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TECHNICAL NOTE—STRESS TESTING THE BANKING SYSTEM

September 2014

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SWITZERLAND

FINANCIAL SECTOR ASSESSMENT PROGRAM

September 2014

TECHNICAL NOTE

STRESS TESTING THE BANKING 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 Switzerland. It contains technical analysis and detailed information underpinning the FSAP's findings and recommendations.

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GLOSSARY

BBA	Building Block Analysis
BCBS	Basel Committee on Banking Supervision
BU	Bottom-up (stress test)
CET1	Common Equity Tier 1 capital
CoCos	Contingent convertible capital instruments
FINMA	Swiss Financial Market Supervisory Authority
FSAP	Financial Sector Assessment Program
GRAM	Global Risk Assessment Matrix
GSIFI	Global Systemic Financial Institution
HQLA	High-Quality Liquid Assets
IMF	International Monetary Fund
LCR	Liquidity Coverage Ratio
LGD	Loss-Given-Default
LPA	Loss Potential Analysis
PD	Probability of Default
RAM	Risk Assessment Matrix
RMBS	Residential Mortgage-Backed Securities
RWA	Risk-Weighted Assets
SNB	Swiss National Bank
TD	Top-down (stress test)

EXECUTIVE SUMMARY[1]

This note summarizes the stress tests undertaken for the Swiss banking system as part of the 2013 Financial Sector Assessment Program (FSAP) Update. The objective of this exercise was to assess the resilience of the banking system to major macroeconomic shocks and sources of risk. The stress tests were conducted in collaboration with the Swiss Financial Market Supervisory Authority (FINMA) and the Swiss National Bank (SNB). These banking sector stress tests complement other approaches, such as the analysis of financial systemic risk and spillover analysis and the assessment of the quality of banking sector supervision.

The stress tests focused on the banking system and covered almost the entire banking system. Top-down stress tests conducted by the IMF FSAP team included 30 representative banks (representing around 83 percent of total banking sector assets, measured according to the parent company view), whilst the stress tests conducted by the authorities (both SNB and FINMA) aimed at including the banking sector in its entirety.[2] Depending on the stress testing framework used, some banks were excluded from specific sections of the analysis owing to non-availability of (adequate) data. These top-down stress tests were complemented by FINMA's Loss Potential Analysis (LPA) framework for the two large banks, which is a bottom-up stress test based on bank analysis, not identical to the banks' internal stress tests.

Systemic banks should continue the front-loaded build-up in capital buffers, which has contributed to their resilience to shocks. Stress tests results for the two large systemic banks are sensitive to the definition of capital used. Using CET1 capital with transition (i.e., allowing for the phase-in transition period embedded in Basel III rules), the systemic banks' capital ratios comfortably exceed capital requirements and commonly used hurdle rates, with large remaining capital buffers, under all three adverse scenarios. However, stress tests conducted using "fully loaded" CET1 capital (2019 definition of capital under Basel III) as a starting point, suggest that the capital ratios of systemic banks could fall around the 7 percent threshold under our most severe macroeconomic scenario.[3] From a transitional capital view perspective, a CET1 ratio of 7 percent is considered a trigger level for recovery measures. As such, it is also used as the trigger level for high-trigger CoCos. These findings are fairly robust, with the top-down and bottom-up stress test results broadly aligned. Overall, and considering the severity of the tests conducted, these results suggest that systemic banks are well placed vis-à-vis the introduction of Basel III. However, these banks should continue decisively with their capital build-up plans, as expected by Swiss authorities, to enhance their resilience in the event that downside risks materialize during the transition period.

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[1] This Technical Note was prepared by Carlos Caceres (MCM) and Fabian Lipinsky (WHD).

[2] SNB's approaches on the large and domestically oriented banks (mostly cantonal, regional and savings banks) were applied to a sample of more than 100 banks. The sample covers close to 95 percent of domestic credit assets.

[3] No management actions are included in the stress tests.

Stress tests results suggest that banks in the other banking categories covered in the sample are well capitalized. Due to legal constraints, crucial balance sheet supervisory data on a bank-by-bank basis for cantonal, regional, Raiffeisen, foreign-controlled, and a few small banks specializing in asset management and securities, were not made available to the FSAP team. Owing to the lack of a bank-by-bank supervisory data, the FSAP team's top-down stress tests had to rely on publicly available data, raising issues of data quality, consistency and comparability. Notwithstanding these limitations, and relying on broad assumptions based on aggregate and partial information, which might conceal important vulnerabilities, stress tests show that capital ratios remain broadly adequate for most banks under all scenarios. This is consistent with the authorities' stress test results. Nevertheless, bank-specific losses related to the natural concentration risk (e.g., , geographical, sectoral, etc.) to which cantonal and regional banks are exposed could be underestimated using these aggregate data. Indeed, analysis conducted by the authorities suggests that cantonal and regional bank potential losses are mostly concentrated in the real estate market.

The banking sector seems to benefit from sufficient liquidity, with almost all banks satisfying the LCR requirement in Swiss Francs. The vast majority of banks exceed the 100 percent mark for the LCR, which is in large part due to the unusually high amount of deposits in the central bank. Over the medium term, once accommodative monetary policies are reversed, banks would need to substitute these central bank reserves with other sources of high quality liquid assets (HQLA) or reduce net outflows. Liquidity prudential norms would need to take into account the limited supply of Swiss franc-denominated level 1 liquid assets (Swiss government bonds).[4] Furthermore, some small banks have foreign currency-denominated outflows (mainly in EUR and USD) within the next 30 days, but have no HQLA in the corresponding currency. Average LCRs in euros and U.S. dollars remain fairly low, with several small banks presenting euros or U.S. dollar-denominated outflows (over the next 30 days), whilst essentially having "zero" HQLA in those currencies. Nevertheless, the average LCRs in euros and U.S. dollars without inflow cap are around 109 percent and 88 percent, respectively. This suggests that the market as a whole is sufficiently liquid, but smaller banks cover their outflows with inflows (also from deposits at larger banks) instead of HQLA.

This note is structured as follows: Section I presents a brief description of the Swiss banking sector; Section II describes the solvency stress test, including coverage, main risks and macroeconomic scenarios, and the methodological features and assumptions used in this stress test; Section III describes the liquidity stress test; and Section IV concludes.

[4] Banks reserves at the central bank currently stand at around CHF 320 billion, whilst the outstanding amount of Swiss government bond is roughly CHF 120 billion (of which, 50 billion is held by the banks, and 50 billion by insurance companies).

INTRODUCTION

1. The Swiss banking sector is diverse, but with close to 55 percent of total assets concentrated within the large two banks. As of June 2013, there were almost 300 licensed banks reported to be operating in Switzerland. These include two global systemically important financial institutions (GSIFIs), UBS, and Credit Suisse, whose combined assets of around CHF 2 trillion,[5] cantonal banks, Raiffeisen banks, regional and savings banks, private banks, and banks specializing in securities and asset management, among others. In spite of their relatively small size compared to the two large banks, some cantonal and regional banks are still large compared to the size of the Swiss economy. Indeed, the combined assets of the last five cantonal banks are equivalent to roughly half of Switzerland's GDP, whilst Raiffeisen banks' assets represent about a quarter of the latter.

2. This note focuses on the sample of banks on which the different stress tests were conducted. Depending on the stress test framework, the overall coverage represents almost the entire banking system. The IMF FSAP team's stress tests focused on a representative sample of 30 banks (about 85 percent of the system's total assets). The sample selection aimed at capturing 70 percent of assets in each of the bank categories defined in the monetary statistics of the SNB.[6] Some banks were excluded from specific components of the stress test owing to lack of data. Stress tests conducted by the authorities aimed at capturing almost the whole banking system. However, stress tests were not conducted on the branches of foreign banks. These represent only a relatively small share of the financial sector in Switzerland, and are not directly under the supervision of the Swiss authorities.

BANK SOLVENCY STRESS TESTS

A. Macroeconomic Scenarios and Stress Test Approaches

3. The tests simulated the impact of three different adverse macroeconomic scenarios, as well as baseline conditions on Swiss banks. Three adverse scenarios were considered in the banking sector stress test (Figure 1, Box 1, and Appendix 1):

- A re-intensification of stress in the euro area periphery, accompanied by a resumption of 'safe haven' inflows to Switzerland, leading to a reassessment of the existing exchange rate floor; output growth in Switzerland falls owing to the appreciation of the Swiss franc, and weakened demand from the euro area.

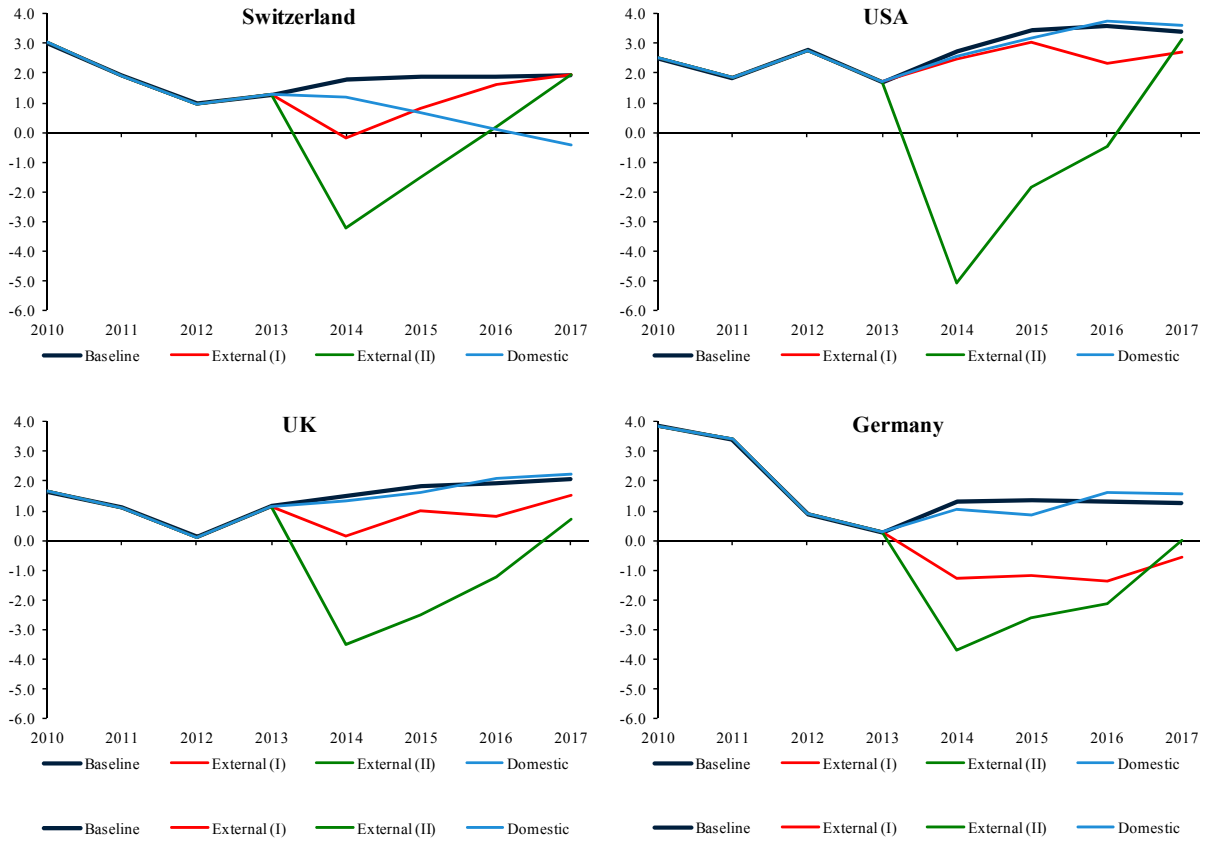
[5] The size of the balance sheet of these two banks used for stress test purposes is based on consolidated accounts. Considering their domestic assets only, these two banks still represent roughly half of the Swiss domestic banking sector assets.

[6] These include: "large banks"; "cantonal banks"; "regional, savings and Raiffeisen banks"; "banks specialized in securities and asset management"; "foreign-controlled banks"; "private banks"; and "other banking institutions."

- A severe global recession, triggered by the disorderly unwinding of unconventional monetary policies, leading to broad-based correction in asset price valuations, simultaneously affecting global financial markets and the global economy. Real GDP growth falls sharply owing to Switzerland's linkages to the rest of the world.

- A correction in the domestic real estate market, emulating the conditions observed during the residential house price correction throughout the early 1990s.

Figure 1. Switzerland: Real GDP Projections for Switzerland and Selected Countries
(Percent change over the previous year)



Source: IMF staff calculations.

Box 1. Macroeconomic Scenarios for the Stress Tests of the Banking Sector

The banking sector stress tests involved four different scenarios: a baseline scenario (based on recent Article IV projections), and three alternative "stress" scenarios:

"External (I)" is a stress scenario that assumes an intensification of stress in the euro area periphery, whilst the core euro area countries continue to "muddle through."[7] Switzerland is seen as a safe haven, and capital inflows have intensified. The SNB 'recalibrates' the exchange rate floor level and allows the exchange rate to 'overshoot' (reaching parity to the euro in 2014) before returning to the current levels toward the end of the stress test horizon.

"External (II)" is a scenario in which there is a severe global shock. The latter might be caused by the disorderly unwinding of unconventional monetary policies.[8] The mispricing of risk assets translates into a broad-based correction in valuations. The global economy is adversely affected in tandem with global financial markets. Real GDP growth falls sharply owing to Switzerland's (real and financial) linkages to the rest of the world.[9]

Finally, "Domestic" is a scenario in which there is a significant correction in residential house prices, of a similar magnitude to that seen throughout the 1990s, potentially triggered by a rise in real interest rates.[10]

The behavior of different macroeconomic variables was quantified using historical trends and empirical relationships, and based on satellite models. In scenarios "External (I) and (II)," real GDP growth and exchange rate assumptions are the main drivers of all other variables in the projections. In scenario "Domestic," the assumed path for house prices and exchange rate behavior are the main drivers, whilst other variables in the projections react to these two variables. These scenarios were fine-tuned based on discussions with the authorities.

Projections for global macroeconomic variables, including those of Switzerland's main trading and financial partners, were constructed by the IMF's Research Department (RES), using their own modelware. These global scenarios are consistent with the adverse macro-scenarios presented in the World Economic Outlook (WEO), and were scaled using the projections for the Swiss domestic macroeconomic variables.

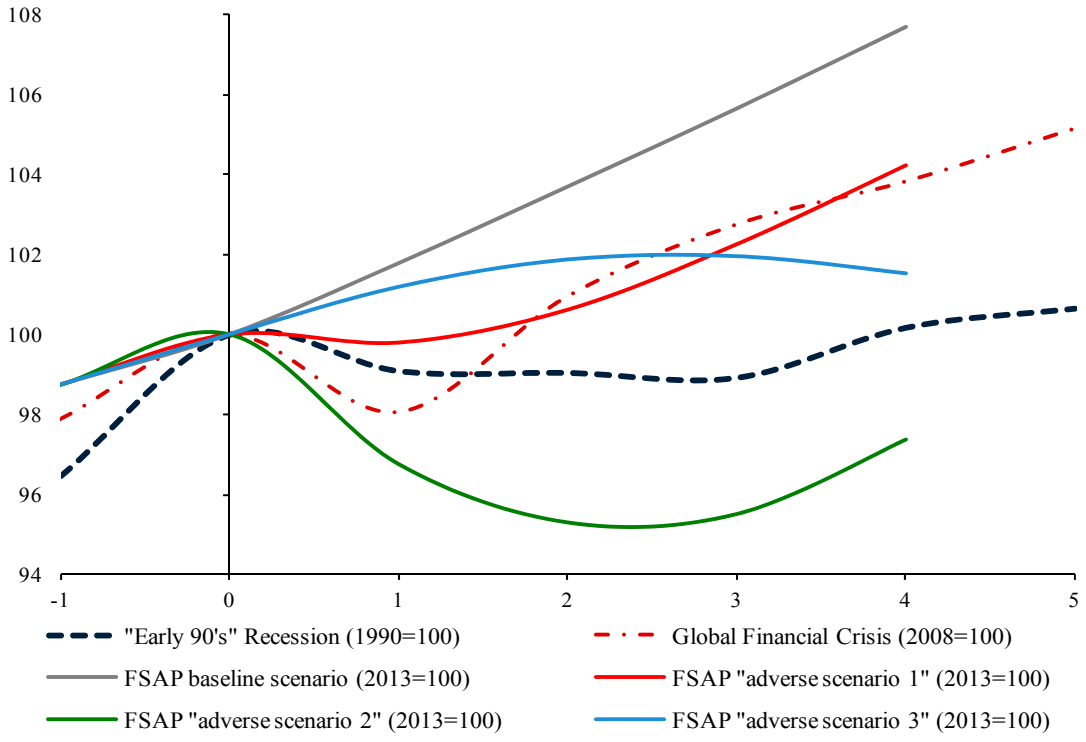
[7] This is in line with risk No.1 in the May 2013 Global Risk Assessment Matrix (GRAM), and risk No.3 in the Risk Assessment Matrix (RAM).

[8] This is in line with risk No.5 in the May 2013 GRAM, and risks No.1 and No. 5 in the RAM.

[9] Admittedly, this is an extreme scenario. The losses in terms of output levels are larger in this scenario than those observed during the global financial crisis of 2008–09, and the domestic recession recorded in the early 1990s in Switzerland (see Figure 2).

[10] The increase in interest rates might originate, for instance, from the SNB's response to a global oil price shock, which is in line with risk No.3 in the May 2013 GRAM, and risk No.4 in the RAM.

Figure 2. Switzerland: FSAP Stress Test Scenarios in a Historical Context
(Real GDP Level)



Source: IMF staff calculations.

4. A broad range of stress tests were conducted, covering the vast majority of the Swiss banking system (Appendix II). Top-down (TD) balance sheet stress tests were conducted by the authorities, aiming to capture all licensed banks. These top-down stress tests were complemented by FINMA's Loss Potential Analysis (LPA) framework for the two large banks, which is a bottom-up stress test based on bank analysis, not identical to the banks' internal stress tests, and by TD stress tests carried out by the IMF FSAP team covering 30 representative banks. These stress tests covered a wide range of risk factors, including credit, market contagion (through interbank exposures), funding, and liquidity, and, in some cases, operational risk. Owing to the lack of supervisory data on a bank-by-bank basis, the IMF's TD stress tests had to rely on aggregated data provided by the authorities and publicly available data, the latter raising issues of data quality, consistency, and comparability.

5. Top-down and bottom-up stress tests were based on different methodologies, allowing for robustness checks on the results. One of the key elements of these methodological frameworks is that they include the treatment of income assumptions and the computation of credit, market, and operational risk losses under stress through both the profit-and-loss account ("Expected Loss") and RWAs ("Unexpected Losses"). The authorities' top-down stress tests relied extensively on using the detailed analysis of risk factors embedded in their own

Building Block Analysis (BBA) framework, which is run regularly by the authorities for monitoring purposes and benefits from a high degree of granularity.

B. Methodological Concepts and Assumptions

Credit risk and market risk

6. The computation of expected credit losses was based on the use of probabilities of default (PDs), loss-given default (LGD), and satellite models. Point-in-time risk parameters (PDs, LGDs) on a bank-by-bank basis were not provided by the authorities. Therefore, alternative risk parameters were computed by the FSAP team using Moodys KMV's PDs and LGDs for the relevant countries. The levels of these risk parameters were then matched to the levels of PDs and LGDs provided by the authorities, aggregated for the two large banks.[11] These resulting risk parameters were then modeled as a function of macroeconomic variables, and are thus scenario dependent.

7. Market risk stress losses were directly linked to the macroeconomic scenarios. In the case of the small banks, the projection of losses related to market risk (due, for instance, to changes in interest and exchange rates, stock prices, etc.) were modeled by the FSAP team as a function of macroeconomic variables. For the two large banks, SNB estimated market risk losses based on their BBA. Similarly, the two large banks estimated market risk losses within the LPA framework, which were then translated by FINMA to the macroeconomic scenarios used in the FSAP. In addition to market risk losses, both frameworks also include the estimation of operational risk losses under stress. The FSAP team computed the effects on capitalization both with and without these market and operational risk losses estimated by the large two banks.

Net income

8. Pre-impairment income was projected based on satellite models. Essentially, the projections of the different income items in the profit and loss account were guided by these models. Broad income categories include (i) net interest income; (ii) net fees and commissions; (iii) non-interest operating expenses; and (iv) other sources of income (residual income). These different income lines were modeled as a linear function of macroeconomic variables. The corresponding elasticities were estimated using regression analysis based on a (unbalanced) panel of 30 banks, with data spanning over the period 1997–2012. Income projections, together with impairments for expected losses, were then translated in terms of impact on the banks' balance sheet, assessing their profitability, solvency, and remaining capital buffers at each period in time.

[11] The aggregate PDs and LGDs provided by the authorities were "through-the-cycle," and thus exhorted limited variability vis-à-vis macroeconomic conditions. The IMF constructed PDs and LGDs were "point-in-time," preserving the cyclical variability embedded in Moodys KMV's risk parameters.

Risk-weighted assets

9. The modeling of RWAs under stress represents a key feature of the analysis. In order to better capture the uncertainty related to the estimation of losses, the framework assumes that economic loss distributions are likely to depend on broad macroeconomic conditions. In particular, unexpected losses are likely to be larger under a weaker state of the world than under a more favorable macroeconomic environment. This is reflected in the computation of RWAs under stress. In particular, RWAs for credit risk are driven by changes in point-in-time risk parameters that are themselves dependent directly on macroeconomic conditions based on credit risk models.

10. Stressed RWAs for credit risk were modeled as a function of risk parameters, whilst RWAs for other risks simply reflected changes in balance sheet size, for all banks in the IMF sample. Given the limited data environment, RWAs for credit risk were computed as a function of risk parameters (PDs, LGDs) to reflect changes in unexpected losses, in addition to accounting for defaulted assets and credit growth.[12] Stressed RWAs for credit risk were modeled as a function of point-in-time PDs and LGDs based on the standard Basel II/III IRB formulae for RWAs (see Appendix IV for more details). Using IRB formulas, even for banks whose regulatory capital requirements are based on standardized approaches, aims at simulating capital requirements (covering unexpected losses) from an economic point of view. The stress sensitivity of such stressed RWAs is significantly higher than for the regulatory RWAs based on standardized approaches. Hence, for these banks, the resulting capital ratios correspond to economically adjusted ratios, rather than the regulatory ones. RWAs for credit risk make up close to 80 percent of total RWAs. The modeling of RWAs for market risk, operational risk, and that of other risks is usually complex and requires fairly detailed information. Again, owing mainly to limited data availability, those RWAs were assumed to grow in line with total assets.

Dividend payout and behavioral adjustments

11. Dividend payouts from positive after-tax profits were allowed for banks with sound capitalization. Banks' net profits were subject to a flat tax rate of 25 percent. Subsequently, for those banks with positive after-tax profits, a dividend payout rate of 20 percent was used. However, the model assumes that only banks whose regulatory capital ratio exceeds 8 percent were allowed to pay dividends;[13] otherwise, banks would need to save all of their profit after tax to strengthen capital buffers.

12. Banks' portfolio allocation during the projection period is assumed to remain constant. The stress tests assume that all banks maintained a constant composition of assets (other than changes in provisions for impaired loans) throughout the simulation horizon. Banks

[12] Credit growth is assumed to be in line with GDP growth.

[13] As the vast majority of banks maintain a capital ratio above 8 percent under the different scenarios, this assumption is not binding in those cases, and banks would pay dividends at the assumed rate.

were not able to include changes in their hedging positions. That said, total gross loans and other assets were assumed to grow in line with nominal GDP. In other words, balance sheets were allowed to change in terms of size, but not composition.

Hurdle rates

13. Stress tests were mainly based on core capital measures to which different hurdle rates may apply. Swiss regulation embeds different CET1 capital ratio targets for the different banks in the system, based on size and other measures (see Appendix in FINMA Circular 11/2, from which the table below is drawn, and the Capital Adequacy Ordinance for more details). For the two large banks, the IMF FSAP team used a hurdle rate of 10 percent for CET1. Note that the latter is based on the Basel III definition of "CET1 with transition" (to accommodate for the phase-in period). Stress tests were also conducted for these banks using the "fully loaded" (2019 definition) of CET1. These were implicitly compared to the 7 percent threshold.

Table 1. Switzerland: Capital Requirements
(In percent)

	Required CAR Ratio	Required CET 1 Ratio
Category 2	13.6–14.4	8.7–9.2
Category 3	12	7.8
Category 4	11.20	7.40
Category 5	10.50	7.00

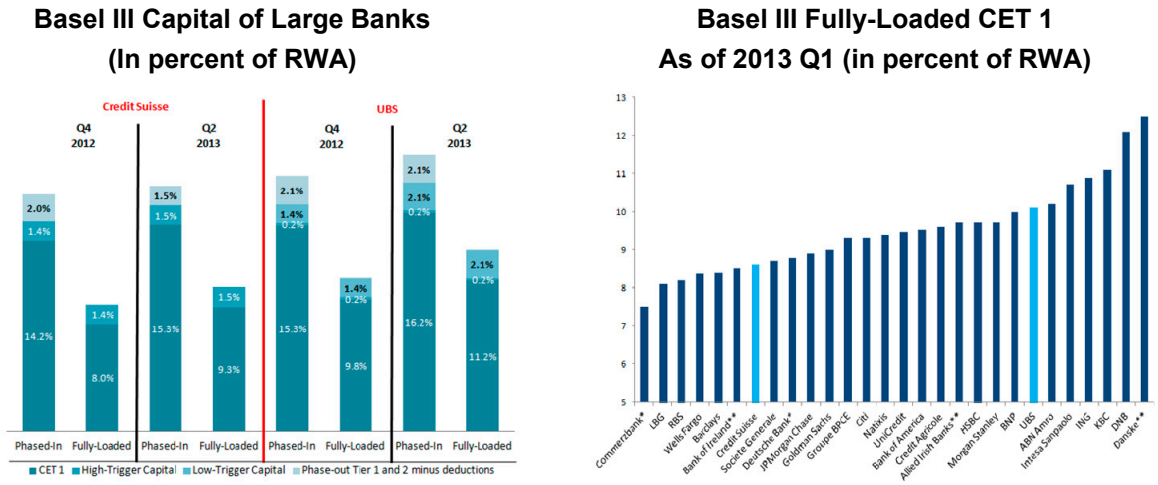
C. Outcome of the Solvency Tests

Solvency of the two large banks

14. Stress tests results for the two large systemic banks are sensitive to the definition of capital used (Figure 3). Using CET1 capital with transition (i.e., allowing for the phase-in transition period embedded in Basel III rules), the systemic banks' capital ratios comfortably exceed capital requirements and commonly used hurdle rates, with large remaining capital buffers, under all three adverse scenarios (Figure 4). However, stress tests conducted using "fully loaded" CET1 capital (2019 definition of capital under Basel III) as a starting point, suggest that the capital ratios of systemic banks could fall to around the 7 percent threshold under our most severe macroeconomic scenario.

15. Top-down stress test results conducted by the authorities and bottom-up stress tests conducted by the two large banks confirm these results. These findings are fairly robust, with the top-down stress tests conducted by the SNB based on the BBA and bottom-up stress test results based on the LPA broadly aligned. The main variation among these results are due to differences in data inputs and granularity, estimated parameters and elasticities, selection of key drivers of risk parameters and their corresponding sensitivities, and modeling framework and methodologies, among other factors. In particular, different stress tests yield similar results for the years 2014 and 2015 (when the shocks occur within the macroeconomic scenarios); however, these tend to differ in the outer years (2016–2017). This is mainly due to differences in the income elasticities and the fact that authorities tend to model RWAs more smoothly (i.e., with longer lags) than the RWAs modeled by the FSAP team, which are directly linked to contemporaneous changes in risk parameters (e.g., , PDs and LGDs).

Figure 3. Switzerland: Basel III Capital Measures of the Two Large Swiss Banks



Source: Ratios shown as disclosed by banks; BBVA and Banco Santander did not disclose fully loaded ratios. Banks may apply different adjustment based on individual interpretation of Basel III requirements. Ratios may also vary due to different discretionary accounting.

Notes: * Commerzbank and Deutsche Bank raised EUR 2.5 billion and EUR 2.96 billion of equity. As a result, the ratio will increase to 8.4 percent and 9.5 percent respectively. ** Ratios as of end-2012.

Solvency of domestically oriented and small banks

16. Stress tests results suggest that banks of the other banking categories covered in the sample are well capitalized (Figure 5). Crucial balance sheet supervisory data on a bank-by-bank basis for cantonal, regional, Raiffeisen, foreign-controlled, and a few small banks specializing in asset management and securities, were not made available to the FSAP team. Notwithstanding these limitations, and relying on broad assumptions based on partial information and aggregated data provided by the authorities,[14] stress tests show that capital ratios remain broadly adequate for most banks under all scenarios.[15] This is consistent with the authorities' top-down stress test results.

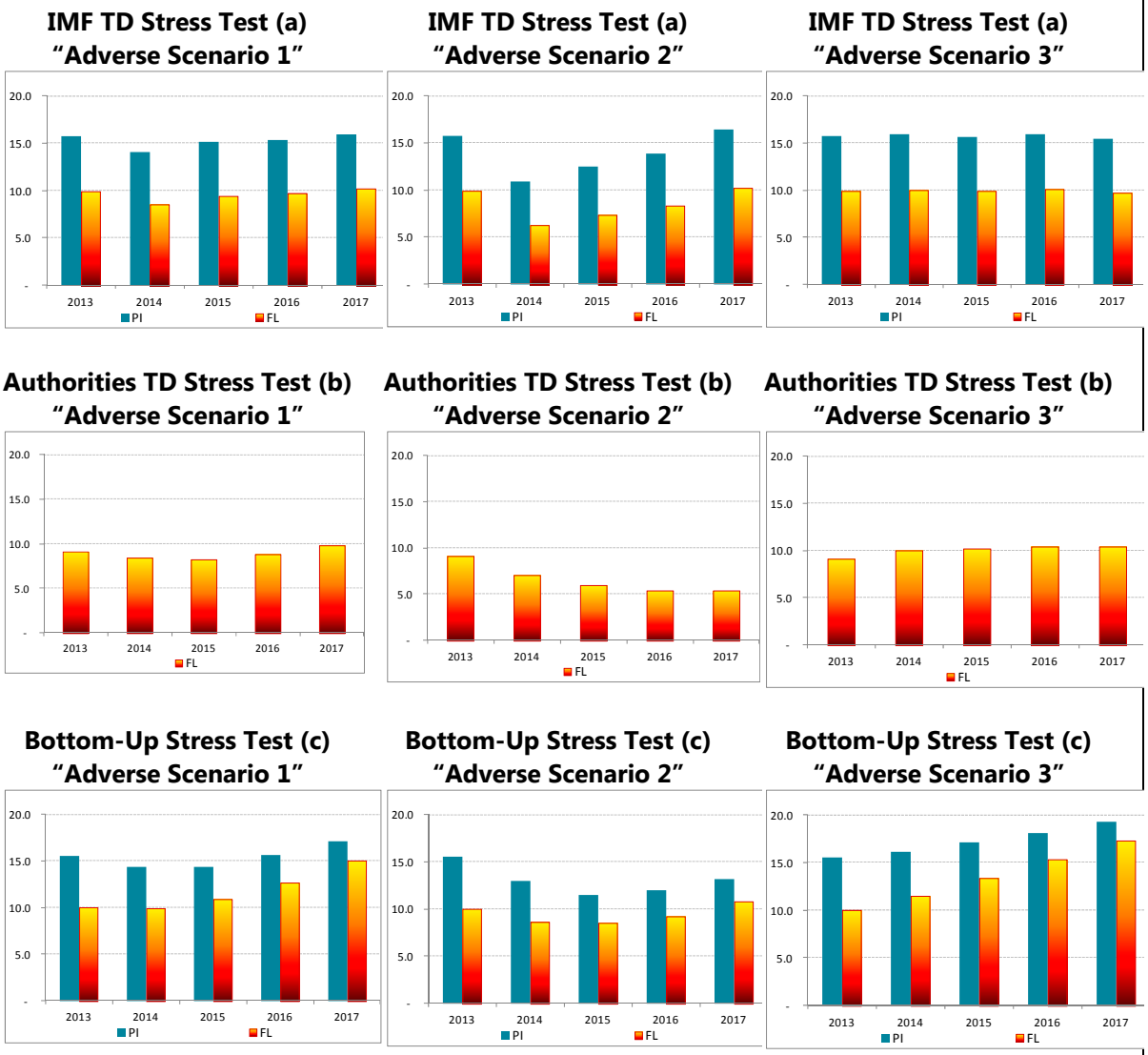
17. That said, domestically oriented banks would be the most affected by a correction in the real estate market. Bank-specific losses related to the natural concentration risk (e.g., geographical, sectoral, etc.) to which cantonal and regional banks are exposed could be underestimated using these aggregate data. Indeed, analysis conducted by the authorities

[14] The pre-shock core capital ratio for several of these banks was computed using the "Fitch core capital" measure, available in Bankscope.

[15] The lack of granularity on exposures and risk parameters on a bank-by-bank basis poses significant challenges to the modeling of losses for domestically oriented banks. Aggregated data along bank groups might conceal important vulnerabilities of individual banks, and might lead to an underestimation of losses for specific banks.

suggests that cantonal and regional banks potential losses are mostly concentrated in real-estate market.

Figure 4. Switzerland: Banking Sector Stress Test Results – Large Banks
CET1 Ratio
(In percent of total risk-weighted assets)

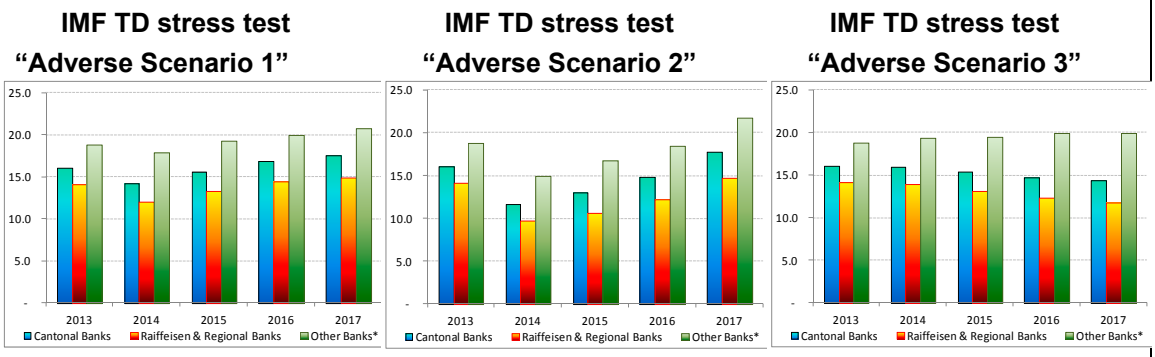


Source: Authorities and IMF staff calculations.

Notes:
"PI" denotes the use of CET1 capital allowing for the "phase-in" transition period embedded in Basel III rules.
"FL" stands for "fully loaded" CET1 capital, using the 2019 definition under Basel III rules.

(a) IMF TD stress tests carried out using both "phased-in CET1" and "fully loaded CET1" (2019 definition).
(b) Authorities TD stress tests carried out using "fully loaded CET1" (2019 definition).
(c) Banks' BU stress tests carried out using both "phased-in CET1" and "fully loaded CET1" (2019 definition).

Figure 5. Switzerland: Banking Sector Stress Test Results – All Other Banks
Core Capital Ratio[1/]
(In percent of total risk-weighted assets)



Source: IMF staff calculations

1/ Core capital ratio based on "Fitch core capital" as provided by Bankscope.

Note: Other banks refer to the aggregate numbers for all banks in the IMF's sample (30 banks), excluding the two large banks, Raiffeisen, cantonal banks, regional banks and a couple of subsidiaries of foreign controlled banks for which sufficient data were not available.

LIQUIDITY STRESS TESTS

18. Liquidity stress test centered on the analysis of the liquidity coverage ratio (LCR). In Switzerland, six banks have been participating in the semi-annual international QIS since June 2010; whilst LCR reporting has been in place for approximately 40 banks since the end of 2011. The Swiss authorities issued and published the reporting template, together with instructions and FAQs, in preparation for the comprehensive LCR reporting. Requirements were broadly similar to those of the QIS. Comprehensive LCR reporting for all banks started at end-June 2013. Final LCR rules will be released in the first quarter of 2014 in anticipation of the application of the LCR regulatory requirement from January 1, 2015 onwards.

19. Compliance with Basel Principles is the main guiding factor for the implementation of the LCR in Switzerland. Nonetheless, the LCR requirements in Switzerland, as currently defined, are more demanding in certain areas. These include: higher outflow rates for high value retail deposits; 100 percent LCR requirement for the two large banks from 2015 onwards;[16] no inclusion of RMBS and lower quality bonds ("level 2B"), while the inclusion of equities is under consideration. In terms of currency denomination, whilst Basel III rules imply that the LCR is expected to be met in Swiss francs, banks are also expected to report and be able to meet their

[16] The 100 percent LCR requirement will be phased-in for all other banks, following Basel Principles.

liquidity needs in each currency and maintain HQLA consistent with the distribution of their liquidity needs by currency.

20. Using the LCR stress assumption, the Swiss banks on average have no problem in exceeding an LCR of 100 percent at the moment. In the comprehensive LCR reporting from June 2013, the median LCR of the 308 banks included in the analysis reached 130 percent. Only 36 percent of these banks had an LCR below 30 percent, mainly small banks. However, in terms of LCR per currency, the median LCR is extremely low at 3 percent and close to zero for the LCR in euros and U.S. dollars, respectively. In fact, most small banks have some outflows (over the next 30 days) denominated in euros or U.S. dollars, whilst essentially having "zero" HQLA in those currencies. Nevertheless, the average LCR in U.S. dollars and euros without inflow cap is close to or above 100 percent, which shows that the market as a whole is sufficiently liquid, but smaller banks cover their outflows with inflows (also from deposits at larger banks) instead of HQLA. Once again, the LCR by currency is not a regulatory requirement, and is currently in use as a monitoring tool for potential currency mismatch issues that may arise.

21. Complementary liquidity stress tests were carried out based on deposit run-off scenarios. This sensitivity analysis assumes different deposit run-off and asset disposal rates, over a predetermined period of time (five working days), and assesses the liquidity stance and counterbalancing capacity of banks at the end of each day. Deposit run-off rates and asset disposal rates were based on expert judgment. Notwithstanding data quality issues, this type of stress test suggests that most banks remain liquid under a broad range of reasonable assumptions.[17] However, out of the 27 banks included in the sample, two small banks might run into liquidity difficulties over the course of the five-day period. The combined assets of these two banks amount to just SWF 27 million (representing less than 1 percent of total bank assets in the sample).

CONCLUSIONS AND RECOMMENDATIONS

22. The two large banks should continue the front-loaded build-up in capital buffers, which has contributed to their resilience to shocks. Stress tests results for the two large systemic banks are sensitive to the definition of capital used. Using CET1 capital with transition (i.e., allowing for the phase-in transition period embedded in Basel III rules), the systemic banks' capital ratios comfortably exceed capital requirements, with large remaining capital buffers, under all three adverse scenarios. However, stress tests conducted using "fully loaded" CET1 capital (2019 definition of capital under Basel III) as a starting point, suggest that the capital ratios of systemic banks could fall around the 7 percent threshold under our most severe

[17] Our main stress scenario assumes daily deposit run-off rates of 5, 0.5, 0.1, and 10 percent for customer deposits on their current, savings, and term accounts, and wholesale deposits, respectively. Similarly, the assumed asset disposal rates are 90 and 1 percent for liquid assets and non-liquid assets, respectively. Sensitivity around these deposit run-off and asset disposal rates was carried out, resulting in broadly similar results.

macroeconomic scenario. These results suggest that systemic banks are well placed vis-à-vis the introduction of Basel III. Nevertheless, these banks should continue with their capital build-up plans, as expected by the Swiss authorities, to enhance their resilience in the event that downside risks materialize during the transition period.

23. Stress tests results suggest that banks in other banking categories are well capitalized. Notwithstanding important data limitations, and relying on broad assumptions based on aggregate and partial information, stress tests show that capital ratios remain broadly adequate for most banks under all scenarios. However, domestically oriented banks are likely to experience the largest share of losses from a correction in the domestic real estate market. In addition, business risks (such as litigation risks) and issues related to the corporate structure and governance could be sizeable for some of these banks, but cannot be addressed within the stress test framework.

24. The banking sector seems to benefit from sufficient liquidity, with almost all banks satisfying the LCR requirement in Swiss Francs. This is in large part due to the unusually high amount of deposits at the central bank. Over the medium-term, banks would need to substitute these central bank reserves with other sources of high quality liquid assets (HQLA). Liquidity prudential norms would need to take into account the limited supply of Swiss franc denominated level 1 liquid assets (Swiss government bonds).

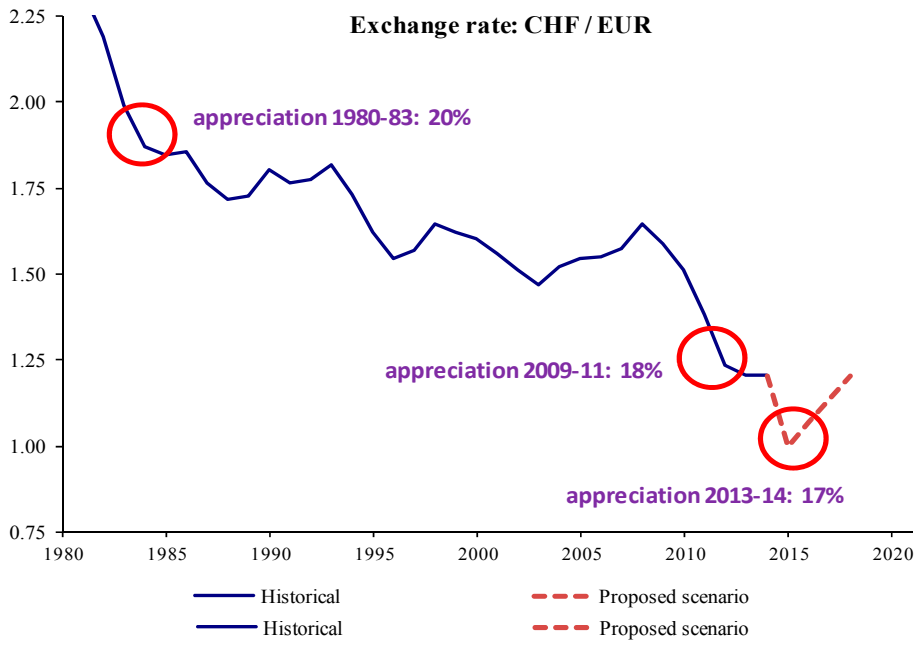
Appendix I. Quantitative Description of Macroeconomic Scenarios

The stress tests for the Swiss FSAP involve four different scenarios: a baseline scenario (consisting mainly of the projections done by the Article IV team), and three alternative "stress" scenarios (i.e., "External (I)", "External (II)", and "Domestic").

In each of the three scenarios described above, there is a main macro-economic variable ("anchor variable") depicting, in a quantitative manner, the origination and main channels of stress onto the other macro-variables. In other word, in each of these scenarios, the behavior of all macro-variables is driven by the behavior of the anchor variables.

In the first adverse scenario (i.e., "External (I)"), the anchor variable is the exchange rate. This scenario assumes that the CHF/EUR exchange rate 'jumps' to parity in 2014,[1] and moves back towards the level of the baseline scenario, reaching the latter by 2017. The implied appreciation of the exchange rate is in line with historical episodes (see Appendix Figure 1).

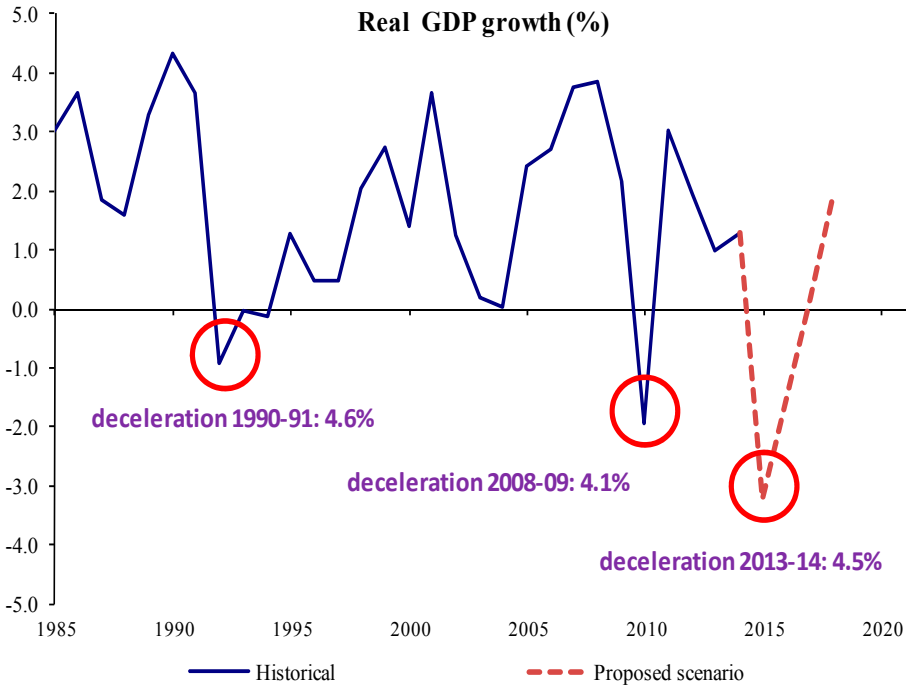
Appendix Figure 1. Switzerland: Stress Scenario "External (I)"–Anchor Variable: Exchange Rate



[1] This is accompanied by an appreciation of the CHF against the USD of a similar magnitude (see Figure 1).

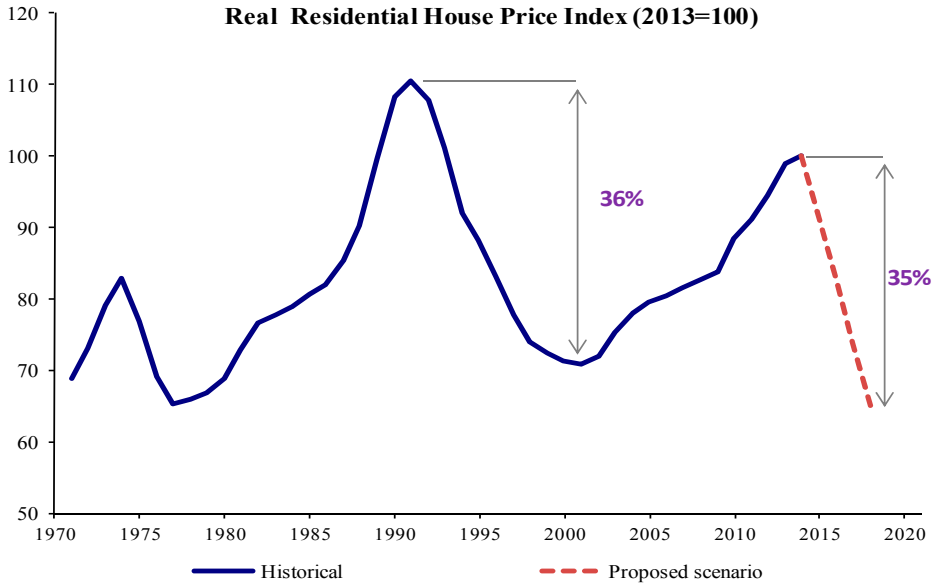
In the second adverse scenario (i.e., "External (II)"), Real GDP growth is the anchor variable. Such a scenario would likely affect considerably real output in Switzerland, as it has taken place during previous global crises. Thus, the deceleration (or 'delta') in real GDP growth was calibrated based on previous episodes (see Appendix Figure 2),

Appendix Figure 2. Switzerland: Stress Scenario "External (II)"–Anchor Variable: Real GDP Growth



Finally, in the third adverse scenario (i.e., "Domestic"), the anchor variable is the price of residential houses. This scenario assumes that the correction in houses prices is of a similar magnitude to that observed in the 1990's in Switzerland. This implies a fall in real house prices of around 35 percent (see Appendix Figure 3).

Appendix Figure 3. Switzerland: Stress Scenario "Domestic"–Anchor Variable: House Prices



The projections of the main macroeconomic variables under these three scenarios are presented in Appendix Tables 1 and 2 for Swiss and global economies, respectively.

Appendix Table 1. Switzerland: Main Macroeconomic Variables for the Swiss Economy

			Historical				Projection			
	mean	s.d.	2010	2011	2012	2013	2014	2015	2016	2017
Baseline scenario:										
Real GDP growth (%)	1.7	1.6	3.0	1.9	1.0	1.3	1.8	1.9	1.9	1.9
CPI inflation (%)	2.7	2.6	0.7	0.2	-0.7	-0.2	0.2	0.7	1.0	1.0
Interest rates:										
3-month CHF Libor (%)	2.8	2.7	0.2	0.1	0.1	0.1	0.7	1.4	1.9	1.9
Exchange rates:										
CHF/EUR	1.67	0.26	1.38	1.23	1.21	1.21	1.21	1.21	1.21	1.21
CHF/USD	1.80	0.82	1.04	0.89	0.94	0.94	0.94	0.94	0.94	0.94
NEER (increase = appreciation)	84.9	22.5	113.1	127.4	127.1	127.1	127.1	127.1	127.1	127.1
REER (increase = appreciation)	99.1	7.4	107.5	118.0	114.3	113.2	112.1	111.0	109.8	108.7
House price index:										
Residential (1970Q1=100) 1/	274.9	94.5	405.0	420.9	437.7	441.3	448.5	458.5	470.0	482.1
Stock price index (01/01/1973=100)	402.0	336.2	817.0	769.8	792.3	945.6	1015.3	1099.6	1194.6	1300.2
Domestic credit growth (%)	4.4	4.7	2.9	5.1	4.7	1.1	2.0	2.6	2.9	3.0
Alternative scenario 1 - External (I):										
Real GDP growth (%)	1.7	1.6	3.0	1.9	1.0	1.3	-0.2	0.8	1.6	1.9
CPI inflation (%)	2.7	2.6	0.7	0.2	-0.7	-0.2	-0.4	0.4	0.9	1.0
Interest rates:										
3-month CHF Libor (%)	2.8	2.7	0.2	0.1	0.1	0.1	0.0	0.9	1.8	1.9
Exchange rates:										
CHF/EUR	1.67	0.26	1.38	1.23	1.21	1.21	1.00	1.07	1.14	1.21
CHF/USD	1.80	0.82	1.04	0.89	0.94	0.94	0.80	0.85	0.89	0.94
NEER (increase = appreciation)	84.9	22.5	113.1	127.4	127.1	127.1	147.9	138.2	129.7	127.1
REER (increase = appreciation)	99.1	7.4	107.5	118.0	114.3	113.2	130.7	120.8	112.2	108.7
House price index:										
Residential (1970Q1=100) 1/	274.9	94.5	405.0	420.9	437.7	441.3	439.0	443.7	453.7	465.3
Stock price index (01/01/1973=100)	402.0	336.2	817.0	769.8	792.3	945.6	934.6	969.4	1042.5	1134.7
Domestic credit growth (%)	4.4	4.7	2.9	5.1	4.7	1.1	-0.6	1.2	2.6	3.0
Alternative scenario 2 - External (II):										
Real GDP growth (%)	1.7	1.6	3.0	1.9	1.0	1.3	-3.2	-1.5	0.2	1.9
CPI inflation (%)	2.7	2.6	0.7	0.2	-0.7	-0.2	-0.4	0.3	0.8	1.0
Interest rates:										
3-month CHF Libor (%)	2.8	2.7	0.2	0.1	0.1	0.1	0.0	0.6	1.5	1.9
Exchange rates:										
CHF/EUR	1.67	0.26	1.38	1.23	1.21	1.21	1.21	1.21	1.21	1.21
CHF/USD	1.80	0.82	1.04	0.89	0.94	0.94	0.95	0.95	0.95	0.94
NEER (increase = appreciation)	84.9	22.5	113.1	127.4	127.1	127.1	126.6	126.6	126.6	127.1
REER (increase = appreciation)	99.1	7.4	107.5	118.0	114.3	113.2	111.7	110.6	109.5	108.7
House price index:										
Residential (1970Q1=100) 1/	274.9	94.5	405.0	420.9	437.7	441.3	428.2	424.3	428.5	439.5
Stock price index (01/01/1973=100)	402.0	336.2	817.0	769.8	792.3	945.6	820.4	773.4	786.5	856.0
Domestic credit growth (%)	4.4	4.7	2.9	5.1	4.7	1.1	-3.6	-1.2	1.0	3.0
Alternative scenario 3 - Domestic:										
Real GDP growth (%)	1.7	1.6	3.0	1.9	1.0	1.3	1.2	0.7	0.1	-0.4
CPI inflation (%)	2.7	2.6	0.7	0.2	-0.7	-0.2	0.3	0.9	1.3	1.3
Interest rates:										
3-month CHF Libor (%)	2.8	2.7	0.2	0.1	0.1	0.1	0.8	1.6	2.2	2.3
Exchange rates:										
CHF/EUR	1.67	0.26	1.38	1.23	1.21	1.21	1.32	1.44	1.56	1.67
CHF/USD	1.80	0.82	1.04	0.89	0.94	0.94	1.15	1.37	1.59	1.80
NEER (increase = appreciation)	84.9	22.5	113.1	127.4	127.1	127.1	116.5	106.0	95.4	84.9
REER (increase = appreciation)	99.1	7.4	107.5	118.0	114.3	113.2	109.7	106.1	102.6	99.1
House price index:										
Residential (1970Q1=100) 1/	274.9	94.5	405.0	420.9	437.7	441.3	410.1	379.0	347.8	316.7
Stock price index (01/01/1973=100)	402.0	336.2	817.0	769.8	792.3	945.6	993.5	1029.3	1045.6	1041.8
Domestic credit growth (%)	4.4	4.7	2.9	5.1	4.7	1.1	1.5	1.6	1.3	0.9

1/ Average of for rent, owner-occupied house (OOH), and single-family house prices

Source: IMF staff calculations.

Appendix Table 2. Switzerland: Main Macroeconomic Variables in Selected Countries

	Baseline Scenario:					Adverse Scenario 1 - External (I):					Adverse Scenario 2 - External (II):					Adverse Scenario 3 - Domestic:				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Real GDP growth																				
Austria	0.4	1.6	1.7	1.7	1.5	0.4	-1.8	-1.0	-0.7	0.2	0.4	-4.3	-2.3	-0.9	1.4	0.4	1.3	1.3	2.1	1.8
Belgium	0.0	1.0	1.3	1.4	1.5	0.0	-3.0	-1.8	-0.6	0.6	0.0	-6.6	-3.5	-1.0	2.8	0.0	0.6	0.8	1.9	1.9
Finland	-0.4	1.0	1.3	2.0	2.0	-0.4	-1.7	-1.3	-0.8	0.6	-0.4	-4.8	-3.1	-1.0	1.7	-0.4	0.7	0.9	2.3	2.3
France	-0.2	0.8	1.5	1.7	1.8	-0.2	-2.1	-0.8	-0.6	0.2	-0.2	-3.6	-2.0	-1.3	0.5	-0.2	0.7	1.2	1.9	2.0
Germany	0.3	1.3	1.3	1.3	1.3	0.3	-1.3	-1.2	-1.4	-0.6	0.3	-3.7	-2.6	-2.1	0.0	0.3	1.0	0.9	1.6	1.6
Greece	-4.2	0.6	2.9	3.7	3.5	-4.2	-14.2	-4.5	6.6	5.1	-4.2	-3.3	-0.4	1.1	2.5	-4.2	0.5	2.7	3.9	3.6
Ireland	0.6	1.8	2.5	2.5	2.5	0.6	-5.9	-3.3	-0.3	0.2	0.6	-5.6	-2.2	0.1	3.0	0.6	1.6	2.1	2.8	2.8
Italy	-1.8	0.7	1.1	1.4	1.4	-1.8	-6.1	-3.4	0.5	0.3	-1.8	-3.9	-2.5	-1.5	0.6	-1.8	0.5	0.7	1.6	1.6
Netherlands	-1.1	0.5	1.2	1.8	2.0	-1.1	-2.9	-1.7	-0.8	0.7	-1.1	-5.6	-3.5	-1.2	1.8	-1.1	0.3	0.8	2.1	2.3
Portugal	-2.3	0.6	1.5	1.8	1.8	-2.3	-10.6	-5.0	2.8	2.2	-2.3	-3.9	-2.0	-0.9	1.0	-2.3	0.5	1.3	2.0	2.0
Spain	-1.6	0.0	0.3	0.6	0.9	-1.6	-9.8	-5.7	0.7	0.6	-1.6	-4.2	-3.0	-2.0	0.0	-1.6	-0.1	0.0	0.8	1.0
Sweden	1.1	2.3	2.3	2.4	2.4	1.1	1.5	2.2	1.8	2.1	1.1	-0.5	1.4	1.8	2.5	1.1	2.2	2.3	2.6	2.6
United Kingdom	1.1	1.5	1.8	1.9	2.1	1.1	0.1	1.0	0.8	1.5	1.1	-3.5	-2.5	-1.2	0.7	1.1	1.4	1.6	2.1	2.2
Other E.Union	1.4	1.4	1.5	1.5	1.6	1.4	0.0	1.3	1.3	1.5	1.4	-1.4	0.4	0.7	1.5	1.4	1.3	1.4	1.7	1.7
China	7.5	7.3	7.0	7.0	7.0	7.5	6.9	6.7	5.7	6.1	7.5	4.0	5.3	5.9	6.6	7.5	6.4	5.7	7.3	7.4
Japan	2.0	1.2	1.1	1.2	1.1	2.0	0.8	0.5	-0.5	0.1	2.0	-5.2	-3.9	-2.9	-0.1	2.0	0.8	0.5	1.4	1.4
United States	1.7	2.7	3.5	3.6	3.4	1.7	2.5	3.1	2.3	2.7	1.7	-5.0	-1.9	-0.4	3.1	1.7	2.5	3.2	3.8	3.6
CPI inflation																				
Austria	2.1	1.8	1.8	1.8	1.8	2.1	0.2	-0.8	-2.0	-2.8	2.1	0.4	0.3	0.0	-0.1	2.1	1.7	1.4	1.5	1.6
Belgium	1.5	1.4	1.2	1.2	1.2	1.5	-0.3	-1.6	-2.8	-3.4	1.5	-0.5	-1.2	-1.4	-1.2	1.5	1.2	0.7	0.9	1.0
Finland	2.4	2.6	2.2	2.0	2.0	2.4	1.2	-0.3	-2.0	-3.0	2.4	1.0	0.2	-0.4	-0.7	2.4	2.5	1.8	1.7	1.8
France	1.4	1.5	1.5	1.6	1.7	1.4	-0.2	-1.0	-1.7	-2.2	1.4	0.0	0.3	0.5	0.4	1.4	1.4	1.2	1.4	1.5
Germany	1.5	1.7	1.7	1.8	1.9	1.5	0.3	-0.6	-1.7	-2.4	1.5	0.4	0.5	0.5	0.2	1.5	1.6	1.3	1.5	1.7
Greece	-0.8	-0.4	0.3	1.1	1.1	-0.8	-4.9	-6.0	-3.2	-0.8	-0.8	-1.1	-0.2	0.3	-0.3	-0.8	-0.5	0.0	0.9	0.9
Ireland	1.0	1.2	1.4	1.6	1.7	1.0	-1.3	-2.6	-3.0	-2.9	1.0	-0.9	-1.0	-1.0	-0.8	1.0	1.1	1.1	1.3	1.5
Italy	1.6	1.3	1.2	1.3	1.4	1.6	-1.3	-2.3	-1.8	-1.3	1.6	-0.1	-0.3	-0.3	-0.3	1.6	1.2	0.8	1.0	1.2
Netherlands	2.8	1.5	0.9	0.9	1.0	2.8	-0.1	-1.8	-3.2	-4.0	2.8	-0.2	-1.0	-1.4	-1.5	2.8	1.4	0.6	0.6	0.8
Portugal	0.7	1.0	1.5	1.5	1.5	0.7	-2.4	-3.2	-2.1	-0.5	0.7	0.2	0.8	0.4	-0.1	0.7	1.0	1.2	1.2	1.3
Spain	1.7	1.4	1.2	1.2	1.2	1.7	-1.6	-3.0	-2.2	-1.1	1.7	0.5	0.5	0.3	-0.3	1.7	1.3	0.9	1.0	1.0
Sweden	0.3	1.6	2.4	2.4	2.1	0.3	1.6	3.1	3.1	2.7	0.3	2.1	4.4	5.5	5.9	0.3	1.6	2.2	2.2	2.0
United Kingdom	2.7	2.3	2.0	1.9	2.0	2.7	1.9	2.0	1.7	1.5	2.7	1.1	0.6	0.2	0.1	2.7	2.2	1.8	1.7	1.9
Other E.Union	2.0	2.1	2.3	2.4	2.4	2.0	2.0	2.8	2.9	2.9	2.0	2.6	4.3	5.5	6.2	2.0	2.1	2.1	2.2	2.4
China	2.7	3.0	3.0	3.0	3.0	2.7	3.1	4.0	3.9	3.6	2.7	2.5	4.0	5.5	6.6	2.7	2.6	1.9	2.3	2.7
Japan	0.1	2.9	1.9	1.9	2.0	0.1	3.0	2.9	2.7	2.6	0.1	1.9	2.1	2.7	3.2	0.1	2.7	1.6	1.6	1.8
United States	1.7	1.8	1.9	2.0	2.2	1.7	2.0	2.8	2.9	2.9	1.7	-1.8	-2.1	-1.7	-0.8	1.7	1.7	1.6	1.8	2.1
Short term interest rate																				
Austria	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Belgium	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Finland	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
France	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Germany	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Greece	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Ireland	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Italy	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Netherlands	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Portugal	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Spain	0.2	0.3	0.6	1.1	1.7	0.2	0.3	0.9	1.2	1.5	0.2	3.3	3.9	4.1	3.4	0.2	0.3	0.6	0.9	1.5
Sweden	1.4	1.6	2.6	2.9	3.4	1.4	0.3	0.8	1.0	1.6	1.4	-0.6	-2.4	-2.6	-1.6	1.4	1.3	2.3	2.6	3.3
United Kingdom	0.5	0.6	1.0	1.7	2.5	0.5	0.6	1.2	1.6	1.9	0.5	3.4	3.8	3.9	3.1	0.5	0.6	1.0	1.6	2.4
Other E.Union	2.2	2.2	2.4	2.6	2.9	2.2	0.4	-0.4	-0.1	0.4	2.2	0.1	-2.6	-2.9	-2.3	2.2	1.9	2.1	2.4	2.8
China	0.4					0.4					0.4					0.4				
Japan	0.2	0.2	0.3	0.5	0.8	0.2	0.2	0.7	0.8	1.0	0.2	3.0	4.5	3.1	2.1	0.2	0.2	0.3	0.4	0.6
United States	0.1	0.1	0.2	0.9	2.1	0.1	0.1	0.4	0.4	1.4	0.1	5.7	3.9	2.2	1.0	0.1	0.1	0.2	0.9	2.0
Long term interest rate																				
Austria	2.0	2.3	2.6	2.8	2.9	2.0	1.7	1.9	2.5	2.7	2.0	1.2	1.6	2.2	2.4	2.0	2.3	2.5	2.7	2.9
Belgium	2.3	2.7	3.0	3.2	3.3	2.3	2.1	2.3	2.9	3.1	2.3	1.6	2.0	2.6	2.8	2.3	2.7	2.9	3.1	3.3
Finland	1.9	2.3	2.6	2.8	2.9	1.9	1.7	1.9	2.5	2.7	1.9	1.2	1.6	2.2	2.4	1.9	2.3	2.5	2.7	2.9
France	2.3	2.3	2.4	2.5	2.6	2.3	1.7	1.7	2.2	2.4	2.3	1.2	1.4	1.9	2.2	2.3	2.3	2.3	2.5	2.6
Germany	1.6	1.9	2.2	2.4	2.5	1.6	1.3	1.5	2.1	2.3	1.6	0.8	1.2	1.8	2.0	1.6	1.9	2.1	2.3	2.5
Greece	10.0	9.8	9.5	9.3	9.0	10.0	13.0	14.6	13.6	12.9	10.0	8.9	9.1	9.6	9.7	10.0	10.2	10.4	10.7	10.8
Ireland	5.9	5.7	5.4	5.1	5.2	5.9	9.4	12.2	12.8	13.4	5.9	6.9	7.9	7.7	6.6	5.9	6.1	6.3	6.6	6.7
Italy	4.6	4.8	5.1	5.2	5.3	4.6	6.2	7.3	7.0	6.9	4.6	3.6	3.9	4.3	4.3	4.6	4.8	5.1	5.3	5.4
Netherlands	2.9	2.8	3.0	3.2	3.3	2.9	2.1	2.3	2.8	3.1	2.9	1.6	2.0	2.6	2.9	2.9	2.7	2.9	3.1	3.3
Portugal	6.0	6.0	5.5	5.0	5.0	6.0	9.6	11.7	10.5	9.7	6.0	4.9	5.2	5.4	5.4	6.0	6.2	6.4	6.6	6.8
Spain	5.6	5.5	5.6	5.6	5.6	5.6	9.1	11.1	10.2	9.6	5.6	4.4	4.5	4.7	4.7	5.6	5.8	6.0	6.2	6.4
Sweden	1.8	2.6	3.7	4.0	4.5	1.8	2.2	3.2	3.6	4.2	1.8	1.4	2.7	3.7	4.8	1.8	2.6	3.7	4.0	4.5
United Kingdom	3.0	3.3	3.5	3.7	3.9	3.0	3.0	3.2	3.4	3.6	3.0	2.5	2.8	3.3	3.7	3.0	3.3	3.5	3.7	3.9
Other E.Union	3.1	3.3	3.5	3.7	3.7	3.1	2.7	2.7	3.1	3.2	3.1	2.0	2.4	3.2	3.8	3.1	3.3	3.4	3.6	3.7
China	3.6					3.6					3.6					3.6				
Japan	0.7	0.8	1.2	2.0	2.7	0.7	0.8	1.2	2.0	2.7	0.7	0.6	1.8	2.8	3.7	0.7	0.8	1.2	2.0	2.7
United States	2.2	2.7	3.5	4.2	5.1	2.2	2.6	3.3	4.0	4.9	2.2	2.2	2.8	3.6	4.6	2.2	2.7	3.4	4.2	5.0
Real effective exchange rate																				
Austria	94.7	94.9	94.9	94.9	94.9	94.7	95.9	97.0	97.6	97.3	94.7	97.9	99.2	99.3	98.6	94.7	95.1	95.2	94.8	94.7
Belgium	104.4	104.9	104.9	104.9	104.9	104.4	105.6	106.9	107.7	107.5	104.4	108.0	108.7	108.3	107.3	104.4	105.0	105.1	104.7	104.7
Finland	91.6	92.0	92.0	92.0	92.0	91.6	93.4	95.3	96.4	95.8	91.6	96.9	99.1	98.9	97.2	91.6	92.2	92.4	92.0	91.8
France	108.7	109.3	109.3	109.3	109.3	108.7	110.4	112.3	114.0	114.5	108.7	113.8	116.2	117.5	117.5	108.7	109.5	109.8	109.5	109.3
Germany	99.6	100.1	100.1	100.1	100.1	99.6	101.7	103.9	105.6	105.6	99.6	105.2	107.9	108.8	108.1	99.6	100.3	100.6	100.1	99.9
Greece	88.0	87.1	87.1	87.1	87.1	88.0	85.6	83.9	84.3	86.3	88.0	91.5	94.3	95.5	95.1	88.0	87.4	87.7	87.4	87.2
Ireland	64.0	64.2	64.2	64.2	64.2	64.0	64.3	64.6	65.3	65.4	64.0	66.9	67.2	67.2	66.6	64.0	64.3	64.5	64.2	64.1
Italy	121.5	121.7	121.7	121.7	121.7	121.5	121.8	122.6	124.7	126.7	121.5	126.9	129.6	130.3	129.5	121.5	122.0	122.2	121.7	121.5
Netherlands	99.1	99.5	99.5	99.5	99.5	99.1	100.5	102.1	103.1	102.6	99.1	104.1	105.6	105.7	104.3	99.1	99.7	100.0	99.5	99.3
Portugal	92.7	92.4	92.4	92.4	92.4	92.7	91.7	90.9	91.4	92.9	92.7	94.8	96.2	96.8	96.6	92.7	92.6	92.7	92.5	92.4
Spain	96.1	95.7	95.7	95.7	95.7	96.1	95.3	95.4	96.8	98.7	96.1	100.4	103.2	104.5	104.1	96.1	95.9	96.2	95.8	95.6
Sweden	94.3	93.7	93.7	93.7	93.7	94.3	92.0	90.7	90.1	90.3	94.3	89.8	87.6	87.9	89.5	94.3	93.6	93.4	93.6	93.6
United Kingdom	88.2	88.0	88.0	88.0	88.0	88.2	88.0	87.7	87.0	86.5	88.2	90.5	90.7	91.1	90.9	88.2	88.2	88.4	88.1	87.8
Other E.Union																				
China																				
Japan	98.0	96.8	96.8	96.8	96.8	98.0	97.4	98.5	98.7	98.7	98.0	109.0	113.5	114.4	113.2	98.0	97.4	98.2	97.3	96.8
United States	92.1	92.3	92.3	92.3	92.3	92.1	92.6	92.6	91.6	91.3	92.1	91.5	99.4	97.7	94.2	92.1	92.8	93.0	92.5	91.9

Source: IMF staff calculations.

Appendix II. Solvency Stress Test Matrix

Domain	Assumptions		
	Bottom-Up by Authorities, based on LPA by banks (if applicable) 1/	Top-Down by Authorities (if applicable)	Top-down by IMF Team (if applicable)
Institutions included	• 2 banks	• Almost all banks (depending on the test)	• 30 Banks
Market share	• Percentage of total sector assets: 55	• Percentage of total sector assets: 95	• Percentage of total sector assets: 85
Data and baseline date	• Banks' own data	• Supervisory data	• Publicly available data. • Supervisory data, aggregated along bank groups only.
Methodology	• Combination of banks' own models and pre-defined benchmarks. • Translation to IMF scenarios based on LPA results.	• SNB stress testing framework (including BBA).	• IMF stress testing framework (tailor-made for the Swiss FSAP; enables modeling of "Expected Loss" (EL) and "Unexpected losses" (UL) under stress).
Stress test horizon	• 2 years (translated to 5 years using results from the LPA)	• 5 years (2013-2017)	• 5 years (2013-2017)
Shocks	• Shocks based on GDP trajectories and other relevant macroeconomic variables (evolution of Swiss macro variables agreed with the authorities; global variables modeled by RES, consistent with Swiss scenarios). • Three adverse scenarios: moderate external shock (1.2 StD in historical terms); severe external shock (3 StD in historical terms); domestic shock (protracted low growth).		
Risks/factors assessed	• Comprehensive coverage of solvency risks: credit, market, income risks, fixed income holdings (incl. of 'peripheral Europe'), funding, and other risks (including	• Comprehensive coverage of solvency risks: credit, market, income risks, fixed income holdings (incl. of 'peripheral Europe'), funding, concentration,	• Coverage of solvency risks: credit, market, income risks, funding, and contagion risks. • Comprehensiveness was *'limited'* by the unavailability of supervisory data on a

Domain	Assumptions		
	Bottom-Up by Authorities, based on LPA by banks (if applicable) 1/	Top-Down by Authorities (if applicable)	Top-down by IMF Team (if applicable)
	operational risk),	contagion, and other risks (including operational risk).	bank-by-bank basis.
Calibration of risk parameters	• Credit losses, pre-impairment income (components) and funding costs based on internal models. • Calibration of risk parameters for the different risks based on banks internal and regulatory models.	• Credit losses, pre-impairment income (components) and funding costs based on satellite models and the BBA. • Calibration of risk parameters for credit risk based on SNB models.	• Credit losses, pre-impairment income (components), and funding costs based on satellite models. • PIT PDs for credit risk based on Moodys KMV EDFs, matched to average supervisory PDs. LGDs based on average supervisory LGDs. • Asset correlations based on IRB formulae.
Behavioral adjustments	• Changes in RWAs take into account credit growth and changes in risk weights based on internal models. • Constant balance sheet composition. • No dividend payout. • No management actions considered.	• Changes in risk weights based on authorities models. • Constant balance sheet composition. • Pre-defined dividend payout based on income and capital ratio after stress.	• Changes in RWAs take into account credit growth and changes in risk weights based on IRB models. • Constant balance sheet composition. • Pre-defined dividend payout based on income and capital ratio after stress.
Regulatory standards	• Capital target based on Basel III and Swiss regulatory minimum for CET1 capital ratios.	• Capital target based on Basel III and Swiss regulatory minimum for CET1 capital ratios. • Basel II/III IRB rules, & StA.	• Hurdle rates based on Basel III and Swiss regulatory minimum for CET1 capital ratios. • Basel II/III IRB rules.
Results	• Capital ratios, shortfall (if applicable).	• Capital ratios, shortfall (if applicable), and	• Capital ratios, shortfall (if applicable), and

Domain	Assumptions		
	Bottom-Up by Authorities, based on LPA by banks (if applicable) 1/	Top-Down by Authorities (if applicable)	Top-down by IMF Team (if applicable)
		buffer changes; system-wide and by bank-type.	buffer changes; system-wide and by bank-type. • Pass or fail (number of banks); percentage of assets that fail.

Source: IMF staff

Notes:

1/ The LPA is not the firm-wide stress test of the banks. It is run by the authorities rules, assumptions and scenarios. However, it is based on bank-internal method-modules per (risk)-category

Appendix III. Liquidity Stress Test Matrix

Domain	Assumptions		
	Bottom-Up	Top-Down by Authorities	Top-down by IMF
Institutions included	• N/A	• Almost all banks	• 30 banks
Market share		• Percent of total sector assets: close to 100	• Percent of total sector assets: 85
Data and baseline date		• Supervisory data	• Publicly available data
Methodology		• Basel III ratio (LCR).	• Bank-run type test, (bank-run scenarios based on expert judgment).
Risks		• Funding & market liquidity, maturity mismatches.	• Funding liquidity, maturity mismatches.
Regulatory standards		• Proxy for Basel III ratio (LCR).	• N/A.
Results		• Pass rate, and remaining buffers; system-wide and by bank-type.	• Pass rate, and remaining buffers; system-wide and by bank-type.

Source: IMF staff

Appendix IV. Risk Assessment Matrix (RAM)

Appendix Table 3. Switzerland: Risk Assessment Matrix[1]

Switzerland	Overall Level of Concern	
Nature/Source of Main Threats and Possible Triggers	**Likelihood of severe realization of threat sometime in the next three years**	**Expected impact on financial stability if threat is realized**
Side-effects from global financial conditions (risk #1): • Surges in global financial market volatility (related to UMP exit), leading to economic and fiscal stress, and constraints on country policy settings.	High Bouts of market volatility and higher-than-expected increases in long-term rates could occur as a result of advanced countries exiting from UMP.	Medium Disorderly unwinding of UMP might cause renewed safe haven inflows into Switzerland, forcing the SNB to intervene again to defend the floor. Pressures on the housing market may also intensify.
Protracted period of slower growth in advanced and emerging economies (risk #2): • Advanced economies: larger than expected deleveraging or negative surprises on potential growth. • Emerging markets: earlier maturing of the cycle and incomplete structural reforms leading to prolonged slower growth.	High for Europe A protracted period of weak demand could take a toll on productive capacity across advanced economies. In Europe in particular, the risk of deflation has increased. Medium for elsewhere Trend growth is lower as a result of weaker than expected productive capacity and human capital. Disappointing activity in emerging markets would bring about a reassessment that the cycle is more mature, amid quasi-fiscal activities more pervasive than in the baseline.	Low Europe is the main trading partner of Switzerland; a protracted period of slower European growth would dampen economic growth and possibly cause a recession.
Financial stress in the euro area re-emerges (triggered by stalled or incomplete delivery of euro area policy commitments) (risk #3)	Medium Financial stress re-emerges and bank-sovereign links re-intensify as a result of stalled or incomplete delivery of policy commitments at the national or euro area level (e.g., , banking union), a negative assessment of the asset quality review combined with insufficient backstops, or adverse developments in some peripheral countries.	Medium Given the close trade links, a re-emergence of the stress would slow economic growth. Safe haven capital inflows would resume, requiring intervention. Pressures on the housing market may also intensify. Direct financial sector exposure to euro area countries under market pressure is moderate. Indirect exposures could become problematic in a tail risk situation.

[1] The Risk Assessment Matrix (RAM) shows events that could materially alter the baseline path (the scenario most likely to materialize in the view of IMF staff). The relative likelihood of risks listed is the staff's subjective assessment of the risks surrounding the baseline ("low" is meant to indicate a probability below 10 percent, "medium" a probability between 10 and 30 percent, and "high" a probability of 30 percent or more). The RAM reflects staff views on the source of risks and overall level of concern as of the time of discussions with the authorities. Non-mutually exclusive risks may interact and materialize jointly.

Appendix Table 4. Switzerland: Risk Assessment Matrix (Concluded)		
Switzerland	**Overall Level of Concern**	
Nature/Source of Main Threats and Possible Triggers	**Likelihood of severe realization of threat sometime in the next three years**	**Expected impact on financial stability if threat is realized**
Sharp correction in the housing market (risk #4)	Medium Low interest rates and ample liquidity continue to drive prices higher. A price correction is likely once interest rates return to normal levels.	Medium A sharp correction in housing prices would weaken household balance sheets and slow down growth. The banking and insurance industries, both exposed to the mortgage market, would suffer. Domestically focused banks are particularly vulnerable, though they are well capitalized on average.
Bond market stress from a reassessment in sovereign risk (risk #5)	Medium • Japan: Abenomics falters, depressed domestic demand and deflation (short term), leading to bond market stress (medium term) Low • United States: protracted failure to agree on a credible plan to ensure fiscal sustainability (medium term)	Medium Global asset managers may maintain or further shift asset allocations to safe havens, including Swiss franc-denominated assets. Safe haven flows would put the currency under pressure again and possibly re-exacerbate pressures in the housing market.
Risks to financial stability from incomplete regulatory reforms: delays, dilution of reform, or inconsistent approaches (medium term) (risk #6)	Medium Remaining uncertainties about the design of future global regulatory landscape and slow progress in reaching agreements on effective crisis resolution mechanisms continue to hinder developments of appropriate business models.	Medium The banking sector is highly globally interconnected, and large banks are highly leveraged and dependent on wholesale funding. As such, they are a potential source of outward spillovers and vulnerable to inward spillover from instability in global financial markets.
Increasing geopolitical tensions surrounding Ukraine lead to disruptions in financial, trade, and commodity markets (risk #7)	Medium Doubts about whether Ukraine will consistently make timely commercial and financial payments, both internally and externally; financial and trade disruptions; contagion; a further slowdown in Russia; and uncertainty all trigger a re-pricing of risks and heightened volatility in financial markets.	Medium The direct impact should be limited. However, contagion and heightened volatility in financial markets may trigger renewed safe haven flows.

Appendix V. Computation of Expected Losses and Risk Weighted Assets Under Stress

The computation of risk-weighted assets is based on the computation of Unexpected Losses. Expected Losses are equal to the product of the probability of default (PD), the loss-given default (LGD), and exposure at default (EAD).

Expected Losses

In order to compute Expected Losses, PDs are forecasted using credit risk models. These are based on the historical empirical relationship between PDs and macroeconomic variables, mainly GDP, but also interest and exchange rates. This relied on the use of standard regression analysis.[1] The historical PDs are taken from Moody's KMV and calibrated to match the average level of the PDs provided by the authorities.

Unexpected Losses/Risk Weighted Assets

Unexpected Losses and hence risk weighted assets are calculated using the IRB capital requirement formula of Basel II/III (the capital requirement), based on the Vasicek one factor model. The use of these formulae to project RWAs for IRB portfolios is a commonly accepted approach in FSAP stress tests (using point-in-time PDs instead of through-the-cycle PDs), and is complemented by credit risk models to translate changes in macroeconomic and financial variables into risk parameters. Such an approach corresponds to an economic view of the computation of unexpected losses, rather than a model for *regulatory* RWAs.

The Basel capital requirement formula has been criticized for a number of reasons: It assumes a time-invariant normal distribution of the systematic and idiosyncratic factors, and a time-invariant correlation with both factors. Furthermore it does not account for concentration risk. Another problem is that it is a pure model construct and despite the through-the-cycle PD, it doesn't include any time-sensitive information.

To address the criticized time-invariance and the static nature of RWAs, we use the empirical relationship between PDs and macroeconomic variables to account for higher co-movement with macroeconomic variables, and adjust the through-the-cycle PDs for changes in the economic variables under the different stress scenarios by using the calibrated point-in-time PD described earlier. With this adjustment, several of the criticisms could be addressed at once. As a result, risk-weighted assets move in line with macroeconomic conditions. In other words Unexpected Losses are likely to be higher when the economic outlook deteriorates.

[1] Owing to the short nature of the time series available for the risk parameters, these were modeled as a linear function of the macroeconomic variables.