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FINANCIAL SECTOR ASSESSMENT PROGRAM

March 2015

STRESS TESTING THE FINANCIAL SYSTEM—TECHNICAL NOTE

This Technical Note on Stress Testing the Financial System on South Africa was prepared by a staff team of the International Monetary Fund. It is based on the information available at the time it was completed in February 2015.

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STRESS TESTING THE FINANCIAL SYSTEM

Prepared By
Monetary and Capital Markets Department

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

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Glossary

BU	Bottom-up (stress test)
CAR	Capital Adequacy Requirement
CAT	Catastrophic event
CCAR	Comprehensive Capital Analysis and Review
CET1	Common Equity Tier One
CLF	Committed Liquidity Facility
CVA	Credit Valuation Adjustment
D-SIB	Domestic Systemically Important Bank
FSAP	Financial Sector Assessment Program
FSB	Financial Stability Board
GDP	Gross Domestic Product
HQLA	High Quality Liquid Assets
IDR	Incremental Default Risk
IMF	International Monetary Fund
IRB	Internal Ratings-Based
JIBAR	Johannesburg Interbank Agreed Rate
LCR	Liquidity Coverage Ratio
LGD	Loss Given Default
LTV	Loan-to-Value
NBFI	Nonbank Financial Institution
NII	Net Interest Income
NRR	Negative Rand Reserves
NSFR	Net Stable Funding Ratio
ORSA	Own Risk and Solvency Assessment
OTC	Over the Counter
P&L	Profit and Loss
PD	Probability of Default
PIT	Point-in-Time
PSE	Public Sector Entities
RAM	Risk Assessment Matrix
RoE	Return on Equity
RWAs	Risk-Weighted Assets
SAM	Solvency Assessment and Management
SARB	South African Reserve Bank
STeM	Stress Test Matrix (for FSAP stress tests)
STs	Stress Tests
TD	Top-down (stress test)
TTC	Through-the-Cycle
ZAR	South African Rand

EXECUTIVE SUMMARY

The mission conducted stress tests (STs) for the banking and insurance sectors. The bank ST includes both top-down (TD) and bottom-up (BU) components, which cover 86 and 94 percent of banking assets in the system, respectively. The BU insurance STs cover the major life and non-life insurers.

The bank STs suggest that banks have adequate capital to withstand severe shocks, but need larger liquidity capacity to meet regulatory requirements. Even in the severe scenario in which GDP falls for three consecutive years, banks' capital buffers seem sufficient, although the impact of a large default could be significant. Banks also appear resilient to market risks in both the trading and banking books. Some banks, however, would have difficulty meeting the Liquidity Coverage Ratio (LCR) without the Committed Liquidity Facility (CLF) of the South African Reserve Bank (SARB), and face even bigger challenges meeting the Net Stable Funding Ratio (NSFR) without reducing the maturity profile of assets.

The insurance ST indicates that, despite market value losses, the sector, on aggregate, remains solvent and profitable. The ST pointed to a high sensitivity of insurers to market risks, especially equity prices and the default of the largest banking counterparty. Life insurers' solvency ratios declined sharply under the shocks, although the decline was mitigated by passing on lower investment returns to policyholders. Non-life insurers were more resilient with their more conservative investment strategies.

On a conglomerate level, financial institutions could weather the combined losses from their banking and insurance operations. The banking operations would be able to withstand the severe shocks; the recapitalization need, at ZAR 72 bn or 1.6 percent of 2018 nominal GDP at the maximum, is manageable, and the capital shortfall for the insurance companies, at 0.1 percent of nominal GDP, is even smaller. Recapitalizing the few insurance companies would be within the capacity of the corresponding conglomerates, owing to the small size of the capital required as compared to the level of aggregate capital in the group.

Table 1. Summary of Recommendations

Recommendations for Implementation	Time[1]
Continue building a top-down stress test framework for the banking sector.	NT
Allocate more resources to validate models and assumptions used in the bottom-up stress tests by banks.	MT
Develop a macro stress test for insurance companies.	MT
Establish a stringent monitoring framework for assessing the concentration risk of the insurance sector towards the largest domestic banks.	NT

[1] "NT-near-term" is 1–3 years; "MT-medium-term" is 3–5 years.

INTRODUCTION

1. **The financial sector in South Africa is large and sophisticated.** Total financial sector assets of about 298 percent of GDP exceed those of most other emerging market economies. Commercial banks' assets total 112 percent of GDP, and their share in total financial assets has been declining in recent years with the rapid growth of the nonbank financial sector. The insurance sector's gross assets[1] account for 67 percent of GDP.

2. **The financial sector emerged relatively unscathed from the global financial crisis.** Banks remained profitable during the crisis, with the return on equity of the four largest banks remaining above 20 percent. The non-performing loans declined from 6 percent in late 2009 to 3.6 percent in 2013, and the regulatory tier one ratio of 13.5 percent in 2013 also compares favorably with banks in other countries. The nonbank financial sector also continued to thrive, as seen by the record increase in assets under management. The life insurance sector is overall well capitalized and both life and nonlife companies are, on aggregate, highly profitable.

3. **Nevertheless, the financial sector operates in a challenging economic environment and macroeconomic and credit risks are building up.** A combination of slow growth, high unemployment, low savings, and high public investment is sustaining large current account and fiscal deficits. In June, Standard and Poor's downgraded the sovereign foreign and local currency rating by one notch to BBB- and BBB+, respectively. Although unlikely, further rating actions could potentially threaten the inclusion of South African debt in global benchmark indices. An exclusion from the benchmark would significantly weaken the demand for sovereign debt from foreign investors, pushing funding costs notably higher and adding further strain on the fiscal outlook from higher contingent liabilities.

4. **Against this background, the mission assessed risks to financial stability in four broad areas:** [2]

- **Systemic liquidity risk**: The need to finance large current account and fiscal deficits leaves financial markets potentially vulnerable to a re-pricing of risk and a sudden stop of capital inflows**.** The second source of potential systemic liquidity risk stems from banks' very high dependence on short-term wholesale funding. Moreover, domestic participants active in over-the-counter (OTC) derivatives trading are exposed to counterparty credit risk and potentially to global liquidity shocks through increased trading with foreign counterparties.

- **Household and corporate indebtedness**: Household debt may become a risk in an environment of rising interest rates. The expansionary fiscal policy, combined with loose

[1] Including underwritten pension funds and insurance policies of domestic pension funds.

[2] Please refer to the South Africa FSAP Financial System Stability Assessment (FSSA) report for a full assessment, which considers mitigation factors.

monetary conditions after the global financial crisis, led to a record increase in unsecured lending to low-income households, which grew by 50 percent year-on-year in 2011. As growth slows, the already stretched repayment capacity of low-income households could be further undermined. In addition, floating-rate mortgages account for a large proportion of household debt. Under these circumstances, rising interest rates would make it difficult for households to service their debt. On the corporate side, private sector balance sheets appear to be strong, but rising debt levels leave public sector corporations vulnerable to interest rate and exchange rate shocks.

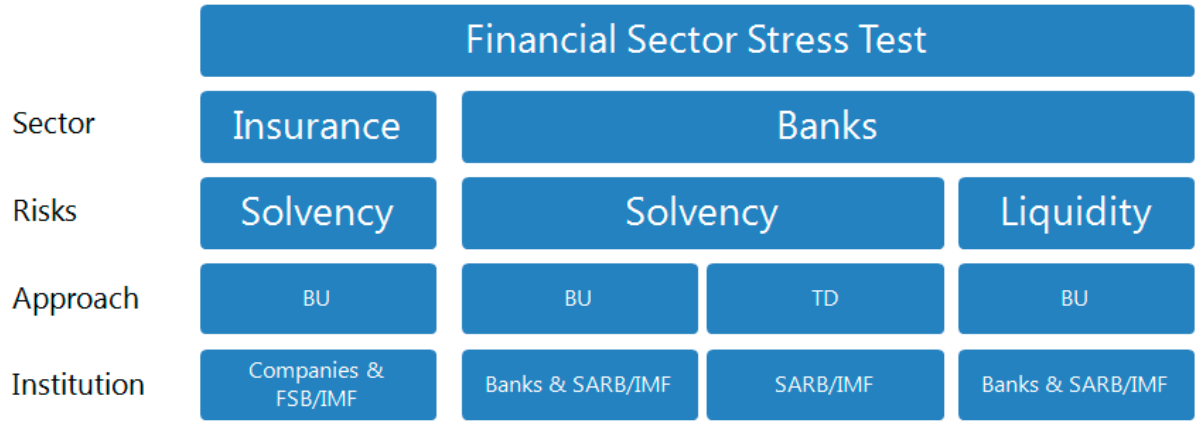
- **Concentration and interconnectedness within the financial system:** The financial sector has a high degree of concentration and interconnectedness. Five large banks together account for 90.5 percent of total banking assets. As for the nonbank financial institutions (NBFIs), the top five insurance companies account for 74 percent of the market for long-term insurance and 44 percent of the market for short-term insurance; while the seven largest fund managers control 60 percent of the unit trust collective investment schemes industry. All the major banks are affiliated with insurance companies through either a holding company structure or direct ownership. In addition to shareholdings, these entities are connected through balance sheet transactions. For instance, NBFIs hold substantial amounts of assets in the largest four banks' deposits, which expose them to counterparty risks and banks to liquidity risks.

- **Cross-border expansion of the banking sector:** Claims of South African banks on other African countries, mostly in Sub-Saharan Africa and mostly through subsidiaries, have more than tripled over the last five years to 2 percent of total assets.

5. **The impacts of these risks on the financial system are assessed through comprehensive stress tests (STs) of banks and insurance companies.** The bank STs include both top-down (TD) and bottom-up (BU) components, covering four banks and six banks, corresponding to 86 and 94 percent of banking system assets, respectively. The BU STs cover both local and foreign operations to adequately assess the risks associated with the rapid expansion in cross-border business.[3] The insurance ST includes only a BU component and covers five major life insurers with 70 percent of the sector's assets, and four non-life insurers with 50 percent of the sector's premiums. To address the risks identified above, a comprehensive set of risk factors are considered, including credit risks, market risks, liquidity risks, and contagion risks. In particular, one sensitivity analysis assesses the credit risks of household debt to large interest rate hikes, and a number of sensitivity analyses are introduced to assess counterparty risks due to the interconnected structure of the financial system, including the failure of a large bank for insurance companies. Insurance underwriting risks, like the impact of a catastrophic event, have been added as a sensitivity analysis for the insurance sector.

[3] The TD ST has a smaller coverage since the supervisory data on the probability of default (PD), loss given default (LGD) and exposure at default are available only for the four large internal ratings-based (IRB) banks and are based on domestic operations.

Figure 1. Testing Program under the 2014 FSAP Update



Sources: IMF staff.

SOLVENCY RISK

A. Methodologies

Macro-financial Scenarios

6. **The macro-financial scenarios for STs are aligned with the IMF's Global Risk Assessment Matrix (G-RAM), and generated using a model-based approach.** The G-RAM identified as major global shocks a surge in global financial market volatility and a protracted period of slower growth in advanced and emerging economies.[4] The external shocks were used as inputs to the SARB's Global Projection Model and Core Model to generate three global and domestically consistent macro-financial scenarios for South Africa and its main trading partners:[5]

- *Baseline scenario*: modest GDP growth, persistent high unemployment level, and the gradual upward normalization of interest rates. The projections are aligned with the IMF's economic projections for South Africa as of April 2014, which were subsequently adjusted downward in August 2014. Since the stress tests were conducted, the baseline macroeconomic scenario has become considerably worse.

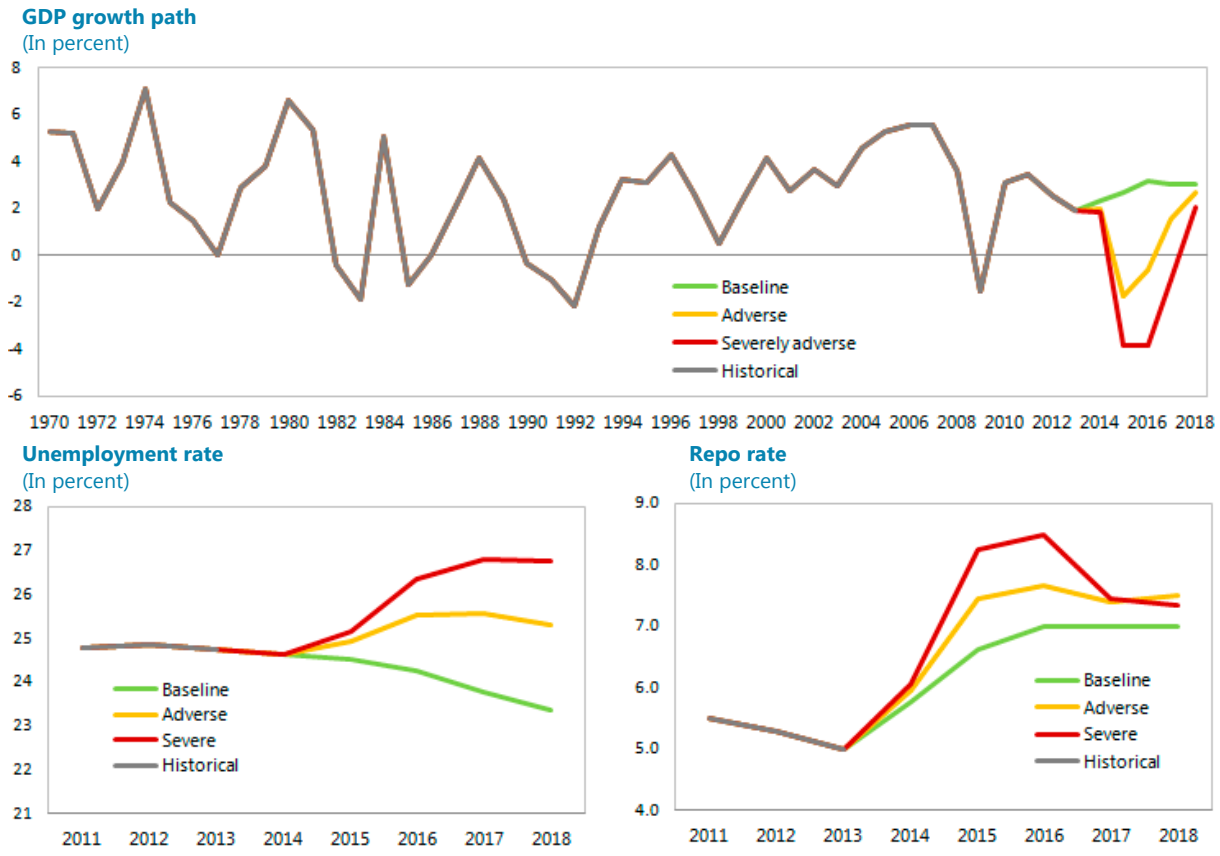
- *Adverse scenario*: mild decline in GDP growth because of a disorderly exit from unconventional monetary policy by the advanced economies, resulting in capital outflows, increased market volatility, and higher-than-expected increases in interest rates.

[4] Other major, relevant global shocks potentially affecting South Africa include a short-term, sharp economic slowdown in China and a sustained decline in commodity prices (Appendix I).

[5] See Appendix Table 1 for details.

- *Severely adverse scenario*: a "perfect storm," where GDP growth falls sharply and stays in negative territory for three consecutive years due to the confluence of several negative factors including a recession in advanced economies; large capital outflow; and substantially higher domestic interest rates. In terms of the GDP path, the scenario would be equivalent to a cumulative eight standard deviation event from the baseline.[6]

Figure 2. Macro-financial Scenarios (Key Variables)



Sources: Haver and IMF staff projection.

Bank stress test

7. **The BU and TD STs assess banks' capital adequacy under the above scenarios.**[7] The TD ST relies on supervisory data, which span a relatively short horizon, and high level assumptions, while the BU STs, following broadly the guidance note issued by the FSAP team, are based on banks' proprietary data, own estimated models, and expert judgment (Box 1). In terms of their scope, the

[6] The standard deviation is based on the historical sample of 1963 to 2013.

[7] For a summary of the methodologies used by the BU and TD STs on the banking sector, see Box 1 and Appendix III.

BU STs cover six banks and both local and foreign operations to adequately assess the risks associated with the rapid expansion in cross-border business. Due to data limitations, the TD ST is based on the four largest banks and local operations.

Box 1. Modeling Approaches and Assumptions in the TD and BU STs

Probabilities of default (PDs)

In the TD ST, panel data models for PDs are estimated for the 10 asset classes.[1] The panel data model is chosen to address the issue of short time series.[2]

- We perform logit transformation to the PDs and take the first difference of the new series as the dependent variables.
- The explanatory variables for each model are chosen from the following list of variables: GDP growth rate, policy rate, 10-year government bond yield, property price growth, household debt-to-income ratio, government debt to GDP ratio, official unemployment rate, domestic credit extension, M3 money supply growth, nominal effective exchange rate, Rand/US Dollar exchange rate, commodity price in US$, stock market index, crude oil price, capital ratio and exposure growth. For each variable, the current value and up to four lags are considered.
- The best model is selected based on the Bayesian information criteria**.**

In the BU STs, to project PDs, banks use a combination of modeling and expert judgment, reflecting the heterogeneities in customer base and risk appetite across banks.

Loss given default (LGD)

In the TD ST, for each asset class and each bank, the downturn LGD is computed using linear mapping functions (denoted "LGD_TTC," the through-the-cycle (TTC) LGD as of Dec 2013 in the supervisory data):

Baseline scenario: LGD=LGD_TTC

Adverse scenario: LGD=0.08+0.92*LGD_TTC

Severe scenario: LGD=0.10 + 0.92*LGD_TTC

Note that the above gives a conservative assumption on LGDs. For instance, for the residential mortgage portfolio, the LGD under the severely adverse scenario would imply, for a loan with an LTV of 80 percent, a decline of the collateral price by 40 percent since the origination point.

In the BU STs, banks use their internal models to estimate the LGD.

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[1] The 10 asset classes include: total corporate, public sector, sovereign and central bank, local government, banks, securities, residential mortgages, retail revolving, retail SME, and retail others.

[2] Data on PDs for each asset class are available from January 2010. The monthly supervisory data are converted into quarterly frequency using an equally weighted average, which yields 16 data points from Q1 2010 to Q4 2013. Ideally, the model estimation should use data covering at least one business cycle, but this is not feasible partly because the definition of credit risk measures varied over time following the changes in regulations and accounting rules following BASEL best standard. The same data issue applies for other variables in the supervisory database.

Box 1. Modeling Approaches and Assumptions in the TD and BU STs (continued)

Balance sheet growth

- In both the TD and BU STs, the relative proportion of the balance sheet items and the trading positions remain the same under all scenarios.

In both tests, banks with capital ratios above the minimum common equity tier one (CET1) capital requirements increase their estimated balance sheet at an own estimated rate or at the same pace as nominal GDP, if the latter is positive.[3] If the nominal GDP growth rate is negative, balance sheet growth will be capped at zero. Banks that fail to meet the Tier 1 capital requirements will keep their balance sheet even under positive nominal GDP growth in the TD ST, while some banks would deleverage in the BU STs.

Loan loss provision

- The provision is equal to the expected loss, which is the product of PD, LGD and the amount of exposure. We assume that the expected loss is equal to the realized loss.

Net income growth

- In the TD ST, the net income for each bank is assumed to grow at the same rate as the nominal GDP. The net income is defined as income before deducting the loan loss provision.
- In the BU STs, to reflect the impact from banks' asset liability structure, income projections under each scenario are disaggregated into its main components: interest income, interest expenses, trading income, and operating expenses. Both pre-tax and after-tax projections are reported.

Risk weighted assets (RWAs)

- In the TD approach, the changes in RWAs are calculated following an approximate Basel II internal ratings-based (IRB) approach. The IRB formula is used to determine regulatory RWAs for the loan book and their changes over the stress horizon. For calculating the regulatory RWAs, the point-in-time (PIT) PD and the above downturn LGDs are assumed and the exposures are net of provisions. Percentage changes in the regulatory RWAs from the base year (i.e., year 2013) are applied to the base year realized RWAs[4] to generate the final RWAs.
- In the BU STs, banks follow the regulatory approach to formulate RWAs with the one exception that PIT PDs, rather than TTC PDs, are used in the exercise. Using TTC PDs would be consistent with the regulatory requirement, which aims to avoid the procyclicality issue. However, PIT PDs are preferred in STs since they fully incorporate the unexpected loss, measured by RWAs, which could materialize under stress conditions. Nevertheless, some banks noted that their system does not have the capacity to generate PIT equivalent results for certain loan portfolios.

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[3] In particular, in the TD ST, it is assumed that all banks grow the balance sheet at the same rate as the nominal GDP.
[4] The realized RWAs include RWAs for credit risk, market risk, and operational risk. They are based on the total assets rather than on the loan book.

Box 1. Modeling Approaches and Assumptions in the TD and BU STs (concluded)

Dividend

- The dividend payout depends on a bank's buffer over the minimum capital ratio, following the maximum payout ratio in the table below. In the BU STs, banks pay out less than in the maximum, which is assumed in the TD ST.

Buffer above minimum capital ratio (in percent)	Maximum dividend payout ratio (in percent of earnings)
0 - 0.5	0
> 0.5 - 1.5	20
> 1.5 - 2.5	40
> 2.5	50

Source: IMF Staff.

Hurdle rates

- The minimum capital ratio consists of Basel III minimum CET1 requirements, and Pillar 2A and Pillar 2B charges. It reflects the phase-in of the Domestic Systemically Important Bank (D-SIB) charge and the capital conservation buffer.[5]

CET 1 requirements	2014	2015	2016	2017	2018
Minimum CET1 ratio (per Basel III) (in percent)	4.00	4.50	4.50	4.50	4.50
Pillar 2A for CET1 (in percent)	1.00	2.00	1.75	1.50	1.00
Phasing in of D-SIB requirements at CET1 level (in percent)			25.00	50.00	75.00
Capital conservation buffer (in percent)			0.63	1.25	1.88
Countercyclical capital buffer (maximum percent, if imposed) (in percent)			0.63	1.25	1.88

Source: SARB D5/2013.

Capital formulation

The amount of capital in each year equals the amount of capital from the previous year plus the net income in the current year, and is net of the dividend payout and the loan loss provisions.

[5] The Pillar 2B charge and D-SIB charge are bank-specific and confidential information.

8. **To assess market risks in the scenario-based analysis, a comprehensive set of instantaneous market shocks[8] were added to the second year of the severely adverse scenario, following the US Comprehensive Capital Analysis and Review (CCAR) methodology**. Trading positions, including those on interest rate, exchange rate, equity, commodity and credit-risk sensitive instruments, were evaluated to assess banks' potential trading losses under the stressed

[8] See Appendix Table 2 to 9 for details.

market condition. The same valuation process was applied to financial assets classified as "available for sale" and "designated at fair value through profit and loss." The shocks involve large and sudden changes in levels, spreads, and volatilities, which are calibrated to be consistent with those observed in 2008.

9. **The scenario analyses for the banking sector are complemented by several sensitivity tests.**[9] Among them, failures by large financial and non-financial borrowers are introduced to study concentration risks and counterparty risks that could be significant in the highly concentrated and interconnected financial system. The sensitivity of the credit quality of the mortgage portfolio and unsecured lending to large interest rate hikes is also assessed. Finally, sensitivity to market risks (e.g., Prime-JIBAR (Johannesburg Interbank Agreed Rate) basis risk and widened credit spreads) on both the trading book and banking book is examined.

Insurance stress test

10. **The main focus in the insurance STs was on market risks, while counterparty risks and specific insurance underwriting risks were also tested.** A BU solvency ST was performed for both life and non-life insurers, based on a solvency ST that the Financial Services Board (FSB) conducts on a semiannual basis as part of its regular prudential supervision. South Africa will implement a new solvency regime (Solvency Assessment and Management, SAM) by 2016, and a quantitative impact study was ongoing in parallel to the ST exercise; therefore, a comprehensive stress testing approach based on the forthcoming regime was not seen as practical at this stage. The FSB ST includes single-factor shocks, as well as a combined economic scenario that addresses interest rate, equity, property, exchange rate, and (corporate) credit risks (see Box 2).

11. **Overall, the stress level in the solvency test was higher for insurers than under the macro-financial scenario used for the banking ST.** This results from the inherent conservativeness of the FSB's own ST specification and the addition of further shocks to the FSAP ST (for more details see Appendix IV):

- An increase in sovereign spreads, reaching 262 basis points for South African government bonds;
- The default of the largest banking counterparty where the LGD on all contractual obligations was assumed to be 45 percent of the gross exposure, except for equity exposures for which a price decline of 100 percent was used instead of the standard 50 percent shock applied for other equity exposures;
- As a separate single-factor sensitivity analysis: a catastrophic event of a magnitude that is expected to occur once in 100 years; following the event, the default of the largest reinsurer is assumed (with an LGD of 45 percent).

[9] See Appendix III for the complete set of tests.

Box 2. Insurance Stress Testing by the FSB

Following the global financial crisis, stress testing requirements were developed for the insurance industry. Since 2010, the major insurance companies in the South African market are required to submit stress testing results in respect of market risk on a semi-annual basis as part of the prescribed statutory returns. In addition, all insurers must submit stress testing results on both market and underwriting risks on an annual basis.

Market risks are covered in the form of single-factor shocks, and companies report the sensitivity to each of the shocks assuming them to occur instantaneously. In addition, a combined economic scenario is tested in which various asset classes are stressed simultaneously as specified below:

Single factor stresses

Interest rates	Shift in the yield curve – 50% up
	Shift in the yield curve – 35% down
Equity prices	Ordinary shares – 50% down Preference shares (fixed rate) – 30% down Preference shares (variable rate) – 10% down
Property prices	30% down
Exchange rate	30% depreciation
	30% appreciation
Volatility	15% addition for equity 10% addition for interest rate
Credit risk	Double the CAR credit risk allowance

Economic scenario stress

Interest rates	Shift in the yield curve – 35% down
Equity prices	Ordinary shares – 50% down Preference shares (fixed rate) – 30% down Preference shares (variable rate) – 10% down
Property prices	30% down
Exchange rate	30% depreciation
Credit risk	Double the CAR credit risk allowance
Volatility	15% addition for equity 10% addition for interest rate

Source: FSB.

Notes: 1/ The economic scenario stress performed by the FSB includes a decline in interest rates. Compared to an increase in interest rates, this is the more severe stress for life insurers in South Africa as the FSB sensitivity analysis as of end-2013 shows. While the increase by 50 percent results in the average CAR coverage ratio going up by 29 percentage points, a decline in interest rates by 35 percent results in a 37 percentage point drop in the ratio. To be more consistent with the macrofinancial scenario used for the banking ST, the FSAP insurance ST used an upward shock for interest rates (for details see Appendix IV). 2/ The table depicts only the specification of the FSB stress test for life insurers; the specification for non-life insurers differs slightly in some aspects.

Under the forthcoming SAM regime, the current STs are planned to be phased out. The calculation of the standard formula for the solvency requirement which is built on sensitivities to a broad set of shocks will then inform about the risk profile of an insurer. Stress testing will, however, continue to feature in two ways: Firstly, the own risk and solvency assessment (ORSA) will require insurers to conduct a number of STs, including reverse STs. These will provide insights into concentrations and stability risks. Secondly, it is proposed that a supervisory committee be established under the new Twin Peaks regime to periodically review industry-level statistics and consider what, if any, specific macro-prudential STs may be required. These will be conducted as-and-when deemed necessary, and will consider the emerging risk universe as potential stressors.

12. **The statutory values of assets and liabilities, as calculated according to the South African insurance solvency regime, formed the basis of the ST calculations.** Companies reported on a solo basis, and the impact of the stress scenarios on the capital adequacy requirement (CAR) was calculated based on the statutory valuation[10] and the solvency regime in place at the reference date. To assess the medium-term ability of insurance companies to recover from the stress scenario, which was modeled to occur instantaneously, five-year projections were also requested. These had to include asset returns below historic averages and the very strict assumption that no new business is underwritten, which results in gradually declining premium income.

B. Results for the Banking Sector

Scenario Analyses

13. **The STs confirm that banks' capital levels are adequate to withstand credit losses in the adverse and severe scenarios.** Resilience is partly due to the high capital buffers in the banking system. As of 2013Q4, the average common equity tier one (CET1) ratio of the six banks was about 11.8 percent of RWAs,[11] well above the regulatory minimum of 6.74 percent.[12]

14. **Banks' capital positions remain resilient in the BU STs (Figures 3 and 5), since the net income will not be much affected in the stress scenarios, offsetting credit losses.** Higher interest income from higher interest rates offsets the declines in non-interest revenue (down 7 percent from the baseline owing to lower business volume). As a result, gross operating income is only 4 percent lower than in the baseline scenario, serving as a formidable line of defense against credit losses, which are on aggregate 40 percent higher than in the baseline. Compared to the starting point of end-2013, the system-wide CET1 ratio only declines by one percentage point by year three, even though the average annual credit loss in the severely adverse scenario increases by 80 percent.

15. **In the TD ST, the shocks have a larger negative impact on capital ratios, but the capital shortfall remains manageable (Figures 3, 4, and 5).** The system-wide CET1 ratio declines from 11.2 percent to 7.0 percent in year three in the severely adverse scenario. Extending the test to year five reduces the CET1 ratio by another 100 basis points. Three of the four banks would have a capital shortfall with respect to their minimum CET1 requirements starting from 2016, while all banks would fall below their minimum capital requirements in 2017 and 2018. However, the maximum capital shortfall, at 1.6 percent of 2018 nominal GDP, is manageable, reflecting a high initial capitalization level. The decline is driven by a substantial deterioration in the credit quality of the loan portfolios, reflected in higher probabilities of default and loss given default across all asset classes. In particular,

[10] Assets are generally stated at fair value if not directed otherwise by the FSB. Technical provisions in life business are discounted based on a government bond rate plus a margin. Non-life technical provisions are not discounted.

[11] The capital ratio is for bank solo, including foreign and local banking operations. The number is based on data submitted in the BU STs.

[12] This is the RWA weighted average of minimum CET1 requirements, which include the Basel III minimum CET1 requirements, Pillar 2A and Pillar 2B charges.

the PD for the performing floating-rate mortgage portfolio rises to a peak of 12 percent from 3.4 percent, partly the result of a sudden and large jump in interest payments. For the retail revolving credit portfolio, the performing PD rises almost four times to 19 percent from 4.4 percent.[13] Credit losses exceed the net income in 2017 and 2018, resulting in a total loss equivalent to 4.4 percent of post-shock CET1 capital. Finally, higher PDs drive RWAs to grow by 16.8 percent per year on average, far exceeding the 2.5 percent nominal average growth rate of the entire portfolio.

16. **The TD ST uses more stringent assumptions than the BU STs, which generate higher net income; lower PDs, LGD, and credit losses; and smaller RWAs.**

- In the BU tests, banks benefit from the higher interest rates in the severely adverse scenario, due to the positive, net rate-sensitive asset positions.[14] This effect is not considered in the TD test, where net income grows with nominal GDP.

- Moreover, while the TD exercises mostly rely on a statistical approach[15] to project credit quality, banks use a combination of modeling and expert judgment and report smaller PDs.[16] In addition, the TD ST uses more stringent assumptions on LGDs. Overall, the credit quality of loans deteriorates much more significantly in the TD ST than in the BU STs.

- Another difference comes from the modeling of RWAs. In the BU STs, some banks use TTC PDs, which are lower than PIT PDs during periods of stress, to project RWAs for certain portfolios. This generates lower RWAs than those in the TD tests, which use PIT PDs to formulate capital requirements for all portfolios.[17]

[13] The magnitude of the increase in the performing PD is large. For instance, the proportion of defaulted loans would be 57 percent of the gross loan portfolio by the end of the five-year horizon, assuming no write-offs are taken, given a portfolio with default loans of 17 percent at the starting point.

[14] The net interest income is only 0.6 percent lower than in the baseline, even though the amount of loans and advances is 3 percent smaller. The loans and advances are mostly prime-linked and therefore rate-sensitive. The non-rate-sensitive funding includes shareholders' funds and non-repricing transactional deposits, which together account for a quarter of banks' funding.

[15] The TD approach is subject to the caveat that the time series is relatively short.

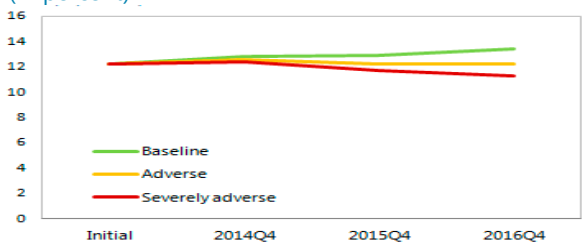
[16] For instance, although the TD ST leads to a spike in PDs for the mortgage book, banks noted that, since interest rates rise gradually, allowing for adjustment in household expenditure, the impact of higher interest rates on household repayment rates would be limited in the short term. Compared to 2013 levels, the annual average credit loss in the BU STs is 78 percent higher and the annual average credit exposure is 10 percent higher. In the TD ST, the annual credit loss is 128 percent higher than the 2013 level, significantly higher than in the BU ST, even though the annual average credit exposure, which is 11 percent higher than the 2013 level, is not much different from the amount of credit exposure in the BU STs.

[17] Moreover, since two out of the six banks use the standardized approach other than the IRB approach, the RWAs in the BU STs will always be less risk-sensitive than in the TD ST on aggregate. Other reasons for the differences include 1) due to management action, the balance sheet growth is slower in the BU STs than in the TD ST, yielding smaller credit losses and smaller RWAs. 2) Due to time constraints, some banks could not adjust their existing stress testing frameworks, which adopt a three-year horizon instead of a five-year horizon. As a result, they use a shorter horizon than in the TD ST. Conversations with banks confirmed that ST results could have been worse if the horizon was extended, due to the lagged effects. For instance, it would take 18 months for the macroeconomic downturn to

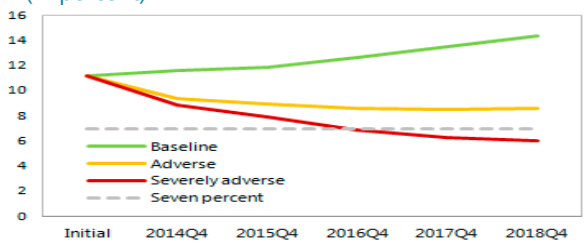
(continued)

Figure 3. Bank—Scenario-based Stress Test Results

BU STs, banking group system-wide CET1 ratio
(In percent)



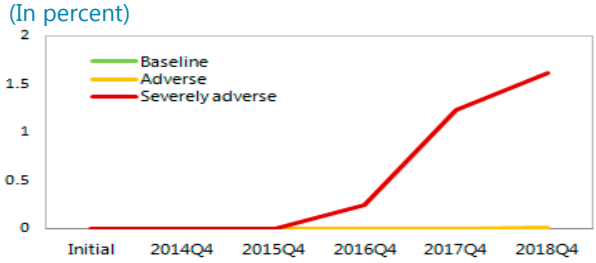
TD ST, local banking system CET1 ratio
(In percent)



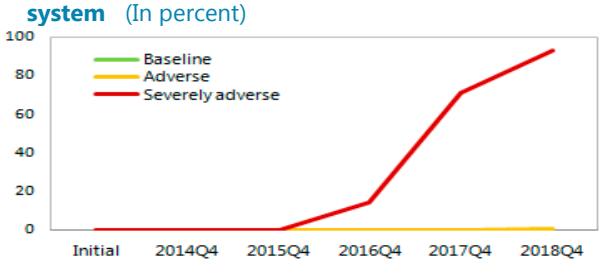
Sources: SARB supervisory data, bank reported results and IMF staff calculations.
Note: the starting point capital ratio is different because the BU STs apply to both local operations and foreign subsidiaries, while the TD ST applies to the local banks only.

Figure 4. Bank—Top Down Stress Test System-wide Capital Shortfall

As a percent of GDP
(In percent)



As a percent of annual net income in the banking system (In percent)



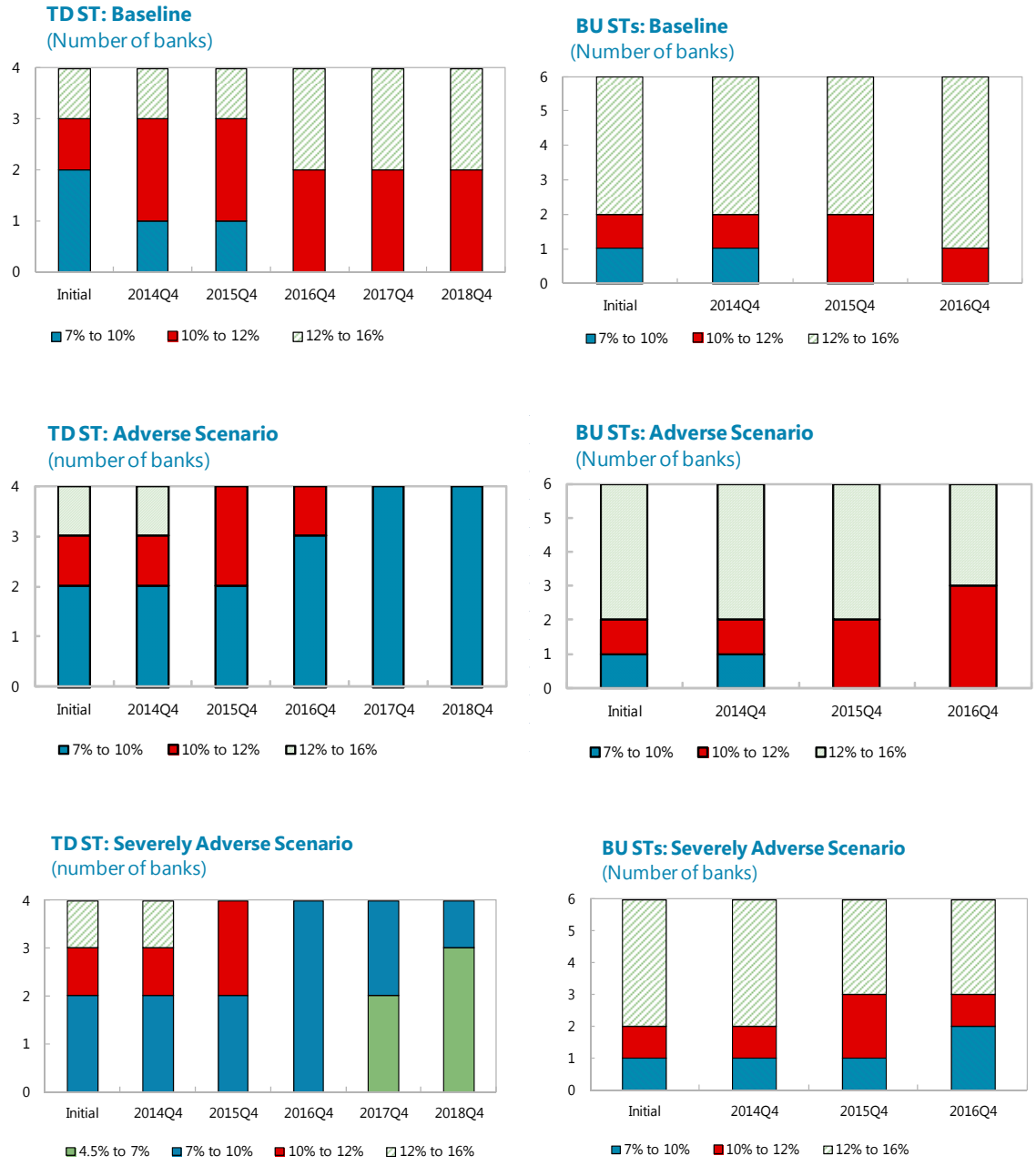
Sources: SARB supervisory data and IMF staff calculations.

17. **Banks' trading and fair valued banking books[18] appear to be resilient to global market shocks, which are part of the macro-financial scenarios, and any losses are within group risk limits (Table 2).** The largest losses come from interest rate directional movements and widening credit spreads. Higher interest rates and larger credit spreads reduce the mark-to-market value of sovereign and corporate bond portfolios in the trading book, which are partly held to meet liquidity needs. Other large losses are due to credit value adjustment (CVA), the market value of counterparty default risk, and incremental default risk (IDR), a capital charge to trading book exposures to credit-risk related and often illiquid products whose risk is not reflected in Value at Risk.

affect the credit quality of some portfolios. 3) The TD ST assumes a maximum dividend payout ratio (Box 1) while the BU STs may restrict dividends.

[18] Assets allocated to both the "available for sale" and those "designated at fair value through profit and loss" portfolios are subject to the application of the same valuation rules applied to the trading book on similar assets.

Figure 5. TD ST Capital Ratio Distribution



Sources: SARB supervisory data and IMF staff calculations.

Table 2. Results of Global Market Shocks

(in Mn ZAR)	
Total P&L in the system	-1529
Interest rate related instrument	-1403
P&L due to interest rate directional risk shocks	-1401
P&L due to interest rate volatility shocks	64
P&L due to cross-currency basis risk shocks	-66
FX sensitive positions	699
P&L due to FX directional risk shocks	675
P&L due to FX volatility shocks	25
Commodity trading positions	55
P&L due to commodity price shocks	21
P&L due to commodity volatility shocks	34
Equity instruments positions	343
P&L due to equity price shocks	194
P&L due to equity volatility shocks	150
Traded credit risk positions	-760
P&L due to sovereign credit risk shocks	-526
P&L due to corporate credit risk shocks	-234
CVA and IDR charges	-852

Sources: SARB supervisory data and IMF staff calculations.

BU Sensitivity Analyses

19. **Sensitivity tests indicate that the default of large exposures could impact banks substantially.** Total exposure to the five largest non-financial borrowers was around 35 percent of total CET1 capital. A default by all the five borrowers would lower the CET1 ratio by 1 percent. The aggregate exposure to the five largest financial borrowers was larger still, amounting to 50 percent of CET1 capital. The CET1 ratio would decline by 1.9 percent due to a jump in default losses owing to the failure of all the five borrowers (Table 3).[19] In particular, one bank would lose almost all of its equity if the shocks were realized. The banks' staffs, however, noted that the shock is extreme since these were exposures to top tier entities and highly regulated banks in South Africa and abroad, and they were partly held to meet liquidity needs.

[19] Banks assumed different LGDs, reflecting the variations in loan quality and the level of collateral. The average LGDs assumed are 27 and 54 percent for non-financial and financial borrowers, respectively.

Table 3. Sensitivity Analyses—Large Exposure Impacts

Large exposures	Exposure as a percentage of total capital (In percent)	Impact of default on CET1 (in percentage point)
Five largest non-financial borrowers	35	-1
Five largest financial borrowers	50	-1.9

Sources: SARB supervisory data and IMF staff calculations.

20. **BU STs indicate that losses from unsecured credit exposures due to higher interest rates have a negligible impact on capital adequacy.** Interest rate increases of 100 bps and 500 bps correspond to expected losses of 9.0 and 9.9 percent of total capital, respectively.[20] Considering the level of provisions, these losses translate into reductions of 1.8 and 2.2 percent of total capital. Banks noted that the impact is limited partly because the unsecured lending book combined both floating-rate and fixed-rate loans, reducing the interest pass-through effects of higher rates; and for the large banks, the customer base comprises high-income professionals and/or government employees whose income and creditworthiness are less likely to be affected by macro downturns. Some banks noted that the legacy portfolio of nonperforming loans of unsecured lending to the lower income sector has already been cleaned up, so no further considerable deterioration of its credit quality is expected.

21. **Similarly, the credit quality of the floating-rate mortgage portfolio is not much affected by higher rates, as reported in the BU STs**. Increasing interest rates by 100 bps and 500 bps respectively would result correspond to expected losses as a percentage of total capital of 6.2 percent and 6.9 percent, reflected in capital level declines of 0.8 percent and 1.5 percent. The limited impact is due to the good quality of customers.

22. **The above limited impact of interest rate driven credit risks on household debt is partly due to the caveat inherent in the ST approach (i.e., sensitivity analyses).** Sensitivity analyses of interest rate shocks only account for changes in interest rates without including increases in unemployment or declines in house and asset prices. Banks noted that, while higher interest rates increase debt repayments, they will not have a large impact on credit quality unless house prices decline significantly. Moreover, sensitivity analyses usually assess the impact over a 12-month horizon and hence lagged effects (i.e., those that materialize beyond 12-months) are not considered.

[20] The 9.0 and 9.9 percent include the expected losses under the current business condition and the added losses caused by the higher interest rates.

Table 4. Sensitivity Analyses—Interest Rate Hike Impacts on Household Debt

Unsecured credit	Expected loss as a percent of total capital (In percent)	Net of provision loss as a percent of total capital (In percent)
Increase interest rate by 100 bps	9.0	1.4
Increase interest rate by 200 bps	9.2	1.5
Increase interest rate by 300 bps	9.5	1.6
Increase interest rate by 500 bps	9.9	1.7

Mortgage portfolio	Expected loss as a percent of total capital (In percent)	Net of provision loss as a percent of total capital (In percent)
Increase interest rate by 100 bps	6.2	0.8
Increase interest rate by 200 bps	6.3	1
Increase interest rate by 300 bps	6.5	1.2
Increase interest rate by 500 bps	6.9	1.5

Sources: SARB supervisory data and IMF staff calculations.

23. **Banks would not suffer material losses on the trading book and the fair valued banking book under the single factor shocks in the BU STs.** Positions on the trading and fair valued banking books, including interest rate, exchange rate, equity, commodity, and credit-risk sensitive exposures, were tested. The most adverse outcome is due to the failure of the three largest counterparty exposures, which would reduce the system CET1 ratio by 28 bps, with the highest impact on one bank being 42 bps. The limited impact is due to hedging practices as well as a daily monitoring process to ensure that exposures and losses are within risk appetite. A number of banks follow long gamma strategies, which benefit from increased currency or equity price fluctuations.[21]

[21] The success of these strategies relies on the solvency and creditworthiness of the trading counterparties. This raises concerns about counterparty risk, proper diversification of counterparties, and whether counterparties can manage their short-gamma positions adequately. Conversations with banks indicated that the counterparties are diversified and the markets are relatively liquid.

Table 5. Sensitivity Analyses—Market Risks on the Trading Book

Interest rate shocks	P&L (in Mn ZAR)	Impact on CET1 ratio (in percentage points)
Level down 300 bps	2003	0.08
Level down 500 bps	2746	0.11
Level up 300 bps	-1916	-0.07
Level up 500 bps	-2657	-0.10
Volatility up 50%	81	0.00
Volatility up 100%	143	0.01
Total basis moves adversely by 20bps	-766	-0.03
Total basis moves adversely by 40bps	-1452	-0.06
Biggest basis position between 2 curves moves adversely 50bps	-720	-0.03
Biggest basis position between 2 curves moves adversely 100bps	-1404	-0.05

Equity shocks	P&L (in Mn ZAR)	Impact on CET1 ratio (in percentage points)
Directional move down 15%	244	0.01
Directional move down 40%	674	0.03
Directional move up 15%	470	0.02
Directional move up 40%	1886	0.07
Volatility up 50%	54	0.00
Volatility up 100%	298	0.01
Total basis moves adversely by 20%	-35	0.00
Total basis moves adversely by 40%	-88	0.00
Largest two basis strategies move adversely by 30%	-56	0.00
Largest two basis strategies move adversely by 50%	33	0.00

FX shocks	P&L (in Mn ZAR)	Impact on CET1 ratio (in percentage points)
ZAR strengthens against all currencies 30%	-421	-0.02
ZAR strengthens against all currencies 50%	-747	-0.03
ZAR weakens against all currencies 30%	1187	0.05
ZAR weakens against all currencies 50%	1569	0.06
ZARUSD volatility up 20%	-23	0.00
ZARUSD volatility up 50%	-76	0.00
Total basis moves adversely 10%	-9	0.00
Total basis moves adversely 20%	-23	0.00
Largest basis strategy moves adversely 15%	9	0.00
Largest basis strategy moves adversely 30%	17	0.00

Table 6. Sensitivity Analyses—Market Risks on the Trading Book

Commodity shocks	P&L (in Mn ZAR)	Impact on CET1 ratio (in percentage points)
All commodities strengthen 15%	-37	0.00
All commodities strengthen 30%	-73	0.00
All commodities weaken 15%	20	0.00
All commodities weaken 40%	69	0.00
All commodities volatilities up 50%	9	0.00
All commodities volatilities up100%	9	0.00
Total basis moves adversely 15%	-21	0.00
Largest basis strategy moves adversely 30%	-23	0.00

Credit spread shocks	P&L (in Mn ZAR)	Impact on CET1 ratio (in percentage points)
Credit spread up 300 bps for IG	-735	-0.03
Credit spread up 500 bps for IG	-1221	-0.05
Credit spread up 400 bps for sub IG	-270	-0.01
Credit spread up 1000 bps for sub IG	-674	-0.03
Speculative spread up 500 bps for speculative grade	-81	0.00
Speculative spread up 2000 bps for speculative grade	-324	-0.01
Total basis moves adversely 200bps	-252	-0.01
Total basis moves adversely 400bps	-466	-0.02
Largest 2 basis strategies move adversely 300bps	-159	-0.01
Largest 2 basis strategies move adversely 500bps	-213	-0.01

Counterparty risk factors (Mn ZAR)	P&L (in Mn ZAR)	Impact on CET1 ratio (in percentage points)
Largest counterparty exposure fails (assume recovery rate of 55%)	-3124	-0.12
Largest 3 counterparty exposures fail (assume recovery rate of 55%)	-7260	-0.28

Specific risk factors	P&L (in Mn ZAR)	Impact on CET1 ratio (in percentage points)
Top non-SA-gov't issuer fails (assume recovery rate of 40%)	-785	-0.03
Top 3 non-SA gov't issuers fail (assume recovery rate of 40%)	-1968	-0.08

24. **The impact of interest rates change on the banking book is limited in the BU STs.** Overall, banks remain asset sensitive, accumulating ZAR 235 billion of net, cumulative interest sensitive assets over a 6 to 12 month horizon. Sensitivity analysis indicates that a downward parallel move of the interest rate by 200 bps causes the CET1 ratio to fall by only 32 bps, while banks would

benefit from an upward parallel move of rates by 36 bps if the interest rate increases by 200 bps. Due to the structural nature that assets are linked to the prime rate and liabilities are based on JIBAR, banks are subject to basis risks. The CET1 ratio would decline, on average, by 18 bps if the spread narrows by a relatively large amount of 50 bps. Given the current economic outlook, the downside risk on banking book earnings seems to be limited.

Table 7. Sensitivity Analyses—Interest Rate Risks on the Banking Book

Interest rate direction movements	**P&L** (in Mn ZAR)	**Impact on CET1** (in percentage points)
-200 bps	-8273	-0.32
+200 bps	9331	0.36
+300 bps	14000	0.54
+500 bps	24075	0.92

Prime-Jibar basis risk	**P&L** (in Mn ZAR)	**Impact on CET1** (in percentage points)
Narrow by 50 bps	-4667	-0.18
Narrow by 100 bps	-9759	-0.37
Widen by 50 bps	5556	0.21
Widen by 100 bps	10686	0.41

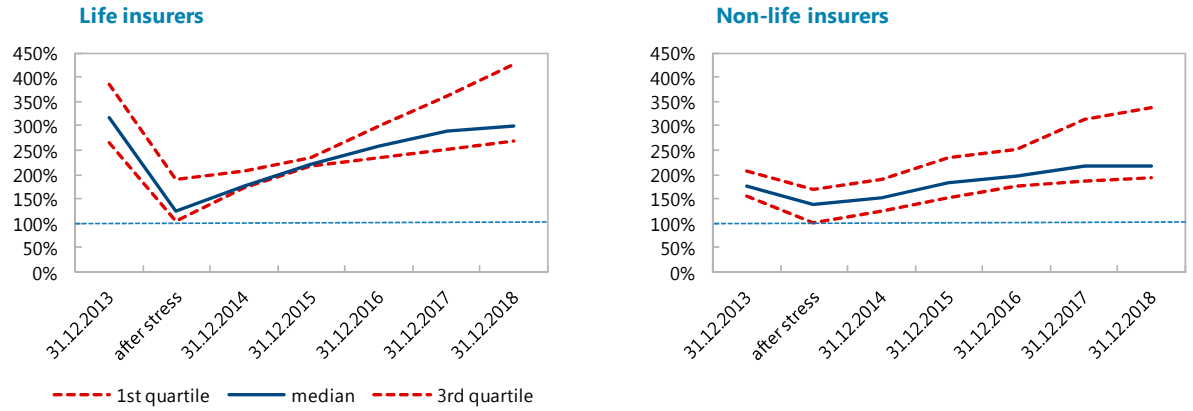
C. Results for the Insurance Sector

25. **The insurance ST showed a substantial impact on the participating life insurers, though on aggregate the sector is able to withstand the shock.** The median CAR coverage ratio declines from 317 percent at end-2013 to 125 percent immediately after the shock, which is assumed to occur at the beginning of 2014 (Figure 6). While one company's CAR coverage drops below 100 percent, the capital shortfall amounts to only ZAR 4 billion, which corresponds to 4 percent of the ST sample's available capital before stress, or 0.1 percent of GDP. By end-2014, the median CAR coverage reverts back to 177 percent, and by end-2018, at the end of the projection horizon, the ratio is expected to stand at 300 percent, though still below pre-stress levels. The recovery is mainly driven by operating profits: the assumption that no new business is underwritten results in a reduction in variable costs (acquisition and set-up costs for new contracts[22]) and an increase in profitability.

[22] South African valuation rules allow for a zeroization of negative rand reserves (NRR). The NRR arises after the inception of an insurance contract when the present value of future premiums and fee income exceeds the value of benefits and expenses. The zeroization translates the build-up of the negative reserve into an accounting loss in the first year after the inception of the contract. If no new business is underwritten as assumed in this ST, this drain on profits is eliminated and net income is higher.

26. **Non-life insurers show an even higher degree of resilience in the stressed scenario, although they start from a lower pre-stress CAR coverage ratio than the life insurers.** This is because their asset allocation is more conservative, which makes them less sensitive to the market risk shocks applied. The median CAR coverage ratio drops from 175 percent at end-2013 to 138 percent immediately after the shock, with one company reporting a CAR coverage ratio below 100 percent. The capital shortfall is, however, limited and amounts to 2 percent of participating non-life companies' available capital before stress. By end-2014, the median CAR coverage ratio is expected to increase to 151 percent, surpassing pre-stress levels already in 2015. By end-2018, the ratio rises to 218 percent.

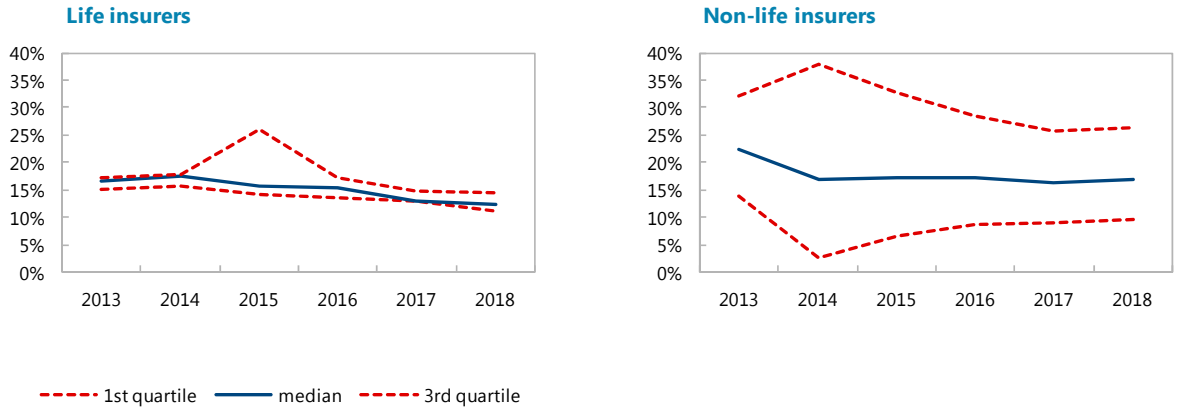
Figure 6. Insurance—CAR Coverage Ratios



Sources: Participating companies and IMF staff calculations.

27. **The cumulative impact on net income is limited** (Figure 7): In 2014, when all stresses are assumed to materialize, the aggregated profit of the five life insurers declines by 58 percent to ZAR 9 billion, after ZAR 21 billion in 2013. However, only one of the five life companies records a loss in 2014, which results in a very skewed distribution of return on equity (RoE) where the median increases slightly from 16.5 percent in 2013 to 17.6 percent in 2014. In the years 2015 to 2018, annual net income of the companies in the sample is expected to fluctuate around ZAR 16 billion, with all five companies reporting positive earnings from 2015 onwards. Non-life insurers would also experience a reduction in their profitability: Aggregated net income declines by 37 percent in 2014 and the median RoE drops from 22.3 percent to 16.8 percent. The range of results across companies, though, is much wider than for life companies.

Figure 7. Insurance—Return on Equity



Sources: Participating companies and IMF staff calculations.

28. **The largest contribution to the deterioration in the life insurers' solvency position comes from the equity shock,** which reduces available capital on average by 28 percent. A second major contributor would be the default of the largest banking counterparty, which results in a reduction in available capital of about 23 percent (Figure 8). However, it should be noted that any second-round effects of a bank default (like contagion effects in the South African banking sector resulting in further defaults), as well as operational disruptions, have not been modeled in this ST, and so the results are likely to be significantly underestimating the overall impact. Finally, the interest rate shock also has a substantial impact by changing the value of both assets and liabilities, which both decline in the scenario of rising interest rates (Table 7).

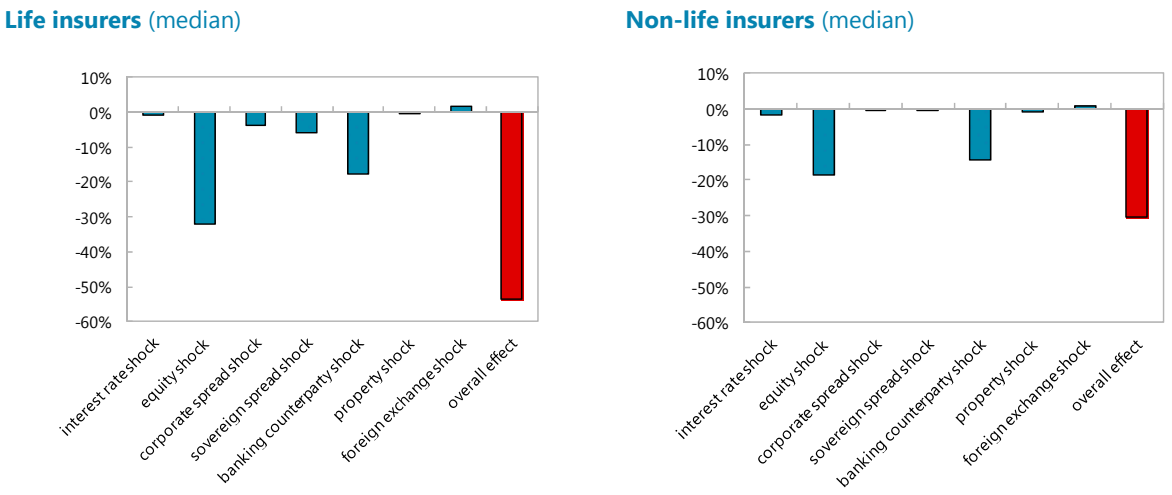
29. **Also for the non-life insurers, the equity shock is the main contributor to the decline in solvency ratios;** available capital would drop by 19 percent on average. The banking default would cause a reduction in available capital of 13 percent. Overall, the scenario affects the non-life sector only via the reduced value in assets and subsequently via lower available capital. The value of liabilities is unchanged as these are not discounted according to statutory rules and are therefore insensitive to interest rate changes. Also, required capital remains constant for non-life insurers because it is not sensitive to the shocks applied in the ST.[23]

30. **The additional sensitivity analysis with regard to catastrophe risks revealed a limited effect as the large non-life companies have wide-ranging reinsurance coverage with foreign reinsurers in place.** On average, solvency ratios decline by only 14 percentage points when assuming a catastrophic loss that is expected to materialize once every 100 years. While South Africa has hardly been harmed at all in the past by large-scale weather-related catastrophes, the main risk, which was used to determine the 1-in-100 year loss, is a strong earthquake in the Johannesburg

[23] Technical provisions in non-life insurance are not discounted under the South African valuation framework which means that companies (and ultimately policyholders) have an additional buffer to withstand shocks.

region; while the probability of such an event is low,[24] the potential claims would be substantial due to high population density and economic activity.

Figure 8. Insurance—Reduction in Available Capital



Sources: Participating companies and IMF staff calculations.

Table 8. Insurance—Effect on available and required capital

In million ZAR

Life	pre-stress	post-stress	change
Assets	1,481	1,015	-31%
Liabilities	1,376	966	-30%
Excess assets	105	48	-54%
Required capital	32	40	25%

Non-Life	pre-stress	post-stress	change
Assets	35	30	-15%
Liabilities	20	20	0%
Excess assets	15	10	-35%
Required capital	9	9	0%

Sources: Participating companies and IMF staff calculations.

31. **Life insurers benefit from the risk-sharing features of the main types of life insurance contracts.** Investment losses in the stress scenario can partially be passed on to policyholders by reducing bonus allocations and smoothening the bonus allocation over time. This practice has been actively used by the large life insurers in the past; it follows a rather automatic mechanism with

[24] The largest seismic event in this region in the recent past was in March 2005. It reached a magnitude of 5.3 and caused only relatively low damage above ground, though more severe damage was recorded in adjacent mines.

limited management discretion, and the mechanism is disclosed to policyholders. Furthermore, South African life insurers have been holding high levels of capital in recent years (also in anticipation of the new solvency regime to be implemented in 2016), which at the time of the ST provides them with a solid buffer. However, a prolonged period of lower or even negative investment returns could diminish this buffer.

D. Aggregating Banking and Insurance Stresses

32. **On a conglomerate level, financial institutions could weather the combined losses from their banking and insurance operations**. The banking operations would be able to withstand severe shocks; the recapitalization need, at 1.6 percent of nominal GDP at the maximum, is manageable, and the capital shortfall for the insurance companies, at 0.1 percent of nominal GDP, is even smaller. Recapitalizing the few insurance companies would be within the capacity of the corresponding conglomerates, owing to the small size of the capital required as compared to the level of aggregate capital in the group.

LIQUIDITY RISK

33. **Banks conduct BU STs using the Basel III framework for liquidity risk measurement and the regulatory standards proposed in BCBS (2013) and BCBS (2014).** The tests cover the results for the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR).[25]

- The LCR measures whether banks have adequate levels of unencumbered, high-quality liquid assets that can be converted into cash to meet their liquidity needs for a 30 calendar day time horizon. The LCR is defined as the ratio between the stock of high-quality assets to the total net cash outflow over the next 30 calendar days. In particular, the liquidity risk stemming from funding withdrawals by related parties was assessed in the LCR by imposing a 100 percent run-off rate.

- The NSFR complements the LCR by testing whether banks hold a minimum acceptable amount of stable funding based on the liquidity characteristics of an institution's assets and liabilities over one year. The ratio is calculated as that between the available amount of stable funding and the required amount of stable funding.

34. **The majority of banks are yet to meet the Basel LCR requirement.** The LCR of five of the six large banks tested was below 100 percent, and for some banks it was below the 60 percent minimum requirement that will become effective from 2015,[26] without using the proposed Committed Liquidity Facility (CLF) of the SARB. Conversations with banks and the authorities

[25] The results are based on SA banking operations as of March 31st, 2014.

[26] The LCR requirements will be effective from 2015 with an initial requirement of 60 percent and an additional 10 percent each year thereafter until it reaches 100 percent.

indicated that the banks have the capacity to meet the 60 percent minimum requirement, mainly through selling tri-party repo assets to acquire more high quality liquid assets (HQLA).

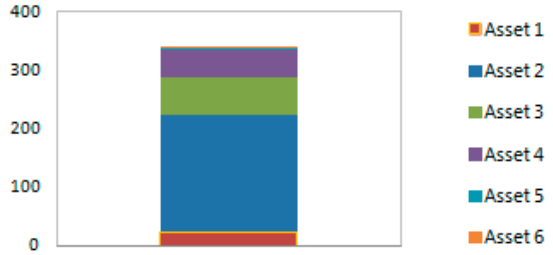
35. **This shortfall results from a dependence on wholesale, short-term funding, and the limited availability of HQLA.** In South Africa, a large chunk (60 percent) of bank deposits is wholesale funding from NBFIs and the corporate sector. Moreover, the average funding maturity has shortened in recent years.[27] Compared with more stable funding sources, wholesale and short-term funding attract much higher run-off rates and thus larger liquidity needs in the LCR test. Regarding the supply of HQLA, South Africa has a limited pool of level 1 assets, and virtually no level 2 assets that satisfy the criteria specified in the BCBS (2013)[28] [29](Figure 9).

36. **The SARB's CLF is necessary in a system with insufficient HQLA.** Given the structural issue of a small retail deposit base and the limited supply of HQLA, SARB introduced the CLF to help banks meet the LCR requirement and, ultimately, liquidity needs under extreme market conditions. Without the CLF arrangement, Figure 9 shows that banks would be experiencing a shortfall in liquidity in less than 20 days, if the level of cash outflow assumed in the stress test were to be realized. The CLF, which provides up to 40 percent of HQLA, would help banks to meet the liquidity shortfall once they have met the initial 60 percent requirement on their own. Banks indicate that they will increase the securitization of home loans to boost the stock of collateral eligible for the CLF.

Figure 9. Bank—Liquidity Stress Test

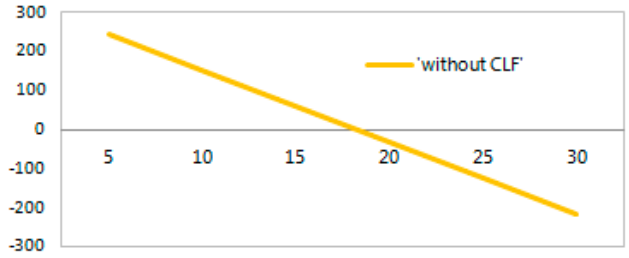
The following composition of HQLA shows that there are virtually no level 2 assets.

Composition of HQLA
(In Zar Bn)



The chart shows that, without using the CLF, banks would experience a liquidity shortage in less than 20 days.

Simulated 30 day cumulative cash flow
(In Zar Bn)



Note, asset 1 to asset 6 on the LHS panel are: coins and bank notes; qualifying marketable securities from sovereigns, central banks, public sector senterprises (PSEs), and multilateral development banks; qualifying central bank reserves; domestic sovereign or central bank debt for nonzero risk-weighted entities; qualifying marketable securities from sovereigns, central banks, PSEs, and multilateral development banks (with 20percent risk weighting); and qualifying corporate debt securities rated AA- or higher.
Sources: SARB supervisory data, bank reported results and IMF staff calculations.

[27] Short-term deposits (6 months in maturity) rose to 63.3 percent of total deposits from 60.3 percent in 2008.

[28] SARB guidance note 5/2012.

[29] For the definition of level 1 and level 2 assets, see BCBS (2013).

37. **Regarding the NSFR, all banks except one would have less than 100 percent coverage.** Banks indicated that they will have difficulty in fully complying with the minimum NSFR, effective from 2018, given the structural small retail deposit base and the difficulty in obtaining long-term funding from the capital markets, partly because it is expensive and funding sourced through the off-shore markets could also introduce FX risks. Banks noted that they may need to reduce the amount of long-term assets to meet the NSFR requirement. Banks could also consider raising the interest rate offered to attract more retail deposits and obtain more funding with maturity beyond one year. Our analysis indicates that the corresponding increase in interest rate payments is affordable given the high profitability of the banking sector.[30]

CONTAGION RISK

38. **The contagion risk from the recent failure of African Bank was limited.** The SARB acted decisively in resolving African Bank and in soothing market jitters when some money market funds with exposure to African Bank "broke the buck"[31] in 2014. Capitec, the other boutique lender, saw only a slight decline in its share price as it was perceived to have a more conservative credit risk policy. Market participants also quickly realized that the Moody's downgrade was not related to the soundness of the large banks but to a reduction in the "too big to fail premium" that had been implicit in the banks' credit ratings.[32] The vulnerability of financial institutions to contagion risk has remained low throughout the African Bank episode (Figure 10)[33].

RECOMMENDATIONS

39. **In terms of next steps, the SARB should continue to develop a TD macro stress testing framework.** A TD ST, to be conducted at least annually, should complement the existing BUs exercises conducted by banks. The scenario should be derived from the macroeconomic baseline projection taking the latest risk assessments into account. More resources should be allocated to the validation of banks' models and assumptions, as a substantial gap in the TD and BU results was found in this assessment**.**

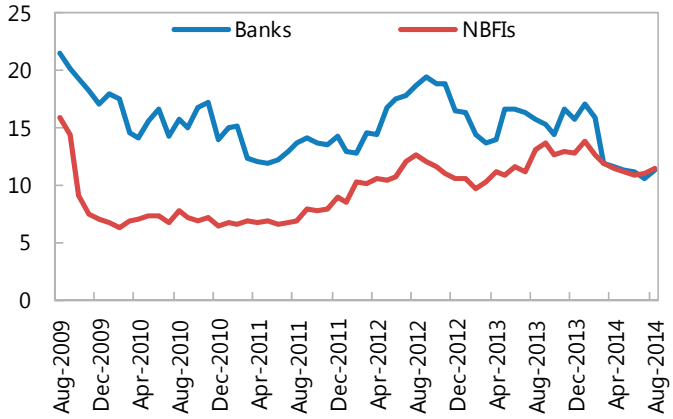
[30] Assuming that banks offer an interest rate of 8.7 percent to attract longer term funding, the additional funding cost would amount to ZAR 10 bn per year, equivalent to 1/6 of banks' after tax profit as of end-2013. Assuming a proportionate reduction in return on equity (ROE), this would imply an ROE of 14 percent. The 8.7 percent rate could be attractive for investors. It is 3 percent higher than the historical average deposit rate of 5.7 percent, based on the historical data from 2010Q1 to 2013Q4. The 3 percent spread is greater than the average spread between the government bond yield and deposit rate of 2.7 percent, based on the same historical sample.

[31] While African Bank's debt accounted for only 1.3 percent of the assets held by the 43 money market funds, at least 10 of these funds "broke the buck," i.e., the losses caused the unit price to fall.

[32] Standard and Poor's ratings do not incorporate an implicit subsidy of government support.

[33] The vulnerability of a financial institution to spillover risks is measured by the conditional probability of its default given the default of another financial institution.

Figure 10. Financial System Spillover Coefficients (In percent)



Sources: Moody's KMV, IMF, Financial Stability Measurement, and IMF Staff calculations.

40. **For the insurance sector, a macroprudential stress testing framework should be developed.** This ST should be:

- ***Severe (but plausible):*** Scenarios should entail a high degree of conservativeness and adequately address the structural specificities of the South African insurance sector, especially the concentrated exposures to domestic banks.

- ***Comprehensive:*** The test should also include risk factors that will not be covered by the standard formula of the forthcoming solvency regime, e.g., sovereign risk.

- ***Forward-looking:*** The test should capture long-term dynamics by using a multi-year projection horizon, and assess the feasibility and effectiveness of various risk-mitigating strategies.

- ***Easy to communicate***: Each scenario should be based on a clear narrative.

41. **The FSB, and in the future the prudential regulator, should establish a stringent monitoring framework for assessing the concentration risk of the insurance sector towards the largest domestic banks.** It should request from insurance companies contingency plans that not only cover financial planning but also measures to address operational risks.

Appendix I. Risk Assessment Matrix (RAM)

	Overall Level of Concern	
	Likelihood of Severe Realization of Threat in the Next 1–3 Years	**Expected Impact on Financial Stability if Threat is Realized**
	(high, medium or low)	***(high, medium or low)***
1. Surge in market volatility and higher-than-expected increases in interest rates	**Staff assessment: High** • South Africa is vulnerable to the shocks as its financial market is large relative to GDP; the rand is widely used as a proxy for EM currency; sovereign yields in South Africa are highly responsive to those in the US; and foreign participation in the domestic bond market is high.	***Staff assessment: High*** • Higher rates would affect households' ability to service debt. While most mortgages are held by high income households, which should have a higher debt service capacity, a sharp rise in interest rates could still hamper their ability to service their debt. The deterioration in household debt quality would have a large impact on bank capital. • Market volatility could cause significant price changes and spillovers across domestic markets. ST results show that banks and insurance companies could withstand large market risk shocks. • A sharp fall in capital inflows would likely entail an abrupt reversal of the current account deficit and a concomitant fall in growth, with implications for financial institutions' asset quality. ST results show that capital ratios of banks remain adequate in the adverse scenarios with lower growth and capital outflows. • Banks themselves do not rely heavily on external funding, but capital inflows, necessitated by the large current account and fiscal deficits, affect the pricing in the domestic funding market. As swings in investor demand could push banks' funding costs higher, the dependence of the large banks on short-term wholesale funding and their active trading in the OTC derivatives market make them susceptible to external shocks and global re-pricing of risk. The flexible exchange rate and limited capital controls may help buffer the economy from volatile capital flows, South Africa's external position remains weaker than implied by desired policies and fundamentals, and reserve coverage remains below most Ems'.
2. Protracted period of slower growth in advanced and emerging economies	***Staff assessment: High*** • External headwinds could trigger a severe recession in South Africa, compounded by lackluster growth in an environment of already persistently high unemployment.	***Staff assessment: Medium*** • Substantially lower output and higher unemployment would hamper debt repayment, particularly on unsecured credits. • ST indicates that the well capitalized banking system would be able to withstand large shocks with manageable recapitalization needs in the most severe scenario. • Weaker fundamentals and structural issues would weigh on the sovereign credit rating, potentially increasing funding costs and credit risks of the financial and non-financial sectors.

	Overall Level of Concern	
	Likelihood of Severe Realization of Threat in the Next 1–3 Years	**Expected Impact on Financial Stability if Threat is Realized**
	(high, medium or low)	***(high, medium or low)***
3. Liquidity shortfall in banking system	***Staff assessment: Medium*** • Banks are dependent on wholesale funding. • Banks' reliance on short-term deposits, which already exceed 60 percent of total deposits, appears to be increasing.	***Staff assessment: Medium/High*** • Five out of the six banks maintain LCR and NSFR lower than 100 percent. Some banks are yet to meet the minimum 60 percent target (effective 2015). • The SARB's CLF and banks' strong capitalization, which would reduce run risks in the system, should limit the impact.
4. Stress in certain financial institutions spilling over to others in the financial system	***Staff assessment: Medium*** • The financial sector has a high degree of interconnectedness. All major banks belong to financial conglomerates that own banks and NBFIs, or own shares in NBFIs, which provide funding to banks. • Risk could accumulate due to the lack of a robust group-wide supervisory approach to conglomerate supervision.	***Staff assessment: High*** • The large amount of funding provided by NBFIs to banks, and the highly concentrated and interconnected market structures of banks and NBFIs mean that an idiosyncratic shock in one sector could be easily translated into another, becoming systemic. • Funding withdrawals by a stressed NBFI are likely to cause a significant liquidity shortage in banks (linked to risk no.3) while the default of a large bank would cause substantial losses to NBFIs. • ST shows that failure of banks' five largest financial borrowers of banks has a large impact, causing the CET1 ratio to decline by 1.9 percentage points.
5. Losses due to cross-border expansions	***Staff assessment: Medium*** • Claims of South Africa banks on Sub-Saharan Africa have tripled over the last five years. • Incomplete cross-border supervision leaves gaps in risk management.	***Staff assessment: Medium/Low*** • The significant presence of South African banks in neighboring countries means they could have spillovers to, and spillbacks from, Sub-Saharan Africa, although the combined African exposure accounts for only 2 percent of banking assets. • Bank supervision and compliance with AML/CFT rules are typically weak in African countries, where less developed infrastructure adds to the cost of doing business. • BU STs cover banks' foreign exposures. Banks' overall capital adequacy position remains solid under large adverse shocks.

Appendix II. Macro-financial Scenarios

Appendix Table 1. Main Variables

	Historical	Baseline					Adverse					Severely adverse				
	2013	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Policy interest rate (REPO) (in percent)	5.0	5.8	6.6	7.0	7.0	7.0	5.9	7.4	7.6	7.4	7.5	6.1	8.2	8.5	7.5	7.3
Government 10y bond yield (in percent)	7.7	8.5	8.4	8.4	8.4	8.4	8.8	10.0	10.2	9.8	9.4	9.0	11.2	11.7	10.6	9.7
Credit spread (in percent)	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.9	1.4	1.6	1.9	0.6	1.3	2.0	2.5	2.8
GDP growth (in percent)	1.9	2.4	2.7	3.2	3.5	3.2	2.0	-1.8	-0.6	1.6	2.7	1.9	-3.9	-3.9	-1.0	2.1
Property price growth (in percent)	10.0	7.2	4.5	4.6	5.8	5.5	7.3	5.0	1.3	0.6	0.0	7.2	5.3	-0.3	-2.9	-3.7
Inflation (in percent)	5.7	5.9	5.6	5.4	5.4	5.3	6.0	7.3	5.6	4.7	5.1	6.0	8.4	6.2	4.2	4.5
Household debt to income ratio (in percent)	76.9	76.8	74.6	72.5	70.1	68.2	77.0	76.7	77.2	77.1	76.2	77.2	77.8	80.3	82.7	83.0
Government debt to GDP ratio (in percent)	46.1	44.5	44.9	45.7	46.6	47.8	44.6	46.8	50.5	54.1	57.1	44.8	48.1	54.2	60.6	64.7
Official unemployment rate (in percent)	24.7	24.6	24.5	24.2	23.8	23.4	24.6	24.9	25.5	25.6	25.3	24.6	25.2	26.3	26.8	26.7
Domestic credit extension (in percent)	7.6	6.3	4.5	5.7	6.6	6.4	6.3	2.4	-0.9	-0.5	0.7	6.2	1.2	-4.8	-5.7	-3.2
M3 money supply growth (in percent)	7.6	7.5	9.1	8.3	8.5	8.7	7.4	7.4	5.3	5.6	6.8	7.2	6.5	3.4	2.9	5.2
NEER change (in percent)	-13.9	-11.4	-1.8	-3.4	-3.8	-3.5	-17.9	-12.5	1.9	-0.9	-4.3	-20.0	-19.0	2.8	0.6	-4.4
Rand/ US Dollar exchange rate	9.7	10.6	10.6	11.0	11.3	11.5	11.4	13.0	12.7	12.8	13.2	11.8	14.5	14.1	13.9	14.4
Commodity prices change (in percent)	-8.1	-3.1	3.8	3.0	3.0	3.0	-14.4	-9.8	3.0	3.4	4.9	-19.3	-16.1	3.0	3.4	4.9
Stock market index change (in percent)	19.0	9.0	0.8	2.3	1.9	2.0	6.2	-19.0	-14.6	-1.9	2.5	4.6	-25.3	-25.3	-14.7	-6.0
Crude oil price (US$/bl)	108.0	105.2	105.2	105.2	105.2	105.2	93.0	79.0	79.0	81.5	85.6	87.4	66.8	66.8	68.8	72.3
World GDP growth (in percent)	2.4	3.1	3.4	3.5	3.5	3.5	2.4	-1.9	0.0	2.8	3.5	2.2	-3.5	-2.2	-0.3	0.7
China GDP growth (in percent)	7.7	7.4	7.3	7.6	8.0	7.6	6.9	2.3	1.4	5.5	7.1	6.9	1.2	-1.0	1.9	3.4
Emerging Asia GDP growth (in percent)	4.2	5.1	5.2	5.5	5.1	5.1	4.6	0.3	-0.5	2.6	4.6	4.6	-0.8	-2.8	-0.8	1.0
Europe GDP growth (in percent)	-0.4	1.3	1.6	1.8	1.8	1.7	0.8	-4.1	-5.3	-1.2	1.1	0.7	-5.4	-8.1	-5.2	-3.2
Japan GDP growth (in percent)	1.5	1.3	1.2	0.9	1.6	1.5	1.1	-1.2	-2.0	0.5	1.3	1.1	-1.7	-3.1	-1.2	-0.4
Latin America GDP growth (in percent)	2.3	2.4	3.3	3.8	3.5	3.4	2.3	2.2	2.5	3.0	3.3	2.3	2.0	2.0	2.2	2.6
USA GDP growth (in percent)	1.9	2.6	3.0	3.2	2.9	2.5	2.3	-0.5	-1.1	1.2	2.2	2.2	-1.2	-2.8	-1.3	-0.4
Rest of Countries GDP growth (in percent)	2.0	2.1	2.4	2.8	3.2	3.0	2.0	1.2	1.4	2.6	2.9	2.0	1.0	0.9	1.8	2.1

Appendix Table 2. Global market shocks – interest rate directional shock

	Maturity				
(in bps)	1Y	3Y	5Y	7Y	10Y
ZAR interest rate directional risk					
Government securities	210	213	215	218	220
Corporate bonds	290	290	290	290	290
Swap / discounting curve	250	251	253	254	255
Other	290	290	290	290	290
Directional risk of interest rates in other currencies					
USD	-13	-29	-45	-51	-54
EUR	1	-2	-3	-3	-1
GBP	-11	-19	-24	-26	-26
AUD	3	4	4	4	6
CAD	-45	-45	-49	-49	-45
CHF	0	-1	-1	0	4
CNY	22	-12	-41	-47	-59
JPY	1	-1	-4	-6	-9
BRL	288	291	22	22	22

Appendix Table 3. Global market shocks – interest rate volatilities shock

(in percent)		USD		EUR		GBP		Other	
		Maturity							
		1M	10Y	1M	10Y	1M	10Y	1M	10Y
	1Y	132	87	85	35	119	42	120	50
Expiry	5Y	41	44	17	12	21	4	30	30
	10Y	26	33	5	11	-4	-3	10	5

Appendix Table 4. Global market shocks – cross-currency basis shocks

	Maturity				
	1Y	3Y	5Y	7Y	10Y
Curve moves relative to the base curve in ZAR (in bps)					
USD	-383	-268	-223	-202	-189
EUR	-144	-116	-104	-99	-93
GBP	-245	-183	-160	-151	-140
AUD	-168	-118	-97	-92	-88
CAD	-316	-235	-203	-184	-165
CHF	-165	-119	-98	-89	-80
CNY	-134	-112	-126	-131	-143
JPY	-144	-117	-111	-110	-112

Appendix Table 5. Global market shocks – exchange rate directional shocks

Currency 1	Currency 2		Currency 1	Currency 2	
(currency 1 / currency 2, in percent)					
ZAR	USD	22	INR	USD	5
USD	EUR	7	JPY	USD	-12
USD	GBP	-7	KRW	USD	18
AUD	USD	0	NGN	USD	-5
BRL	USD	-6	PLN	USD	-13
CAN	USD	-1	RON	USD	3
CHF	USD	-10	RUB	USD	-3
CNY	USD	-9	SGD	USD	-6
HKD	USD	0	TRY	USD	0
IDR	USD	6			

Appendix Table 6. Global market shocks – exchange rate volatilities shocks

Currency 1	Currency 2	Maturity	
		1Y	10Y
(currency 1/currency 2, in percent)			
ZAR	USD	43	30
USD	EUR	78	26
USD	GBP	65	46
CAN	USD	59	32
CNY	USD	137	50
CHF	USD	68	48
JPY	USD	52	28
Others	USD	80	40

Appendix Table 7. Global market shocks – commodity shocks

(In percent)	Level	Volatility
Brent crude future	-23	111
Other engergy	-23	100
Gold Spot	25	75
Silver Spot	12	90
Platinum spot	21	174
Other previous metal spot	20	80
Palladium spot	-1	164
LME copper 3M	-3	30
Other basic metal spot	-10	50
Agricultural	-10	50

Appendix Table 8. Global market shocks – equity shocks

	Level	Volatility		Level	Volatility
(in percent)					
US	-16	130	Australia	-19	99
Canada	-6	137	Hong Kong	-12	62
Austria	-34	127	Japan	-29	113
Belgium	-39	122	New Zealand	-28	98
Denmark	-16	97	Singapore	-21	46
Finland	-23	88	Korea	-10	62
France	-24	114	Taiwan	-19	65
Germany	-20	109	China	-12	70
Greece	-29	133	India	-8	91
Ireland	-46	131	Indonesia	1	69
Italy	-30	124	Malaysia	-13	32
Netherlands	-25	135	Philippines	-26	21
Norway	-21	120	Sri Lanka	-28	56
Portugal	-30	130	Thailand	-9	63
Spain	-19	132	Other EM Asia	-12	67
Sweden	-30	90	Argentina	-12	114
Switzerland	-23	110	Brazil	3	75
UK	-17	104	Chile	-9	54
Czech Republic	-8	118	Mexico	-14	53
Hungary	-27	110	Peru	-2	63
Poland	-29	50	Venezuela	-16	-68
Turkey	-23	45	Egypt	7	86
Other EM Europe	-16	114	Morocco	20	16
Israel	-8	90	South Africa	-25	80
Jordan	13	151	Other Africa	-1	10
Pakistan	-10	24	Others	-10	100

Appendix Table 9. Global market shocks – sovereign credit spread shocks

(in percent)			
South Africa	435	US	155
Other Africa	435	Canada	155
Greece	860	Japan	140
Portugal	571	Korea	566
Italy	562	Singapore	458
Spain	616	India	287
Germany	258	Indonesia	176
France	454	Malaysia	478
UK	294	Other Asia	393
Other advanced Europe	356	Argentina	352
Russia	344	Brazil	110
Ukrain	377	Mexico	255
Turkey	86	Chile	457
Other EM Europe	459	Peru	104
Qatar	512	Other Latin America	256
Other Middle East	512	Others	500

Appendix Table 10. Global market shocks – corporate credit spread shocks

	IG	HY	Not-rated
(in percent)			
Advanced	346	642	494
Emerging	434	297	365

Appendix III. Stress Test Matrix (STeM) for the Banking Sector

Domain		Assumptions	
		Bottom-up by banks	**Top-down by FSAP Team**
Banking Sector: Solvency Risk			
1. Institutional Perimeter	Institutions included	• Six banks.	• Four banks.
	Market share	• 93.9 percent of the total assets in the banking system.	• 85.7 percent of the total assets in the banking system.
	Data and baseline date	• Bank proprietary data. • Baseline date: end-Dec 2013. • Bank solo; foreign and local operations.	• Supervisory data and public information. • Baseline date: end-Dec 2013. • Bank solo; local operations.
2. Channels of Risk Propagation	Methodology	• Banks' internal models. • Guidelines issued by the FSAP team.	• Balance sheet approach.
	Satellite models for macro-financial linkages	• Satellite models for credit risk measures, income and expense items, and balance sheet growth.	• FSAP team estimated models for credit risk measures.
	ST horizon	• 3-year (2014-2016).	• 5- year (2014-2018).
3. Tail shocks	**Scenario analysis** • Macro scenarios include baseline, adverse, and severely adverse scenarios for both TD and BU STs to analyze impacts on the banking book and the trading book. • Baseline scenario: modest GDP growth, persistent high unemployment level and the gradual upward normalization of interest rates. The baseline projections are aligned with the IMF's economic projections for South Africa as of April 2014. In August 2014, the projections for GDP growth rates in 2014 and 2015 were adjusted to 1.4 and 2.3 percent, respectively. • Adverse scenario: mild decline in GDP growth because of a disorderly exit from unconventional monetary policy by the advanced economies, resulting in capital outflows, increased market volatility and higher-than-expected increases in interest rates. It assumes GDP growth declines to -1.8 percent in the first year, recovering afterwards and turning positive in 2017. The first year shock corresponds to the 2.5 percent left tail of the historical distribution. • Severely adverse scenario: a "perfect storm," where GDP falls sharply due to the confluence of several negative factors including a recession in advanced economies; large capital outflows; and substantially higher domestic interest rates. In terms of the GDP path, the scenario would be equivalent to a cumulative eight standard deviation event from the baseline. It assumes three years of negative growth (-3.9, -3.9 and -1 percent from 2015 to 2017, respectively). The "-3.9" percent growth corresponds to the 0.25 percent left tail of the historical distribution. For the BU STs, an additional set of market shocks applies in 2015 in the severely adverse scenario following the US CCAR methodology. These shocks are calibrated to be consistent with those observed in 2008. • Macro-financial variables include real GDP growth, repo rate, 10y government bond yield, inflation, unemployment, credit spread between the effective lending rate and prime rate, household debt to GDP ratio, government debt to GDP ratio, domestic credit extension growth, M3 money supply growth, property price growth, stock market index, nominal effective exchange rate, rand/USD effective exchange rate, real GDP growth for key trading partners and regions, oil prices, and commodity prices. • A caveat is that the evolution of the macro variables in the five-year scenarios is pre-determined and no second round effects are considered.		

	Sensitivity analysis
	• Sensitivity analyses are conducted in the BU STs.
	• Credit risk on the banking book is analyzed using single-factor and multi-factor shocks including:
	  • Failure of five largest non-financial or financial borrowers.
	  • Interest rate shocks affecting floating-rate mortgages and unsecured credit.
	• Market risk in the banking book is analyzed, assuming:
	  • Upward parallel moves in rates by 200, 300, and 500 bps, and downward move by 200 bps.
	  • A widening and narrowing of the Prime- JIBAR spread of 50 and 100 bps.
	• The trading book and fair valued banking book, including equity, commodity, interest rate, exchange rate, and credit risk sensitive exposures, are tested using additional single-factor shocks, including:
	  • A widening and narrowing of interest rates of 300 and 500 bps.
	  • A widening of credit spreads of 300 and 500 bps for investment grade, 400 and 1000 bps for sub-investment grade, and 500 and 2000 bps for speculative grade.
	  • A depreciation or appreciation of the Rand against all currencies by 30 and 50 percent.
	  • A strengthening of commodity prices by 15 and 30 percent as well as a weakening by 15 and 40 percent.
	  • Volatility in interest rates: increases of 50 and 100 percent.
	  • Volatility in equity prices: increases of 50 and 100 percent.
	  • Volatility in the rand/U.S. dollar exchange rate: increases of 20 and 50 percent.
	  • Volatility in commodity prices: increases of 50 and 100 percent.
	  • Adverse movements of curves to examine the impact of basis risk owing to approximate hedging strategies. The curves movements assumed are:
	  • Total basis of interest rates curve: move adversely by 20 and 40 bps.
	  • Total basis of equity price: move adversely by 20 and 40 percent.
	  • Total basis of exchange rates: move adversely by 10 and 20 percent.
	  • Total basis of commodity prices: move adversely by 15 percent.
	  • Total basis of credit spreads: move adversely by 200 and 400 bps.
	  • Largest basis position between two interest rates curves moves adversely by 50 and 100 bps.
	  • Largest basis strategy in equity positions moves adversely by 30 and 50 percent.
	  • Largest basis strategy in currency moves adversely by 15 and 30 percent.
	  • Largest basis strategy in commodities moves adversely by 30 percent.
	  • Largest basis strategy in credit risk sensitive instruments moves adversely by 300 and 500 bps.
	  • Largest counterparty exposure fails (assume a recovery rate of 55 percent).
	  • Largest three counterparty exposures fail (assume recovery rates of 55 percent).
	  • Top non-SA-government issuer fails (assume a recovery rate of 40 percent).
	  • Top three non-SA-government issuers fail (assume recovery rates of 40 percent).		

4. Risks and Buffers	Risks/factors assessed (How each element is derived, assumptions).	• Credit risk on the banking book and trading book. • Market risk on the banking book and trading book due to adverse movements in interest rates, exchange rates, equity prices and sustained declines in commodity prices. To adequately assess trading losses, credit value adjustment and incremental	• Credit risk on the banking book.

		default risk are considered.	
	Behavioral adjustments	• The relative proportion of the balance sheet items and trading positions will remain the same under all macro-financial scenarios. • The growth of the balance sheet will depend on banks' capital adequacy ratios and the nominal GDP growth rate, following a rule specified by the FSAP team. • The dividend payout will depend on the banks' buffer over the minimum capital requirements, following a rule specified by the FSAP team.	
5. Regulatory and Market-Based Standards and Parameters	Calibration of risk parameters	• Banks use internal models to estimate PDs, LGDs and RWAs.	• PDs are estimated using satellite models. • Downturn LGDs are assumed. • Regulatory RWAs are calculated using the Basel II formula; actual RWAs are assumed to grow at the same rate as the regulatory RWAs.
	Regulatory/Accounting and Market-Based Standards	• Capital metrics: Basel III and SA regulatory requirements. • Common equity tier one capital.	
6. Reporting Format for Results	Output presentation	• System-wide capital ratio and capital shortfall. • Number of banks[34] in the system that fall below certain ratios.	

Banking Sector: Liquidity Risk (Bottom-up only)		
1. Institutional Perimeter	Institutions included	• Six banks.
	Market share	• 93.9 percent of total banking assets in the system.
	Data and baseline date	• Bank proprietary data. • Positions as of March 31, 2014.
2. Channels of Risk Propagation	Methodology	• LCR. • NSFR.
3. Risks and Buffers	Risks Buffers	• Risks: funding liquidity risk and market liquidity risk. • Buffers: SARB's provision of committed liquidity facility.
4. Tail shocks	Size of the shock	• LCR: adjustment factors as specified in the Basel Committee on Banking Supervision (BCBS) (2013); which are consistent with stressed funding conditions.
5. Regulatory and Market-Based Standards and Parameters	Regulatory standards	• LCR and NSFR.
6. Reporting Format for Results	Output presentation	• The number of banks that fall within certain ratios.

[34] We prefer not to disclose the distribution by size since it may reveal bank specific information given the small number of banks included in the ST.

Appendix IV. Stress Test Matrix (STeM) for the Insurance Sector

Domain		Assumptions Bottom-Up by Insurance Corporations
Insurance Sector: Solvency Risk		
1.Institutional Perimeter	Institutions included	• Life: Old Mutual, Sanlam, MMI, Liberty, Discovery. • Non-Life: Santam, Mutual&Federal, Hollard, Outsurance.
	Market share	• Life: 70 percent (assets). • Non-Life: 50 percent (premiums).
	Data and baseline date	• Companies' own data. • Reference date: 31/12/2013. • Solo-entity basis.
2. Channels of Risk Propagation	Methodology	• Companies' internal models.
	Valuation	• Statutory values of assets and liabilities.
	Stress test horizon	• Instantaneous shocks at reference date, followed by baseline projections for 5 years (2014-2018). • Instantaneous shocks in sensitivity analyses.
3. Tail shocks	Scenario analysis	• Adverse scenario: severe decline in asset prices and increasing interest rates (assuming that policy rates would be raised to prevent capital flights).
	Sensitivity analysis	• Sudden decline in interest rates. • Catastrophic event.
4.Risks and Buffers	Risks/factors assessed	• Interest rates, equity, property, FX, credit spreads, default of largest banking counterparty. • Summation of risks within scenarios, no diversification effects.
	Buffers	• Absorption effect of technical provisions (profit sharing).
	Behavioral adjustments	• Management actions are discretionary, but in the case of discretionary participation products, limited to disclosed rules in place at the reference date.

5. Regulatory and Market-Based Standards and Parameters	Calibration of risk parameters	• Interest rates: +50 percent parallel shift.
		• Equity: -50 percent for ordinary shares (-30 percent for fixed-rate preference shares, -10 percent for variable-rate preference shares).
		• Real estate: -30 percent.
		• FX: 30 percent depreciation of ZAR.
		• Corporate spreads: +173bp for investment grade in advanced economies, +321bp for non-investment grade in advanced economies, +217bp for investment grade in emerging economies, +148bp for non-investment grade in emerging economies.
		• Sovereign spreads: +262bp for South African government bonds.
		• Default of largest banking counterparty: 45 percent LGD on obligations, -100 percent for equity exposures.
		• Sensitivity analyses:
		  ◦ Interest rates: -35 percent parallel shift.
		  ◦ Catastrophe: 1-in100 years probable maximum loss, followed by a default of the largest reinsurer (45 percent LGD).

	Regulatory/Accounting and Market-Based Standards	• Statutory solvency regime (CAR).
6. Reporting Format for Results	Output presentation	• Impact on solvency ratios (CAR coverage ratios). • Capital shortfall for companies falling below 100 percent CAR coverage ratio. • Impact on net income. • Contribution of individual shocks. • Dispersion measures of solvency ratios and net income.