trends in the manufacturing and trade sectors recently, while firms operating in the housing sector remain relatively more vulnerable.

ICR of Domestic of Non-Financial Corporations by Firm Sector
(median, in percent)

	2009	2011	2013	2015
Total	9.9	9.7	11.1	12.7
Agriculture	9.2	10.5	6.9	10.3
Manufacturing	15.3	19.2	19.9	12.1
Trade	16.1	19.4	23.1	14.0
Information	28.4	24.5	22.8	13.9
Finance	9.7	8.4	11.1	15.8
Housing	2.9	2.6	4.2	4.4
Services	13.8	12.3	13.2	19.2
Other	8.5	7.5	5.4	3.1

Sources: ORBIS, and IMF staff calculations

77. Nonetheless, firm-level data indicate that a segment of sample enterprises continues to have low ICRs, also holding a non-trivial proportion of corporate debt. Despite significant improvements since the financial crisis, about 16.5 percent of firms, holding about 21.5 percent of total corporate debt, still exhibited ICRs below 1 in 2015—with higher proportions reported for the small- and medium-sized firm categories. While already-mentioned sample distortions likely result in an overestimation of the share of debt held by firms with low ICRs, these numbers would warrant further investigation using a more granular and complete dataset, as they point to the existence of remaining pockets of vulnerabilities among firm categories. Focusing on variations rather than levels, noteworthy developments include the sharp decrease in the share of debt held by vulnerable firms from the peak reached during the 2012 recession across all firm sizes. In terms of sectoral breakdown, debt held by firms with low ICRs appears mostly concentrated in the services and, to a lesser extent, in the housing industry—but these observations emanate from a very limited number of observations.

Share of Domestic Non-Financial Corporations by ICR Category
(Percent of total)

	2009	2011	2013	2015
ICR Total	100.0	100.0	100.0	100.0
ICR < 1	27.0	25.9	26.6	16.4
1 ≤ ICR <2	3.7	3.9	3.1	4.0
2 ≤ ICR < 3	3.2	3.8	3.4	3.5
ICR ≥ 3	66.1	66.3	66.9	76.1

Sources: ORBIS and IMF staff calculations.

Debt at Risk of Domestic Non-Financial Corporations by Firm Size
(Percent of each size category)

	2009		2011		2013		2015	
	ICR < 2	ICR < 1	ICR < 2	ICR < 1	ICR < 2	ICR < 1	ICR < 2	ICR < 1
Total	65.3	57.1	27.3	19.7	49.7	34.9	31.4	21.3
Small	55.8	43.0	15.9	12.6	55.0	42.6	34.1	26.2
Medium	77.2	52.0	53.1	33.1	66.2	58.1	44.3	34.8
Large	64.7	59.8	24.2	18.4	46.1	29.7	30.5	20.3

Sources: ORBIS and IMF staff calculations.

C. Sensitivity Analysis of the Dutch NFC Sector

78. This section assesses the financial resilience of Dutch firms to adverse changes in the macroeconomic environment. To conduct sensitivity analysis, the ICR of each firm is recalculated using adjusted EBITDA and interest payment amounts following three kind of shocks: on interest rates; on profit; and featuring a combination of both (Table 8). More precisely:

- The interest rate shock takes the form of a uniform tightening of nominal effective interest rates along the yield curve, coupled with a reduction in nominal profits aimed at capturing deflationary trends. While current liabilities are immediately affected, it is assumed that 70 percent of long-term debt is renegotiated at the time the environment deteriorates. The impact of the shock is mitigated, however, by gains realized by firms on their financial assets, with a pass-through of 50 percent of the interest rate increase. Thus:

$$ICR_{IR\ shock_t} = \frac{(1 - deflation\ rate_t) * EBITDA_t + 0.5 * IR\ shock_t * Financial\ assets_t}{(ST\ IR_t + IR\ shock_t) * Current\ Liabilities_t + LT\ IR_t(1 + 0.7 * IR\ shock_t) * \ Non\ current\ liabilities_t}$$

- The profit shock assumes that EBITDA drops in nominal terms, hence straightforwardly incorporating deflationary movements:

$$ICR_{Profit\ shock_t} = \frac{(1 - nominal\ drop\ rate_t) * EBITDA_t}{ST\ IR_t * Current\ Liabilities_t + LT\ IR_t * Non\ current\ Liabilities_t}$$

- The combined shock is obtained as:

$$ICR_{Comb\ shock_t}$$

$$= \frac{(1 - nominal\ drop\ rate_t) * EBITDA_t + 0.5 * IR\ shock_t * Financial\ assets_t}{(ST\ IR_t + IR\ shock_t) * Current\ Liabilities_t + LT\ IR_t(1 + 0.7 * IR\ shock_t) * \ Non\ current\ liabilities_t}$$

79. The sensitivity analysis is conducted using two scenarios. The "adverse" scenario features an 80 basis points interest rate hike combined with a 2.5 percent deflation rate, and a 9 percent shortfall in nominal profits. The "severe" scenario assumes an interest rate increase of 200 basis points, a 6 percent deflation rate, and a profit contraction of 15 percent.

80. The Dutch NFC sector appears generally resilient to adverse macroeconomic conditions (Table 8). Results indicate that, notwithstanding sizeable deviations in ICRs compared to the baseline scenario, especially for the largest enterprises, the Dutch NFC sector appears broadly resilient to adverse macroeconomic shocks, on account of strong initial buffers. Following the combined shock under the "severe" scenario, the median ICR for all firms falls to 6.5 percent, still comfortably above levels indicating financial distress, while the share of firms with ICR below 1

increases from 16.4 to 18.2 percent and the proportion of debt held by those firms increases from 21 to 26 percent, respectively. Given the assumed calibration under both scenarios, the impact of the interest rate increases appears to dominate the one associate with profit shortfall, despite financial gains likely realized by some of the small and large firms.

Table 8. Netherlands: Sensitivity Analysis of the Dutch NFC Sector under 'Adverse' and 'Severe' Scenarios

(In percent)

Sensitivity Analysis of the Dutch NFC Sector under 'Adverse' and 'Severe' Scenarios

	ICR of the median firm		Share of firms				Share of debt			
			ICR<1		ICR<2		ICR<1		ICR<2	
	Adverse	*Severe*	Adverse	*Severe*	Adverse	*Severe*	Adverse	*Severe*	Adverse	*Severe*
Baseline 1/										
All firms	12.2		16.4		20.4		21.3		31.4	
of which:										
Small	12.9		17.4		22.5		26.2		34.1	
Medium	13.8		15.9		19.0		34.8		44.3	
Large	10.4		16.3		20.8		20.3		30.5	
Interest rate shock										
All firms	9.5	*7.1*	17.1	*18.2*	21.8	*25.1*	21.7	*25.8*	32.6	*51.1*
of which:										
Small	10.4	*7.9*	18.0	*18.6*	23.8	*26.7*	27.6	*27.6*	34.4	*41.8*
Medium	10.6	*7.9*	16.4	*17.9*	20.1	*22.5*	38.3	*39.7*	47.8	*51.9*
Large	8.0	*6.0*	17.4	*18.2*	22.9	*27.7*	20.5	*24.7*	31.5	*51.2*
Profit shock										
All firms	11.1	*10.4*	16.7	*16.7*	21.1	*21.1*	21.5	*21.5*	32.5	*32.6*
of which:										
Small	11.8	*11.0*	18.0	*18.0*	23.8	*23.8*	27.5	*28.9*	34.4	*34.4*
Medium	12.5	*11.7*	16.1	*16.1*	19.3	*19.3*	38.1	*38.3*	47.7	*47.7*
Large	9.5	*8.8*	16.6	*16.6*	21.5	*21.5*	20.3	*20.4*	31.4	*31.5*
Combined shock										
All firms	8.9	*6.5*	17.3	*18.9*	22.3	*26.6*	25.6	*25.8*	44.2	*56.2*
of which:										
Small	9.7	*7.1*	18.2	*19.4*	24.0	*28.1*	27.6	*31.1*	34.4	*49.2*
Medium	9.9	*7.1*	16.5	*18.2*	20.7	*24.1*	38.3	*39.7*	49.4	*52.8*
Large	7.5	*5.4*	17.9	*19.5*	23.3	*29.2*	24.7	*24.8*	43.8	*56.7*

Sources: ORBIS and IMF staff calculations.
Note: median ICRs reported under the baseline scenario slightly differ from numbers reported in section C due to slight changes in the sample size.

D. Conclusion

81. The overall Dutch NFC sector has emerged from the crisis with strong financial buffers, albeit with some likely heterogeneity across firm categories. While total corporate debt remains elevated, Dutch firms appear to have generally restored their profitability, strengthened their equity and built up liquidity buffers—thus preserving their capacity to service their debt in the face of shocks. However, preliminary results from the examination of disaggregated firm-level information

point to likely financial vulnerabilities among some subcategories of firms, as also suggested by persistently tight lending standards and subdued credit growth that appear to trail the economy recovery. From a prudential viewpoint, this observation pleads for swiftly addressing data gaps that may hamper more granular investigation into corporate balance sheets.

Appendix I. Stress Testing Matrix for the Banking Sector

Domain		Assumption		
		Bottom-Up by Banks (EBA)	Top-Down by Authorities	Top-Down by FSAP Team
BANKING SECTOR: SOLVENCY RISK				
1. Institutional Perimeter	Institutions included	• The following four banks: ING Bank N.V.; Coöperatieve Rabobank U.A.; ABN AMRO Bank N.V.; N.V. Bank Nederlandse Gemeenten.	• The following six banks: ING Bank N.V.; Coöperatieve Rabobank U.A.; ABN AMRO Bank N.V.; N.V. Bank Nederlandse Gemeenten; Nederlandse Waterschapsbank N.V.; SNS Bank N.V.	• The following six banks: ING Bank N.V.; Coöperatieve Rabobank U.A.; ABN AMRO Bank N.V.; N.V. Bank Nederlandse Gemeenten; Nederlandse Waterschapsbank N.V.; SNS Bank N.V.
	Market share	• 81 percent of total assets in the banking system.	• 87 percent of total assets in the banking system.	• 87 percent of total assets in the banking system.
	Data and baseline date	• Latest data: December 2015. • Supervisory data reported by banks in especial templates for the 2016 EBA EU-wide stress tests. • Scope of consolidation: banking activities of the consolidated banking group. • Coverage of sovereign and non-sovereign securities exposures: HFT, AFS, and FV accounts, valued at MTM or fair-value respectively at starting point.	• Latest data: December 2015. • Supervisory data: balance sheet and income statements provided by authorities, sub-sets of templates submitted by banks to EBA. • Scope of consolidation: banking activities of the consolidated banking group. • Coverage of sovereign securities exposures: HFT, AFS, and FV accounts, valued at MTM or fair-value respectively at starting point.	• Latest data: December 2015. • Supervisory data: balance sheet and income statements provided by authorities (ITS system/Corep and Finrep data provided by ECB supervision; sub-sets of templates submitted by banks to EBA). • Scope of consolidation: banking activities of the consolidated banking group. • Coverage of sovereign and non-sovereign securities exposures: HFT, AFS, and FV accounts, valued at MTM or fair-value respectively at starting point.

Domain		Assumption		
		Bottom-Up by Banks (EBA)	Top-Down by Authorities	Top-Down by FSAP Team
2. Channels of Risk Propagation	Methodology	• Banks' own internal models, constrained by methodological guidelines provided by EBA.	• Authorities' satellite models and methodologies. • Balance-sheet regulatory approach.	• Macroeconomic scenarios were quantified using IMF models (MCM) (Vitek, 2015). • FSAP team satellite models and methodologies. • Balance-sheet regulatory approach.
	Satellite Models for Macrofinancial linkages	• Banks' own internal models, constrained by methodological guidelines provided by EBA.	• Models for credit losses on mortgage loans based on micro-level large dataset (from tax and survey sources). • Own models and methodologies for net interest and other income. • All assumptions on shocks and were agreed with the FSAP team.	• FSAP team estimated models for credit losses on foreign portfolios, and used authorities' (highly granular) models for credit losses on domestic mortgage loan portfolios. • Methodology to calculate losses from debt instruments (sovereign and other issuers). Haircuts are calculated based on a modified duration approach and historical distributions of changes in yield.
	Stress test horizon	• 2016–18	• 2016–18	• 2016–18
3. Tail Shocks	Scenario analysis	• Macro scenarios developed by EBA and ECB (include paths to GDP, inflation, interest rates, unemployment, property prices, equity prices, haircuts on securities). • The (U-shaped) adverse scenario is based on a cumulative decline of GDP of two standard deviations over two years.	• Macroeconomic scenario analysis: agreed with authorities. • Baseline scenario based on latest IMF staff projections. • The (V-shaped) adverse scenario is based on a cumulative decline of GDP of two standard deviations over two years that incorporates shocks external to the EA, shocks common to the EA (differentiated across groups of countries), and specific domestic shocks to real estate prices and banks' cost of funding.	

Domain		Assumption		
		Bottom-Up by Banks (EBA)	Top-Down by Authorities	Top-Down by FSAP Team
	Sensitivity analysis	n.a.	• Sensitivity analysis: agreed with authorities. They evaluate domestic shocks: failure of the largest 1, 2, 5, and 10 corporate exposures; effect of introducing RWA floors for mortgages, equivalent to 60, 80, and 90 percent of risk weight corresponding to standardized portfolios.	
4. Risks and Buffers	Risks/factors assessed (How each element is derived, assumptions)	• Based on EBA 2016 EU-wide stress testing methodology.	• Credit losses by exposure type and country. • Losses from debt instruments (sovereign and other issuers) in the banking and trading books. • Impact of funding cost shocks on net interest income. • Market risk, including foreign exchange risk.	
	Behavioral adjustments	• Static balance sheet assumption. • Payout rates consistent with past experience.	• Static balance sheet. • Dividends can only be paid out by banks that remain adequately capitalized. Payout rates consistent with past experience.	• Static balance sheet. • Dividends can only be paid out by banks that remain adequately capitalized. Payout rates consistent with past experience.
5. Regulatory and Market-Based Standards and Parameters	Calibration of risk parameters	• PDs and LGDs: point in time for credit losses and through the cycle for stressed RWA calculations.	• PDs and LGDs: point in time for credit losses and through the cycle for stressed RWA calculations.	• PDs and LGDs: point in time for credit losses and through the cycle for stressed RWA calculations.
	Regulatory/Accounting and Market-Based Standards	• Hurdle rate: not specified. • Capital metrics: transitional and fully loaded Basel III regulatory requirements. • CET1, T1, CAR, leverage ratio.	• Hurdle rates: as indicated in Table 4. • Capital metrics: fully loaded Basel III regulatory requirements. • CET1, T1, and leverage ratio.	• Hurdle rates: as indicated in Table 4. • Capital metrics: fully loaded Basel III regulatory requirements. • CET1, T1, and leverage ratio.

Domain		Assumption		
		Bottom-Up by Banks (EBA)	Top-Down by Authorities	Top-Down by FSAP Team
6. Reporting Format for Results	Output presentation	• Not determined.	• Capital shortfall system wide. • Dispersion of capital ratios: min., avg., max.; percentage of assets that fail. • For each hurdle rate (or range), share in whole system by asset.	• Capital shortfall system wide. • Dispersion of capital ratios: min., avg., max.; percentage of assets that fail. • For each hurdle rate (or range), share in whole system by asset.
BANKING SECTOR: LIQUIDITY RISK (JOINT BETWEEN AUTHORITIES AND FSAP TEAM)				
1. Institutional Perimeter	Institutions included	n.a.	• The following seven banks: ING Bank N.V.; Coöperatieve Rabobank U.A.; ABN AMRO Bank N.V.; N.V. Bank Nederlandse Gemeenten; Nederlandse Waterschapsbank N.V.; SNS Bank N.V.; The Royal Bank of Scotland N.V.	
	Market share	n.a.	• 88 percent of total assets in the banking system.	
	Debt and baseline date	n.a.	• Latest data: December 2015. • Source: supervisory data. • Scope of consolidation: consolidated banking group.	
2. Channels of Risk Propagation	Methodology	n.a.	• Cash-flow-based using data on the time structure of undiscounted cash flows for up to one year. • Variants of LCR ratios by currency. • Test will be top-down.	
3. Risks and Buffers	Risks	n.a.	• Funding liquidity • Market liquidity	
	Buffers	n.a.	• Counterbalancing capacity. • Central bank (standing) facilities (general framework only, excluding unconventional facilities).	
4. Tail Shocks	Size of the shock	n.a.	• Bank run on deposits and dry up of wholesale funding markets, taking into account haircuts to liquid assets. • Run-off rates on funding sources calibrated to trigger a severe cumulative withdrawal of overall funding amount (about 20 percent over a three-month period).	

Domain		Assumption		
		Bottom-Up by Banks (EBA)	Top-Down by Authorities	Top-Down by FSAP Team
5. Regulatory and Market-Based Standards and Parameters	Regulatory standards	n.a.	• Liquidity gap, survival period. • Consistent with Basel III draft standards (LCR).	
6. Reporting Format for Results	Output presentation	n.a.	• Liquidity gap by bank. • Survival period in days by bank, number of banks that still can meet their obligations.	
BANKING SECTOR: CONTAGION RISK				
1. Institutional Perimeter	Institutions included	n.a.	n.a.	• For domestic network analysis of contagion based on balance sheet data, the following six banks: ING Bank N.V.; Coöperatieve Rabobank U.A.; ABN AMRO Bank N.V.; N.V. Bank Nederlandse Gemeenten; Nederlandse Waterschapsbank N.V.; SNS Bank N.V. • For market based analysis: ING Bank N.V.; other G-SIBs; and other foreign banks.
	Market share	n.a.	n.a.	• 87 percent of total assets in the banking system.
	Data and baseline date	n.a.	n.a.	• December 2015 (balance sheet approaches). • Historical data for publicly traded banks up to June 2016 (market based approaches).

Domain		Assumption		
		Bottom-Up by Banks (EBA)	Top-Down by Authorities	Top-Down by FSAP Team
2. Channels of Risk Propagation	Methodology	n.a.	n.a.	• Network analysis using supervisory balance sheet data (Espinosa-Sole approach). • Network analysis using BIS data (Espinosa-Sole approach). • Analysis based on market data (Diebold-Yilmaz approach).
3. Tail Shock	Size of the shock			• Pure contagion: default of institutions, withdrawal of funding of failing institutions leading to partial replacement and fire sale of assets.
4. Reporting Format for Results	Output presentation	n.a.	n.a.	• Capital shortfall, by bank. • Capital shortfall, system wide. • Failure of individual institutions. • Interconnectedness measures.

Appendix II. Risk Assessment Matrix

Source of Risks	Relative Likelihood	Impact
Economic fallout from political fragmentation and tighter or more volatile global financial conditions		
• **Rise in populism and nationalism in large economies** could reverse international integration and policy coordination, weighing on global growth and exacerbating financial market volatility. • **Protracted uncertainty associated with negotiating post-Brexit arrangements** could weigh on confidence and investment more than expected—most prominently in the United Kingdom and the rest of Europe with possible knock-on effects elsewhere. Increased barriers could also dampen the longer-run economic performance of affected countries more than expected. • **Sharp rise in risk premia with flight to safety.** Investors withdraw from specific risk asset classes as they reassess underlying economic and financial risks in large economies, or respond to unanticipated Fed tightening, and increases in U.S. term premia, with poor market liquidity amplifying volatility. Surge in safe haven currencies—especially the US dollar—creates balance sheet strains for FX debtors.	High Medium Medium	• Slower than anticipated external demand associated with diminished confidence and investment in Europe would negatively affect net exports, business confidence, and investment in the Netherlands. Lower domestic growth would exacerbate credit risks. • A drop in stock and bond prices would affect the solvency of insurers and reduce coverage ratios in the pension sector, and will also have important effects on banks' capital ratio as 28 percent of their assets are in securities. It could also trigger redemptions in investment funds. • Renewed stress in global wholesale funding markets would increase funding costs for Dutch banks that rely on wholesale funding, with adverse effects on their profitability and solvency. It could also result in funding liquidity strains. • A depreciation of the euro could have a negative impact on solvency in un-hedged financial and nonfinancial institutions (the extent of this effect will be evaluated by stress tests). On the positive side, it could improve the financial strength of nonfinancial corporates (NFCs), which are highly dependent on exports.

Source of Risks	Relative Likelihood	Impact
Weaker-than-expected global growth		
• **Structurally weak growth in the Euro Area and emerging economies**. Weak demand, low productivity growth, and persistently low inflation from a failure to fully address crisis legacies and undertake structural reforms, lead to lower medium-term potential growth and exacerbate financial imbalances especially among banks (high likelihood). Tighter financial conditions and insufficient reforms undermine medium-term growth in emerging markets (medium likelihood). • **Significant China slowdown and its spillovers.** Key near term risks are a loss of investor confidence, disorderly corporate defaults, a sharp fall in asset prices, and a quicker fading of the stimulus impact. Weak domestic demand further suppresses commodity prices, roils global financial markets, and reduces global growth (low likelihood in the short-term, medium thereafter). • **Significant slowdown in other large EMs/frontier economies.** Turning of the credit cycle and fallout from excess household and corporate (FX) leverage as investors withdraw from EM corporate debt, generate disorderly deleveraging, with potential spillbacks to advanced economies.	High/ Medium Low/ Medium Medium	• The Netherlands has strong trade linkages with other European and EM countries. Close to 70 percent of exports are to European countries and Netherlands' Amsterdam Exchange index (AEX) stock market index is the third most EM-exposed stock market in Europe. Weakness in the EU or EMs could reduce demand for Dutch exports, thus affecting the profitability and solvency of NFCs, which could also lead to deterioration in domestic consumer and business confidence, increasing strains on banks' asset quality. • Deflation in the Netherlands could exacerbate real debt, compounding vulnerabilities associated with the household debt overhang and the high indebtedness of the NFC sector. • Continued low interest rates and low returns in equity markets could threaten the solvency of insurance companies and prolong pension sector stress.
Lower-than-expected domestic growth		
• **Renewed weaknesses in housing markets.** While the housing market seems to have turned the corner, a reversal of the recent recovery in house prices could weaken household balance sheets and dampen domestic demand.	Low	• Dutch banks are highly exposed to households and NFCs. A halt or reversal of the ongoing domestic economic recovery will impact the ability of these borrowers to service their loans worsening banks' asset quality. It would also have implications on economic growth through macrofinancial linkages (lower consumption).

Appendix III. Methodology for the Construction of Macroeconomic Scenarios

82. For the construction of the adverse macroeconomic scenario for stress testing, the country-specific layer includes shocks to domestic residential real estate markets. The global macroeconomic model used to simulate the adverse scenario is designed to analyze interlinkages among many economies and does not include country-specific housing markets—from a technical standpoint, it is typically intractable or infeasible to account for idiosyncrasies of local housing markets in world economy models. To bridge this gap and establish a link between domestic housing markets and the simulated macroeconomic environment, a common approach is to: (1) analyze how real estate market shocks would affect consumption and investment; and (2) use the model to simulate the effects of (exogenous) consumption and investment shocks, which work as a proxy for the original housing market shocks. In this appendix, we clarify (1), i.e., how housing price shocks are translated into consumption and investment shocks, and derive a specific mapping by combining current data with available evidence from past studies.

Residential real estate prices and consumption

83. Beers, Bijlsma, and Mocking (2015) review evidence on the effects of house price shocks on household savings. Most studies find that the average marginal propensity to consume out of housing wealth is about 0.03–0.05 (the widest plausible range is 0.01–0.08). This means that consumption falls by €3–5 for every €100 decline in value of housing wealth.

Input data for calculations. Nominal GDP in 2015 =€665 billion; estimated value of residential housing in the Netherlands = 3 X GDP = €2 trillion; nominal private consumption in 2015 = €302 billion:

Estimated Impact of Housing Wealth Shock on Private Consumption
(In percent)

Decline in housing prices and value (in percent)	Marginal Propensity to Consume (MPC)		
	0.02	0.03	0.05
5	0.7	1.0	1.7
10	1.3	2.0	3.3
15	2.0	3.0	5.0
20	2.6	4.0	6.6

Calculation. A 15 percent decline in residential housing prices (and also household wealth) = €300 billion; marginal propensity to consume (MPC) = 0.2; impact on consumption = 0.02 X €300 billion = €6 billion; percentage decline in consumption = (6/302) X 100 = 2.0 percent—this is the private consumption shock corresponding to the country-specific layer in Table 3. (Note

that the mapping above can be performed in nominal or real terms (as long as both housing prices and consumption are expressed in similar terms.)

Residential real estate prices and residential investment

84. Decline in housing prices from 2008-Q3 (peak) to 2013-Q2 (bottom) = 21 percent (in five years)—of which about 15 percent occurred during the second part of the period, from 2010-Q2 to 2013-Q2.

Year	Real Residential Investment Growth Rates (in percent)	Real Non-residential Investment Growth Rates (in percent)	Real private Investment Growth Rates (in percent)
2009	-14.9	-10.5	-12.0
2010	-15.9	-2.9	-7.2
2011	-4.4	12.9	7.8
2012	-12.9	-3.8	-6.2
2013	-11.5	-2.7	-4.9

85. Gross fixed capital formation is classified into private vs. public, and residential vs. non-residential. Assuming that business investment is approximately 70 percent of private investment, and residential investment is approximately 30 percent, a 31 percent decline in residential investment and a 13.4 percent decline in non-residential investment (over two years, as in 2009–10) would result in a 19 percent decline in private investment.

Appendix IV. Satellite Models and Methodologies for Credit Loss Projections

The PD model was specified using the following panel auto-regressive distributed lag (*p*,*p*) structure:

$$LPD_{i,t} = g_{i,t} + \sum_{s=1}^{p} \alpha_s \cdot LPD_{i,t-s} + \sum_{s=1}^{p} \beta_s \cdot X_{i,t-s} + \eta_i + \varepsilon_{i,t}^{j} \ ,$$

where $g_{i,t}$ determines the behavior of LPD in the long-run, and is modelled as follows:

$$\Delta g_{i,t} = \theta_0 + \theta_0 \cdot X_{i,t} + \mu_i + v_{i,t} \, .$$

In the above equations, the indexes *i* and *t* indicate, respectively, the country and the time period. LPD denotes the logistic transformation of the default probability (PD), where the measure of PD is Moody's empirical default frequencies (EDFs): $LPD = \ln(\frac{PD}{1-PD})$. η_i and μ_i denote country-specific fixed effects and $X = (RGDPG, RGDPG2, RLR)$ is a vector of country-specific macroeconomic variables, where RGDPG denotes the real GDP growth (quarterly) rate; RGDPG2 is the squared of the real GDP growth rate; and RLR is the real lending (annualized) interest rate prevailing in the quarterly period. Taking first differences from the first equation and substituting for $\Delta g_{i,t}$ from the second equation yields the following dynamic panel model, which was estimated using quarterly data for the period 2004:Q1 through 2015:Q4:

$$\Delta LPD_{i,t} = \mu_i + \theta_0 + \theta_1 \cdot X_{i,t} + \sum_{s=1}^{p} \alpha_s \cdot \Delta LPD_{i,t-s} + \sum_{s=1}^{p} \beta_s \cdot \Delta X_{i,t-s} + v_{i,t} + \Delta \varepsilon_{i,t}^{j} \ ,$$

The estimated coefficients (except for the country-specific fixed effects) are presented in the following table:

Explanatory Variable	Coeff
Change in PD (logit transformation, one-quarter lag)	0.19
Real GDP growth (contemporaneous)	-7.09
Real interest rate (contemporaneous)	2.00
Change in Real GDP growth (one-quarter lag)	-9.15
Change in Real GDP growth (two-quarter lag)	-6.33
Change in Real GDP growth squared (one-quarter lag)	-224.90
Change in Real GDP growth squared (two-quarter lag)	-319.68
Change in real interest rate (one-quarter lag)	0.07
Change in real interest rate (two-quarter lag)	-0.88
Constant	-0.01

Bank specific PDs corresponding to corporate loan portfolios were projected using the model's predictions under the adverse scenario.[32] The projections account for the country-specific fixed-effects of the regression as well as for differences in end-2015 PDs, which results in differentiated time changes in PDs across countries. Except for exposures secured by mortgages, the PDs for exposures to counterparts in other sectors (e.g., governments, central banks, or public sector entities; financial institutions, and retail) were assumed to increase by the same multiple as the corporate loans. The multiple for mortgage loan PDs was equivalent to 0.85 times the corresponding corporate PD multiple.

Adjustment of LGDs for mortgage loans in response to a decline in housing prices

The following numerical example and formula illustrate the approach used to adjust the LGDs of mortgage portfolios to reflect the impact of declining house prices under the adverse scenario:

Example 1:

Case 1: baseline				**Case 2: adverse scenario**	
House price 1:	H1	= 100	→	H2	= 90
Loan 1:	L1	= 70	→	L2	=70
LGD rate 1:		LGD1 = 0.3	→	LGD2	= ?
Recovery rate 1:	RR1	= 0.7			
Recovery value:	R1	= 49			

Assuming that the recovery value over the house price is the same in both cases: 0.49. Then, R2 = 0.49*90 = 44.1; RR2 = 44.1/70 = 0.63; and LGD2=0.37.

Formula: $(1\text{-LGD2}) = (H2/H1) * (1\text{-LGD1})$

If house prices decline 15 percent and LGD1 = 0.15; LGD2=0.28.

[32] Dutch banks also provided loans in a few countries (listed among the top 10 destinations) that were not included in the regression; in these cases, the following proxies were used: New Zealand's, Brazil's, and Singapore's PD multiples were proxied by those of Australia, Spain, and Germany, respectively.

Appendix V. Contributions to Changes in Capital—Adverse Scenarios

Let CAR denote the CET1 capital adequacy ratio. Changes over time in the capital adequacy ratio $\text{CAR} = \frac{\text{Capital}}{\text{RWA}}$ can be expressed as follows:

$$\Delta \text{CAR}_{t+1} = \text{CAR}_{t+1} - \text{CAR}_t = \frac{\Delta \text{Capital}_{t+1}}{\text{RWA}_t} - \frac{\Delta \text{RWA}_{t+1} \cdot \text{CAR}_t}{\text{RWA}_{t+1}} - \frac{\Delta \text{Capital}_{t+1} \cdot \Delta \text{RWA}_{t+1}}{\text{RWA}_t \cdot \text{RWA}_{t+1}}.$$

In the last expression, the first term on the right indicates the (partial) contribution of changes in capital (numerator) to variations in the CAR ratio; similarly, the second term is the contribution of changes in RWA (denominator). The third term captures the (joint) contribution of changes in RWA and capital to changes in the CAR ratio. The latter term is (very) small in size and can be added to the contributions of RWA, capital, or both. For the construction of the decomposition chart, we add the joint effect (third term) to the contribution of changes in capital (numerator), as follows:

$$\text{Contribution of } \Delta\text{Capital to } \Delta\text{CAR} = \frac{\Delta \text{Capital}_{t+1}}{\text{RWA}_t} \cdot \left(1 - \frac{\Delta \text{RWA}_{t+1}}{\text{RWA}_{t+1}}\right)$$

$$\text{Contribution of } \Delta\text{RWA to } \Delta\text{CAR} = -\frac{\Delta \text{RWA}_{t+1} \cdot \text{CAR}_t}{\text{RWA}_{t+1}}$$

Assuming no capital injections in the period, the evolution of capital over time can be further decomposed as follows: $\Delta \text{Capital}_{t+1} = \text{Capital}_{t+1} - \text{Capital}_t = \text{Profit}_{t+1} - \text{Dividends}_{t+1}$, where

$\text{Profit}_t = \text{Net interest income}_t + \text{Net gains on securities}_t + \text{Other items}_t + \text{Credit losses}_t - \text{Taxes}_t$ and

Other items_{t+1} include net fee and commission income, dividend income, and other items such as administrative/operational expenses. Note that Profit_{t+1} can be written as follows:

$$\begin{aligned}\text{Profit}_{t+1} = {} & \text{Pre-impairment profit from previous year}_{t+1} + \Delta\text{Net interest income}_{t+1} + \Delta\text{Net gains on securities}_{t+1} \\ & + \text{Credit losses}_{t+1} + \Delta\text{Other items}_{t+1} - \text{Taxes}_{t+1},\end{aligned}$$

where pre-impairment profit from previous year at time $t+1$ is defined as follows:

$$\text{Pre-impairment profit from previous year}_{t+1} = \text{Net interest income}_t + \text{Net gains on securities}_t + \text{Other items}_t.$$

Using the previous expressions, we can decompose the change in capital as follows:

$$\Delta\text{Capital}_{t+1} = \text{Pre-impairment profit from previous year}_{t+1} + \Delta\text{Net interest income}_{t+1} + \Delta\text{Net gains on securities}_{t+1} + \text{Credit losses}_{t+1} + \left(\Delta\text{Other items}_{t+1} - \text{Taxes}_{t+1} - \text{Dividend}_{t+1}\right).$$

X=source of change in capital (numerator)	Contribution of X to changes in CAR
- Pre-impairment profits from previous year ($\text{Pre-impairment profit from previous year}_{t+1}$) - Losses or gains due to change in net interest income ($\Delta\text{Net interest income}_{t+1}$) - Losses or gain due to market risk (securities) ($\Delta\text{Net gains on securities}_{t+1}$) - Credit losses ($\text{Credit losses}_{t+1}$) - Taxes and other items ($\Delta\text{Other items}_{t+1} - \text{Taxes}_{t+1} - \text{Dividend}_{t+1}$)	$\frac{X_{t+1}}{\text{RWA}_t} \cdot (1 - \frac{\Delta\text{RWA}_{t+1}}{\text{RWA}_{t+1}})$
Change in RWAs	$-\frac{\Delta\text{RWA}_{t+1} \cdot \text{CAR}_t}{\text{RWA}_{t+1}}$

Note that for the calculation of RWAs under the adverse scenario, the following through-the-cycle adjustments were applied to all PDs/LGDs:

$$\Delta PD_{REG} = 0.5 \cdot \Delta PD_{PIT} \text{ (corporate and sovereign)}$$
$$\Delta PD_{REG} = 0.8 \cdot \Delta PD_{PIT} \text{ (retail)}$$
$$LGD_{REG} \text{ constant (all exposures)}$$

Liquidity Stress Tests: Run-off Rates for Liquidity Outflows

(In percent)

Code	ID	Item	020	030	040	050	060	070	080	090	100	110	120	130	140	150	160	170	180
010-550	1	OUTFLOWS	Open maturity / Overnight	Greater than overnight up to 2 days	Greater than 2 days up to 3 days	Greater than 3 days up to 4 days	Greater than 4 days up to 5 days	Greater than 5 days up to 6 days	Greater than 6 days up to 7 days	Greater than 7 days up to 2 weeks	Greater than 2 weeks up to 3 weeks	Greater than 3 weeks up to 4 weeks	Greater than 4 weeks up to 5 weeks	Greater than 5 weeks up to 2 months	Greater than 2 months up to 3 months	Greater than 3 months up to 6 months	Greater than 6 months up to 9 months	Greater than 9 months up to 12 months	Greater than 12 months up to 2 years
010	**1.1**	**Liabilities resulting from securities issued**																	
020	1.1.1	Unsecured bonds due	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
		Unsecured bonds due (open maturity)	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
030	1.1.2	Hybrid bonds due	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
		Hybrid bonds due (open maturity)	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
040	1.1.3	Bonds eligible for the treatment set out in Article 129(4) or (5) of CRR due	25	25	25	25	25	25	25	25	25	25	20	20	20	15	15	15	15
050	1.1.4	Bonds as defined in Article 52(4) of Directive 2009/65/EC other than those reported to in item 1.1.3	25	25	25	25	25	25	25	25	25	25	20	20	20	15	15	15	15
060	1.1.5	Securitisations due	35	35	35	35	35	35	35	35	35	35	25	25	25	20	20	20	20
070	1.1.6	Short-term paper due	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
080	1.1.7	*Of which:* to intragroup entities																	
090	1.1.8	*Of which:* debt securities issued for retail only	30	30	30	30	30	30	30	30	30	30	25	25	25	20	20	20	20
100	**1.2**	**Liabilities from secured lending and capital market driven transactions as defined in Article 192 of CRR, collateralised by:**																	
110	1.2.1	Central Bank eligible assets																	
120	1.2.1.1	Securities with a 0% risk weight	5	5	5	5	5	5	5	5	5	5	2	2	2	0	0	0	0
130	1.2.1.2	Securities with a 20% risk weight	20	20	20	20	20	20	20	20	20	20	15	15	15	10	10	10	10
140	1.2.1.3	Bonds eligible for the treatment set out in Article 129(4) or (5) of CRR	50	50	50	50	50	50	50	50	50	50	30	30	30	20	20	20	20
150	1.2.1.3.1	Credit quality step 1																	
160	1.2.1.3.2	Credit quality step 2																	
170	1.2.1.3.3	Credit quality step 3																	
180	1.2.1.4	Bonds as defined in Article 52(4) of Directive 2009/65/EC other than those reported to in item 1.2.1.3	50	50	50	50	50	50	50	50	50	50	30	30	30	20	20	20	20
190	1.2.1.4.1	Credit quality step 1																	
200	1.2.1.4.2	Credit quality step 2																	
210	1.2.1.4.3	Credit quality step 3																	

Liquidity Stress Tests: Run-off Rates for Liquidity Outflows (continued)

(In percent)

Code	ID	Item	020	030	040	050	060	070	080	090	100	110	120	130	140	150	160	170	180
010-550	1	OUTFLOWS	Open maturity / Overnight	Greater than overnight up to 2 days	Greater than 2 days up to 3 days	Greater than 3 days up to 4 days	Greater than 4 days up to 5 days	Greater than 5 days up to 6 days	Greater than 6 days up to 7 days	Greater than 7 days up to 2 weeks	Greater than 2 weeks up to 3 weeks	Greater than 3 weeks up to 4 weeks	Greater than 4 weeks up to 5 weeks	Greater than 5 weeks up to 2 months	Greater than 2 months up to 3 months	Greater than 3 months up to 6 months	Greater than 6 months up to 9 months	Greater than 9 months up to 12 months	Greater than 12 months up to 2 years
220	1.2.1.5	Nonfinancial corporate bonds	50	50	50	50	50	50	50	50	50	50	30	30	30	20	20	20	20
230	1.2.1.5.1	Credit quality step 1																	
240	1.2.1.5.2	Credit quality step 2																	
250	1.2.1.5.3	Credit quality step 3																	
260	1.2.1.6	Residential mortgage backed securities of credit quality step 1	50	50	50	50	50	50	50	50	50	50	30	30	30	20	20	20	20
270	1.2.1.7	Other assets	75	75	75	75	75	75	75	75	75	75	50	50	50	30	30	30	30
280	1.2.1.8	*Of which:* central bank open market operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290	1.2.2	Non-central bank eligible but tradable assets	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
300	1.2.2.1	Equities listed on a recognised exchange, not self issued or issued by financial institutions	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
310	1.2.2.2	Gold	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
320	1.2.2.3	Other assets	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
		Other assets (open maturity)	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
330	1.2.3	*Of which:* to intragroup entities																	
340	**1.3**	**Liabilities not reported in 1.2, resulting from deposits by customers that are not financial customers**																	
350	1.3.1	By retail customers																	
		Stable	-	1	2	3	5	7	8	10	15	20	20	20	20	15	15	15	15
		Less stable	-	3	5	7	10	13	15	20	25	30	30	30	30	15	15	15	15
		By retail customers (open maturity)																	
		Stable	-	0.1	0.1	0.1	0.1	0.1	0.1	1.0	1.0	1.0	0.5	1.5	0.5	0.5	0.5	0.5	0.5
		Less stable	-	0.5	0.5	0.5	0.5	0.5	0.5	3.0	3.0	3.0	2.0	6.0	2.0	2.0	1.0	1.0	1.0
360	1.3.2	By nonfinancial corporate customers	40	40	40	40	40	40	40	40	40	40	30	30	30	20	20	20	20
		By nonfinancial corporate customers (open maturity)																	
		Operational	-	0.1	0.2	0.2	0.2	0.2	0.2	1.3	1.3	1.3	0.5	1.5	0.5	0.5	0.5	0.5	0.5
		Other	-	0.2	0.4	0.4	0.4	0.4	0.4	6.0	6.0	6.0	1.5	4.5	2.0	2.0	1.0	1.0	1.0

Liquidity Stress Tests: Run-off Rates for Liquidity Outflows (concluded)

(In percent)

Code	ID	Item	020	030	040	050	060	070	080	090	100	110	120	130	140	150	160	170	180
010-550	1	OUTFLOWS	Open maturity / Overnight	Greater than overnight up to 2 days	Greater than 2 days up to 3 days	Greater than 3 days up to 4 days	Greater than 4 days up to 5 days	Greater than 5 days up to 6 days	Greater than 6 days up to 7 days	Greater than 7 days up to 2 weeks	Greater than 2 weeks up to 3 weeks	Greater than 3 weeks up to 4 weeks	Greater than 4 weeks up to 5 weeks	Greater than 5 weeks up to 2 months	Greater than 2 months up to 3 months	Greater than 3 months up to 6 months	Greater than 6 months up to 9 months	Greater than 9 months up to 12 months	Greater than 12 months up to 2 years
370	1.3.2.1	*Of which:* are intragroup entities																	
380	1.3.3	By central banks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
390	1.3.4	By other entities	30	30	30	30	30	30	30	30	30	30	20	20	20	15	15	15	15
		By other entities (open maturity)	-	0.2	0.4	0.4	0.4	0.4	0.4	6.0	6.0	6.0	1.5	4.5	2.0	2.0	1.0	1.0	1.0
400	1.3.4.1	*Of which*: are intragroup entities																	
410	1.3.4.2	*Of which:* are public sector entities																	
420	**1.4**	**Liabilities not reported in 1.2, resulting from deposits by customers that are financial customers**																	
430	1.4.1	By credit institutions	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
		By credit institutions (open maturity)	-	5.0	5.0	5.0	5.0	5.0	5.0	10.0	10.0	10.0	5.0	10.0	5.0	2.0	1.0	1.0	1.0
440	1.4.1.1	*Of which:* are intragroup entities																	
450	1.4.2	By financial customers other than credit institutions	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
		By financial customers other than credit institutions (open maturity)	-	5.0	5.0	5.0	5.0	5.0	5.0	10.0	10.0	10.0	5.0	10.0	5.0	2.0	1.0	1.0	1.0
460	1.4.2.1	*Of which*: are intragroup entities																	
470	1.4.3	*Of which:* are members of an institutional network	25	25	25	25	25	25	25	25	25	25	20	20	20	15	15	15	15
480	1.4.3.1	*Of which:* are intragroup entities																	
490	**1.5**	**FX-swaps maturing**																	
500	**1.6**	**Amount payable from the contracts listed in Annex II of CRR other than those reported in item 1.5**																	
510	**1.7**	**Other cash-outflows**	100	100	100	100	100	100	100	100	100	100	75	75	75	50	50	50	50
		Other cash-outflows (open maturity)	-	5.0	5.0	5.0	5.0	5.0	5.0	10.0	10.0	10.0	5.0	10.0	5.0	2.0	1.0	1.0	1.0
520	1.7.1	*Of which:* to intragroup entities																	
530	**1.8**	***Of which:* Interest flows due**	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
		***Of which:* Interest flows due (open maturity)**	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
540	1.8.1	*Of which:* to intragroup entities																	
550	**1.9**	**Total outflows**																	

Sources: Authorities; and IMF staff.

Liquidity Stress Tests: Roll-off Rates for Liquidity Inflows

(In percent)

Code	ID	Item	020	030	040	050	060	070	080	090	100	110	120	130	140	150	160	170	180
560-1010	1	INFLOWS	Open maturity / Overnight	Greater than overnight up to 2 days	Greater than 2 days up to 3 days	Greater than 3 days up to 4 days	Greater than 4 days up to 5 days	Greater than 5 days up to 6 days	Greater than 6 days up to 7 days	Greater than 7 days up to 2 weeks	Greater than 2 weeks up to 3 weeks	Greater than 3 weeks up to 4 weeks	Greater than 4 weeks up to 5 weeks	Greater than 5 weeks up to 2 months	Greater than 2 months up to 3 months	Greater than 3 months up to 6 months	Greater than 6 months up to 9 months	Greater than 9 months up to 12 months	Greater than 12 months up to 2 years
560	**2.1**	**Monies due from secured lending and capital market driven transactions as defined in Article 192 of CRR, collateralised by:**																	
570	2.1.1	Central Bank eligible assets																	
580	2.1.1.1	Securities with a 0% risk weight																	
590	2.1.1.2	Securities with a 20% risk weight																	
600	2.1.1.3	Bonds eligible for the treatment set out in Article 129(4) or (5) of CRR																	
610	2.1.1.3.1	Credit quality step 1																	
620	2.1.1.3.2	Credit quality step 2																	
630	2.1.1.3.3	Credit quality step 3																	
640	2.1.1.4	Bonds as defined in Article 52(4) of Directive 2009/65/EC other than those reported to in item 2.1.1.3																	
650	2.1.1.4.1	Credit quality step 1																	
660	2.1.1.4.2	Credit quality step 2																	
670	2.1.1.4.3	Credit quality step 3																	
680	2.1.1.5	Nonfinanciall corporate bonds																	
690	2.1.1.5.1	Credit quality step 1																	
700	2.1.1.5.2	Credit quality step 2																	
710	2.1.1.5.3	Credit quality step 3																	
720	2.1.1.6	Residential mortgage backed securities of credit quality step 1																	
730	2.1.1.7	Other assets																	
740	2.1.1.8	*Of which:* central bank open market operations																	
750	2.1.2	Noncentral bank eligible but tradable assets																	
760	2.1.2.1	Equities listed on a recognised exchange, not self issued or issued by financial institutions																	
770	2.1.2.2	Gold																	
780	2.1.2.3	Other assets																	
790	2.1.3	*Of which:* rom intragroup entities																	

Liquidity Stress Tests: Roll-off Rates for Liquidity Inflows (concluded)

(In percent)

Code	ID	Item	020	030	040	050	060	070	080	090	100	110	120	130	140	150	160	170	180
560-1010	1	INFLOWS	Open maturity / Overnight	Greater than overnight up to 2 days	Greater than 2 days up to 3 days	Greater than 3 days up to 4 days	Greater than 4 days up to 5 days	Greater than 5 days up to 6 days	Greater than 6 days up to 7 days	Greater than 7 days up to 2 weeks	Greater than 2 weeks up to 3 weeks	Greater than 3 weeks up to 4 weeks	Greater than 4 weeks up to 5 weeks	Greater than 5 weeks up to 2 months	Greater than 2 months up to 3 months	Greater than 3 months up to 6 months	Greater than 6 months up to 9 months	Greater than 9 months up to 12 months	Greater than 12 months up to 2 years
800	**2.2**	**Monies due not reported in 2.1 from customers that are not financial customers**																	
810	2.2.1	From retail customers	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
820	2.2.2	From nonfinancial corporate customers	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
830	2.2.2.1	*Of which*: are intragroup entities																	
840	2.2.3	From central banks	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
850	2.2.4	From other entities	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
860	2.2.4.1	*Of which:* are intragroup entities																	
870	2.2.4.2	*Of which*: are public sectior entities																	
880	**2.3**	**Monies due not reported in 2.1 from financial customers**	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
890	2.3.1	From credit institutions	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
900	2.3.1.1	*Of which:* are intragroup entities																	
910	2.3.2	From financial customers other than credit institutions	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
920	2.3.2.1	*Of which*: are intragroup entities																	
930	2.3.3	*Of which:* are members of an institutional network	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
940	**2.4**	**FX-swaps maturing**																	
950	**2.5**	**Amount receivable expected from the contracts listed in Annex II of CRR other than those reported in item 2.4**																	
960	**2.6**	**Paper in own portfolio maturing**																	
970	**2.7**	**Other cash inflows**																	
980	2.7.1	*Of which*: from intragroup entities																	
990	**2.8**	***Of which*: Interest flows received**																	
1000	2.8.1	*Of which:* from intragroup entities																	
1010	**2.9**	**Total inflows**																	

Sources: Authorities; and IMF staff.

Liquidity Stress Tests: Haircuts 1/ 2/

(In percent)

1040-1420	3	COUNTERBALANCING CAPACITY	Haircut (%)
1040	**3.1**	**Cash**	**0**
1050	**3.2**	**Exposures to central banks**	**0**
1060	**3.3**	**Unencumbered Central Bank eligible collateral**	
1070	3.3.1	securities with a 0% risk weight	
1080	3.3.1.1	representing claims on sovereigns	**3.8**
1090	3.3.1.2	guaranteed by sovereigns	**3.8**
1100	3.3.1.3	representing claims on or guaranteed by central banks	**3.8**
1110	3.3.1.4	representing claims on or guaranteed by public sector entities, regions with fiscal autonomy to raise and collect taxes and local authorities	**3.8**
1120	3.3.1.5	representing claims on or guaranteed by the Bank for International Settlements, the International Monetary Fund, the European Union or multilateral development banks	**3.8**
1130	3.3.1.6	representing claims on or guaranteed by the European Financial Stability Facility and the European Stability Mechanism	**3.8**
1140	3.3.2	securities with a 20% risk weight	
1150	3.3.2.1	representing claims on sovereigns	**25**
1160	3.3.2.2	guaranteed by sovereigns	**25**
1170	3.3.2.3	representing claims on or guaranteed by central banks	**25**
1180	3.3.2.4	representing claims on or guaranteed by public sector entities, regions with fiscal autonomy to raise and collect taxes and local authorities	**25**
1190	3.3.2.5	representing claims on or guaranteed by multilateral development banks	**25**
1200	3.3.3	bonds eligible for the treatment set out in Article 129(4) or (5) of CRR	**39**
1210	3.3.3.1	credit quality step 1	
1220	3.3.3.2	credit quality step 2	
1230	3.3.3.3	credit quality step 3	
1240	3.3.4	bonds as defined in Article 52(4) of Directive 2009/65/EC other than those referred to in item 3.3.3	**39**
1250	3.3.4.1	credit quality step 1	
1260	3.3.4.2	credit quality step 2	
1270	3.3.4.3	credit quality step 3	
1280	3.3.5	non financial corporate bonds	**50**
1290	3.3.5.1	credit quality step 1	
1300	3.3.5.2	credit quality step 2	
1310	3.3.5.3	credit quality step 3	
1320	3.3.6	residential mortgage backed securities of credit quality step 1	**30**
1330	3.3.7	other central bank eligible assets (including credit claims)	**50**
1340	**3.4**	**Other unencumbered non central bank eligible, tradeable assets**	**50**
1350	3.4.1	equities listed on a recognised exchange, not self issued or issued by financial institutions	
1360	3.4.2	gold	
1370	**3.5**	**Undrawn committed credit lines granted to the reporting institution**	**0**
1380	3.5.1	by members of the institutional network	
1390	3.5.2	by intragroup entities	
1400	3.5.3	by other entities	
1410	**3.6**	**Net change of Counterbalancing Capacity**	
1420	**3.7**	**Cumulated Counterbalancing Capacity**	

Sources: Authorities; and IMF staff.

1/ A run-off rate is defined as the *fraction of the liability amount maturing in a given period* that is withdrawn by the claim holders. Sight deposits and contingent liabilities (committed credit and liquidity lines) are exceptions, however. Due to the instantaneous maturity of sight deposits, a run-off rate on these deposits is the *fraction of the initial outstanding balance* that is withdrawn in a given period of time. Credit/liquidity lines can also be withdrawn at any time by clients or other financial institutions once they have been granted by the bank. In the above Table, all run-off rates highlighted in red are defined with respect to the initial outstanding balance.

2/ A roll-off rate is defined as the *fraction of the asset amount maturing in a given period* that is converted into a cash inflow by the bank. Cash inflows from contingent credit/liquidity lines obtained by the bank, however, are an exception. Once these lines have been approved and contracted, the bank can exercise the option to withdraw liquidity at any time; hence, in this case, a roll-off rate is defined as the *fraction of the initial contracted amount* that is withdrawn by the bank in a given period of time.

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