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FINANCIAL SECTOR ASSESSMENT PROGRAM UPDATE—TECHNICAL NOTE—STRESS TESTING THE BANKING AND INSURANCE SECTORS

EXECUTIVE SUMMARY

The Financial Sector Assessment Program Update (FSAP) stress testing exercise comprises a comprehensive analysis of solvency and liquidity risks of key institutions in the Belgian banking and insurance sectors, using mid-2012 data. Solvency tests consist of bottom-up (BU) stress test by the six biggest banks in Belgium and cross-validation by a top-down (TD) test covering all Belgian banks undertaken by the FSAP team with support from the National Bank of Belgium (NBB) staff. In parallel, a BU solvency stress test was conducted by the six largest insurers. Liquidity stress tests for banks consisted of sensitivity analyses within the existing liquidity reporting framework, using supervisory data and parameters specified by the FSAP team.

The solvency stress tests of the banking sector are based on two adverse macroeconomic scenarios and their deviations from the IMF's World Economic Outlook (September 2012) baseline over a five-year forecast horizon. They comprise a double-dip recession and a prolonged slow growth scenario. Hurdle rates are applied according to the Basel III implementation schedule.

Bank liquidity tests focus on the sudden, sizable withdrawal of funding and the sufficiency of existing assets to withstand those shocks under stressed conditions. These tests comprise assumptions on the in- and outflows of existing and contingent assets and liabilities ("funding liquidity risk") and the application of haircuts to assets on the balance sheet ("market liquidity risk"). The NBB regulatory standard for liquidity, as well as Liquidity Coverage Ratio and Net Stable Funding Ratio tests under the revised Basel III liquidity risk framework were applied to determine the short- and medium-term resilience of individual banks and the overall system.

The insurance stress test assesses the capital impact of a moderate and severe adverse scenario on the market-consistent balance sheet of insurers. The scenarios were defined by the specification of four financial market risk factors—interest rates, equities, commercial spreads and sovereign spreads—and two insurance risk factors, namely a life insurance mass lapse event and a nonlife catastrophe. The stress test was based on mid-2012 data with the participation of the six largest insurers.

The stress testing exercises indicate that the financial sector has restored pre-crisis stability, but remains vulnerable to a deterioration of economic conditions. While banks have solid capital buffers on aggregate, they face medium-term pressures on their earnings capacity due to declining investment returns and interest margins, and a sizable impact of new capital requirements. Credit risk appears generally limited, but may warrant in-depth review as institutions prepare for implementation of the new capital adequacy framework. The sovereign-bank link has intensified, with a tight fiscal position exacerbated by crisis measures to shore up financial stability. The fragile sovereign position has the potential to limit the scope for remedial action in the future, and it will be important to guard against the risk of inaction or forbearance. The stress tests of insurers indicate that the sector, overall, remains sufficiently capitalized under the current solvency regime, but the picture under market-consistent valuation underscores the need for supervisors to remain vigilant. Even though banks and insurers alike have significantly reduced their exposures to debt securities issued by countries that have seen a surge in borrowing costs until the end of last year, exposures to the local government debt have remained high, and even increased recently.

More specifically, the banking stress test results confirm the appropriateness of the supervisory focus on the timely increase of capital buffers and the implementation of stringent liquidity standards. Both the bottom-up and top-down results show that the sector's aggregate capitalization remains well above the Basel III minima, but individual weaker banks might face significant capital needs under the adverse scenarios. There are also substantial vulnerabilities to greater competitive pressures in the domestic lending market, resulting in low profitability impeding the sector's ability to further build capital buffers. Stricter liquidity requirements, which became effective in 2011, have been conducive to greater focus on liquidity risk management. Since 2008, banks have made material progress in reducing their dependence on wholesale funding and collateralized central bank repos, and liquidity buffers are comfortable in most large banks. However, asset encumbrance levels remain relatively high, and the need for large liquidity buffers perpetuates the general preference for sovereign debt securities and other liquid assets.

Capital levels of insurers are sufficient under the current regulatory regime but the sector appears vulnerable to market shocks, especially after the transition to a risk-based regulatory framework. While a few insurers exhibit sufficient capital buffers, most firms are likely to show a significant decline in solvency ratios when measured using a more market-sensitive approach. Under a market-consistent valuation, which represents a very conservative assessment approach and does not include mitigating factors under the proposed Solvency II regime, the stress test results indicate a severe undercapitalization of the sector under both scenarios, suggesting that some business models might no longer be viable over the medium term.

Authorities should use the stress test results for a thematic review of identified vulnerabilities and as a conduit for integrating risk-based supervision into the macroprudential policy and surveillance framework. Supervisory follow-up would be needed to support the ongoing business model review of several firms. Greater involvement of supervisors in financial stability analysis of both banks and insurers is encouraged. Finally, the implementation of stress tests needs to be closely aligned with the supervisory resolution and recovery planning.

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Glossary

BU	Bottom-up
CET1	Common Equity Tier 1
CRD	Capital Requirements Directive
EBA	European Banking Authority
FSAP	Financial Sector Assessment Program
FSSA	Financial System Stability Assessment
GEV	Generalized Extreme Value
ICAAP	Internal Capital Adequacy Assessment Process
LCR	Liquidity Coverage Ratio
LGD	Loss-given-default
NBB	National Bank of Belgium
NSFR	Net Stable Funding Ratio
PD	Probability of default
PML	Probable Maximum Loss
RAM	Risk Assessment Matrix
RWAs	Risk-weighted assets
TD	Top-down
TN	Technical Note
UFR	Ultimate Forward Rate
WEO	World Economic Outlook

INTRODUCTION[1]

1. This note presents the results of a comprehensive vulnerability analysis of the macro-financial conditions affecting the banking and insurance sectors in Belgium. The document follows a multi-pronged approach, reflecting a critical assessment of a large variety of possible vulnerabilities that can affect individual and system-wide risks in both sectors. The findings are to be used flexibly, given the forward-looking perspective and the objective of identifying emerging vulnerabilities under extreme but plausible stress scenarios. The completion and reporting of findings have been closely coordinated with National Bank of Belgium (NBB).

2. The Belgium FSAP stress testing exercise examines a financial sector that remains in a state of transformation. The crisis set the stage for major restructuring of the financial sector, whereby major banks shed investment banking and asset management activities and shifted focus to a more "traditional" banking model, focused primarily on the domestic market. The top three banking groups were hit hard after massive losses on structured financial products, large write-offs, and provisions forced them to raise capital, reduce their balance sheets, and appeal to the state for capital infusions. The Belgian state provided extensive funding and asset guarantees. Public sector support was also extended to several insurers to maintain the stability of the sector given the systemic relevance of conglomerate structures.

3. The banking system is concentrated with four dominant banking groups representing almost three quarters of consolidated system assets (Figure 1). Assets of foreign-owned banks account for more than half of the sector. The deleveraging in the wake of the financial crisis significantly reduced the size of the banking sector to 310 percent of GDP in mid-2012, with a second wave of deleveraging currently under way, albeit at a slower pace.

4. The insurance sector is embedded in the predominant bancassurance model and dominated by a few conglomerates. It is relatively small compared to the banking sector, accounting for one fifth of the assets held by banks at end-2011. The top five life insurers account for about three quarters of total assets, while the top five nonlife insurers hold some 60 percent. The industry is dominated by composite insurers that conduct both life and nonlife insurance operations.

5. Domestic economic challenges remain sources of continued uncertainty as the banking sector consolidates and reduces funding risks. While aggregate capitalization of the sector

[1] Prepared by Andreas (Andy) Jobst (Bermuda Monetary Authority), Philipp Keller (formerly Switzerland Financial Markets Authority, consultant), and Sylwia Nowak (EUR), with research assistance from Suchitra Kumarapathy (MCM). The FSAP team would like to express its deep gratitude to counterparts at the National Bank of Belgium (NBB) for close collaboration in facilitating this comprehensive stress testing exercise; and to management and the stress testing teams at the banks (Belfius, KBC Bank, BNP Paribas Fortis, ING Belgium, AXA Bank Europe, and Argenta) and insurance companies (Ageas, AXA Belgium, Belfius Insurance, Ethias, KBC, and P&V-Vivium Group), which participated in the bottom-up solvency stress testing exercises of the respective sectors.

compares favorably to other major international banking systems, profitability remains low.[2] Despite the stabilization of business margins during the financial crisis and a significant decline of structural costs, further efficiency gains might be difficult to achieve due to the natural wage drift.[3] In addition, interest margins are likely to come under pressure in response to lower investment returns, greater use of more costly term deposits and longer-maturity retail bonds (in lieu of wholesale funding), and limited pricing power in an increasingly saturated lending market. Weaker earnings capacity will constrain the banks' ability to maintain existing capital buffers under the forthcoming new capital requirements and replenish capital in case of renewed macro-financial shocks.

6. Several insurers face challenges from adverse economic and business conditions. The industry's solvency position has not recovered since the financial crisis. Life insurers have significant liabilities in the form of guaranteed high returns from past policies and have been gradually shifting towards offering contracts with lower guarantees, which increased the risk of surrenders by policyholders.[4] Underwriting premiums (although rising) have not been able to offset the negative impact of low interest rates on investment income, which has resulted in below average profitability. The demand for life policies has been eroded by households' stronger preference for liquidity in recent years and reinforced by a different tax treatment. Nonlife insurers have taken measures to improve their underwriting performance although they remain susceptible to investment risks.

7. Comprehensive and stringent stress tests of the banking and insurance sectors have been conducted in close cooperation with the NBB staff. Both solvency and liquidity stress tests were conducted based on the mid-2012 financial data of the key institutions in the Belgian financial system, as well as the macroeconomic projections and financial market information available at that time. The six largest banks, 36 smaller banks (with a retail and corporate focus), and the six largest insurers were included in the stress tests. The FSAP's close collaboration with the authorities, banks, and insurance companies meant that granular supervisory information as well as firms' own internal data were used in the tests, in addition to publicly available information.

8. The objective of the bank stress test exercise was to assess the solvency and funding shocks under different macroeconomic scenarios. The stress test considers the sector's

[2] Tier 1 capital for the Belgian banking system has risen from 11.5 percent of risk-weighted assets in 2008 to 13.4 percent in mid-2012.

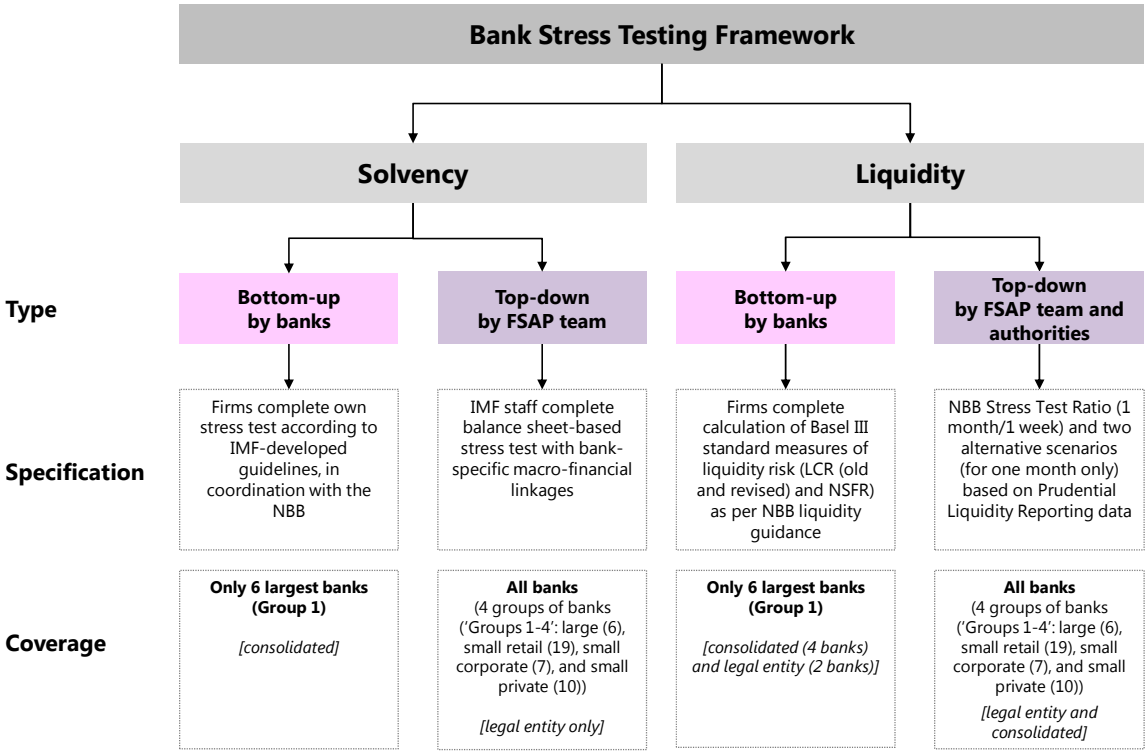
[3] The general administrative spending relative to operating profit of the sector declined from a peak of 86.1 percent in 2008 to 67.3 percent by the end of 2011. By comparison, the average cost-to-income ratio of large EU banks was 61.8 percent during the first half of 2012 (up from 58.2 percent in 2010) according to ECB statistics. See http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=231.CBD.H.V1.67.A.72100.X.X.Z5.0000.Z0Z.F.

[4] The average guaranteed rate of return was still 3.25 percent at end–2010. Technical provisions associated with guaranteed rates of return for traditional individual policies totaled EUR 32 billion as at end–2010 or 32 percent of the total technical provisions for this class of business (NBB, 2012). The NBB's prudential decision to lower the maximum interest rate from 3.75 percent to 2 percent was vetoed by the Ministry of Economy and Consumer Affairs in late 2011 on competition grounds. The NBB is empowered to intervene on a case-by-case basis if it opines an insurer offers a guarantee rate imprudently.

vulnerability to a renewed economic contraction, including a substantial rise in unemployment, a depreciation of real estate prices, and declining profitability from lending due to competitive pressures on lending rates and rising funding pressures. Also the impact of general conditions affecting risk factors, such as rising sovereign risk and upcoming regulatory reforms, as well as the behavioral changes of banks are examined (together with the impact of the ongoing re-structuring plans).

9. Rising capital levels have enhanced banks' resilience but some capital shortfall might materialize if the economy does not recover as expected. The results confirm the appropriateness of the supervisory focus on the timely increase of capital buffers, with support measures focused on the restructuring and/or integration of the weaker banks, with dominant foreign ownership in some banks. While most of the large banks exhibit solid capital buffers, several banks are likely to experience a significant deterioration of profitability under certain scenarios which could result in some capital shortfall over the forecast horizon. Credit risk appears generally limited, with historically low loss rates, but potential vulnerabilities from real estate overvaluation warrant deeper supervisory follow-up. Moreover, uncertainty about hard-to value portfolios (most of which comprise legacy assets from a reduction of activities abroad) is a downside risk affecting banks' internal projections of future performance under stress.

Belgium—Macroprudential Stress Tests of Banking Sector



10. Liquidity and funding risks have abated for the time being. Funding structures have become more favorable overall. Stricter liquidity regulation by the NBB introduced in 2011 has been conducive to greater focus on liquidity risk management. The European Central Bank's longer-term refinancing operation program has removed intermittent funding problems during the height of the European sovereign debt crisis and remains an important backstop for the sector. However, banks have reduced the amount of outstanding wholesale funding, but remain dependent on market-sensitive nonbank institutional and corporate deposits, which amount to about one third of the deposit base. Nonetheless, asset encumbrance is relatively high, with total unencumbered liquid assets having declined relative to the amount of short-term liabilities. In absence of greater diversity of funding sources with longer maturity tenors, greater reliance on deposit funding will, however, perpetuate the high level of sovereign debt and other liquid assets as liquidity buffers.

11. The insurance stress test assessed the capital adequacy of the sector under the impact of different shocks to both investment and underwriting performance. The stress test comprises single factor shocks to a selected set of risk drivers that are directly inferred—or reasonably sensitive—to the general economic scenarios examined in the banking sector stress test. Also the impact of general conditions affecting risk factors, such as rising sovereign risk and upcoming regulatory reforms are examined as the sector transitions from the current Solvency I regime to a more risk-based and market-consistent solvency standard (Solvency II).

12. Insurers' capital levels are sufficient under the current regulatory regime but pressure points have emerged. While a few insurers exhibit sufficient capital buffers, most firms are likely to show a significant decline in solvency ratios under a full "market-consistent valuation" (MCV) approach.[5] Generally low investment returns have compounded several other steadily building pressures on nontechnical income, which compressed profit margins and is likely to limit the sector's claims-paying capacity over the medium term. Insurers also face liquidity risks. A weakening of confidence can increase early surrenders of policies, especially given the low penalty rate. Also liquidity management via intragroup transactions in conglomerates through liquidity transformation may underestimate the liquidity needs of insurers in the longer term.

13. Both banking and insurance tests underscore the importance of sovereign risk for financial stability. The wholesale funding access of banks is likely to remain vulnerable to changes in market's perception of sovereign risk.

14. This Technical Note is structured as follows. The next section, Banking—Solvency Stress Tests, presents the different components of the FSAP's solvency stress test of the banking sector, analyzes the results of the bottom-up (BU) test, and cross-validates the findings of the corresponding top-down (TD) test results. The findings of the liquidity stress testing exercise are covered in the third section, Banking—Liquidity Stress Tests, followed by a summary of important findings for further work in this area. It is followed by the analysis of the insurance stress test in the

[5] Given the very conservative nature of this assessment approach, it is important to put the results of the stress test into context, in particular when comparing against other sectors and other jurisdictions.

fourth section, Insurance—Solvency Stress Tests. The fifth section presents important policy implications of these findings. The final section concludes.

BANKING—SOLVENCY STRESS TESTS

15. Solvency stress tests based on banks' mid-2012 unaudited financial results were undertaken in this FSAP exercise. The objective was to determine the capacity of the banking sector to absorb realization of key macro-financial risks, which would result in downside deviations from a defined baseline scenario. The stress tests were based on economic and market conditions as of mid-2012, the cut-off date of the exercise, and did not take into account developments in the international capital markets during the completion of the exercise.

16. Two-pronged approach to solvency stress testing covered more than 93 and 91 percent of the domestic banking sector on a solo and consolidated basis, respectively, and comprises (Tables 1 and 2):

- *A bottom-up (BU), balance sheet stress tests* conducted by the six largest banks ("Group 1") in collaboration with the FSAP team and NBB staff based on consolidated data, following the calculation method and guidelines provided by the FSAP team.[6]

- *A cross-validation of results by a top-down (TD), balance sheet stress test* based on solo data on the FSAP team's assumptions, in collaboration with NBB staff.[7] This part of the exercise involved "Group 1" banks and 36 smaller banks, which were grouped into three different groups ("Group 2": 19 small retail banks, "Group 3": 7 small retail banks, and "Group 4": 10 small private banks).[8]

17. Two adverse macro scenarios were used, a severe and short-term "double-dip recession" and a protracted slow growth environment ("slow growth scenario"). The first scenario comprises two standard deviations of long-term real GDP growth from the IMF-projected baseline growth trend over the first two years with a positive adjustment dynamics during the subsequent three years of a five-year forecast horizon (Table 4 and Figure 5).[9] In the slow growth scenario, a similar cumulative deviation from the baseline is distributed over the forecast horizon as

[6] The institutions involved in this exercise are the six largest banks in terms of assets, namely Argenta, AXA Bank Europe, Belfius, BNP Paribas Fortis, ING Belgium, and KBC Bank.

[7] The specification of the TD stress test exercise was informed by, inter alia, Borio and others (2012), BCBS (2009 and 2012a), Board of Governors of the Federal Reserve System (2009 and 2012a-b), Čihák (2007), CEBS (2010a), Drehman (2009), EBA (2011a-b), Fell (2006), IMF (2011a-d and 2012), as well as Schmieder and others (2011).

[8] The TD exercise included 42 banks on solo basis (Groups 1-4), representing 93 percent of the banking sector (excluding foreign branches), whereas the BU exercise comprises the six largest banks (Group 1) on a consolidated basis, covering 91 percent of the sector (Table 3).

[9] The calculation of standard deviations for real GDP growth was based on the volatility of the two-year growth rate in 1981-2011.

a result of continued shocks to demand amid rising inflation expectations. The severity of these shocks is consistent with other stress testing exercises in the European country FSAPs.

18. Macro projections and guidelines on selected parameters are applied as much as feasible in a consistent manner:

- *Based on the growth scenarios, related key macro and financial variables are projected using IMF staff estimates and the NBB's macro model* (Jeanfils and Burggraeve, 2005) (Figure 5). The inputs to the solvency stress tests consist of real GDP (including private consumption, gross fixed capital formation, imports, exports, and inventories), household savings and unemployment rate, price and cost developments (consumption prices, house prices, commercial real estate prices, equity market index, GDP deflator, unit labor cost, and terms of trade), and interest rates (short-term interest rate and 10-year sovereign bond yield).

- *Both TD and BU exercises include prescriptive assumptions* covering areas such as risk factors (loss rates, profitability, fixed income holdings, exchange rates, taxes, sovereign debt haircuts, and funding costs), behavioral adjustments (balance sheet growth, dividend payout, credit growth, asset disposal, and capital raising), and regulatory changes (capital requirements, risk-weighted assets (RWAs), and definition of capital) (Attachment I).

- *Structural changes to business models and some potential mitigating factors have not been considered within the scope of the exercise.* For example, on-going de-risking of balance sheets through restructuring, which is reflected in a gradual decrease of RWAs,[10] and de-leveraging through run-offs and divestments have only been included if they were announced/implemented before the cut-off date of the stress test exercise and did not require further managerial intervention. Other mitigating factors, such strategic decisions resulting in changes to financial obligations vis-à-vis third parties over the forecast horizon as well as contingent capital arrangements and bail-in provisions, are not considered.

19. Solvency is assessed in accordance with Basel III standard. The hurdle rates applied in the stress tests follow the internationally agreed schedule for Basel III implementation (Table 5). As the capital conservation buffer will come into full effect only after the end of the stress test horizon, it is relevant for this exercise only in the last two years of the five-year forecast horizon.

A. Summary of Both Solvency Stress Tests

20. Results from both BU and TD exercises suggest a significant erosion of the capital base under stress (Figure 6). Given the solid capital buffers in the beginning of stress test, the potential capital shortfall in the sector is limited to EUR 1.6 billion of CET1 until the end of the forecast

[10] This helps limit potential bias in estimating RWAs due to restructured loans that no longer meet contractual covenants (and the scope for regulatory forbearance).

horizon, which represents 3.6 percent of CET1 in the sector (Figure 10).[11] The same macro-financial sensitivity of risk drivers translates into higher reductions of risk-based capitalization for the two alternate hurdle rates of lower-quality capital. The Tier 1 capital ratio declines by 4.4 and 4.5 percentage points for the TD exercise and 4.8 and 4.0 percentage points for the BU exercise under both adverse scenarios, respectively. For the total capital ratio, these values increase to 4.9 and 5.0 percentage points for the TD exercise and 5.5 and 4.7 percentage points for the BU exercise under both adverse scenarios, respectively. Under the BU approach, the aggregate CET1 capital ratio declines by 4.2 and 3.5 percentage points under the double dip and slow growth scenarios, respectively. The findings are similar for the TD exercise, which indicates a decline by 3.7 and 3.9 percentage points, respectively. The different results obtained under the two adverse scenarios in the BU exercise reflect a faster rise of the marginal loss rates under the double-dip scenario while the slow growth scenario allows for a less adverse evolution of net interest margins.

21. The results are heavily influenced by more stringent capital requirements and the diminished earnings capacity of the sector if economic conditions were to deteriorate. Increasing provisions for credit risk and higher loan impairments, valuation losses from rising sovereign risk, and the impact of regulatory changes on both RWAs and capital are the main risk drivers, whose impact on solvency is currently mitigated by robust credit conditions and significant deleveraging of the sector (Figure 6). RWAs increase by 10.3 percent over the stress test horizon under each scenario suggests that the transition to Basel III provides incentives for further de-risking of balance sheets, a process that is continuing at present. Credit risk is currently limited due to low marginal loss rates in the sector, but nonperforming loan balances in the real estate sector rise considerably in relative terms under stress. The flattening of the sovereign yield curve diminishes the benefits of cost-effective deposit funding as net interest margins are likely to decline due to the indexation of domestic variable-rate loan mortgages on Belgian government bonds and lower investment yields.[12] However, insufficient profitability limits further build-up of capital buffers, especially after the full adoption of the forthcoming new capital requirements. Some larger banks in the system appear more affected even under baseline conditions, possibly owing to uncertainty about valuation of legacy assets and increased lending competition.

22. In particular, sovereign risk affecting nonbanking income is material and heavily affects overall results in both BU and TD exercises. Market-implied valuation haircuts of more than five percent on the debt securities issued by the Belgian government (and more than 10 percent for securities issued by vulnerable European sovereigns; Attachment I) have been applied to all direct and indirect (via derivatives positions) exposures at mid-2012 prices. These haircuts to capital buffers reduce CET1 capital in the system by more than EUR 4.6 billion (or 10.4 percent) under the adverse scenarios. The aggregate effect of escalating sovereign risk was more pronounced in the TD exercise, and contributed more than half of the estimated decline of net

[11] The number reflects the aggregate shortfall for banks that are below the CET1 hurdle rate without considering any surplus capital at banks above the hurdle rate at the time of the capital assessment.

[12] Moreover, greater reliance on term deposit and longer-maturity retail bonds will increase funding costs.

income due to trading and valuation losses under both adverse scenarios.[13] However, the sovereign risk of main debtor countries (including that of the local government) has in fact decreased since mid-2012, which would reduce the estimated valuation haircuts. In addition, this would reduce the need to build available for sale (AfS) reserves, whose mitigating effect is not considered in the stress tests.

B. Bottom-Up Solvency Stress Tests

23. The BU stress tests involving the six major banks formed the core element of the solvency risk assessment. The exercise was administered jointly with the NBB, with banks conducting the stress tests using their own internal models. Detailed guidelines on assumptions were drawn up by the FSAP team in collaboration with the NBB and in consultation with the banks themselves (Attachment I). These guidelines contain key assumptions relating to the calibration and estimation of important risk drivers, which are necessary to ensure a robust and credible assessment of system-wide capital adequacy during times of stress.

24. Each bank submitted a "report card" of the outcome to the NBB, which provided them to the FSAP team for further analysis. For each bank, the analysis estimates changes in potential losses from asset impairments, profitability, regulatory impact of Basel III on the definition of capital as well as post-shock RWAs and, where applicable, the capital needs (Attachment I).[14] The team also met with the risk management and stress testing teams from each bank to discuss in detail the stress test design and results.

25. The BU stress test results suggest that the largest Belgian banks are resilient to significant economic stress, but at least two institutions are vulnerable in the medium term. Specifically, the findings were:

- *Although five out of six firms pass the capital hurdle rates under all scenarios, two banks experience a substantial impact on capital in the double-dip and slow-growth scenarios.* The common Tier 1 ratios diverge by as much as 4.5 percentage points from their pre-stress capitalization.

- *Both adverse scenarios generated similar results, but the double-dip scenario turned out to be the more stringent.* The prolonged slow growth scenario did not have as negative an impact as initially anticipated—an outcome that banks attributed to the relatively benign development of the interest rate scenario. That being said, the likely spread compression in a more competitive market and a gradual increase of impairment balances will challenge their earnings capacity under both adverse scenarios.

[13] Since more than 82 percent of all sovereign exposures are categorized as available for sale (AfS), the economic impact of applying these haircuts would normally be offset by an increase in the AfS reserve.

[14] A template of the report card is provided in Attachment I, Annex 10.

- *Since most banks currently hold robust capital positions (with a large share of common equity), the capital impact of economic stress shows towards the end of the five-year forecast period.* The weighted-average total capital, Tier 1 and common equity Tier 1 capital ratios for the aggregated sample stay at or above 11.3 percent, 9.6 percent, and 9.0 percent, respectively (under the slow growth scenario), and fall to 10.1 percent, 8.5 percent, and 7.9 percent, respectively (under the double-dip scenario)—but still above the Basel III hurdle rates. However, the leverage ratio for two banks drops below the three percent threshold in the final year of the forecast horizon (under the double-dip scenario) due to increasing negative profitability. Not surprisingly, retail-focused banks with large mortgage loan portfolios would be hardest hit by a sharp economic downturn.

C. Top-Down Solvency Stress Tests

26. A balance sheet-based framework was used to generate stress estimates for assessing the systemic risk and individual capital adequacy of all commercial banks. The approach provided a quantitative assessment of capital adequacy on bank-by-bank basis. Several satellite models were used under each scenario to determine changes in profitability and credit losses using the historical sensitivity of bank performance to macro-financial variables. These macro-financial linkages were estimated based on two-stage least squares panel data regressions over quarterly observations between Q3 1997 and Q1 2012 (using general method of moments with orthogonal deviations; see Arellano and Bond (1991) and Arellano and Bover (1995)) of the profitability components (interest income, interest expenses, fee/commissions income, and operating expenses) as well as the flow of asset impairments (i.e., nonperforming loan balance).[15]

27. The results from the TD exercise confirm the BU stress test results, but suggest potentially higher capital needs under stress for weaker firms:

- *Two firms fall below the capital hurdle rates under any scenario, with one additional bank experiencing a shortfall of Tier 1 capital in the last year of the forecast horizon under the slow growth scenario.*

- *In contrast to the BU exercise, the slow growth scenario turned out to be more severe.* Indeed, the impact of prolonged slow growth on all capital components generally appears less benign than that of the double-dip recession and had a more significant impact on the aggregate capitalization of the sector. The weighted-average total capital, Tier 1 and common equity Tier 1 capital ratios for the aggregated sample stay at or above 11.8 percent, 9.2 percent, and 8.6 percent, respectively (under the slow growth scenario), but slightly increase to 11.9 percent, 9.4 percent, and 8.7 percent, respectively (under the double-dip scenario).

[15] Changes in NPLs are modeled independently of changes in loan loss provisions, which provide the starting point for the marginal loss rate at the beginning of the forecast horizon. As NPLs increase under stress, each material loan category includes an increase of LGDs according to historically consistent increase of default risk (PD), after controlling down-cycle LGDs that are based on a long-term average, i.e., "through the cycle." The change in trading income was mapped to nominal GDP growth.

- *A sensitivity analysis of the individual capital ratios shows that capitalization of smaller banks is falling very close to the hurdle rates* suggesting that these banks would need to build additional capital buffers under the adverse scenarios in order to satisfy market expectations of maintaining a buffer above the regulatory minimum throughout transition schedule to Basel III.

D. Reconciliation of Both Solvency Stress Tests

28. The TD stress test results are broadly consistent with the aggregated BU findings. The trends for core Tier 1, Tier 1, and total capital ratios under both approaches, for the baseline and both adverse scenarios, are similar but show some differences that are driven by the baseline estimates (Figures 7-11). TD results show a greater decrease in capital ratios than the BU outcomes in the baseline scenario, whereas the converse holds true under the adverse scenarios, with differences between both approaches becoming more marked in the latter years of the stress test horizon. The impact of the prolonged slow growth scenario in the TD exercise appears somewhat stronger than the same scenario in the BU exercise. The distribution of individual capital ratios differs somewhat, but the median result is generally consistent for each of the three hurdle rates both approaches.

29. Differences in the two sets of results are likely attributable in part to the model design and the scope of the stress testing exercise. The aggregate BU results are based on bank's own approaches, as long as they are consistent with the common principles stated in the BU stress testing guidelines (Attachment I). Firm-specific assumptions and the application of internal models based on more granular data can lead to differences in the projection of profits and losses for individual firms under the various scenarios. For instance, projected net interest income and credit losses account for much of the difference in the impact of the various adverse scenarios on the capital ratios in both TD and BU exercises. It is most obvious in the severe double-dip and the slow growth scenarios for each of the capital ratios. This can be explained by the fact that the uniform sensitivity of changes in nonperforming loan balances for each bank (implied by the panel data estimates) creates less diverse loss results across banks under prolonged stress in the context of the TD exercise. Moreover, differences can also be explained by the fact that the BU tests are undertaken by the six largest banks at the consolidated level whereas the TD analysis is performed on a larger sample (also including smaller banks) on a solo basis.

BANKING—LIQUIDITY STRESS TESTS

30. A suite of liquidity stress tests was carried out by the NBB staff in consultation with the FSAP team based on the NBB liquidity ratio and the standard Basel III measures of liquidity risk. The NBB's liquidity reporting format was used for this part of stress testing exercise. Similarly to the internal thematic liquidity risk assessment exercise of the 2011 system-wide stress test of the largest European banks conducted by EBA, all liquidity stress tests were completed separately from the solvency risk analysis. Due to the stringency of assumptions that have been applied consistent with other FSAP stress tests, the findings are informative regarding the dynamics of aggregate funding positions under very severe system-wide distress.

31. The liquidity stress tests aimed to capture the risk that a bank fails to generate sufficient funding to satisfy short-term payment obligations due to one or more of the following channels affecting cash flows: (i) scheduled and unscheduled cash outflows; (ii) cash inflows related to maturing assets and assets repo-able or saleable at stressed market values ("market liquidity risk"); (iii) restricted ability to access funding markets ("funding liquidity risk"); and (iv) the ability to survive funding constraints due to the rollover risk stemming from maturity mismatches. In this regard, assumptions about the decline in asset values, amortization/renewal rates, and the extent to which assets were subject to haircuts when used as collateral for wholesale funding influence the severity of cash flow calculations have been made (Tables 6 and 7).

32. Two types of liquidity regimes were examined: (i) the Basel III standard measures of liquidity risk—the Liquidity Coverage Ratio (LCR), in its old and revised definition, and the Net Stable Funding Ratio (NSFR)—for "Group 1" banks only; and (ii) the national liquidity risk framework—the NBB's liquidity ratios (at one-week/one-month risk horizons)—covering 42 institutions (i.e., "Groups 1-4"). Additional scenarios were applied to the one-month NBB liquidity ratio (Table 8): (i) the absence of a retail deposit run (in order to examine the impact of the large deposit base on the liquidity ratio), (ii) the escalation of sovereign risk (requiring higher valuation haircuts for collateralized funding with major central banks), and (iii) the absence of contingent cash inflows from related parties.

33. The Basel III liquidity framework is based on two quantitative liquidity standards that aim to strengthen liquidity risk management practices in banks. Under this proposal, banks are expected to maintain a stable funding structure, reduce maturity transformation, and hold a sufficient stock of assets that should be available to meet its funding needs in times of stress (BCBS, 2010c and 2012b). The framework is based on two standardized ratios:

- *Liquidity Coverage Ratio* (LCR)—This ratio is intended to promote short-term resilience to potential liquidity disruptions by requiring banks to hold sufficient high-quality liquid assets to withstand the run-off of liabilities over a stressed 30-day scenario specified by supervisors. LCR requires that banks hold a sufficient stock of unencumbered, high-quality liquid assets to cover cash outflows less cash inflows (subject to a cap at 75 percent of total cash inflows) that are expected to occur during in times of stress. In January 2013, the Basel Committee reached an agreement on a composition of high-quality liquid assets and parameters for net cash outflows resulting from deposits and contingent liabilities, as well as a transition period for introduction of LCR (BCBS, 2012b and 2013). LCR of less than 100 percent indicates a liquidity shortfall.

- *Net Stable Funding Ratio* (NSFR)—Final agreement on this structural ratio, which would limit the stock of unstable funding by encouraging longer-term borrowing in order to restrict liquidity mismatches from excessive maturity transformation, has not yet been reached by the Basel Committee. Based on existing proposals, it would require banks to establish a stable funding profile over the short term, i.e., the use of stable (long-term and/or stress-resilient) sources to continuously fund cash flow obligations that arise from lending and investment activities inside a one-year time horizon. The NSFR would reflect the proportion of long-term assets that are funded by stable sources of funding, which includes customer deposits, long-term wholesale

funding with maturities of more than one year, and equity (but excludes short-term funding). A value of this ratio of less than 100 percent indicates a shortfall in stable funding (BCBS, 2010c).

34. NBB's liquidity risk framework consists of one-week and one-month liquidity ratios ("NBB liquidity ratios"). The framework was introduced in 2009 and became binding in 2011 (CBFA, 2010). The NBB liquidity ratio broadly follows LCR's 30-day risk horizon and rationale but defines the liquidity position after deducting cash inflows from cash outflows (rather than the other way around as in the definition of the LCR) in order to derive net cash outflows (if any) relative to the stock of liquid and unencumbered assets. Thus, an NBB stress test ratio higher than 100 percent implies a liquidity shortage if the stress scenario—implied by the application of suitable funding and market liquidity risks to liquid assets and cash flows—would materialize at the reporting date (i.e., potentially required liquidity greater than potentially available liquidity).

35. Overall, the stringency of the Belgian liquidity standard is consistent with the revised LCR but stems from different assumptions that determine net stressed outflows and the scope of the liquidity buffer. The NBB liquidity ratio is generally less severe with regard to the definition of the liquidity buffer (i.e., the evaluation of high-quality, liquid assets), which is compensated by stricter assumptions on the stress scenario and contingent cash outflows, which shows in a greater sensitivity of banks conducting trading activities. Another difference is the risk-based treatment of available liquidity from sovereign assets in central bank and repo market operations, which receive a zero run-off assumption under the revised LCR as opposed to the NBB ratio, which applies a valuation haircut of up to 30 percent.

36. Most large banks hold sufficient liquidity under the Basel III framework (Figures 2 and 11). The revised definition of the LCR leads to a significant improvement in the banks' ability to comply with standard measures of liquidity risk. Estimates suggest that applying the new definition of the LCR improves the system-wide ratio to 103 percent, with only one institution below the threshold. Most banks have access to sufficient stable sources of funding due to a large deposit base, with the average NSFR at 112 percent. Even though only four of the six largest banks pass the test, all of them exhibit NFSR ratios higher than 95 percent.[16]

37. The stress test results using the regulatory liquidity ratios of the national liquidity framework ("NBB Liquidity Ratio") show that most banks are able to support a severe but short-lived shock to cash flows:

[16] Belgian banks fare well compared with European peers. The most recent EBA quantitative impact study, based on the old definition of LCR and end-2011 data, shows that only 37 percent of large EU banks (with capital above EUR 3 billion) report LCR above 100 percent, with the large-bank average of 72 percent (91 percent for banks with capital below EUR 3 billion). The average NSFR is about 93 percent, with only 40 percent of the sample having enough stable funding.

- *All Belgian banks have enough liquid assets to withstand a week-long net cash outflows (on a solo and consolidated basis)*, with the average inverse NBB liquidity ratio of 263 percent.[17] At 220 percent, the ratio for the large banks is only slightly lower than the system-wide average, and well above the required 100 percent.

- *Extending the risk horizon to one month results in some liquidity shortage, which remains concentrated in a very few institutions, with the average ratio still high at 159 percent (141 for Group 1 banks).* Results suggest an underlying shortfall (i.e. the difference between net cash outflows and high-quality liquid assets) of EUR 3.9 billion, or 0.5 percent of assets used in the liquidity calculations for the six largest banks. This number is reflective of the aggregate shortfall for banks that are below the 100 percent requirement and does not reflect surplus liquid assets at banks above the 100 percent requirement.

- *The withdrawal of contingent intragroup funding does not change the results markedly.* The additional severity of disregarding potential cash inflows from related parties is limited, with the aggregate liquidity shortage in line with the baseline scenario. The liquidity ratio falls to 134 percent for the large banks (120 percent on consolidated basis), with two large banks failing the test on consolidated basis, one of them close to the hurdle rate. However, intragroup funding by larger institutions to their foreign parents remains large—despite the introduction of a 100 percent of own funds limit in 2011—and places a premium on sufficient liquidity buffers at Belgian subsidiaries.

- *Similarly, a liquidity risk from a moderate increase in sovereign risk is very small.* A 50-percent increase in haircuts on sovereign bonds eligible for collateralized central bank funding with the ECB/Eurosystem, the Bank of England, or the Swiss National Bank (from 5 percent included in the standard definition of the NBB ratio to 7.5 percent) has only limited impact on banks' liquidity buffers. Most banks pass the test, with the resulting liquidity ratio of 141 percent (121 percent of consolidated basis).

38. However, the aggregate implications of bank-by-bank prudential measures under the Basel III and national liquidity framework disregard the system-wide perspective. The current approaches assume that sufficient institutional liquidity reduces the likelihood of knock-on effects on solvency conditions in distress situations and complement the risk absorption role of capital—but without considering system-wide effects. This implies that larger liquidity buffers at each bank should lower the risk that multiple institutions will simultaneously face liquidity shortfalls, which would ensure that central banks are asked to perform only as lenders of last resort—and not as lenders of first resort.

[17] NBB's regulatory liquidity stress test ratio is calculated as net cash outflows in a liquidity stress test scenario over the available unencumbered liquidity buffer. The ratio should be 100 percent or lower. To facilitate the easy comparison with Basel III liquidity indicators, this analysis uses an inverse of the NBB ratio, which should be 100 percent or higher.

39. These liquidity stress test results need to be put into context given their static nature and the assumption that all banks face escalating liquidity risk at the same time. Given the assumptions and modeling technique, any estimated liquidity shortfall should be interpreted in terms of a general vulnerability to the particular set of assumptions, rather than it being representative of an actual liquidity need in a general stress situation. In fact, the calculated effect might overstate the actual impact of assumptions on the actual realization of varying cash flow scenarios. Ideally, the results would be qualified based on mitigating considerations, such as, for example, the likely reallocation of deposits within the banking sector in a situation when not all banks experience funding shocks simultaneously (and assuming that deposits largely remain in the banking system).

SUMMARY AND POLICY IMPLICATIONS—BANKING

40. Overall, the stress test results confirm the importance of continued supervisory commitment towards the maintenance of existing capital and liquidity buffers given the significant feedback loops to sovereign risk. While most banks appear sufficiently capitalized to withstand a further deterioration of economic conditions, there are substantial vulnerabilities to rising sovereign risk impacting both funding and solvency conditions. In fact, the banking-sovereign linkages have intensified and put a premium on sufficient shock absorbers in the system as the capacity of the public sector to provide future financial sector support in times of distress has diminished.

41. The tenuous economic recovery and the impact of impending regulatory changes affect the forward-looking capital assessment of the sector. Belgian banks are subject to the Basel III capital requirements according to the agreed gradual phase-in schedule. The authorities also have the intention to implement the liquidity standards ahead of the phase-in schedule agreed under the revised liquidity risk framework under Basel III. The potential adverse implications of these regulatory changes on risk-based capitalization would need to be carefully balanced as new vulnerabilities are emerging from the transformation of the sector. A weak economic environment and higher unemployment are likely to affect debt servicing capacity and affordability, which might lead to rising asset impairments that would be difficult to offset in more competitive environment reducing profitability due to lower net interest margins over the medium term. Also a price correction of residential and commercial real estate would put further downward pressure on the net operating income of the sector and could significantly increase the estimated capital shortfall on aggregate. Faced with excess liquidity from domestic savings, banks could also be inclined to increase investment yields and intragroup funding arrangements within conglomerate structures.

42. Authorities should use the stress test results for a thematic review of identified vulnerabilities and integrate risk-based supervision into the macroprudential policy and surveillance framework. Supervisory follow-up would be needed to support the current business model review of some banks and encourage greater involvement of supervisors in financial stability analysis. The authorities should carefully assess the impact of further spread compression, interest

rate shocks, and the gradual deterioration of credit quality at some banks and expedite the consolidation process to restore confidence in the domestic banking sector. For liquidity risk, the close alignment of the recently revised definition of the LCR and the Belgian liquidity ratio suggest that the current liquidity regime should be preserved (and liquidity buffers be maintained) before the LCR is fully adopted at the European level in 2018.

43. Going forward, the authorities should embed this stress testing approach in the macroprudential policy and surveillance framework. The systematic integration of both TD and BU stress testing into the supervisory framework will help inform the assessment of the financial soundness of individual firms under different scenarios and encourage greater involvement of supervisors in financial stability analysis. Even though the stress tests comprehensively cover the most salient risk drivers, other sources of vulnerability require more granular prudential information, e.g., intragroup transactions within conglomerates under severe stress conditions. This would allow stress testing to become a routine tool for micro- and macroprudential surveillance. Finally, greater awareness on the flexible use of stress testing could also support self-assessment as part of the current peer review on macroprudential supervision among euro area members.

INSURANCE—SOLVENCY STRESS TESTS

44. Stress testing of insurer solvency was undertaken as a bottom-up exercise to determine the capacity of the sector to absorb a combination of single factor shocks affecting each capital component. The stress test covered the six largest insurers, comprising more than 70 percent of the insurance sector, and was conducted by insurers themselves in collaboration with the FSAP team and NBB staff based on mid-2012 prudential data, following the calculation method and guidelines provided by the NBB.[18,19] In the insurance sector, macro-financial linkages often vary by different business lines as well as technical factors influencing the pricing and reserving of insurance products. In general, the most significant association of the insurance cycle with changes in economic growth can be found in forward-looking indicators of monetary conditions (interest rates and inflation), asset valuations in capital markets (equity and debt prices), and general risk aversion (credit spreads).

45. The NBB defined two adverse scenarios based on a historical data of market risk factors and two insurance risks (in the form of a nonlife catastrophe and a life insurance mass lapse event). The NBB calibrated four market risk factors—interest rates, equity prices, corporate spreads, and sovereign spreads—for a mild and a severe adverse scenario, together with a mass

[18] Ageas, AXA Belgium, Belfius Insurance, Ethias, KBC, and Vivium Group (including P&V).

[19] Note that Vivium is a subsidiary of P&V, both comprising the main part of the P&V group. Ageas reported its results on a solo basis (for its main insurance entity AGI) and a group level. KBC insurance group calculated results on a consolidated basis. Axa Belgium, Ethias, P&V, and Vivium determined their results on a legal entity level. P&V has also been included as a consolidated group, since P&V owns Vivium. This was done by simply adding changes in own funds of Vivium to the changes in own funds of P&V both scenarios. For the assessment of the impact on Solvency I ratios, only legal entities were considered.

lapse event in the life business and the realization of the largest probable maximum losses (PML) on a single (man-made or natural) catastrophic tail event (Table 8).[20] The nonlife catastrophe and the life insurance mass lapse were identical for both scenarios.

46. Insurers calculated the overall capital impact by aggregating the individual impact of each risk factor, using a correlation approach, similar to the technique applied within the Solvency II standard formula (Box 1). The amount of own funds available under each scenario is then compared with the Solvency Capital Requirement (SCR) and the Minimum Capital Requirement (MCR), subject to eligibility conditions. This can be seen as a slight simplification, since the SCR and the MCR change during times of stress. However, the main effect of the scenario is its impact on own funds, rather than on SCR.[21] Also the impact of general conditions affecting risk factors, such as the upcoming regulatory reforms were examined as the sector transitions from the current Solvency I regime to a more risk-based solvency standard (Solvency II).

47. Six single-factor shocks have been applied to pre-stress balance sheets as at end-June 2012 (Figure 12). The NBB specified the following risk factors for a mild and a severe adverse scenario, based on model output (e.g., in the case of interest rates), expert judgment (in the case of insurance risks), and parameter estimates from the banking stress test (in the case sovereign risk under the current regulatory regime), allowing the participating insurers to determine the capital impact (Table 8):

- *Interest rates*: A horizontal downward shift of the yield curve.
- *Equity prices*: A downward shock for equity exposures, based on re-sampled monthly data.
- *Credit spreads*: Bond stress factors (i.e., rising credit spreads) defined for different rating classes, using empirical Value-at-Risk (VaR) with corporate bonds subdivided into financials and nonfinancials.

[20] The tests were carried out using data as of end-June 2012 (with the exception of one insurer, which used end-September 2012 data due to its significant transformation in the interim period).

[21] The NBB supplied the participating insurers with detailed guidance for both the valuation of assets and liabilities as well as for the evaluation of risk impacts. In addition, the NBB had regular discussions with the participating insurers during the evaluation of the stress test, giving guidance and ensuring as far as possible a consistent calculation by all participating firms.

Box 1. Review of Aggregation Approach

Iinsurers combine the individual impact for each of the six risk factors—interest rate risk, equity risk, spread risk, sovereign risk, nonlife catastrophe risk and life insurance mass lapse risk in order to arrive at the total capital impact under for each scenario. In a first step, the four market risk factors are aggregated to a total impact due to market risk factor changes. The technique of the correlation matrix is similar to the one used by the Solvency II standard formula. Although, the actual correlation figures used here were derived only for the purpose of this stress test:

$$Impact_{Market} = \left(Impact_{Interest\_Rates}, Impact_{Equity}, Impact_{Credit\_Spread}, Impact_{Sovereign}\right)$$

$$\left(Total\ Impact_{Market}\right)^2 = \left(Impact_{Market}\right)\begin{pmatrix} 1 & 0.25 & 0.25 & 0.25 \\ 0.25 & 1 & 1 & 1 \\ 0.25 & 1 & 1 & 1 \\ 0.25 & 1 & 1 & 1 \end{pmatrix}\left(Impact_{Market}\right)^{T}$$

In a second step, the total impact due to market risk factor changes is aggregated with the impacts due to nonlife catastrophe risk factor changes and life insurance mass lapse risk factor changes, using again a correlation matrix from the Solvency II standard formula. This results then in the total impact due to all risk factor changes.

$$\left(Total\ \ Impact\right)^2 = \left(Total\ Impact_{Market}, Impact_{Non\text{-}life}, Impact_{Life}\right)\begin{pmatrix} 1 & 0.25 & 0.5 \\ 0.25 & 1 & 0.25 \\ 0.5 & 0.25 & 1 \end{pmatrix}\begin{pmatrix} Total\ \ Impact_{Market} \\ Impact_{Non\text{-}life} \\ Impact_{Life} \end{pmatrix}$$

Also an alternate aggregation was considered, resulting in additive adverse scenarios. Here, the impacts of the six risk factors are summed up rather than aggregated by using correlation matrices. The additive scenarios maintain the same risk impacts under both adverse scenarios, except for the equity stress and catastrophe risk factors, which are not taken into account. This describes a stress in the Euro area with lower interest rates, and higher sovereign and corporate spreads but without an additional nonlife catastrophe occurring. Investors do no exit the equity market, leading to flat equity prices, but an increase in life insurance lapses is observed. The additive aggregation implies a determinist scenario, rather than a stochastic event as is implied by the NBB aggregation.

- *Sovereign spreads*: A decrease of the valuation of sovereign debt holdings for different countries based on haircuts estimated as of mid-2012.[22]
- *Nonlife catastrophe event*: The largest probable maximum loss (PML) for nonlife exposures for a single catastrophic event (natural or man-made) on a 1-in-40 year basis.
- *Life insurance mass lapse event*: A 30 percent mass lapse rate for all life insurance policies for which the lapse would cause a loss.

[22] The haircuts of the banking stress test (Attachment I, Appendix VII) were applied for stress test of the insurance sector under the current Solvency I regime. For both the MCV and the QIS-5 valuation, the EIOPA specifications of sovereign bond stresses were used (Table 8).

48. The impact of individual stress scenarios under three different solvency standards was calculated: Solvency I, the future solvency standard (Solvency II) tested under the latest EU quantitative impact study (QIS-5), and a full "market-consistent valuation" (MCV) method. The MCV calculation was completed by the participating insurers, while the NBB determined the Solvency I and QIS-5 results. The MCV is based on replicating insurance liability cash flows with sovereign bonds only, which have reliable market prices and do not introduce additional credit or liquidity risks into the valuation. Even though the current regulatory regime is based on Solvency I, the absence of risk-based elements makes this standard less suitable for the quantification of the economic impact of capital market events. Equally, elements of QIS-5 (e.g., the illiquidity premium) dampen by construction the economic impact of spread and interest rate shocks. The full MCV leads to a more realistic capital assessment.

49. The stress test was as much an assessment of the different valuation standards as of the participating insurers. It is important to put the results of the NBB insurance stress test into context, in particular when comparing against other sectors and other jurisdictions. Application of the MCV standard results in a reliable and objective view of the economic costs of the insurance liabilities, but results in materially lower solvency ratios than under QIS-5. Not using concepts like the counter-cyclical premium (CCP) and the matching adjustment leads to lower solvency ratios and a stronger impact of market stress scenarios than we can reasonably expected under the future Solvency II framework.[23] The effect is even more pronounced when comparing MCV-based results against the Solvency I. Solvency I ratios react very weakly to stresses, leading to generally very stable Solvency I margins (Box 2).

[23] Some elements of Solvency II, such as the counter-cyclical premium (CCP) and the matching adjustment, imply strong assumptions. The CCP entails supervisory discretion to set discount rates at an additional spread over the risk-free yield curve during times of market stress. In turn, the matching adjustment allows for discounting insurance liability cash flows with reference to the expected return of the actual assets held. Furthermore, both these adjustments are based on a hold-to-maturity assumption and the replication of insurance liability cash flows with illiquid financial instruments. Given the turnover of assets in insurers' balance sheets, empirical evidence suggests that the hold-to-maturity assumption is not in line with actual asset management strategies. The CCP assumes replication with illiquid assets, specified by the supervisory authority during times of financial market turmoil. The matching adjustment assumes static replication with the actual assets held by the insurer. This results in valuation uncertainty as illiquid assets by definition have less reliable market prices. In contrast, applying MCV limits incentives for insurers to invest in as illiquid and risky assets as possible to minimize technical provisions.

Box 2. Key Elements of Different Valuation Approaches Applied in the Stress Test

Solvency I Basis—The NBB performed an in-house analysis on the impact of both adverse scenarios on the Solvency I ratio at a legal-entity level. The Solvency I ratio was approximated by applying haircuts for the impact of market risk factors under the market-consistent valuation underlying the reported stress test results. If market values fell below the accounting values, the entire difference was assumed to be impaired and was passed through the own funds margin. Equally, the available solvency capital includes all net unrealized capital gains and losses. Then the impacts due to the changes in risk factors were added together rather than aggregated using correlation matrices.

Market Consistent Valuation (MCV) Basis—Insurers calculated the balance sheet both pre-stress and post-stress based on a MCV standard. The following specifications were used for the balance sheet valuation and the calculation of solvency capital requirements: (i) The technical specifications of the QIS5 exercise were updated for the relevant *Level 2 Draft Implementing Measures* and (where available and relevant) the *Level 3 Draft Technical Standards and Guidelines*. The dampeners of the long-term guarantee package, i.e., counter-cyclical premium, (extended) matching adjustment, and the convergence period for extrapolating the basic risk free curve were not included; (ii) the discount curves were extrapolated based on the Smith-Wilson method, assuming an Ultimate Forward Rate (UFR) of 4.2 percent and the last liquid point at a maturity tenor of 20 years for the Euro, 50 years for the British Pound, and 30 years for the U.S. dollar. The convergence speed is such that there is a 3 basis point deviation within 40 years to the UFR. Credit risk is taken into account by a 10 basis point downward adjustment to the calculated forward rates. This approach results overall in a market consistent valuation since the valuation of the insurance liabilities is based on financial instruments with reliable market prices and without introducing unnecessary credit risks and valuation uncertainty.

QIS-5 Basis—The stress scenarios were also evaluated using the Solvency II specification in QIS-5. This valuation basis includes the illiquidity premium, which decreases the sensitivity to interest rate and spread changes, which results in lower technical provisions and higher own funds.

50. Insurers' capital levels are sufficient under the current regulatory regime but the sector appears vulnerable to downside risks from market shocks, especially after the transition to a risk-based solvency framework. With the exception of one firm, all insurers exceeded the minimum Solvency I ratio under both adverse scenarios. More specifically, the results suggest that hidden reserves, i.e., net unrealized capital gains included in the statutory solvency margin, were sufficient to buffer the impact of significant market risk shocks as well as an escalation of underwriting risks.

51. While a few insurers exhibit sufficient capital buffers, most firms are likely to experience a significant decline in solvency ratios when measured using the more risk-sensitive valuation method. For QIS-5 results, the industry is generally resilient to adverse scenarios in spite of a decline of the pre-stress median solvency ratio by 68 percentage points compared to Solvency I. However, the application of MCV indicates a significant erosion of capital,

calling into question some business models over the medium term.[24] The average weighted solvency ratio drops materially relative to the QIS-5 results under both adverse scenarios, respectively.[25] Even though such a decline in solvency conditions might be manageable if timely measures were taken, it could impose excessive strains on the market, with potentially knock-on effects to the financial sector at large.

52. The solvency position of insurers is significantly impacted by sovereign risk. The market-implied valuation haircuts used for the banking sector stress test have also been applied to all direct and indirect exposures of insurers at mid-2012 prices, which decrease the QIS-5 solvency ratio with weighted solvency components (SCRs) by 54 and 45 percentage points under both adverse scenarios, respectively (and between 30 and 46 percentage points without using a correlation approach for aggregating risk factors).

53. Liquidity risk could further amplify solvency pressures of insurers within conglomerate structures. Insurers that are part of a conglomerate might find it expedient to transfer their liquid assets in exchange for illiquid ones from the banking operations potentially increasing the expect yield of their assets (Box 3). In particular, for weak insurers, there is an incentive to increase investments in illiquid assets to benefit from the additional spread and to gradually improve the solvency position. However, a rise in credit spreads in tandem with greater market uncertainty would put a premium on the asset liquidity of investments held by insurers that experience a significant capital shortfall in both adverse scenarios.

54. Neither nonlife catastrophe risk nor equity risk was material for the financial soundness of insurers. Sovereign risk, corporate spreads and interest rate risks were the main drivers of the solvency. Specific risks, e.g., legal risk or contagion risk within the group or conglomerate, could also be relevant but were not covered by the stress test and, therefore, should be analyzed separately.

[24] Note that the average QIS 5 solvency margin is about two thirds higher than the pre-stress average solvency margin based on the MCV.

[25] It is important to note that the stress test does not include any mitigating factors (i.e., illiquidity premiums, swap rates or matching adjustments but is based on a pure risk-free discount rate) and is therefore much stricter than the proposed Solvency II regime.

Box 3. Contagion Effects in Bancassurance

Liquidity risk in the banking sector can cause negative externalities, with possible implications for insurance companies based on their asset exposures and/or relationships with banks within conglomerate structures. Insurers that are part of conglomerates are susceptible to contagion effects and liquidity risk.

While the long-term funding profile of insurers is less susceptible to funding shocks (although such risks cannot be excluded particularly in life insurance), contingent intragroup obligations could create vulnerabilities. For instance, asset liquidity swaps and securities lending establish cash flow requirements for a transaction-based business that are markedly different from long-term cash flow projections associated with insurance liabilities and are inherently more susceptible to the financial market effects. Also the banking side of conglomerates could become vulnerable to the risk of large withdrawals of deposits and/or the run-off of liabilities, with both banking and insurance activities sustaining a sharp decrease in the value of investment portfolios, which in turn could lead to greater reliance on intragroup transactions.

Moreover, the crisis revealed that negative externalities of liquidity risk management precipitated collective insolvency problems. Many business models of banks—but also a number of nonbank financial institutions, such as insurance firms—were vulnerable to sharp declines in financial asset prices, which increased counterparty risks, undermined solvency, and led to a collapse of private markets outside the scope of regulated financial intermediation. However, in such situations it also becomes more difficult to delineate the cause and effect of the negative dynamics that afflicted both banking and insurance operations.

There are five large, bank-dominated conglomerates in Belgium, all of which were included in both banking and insurance stress testing exercises of the FSAP. Some of these firms report contingent intragroup obligations that could result in considerable changes in cash flow projections during periods of stress, with potential implications for solvency ratios. However, funding obligations from banking operations to other activities within the conglomerate are beyond a one-month maturity tenor (with some related to arrangements related to legacy portfolios and/or organizational structures that existed prior to the consolidation and asset reduction of the sector). Based on the liquidity stress test results, some banks within conglomerate structures exhibit limited sensitivity to a reduction of intragroup funding support to banking activities (Figure 11). In general, systemic spillovers resulting from this linkage have yet to be observed in jurisdictions with an active bancassurance sector (IAIS, 2011). That being said, the 2009 example of capital support provided by the Dutch government to the bancassurance groups—ING Group, Aegon Group and SNS Reaal— to mitigate the contagion risk from their banking operations demonstrates that such vulnerabilities do indeed exist.

Conglomerates could also engage in liquidity transformation between the insurance and banking entities where liquid assets were transferred to the banking entity in exchange for less liquid assets. This allows the banking part of the conglomerate to satisfy Basel III liquidity requirements, while the insurer benefits from higher asset returns. While this might seem as a win-win situation for the conglomerate in the near term, in time of stressed financial markets, the insurer will be exposed to liquidity shocks and to deteriorating asset values. The argument that insurers can hold assets to maturity and are therefore less impacted by asset value declines is not convincing. In reality, insurers have an active asset-liability management. This underlines the importance of strengthening conglomerate supervisory framework and associated corporate governance requirements which will help raise the NBB's awareness of potential underlying conflicts of interests that can arise from such and similar transactions within insurers and banks within a conglomerate.[1]

[1]For more detail see the Technical Note on Financial Conglomerates Supervision.

SUMMARY AND POLICY IMPLICATIONS—INSURANCE

55. Authorities are encouraged to continue to apply a MCV approach in assessing the solvency position of insurers under stress. The results obtained from the stress test can inform a thematic review of key vulnerabilities and help integrate stress testing with the prudential supervision of insurers. This approach generates valuable information on the individual and system-wide vulnerabilities of insurers to specific events and risk factors, which also allows the NBB to determine the extent to which dampeners being used in Solvency II could distort the actual solvency position of insurers. These insights would also inform the policy position of the NBB regarding the relevance of these elements in the implementation of Solvency II. In contrast, valuation standards that use illiquidity premiums or matching adjustments—such as currently discussed for Solvency II—introduce additional valuation uncertainty (e.g., via the replication with illiquid financial instruments or with the assets being held by the insurer).

56. Simplifying the approach for aggregating the impacts of single risk factors would make the scenarios of the regular stress tests more intuitive. While it is generally straightforward to generate stress test results based on the effect of a single risk, combining multiple risk factors (and the extent to which firms might affect each other in terms of default risk) under different scenarios tends to complicate a reliable capital assessment. In particular, most conventional balance sheet-based stress tests account for diversification effects, which recognize the potential role of dependencies, but possibly underestimate joint outcomes.

57. The authorities could consider an alternative to the aggregation approach underpinning the calculation of the total stress impact. Under the current specification, the total impact is derived from aggregating the individual impacts of the market risk factors using a correlation matrix, and then aggregating this result with the two insurance risk factors using another correlation matrix. Mathematically, this approach implies that the changes of the six risk factors are random with a given correlation. The total impact is calculated assuming that both adverse scenarios are random events. More intuitive would be to consider the total impact based on a linear combination of the six separate risk factor impacts. Such an aggregation would allow for a simpler and more intuitive interpretation of the scenario, allowing for the formulation of deterministic events.

58. The NBB should extend the number of scenarios and supplement them with narratives. The data on the single risk factor impacts can be used to arrive at different combinations and magnitudes of changes in the six risk factors. This would allow the NBB to extend the analysis beyond both adverse scenarios and include the assessment of the impact of events with different magnitude in changes of risk factors. The buy-in by stakeholders of the stress test could be enhanced if the scenarios were explained and described in a narrative form. This would allow a discussion of the scenarios with different stakeholders, and would facilitate the analysis and improvements of the specification of the risk factors.

59. Extending the stress test horizon would help identify medium- and long-term vulnerabilities. Given the exposure of life insurers to a prolonged low-interest rate environment, the NBB might consider conducting multi-year stress testing. This would allow the NBB to analyze the risk of a gradual erosion of the solvency position of life insurers and to require the implementation of recovery plans, where this is seen to be necessary.

60. The NBB should consider integrating stress test into the solvency assessment of insurers. Even if no probabilities can or are intended to be assigned to scenarios, the NBB could still require from insurers the ability to survive certain scenarios. For example, irrespective of the likelihood of a further sovereign spread widening occurring, the NBB could decide that such an event of a certain magnitude has to be within the risk bearing capabilities of insurers. Such an approach could be a valuable complement to the Solvency II requirements.

61. The authorities are encouraged to deepen the analysis of the impact of scenarios on intragroup transactions within insurance groups and conglomerates. Intragroup transactions or transactions between banking and insurance legal entities within a conglomerate can be very material for the exposures to risk and for the capital and liquidity positions of legal entities within the groups and conglomerates. Currently, the insurance stress test focuses on a consolidated view, which is in line with the Solvency II approach. The stress test should require a more detailed analysis of intragroup transactions. Such an analysis should include the assessment of the capital and liquidity positions of legal entities that are part of groups or conglomerates, taking into account the transferability of assets between different legal entities and potential legal and regulatory constraints.

62. The current practice of requiring participating insurers to include secondary impacts should be continued and deepened. Secondary impacts emanating from a deteriorating financial position can be material. In particular in situations of financial stress or distress, secondary impacts, e.g., potential changes in MCV in a run-off situation, higher cost of capital, the impact of rating downgrades and of intragroup transactions, constrained capital mobility, can become important. The detailed analysis of secondary impacts should be linked to contingency and recovery and resolution planning.

63. The implementation of stress tests needs to be closely aligned with the resolution and recovery planning. Developing a medium-term strategy for the insurance sector consolidation is warranted. For insurers that are overly exposed to adverse but plausible shocks, contingency plans should be prepared by both insurance companies and the authorities. For a number of insurers, timely remedial actions would improve their resilience. These actions can range from short-term measures, such as de-risking their investment portfolio and improving the asset liability matching, to capital transfers from groups and conglomerates or restrictions on writing certain lines of business, and finally to the consideration of run-off. For groups and conglomerates, increasing focus should be placed on potential secondary effects in situations where scenarios cause financial strain, i.e., the impact of rating downgrades, spillover, and contagion effects between different legal entities within groups and conglomerates via intragroup transactions

References

Arellano, Manuel, and Stephen Bond, 1991, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, Vol. 58, No. 2, pp. 277-97.

Arellano, Manuel, and Olympia Bover, 1995, "Another Look at the Instrumental Variable Estimation of Error-components Models," *Journal of Econometrics*, Vol. 68, No. 1, pp. 29-52.

Borio, Claudio, Drehmann, Mathias, and Kostas Tsatsaronis, 2012, "Stress-testing Macro Stress Testing: Does It Live Up to Expectations?," BIS Working Paper No. 369 (Basel: Bank for International Settlements).

Basel Committee on Banking Supervision (BCBS), 2009, "Principles for Sound Stress Testing Practices and Supervision," BCBS Publication No. 147, May (Basel: Bank for International Settlements).

_____, 2010a, "Results of the Comprehensive Quantitative Impact Study," BCBS Publication No. 186, December (Basel: Bank for International Settlements).

_____, 2010b, "Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems," BCBS Publication No. 189, December (Basel: Bank for International Settlements).

_____, 2010c, "Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring," BCBS Publication No. 188, December (Basel: Bank for International Settlements).

_____, 2012a, "Peer Review of Supervisory Authorities' Implementation of Stress Testing Principles," BCBS Publication No. 218, April (Basel: Bank for International Settlements).

_____, 2012b, "Basel III Liquidity Standard and Strategy for Assessing Implementation of Standards Endorsed by Group of Governors and Heads of Supervision," January 8 (Basel: Bank for International Settlements).

_____, 2013, "Basel III: The Liquidity Coverage Ratio and Liquidity Risk Monitoring Tools," BCBS Publication No. 238, January 7 (Basel: Bank for International Settlements).

Board of Governors of the Federal Reserve System, 2009, "Supervisory Capital Assessment Program," May (Washington: Board of Governors of the Federal Reserve System).

_____, 2012a, "Comprehensive Capital Analysis and Review," March (Washington: Board of Governors of the Federal Reserve System).

_____, 2012b, "Comprehensive Capital Analysis and Review 2012: Methodology for Stress Scenario Projection," March (Washington: Board of Governors of the Federal Reserve System).

Board of Governors of the Federal Reserve System/Federal Deposit Insurance Corporation/Office of the Comptroller of the Currency, 2012, "Guidance on Stress Testing for Banking Organizations with Total Consolidated Assets of More Than $10 Billion," SR Letter 12-7, May (Washington: Board of Governors of the Federal Reserve System).

Čihák, Martin, 2007, "Introduction to Applied Stress Testing," IMF Working Paper No. 07/59 (Washington: International Monetary Fund).

Commission Bancaire, Financière Et Des Assurances (CBFA), 2010, "Règlement De 27 Juillet 2010 Relatif À La Liquidité Des Établissements De Crédit, Des Companies Financières, Des Organismes De Liquidation Et Des Organismes Assimilés À Des Organismes De Liquidation," Annexe Circulaire No. 21-2, July 27 (Brussels: Commission Bancaire, Financière Et Des Assurances).

Committee of European Banking Supervisors (CEBS), 2010a, "2010 EU Wide Stress Testing," July (London: Committee of European Banking Supervisors).

_____, 2010b, "Results of the Quantitative Impact Study," December (London: Committee of European Banking Supervisors).

Drehmann, Mathias, 2009, "Macroeconomic Stress-testing Banks: A Survey of Methodologies," in Mario Quagliariello (ed.). *Stress Testing the Banking System: Methodologies and Applications* (New York: Cambridge University Press).

European Banking Authority (EBA), 2011a, "2011 EU-wide Stress Testing Exercise" (London: European Banking Authority).

_____, 2011b, "Overview of the 2011 EU-Wide Stress Test: Methodological Note" (London: European Banking Authority).

Fell, John, 2006, "Overview of Stress Testing Methodologies: From Micro to Macro", Powerpoint Presentation at the Korea Financial Supervisory Commission/Financial Supervisory Service-International Monetary Fund Seminar on Macroprudential Supervision Conference: Challenges for Financial Supervisors, Seoul, November 7.

International Association of Insurance Supervisors (IAIS), 2011, "Insurance and Financial Stability," November (Basel: International Association of Insurance Supervisors).

_____, 2011a, "United Kingdom FSAP Update: Stress Testing the Banking Sector Technical Note," IMF Country Report No. 11/227 (Washington: International Monetary Fund).

_____, 2011b, "Sweden: Financial Sector Assessment Program Update—Technical Note on Contingent Claims Analysis Approach to Measure Risk and Stress Test the Swedish Banking Sector," IMF Country Report 11/286 (Washington: International Monetary Fund).

_____, 2011c, "Germany: Technical Note on Stress Testing," IMF Country Report No. 11/371 (Washington: International Monetary Fund).

_____, 2012, "Spain: Financial System Stability Assessment," IMF Country Report No. 12/137 (Washington: International Monetary Fund).

Jeanfils, Philippe, and Koen Burggraeve, 2005, "Noname—A New Quarterly Model for Belgium," NBB Working Paper No. 68, Research Department (Brussels: National Bank of Belgium).

Jobst, Andreas A., Hardy, Daniel, and Christian Schmieder, *forthcoming*, "Sovereign Haircuts," IMF Working Paper (Washington: International Monetary Fund).

Moretti, Marina, Stolz, Stéphanie, and Mark Swinburne, 2008, "Stress Testing at the IMF," IMF Working Paper No. 08/206 (Washington: International Monetary Fund).

National Bank of Belgium (NBB), 2012. *Financial Stability Review* (Brussels: National Bank of Belgium), available at http://www.nbb.be/doc/ts/Publications/FSR/FSR_2012_EN.pdf.

Schmieder, Christian, Puhr, Claus, and Maher Hasan, 2011, "Second Generation Applied Stress Testing—Solvency Module," IMF Working Paper No. 11/83 (Washington: International Monetary Fund).

Table 1. Stress Test Matrix (STeM) for the Banking Sector: Solvency and Liquidity Risks

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
BANKING SECTOR: SOLVENCY RISK				
1.Institutional Perimeter	Institutions included	• 6 largest banks (KBC, Belfius, BNP Paribas Fortis, ING Belgium, AXA Bank Europe, and Argenta), excluding Dexia Group, which is under the restructuring plan approved by the European Commission.		• Entire banking system, excluding foreign branches, Euroclear and Bank of NY Mellon (which is a custodian bank) as well as Dexia Group, which is under the restructuring plan approved by the European Commission. • 6 largest banks individually, the rest consolidated into three groups based on proximity of business models: small retail banks, small corporate banks and small private banks.
	Market share	• 82 percent of total banking sector assets (excluding foreign branches) on a solo basis and 90 percent on a consolidated basis.		• 93 percent of total banking sector assets excluding foreign branches.
	Data and baseline date	• Source: institutions' own granular data. • Date: end-June 2012 (projected to end-2012). • Scope: consolidated banking group. • Coverage of sovereign risk: all direct and indirect net exposures in both trading and investment book.		• Source: supervisory data. • Date: end-June 2012 (projected to end-2012). • Scope: legal entity (solo basis). • Coverage of sovereign risk: all direct and indirect net exposures in both trading and investment book.
		• Banks' internal models.		• Balance sheet-based model (IMF, 2011c and 2012).

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
2. Channels of Risk Propagation		• BU guidance • Valuation haircut model for sovereign risk (Jobst and others, *forthcoming*; IMF, 2012).		• Valuation haircut model for sovereign risk (Jobst and others, *forthcoming*; IMF, 2012).
	Satellite Models for Macro-Financial linkages	• Macro-financial linkages estimated based on firm's internal models to forecast the profitability components (interest income, interest expenses, fee/commissions income, and operating expenses) as well as the flow of asset impairments. • Key macroeconomic and financial variables were projected using the NBB's macro model (Jeanfils and Burggraeve, 2005) and IMF staff estimates, for input into the solvency stress tests (real GDP (including private consumption, gross fixed capital formation, imports/exports (goods and services), and inventories), household savings and unemployment rate, price and cost developments (consumption prices, house prices, commercial real estate prices, equity market index GDP deflator, ULC (whole economy), and terms of trade), and interest rates (short-term interest rate and 10-year sovereign bond yield). • Sovereign risk assessed by applying valuation haircuts on all direct and indirect net exposures to sovereign risk (including home country) over the entire time horizon after controlling for changes of market valuation		• Macro-financial linkages estimated based on 2SLS panel data regression (using GMM with orthogonal deviations over quarterly observations between Q3 1997 and Q1 2012; see Arellano and Bover, 1995) to forecast the profitability components (interest income, interest expenses, fee/commissions income, and operating expenses) as well as the flow of asset impairment; each material loan category includes an increase of LGDs under stress according to the increase of default risk (PD), after controlling down-cycle LGDs that are based on a long-term average, i.e., "through the cycle"; the change in trading income was mapped to nominal GDP growth. • Key macroeconomic and financial variables were projected using the NBB's macro model (Jeanfils and Burggraeve, 2005) and IMF staff estimates, for input into the solvency stress tests (real GDP (including private consumption, gross fixed capital formation, imports/exports (goods and services), and inventories), household savings and unemployment rate, price and cost developments (consumption prices, house prices, commercial real estate prices, equity market index GDP deflator, unit labor cost (whole economy), and terms of trade), and interest rates (short-term

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
		between 2009 and 2012; cash at central banks as well as repos or asset swaps where there is no economic interest in the security (for instance, instruments held against assets pledged to the ECB) are excluded. • *Calibration of shock*: common interest rate shock of 50bps and idiosyncratic credit shock for each country based on the 50th (baseline) 75th (adverse scenarios) percentile of the historical volatility of forward rates on credit default swap spreads (CDS) with five year maturity; e.g., haircut for Belgium rises to 5.2% and above 10% (relative to mid-2012 market values) for the European periphery in adverse scenario). • *Exposure*: trading book as well as available-for-sale (AfS) and hold-to-maturity (HtM) assets; Belgium is *not* excluded. • Cross-border effects are considered in all macro scenarios: IMF staff provided estimates for real GDP growth, inflation, and short-term interest rates consistent with the macroeconomic forecast for Belgium under both baseline and adverse scenarios for all relevant countries (Czech Republic, France, Germany, Hungary, Ireland, the Netherlands, Switzerland, and Turkey) affecting bank performance abroad.		interest rate and 10-year sovereign bond yield). • Sovereign risk assessed by applying valuation haircuts on all direct and indirect net exposures to sovereign risk (including home country) over the entire time horizon after controlling for changes of market valuation between 2009 and 2012; cash at central banks as well as repos or asset swaps where there is no economic interest in the security (for instance, instruments held against assets pledged to the ECB) are excluded. • *Calibration of shock*: common interest rate shock of 50bps and idiosyncratic credit shock for each country based on the 50th (baseline) 75th (adverse scenarios) percentile of the historical volatility of forward rates on credit default swap spreads (CDS) with five year maturity; e.g., haircut for Belgium rises to 5.2% and above 10% (relative to mid-2012 market values) for the European periphery in adverse scenario). • *Exposure*: trading book as well as available-for-sale (AfS) and hold-to-maturity (HtM) assets; Belgium is *not* excluded. • Cross-border effects are considered in all macro scenarios: IMF staff provided estimates for real GDP growth, inflation, and short-term interest rates consistent with the macroeconomic forecast for Belgium under both baseline and adverse scenarios for all relevant countries (Czech Republic,

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
				France, Germany, Hungary, Ireland, the Netherlands, Switzerland, and Turkey) affecting bank performance abroad.
	Stress test horizon	• 2013-2017 (five years).		• 2013-2017 (five years).
3. Tail shocks	Scenario analysis	• Baseline: September 2012 WEO, real GDP growth rate for 2013 is 0.3 percent and for 2014 is 1.0 percent. • Adverse ("double-dip"): negative two standard deviations of real GDP growth (based on the volatility of the two-year growth rate between 1982 and 2011) from the baseline growth trend. This scenario results in a cumulative negative deviation of about 4.7 percentage points in real GDP over a five-year horizon (with a sharp decline of output and rising inflation over the first two years but positive adjustment dynamics during the subsequent three years). • Adverse ("slow growth"): cumulative negative deviation of about 4.5 percentage points in real GDP (at a constant rate of deviation from the annual baseline growth rate of 0.9 percent over a five-year horizon), as a result of continued shocks to demand amid rising inflation expectations.		• Baseline: September 2012 WEO, real GDP growth rate for 2013 is 0.3 percent and for 2014 is 1.0 percent. • Adverse ("double-dip"): negative two standard deviations of real GDP growth (based on the volatility of the two-year growth rate between 1982 and 2011) from the baseline growth trend. This scenario results in a cumulative negative deviation of about 4.7 percentage points in real GDP over a five-year horizon (with a sharp decline of output and rising inflation over the first two years but positive adjustment dynamics during the subsequent three years). • Adverse ("slow growth"): cumulative negative deviation of about 4.5 percentage points in real GDP (at a constant rate of deviation from the annual baseline growth rate of 0.9 percent over a five-year horizon), as a result of continued shocks to demand amid rising inflation expectations.
	Sensitivity analysis	• FX shock: included in market RWAs under Basel 2.5 as of end-December 2011.		• FX shock: firms are asked to report the aggregate impact of the following FX shock of the

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
				following currencies on FX net open positions and FX assets: U.S. dollar, Pound sterling and Japanese yen. The shock for each currency calibrated to four times (twice) the standard deviation of the respective FX volatility during 2011 for the "double-dip" ("slow growth") scenario and impact the trading book in 2013 (100 percent) and 2014 (50 percent) only.
4.Risks and Buffers	Risks/factors assessed (How each element is derived, assumptions.)	• Credit risk (households and corporates, domestic and foreign exposures). • Sovereign risk for *all* government bonds and indirect sovereign exposure. • Counterparty risk in the banking book. • Funding risk (additional add-on to interest expenses, contingent on Tier 1 capitalization). • Market risk, including FX risks. • Tax rate: 30 percent.		• Credit risk (households and corporates, domestic and foreign exposures). • Sovereign risk for *all* government bonds and indirect sovereign exposure. • Counterparty risk in the banking book. • Funding risk (additional add-on to interest expenses, contingent on Tier 1 capitalization). • Market risk, including FX risks. • Tax rate: 30 percent.
	Behavioral adjustments	• Static balance sheet, but constant funding structure and credit growth (i.e., lending increases in line with nominal GDP (if positive), subject to a "deleveraging rule;" no asset disposals/divestments after cut-off date; defaulted loans are *not* replenished. • Dividend payout depends on capitalization under stress: dividend pay-out only if firm		• Static balance sheet, but constant funding structure and credit growth (i.e., lending increases in line with nominal GDP (if positive), subject to a "deleveraging rule;" no asset disposals/divestments after cut-off date; defaulted loans are *not* replenished. • Dividend payout depends on capitalization under stress: dividend pay-out only if firm reports

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
		reports profits over the past year; if total capital ratio is above 8.0 percent (after the envisaged dividend payout and, at the same time, exhibits sufficient Tier 1 and core Tier1 capitalization) but below 10.5 percent (which reflects the magnitude of the CAR and "capital conservation buffer" under Basel III), the firm is considered capital-constrained and restricts dividend; however, firms that are not capital constrained will have to pay out at least 40 percent of earnings after tax each year. • Credit growth in line with nominal GDP for banks with a Tier 1 capital buffer of 2.5 percentage points above the regulatory minimum (for Tier 1); credit growth decreases by 2 percentage points for each decrease in Tier 1 capital by 1 percentage point once the buffer is less than 2.5 percentage points. Hence, growth becomes negative when capitalization is at minimum capital ratio.		profits over the past year; if total capital ratio is above 8.0 percent (after the envisaged dividend payout and, at the same time, exhibits sufficient Tier 1 and core Tier1 capitalization) but below 10.5 percent (which reflects the magnitude of the CAR and "capital conservation buffer" under Basel III), the firm is considered capital-constrained and restricts dividend; however, firms that are not capital constrained will have to pay out at least 40 percent of earnings after tax each year. • Credit growth in line with nominal GDP for banks with a Tier 1 capital buffer of 2.5 percentage points above the regulatory minimum (for Tier 1); credit growth decreases by 2 percentage points for each decrease in Tier 1 capital by 1 percentage point once the buffer is less than 2.5 percentage points. Hence, growth becomes negative when capitalization is at minimum capital ratio.
5. Regulatory and Market-Based Standards and Parameters	Calibration of risk parameters	• Banks' models for point in time PDs and down-cycle LGDs. • RWAs were estimated using through-the-cycle PDs, plus adjustments for loan portfolio concentration and changes in default risk.		• PDs and LGDs: PD estimated as change in the stock of NPLs (via satellite model) while provisioning levels at the start of the forecast horizon is maintained; thus, LGD is assumed to be 100%. • RWAs are estimated in accordance with AIRB under Basel III, plus adjustments for loan portfolio concentration and changes in default risk.

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
	Regulatory/Accounting and Market-Based Standards	• Full Basel III transition schedule. • Capital definition according to the Basel III framework. During the forecast horizon it has to comply with the envisaged phase-in of capital deductions and the phase-out of noneligible forms of capital, without consideration of grandfathering. • *Phase-in of total regulatory adjustments to common CET1 capital:* 20 percent (per annum) of CET1 capital (such as goodwill, deferred tax assets and minority interests that exceed the permissible limit) deducted between 2014 and 2017; firms must document deductions if amount is less than 29.0/20.4 percent [4 largest banks/other banks]* 80/100 = 23.2/16.3 percent (29.0/20.4 percent is the average value for large banks (Group 1)/small banks (Group 2) according to results from the Basel III monitoring exercise as of 31 December 2011). • *Phase-out of non-CET1 and Tier 2 capital elements:* the higher of either 10 percent (per annum) of the amount of capital to be phased-out based on QIS-6 results for Group 1 (large banks) at 26.8 percent or the amount of capital maturing each year subject to phase-out between 2013 and 2017. • Risk-weighted assets (RWAs): • *RWAs for market and operational risk* remain constant throughout the forecast period.		• Full Basel III transition schedule. • Capital definition according to the Basel III framework. During the forecast horizon it has to comply with the envisaged phase-in of capital deductions and the phase-out of noneligible forms of capital, without consideration of grandfathering. • *Phase-in of total regulatory adjustments to common CET1 capital:* 20 percent (per annum) of CET1 capital (such as goodwill, deferred tax assets and minority interests that exceed the permissible limit) deducted between 2014 and 2017; 29.0/20.4 percent [4 largest banks/other banks]* 80/100 = 23.2/16.3 percent (29.0/20.4 percent is the average value for large banks (Group 1)/small banks (Group 2) according to results from the Basel III monitoring exercise as of 31 December 2011). • *Phase-out of non-CET1 and Tier 2 capital elements:* the higher of either 10 percent (per annum) of the amount of capital to be phased-out based based on QIS-6 results for Group 1 (large banks) at 26.8 percent. • Risk-weighted assets (RWAs): • *RWAs for market and operational risk* remain constant throughout the forecast period. • *RWAs for credit risk* are sensitive to the regulatory impact due to Basel III (according to QIS-6 results), which increase by at least 17.25

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
		• *RWAs for credit risk* are subject to the Basel I floor and sensitive to the regulatory impact due to Basel III based on firm's own data; there is no regulatory impact on RWAs for market risk as Belgium has adopted Basel 2.5 on 31 December 2011; in addition, credit RWAs are sensitive both changes in PDs and portfolio correlations: (a) nonlinear effect of changes in PDs and (b) concentration risk impact on RWAs. • *RWA impact of defaulted loans:* The risk-weights for credit risk are subsequently reduced by the RWAs of defaulted exposures, which are approximated by taking 2.5 times the average RWAs for nondefaulted exposures (accounting for the fact that risk-weights for defaulted exposures were higher prior to default).		percent [4 largest banks] and 3.1 percent [other banks] (independent of asset growth) between 2013 and 2015, respectively; there is no regulatory impact on RWAs for market risk as Belgium has adopted Basel 2.5 on 31 December 2011; in addition, credit RWAs are sensitive both changes in PDs and portfolio correlations: (a) nonlinear effect of changes in PDs and (b) concentration risk impact on RWAs. • *RWA impact of defaulted loans:* The risk-weights for credit risk are subsequently reduced by the RWAs of defaulted exposures, which are approximated by taking 2.5 times the average RWAs for nondefaulted exposures (accounting for the fact that risk-weights for defaulted exposures were higher prior to default).
6. Reporting Format for Results	Output presentation	• Basel III (Common Equity Tier 1, Tier 1, Total Capital, conservation buffer) for each year of the risk horizon. • Firms reported capital adequacy for each year over the forecast horizon based on an output template provided by IMF staff. In case of a capital shortfall, firms calculated the recapitalization needs. Firms reported the major risk drivers (profitability, credit/trading losses, RWAs) and showed the impact of including (i) haircuts on sovereign debt holdings, (ii) capital phase-in/phase-out according to Basel III, and (iii) FX shocks. In addition, firms reported		• Basel III (Common Equity Tier 1, Tier 1, Total Capital, conservation buffer) for each year of the risk horizon. • Staff determined capital adequacy for each year over the forecast horizon. In case of a capital shortfall, recapitalization needs are calculated. The major risk drivers (net interest income, haircuts on sovereign debt holdings, capital phase-in/phase-out and increases of RWAs according to Basel III) are identified. •

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
		alternative stress test results without considering the restrictions on the behavioral adjustment of banks as separate output.		
BANKING SECTOR: LIQUIDITY RISK				
1. Institutional Perimeter	Institutions included	• 6 largest banks (KBC, Belfius, BNP Paribas Fortis, ING Belgium, AXA Bank Europe, and Argenta) for Basel III measures (old LCR and NSFR).		• 6 largest banks (KBC, Belfius, BNP Paribas Fortis, ING Belgium, AXA Bank Europe, and Argenta) for Basel III measure (revised LCR). • Entire banking system, excluding foreign branches, Euroclear and Bank of NY Mellon (a custodian bank) for NBB Liquidity Ratios.
	Market share	• 86 percent of total banking sector assets (excluding foreign branches) given the sample split of the reporting basis.		• 82 percent of total banking sector assets (excluding foreign branches) on a solo basis and 90 percent on a consolidated basis [for Basel III measure]. • 93 percent of total banking sector assets excluding foreign branches [for NBB Liquidity Ratios].
	Data and baseline date	• Source: institutions' own granular data. • Date: end-June 2012. • Scope: solo basis (BNP Paribas Fortis, ING Belgium) and consolidated basis (KBC, Belfius, AXA Bank Europe, and Argenta); only unencumbered liquid assets (generating cash inflows), i.e., that can be sold or used as a		• Source: supervisory data [for NBB Liquidity Ratios] and calculations based on institutions' own granular data [for Basel III measures]. • Date: end-June 2012. • Scope: solo and consolidated basis; only unencumbered liquid assets (generating cash inflows), i.e., that can be sold or used as a collateral

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
		collateral to receive funding (with the exception of cash/cash-equivalents) are included in the test ("liquidity scope").		to receive funding (with the exception of cash/cash-equivalents) are included in the test ("liquidity scope").
2. Channels of Risk Propagation	Methodology	• Definition of Basel III measures as per guidance published on Dec. 2010 (including assessment of haircuts on liquid assets, assumption on expected and contingent cash in- and outflows).		• Definition of revised LCR as per guidance published on Jan. 2013 (including assessment of haircuts on liquid assets, assumption on expected and contingent cash in- and outflows). • Calculation of NBB Liquidity Ratio (at one week and one month).
3.Risks and Buffers	Risks	• Funding liquidity. • Market liquidity.		• Funding liquidity. • Market liquidity.
	Buffers	• Constant funding structure; no counterbalancing capacity. • Ability to respond to withdrawals without having access to ECB facilities.		• Constant funding structure; no counterbalancing capacity. • Ability to respond to withdrawals without having access to extraordinary ECB facilities.
4. Tail shocks	Size of the shock	• Bank run and dry up of wholesale funding markets, taking into account haircuts to liquid assets.		• Bank run and dry up of wholesale funding markets, taking into account haircuts to liquid assets. • Three alternative scenarios [for one-month NBB liquidity ratio], which assume (i) the absence of a deposit run, (ii) the escalation of sovereign risk (requiring higher valuation haircuts for collateralized funding with central banks), and (iii) the absence of contingent cash inflows from

Domain		Assumptions		
		Bottom-Up by Banks		Top-down by NBB and FSAP Team
				related parties.
5. Regulatory and Market-Based Standards and Parameters	Regulatory standards	• Basel III ratios: LCR (old version), NSFR.		• Basel III ratios: LCR (new version). • National requirement: NBB liquidity ratio (one week and one month).
6. Reporting Format for Results	Output presentation	• Hurdle metrics: distribution of ratios.		• Hurdle metrics: distribution of ratios, number of failed banks, liquidity shortfall relative to unencumbered assets.

Table 2. Composition of the System and Banks Included in the Stress Tests (As of mid-2012, EUR millions)

Bank Name	SOLO BASIS			CONSOLIDATED BASIS	
	TOTAL ASSETS	In percent of peer group	In percent of banking sector *(excl. foreign branches)*	TOTAL ASSETS	In percent of banking sector *(excl. foreign branches)*
Group 1 - Large banks					
BNPP Fortis	283,539	32.9	27.0	349,767	30.0
KBC Bank	168,618	19.5	16.0	243,749	20.9
Belfius (ex Dexia Bank Belgium)	187,564	21.7	17.8	201,878	17.3
ING Belgium	151,771	17.6	14.4	177,836	15.3
AXA Bank Europe	38,759	4.5	3.7	41,450	3.6
Argenta	32,791	3.8	3.1	34,951	3.0
Subtotal	**863,043**	**100.0**	**82.1**	**1,049,631**	**90.2**
Group 2 - Small retail banks					
ABK	581	0.7	0.1		
Banque de la poste	9,044	10.3	0.9		
BKCP	4,005	4.5	0.4		
CBC Banque	9,860	11.2	0.9		
Centea	9,701	11.0	0.9		
Citibank Belgium	2,796	3.2	0.3		
CKV	193	0.2	0.0		
CPH	2,139	2.4	0.2		
CPSA	3,277	3.7	0.3	4,437	0.4
Delta Loyd Bank	6,705	7.6	0.6	7,091	0.6
Europabank	1,039	1.2	0.1	1,084	0.1
Goffin Bank	211	0.2	0.0		
Keytrade	2,312	2.6	0.2	2,419	0.2
Landbouw krediet	9,784	11.1	0.9	21,958	1.9
OBK	960	1.1	0.1		
Record Bank	18,662	21.2	1.8	18,846	1.6
Tournai	170	0.2	0.0		
Van Breda	3,514	4.0	0.3	4,002	0.3
VDK	3,114	3.5	0.3		
Subtotal	**88,067**	**100.0**	**8.4**	**59,838**	**5.1**
Group 3 - Small corporate banks					
Antwerpse Diamantbank	1,824	10.0	0.2	1,865	0.2
Byblos	595	3.3	0.1		
ENI	456	2.5	0.0		
Banca Monte Paschi	1,419	7.8	0.1		
Santander Benelux	13,262	73.0	1.3		
Shizuoka	378	2.1	0.0		
UTB	226	1.2	0.0		
Subtotal	**18,160**	**100.0**	**1.7**	**1,865**	**0.2**
Group 4 - Small private banks					
Banque Degroof	3,317	40.0	0.3	5,346	0.5
Delen (group Finaxis)	1,270	15.3	0.1	1,404	0.1
Dierickx	221	2.7	0.0	235	0.0
LODH	330	4.0	0.0		
Optima Bank	855	10.3	0.1		
Puilaetco	656	7.9	0.1	789	0.1
SGPB	689	8.3	0.1		
Banque Transatlantique (group CMNE)	442	5.3	0.0		
UBS Belgium	406	4.9	0.0		
Van de Put	98	1.2	0.0		
Subtotal	**8,284**	**100.0**	**0.8**	**7,775**	**0.7**
Total sample	**977,554**	**-**	**93.0**	**1,094,895**	**94.0**
System coverage	80.9	-	-	82.9	-
Other banks	73,820	-	-	69,386	-
Foreign branches	156,239	-	-	156,239	-
Total system	**1,207,613**	**-**	**-**	**1,320,519**	**-**

Table 3. Financial Soundness Indicators for Banks Included in the Solvency Stress Test

	Group 1	Group 2	Group 3	Group 4	Total
Total Assets (in EUR mln.)	863,043	89,486	16,741	8,284	977,554
In percent of CET1 capital	85	10	3	2	100
Capital Adequacy					
Reg. Capital/RWAs (average)	19.0	13.8	11.7	15.1	*17.2*
T1 Capital/RWAs (average)	15.3	12.0	11.3	15.1	*14.5*
CET1/RWAs (average)	14.0	11.9	11.2	15.1	*13.6*
Risk-weight	30.3	43.5	67.0	61.8	*39.3*
Asset Quality & Asset Composition					
Loss Rates (average)	0.3	0.2	0.3	0.0	*0.3*
NPL ratio (average)	2.5	4.2	2.4	0.5	*2.4*
Earnings/Profitability					
RoA (average)	0.2	0.3	0.5	0.8	*0.3*
RoE (average)	5.2	5.8	5.0	7.2	*5.4*
Liquidity					
Loan-to-Deposit Ratio	74.0	83.5	101.4	65.2	*75.4*

Source: NBB and IMF staff calculations.

Table 4. Macroeconomic Scenarios for Solvency Stress Test

Economic Activity under Different Scenarios
(percentage change from previous period, unless otherwise indicated)

	Baseline Scenario					Severe Double-Dip (DD) Scenario					Slow Growth (SG) Scenario				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Real GDP	**0.3**	**1.0**	**1.3**	**1.4**	**1.4**	**-1.6**	**-0.4**	**0.6**	**1.0**	**1.1**	**-0.6**	**0.1**	**0.4**	**0.5**	**0.5**
Private consumption	0.2	0.8	1.0	1.1	0.9	-0.1	0.2	0.7	1.0	0.9	0.1	0.5	0.7	0.9	0.7
Gross fixed capital formation	-0.1	1.0	3.2	3.5	3.5	-1.0	-0.7	1.7	2.6	3.1	-0.9	0.4	1.0	2.0	2.2
Exports (goods and services)	0.5	1.5	3.1	3.8	4.5	-3.6	-1.0	1.9	2.9	3.9	-2.4	0.0	2.4	2.4	2.8
Imports (goods and services)	0.4	1.5	3.4	4.1	4.7	-1.9	-0.3	2.4	3.3	4.2	-1.3	0.3	2.8	3.1	3.4
Inventories	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Household saving ratio (% of disp. inc.)	16.2	16.5	16.7	17.1	17.6	15.2	15.9	16.3	16.7	17.1	15.8	16.0	16.2	16.5	17.0
Labor Market															
Unemployment rate (% of labor force)	7.8	7.6	7.5	7.3	7.4	8.0	8.6	9.3	9.7	10.3	7.9	8.1	8.5	8.9	9.6
Total employment	0.3	0.8	0.8	0.9	0.9	0.1	-0.1	-0.1	0.2	0.3	0.2	0.3	0.2	0.2	0.2
Price and cost developments															
Consumption prices	1.9	1.4	1.2	1.2	1.2	3.8	2.6	2.0	1.7	1.4	2.6	2.4	2.3	2.2	2.0
House prices	0.0	0.5	1.6	2.2	2.5	-2.0	-0.7	0.8	1.2	1.5	-0.7	-0.3	0.9	1.5	1.7
Commercial real estate prices	0.0	0.5	1.6	2.2	2.5	-2.0	-0.7	0.8	1.2	1.5	-0.7	-0.3	0.9	1.5	1.7
Equity market index	2.0	2.5	2.6	2.7	2.7	-20.9	1.2	0.1	1.0	1.4	-7.7	-1.8	-1.5	-1.8	-0.5
GDP deflator	1.7	1.5	1.3	1.3	1.3	2.3	2.7	2.0	1.8	1.5	1.9	2.1	2.2	2.1	2.0
ULC, whole economy	2.0	2.1	1.9	1.7	1.8	4.3	4.1	2.8	1.8	1.9	3.0	3.4	3.3	2.1	2.1
Terms of trade	0.0	0.2	0.2	0.2	0.2	-1.3	0.3	0.0	0.1	0.2	-0.5	-0.1	0.0	-0.1	0.0
Interest rates															
short-term interest rate (In percent) [EONIA]	0.4	0.4	0.4	0.4	0.4	1.0	1.0	0.9	0.9	0.8	0.4	0.4	0.4	0.3	0.3
short-term interest rate (In percent) [3-month T-bill]	0.9	0.9	0.9	0.9	0.9	1.3	1.5	1.7	1.9	1.9	0.9	0.9	0.9	0.6	0.6
10 year sovereign bond yield (In percent)	3.1	3.4	3.6	3.8	3.8	3.3	3.6	3.8	3.9	3.9	3.0	3.3	3.5	3.8	3.8

Source: NBB and IMF staff calculations.

Table 5. Overview of the Basel II and III Minimum Capital Requirements

Basel II and III: Current and Phase-In Arrangements (All dates are as at January 1)									
	2011	2012	2013	2014	2015	2016	2017	2018	As of 1 January 2019
Leverage ratio	Supervisory monitoring		Parallel run 1 Jan 2013 - 1 Jan 2017 Disclosure starts 1 Jan 2015					Migration to Pillar 1	
Minimum Common Equity Core Tier 1	2.0%	2.0%	3.5%	4.0%	4.5%	4.5%	4.5%	4.5%	4.5%
Capital Conservation Buffer						0.625%	1.250%	1.875%	2.5%
Minimum Common Equity plus capital conservation buffer			3.5%	4.0%	4.5%	5.125%	5.750%	6.375%	7.0%
Phase-in of Deductions from CET1(including amounts exceeding the limit for DIAs, MSRs and financials)				20.0%	40.0%	60.0%	80.0%	100.0%	100.0%
Minimum Tier 1 Capital	4.0%	4.0%	4.5%	5.5%	6.0%	6.0%	6.0%	6.0%	6.0%
Minimum Total Capital	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Minimum Total Capital plus conservation buffer			8.0%	8.0%	8.0%	8.6%	9.3%	9.9%	10.5%
Capital Instruments that no longer qualify as non-core Tier 1 capital or Tier 2 capital			Phased out over 10 year horizon beginning 2013						
Liquidity coverage ratio	Observation period begins				Introduce minimum standard				
Net stable funding ratio		Observation period begins						Introduce minimum standard	

Source: Basel Committee for Banking Supervision (BCBS). Note: See BCBS (2010b and 2010c) and Appendix III for capital definitions. According to recent revisions to the liquidity risk framework under Basel III (BCBS, 2013) the introduction of the Liquidity Coverage Ratio (LCR) will be now be graduated. Specifically, the LCR will be introduced as planned on January 1, 2015, but the minimum requirement will begin at 60 percent, rising in equal annual steps of 10 percentage points to reach 100 percent on January 1, 2019.

Table 6. Liquidity Stress Test Parameters (Basel III Standard Measures)

Test	Definition	Basic Assumptions		Other Assumptions
		Asset Side (cash inflows)	Liabilities (cash outflows)	
		Proposed Basel III Standard Measures		
Liquidity Coverage Ratio (LCR): *short-term resilience to potential liquidity disruptions* [old version, Dec. 2010]	Stock of high-quality liquid assets would need to cover 30-day net cash outflows	Assets that remain liquid under stress: (i) government debt holdings and other exposure with zero percent risk-weighting [**haircut:** 0 percent], (ii) high-quality bonds and covered bonds (rated 'AA-' and higher) [15], and (iii) sovereign, central bank and PSE assets qualifying for 20 percent risk-weighting [15]; non-cumulative cash inflows: contractual obligations based on given maturities from financials/other counterparties [**discount factor**: 100/50 percent].	(i) term deposits with residual maturity > 1 month [**discount factor**: 0 percent], (ii) stable/less stable retail deposits and unsecured wholesale funding from SMEs [5/10]; (iii) unsecured wholesale funding with/without operational relationship/funding from other financial institutions [25/75/100] or from non-financials, sovereigns and PSEs [75]; (iv) percentage of interbank market funding secured with illiquid assets [100]; (v) secured funding backed by 'Level 1' assets/'Level 2' assets and by other valuable assets (close to 'Level 2') [0/15/25]; (vi) portion of high-quality liquid asset needed to satisfy margin calls [5]; (vii) market value change of net derivative assets [20]; (viii) draw-down rates for committed credit/liquidity facilities to non-financial corporates, sovereigns and PSEs [100] and for committed credit/liquidity facilities to financial institutions [100].	Bank assumptions on collateralized assets maturing within 30 days, portion of assets reinvested, and renewal rate for amortizing loans and other assets; no inflows from new or the renewal of interbank lending in times of stress, and no consideration of access to ECB liquidity on the basis of non-LCR buffer eligible assets; cash inflows limited to 75 percent of cash outflows.
Liquidity Coverage Ratio (LCR): *short-term resilience to potential liquidity disruptions* [revised version, Jan. 2013] - adapted to liquidity reporting by banks to NBB	Stock of high-quality liquid assets would need to cover 30-day net cash outflows	Assets that remain liquid under stress: (i) government debt holdings and other exposure with zero percent risk-weighting [0], (ii) high-quality bonds and covered bonds (rated 'AA-' and higher) [15], (iii) corporate bonds (rated within the range of 'A+' to 'BBB-') [50], (iv) sovereign, central bank and PSE assets qualifying for 20 percent risk-weighting [15], (v) Residential Mortgage-Backed Securities (RMBS) (rated 'AA' and higher) [25], and (vi) common equity [50]; non-cumulative cash inflows: contractual obligations based on given maturities from financials/other counterparties [100/50].	(i) term deposits with residual maturity > 1 month [0]; (ii) stable/less stable retail deposits and unsecured wholesale funding from SMEs [5/10]; (iii) unsecured wholesale funding with/without operational relationship/funding from other financial institutions [25/75/100] or from non-financials, sovereigns and PSEs [40]; (iv) percentage of interbank market funding secured with illiquid assets [100]; (v) operations with central banks for all types of assets [0]; (vi) portion of high-quality liquid asset needed to satisfy margin calls [5]; (vii) market value change of net derivative assets [20]; (viii) draw-down rates for committed credit/liquidity facilities to non-financial corporates, sovereigns and PSEs [30] and for committed credit/liquidity facilities to financial institutions [40].	Level 2 assets in liquidity buffer (i.e., high-quality bonds and covered bonds (rated 'AA-' and higher), corporate bonds (rated within the range of 'A+' to 'BBB-'), sovereign, central bank and PSE assets qualifying for 20 percent risk-weighting, RMBS (rated 'AA' and higher), andcommon equity) are limited to 40 percent of Level 1 assets (i.e., government debt holdings and other exposure with zero percent risk-weighting), of which corporate bonds, RMBS and equity (Level 2B assets) are capped at 15 percent of the liquidity buffer. The NBB version of the LCR ratio (based on a top-down estimation) assumes that: (i) third-party RMBS (rated 'AAA') that banks hold qualify for inclusion in liquidity buffer (max. average LTV of 80 percent at issuance), (ii) self-issued RMBS are not swapped with other counterparties, (iii) banks do not hold corporate bonds (rated within the range of 'A+' to 'BBB-') and RMBS (rated 'AA' and higher) [no data available], (iv) the Belgian deposit guarantee scheme (DGS) does not comply with requirements for lower run-off rate retail deposits (i.e., no application of decreased 3 percent run-off rate);
Net Stable Funding Ratio (NSFR): *long-term structural ratio to address liquidity mismatches*	Amount of available stable funding to exceed the level of required funding	Required stable funding: (i) cash, short-term unsecured instruments, securities with offsetting reverse repo, non-renewable loans to financials with maturity < 1 year, and securities with maturity < 1 year [0]; (ii) debt issued by 0 percent risk-weighted counterparties (~ 'Level 1' assets) [5]; (iii) unencumbered, senior non-financial bonds, rated at least 'AA-' and maturity > 1 year (~ 'Level 2' assets) [20]; (iv) unencumbered, listed equities and securities, rated 'A+' to 'A-' and maturity > 1 year [50]; (v) loans to non-financial sector, maturity < 1 year [50]; (vi) gold [50]; (vii) unencumbered residential mortgages and other loans, maturity > 1 year [65]; (viii) other loans to retail clients and SMEs, maturity < 1 year [85]; (ix) net derivatives receivables and all other assets [100]; and (x) undrawn off-balance sheet assets [10].	Available stable funding: (i) capital and long-term debt (> 1 year) [100], (ii) 'stable deposits' of retail and SMEs (< 1 year) [90], (iii) 'less stable' deposits of retail and SMEs (< 1 year) [80], (iv) wholesale funding provided by non-financials (< 1 year) [50], and (v) all other liabilities [0].	No inflows of interbank lending in times of stress; no consideration of access to ECB liquidity on the basis of non-eligible assets.

Table 7. Liquidity Stress Test Parameters (NBB Liquidity Ratio)

Test	Definition	Basic Assumptions		Other Assumptions
		Asset Side (cash inflows)	Liabilities (cash outflows)	
		NBB Liquidity Ratio		
One-week horizon	One-off aggregate outflow of liabilities for 1 week	Liquid financial assets: (i) cash and cash balances with central banks [**haircut**: 0 percent], (ii) securities and bank loans eligible at the ECB/Eurosystem, BoE or SNB [5-30], (iii) securities and bank loans which can be mobilized in repo transactions (or another type of lending against financial collateral) [15-50], (iv) marketable securities [20-55], and (v) potentially re-usable securities received as collateral [60]; non-cumulative cash inflows: (i) expected cash inflows related to credit extension without liquid financial assets as collateral [**discount factor**: 100 percent], (ii) expected inflows of cash and liquid assets related to maturing transactions with liquid securities and bank loans (e.g., repo and securities lending transactions) [100], (iii) expected and potential net cash flows related to derivatives (excl. credit derivatives) – net contractual cash flows [100] and maximum additional cash flows [5], (iv) maturing inflows from related parties (cf. IAS 24.9) [100], and (v) potential inflows from related and third parties [100], with the exception of uncommitted lines to related parties [50].	(i) cash outflows related to maturing and non-maturity funding without liquid financial assets as collateral [**discount factor**: 100 percent] (i.e., all deposits and funding from financial and non-financial corporate, sovereign and other public sector and central bank clients) with the exception of sight deposit and regulated savings deposits from private households or SME clients [5], (ii) expected outflows of cash and liquid assets related to transactions with liquid securities and bank loans (e.g., repo and securities lending transactions) [100], (iii) maturing outflows to related parties (cf. IAS 24.9) [100], and (v) contingent claims to related and third parties [5], with the exception of uncommitted credit lines to related and third parties [2.5].	A NBB stress test ratio higher than 100 percent implies a liquidity shortage if the stress scenario would materialize at the reporting date (i.e., potentially required liquidity > potentially available liquidity); only unencumbered liquid assets (generating cash inflows), i.e., assets used as a collateral to receive funding (with the exception of cash/cash-equivalents) are included in the test ("liquidity scope"); new unsecured financing and securitization impossible within the time horizon; no offsetting cash inflows from new or renewed wholesale lending (at contractual maturities); central bank eligible collateral can be monetized at appropriate haircuts; repo markets are open at appropriate haircuts; fire-sale of assets possible at appropriate haircuts; re-use of collateral received possible at appropriate haircuts; potential unsecured support in convertible currencies only from related parties (e.g., in the form of committed lines); no renewal of term retail and wholesale deposits; and full convertibility between currencies (within time frame of one week).
One month horizon	One-off aggregate outflow of liabilities for 1 month	Liquid financial assets: (i) cash and cash balances with central banks [0], (ii) securities and bank loans eligible at the ECB/Eurosystem, BoE or SNB [5-30], (iii) securities and bank loans which can be mobilised in repo transactions (or another type of lending against financial collateral) [15-50], (iv) marketable securities [20-55], and (v) potentially re-usable securities received as collateral [60]; non-cumulative cash inflows: (i) expected cash inflows related to credit extension without liquid financial assets as collateral [100], (ii) expected inflows of cash and liquid assets related to maturing transactions with liquid securities and bank loans (e.g., repo and securities lending transactions) [100], (iii) expected and potential net cash flows related to derivatives (excl. credit derivatives) – net contractual cash flows [100] and maximum additional cash flows [15], (iv) inflows from related parties (cf. IAS 24.9) [100], and (v) potential inflows from related and third parties [100], with the exception of uncommitted lines to related parties [50].	(i) cash outflows related to maturing funding without liquid financial assets as collateral, with the exception of sight deposit and regulated savings deposits [100] (i.e., all deposits and funding from financial and non-financial corporate, sovereign and other public sector and central bank clients) with the exception of sight deposit and regulated savings deposits from private households or SME clients [20], (ii) expected outflows of cash and liquid assets related to transactions with liquid securities and bank loans (e.g., repo and securities lending transactions) [100], (iv) maturing outflows to related parties (cf. IAS 24.9) [100], and (v) contingent claims to related and third parties [15], with the exception of uncommitted credit lines to related and third parties [7.5].	
NBB Liquidity Ratio (one month only) *(alternative scenarios)*		Scenarios (one month): like above, with the exception of: (i) "no deposit run scenario": non-cumulative cash outflows from private sector deposits [from 20 to 0]; (ii) "no intergroup funding scenario": potential non-cumulative cash inflows from committed lines with related parties [from 100 to 0]; and (iii) "rising sovereign risk scenario": increase of haircuts on liquid assets: bonds issued by central governments or central banks eligible at ECB/Eurosystem, BoE or SNB [from 5 to 7.5].		

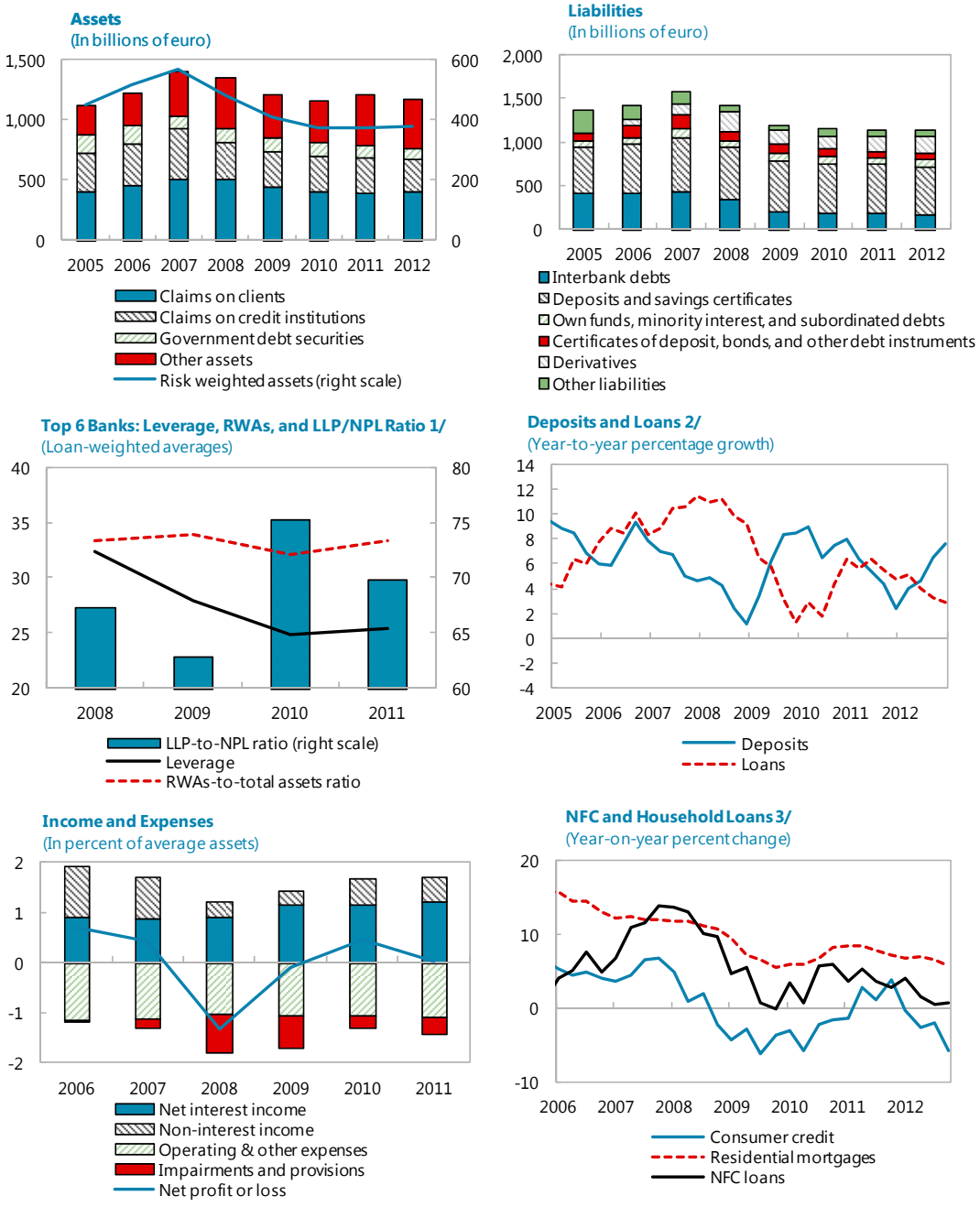
Table 8. Insurance Sector—Stress Test Specification
(In basis points, unless otherwise specified)

	Mild Adverse Scenario	Severe Adverse Scenario
Interest Rates Stress		
Maturity <=1y	73	61
Maturity > 1y and <=5y	74	63
Maturity > 5y and <=10y	80	71
Maturity > 10y and <=20y	82	73
Maturity > 20y	80	71
Equity Stress (in percent)		
MSCI Europe	-16.0	-23.7
Corporate Bond Stress: Financials		
AAA	30	50
AA	40	70
A	50	100
BBB	100	250
BB	250	530
B and lower	500	610
Unrated	110	280
Corporate Bond Stress: Financials		
AAA	30	40
AA	40	50
Corporate Bond Stress: Non-Financials		
AAA	30	40
AA	40	50
A	50	70
BBB	100	150
BB	150	200
B and lower	600	1260
Unrated	110	170
Non-Life Stress		
Natural and man-made catastrophe	Largest probable maximum loss on a single catastrophe event (man-made or natural) (1/40 year event)	

	Mild Adverse Scenario	Severe Adverse Scenario
Sovereign Bond Stress		
Austria	34	52
Belgium	47	72
Bulgaria	222	344
Cyprus	183	284
Czech Republic	65	104
Denmark	28	45
Finland	31	48
France	32	48
Germany	0	0
Greece	525	801
Hungary	141	214
Ireland	104	156
Italy	72	108
Latvia	86	137
Liechtenstein	41	61
Lithuania	86	137
Luxembourg	51	79
Malta	58	88
Netherlands	21	33
Norway	47	73
Poland	81	130
Portugal	142	247
Romania	145	219
Slovakia	52	83
Slovenia	124	182
Spain	74	109
Sweden	35	55
Switzerland	41	61
United Kingdom	34	51
Life Stress		
Mass lapse	30 percent shock on policies where lapse results in loss	

Source: NBB and EIOPA. Note that the haircuts of the banking stress test (Attachment I, Appendix VII) were applied for stress test of the insurance sector under the current Solvency I regime. For both the MCV and the QIS-5 valuation, the EIOPA specifications of sovereign bond stresses were used in the form of higher sovereign spreads for each country shown above.

Figure 1. Belgium Banking Sector Developments



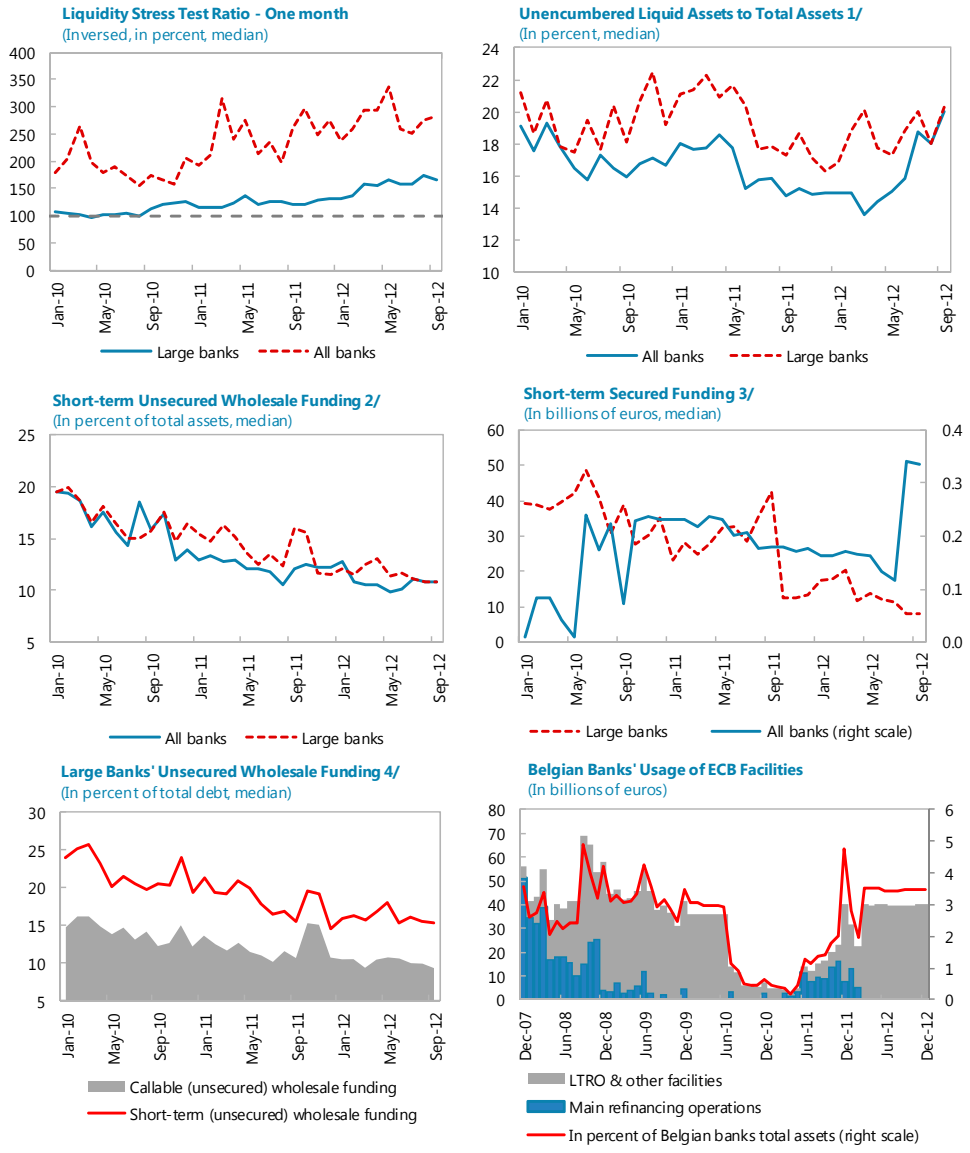
Source: National Bank of Belgium and IMF staff calculations.

[1]The LLP-to-NPL ratio denotes the stock of loan loss provisions (LLPs) as a percentage of non-performing loans (NPLs). The amount of risk-weighted assets (RWAs) is shown as a percentage of total assets. Leverage is defined as the ratio of total assets to CET1 (multiple). All values are calculated as an average for Belgium's six largest banks, weighted by the relative size of their loan book.

[2]NFC and household deposits and loans corrected for the securitization.

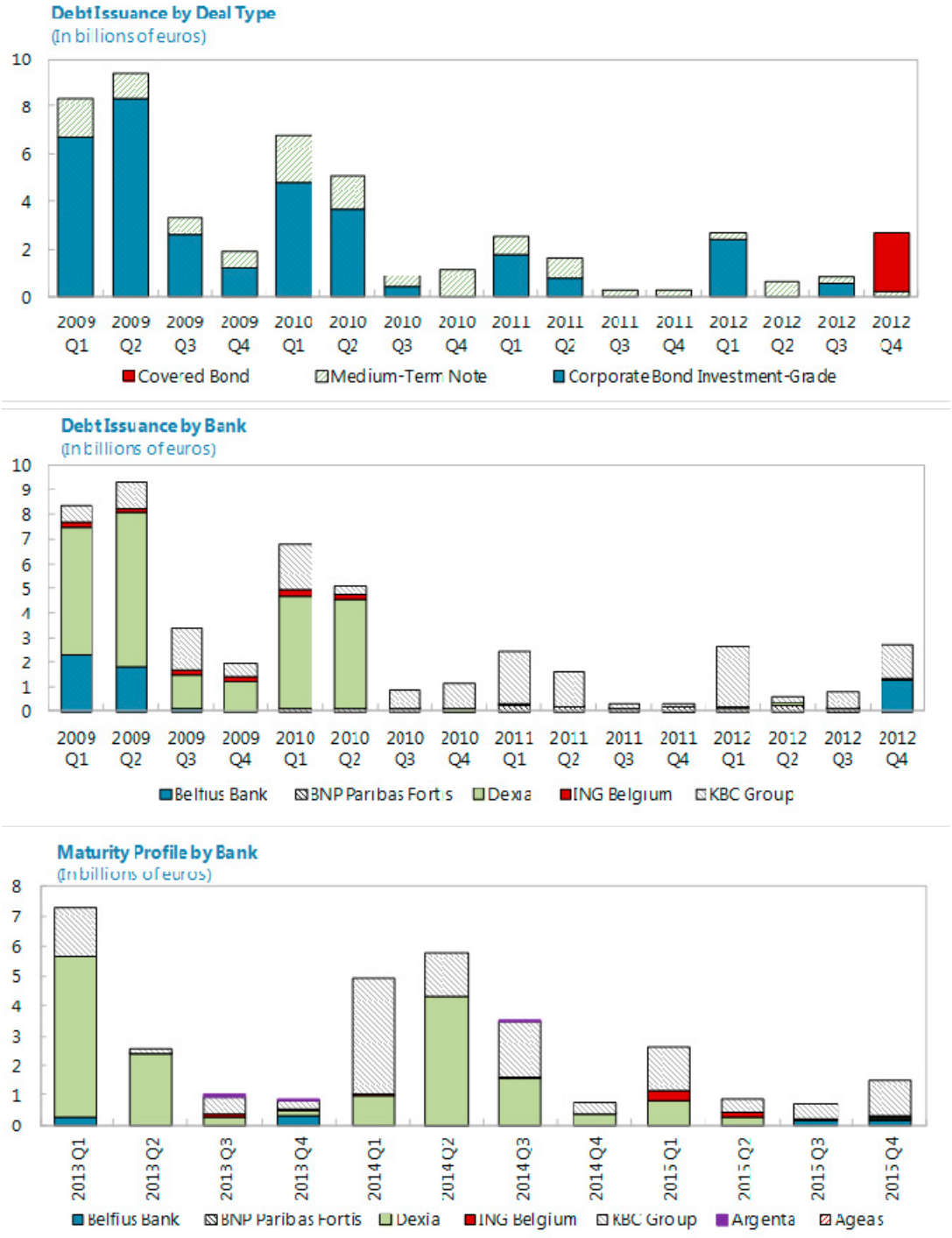
[3]Corrected for the securitization.

Figure 2. Belgium: Liquidity and Short-term Funding



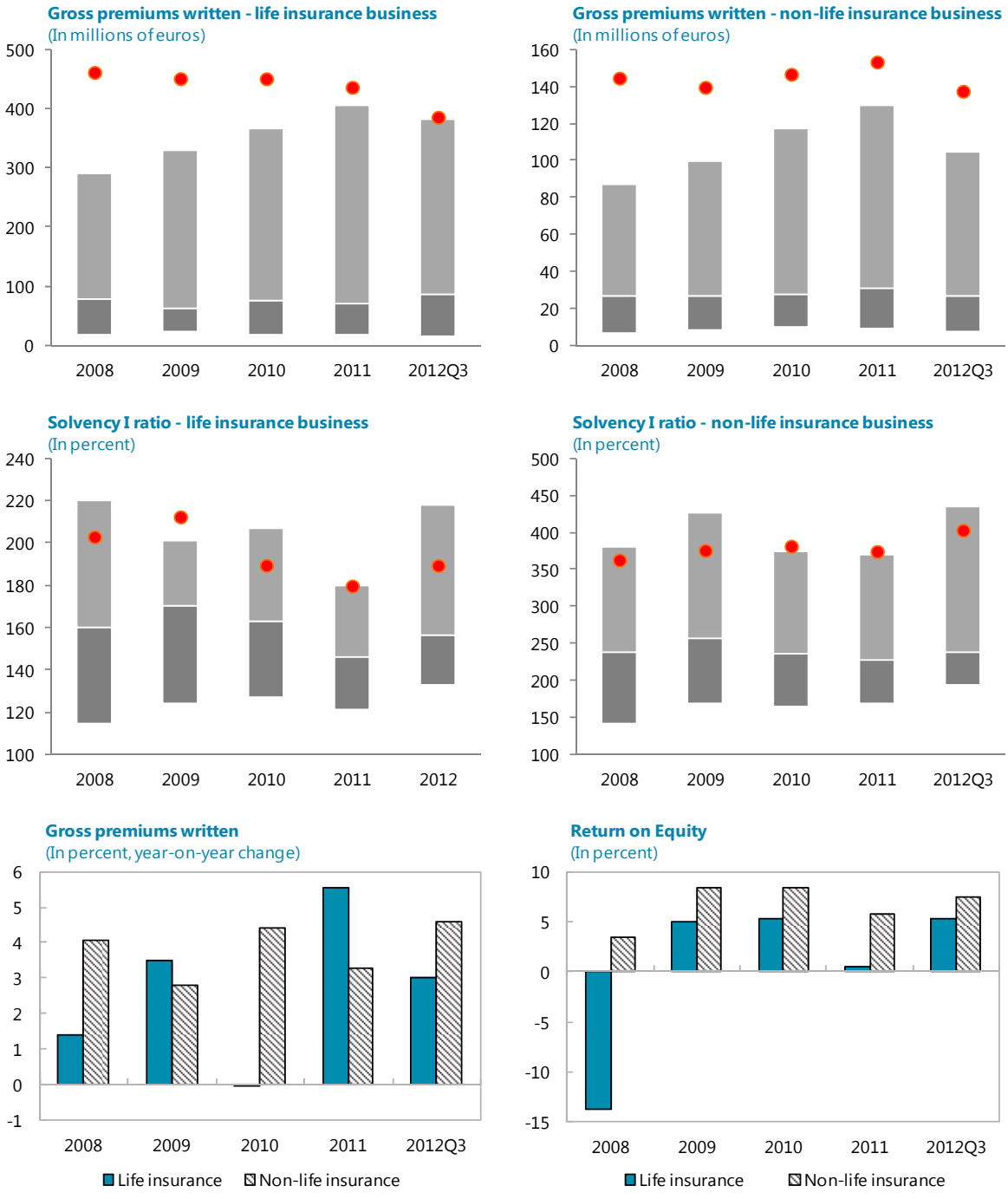
Sources: NBB and IMF staff calculations.
Note: All data were derived from a legal entity basis.
1/ Unencumbered liquid assets: liquid assets include all unencumbered cash and central bank reserves as well as all unencumbered central bank eligible, repo-eligible, marketable and re-usable financial assets, measured at market value and before prudential haircuts (= buffer stress test ratio before haircuts).
2/ Short-term wholesale funding: sum of unsecured open maturity, wholesale deposits and unsecured bonds as well as similar liabilities with a remaining maturity of less than one year; intra-group, secured, long-term (> 1 year) and retail financing is thus not included.
3/ Short-term secured wholesale funding: secured funding with residual maturity of less than one year obtained form third parties (i.e., excluding related party repo financing); the sharp decrease in outstanding between September and October 2011 is driven by the fact that one additional large bank attracted a small amount of secured funding, which decreased the median value substantially.
4/ Callable wholesale funding: callable wholesale funding includes all unsecured wholesale deposits and bonds with an open maturity or maturing within one week. Intra-group, secured, medium term (> 1 week) and retail financing is thus not included. Total debt includes all unsecured/secured retail and wholesale financing.

Figure 3. Belgium: Bank Funding



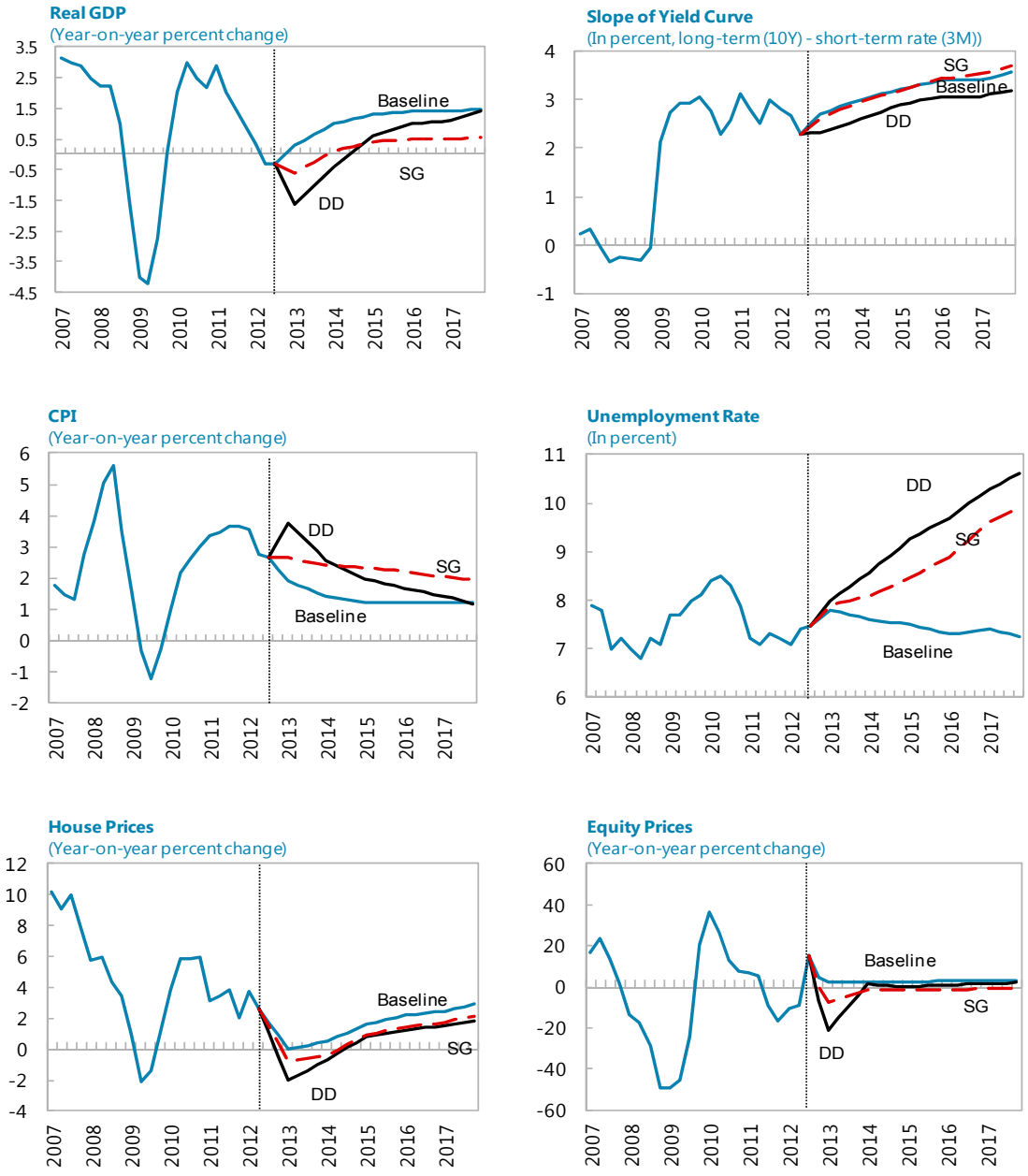
Source: Dealogic and IMF staff estimates.

Figure 4. Belgium: Insurance Financial Soundness Indicators (FSIs)



Source: NBB and IMF staff calculations. Box plots include the mean (red dot) and the 25th and 75th percentiles (grey box, with the change of shade indicating the median). Bar charts in the bottom panel show medians.

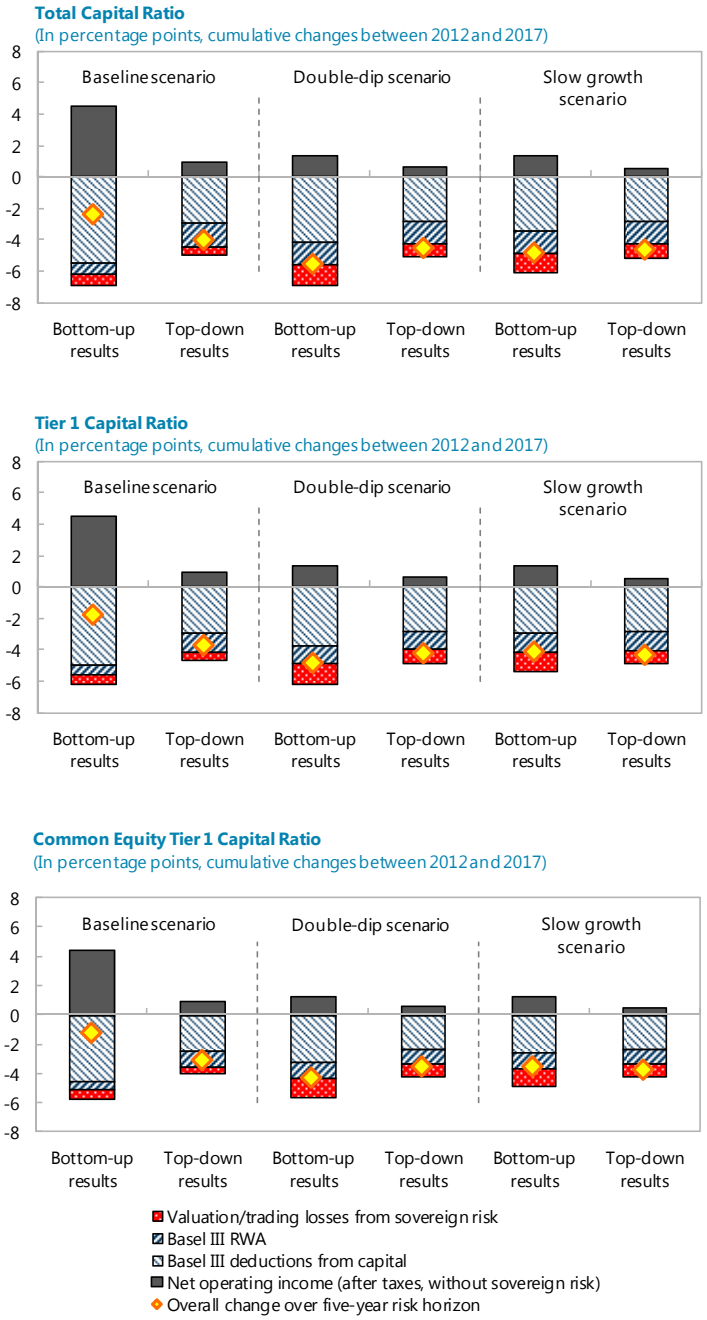
Figure 5. Belgium: Macroeconomic Assumptions under Different Stress Test Scenarios



Sources: National Bank of Belgium; and IMF staff estimates.

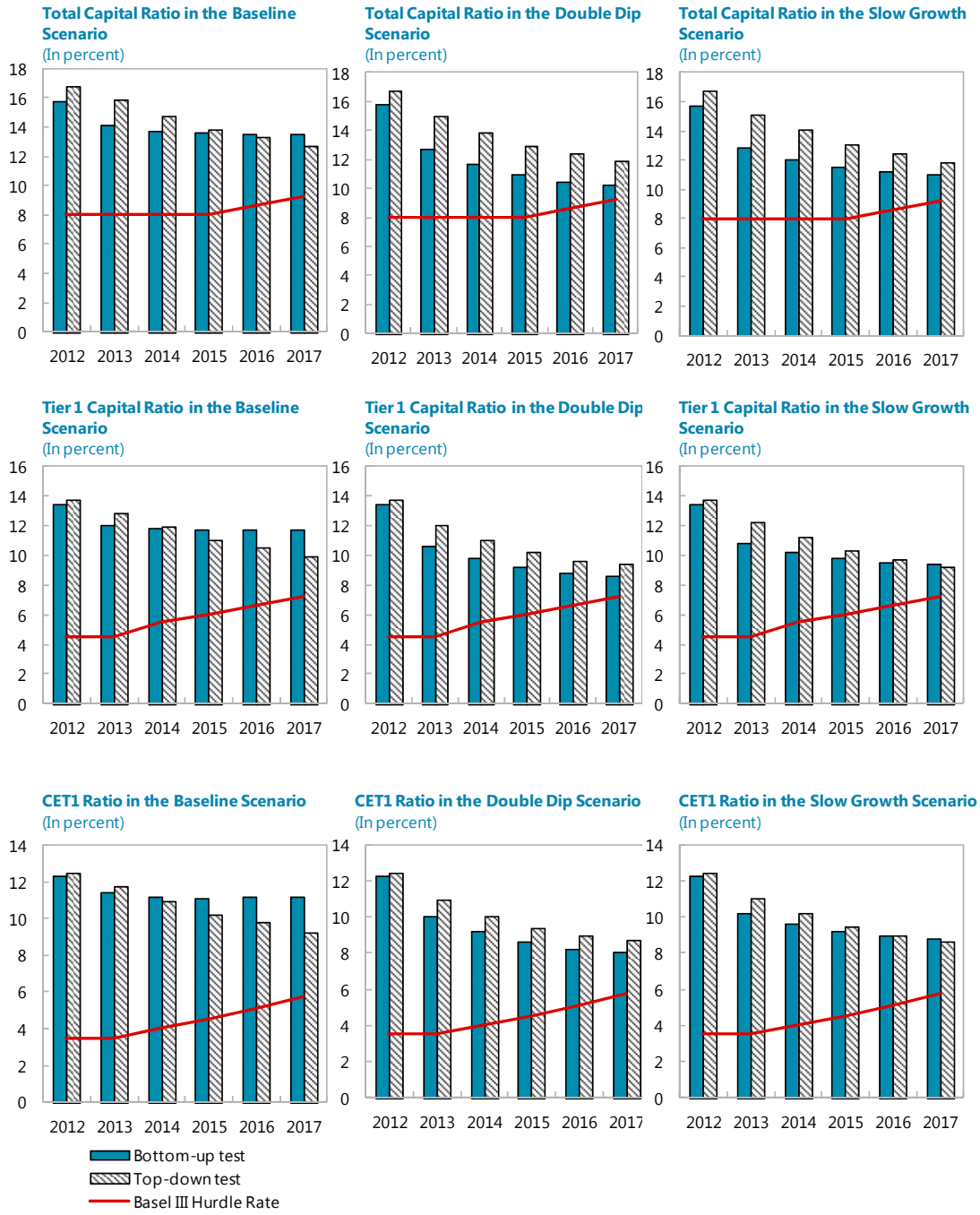
IMF Baseline (Baseline)
IMF double dip scenario (DD)
IMF slow growth scenario (SG)

Figure 6. Belgium: Solvency Stress Tests—Risk Drivers



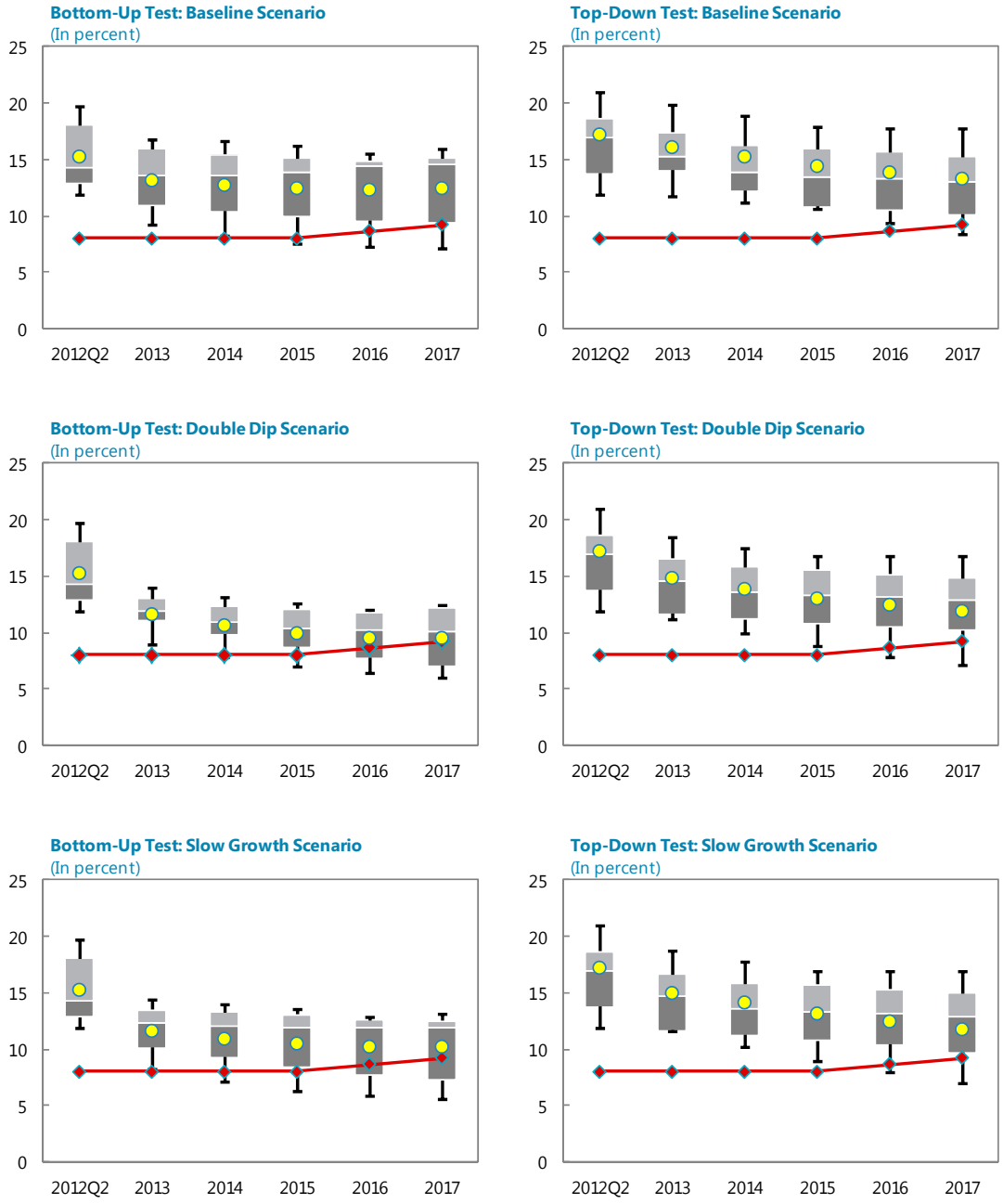
Source: NBB and IMF staff estimates. The sample of banks included in the stress test differs between the two approaches. The top-down exercise includes 42 banks on solo basis (Groups 1-4), representing 93 percent of the banking sector (excluding foreign branches), whereas the bottom-up exercise comprises the six largest banks (Group 1) on a consolidated basis, covering 90 percent of the sector.

Figure 7. Belgium: Evolution of Aggregate Capital Ratios in Solvency Stress Tests



Source: NBB and IMF staff estimates. The sample of banks included in the stress test differs between the two approaches. The top-down exercise includes 42 banks on solo basis (Groups 1-4), representing 93 percent of the banking sector (excluding foreign branches), whereas the bottom-up exercise comprises the six largest banks (Group 1) on a consolidated basis, covering 90 percent of the sector.

Figure 8. Belgium: Solvency Stress Test Results—Total Capital Hurdle Rates

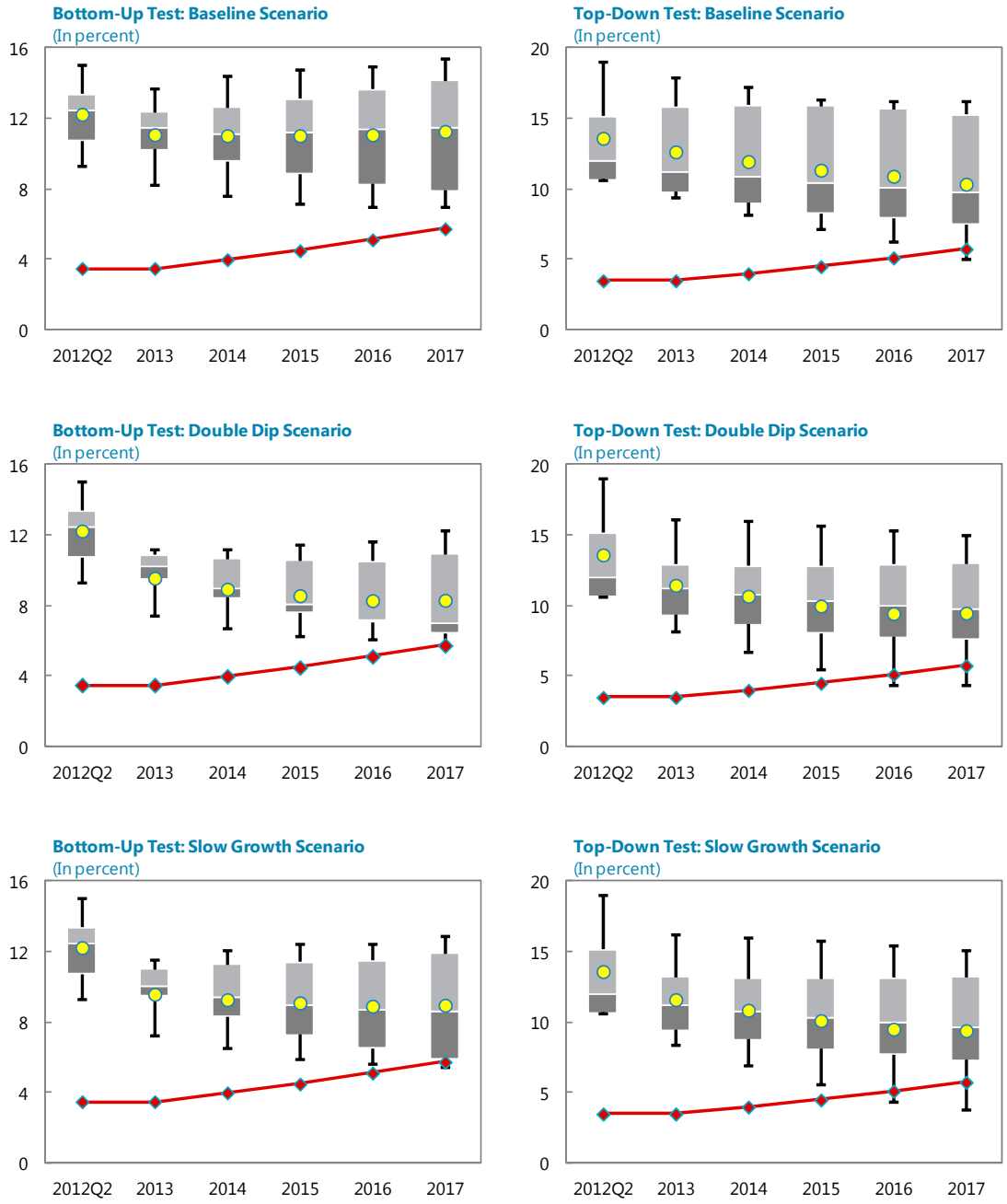


Source: NBB and IMF staff estimates. The sample of banks included in the stress test differs between the two approaches. The top-down exercise includes 42 banks on solo basis (Groups 1-4), representing 93 percent of the banking sector (excluding foreign branches), whereas the bottom-up exercise comprises the six largest banks (Group 1) on a consolidated basis, covering 90 percent of the sector. Box plots include the mean (yellow dot), the 25th and 75th percentiles (grey box, with the change of shade indicating the median), and the 10th and 90th percentiles (whiskers). The red line indicates the Basel III hurdle rate.

Figure 9. Belgium: Solvency Stress Test Results—Tier 1 Capital Hurdle Rate

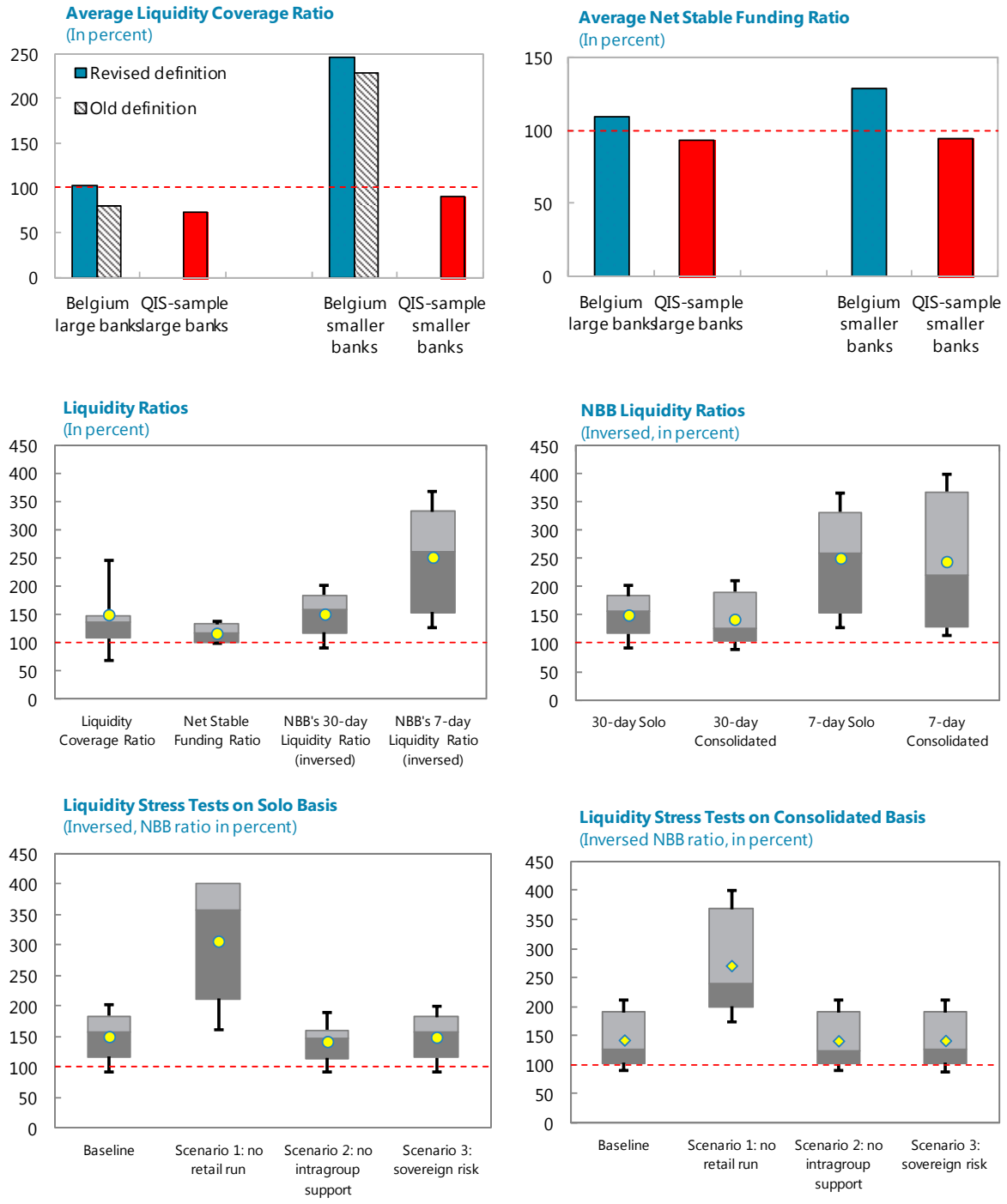
Source: NBB and IMF staff estimates. The sample of banks included in the stress test differs between the two approaches. The top-down exercise includes 42 banks on solo basis (Groups 1-4), representing 93 percent of the banking sector (excluding foreign branches), whereas the bottom-up exercise comprises the six largest banks (Group 1) on a consolidated basis, covering 90 percent of the sector. Box plots include the mean (yellow dot), the 25th and 75th percentiles (grey box, with the change of shade indicating the median), and the 10th and 90th percentiles (whiskers). The red line indicates the Basel III hurdle rate.

Figure 10. Belgium: Solvency Stress Test Results—CET1 Capital Hurdle Rate



Source: NBB and IMF staff estimates. The sample of banks included in the stress test differs between the two approaches. The top-down exercise includes 42 banks on solo basis (Groups 1-4), representing 93 percent of the banking sector (excluding foreign branches), whereas the bottom-up exercise comprises the six largest banks (Group 1) on a consolidated basis, covering 90 percent of the sector. Box plots include the mean (yellow dot), the 25th and 75th percentiles (grey box, with the change of shade indicating the median), and the 10th and 90th percentiles (whiskers). The red line indicates the Basel III hurdle rate.

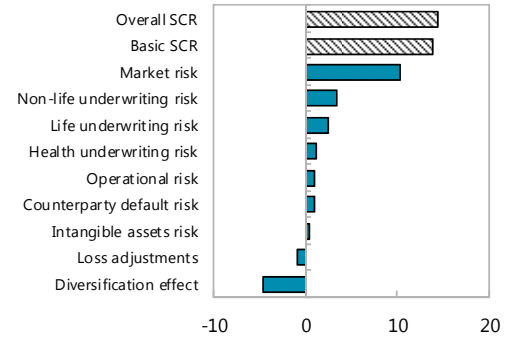
Figure 11. Belgium: Banks' Liquidity Ratios and Stress Test Results



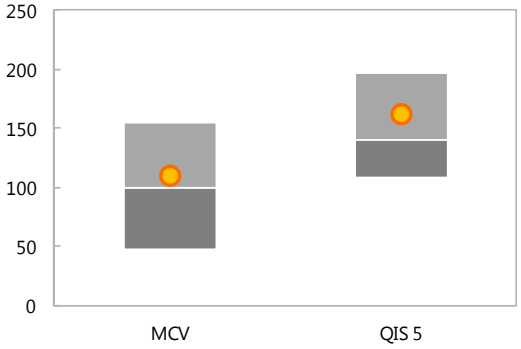
Source: NBB, EBA, and IMF staff calculations. Box plots include the mean (yellow dot), the 25th and 75th percentiles (grey box, with the change of shade indicating the median), and the 10th and 90th percentiles (whiskers). Ratios are capped at 400 percent, both for the calculation of the averages and in the charts.

Figure 12. Belgium: Insurance Stress Test Results

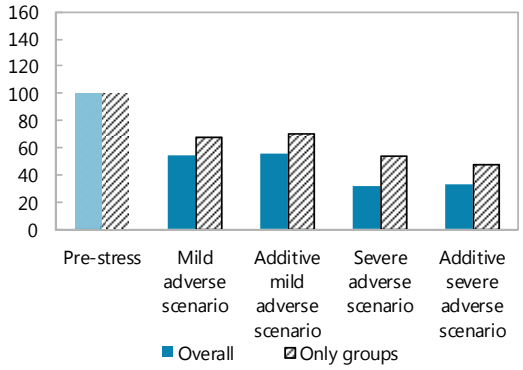
Individual Risk Components of Solvency Capital Requirement
(In billions of euros, pre-stress basis)



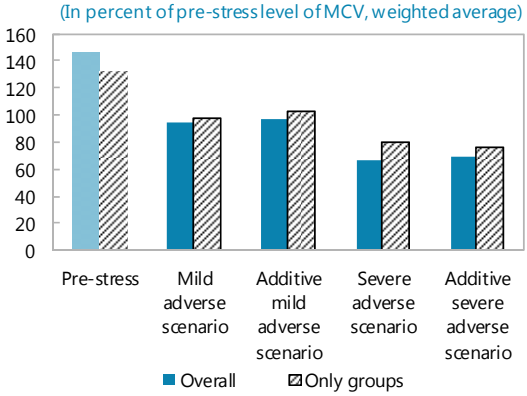
Overall Solvency Ratios (QIS-5 and Market-Consistent Valuation (MCV)), Pre-Stress
(In percent)



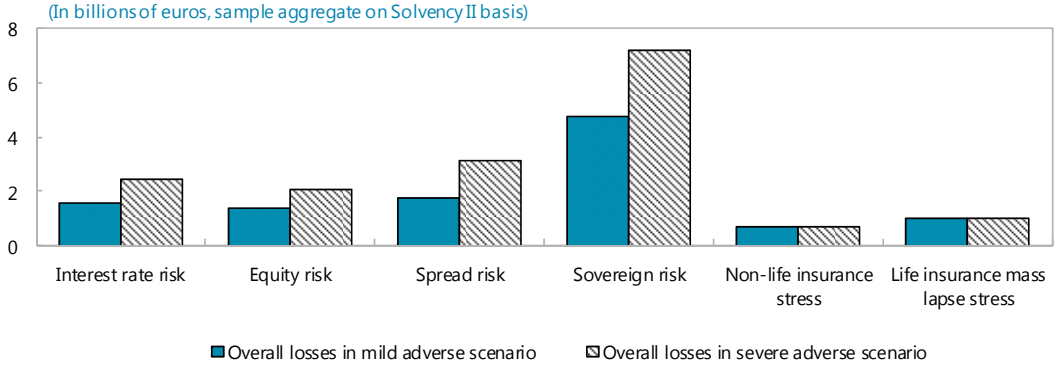
MCV-Based Solvency Ratios 1/
(In percent of pre-stress level, weighted average)



QIS-5 Solvency Ratios
(In percent of pre-stress level of MCV, weighted average)



Individual Risk Impacts
(In billions of euros, sample aggregate on Solvency II basis)



Source: NBB and IMF staff calculations. Box plots include the weighted average (yellow dot) and the 25th and 75th percentiles (grey box, with the change of shading indicating the median). 1/ The pre-stress level of the weighted-average solvency ratio under MCV was set to 100 as a reference basis for the pre-stress level under QIS-5 as well as all scenario-based results.

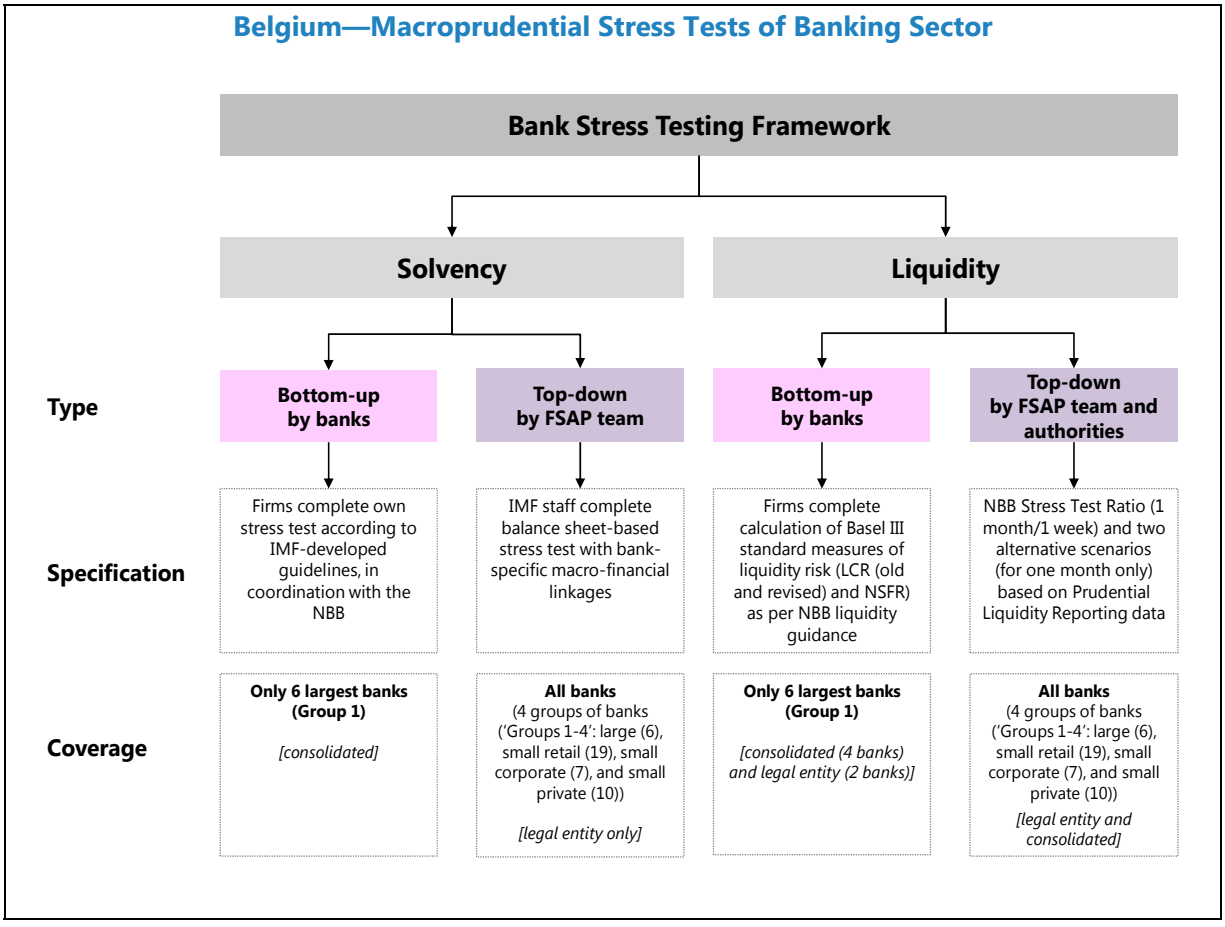
Annex I. Guidelines for the Bottom-Up Solvency Stress Test—Banking

INTRODUCTION

A. Background

1. The stress testing exercise of the Financial Sector Assessment Program (FSAP) Update for Belgium comprises a comprehensive analysis of solvency and liquidity risks of the banking sector to support a financial stability assessment over a five-year forecast horizon. Solvency tests consist of bottom-up (BU) stress tests by the six largest banks in Belgium and a cross-validation by means of top-down (TD) tests covering more than 90 percent of the banking sector, undertaken jointly by the National Bank of Belgium (NBB) staff and the FSAP team; and liquidity stress tests consist of both BU and TD tests of most banks in the system, using supervisory data and parameters specified by the FSAP team.

Belgium—Macroprudential Stress Tests of Banking Sector



2. The solvency tests are based on three macroeconomic scenarios, determined in collaboration with the NBB, and their deviation from the IMF's September 2012 World Economic Outlook (WEO) baseline. They comprise a baseline scenario and two adverse scenarios using mid-2012 data. Hurdle rates are applied according to the Basel III implementation schedule.

3. Liquidity tests focus on the sudden, sizeable withdrawal of funding (liabilities) and the sufficiency of existing assets to withstand those shocks under stressed conditions. The standard liquidity measures under Basel III, the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR), and implied cash flow tests (over one-week and one-month periods) are applied to determine the short- and medium-term resilience of individual banks and the overall system, without taking into account access to central bank liquidity.

B. Objective

4. This note summarizes key assumptions related to the calibration and estimation of the BU solvency stress testing component. The exercise forms part of a wider stability analysis that comprises several tests aimed at assessing the capital adequacy of the banking sector based on end-Q2 2012 financial results. It contains specific instructions regarding the implementation of the stress test that should help determine the capacity of the banking sector to absorb the realization of key macro-financial risks, which would result in downside deviations from a defined baseline scenario.

5. The objective of this stress test, as part of the FSAP mission's analysis of financial stability, is to assess system-wide vulnerabilities of the banking sector under different macroeconomic scenarios and adverse capital market conditions.[1] It is anticipated that this exercise will also contribute to a more comprehensive understanding of sector's general vulnerability to extreme shock. The stress test incorporates specific risk factors, including cross-border developments (particularly sovereign risk), funding risks, the introduction of upcoming regulatory reforms, as well as certain behavioral assumptions in order to determine the capacity of banks to absorb the manifestation of macro-financial stress, without identifying individual institutions.[2]

6. The purpose of the stress test differs from that of other stress testing exercises in which large Belgian banks have involved. In particular, past efforts coordinated by the Committee of European Banking Supervisors (CEBS, 2010) and the most recent one by the European Banking Authority (EBA, 2011) jointly with European Central Bank (ECB, 2011), were aimed at analyzing

[1] It should be emphasized that the stress tests are necessarily based on economic and market conditions as of end-Q2 2012, the cut-off date of the exercise, and do not take into account the most recent developments in the international sphere.

[2] Most stress tests are built on a modular design, based on risk management techniques similar to the ones applied by commercial banks for their internal stress tests. This stress test, however, is focused more on capital adequacy of the banking sector under different macroeconomic scenarios (rather than portfolio stresses of individual firms and/or reverse stress tests) using the historical macro-financial linkages affecting parameter sensitivities.

inherent risks in the near term and to assess potential capital needs of specific institutions, from which management actions may be required. In contrast, the results of this BU stress test provide input into a broader analysis undertaken by the FSAP, forming the basis for policy discussions with the authorities. No management action would be expected as a result of the FSAP stress tests (Jobst and others, 2013).

7. The sample of firms involved in the BU stress test exercise includes the six largest banks: BNP Paribas Fortis, KBC Bank, Belfius Bank, ING Belgium, AXA Bank Europe, and Argenta. The stress test covers banking operations on a consolidated basis. Banks with other significant businesses (e.g., insurance) that are separate companies (subject to separate regulations) and effectively ring-fenced may exclude those businesses from the stress test.

8. The following macroeconomic projections and guidelines on selected risk parameters are consistently applied:

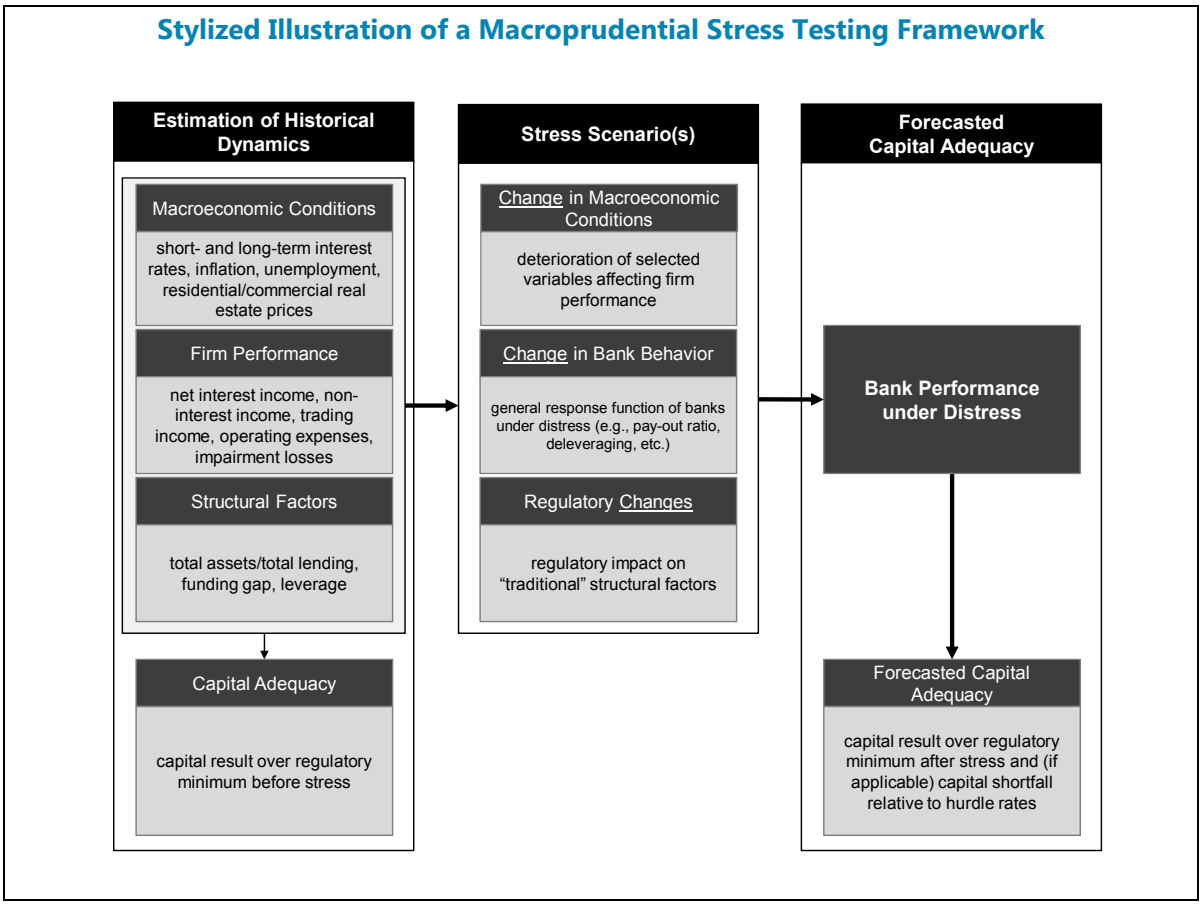
- Based on the given scenarios, related key macroeconomic and financial variables have been projected, using the NBB's macro model (Jeanfils and Burggraeve, 2005) and IMF staff estimates, for input into the solvency stress tests, namely, inflation, unemployment, housing prices, short and long-term interest rates, and equity prices (Appendix III). An illustrative specification of macro-financial linkages affecting firm performance can be found in Appendix V.

- Prescriptive assumptions covering areas such as (i) risk factors (loss rates, market risk impact on fixed income holdings, taxes, and funding costs), (ii) behavioral adjustments (balance sheet and credit growth, dividend pay-out, asset disposal, capital raising), and (iii) regulatory changes (capital requirements, risk-weighted assets, definition of capital) are provided.

- Some elements should be excluded from consideration, including on-going de-risking/de-leveraging of balance sheets through restructuring, run-offs and divestments that have been announced/implemented after the cut-off date, which do not represent a continuation of existing policies and require managerial intervention.[3] Potential mitigating factors, such as managerial actions and strategic decisions as well as contingent capital arrangements and bail-in provisions, are not considered.

9. A summary of the macro scenarios, key assumptions, and hurdle rates is presented in Appendix II. Firms are requested to conduct their BU stress tests, using end-Q2 2012 data, and to report their final results to the NBB by January 7, 2013. The NBB will perform due diligence analysis and report aggregate findings to the FSAP team.

[3] This would otherwise distort results due to a gradual decrease of risk-weighted assets (RWAs) and potential risks from restructured loans that no longer meet contractual covenants (and the scope for regulatory forbearance).



MACRO SCENARIOS

10. The stress testing exercise in the FSAP analyses results using a baseline scenario (based on the IMF's World Economic Outlook (WEO) September 2012 baseline projection of real GDP growth for Belgium) and two adverse scenarios (based on the negative deviation of GDP projections from the central growth forecast). In portraying the stress scenarios as a "mark-up" over the most likely outcome, the adversity of the negative deviation from the expected growth path takes into account perceived risk, i.e., the potential for central expectations to vary due to uncertainties as well as revisions in light of new information. For all scenarios, the following variables are provided (Appendix III):

- real GDP including private consumption, gross fixed capital formation, imports/exports, and inventories;
- household savings and unemployment rate;
- price and cost developments, including consumption prices, house prices, commercial real estate prices, equity market index, GDP deflator, unit labor cost, and terms of trade; and
- interest rates (short-term interest rate, swap rates, and 10-year sovereign bond yield).

11. The adverse scenarios comprise a severe double-dip (DD) recession scenario and a prolonged slow growth (SG) scenario. The DD scenario is specified consistent with the system-wide supervisory stress test conducted by EBA in 2011, whereas the latter adverse scenario amplifies the adversity of stress in terms of duration:

- *"double-dip (DD) recession" scenario (severe and short-term)*—negative two standard deviation of real GDP growth (based on the volatility of the two-year growth rate between 1982 and 2011) from the baseline growth trend. This scenario results in a cumulative negative deviation of about 4.7 percentage points in real GDP over a five-year horizon (with a sharp decline in output and rising inflation over the first two years but positive adjustment dynamics during the subsequent three years); and

- *"slow growth" (SG) scenario (severe and long-term)*—cumulative negative deviation of about 4.5 percentage points in real GDP (at a constant rate of deviation from the annual baseline growth rate of 0.9 percent over a five-year horizon), as a result of continued shocks to demand amid rising inflation expectations.

12. Both macro scenarios are in line with the spectrum of economic shocks considered in the context of other stress testing exercises. The stress tests completed by the European authorities (CEBS and EBA) as well as other recent FSAPs of peer countries, such as France, Germany, and the Netherlands, have in common a DD—like adverse scenario applied in the case of Belgium. In particular, the severe DD scenario is consistent with the adverse scenarios of the stress test conducted by the EBA for 2011 (over the first two years). The EBA test applied a negative deviation from the expected growth path. A prolonged slow growth scenario remains unique to FSAP stress testing exercises, and is considered the "tail shock" scenario (albeit less severe than in the case of the U.K. FSAP (IMF, 2011)).

13. The adverse scenarios are underpinned by the following assumptions:[4]

- Both adverse scenarios are obtained by imposing a semi-permanent commodity price shock (e.g., positive oil price) and a large shock to global demand.[5] In the case of the former, world demand decreases 8.2 percent combined with a 40 percent oil price shock. The same shocks are repeated over time to generate the SG scenario. Given that some of the effects (together with the second round effects of the initial shock) build up with some delay, the magnitude of the

[4] It is important to note that wages in Belgium are indexed on the basis of a so-called "health index" (which is a consumption price sub-basket, excluding tobacco products and fuel, but including heating oil and electricity, both characterized by a quick and relatively strong transmission of oil prices), which can lead to important differences in shock results on prices when comparing them to the average result in the Euro area. Thus, in both scenarios, monetary policy has been simulated on the basis of the output and price-shock results for the euro area. These elasticities were taken from compatible Euro area results of standard shock scenarios, aggregated over all euro area countries. As this set of elasticities also takes into account cross-country feedback effects, this framework has also been used to derive a compatible conditioning of the prices of competitors.

[5] Note that this combination of shocks is necessary to avoid hitting the zero bound for interest rates.

additional shocks constantly decreases over time. More specifically, world demand is shocked continuously—at a level of 2.5 percent under its baseline level in the first year of the simulation and up to 7.5 percent under its baseline level at the end of the simulation horizon. Simultaneously, oil prices are shocked continuously, so that their level gradually increases from 15 percent on impact to 50 percent at the end of the simulation horizon.[6]

- In both scenarios, the combination of a demand and a supply shock, and the resulting negative output gap combined with an increase in inflation, makes it difficult for the central bank to stabilize the economy through changes in its key interest rate. Monetary policy is assumed to be conducted at the Euro area level through the use of a standard but inertial Taylor-rule.[7] The negative output gaps largely offset positive price gaps in such a way that the total effect on short and long-term rates is rather small.

14. Cross-border effects are considered in all macro scenarios. Assumptions about the type of shocks (temporary or permanent) affecting the domestic economy—and the degree to which they affect countries in which banks operate outside Belgium—have been aligned by allowing for time-varying patterns consistent with the forecasts for Belgium under both baseline and adverse scenarios.

15. In addition, further key rate durations of the interest rate term structure and the swap rate curve supplement the short- and long-term rates in the macroeconomic projections (Appendix IV). The swap rate curve has been estimated after (i) completing the interest rate term structure with the missing key rate durations, and (ii) controlling for the impact of rising sovereign risk under the different scenarios. In order to derive the (risk-free) swap rates on Belgian sovereign securities at different maturities (2 years, 5 years, and 10 years), higher sovereign credit spreads have to be excluded from the level of (cash) interest rates at the same maturity tenors. Since the estimated valuation haircuts for sovereign debt under a comparable DD adverse scenario in the 2011 EBA stress test included a common interest rate shock (together with a change in sovereign risk), the risk-free component of changes in interest rates can be identified.[8]

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[6] Consistent with this scenario, one could also assume a small negative endogenous shock to the uncovered interest rate parity governing the euro-dollar exchange rate (i.e., a lower risk premium). This shock can be interpreted as a shift of investors away from euro assets towards dollars assets, thereby aggravating the depreciation of the euro and leading at least to a small increase of output in the short-term.

[7] The impact on the 10-year sovereign bond yield has been calculated as a simple forward convolution of the new short rates, assuming that the shocks that have been imposed gradually and die out over the course of the five years that follow the end of the simulation horizon.

[8] The data input includes the valuation haircut for debt securities issued by the German government at 10-year maturity and the interest rate shock during the second year under the adverse scenario relative to end-2010 in the 2011 EBA stress test (EBA, 2011), the estimated valuation haircuts at five-year maturity (ECB, 2011), and the projections of the short- and long-term (3 month and 10 years) interest rate for government debt and the EONIA rate as of end-June 2012. OLOs are fixed-rate, dematerialized debt securities issued by the Belgian government. See http://www.debtagency.be/en_products_olo_characteristics.htm

16. The following calculations have been applied (Appendix IV):[9]

- First, the elasticity of the risk-free (i.e., common interest rate shock) component of the valuation haircut is derived from the EBA valuation haircut for debt securities issued by the German government with a maturity term of 10 years. Given that no increase in sovereign risk (i.e., constant credit spreads) was applied for estimating the haircut, it can be inferred that a one percentage point change of the haircut implies a change of the risk-free rate by about 36 basis points (bps) = 125 bps/3.5 percent (Germany valuation haircut).

- Second, for the severe DD adverse scenario, the same elasticity of the sovereign risk component is applied to the estimated valuation haircut for debt securities issued by the Belgian government at a five-year maturity term. Since the haircut for Belgian securities includes a 50 bps common interest rate shock, the risk-free component can be determined as 50bps/36bps=1.4 percent valuation haircut.

- Third, for each year over the forecast horizon, the risk-free component is subtracted from the sovereign valuation haircut, which is subsequently transposed into a credit spread according to the above elasticity of the sovereign risk component; the credit spread can then be deducted from the 10-year government debt (*obligations linéaires*, or OLOs) to derive the "synthetic" 10-year swap rate.

- Fourth, for the SG scenario, the credit spreads under DD scenario are scaled by the change of the difference between the 10-year OLO rates under both scenarios. Then the 3-month EURIBOR, the 2-year and 5-year swap rate as well as the 1-, 2- and 5-year OLO interest rates can be interpolated.[10]

SATELLITE MODELS

17. Satellite models should be used to specify the macro-financial linkages of firm performance over the forecast horizon. Firms are required to determine credit losses and various elements of profit, including funding costs in response to changing capitalization via so-called "satellite models" or expert judgment. When expert-judgment is used, it should be closely aligned with the output of satellite models.[11] Satellite models should at least cover the last five years and include a lagged term, GDP growth, interest rates, other macroeconomic variables, and firm-specific variables, such as leverage, loan-to-asset ratio and the funding gap. Appendix V provides an overview of possible satellite specifications for the various profit elements and credit impairment.

[9] Note that firm can apply these rate shocks gradually over each forecasted year. Rate movements in other currency areas need to be in line with presented interest rate dynamics. Interest rate movements on other sovereign debt positions can be deducted using this methodology.

[10] For the baseline scenario, the 10-year swap rate is scaled to the changes of the 10-year OLO.

[11] Benchmarks for the sensitivity of credit losses to macroeconomic variables are the stress tests conducted by the European authorities (CEBS in 2010 and EBA in 2011).

- *Credit losses* are forecasted based on separate models for write-downs and write-ups specific to each sector (corporate, retail, public sector, and other financial institutions). Losses given default (LGDs) under stress should increase according to the following empirical specification: LGD (under stress)=0.3502+2.3408*PD (Moody's, 2009) or LGD (under stress)=0.4022+2.1535*PD (if the down-cycle LGDs actually represent long-term averages).

- *Lending* is assumed to grow broadly in line with nominal GDP (or forecasted based on a suitable satellite model specification comprising changes in real GDP, short-term interest rates, and significant macro variables, such as industrial production and unemployment).

- *Profits* are estimated using separate models for interest income, interest expenses, net fee and commission income, and the operational expenses. Income taxes are assumed to be 30 percent for firms recording a profit, and zero otherwise.

- *Funding costs* should be estimated as a separate component of changes in interest expenses. The specification of changes in interest rate expenses should include the nonlinear sensitivity of funding costs to changes in solvency conditions.

- *Trading income* under stress should be aligned with changes in nominal GDP, based on historical data.[12] To this end, economic growth under each scenario and year can be matched to the corresponding GDP growth rate during the last 15 years (i.e. the growth rate closest to the simulated one). However, firms that experienced exceptionally high trading losses during the recent financial crisis (relative to the historical experience) may wish to model the probability distribution of trading income and match the point estimates to the percentile level of projected GDP growth under different scenarios, all relative to past volatility of growth. A high-dimensional parametric fit function can be used to enhance the alignment of GDP with trading income.

18. As a general rule, satellite models need to be clearly documented and back-tested. Since firms themselves specify the macro-financial linkages affecting their forecasted performance, the NBB, together with the FSAP team, will require full disclosure of the various satellite models and expert judgments on earnings capacity, market and credit losses as well as the change in funding conditions under the various scenarios.

KEY ASSUMPTIONS

19. This section describes the various assumptions that should be applied to the BU solvency stress test. Firms are also encouraged to conduct additional solvency stress tests without

[12] While empirical evidence suggests that there is a very weak relation between trading results and macroeconomic conditions, it is assumed that unfavorable trading results coincide with macroeconomic shocks—a scenario that was observed for many Belgian banks during the recent financial crisis.

these restrictions so that the aggregate impact of business strategies and idiosyncratic assumptions can be compared and assessed.

- Institutions are expected to demonstrate a clear link between their risk appetite, their business strategy, and their capital planning relative to the outcome of different macro scenarios.
- Institutions should assess and be able to demonstrate (through credible management action, including undertaking changes in business strategy, reinforcing the capital base and/or putting in place other contingency plans) their ability to remain above regulatory minimum capital requirements through the period stress, consistent with their stated risk appetite.

A. Balance Sheet Growth

20. Firms' balance sheets are assumed to be static but lending grows broadly in line with nominal GDP. The growth rate of lending will also impact the forecast for profit and loss under various satellite models, which should be demonstrated. The assumption of a static balance sheet is consistent with the EBA stress test, which assumed a static balance sheet (except for pre-agreed disposals).[13] Exposures going into default are not replaced in the performing portfolio and generate no interest income in the period they become impaired.

21. Firms affected by stress are assumed to reduce credit growth through deleveraging or other means (Appendix II). Based on empirical evidence and expert judgment it is assumed that credit growth starts declining once a firm's capital adequacy falls below a threshold of 2.5 percentage points above the minimum Tier 1 capital ratio applicable over the forecast horizon (e.g., 4.5 percent in 2013 (Y1) in the transition to Basel III). If a firm falls below the threshold, credit growth declines by twice the capital shortfall in percentage points. For instance, for a Tier 1 capital ratio of half a percentage point below the regulatory minimum (and capital buffer), credit growth declines by one percentage point.

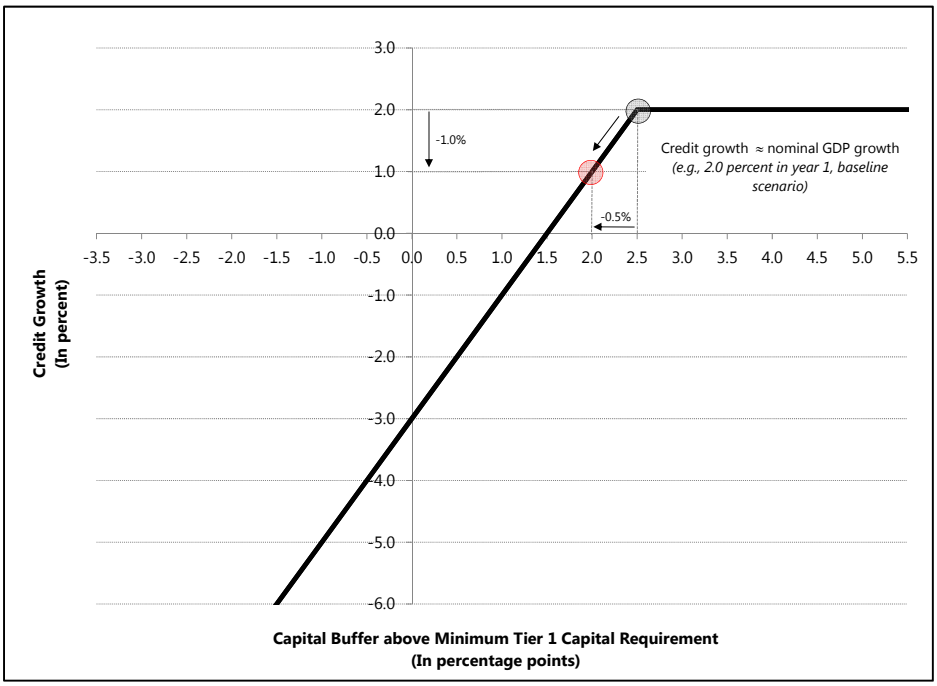
- Each adjustment is made immediately *after* the period during which the potential for deleveraging is assessed, and should shed light on the ability of firms to cope with the capital shortfall, albeit with the simplification of a sequential rather than contemporaneous reaction function.

Since defaulted loans are not replaced they impact the portfolio growth calculation after the period during which they are realized.[14]

[13] Credit growth does not affect the funding structure. As a general rule, all funding needs to be replaced/added in a way that does not materially alter the existing funding structure.

[14] Note, however, that prepaid mortgages are assumed to be refinanced (i.e., they trigger no change for credit volumes and RWAs and only impact interest rate income).

Credit Growth Conditional on Tier 1 Ratio *(Example: Baseline scenario, year 1)*



22. The impact of additional factors influencing asset growth should be minimized. Asset disposals are generally disallowed, and maturing exposures are assumed to be replaced:

- Asset disposals (such as putting assets in run-off or the sale of noncore businesses) and acquisitions over time should not be considered, except where agreed with legally binding commitments under EU State Aid rules, consistent with EBA stress test assumptions.
- Firms are also assumed to replace maturing exposures.
- Any interim capital increase until end-2012 can be considered in calculations.

B. Risk Measurement

23. In order to measure the impact of stress in economic terms, internal capital adequacy models should be used. Since all sample banks have adopted advanced Basel II standards, their economic profile (and attendant capital adequacy) is assessed by calculating IRB capital requirements as a result of an economic capital model. As such, it is important to account for the point-in-time (PIT) level of risk-weighted assets (RWAs), as well as changes in RWAs under stress in economic terms.

24. The test includes, as a minimum, credit risk and market risk. In order to allow for meaningful results, granular data should be used. Ideally, the tests are based on probabilities of default (PDs) and LGDs on a firm and/ or portfolio level. In case this information is not available,

other proxies such as provisions, NPLs and country-level LGDs may be referenced. Besides meaningful data on credit risk, data should include sectoral credit information, information on securities in the trading and banking book, and regulatory data on capital and capital adequacy.

25. Firms are expected to closely follow existing reporting standards, such that:

- PDs and LGDs are assumed to be "through-the-cycle" (TTC), but an appropriate way has to be found to run tests based on "point-in-time" (PIT) risk parameters (such as through the scenario);
- no feedback effect of firms' lending on macro variables is assumed;
- there is no change in the portfolio allocation to reduce RWAs;
- changes to firms' lending standards and credit balance must be in accordance with changes in credit growth experienced during the last business cycle.

C. Dividend Payout Rule/Retained Income

26. The assessment of potential capital shortfall is made conditional on assumptions regarding the payout of dividends, after considering any repayment of public sector support (if applicable):

- Dividend payouts are payable out of the previous year's profit and, thus, cannot result in a drop below any of the minimum capital requirements.
- Well-capitalized firms (i.e., firms that meet the minimum capital requirement and generate positive earnings after taxes) are assumed to pay out dividends only if they report profits.
- Dividends are paid only by firms that satisfy all three measures of capital adequacy (total capital, Tier 1, and common equity Tier 1 (CET1) capital ratios) and exhibit a leverage ratio of no less than three percent in a given year (after having created adequate provisions for impairment of assets and transfer of profits to staff benefits and statutory reserves).

27. The dividend pay-out rule is consistent with the maximum pay-out ratios defined under Basel III but established a floor to minimum payouts depending on the level of Tier 1 capital:[15]

- The dividend payout ratio is defined as the percentage of "dividend payable in a year" to "net profit during the year,"
- The maximum payout is capped at 40 percent of profits, in line with empirical evidence.

[15] Under Basel III, the maximum pay-out rules are defined based on core/common equity Tier 1 capitalization rather than based on total capitalization.

- If the firm meets the minimum total capital ratio of 8.0 percent (after the envisaged dividend payout and, at the same time, exhibits sufficient Tier 1 and CET1 capitalization) but falls below the 10.5 percent threshold, it is considered capital-constrained and follows a schedule of fixed dividend payouts (Appendix X).

D. Additional Elements Impacting Profits and Losses

Funding Risk

28. The treatment of funding costs is explicit (in the form of an additional interest expenses) and avoids the simultaneity problem between contemporaneous losses and higher costs of capital. In each year, the impact of shocks to the firm's balance sheet on the cost of funding ("funding rates") during the *previous* year are estimated (without taking into account the fact that losses themselves during the current year are attributable to higher funding costs).[16] Since the funding structure is fixed due to the constant balance sheet assumption unless there are well-specified funding plans that have been discussed and agreed at board level before Q2 2012.

29. The estimation of the annual increase of funding costs is unaffected by possible balance sheet deleveraging and assumes a constant funding structure:

- Each year, funding costs are estimated—all short-term debt is funded at the new funding rate, but only the long-term debt due in each year is re-priced at the new rate. Based on this information the change in overall funding costs for all liabilities with residual maturity of up to one year can be calculated.

- Against the background of rising competition for stable funding under adverse scenarios, the deposit rate moves in proportion to the change of overall funding costs, weighted by the levels of liabilities with residual maturity of up to one year and all other (longer term) debt.[17]

30. An empirical approach can be used to estimate the annual increase of funding costs over the forecast horizon based on the average historical sensitivity of interest expenses to changes in capitalization. A satellite model could help link short-term funding costs to one-period lagged risk-weighted capital ratios (and/or leverage)—possibly conditional on changes in loan loss provisions, funding gap—to simulate a nonlinear effect with respect to default risk. The marginal change in funding costs should then be added to the estimated (general) interest rate expense.

31. If the firm's existing approach does not meet this precondition, a generic formula is proposed to approximate the macro-financial linkages of short-term funding costs in stress

[16] The macro-scenarios affect any liquidity stress test only insofar as any changes in funding costs will be consistent with assumptions applied to the solvency test.

[17] Assumptions of funding cost in liquidity stress tests should be aligned with the stress parameters affecting the solvency condition of banks on a best effort basis.

situations. This add-on increases interest expenses (in addition to its long-term sensitivity) if the Tier 1 capital ratio of a given bank (after stress) falls below the applicable hurdle rate (including a historical capital buffer of 2.5 percent). This adjustment is shown in the stylized specification of the satellite model for interest expenses (Appendix VI). This approach is also applied in the top-down stress test of the FSAP and results in weighted-average funding cost add-on (for each percentage point below the threshold value) of 5.05 bps. More specifically, the following additional costs (in basis points or bps) are applied each year of the forecast horizon to the following funding sources, with secured (wholesale) borrowing excluded from the calculation:

- renewable retail deposits (all maturities) [3bps],
- renewable interbank deposits (less than one year) [20bps],
- renewable short-term wholesale funding (other wholesale deposits and debt securities) [3bps], and
- renewable long-term wholesale funding [51bps, multiplied by the average share of short-term liabilities in total liabilities, which is about 1/5 for the large Belgian banks).

32. Alternatively, firms can directly apply the results from an aggregate funding risk model based on the generic historical relation between Moody's KMV Expected Default Frequencies (EDFs) and (weighted-average) funding costs of banks—also taking into account variations of relative importance of different funding sources for specific countries. In this general specification of the funding cost elasticity, the implicit sensitivity of the economic capital ratio to the observed (average) funding costs determines an "add-on" to be applied to estimates of expected interest expenses (Appendix VI). The risk-based capital ratios for a series of rating grades are inferred from the Basel II capital model, by using the confidence level corresponding to the EDFs of banks. The method is heavily based on empirical data and determines changes in the cost of debt for the average banking sector. In the case of Belgium, the model specification would define the additional interest rate expenses as indicated in Appendix VI.

Valuation Changes to Fixed Income Holdings

33. The stress test must include a comprehensive assessment of sovereign risk, which covers the impact of adverse price movements on exposures in *both* the trading and banking books in order to cover all material market risk affecting exposures in economic terms, irrespective of their accounting treatment. The mark-to-market test of fixed income securities focuses on the projection of valuation haircuts for holdings of sovereign debt. Firms are asked to adopt IMF estimates of a valuation haircut based on an assumed increase of sovereign distress consistent with market expectations and then estimate the effects on income and expenses.

34. The calculation of valuation haircuts under different adverse macro scenarios is based on the valuation of government bonds using forward-looking information from credit default swap (CDS) markets (Jobst and others, *forthcoming*). Sovereign bond prices for each year under

each scenario are calculated within a model-based specification contingent on market expectations of default risk as reflected in the past dynamics of CDS spreads. More specifically, for all (liquid) bonds of sample country, the future prices over a forecast horizon are calculated by using the end-year risk-free rate and applying a density forecast of expected default risk based on the historical variation of forward rates on sovereign CDS contracts at different maturities. These price changes result in valuation haircuts, whose underlying severity assumptions are contingent on the chosen scenario—current market expectations (baseline scenario) and a high-percentile density forecast of the historical variation of forward contracts on sovereign CDS (adverse scenario) (Appendix VIII).

35. For the purposes of the FSAP, valuation haircuts under the baseline and adverse scenarios are applied at a selected confidence level of the density forecast (50th and 75th percentile) of idiosyncratic credit risk (including a general interest rate shock of 50 basis points) over the forecast horizon of five years (2013 to 2017). The most liquid government bonds at maturities of five years have been considered for this estimation. The estimation results are shown in Appendix VII (for end-December 2011 values, with a common interest rate shock). For instance, in the case of Belgian government bonds, the appropriate haircuts for the first two years are as follows:

- *baseline scenario:*-2.44% (2013) and –2.64%+2.44%=-0.20% (2014). Other years imply no further haircuts (due to favorable sovereign risk dynamics implied by forward CDS prices), and
- *adverse scenario(s):*-4.98% (2013) and –5.18%-4.98%=-0.20% (2014).

36. These haircuts should be applied to all relevant (direct and indirect) sovereign debt exposures in the investment book (HtM) as well as available for sale (AfS), FVO, and trading accounts, covering all significant countries (i.e., Belgium, Czech Republic, France, Germany, Hungary, Ireland, Italy, the Netherlands, Poland, Portugal, Slovakia, Spain, the U.K., and the United States). It is assumed that sovereign risk evolves over time and consequently haircuts will be applied to all years of the forecast horizon.[18]

- *The exposures to be stressed should include all direct and indirect sovereign exposures.* The net direct exposure comprises gross (long) exposures net of cash (short) positions of sovereign debt (without derivative hedges such as CDS). The indirect sovereign exposures include both on- and off-balance sheet exposures. The impact on the gross exposures needs to be documented. Cash at central banks as well as repos or asset swaps where there is no economic interest in the security—for instance, instruments held against assets pledged to the NBB/ECB—are excluded.
- *Direct derivatives positions should be subject to fair value adjustments based on the relevant shock* (e.g. for an interest rate derivative, use the shock on interest rates) and the relevant credit value adjustment CVA adjustments. Indirect exposures (those with counterparties other than the

[18] If the size-weighted maturity profile of debt holdings is significantly different from an assumed five-year maturity term, the valuation haircuts may be adjusted to match the actual key rate durations upon approval by the NBB.

sovereign itself, i.e., CDS) should be treated in a similar way, subject to fair value adjustments of the relevant shock and the CVA adjustment.

- *Haircuts to AfS portfolios would be applied to adjusted (marked-to-market) balance sheet values.* For exposures in the investment book, the *additional* market value adjustment to historical cost until end-Q2 2012 should be added to the overall losses attributable to changes in sovereign risk

Valuation Changes to Foreign Exchange (FX) Positions

37. Firms are asked to report the aggregate impact of FX shocks on net open positions and FX assets in terms of an appreciation of the U.S. dollar, Pound sterling, the Japanese yen (and other material currencies for the firm) vis-à-vis the Euro:

- The shock for each currency should be based on four (two) standard deviations of the FX volatility during 2011 with respect to the DD (SG) scenario.

- The impact of such unexpected revaluation of FX assets should be considered for the determination of market risk RWAs only and do not generate any knock-on effects on other elements of the stress test. The aggregate shock should increase associated RWAs in 2011 (100 percent) and 2012 (50 percent) only.

CAPITAL ASSESSMENT

E. Hurdle Rates

38. Solvency is assessed in accordance with changes in regulations published by the Basel Committee on Banking Supervision (BCBS) in September and December 2010 ("Basel III") and compared against the EBA's hurdle rate for the capital assessment of the largest European banks in 2011. Thus, the hurdle rates applied in the FSAP stress tests follow the graduated schedule of Basel III (Appendix IX). The changes under Basel III include:

- higher in minimum capital requirement ratios, i.e., Tier 1 and common equity Tier 1 (CET1);

- a more restrictive definition of eligible capital ("capital deductions");

- higher asset risk-weightings; and

- the introduction of a maximum leverage ratio.[19]

39. Under the Basel III transition schedule, firms will need to meet the following new minimum capital requirements in relation to RWAs as of January 1, 2013: 3.5 percent common

[19] See http://www.bis.org/press/p100912.htm.

equity/RWAs (up from 2.0 percent) and 4.5 percent Tier 1 capital/RWAs (up from 3.0 percent), in addition to the existing capital adequacy ratio (CAR) of 8.0 percent total capital/RWAs. These capital requirements are supplemented by a minimum Tier 1 leverage ratio of 3.0 percent.[20] The regulatory adjustments (i.e., deductions and prudential filters), including amounts above the aggregate 15 percent limit for investments in financial institutions, mortgage servicing rights, and deferred tax assets from timing differences, are scheduled to begin on January 1, 2014.[21]

40. The definition of capital at end-Q2 2012 should be consistent with the guidelines for the graduated implementation of Basel III, subject to phase-in, phase-out and grandfathering considerations affecting available capital each period over the forecast horizon (Appendix IX):

- The starting point for CET1 and Tier 1 should be the official definitions as laid out by the NBB.
- For the *phase-in of total regulatory adjustments to CET1 capital*, 20 percent (per annum) of CET1 capital (such as goodwill, deferred tax assets and minority interests that exceed the permissible limit) is deducted between 2014 and 2017; firms must document deductions if amount is less than 29.0/20.4 percent [4 largest banks/other banks] * 80/100 = 23.2/16.3 percent (29.0/20.4 percent is the average value for large banks (Group 1)/small banks (Group 2) according to the results from the Basel III monitoring exercise as of 31 December 2011).
- For the *phase-out of non-CET1 and Tier 2 capital elements*, it is the higher of either 10 percent (per annum) of the amount of capital to be phased-out based on the QIS-6 for Group 1 (large banks) at 26.8 percent or the amount of capital maturing each year subject to phase-out between 2013 and 2017.
- Existing capital instruments are not grandfathered until they mature for the tier in which they currently belong.[22]

F. Riskiness of Assets

41. Higher risk-weighted assets (RWAs) due to regulatory changes and deteriorating credit quality under the different macro scenarios should be taken into account with some form of expert judgment:

- Risk-weights for market and operational risk remain constant throughout the forecast period.

[20] The changes in minimum capital requirements also have to be taken into account for counterparty risk and market risk considerations.

[21] In particular, the regulatory adjustments will begin at 20 percent of the required deductions from common equity on January 1, 2014 and 40 percent on January 1, 2015. During this transition period, the remainder not deducted from common equity will continue to be subject to existing national treatments.

[22] Firms should exclude the Tier 1 share of a material holdings deduction for securitization at the consolidated level.

- RWAs for credit risk are subject to the Basel I floor and sensitive to the regulatory impact due to Basel III and should increase by at least 17.25 percent [4 largest banks] and 3.1 percent [other banks] (independent of asset growth) between 2013 and 2015, respectively (consistent with based on the QIS-6 results for large banks); there is no regulatory impact on RWAs for market risk as Belgium has adopted Basel 2.5 on 31 December 2011; the minimum increase of RWAs applies to performing loans only (Appendix IX).[23]

- Moreover, credit RWAs are sensitive to both changes in PDs and portfolio correlations. The following additional increase of risk weights should be considered (in addition to the increase owed to regulatory changes):

  — The *nonlinear effect of changes in PDs on RWAs* is determined by fixing the asset correlations to the lowest level of the PDs (a level corresponding to a "Aaa"-rating) and the LGD to 45 percent (Note: the impact of LGDs on RWAs is linear and thus straightforward to be captured). Thus, the marginal increase of RWAs (for an increase of PDs by 1 percent) can be calculated as: delta_RWA=0.12*delta_PD^2-0.049*delta_PD+0.006;

  — The *impact of concentration risk on RWAs* is calculated as the percentage increase of RWAs based on delta_RWA=0.02+12.6*HHI Parameter (HHI=Herfindahl-Hirschman concentration measure), with an increase of delta_RWA at 1+(PD of bank portfolio/0.4%-1)*0.1 for PDs>0.4 percent;

  — The *impact of defaults on RWAs* is taken into account by reducing total credit risk RWAs by the RWAs of defaulted exposures, which should be approximated by taking 2.5 times the average RWAs for nondefaulted exposures (accounting for the fact that risk-weights for defaulted exposures were higher prior to default);

- Alternatively, firms may choose to estimate their own risk weights using available internal models (as of end-2011) or select minimum increases in risk weights only for certain sub-categories, such as securitization in the trading and/or banking book (Appendix X). Lower values for the changes in risk weights for credit and market risk need to be documented and approved by the NBB in the review process. Where the calculation of Basel III risk weights for some exposure types (e.g., counterparty credit risk) are difficult to estimate, risk weights are double those of the Basel II weights.

[23] For firms reporting under the standardized approach (SA), the general increase of RWAs due to regulatory changes does not apply but would need to be calculated based on the actual portfolio.

OUTPUT

42. Firms assess capital adequacy under stress on consolidated basis by reporting all capital measures for each year over the forecast horizon using the output template presented in Appendix X:

- These metrics comprise (i) total capital, (ii) Tier 1 capital, and (iii) CET1 capital (Appendix X).
- Firms should also disclose the composition of capital in each period; in case of a capital shortfall, firms should show the calculated recapitalization needs.
- Results are collected by the NBB and reported for each year of the forecast time horizon.
- The IMF will only publish results related to the stress test after consulting with the NBB and subject to the existing confidentiality agreement between the NBB and firms as well as IMF statutes that govern data confidentiality with national authorities. The focus will be on the identification of system-wide vulnerabilities and the evolution of overall capital adequacy over the forecast horizon, while information about the impact of changes in hurdle rates and the modification of capital treatment under Basel III, as well as the risk drivers, will be used to support the interpretation of results only.

43. Firms should report the major risk drivers (profitability, credit/trading losses, risk-weights). They should show the marginal impact of including haircuts on sovereign debt holdings. In addition, firms may report alternative stress test results without considering the restrictions on the behavioral adjustment of banks as separate output.

44. Firms should document their estimation of important stress testing elements, such as funding costs, supervisory standards (risk-weightings), and macro-financial linkages ("satellite models" and/or expert judgment), and demonstrate their compliance with the IMF-provided minimum standards:

- Results should show RWAs for credit, market and operational risk, and the specifications of macro-financial linkages ("satellite models" and/or expert judgment) affecting the forecast of profitability and credit losses.
- NBB staff will engage, on an ongoing basis, with the stress testing efforts of firms to help ensure consistency of underpinning assumptions and suitability of models prior to the submission of the stress test results. Moreover, line supervisors at the NBB will conduct an assessment of preliminary results prior to final submission.
- The results will also be checked by NBB staff against historical experience, other stress testing work by the firms, as well as general plausibility by using results from a top-down version of the stress test exercise by IMF staff (jointly with NBB staff), using satellite models estimated based on aggregate data.

45. The proposed timeline for the completion of the BU stress tests is presented in Appendix I.

References

Anderson, Nicola, Breedon, Francis, Deacon, Mark, Derry, Andrew, and Gareth Murphy, 1996. *Estimating and Interpreting the Yield Curve* (Chichester: John Wiley Series in Financial Economics and Quantitative Analysis), pp. 36–41.

Basel Committee for Banking Supervision (BCBS), 2010, "Results of the Comprehensive Quantitative Impact Study," BCBS Publication No. 186, December (Basel: Bank for International Settlements).

Bliss, Robert R., 1997, "Testing Term Structure Estimation Methods," *Advances in Futures and Options Research*, Vol. 9, pp. 197–231.

Committee of European Banking Supervisors (CEBS), 2010, "2010 EU Wide Stress Testing," July (London: Committee of European Banking Supervisors), available at http://www.eba.europa.eu/EuWideStressTesting.aspx.

Coles, Stuart G., Heffernan, Janet, and Jonathan A. Tawn, 1999, "Dependence Measures for Extreme Value Analyses," *Extremes*, Vol. 2, pp. 339–65.

European Banking Authority (EBA), 2011a, "2011 EU-Wide Stress Testing Exercise," available at http://stress-test.eba.europa.eu/.

_____, 2011b, "Overview of the 2011 EU-Wide Stress Test: Methodological Note," available at http://www.eba.europa.eu/News--Communications/Year/2011/The-EBA-publishes-details-of-its-stress-test-scena.aspx.

_____, 2011c, "2011 EU-Wide Stress Test: Methodological Note —Version 1.1," March 18, available at http://www.eba.europa.eu/cebs/media/Publications/Other%20Publications/2011%20EU-wide%20stress%20test/EBA-ST-2011-004-(Detailed-Methodological-Note)_1.pdf.

European Central Bank (ECB), 2011, "Appendix 4—Guidance for Calculations of Losses Due to Application of Market Risk parameters and Sovereign Haircuts," in: European Banking Authority (EBA), 2011, "2011 EU-Wide Stress Test: Methodological Note —Version 1.1," March 18.

International Monetary Fund (IMF), 2011a, "United Kingdom: Stress Testing the Banking Sector Technical Note," Country Report No. 11/222, July 1 (Washington, D.C.: International Monetary Fund), available at http://www.imf.org/external/pubs/ft/scr/2011/cr11227.pdf.

_____, 2011b, "Germany: Technical Note on Stress Testing," Country Report No. 11/371, December 23 (Washington, D.C.: International Monetary Fund), available at http://www.imf.org/external/pubs/ft/scr/2011/cr11371.pdf.

_____, 2012, "Spain: Financial System Stability Assessment," IMF Country Report 12/137, May 30 (International Monetary Fund: Washington, D.C.), available at http://www.imf.org/external/pubs/ft/scr/2012/cr12137.pdf.

Jeanfils, Phlippe, and Koen Burggraeve, 2005, "Noname – A New Quarterly Model for Belgium," Research Series Working Paper No. 68, May (Brussels: National Bank of Belgium), available at http://www.nbb.be/doc/ts/publications/wp/wp68En.pdf.

Jobst, Andreas A., 2007, "Operational Risk – The Sting is Still in the Tail But the Poison Depends on the Dose," Journal of Operational Risk, Vol. 2, No. 2 (Summer), pp. 1-56. Also published as IMF Working Paper No. 07/239 (October).

_____, Hardy, Daniel, and Christian Schmieder, *forthcoming*, "Sovereign Haircuts," IMF Working Paper (Washington, D.C.: International Monetary Fund).

_____, Ong, Li Lian, and Christian Schmieder, 2013, "An IMF Framework for Macroprudential Bank Solvency Stress Testing: Application to S-25 and Other G-20 Country FSAPs," IMF Working Paper No. 13/68 (Washington, D.C.: International Monetary Fund), available at http://www.imf.org/external/pubs/ft/wp/2013/wp1368.pdf.

Moody's Investor Service, 2009, "Corporate Default and Recovery Rates, 1920-2008," February, available at http://www.moodys.com/moodys/cust/content/loadcontent.aspx?source=staticcontent/Free%20Pages/Credit%20Policy%20Research/CreditPolicyCurrentRsrch.htm.

Nelson, Charles R. and Andrew F. Siegel, 1987, "Parsimonious Modeling of Yield Curves," Journal of Business, Vol. 60, No. 4, pp. 473–89.

Poon, Ser-Huan, Rockinger, Michael, and Jonathan Tawn, 2003, "Extreme Value Dependence in Financial Markets: Diagnostics, Models, and Financial Implications," *Review of Financial Studies*, Vol. 17, No. 2, pp. 581–610.

Svensson, Lars E. O., 1994, "Estimating and Interpreting Forward Interest Rates; Sweden 1992-1994," IMF Working Paper WP 94/114 (Washington, D.C.: International Monetary Fund).

Appendix I. Proposed Timeline for Completion of Solvency BU Stress Test

October 9, 2012	Firms receive stress testing guidelines from NBB
November 12-16, 2012	Technical follow-up during first IMF FSAP mission
January 7-11, 2013	Firms report finals results and NBB prepares output for IMF FSAP team
January 14, 2013	NBB communicates results to IMF FSAP team
January 15-29, 2013	Discussion of results by NBB staff and IMF FSAP team

Appendix II. Key BU Solvency Stress Test Parameters

Domain	Element	Specific Rules/Assumptions
Scenarios	(i) Baseline (ii) "Double-Dip" (2 std. devs. from baseline) (iii) "Slow Growth"	• Macroeconomic scenarios over five years (forecast horizon). • Macroeconomic/financial variables (GDP (nominal and real), unemployment, inflation, interest rates/asset swap rates (short-term and long-term), and credit growth) conditional on specific scenario. Models were run by the NBB staff for all variables with the exception of credit growth. • Cross-border effects are considered in all macro scenarios. IMF staff provided estimates for real GDP growth, inflation, and short-term interest rates consistent with the macroeconomic forecast for Belgium under both baseline and adverse scenarios for all relevant countries (Czech Republic, France, Germany, Hungary, Ireland, the Netherlands, Switzerland, and Turkey) affecting bank performance abroad. • Aim to ensure consistency with other European FSAPs (and with European/CEBS/EBA stress tests).
Risk factors assessed	Loss rates Market risk Profitability FX shock Taxes	• ***Credit losses*** based on satellite models depending on the selected scenario; estimates should be specific to each material loan category and include an increase of LGDs under stress according to the following specification: LGD(under stress)=0.3502+2.3408*PD (Moody's, 2009) or LGD(under stress)=0.4022+2.1535*PD (if the down-cycle LGDs are based on a long-term average, i.e., "through the cycle"). • ***Market risk***: (a) FX shock to EUR (vis-à-vis most important currencies) and (b) haircuts on holdings of both sovereign and financial sector debt securities in both trading and investment books based on market expectations over five years after controlling for changes of market valuation using density forecasts of forward contracts on sovereign CDS spread over an estimation using the methodology developed by IMF staff. • ***Profit*** (interest income, interest expenses, net fee and commission income, and

Domain	Element	Specific Rules/Assumptions
		operating expenses) should be based on NBB/firm's satellite models (or expert judgment). For mid-2012, net profit before tax should be adjusted for extraordinary income/losses in order to avoid misleading results. "Other income" changes with nominal GDP. • ***Trading income*** based on satellite model or statistical matching of both trading income and GDP growth using a parametric fit of their historical distribution (i.e., a decline in GDP growth is assumed to result in lower trading income). • ***Funding costs*** based on satellite model for interest expenses, including a nonlinear effect. Changes in funding costs are unaffected by possible balance sheet deleveraging. • ***Sovereign risk:*** Haircut on direct and indirect sovereign debt holdings in the banking and trading books based on market expectations over five years after controlling for changes of market valuation during 2009-11 as developed by IMF staff. Cash at central banks as well as repos or asset swaps where there is no economic interest in the security (for instance, instruments held against assets pledged to the ECB) are excluded. • ***FX shock:*** Firms are asked to report the aggregate impact of the following FX shock of the following currencies on FX net open positions and FX assets: U.S. dollar, Pound sterling, Japanese yen (and other material currencies for the firm). The shock for each currency should be four times (twice) the standard deviation of the respective FX volatility during 2011 for the "double dip" ("slow growth") scenario and impact the trading book in 2013 (100 percent) and 2014 (50 percent) only. • ***Tax assumption:*** 30 percent in case of net operating profits, zero otherwise. Tax credit after the first year of the stress period is taken into account.
Behavioral adjustment of banks	Dividend pay-out rules (similar to Basel III minima) Credit growth	• ***Balance sheets*** are assumed to be static, but constant credit growth (i.e., lending increases in line with nominal GDP (if positive)), subject to a "deleveraging rule"; defaulted loans are not replenished.

Domain	Element	Specific Rules/Assumptions
	Asset disposal Capital raising	• ***Dividend payout*** depends on capitalization under stress: dividend pay-out only if firm reports profits over the past year; if total capital ratio is above 8.0 percent (after the envisaged dividend payout and, at the same time, exhibits sufficient Tier 1 and CET1 capitalization) but below 10.5 percent (which reflects the magnitude of the CAR and "capital conservation buffer" under Basel III), the firm is considered capital-constrained and needs to follow a payout schedule as displayed in Appendix IX; however, firms that are not capital constrained will have to pay out at least 40 percent of earnings after tax each year. • ***Credit growth*** in line with nominal GDP for banks with a Tier 1 capital buffer of 2.5 percentage points above the regulatory minimum (for Tier 1); credit growth decreases by 2 percentage points for each decrease in Tier 1 capital by 1 percentage point once the buffer is less than 2.5 percentage points. Hence, growth becomes negative when capitalization is at minimum capital ratio. • ***Other business strategy considerations:*** asset disposals or acquisitions over time should not be considered, except where legally binding commitments under EU state aid rules exist. Maturing exposures are assumed to be replaced. Any interim capital-raising until mid-2012 can be considered in calculations.
Regulatory standards	Capital requirements ('hurdle rates'), Changes in risk-weighted assets (RWAs) Capital phase-out/-in	• ***Hurdle rates*** for CET1, Tier 1 capital (T1), and total capital (CAR) according to the Basel III schedule (i.e., increasing from 2013 onwards). • ***Changes in risk-weighted assets (RWAs):*** RWAs for market and operational risk remain constant throughout the forecast period; RWAs for credit risk are subject to the Basel I floor and sensitive to the regulatory impact due to Basel III (according to QIS-6 results), which should increase by at least 17.25 percent [4 largest banks] and 3.1 percent [other banks] (independent of asset growth) between 2013 and 2015, respectively; there is no regulatory impact on RWAs for market risk as Belgium has adopted Basel 2.5 on 31 December 2011; in addition, credit RWAs are sensitive both changes in PDs and portfolio

Domain	Element	Specific Rules/Assumptions
		correlations: (a) calculate the nonlinear effect of changes in PDs on RWAs (impact of LGDs on RWAs is linear and thus straightforward to be extracted from the Basel II IRB formula and fixing the asset correlations to the lowest level of the PDs (a level corresponding to a "Aaa"-rating) and the LGD to 45 percent. Thus, the marginal increase of RWAs (in percent) for an increase of PDs (in percent) can be calculated as: delta_RWA=0.12*delta_PD^2-0.049*delta_PD+0.006; (b) control for concentration risk impact on RWAs: delta_RWA=0.02+12.6*HHI Parameter (HHI=Herfindahl-Hirschman concentration measure), with an increase of delta_RWA by 1+(PD of bank portfolio/0.4%-1)*0.1 for PDs>0.4%. Firms may apply lower values for the initial increase of RWAs for credit risk if documented. Where the calculation of Basel III risk weights for some exposure types (e.g., counterparty credit risk) are difficult to estimate, risk weights are double those of the Basel II weights. • ***RWA impact of defaulted loans:*** The risk-weights for credit risk are subsequently reduced by the RWAs of defaulted exposures, which should be approximated by taking 2.5 times the average RWAs for nondefaulted exposures (accounting for the fact that risk-weights for defaulted exposures were higher prior to default). • **Capital definition** according to the Basel III framework. During the forecast horizon it has to comply with the envisaged phase-in of capital deductions and the phase-out of noneligible forms of capital, without consideration of grandfathering. ➢ ***Phase-in of total regulatory adjustments to common CET1 capital:*** 20 percent (per annum) of CET1 capital (e.g., goodwill, deferred tax assets and minority interests that exceed the permissible limit) deducted between 2014 and 2017; firms must document deductions if the amount is less than 29.0/20.4 percent [four largest banks/other banks]*4*20/100 ≈ 23.2/16.3 percent (29.0/20.4 percent is the average value for large banks (Group 1)/small banks (Group 2) according to the results from results from the Basel III monitoring exercise as of 31 December 2011).

Domain	Element	Specific Rules/Assumptions
		➢ ***Phase-out of non-CET1 and Tier 2 capital elements:*** the higher of either 10 percent (per annum) of the amount of capital to be phased-out based on QIS-6 results for Group 1 (large banks) at 26.8 percent or the amount of capital maturing each year between 2013 and 2017.
Outcome	Reporting of results and additional outputs	• ***Output template:*** Firms report capital adequacy under stress based on the common capital measures (total capital, Tier 1 capital and CET1) for each year over the forecast horizon using the suggested output template. In case of a capital shortfall, recapitalization needs are calculated. Firms should report the major risk drivers (profitability, credit/trading losses, risk-weights) and show the marginal impact of including (i) haircuts on sovereign debt holdings; (ii) capital phase-in/phase-out according to Basel III; and (iii) FX shocks. In addition, firms may report alternative stress test results without considering the restrictions on the behavioral adjustment of banks as separate output.

Appendix III. Overview of Stress Test Scenarios (in percent)

	Baseline Scenario					Double-Dip Scenario					Slow Growth Scenario				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Real GDP	0.3	1.0	1.3	1.4	1.4	-1.6	-0.4	0.6	1.0	1.1	-0.6	0.1	0.4	0.5	0.5
Private consumption	0.2	0.8	1.0	1.1	0.9	-0.1	0.2	0.7	1.0	0.9	0.1	0.5	0.7	0.9	0.7
Gross fixed capital formation	-0.1	1.8	3.2	3.5	3.5	-1.8	-0.7	1.7	2.6	3.1	-0.9	0.4	1.8	2.0	2.2
Exports (goods and services)	0.5	1.5	3.1	3.8	4.5	-3.6	-1.0	1.9	2.9	3.9	-2.4	0.0	2.4	2.4	2.8
Imports (goods and services)	0.4	1.5	3.4	4.1	4.7	-1.9	-0.3	2.4	3.3	4.2	-1.3	0.3	2.8	3.1	3.4
Inventories	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Household saving ratio (in percent of disposable income)	16.2	16.5	16.7	17.1	17.6	15.2	15.9	16.3	16.7	17.1	15.8	16.0	16.2	16.5	17.0
Labor Market															
Unemployment rate (in percent of labor force)	7.8	7.6	7.5	7.3	7.4	8.0	8.6	9.3	9.7	10.3	7.9	8.1	8.5	8.9	9.6
Total employment	0.3	0.8	0.8	0.9	0.9	0.1	-0.1	-0.1	0.2	0.3	0.2	0.3	0.2	0.2	0.2
Price and cost developments															
Consumption prices	1.9	1.4	1.2	1.2	1.2	3.8	2.6	2.0	1.7	1.4	2.6	2.4	2.3	2.2	2.0
House prices	0.0	0.5	1.6	2.2	2.5	-2.0	-0.7	0.8	1.2	1.5	-0.7	-0.3	0.9	1.5	1.7
Commercial real estate prices	0.0	0.5	1.6	2.2	2.5	-2.0	-0.7	0.8	1.2	1.5	-0.7	-0.3	0.9	1.5	1.7
Equity market index	2.0	2.5	2.6	2.7	2.7	-20.9	1.2	0.1	1.0	1.4	-7.7	-1.8	-1.5	-1.8	-0.5
GDP deflator	1.7	1.5	1.3	1.3	1.3	2.3	2.7	2.0	1.8	1.5	1.9	2.1	2.2	2.1	2.0
ULC, whole economy	2.0	2.1	1.9	1.7	1.8	4.3	4.1	2.8	1.8	1.9	3.0	3.4	3.3	2.1	2.1
Terms of trade	0.0	0.2	0.2	0.2	0.2	-1.3	0.3	0.0	0.1	0.2	-0.5	-0.1	0.0	-0.1	0.0
Interest rates (in percent)															
Short-term interest rate (EONIA)	0.4	0.4	0.4	0.4	0.4	1.0	1.0	0.9	0.9	0.8	0.4	0.4	0.4	0.3	0.3
Short-term interest rate (3-month T-bill)	0.9	0.9	0.9	0.9	0.9	1.3	1.5	1.7	1.9	1.9	0.9	0.9	0.9	0.6	0.6
10-year sovereign bond yield	3.1	3.4	3.6	3.8	3.8	3.3	3.6	3.8	3.9	3.9	3.0	3.3	3.5	3.8	3.8

Appendix IV. Interpolated Interest Rate Term Structure and Swap Rate Curve Consistent with Estimated Sovereign Risk

	Baseline Scenario						Severe Double-Dip (DD) Scenario						Slow Growth (SG) Scenario					
	2012	2013	2014	2015	2016	2017	2012	2013	2014	2015	2016	2017	2012	2013	2014	2015	2016	2017
Market/Swap Rates																		
EONIA (overnight)	0.38	0.40	0.40	0.40	0.40	0.40	0.38	1.00	1.00	0.90	0.90	0.80	0.38	0.40	0.40	0.40	0.30	0.30
Euribor (3 months)	0.65	0.52	0.54	0.55	0.56	0.56	0.65	1.08	1.10	1.03	1.04	0.95	0.65	0.51	0.53	0.55	0.49	0.49
Swap (2 years)	0.86	0.57	0.59	0.60	0.62	0.62	0.86	1.10	1.13	1.07	1.09	1.01	0.86	0.55	0.57	0.60	0.56	0.56
Swap (5 years)	1.33	0.90	0.96	1.01	1.05	1.05	1.33	1.31	1.39	1.41	1.48	1.42	1.33	0.84	0.91	1.01	1.07	1.08
Swap (10 years)	2.01	2.01	2.20	2.33	2.46	2.46	2.01	1.98	2.25	2.54	2.75	2.79	2.01	1.80	2.03	2.35	2.75	2.79
Government Debt (Linear Bonds, OLO)																		
3 months	0.17	0.90	0.90	0.90	0.90	0.90	0.17	1.30	1.50	1.70	1.90	1.90	0.17	0.90	0.90	0.90	0.60	0.60
1 year	0.45	1.07	1.09	1.11	1.12	1.12	1.66	1.86	2.05	2.05	1.45	1.66	0.45	1.06	1.09	1.10	0.85	0.85
2 years	0.80	1.13	1.16	1.18	1.20	1.20	1.72	1.92	2.11	2.11	1.51	1.72	0.80	1.12	1.15	1.17	0.93	0.93
5 years	2.07	1.59	1.68	1.75	1.81	1.81	2.16	2.36	2.53	2.53	1.93	2.16	2.07	1.56	1.65	1.72	1.60	1.60
10 years	3.14	3.10	3.40	3.60	3.80	3.80	3.14	3.30	3.60	3.80	3.90	3.90	3.14	3.00	3.30	3.50	3.80	3.80

Appendix V. Possible Satellite Model Specification

Dependent Variable	**Lagged Term**	**Total customer loans** to total assets in %	**10-year sov. yield**	**3-month interest rate** (effective)	**Real GDP growth (y-o-y)**	**Total assets** (logarithm of total assets, lagged)	**Leverage ratio** (equity to total assets) in %, lagged	**Nonperforming loans to customer loans** in %, lagged	**Funding gap** (difference between customer loans and deposits in % of total assets, lagged)	**Other macro variables:** headline inflation, unemployment, and asset prices (real estate/equity markets)	Constant	R^2
Change (Δ) in interest Income to total assets in %	**x**	**-**	**x**	**x**	**x**	**x**	**-**	**x**	**-**	**x**	**x**	
Δinterest expenses to total assets in %	**x**	**x**	**x**	**x**	**x**	**x**	**X**	**-**	**x**	**x**	**x**	
	+ funding cost add-on per one percentage point of capital (in percent)*([x]-Tier 1 capital ratio (after stress) in percent)*defined liabilities$_t$ (excl. secured funding)), where [x] represents the hurdle rate (e.g., 6%) for Tier 1 in each forecast period + 2.5pcp capital buffer) 1/											
Δnet fee and commission income to total assets in %	**x**	**-**	**-**	**-**	**x**	**x**	**X**	**-**	**-**	**x**	**x**	
Δoperating expenses to total assets in %	**x**	**-**	**-**	**-**	**x**	**x**	**-**	**-**	**-**	**x**	**x**	
Δloan loss provisions (LLP) (ln of write downs in lending business in % of customer loans)	**x**	**x**	**x**	**x**	**x**	**x**	**-**	**-**	**-**	**x**	**x**	

Note: 1/ This term represents an adjustment of interest expenses by additional funding costs (in basis points) at a level of capitalization consistent with the applicable hurdle rate Tier 1 capital in the stress test and the economic capital ratio approximation in Figure A9.1 (Appendix IX).

Appendix VI. Minimum Funding Cost: Empirical Estimation of Nonlinear Change

Rating scale (S&P, Fitch)	**EDF or PD** (one-year, in percent)	**Funding costs** (spread above T-bills, bps)	**Economic capital ratio** (Basel II (quasi-IRB))	**Change of funding spread** (CAR elasticity)
AAA	0.00004	8.7	28.1	n.a.
AA+	0.00006	8.7	27.3	0.0000
AA	0.0001	8.7	26.2	0.0000
AA-	0.001	8.9	21.2	0.0002
A+	0.002	9.0	19.7	0.0008
A	0.026	11.9	14.3	0.0055
A-	0.032	12.7	13.9	0.0180
BBB+	0.1	21.0	11.7	0.0386
BBB	0.139	25.9	11.1	0.0806
BBB-	0.291	44.6	9.9	0.1464
BB+	0.682	92.7	8.5	0.3541
BB	0.728	98.4	8.4	0.5738
BB-	1.791	229.4	7.1	1.0269
B+	2.45	310.5	6.7	2.0109
B	3.827	480.2	6.2	3.1611

Note: Funding cost exclude the cost of equity. The economic capital ratio includes a capital buffer above the hurdle rate of 2.5 percentage points.

Appendix VII. Sovereign Haircuts for Selected Countries

Sovereign Debt Valuation Haircuts (relative to end-Dec., 2011), *In percent*
(country-specific shock with constant common shock (50bps) to interest rate level)

	Baseline Scenario					Adverse Scenarios				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Belgium	**2.44**	**2.64**	**2.27**	**1.97**	**1.84**	**4.98**	**5.18**	**4.82**	**4.52**	**4.40**
Euro area										
"*Peripheral*" *countrie* s 1/										
Italy	5.99	5.73	4.83	4.34	4.01	8.20	7.94	7.06	6.58	6.26
Ireland	7.49	4.56	3.30	3.90	4.32	9.48	8.75	5.62	4.73	6.37
Portugal 2/	10.76	15.40	18.27	28.28	29.93	13.28	19.28	22.97	35.80	37.90
Spain	6.00	5.43	4.59	3.84	3.69	8.39	7.82	7.01	6.28	6.13
Other countries										
France	2.60	3.41	3.06	2.55	2.48	5.18	5.97	5.63	5.13	5.06
Germany	1.61	2.32	2.31	2.25	2.11	3.92	4.62	4.61	4.55	4.42
Slovakia	2.59	3.50	3.75	3.94	3.89	5.10	5.99	6.23	6.42	6.37
The Netherlands	1.59	2.10	2.01	1.90	1.76	3.82	4.31	4.23	4.12	3.98
Non-euro area countries										
Czech Republic	2.38	3.06	3.09	3.29	3.33	4.75	5.41	5.44	5.63	5.68
Hungary	6.37	6.99	7.11	7.19	7.28	8.77	9.37	9.50	9.58	9.66
Poland	3.47	4.38	4.26	4.13	4.05	5.71	6.60	6.48	6.35	6.28
United Kingdom	2.28	3.23	3.18	3.22	3.25	4.67	5.60	5.55	5.59	5.62
United States	1.03	1.53	1.85	2.02	2.24	3.48	3.97	4.28	4.44	4.66

Source: Bloomberg and Jobst et al. (forthcoming). Pricing information for the assessment of changes in sovereign risk were obtained from forward contracts (with maturity terms between one and five years) on five-year credit default swaps (CDS) at end-August 2012 and applied to bond prices as of end-December 2011 in order to obtain projected changes in future bond prices (and their implications for valuation haircuts). The valuation haircuts for the baseline and the adverse scenarios were generated from the historically derived density forecast at the 50th and 75th percentiles, respectively.

1/ The "peripheral countries" comprises four of the five most fiscally challenged countries within the euro area; valuation haircuts to Greece have not been estimated due to inconsistent market data coverage, and full realization of losses (i.e., valuation haircut of 100%) should be applied;

2/ The valuation haircuts for Portugal are very high relative to other countries in this group due to the timing of the cut-off date (end-December 2011) and should not be interpreted as the result of an expected escalation of default risk over the medium term.

Appendix VIII. Estimation Methodology for Sovereign Risk Valuation Haircuts

The calculation of haircuts on sovereign debt exposures under different adverse macro scenarios is based on the valuation of government bonds using forward-looking information from CDS markets. Sovereign bond prices for each year under each scenario are calculated contingent on changes in the term structure of the applicable risk-free rate and market expectations of default risk as reflected in the past dynamics of CDS spreads. More specifically, for a selection of bonds of a sample country, the future prices over a forecast horizon (e.g., up to five years) are calculated by using the end-year risk-free rate and applying a density forecast of expected default risk based on the empirically derived probability distribution of the forward rates on sovereign CDS contracts at different maturities. For each country, the most liquid bonds in maturity buckets of one, three, five, seven, and ten years (+/- 0.5 years) are assumed to be representative of the maturities of banks' bond holdings.

First, the standard pricing formula for a coupon-bearing bond *(b_1)* is reconciled with the zero-coupon bond pricing formula (assuming equivalence of economic value) in order to project future bond prices contingent on changes in idiosyncratic risk. This is done for several bonds of each sample country (with a specified residual maturity tenor). Since the sample bonds carry regular coupon payments, the discounted cash flow pricing formula

$$P_{b_1,t} = \prod_{m=1}^{T-t} \frac{c}{(1+r_t)^{m/n}} + \frac{p}{(1+r_t)^{T-t}}, \qquad \text{(A8.1)}$$

of fixed-rate bond (b2) with yield-to-maturity (YTM) in year t, principal value p, and time-to-maturity T-t is stripped of coupon payments c (with payout frequency n)[2] and set equal to the quasi-zero coupon price

$$P_{b_2,t} = \exp\left(-r_{f_t}\left(T-t\right)\right)\left(1-LGD\times PD\left(T-t\right)\right), \qquad \text{(A8.2)}$$

with the cumulative probability of default (PD) at the last observable sample date until maturity date *T*, constant loss-given-default (LGD), and risk-free rate r_{f_t} in year *t*, so that

$$P_{b_2,j,t} = \exp\left(-\left(r_{f_t} + s_{CDS_{k,j,t}}/10,000\right)\left(T-t\right)\right), \qquad \text{(A8.3)}$$

[1]For simplicity of notation, the designation of maturity has been ignored in the remainder of the text.

[2] This step ignores the second order effect of interest rate changes on the future bond price (convexity) in the determination of haircuts.

where

$$s_{CDS_{k,j,t}} = -\ln\left(1 - LGD \times PD\left(T-t\right)\right)/\left(T-t\right), \tag{A8.4}$$

is the cash *k*-year credit default swap (CDS) spread (in basis points) of country *j* at time *t* with

$$PD\left(T-t\right) = \left(1-\left(1-PD\left(t\right)\right)^{T-t}\right), \tag{A8.5}$$

which represents the idiosyncratic risk of the reference entity. In cases when the calculations are performed before year-end, controlling for the change in market valuation due to the change in yield between the end-point of the estimation window *t* and starting point of the forecasting period $t+\tau$ we can write[3]

$$\frac{p}{\left(1+r_t^*\right)^{T-t+\tau}} = \exp\left(-\left(\hat{r}_{f_t} + \left(r_t^* - r_t\right) + \overline{s}_{CDS_{k,j,t}}/10{,}000\right)\left(T-t+\tau\right)\right), \tag{A8.6}$$

where r_t^* is the extrapolated yield at year-end to reflect the valuation effect on the discounted cash flow formula

$$P_{b_1,j,t+\tau} = \prod_{m=1}^{T-t} \frac{c}{\left(1+r_t^*\right)^{(m+\tau)/n}} + \frac{p}{\left(1+r_t^*\right)^{T-t+\tau}} > P_{b_1,j,t}, \tag{A8.7}$$

for a coupon-bond issued by country *j* at the start of time period τ prior to the end of the base year *t*, and $\overline{s}_{CDS_{k,j,t}}$ is the average cash CDS spread over the last year prior to the starting point of the forecasting period. Equation (A8.6) above is then solved for the risk-free rate

$$\hat{r}_{f_t} = -\ln\left(\frac{p}{\left(1+r_t^*\right)^{T-t+\tau}}\right)\frac{1}{\left(T-t+\tau\right)} - \left(r_t^* - r_t\right) - \frac{\overline{s}_{CDS_{k,j,t}}}{10{,}000}. \tag{A8.8}$$

Second, the future price $P_{b_2,t+i,j}$ of each outstanding bond of country *j* is then calculated up to a forecast horizon of *T*-*t* years, with and without a common shock to the interest rate term structure. It is derived from using the estimated risk-free rate and applying the *i*-period forward sovereign CDS spread $f_{CDS_{k,j,t+i}}$ with a maturity of *k* years to the standard zero-coupon pricing formula so that

[3] See CEBS (2010) and EBA (2011) for similar approaches.

$$P_{b_2,t+i,j} = \exp\left(-\left(\left(\hat{r}_{f_t} + \Delta r_i\right) + f_{CDS_{k,j,t+i}} / 10,000\right)\left(T-t\right)\right) \qquad \text{(A8.9)}$$

in order to inform haircuts relative to the valuation $P_{B,t,j}$ at time *t*, where the implied periodic default risk for each year of the forecast horizon is given by $PD(t) = f_{CDS_{k,j,t+i}} / LGD \times 10,000$, and $\Delta r_i > 0$ denotes a positive (common) shock to the risk-free rate for all or a particular year during the forecast horizon. This is done for several bonds of each sample country (with similar residual maturity). The same approach can also be applied to the discounted cash flow pricing formula in line with the estimation of market risk parameters in the European stress test (EBA, 2011; ECB, 2011) for comparative purposes, so that

$$P_{b_1,t+i,j} = \prod_{m=1}^{T-t} \frac{c}{\left(1+r_t+\theta\right)^{m/n}} + \frac{p}{\left(1+r_t+\theta\right)^{T-t}}, \qquad \text{(A8.10)}$$

where

$$\theta = \Delta r + \left(r_t^* - r_t\right) + \left(f_{CDS_{k,j,t+i}} - \bar{s}_{CDS_{k,j,t}}\right) / 10,000 \qquad \text{(A8.11)}$$

More specifically, the *i*-period forward rate $f_{CDS_{k,j,t+i}}$ on the CDS spread is derived as a density forecast at time *t* from the past dynamics of expected default risk. The historical series $\mathbf{X}_{CDS_{k,j,t+i}} = f^1_{CDS_{k,j,t+i}}, \ldots, f^z_{CDS_{k,j,t+i}}$ of i.i.d. random observations over an estimation period of *z*-number of observations is parametrically fitted to the *generalized extreme value* (GEV) distribution in order to account for large (nonlinear) fluctuations in sovereign CDS spreads. The cumulative distribution function is defined accordingly as

$$G_{CDS_{k,j}}(x) = \exp\left(-\left(1+\frac{\hat{\xi}_{k,j}\left(x-\hat{\mu}_{k,j}\right)}{\hat{\sigma}_{k,j}}\right)^{-1/\hat{\xi}_{k,j}}\right), \qquad \text{(A8.12)}$$

where $1+\hat{\xi}_{k,j}\left(x-\hat{\mu}_{k,j}\right)/\hat{\sigma}_{k,j} > 0$, scale parameter $\hat{\sigma}_{k,j} > 0$, location parameter $\hat{\mu}_{k,j} > 0$ and shape parameter $\xi_{k,j}$. The higher the absolute value of shape parameter, the larger the weight of the tail and the slower the speed at which the tail approaches its limit.[4] Thus, the quantile value

$$\sup\left\{G^{-1}_{CDS_{k,j}}(\square) \middle| \Pr\left[X_{CDS_{k,j,t+i}} > G^{-1}_{CDS_{k,j}}(\square)\right] \geq a = 0.95\right\} \qquad \text{(A8.13)}$$

[4]The moments of the corresponding density function are estimated via the *linear combinations of ratios of spacings* (LRS) method (Appendix 3), which identifies possible limiting laws of asymptotic tail behavior of normalized extremes (Coles and others, 1999; Poon and others, 2003; Jobst, 2007).

and the density forecast at a certain statistical confidence level *a*

$$G^{-1}_{CDS_{k,j}}(a) = \hat{\mu}_{k,j} + \hat{\sigma}_{k,j} \Big/ \hat{\xi}_{k,j} \left(\left(-\ln(a) \right)^{-\hat{\xi}_{k,j}} - 1 \right), \tag{A8.14}$$

with corresponding probability density function

$$g_{CDS_{k,j}}(x) = \hat{\sigma}^{-1}_{k,j} \left(1 + \frac{\hat{\xi}_{k,j}\left(x - \hat{\mu}_{k,j}\right)}{\hat{\sigma}_{k,j}} \right)^{-1/\hat{\xi}_{k,j}-1} \exp\left\{ -\left(1 + \frac{\hat{\xi}_{k,j}\left(x - \hat{\mu}_{k,j}\right)}{\hat{\sigma}_{k,j}} \right)^{-1/\hat{\xi}_{k,j}} \right\} \tag{A8.15}$$

can be determined. Thus, the specification of the future price of each outstanding bond of country with and without a common shock to the interest rate term structure under both pricing approaches equations (A8.9) and (A8.10) can be revised to

$$\hat{P}(a)_{b_2,t+i,j} = \exp\left(-\left(\left(\hat{r}_{f_t} + \Delta r_i \right) + G^{-1}_{CDS_{k,j}}(a) \Big/ 10{,}000 \right)(T-t) \right), \tag{A8.16}$$

and

$$\hat{P}(a)_{b_1,t+i,j} = \prod_{m=1}^{T-t} \frac{c}{\left(1 + r_t + \hat{\theta}\right)^{m/n}} + \frac{p}{\left(1 + r_t + \hat{\theta}\right)^{T-t}}, \tag{A8.17}$$

respectively, where

$$\hat{\theta} = \Delta r + \left(r^*_t - r_t \right) + \left(G^{-1}_{CDS_{k,j}}(a) - \bar{s}_{CDS_{k,j,t}} \right) \Big/ 10{,}000. \tag{A8.18}$$

The valuation haircuts are derived from changes in prices of selected bonds in response to changes in individual sovereign spreads (and common interest rate shocks) based on (i) current market expectations and (ii) different adverse scenarios defined by the historical changes of expected default risk. For current market expectations, the forward CDS spread $f_{CDS_{k,j,t+i}}$ observed at the end of the estimation period at time *t* is used to project future bond prices over *i*-periods in the future based on the pricing formulas in equations (A8.9) and (A8.10) above.

In contrast, for the adverse scenarios, point estimates of expected changes in default risk based on the historical distribution of forward spreads on CDS are chosen. Since haircuts under the adverse scenario should reflect the volatility of market expectations, the density forecasts at the 75th percentile (for both adverse scenarios) of the cumulative probability distribution is used as country-

specific shocks to $f_{CDS_{k,j,t+i}}$. Thus, for each year over the forecast horizon of $i \in n$ -years, there are two bond prices

$$P_{b_1,t+i,j} \in \mathbf{P}_{b_1,t+i,j} = \left\{ P_{b_1,t+i,j_{current}}; \hat{P}(a)_{b_1,t+i,j_{adverse}} \right\} \quad \text{(A8.19)}$$

and

$$P_{b_2,t+i,j} \in \mathbf{P}_{b_2,t+i,j} = \left\{ P_{b_2,t+i,j_{current}}; \hat{P}(a)_{b_2,t+i,j_{adverse}} \right\} \quad \text{(A8.20)}$$

for each pricing method, based on current market expectations and a density forecast of default risk at statistical confidence level $a = 0.75$.

The corresponding haircuts are calculated for each bond from changes in bond prices in each year *i* over the forecast horizon, relative to the base year *t*, using the following specification

$$\Delta P_{b_1,i,j} = \left(P_{b_1,t+i,j} / P_{b_1,t,j} - 1 \right) \times 100 \quad \text{(A8.21)}$$

and

$$\Delta P_{b_2,i,j} = \left(P_{b_2,t+i,j} / P_{b_2,t,j} - 1 \right) \times 100, \quad \text{(A8.22)}$$

where $\hat{P}_{b_1,t+i,j}$ and $\hat{P}_{b_2,t+i,j}$ are the bond prices under each pricing method, respectively.[5] The general haircut *h* for each sovereign is then derived as an issuance size-weighted average of individual projected haircuts applied to a *q*-number of bonds outstanding,[6] so that

$$\begin{Bmatrix} h_{b_1,t,j} \\ h_{b_2,t,j} \end{Bmatrix} = \max \left(\begin{Bmatrix} \sum_{b=1}^{q} \Delta P_{b_1,i,j} \\ \sum_{b=1}^{q} \Delta P_{b_2,i,j} \end{Bmatrix} \times \frac{Amt_{b,j}}{\sum_{b=1}^{q} Amt_{b,j}}, 0 \right), \quad \text{(A8.23)}$$

where $\Delta P_{b_1,i,j}$ and $\Delta P_{b_2,i,j}$ are the haircuts under each pricing method over forecast period *i*, and Amt_b is the outstanding amount of bond *b* issued by country *j*.[7] As a final step, these haircuts would then be applied to the amount of sovereign and bank debt exposures to countries $j \in J$ held

[5] Note that the haircut estimation is not fully accurate, because in each year over the projected time horizon, the projected yield to maturity is imposed on an unchanged set of bonds. This implies no new government issuance (and time-invariant coupon), which overstates the actual haircut (unlike in cases when the sample of bonds changes and the remaining maturity is kept constant over the projected time period).

[6] Haircuts cannot take negative values when price appreciation occurs between years (e.g., in response to "safe haven flows").

[7] Sovereign exposure gains, should they materialize, are ignored.

in both the banking and trading books at time *t*. The corresponding trading losses or changes in valuation in each year *t* over the forecast horizon are calculated as

$$\sum_{j}^{J}\begin{Bmatrix} h_{b_1,t,j} \\ h_{b_2,t,j} \end{Bmatrix} \times \text{exposure}_{t,j} \tag{A8.24}$$

based on a firm's total exposure to country *j*.

Appendix IX. Pay-out Ratio, Hurdle Rates, and Changes in Risk-Weighted Assets

Table A9.1. Pay-out ratio Conditional on Capitalization under Stress

In percent

Capital buffer *(In percent)*	FSAP (minimum dividend pay-out ratio based on total capital ratio)	Basel III (maximum pay-out ratio based on CET 1 ratio)
0-0.5	5	0
0.5-1	10	20
1-1.5	15	20
1.5-2	20	40
2-2.5	30	40
>2.5	40	40 to 100

Table A9.2. Hurdle Rates (2013-2017)

In percent

Forecast Year	Y1 (2013)	Y2 (2014)	Y3 (2015)	Y4 (2016)	Y5 (2017)
	Hurdle Rates (under Basel III definition of capital)				
(1) Reg. Minimum Total Capital	**8.0**	**8.0**	**8.0**	**8.625**	**9.25**
(2) Reg. Minimum Tier 1 Capital	**4.5**	**5.5**	**6.0**	**6.625**	**7.25**
(3) Reg. Minimum Common Equity Tier 1	**3.5**	**4.0**	**4.5**	**5.125**	**5.75**
Memo item					
Conservation Buffer	0.0	0.0	0.0	0.625	1.25

*Assumption of 2.0 percent Common Equity Tier 1 requirements in 2019 for the six largest banks (Group 1). Note that "Tier 1 capital with add-on" refers to a capital definition under the Basel III regime that is closest to the definition of "core Tier 1 capital" used by EBA during the 2011 capital assessment based on a 9 percent hurdle rate.

Appendix X. Suggested Output Format for Reporting by Firms to NBB

		[Bank Name]			Pre-Stress (mid-2012)	Y1 (2013)	Y2 (2014)	Y3 (2015)	Y4 (2016)	Y5 (2017)
		Reporting basis		solo						
		Macro scenario [select]		Baseline / Double Dip / Slow Growth						
input for system-wide aggregation	1	Main Results	Failed stress test? (1 = yes, 0 = no)	Total Capital						
	2			Tier 1						
	3			Common Equity Tier 1						
	4		Capital needs to recapitalize bank *In EUR millions*	Total Capital						
	5			Tier 1						
	6			Common Equity Tier 1						
	7		Capital needs to recapitalize bank (relative to total assets) *In percent*	Total Capital						
	8			Tier 1						
	9			Common Equity Tier 1						
	10	Hurdle Rate Assumption	Hurdle Rate Total Capital			8.000%	8.000%	8.000%	8.625%	9.250%
	11		Hurdle Rate Tier 1 Capital			4.500%	5.500%	6.000%	6.625%	7.250%
	12		Hurdle Rate Common Equity Tier 1			3.500%	4.000%	4.500%	5.125%	5.625%
not publicly reported	14	Sensitivity Check I: like "Main Results" but without sovereign risk	Failed stress test? (1 = yes, 0 = no)	Total Capital						
	15			Tier 1						
	16			Common Equity Tier 1						
	17		Capital needs to recapitalize bank *In EUR millions*	Total Capital						
	18			Tier 1						
	19			Common Equity Tier 1						
	20		Capital needs to recapitalize bank (relative to total assets) *In percent*	Total Capital						
	21			Tier 1						
	22			Common Equity Tier 1						
	23	Hurdle Rate Assumption	Hurdle Rate Total Capital			8.000%	8.000%	8.000%	8.625%	9.250%
	24		Hurdle Rate Tier 1 Capital			4.500%	5.500%	6.000%	6.625%	7.250%
	25		Hurdle Rate Common Equity Tier 1			3.500%	4.000%	4.500%	5.125%	5.625%
input for system-wide aggregation	27	Risk Drivers	Net profit (before losses) 1/							
	28		Credit losses							
	29		Overall trading/valuation losses							
	30		Risk-weighted assets (RWAs)							
	31	Risk Drivers *(In percent of RWAs)*	Net profit (before losses)			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	32		Credit losses			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	33		Overall trading/valuation losses			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	34		Change in risk-weighted assets (RWAs), *In percent*			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
input for system-wide aggregation	36	Background	Total capital adequacy ratio *(In percent)*							
	37		Tier 1 capital ratio *(In percent)*							
	38		Common equity Tier 1 ratio *(In percent)*							
	39		Total capital							
	40		Tier 1 capital							
	41		Common equity Tier 1 capital							
input for system-wide aggregation	42		Leverage (capital/assets)							
	43		Return on total regulatory capital *(In percent)*							
	44		Dividend yield (dividend paid/equity) *(In percent)*							
input for system-wide aggregation	46	Stress test parameters *(In percent)*	Percentage of profits retained							
	47		Phase-in of deductions from core Tier 1 capital							
	48		Phase-out of non-Tier 1 and Tier 2 capital							
	49		**Credit risk**							
	50		PD/NPL ratio (average)							
	51		LGD (average)							
	52		Asset correlation (average)							
	53		Credit growth							
	54		**Asset risk-weightings**							
	55		Change of credit risk RWAs							
	56		Change of market risk RWAs							
	57		Change of operational risk RWAs							

Note: 1/ minus credit losses/net impairments (including haircuts) and overall trading losses for the period.