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FRANCE

FINANCIAL SECTOR ASSESSMENT PROGRAM

October 2019

TECHNICAL NOTE—RISK ANALYSIS OF BANKING AND INSURANCE SECTOR

This Technical Note on Risk Analysis of Banking and Insurance Sector on France was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on October 1, 2019.

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TECHNICAL NOTE

RISK ANALYSIS OF BANKING AND INSURANCE SECTOR

Prepared By
Monetary and Capital Markets Department

This Technical Note was prepared in the context of an IMF Financial Sector Assessment Program (FSAP) in France in December 2018 and March 2019 that was led by Udaibir Das. Further information on the FSAP program can be found at http://www.imf.org/external/np/fsap/fssa.aspx

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Glossary

AIA	American International Assurance
AC	Amortized Cost
ACPR	French Prudential Supervision and Resolution Authority
BdF	Banque de France
BIS	Bank for International Settlements
BMA	Bayesian Model Averaging
BSCR	Basic Solvency Capital Requirement
CAR	Capital Adequacy Ratio
CBC	Counterbalancing Capacity
CCB	Capital Conservation Buffer
CCBC	Cumulated Counterbalancing Capacity
CCyB	Counter Cyclical Capital Buffer
CFLST	Cash flow-based liquidity stress test
CET1	Core Equity Tier I Capital
COREP	Common Reporting Template
CQS	Credit quality steps
CRD	Capital Requirements Directive
CRR	Capital Requirements Regulation
CVA	Credit Valuation Adjustment
EA	Euro Area
EAD	Exposure at default
EBA	European Banking Authority
EDF	Expected default frequency
EIOPA	European Insurance and Occupational Pensions Authority
FCI	Financial Condition Index
FiCoD	Financial Conglomerates Directive
FINREP	Financial Reporting Template
F&C	Fees and Commissions
FSAP	Financial Sector Assessment Program
FVOCI	Fair Value through Other Comprehensive
FVPL	Fair Value through Profit or Loss
GaR	Growth-at-Risk
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GFSR	Global Financial Stability Report
GMM	Global Macrofinancial Model
G-SII	Global Systemically Important Institution
G-SIB	Global Systemically Important Bank
HC	Haircuts
HQLA	High Quality Liquid Assets
IFRS	International Financial Reporting Standards
IRB	Internal Rating Based Approach
LAC DT	Loss-Absorbing Capacity of Deferred Taxes
LAC TP	Loss-Absorbing Capacity of Technical Provisions

LGD	Loss Given Default
LCR	Liquidity coverage ratio
LTG	Long-Term Guarantees
NPL	Nonperforming Loan
NSFR	Net Stable Funding Ratio
NTUC	National Trade Union Congress
OLS	Ordinary Least Spheres
ORSA	Own Risk and Solvency Assessment
PiT	Point in time
PD	Probability of Default
P2G	Pillar II Guidance
P2R	Pillar II Requirement
RAM	Risk Assessment Matrix
RWA	Risk-Weighted Assets
SCR	Solvency Capital Requirement
SFT	Secured Financing Transactions
SI	Systemic Institution
SME	Small and Medium Enterprises
SSM	Single Supervisory Mechanism
STA	Standardized Approach
ST	Stress Test
STE	Short-Term Exercise
STeM	Stress Testing Matrix
TTC	Through-the-cycle
USD	U.S. Dollar
VA	Volatility Adjustment
VIX	Volatility Index
WEO	World Economic Outlook

EXECUTIVE SUMMARY[1]

France is home to numerous banks and insurers which are very active at a global scale. Four Global Systemically Important Banks (G-SIBs) are incorporated in France as well as multiple number of large insurers. Assets of banking system exceed GDP by 2.7 times. Four G-SIBs dominate France's financial landscape, also taking into account bancassurance (i.e., banking and insurance companies working under financial conglomerate structure) business model they have. Global presence and diversification, integration of banking and insurance activities defined the perimeter and scope of systemic risk assessment (including stress testing) of FSAP.

This technical note contributes to the FSAP's assessment of systemic risk with a comprehensive set of stress testing exercises. The assessment is based on stress tests, which simulate the health of banks, insurers under severe yet plausible (counterfactual) adverse scenarios. Scenarios include global and regional financial market turmoil (shocks to term and risk premiums), a major slowdown of economic activity in Euro Area (EA) and France due to secular stagnation and trade shocks. The analyses include simulations based on solvency and liquidity scenarios.

The stress tests reveal that banks and insurers would be resilient against simulated shocks, although some challenges remain.

Banks: While solvency risks appear to be contained by capital buffers (including additional Pillar II requirements and guidance imposed by Single Supervisory Mechanism (SSM)), negative interest rates, dependency on wholesale funding, particularly in USD remain the key challenges to some banks in terms of profitability and liquidity. Exposure to wholesale funding, coupled with simulated shocks on funding costs (due to increase in term and risk premiums), together with credit risk stemming from corporate portfolio, would be the two most important contributors to simulated losses. Liquidity risks in EUR appear to be well managed by abundant liquidity buffers comprised from high quality and diversified collateral, albeit residual USD funding risks are still present.

Insurers: Under the adverse scenario, the median Solvency Capital Requirement (SCR) ratio would decrease from 201 to 163 percent, mostly caused by higher spreads of sovereign and corporate bonds, while the change in the risk-free interest rate effectively benefitted the companies through lower liabilities. No company drops below the 100 percent regulatory threshold for the SCR coverage. The FSAP furthermore analyzed the liquidity of insurers' asset allocations and the pattern of life insurance lapses as well as the default of the parent banking group: while the immediate risks stemming from the highly liquid nature of French life insurance policies are limited, financial distress at a parent bank could potentially have a significant spillover to a life insurance subsidiary within a conglomerate, causing both solvency and liquidity concerns for the insurer.

Competent authorities could consider available policy tools to minimize wholesale funding related risks to banks. Authorities may consider asking banks to hold liquidity buffers to cover

[1] This Technical Note has been prepared by Mindaugas Leika, Yingyuan Chen (IMF), and Timo Broszeit (consultant).

predetermined threshold of wholesale funding outflows over/up to five days horizon. These buffers could be targeted at all significant currencies.

The FSAP team faced many data limitations which hindered the analysis. Inability to access European Banking Authority (EBA) 2018 Stress Test templates[2] required many additional assumptions to be built into analysis. Limited historic data availability and inability to access probability of default (PDs)/loss given defaults (LGDs) time series produced by banks, required use of market data (such as market-based metrics for PDs) which may be not the same as banks use for internal risk assessment. Moreover, data availability and transparency in EA, in general, is lower compared to such advanced economies, like USA or Japan where public loan portfolio loss data are much more widely available.

Table 1. France: Recommendations on Financial Stability Analysis and Stress Testing

Recommendations	Time*	Responsibility
Discuss options with the ECB and the industry to minimize any disruptions in wholesale funding markets. Consider holding liquidity buffers to cover at least 50 percent of wholesale funding outflows over/up to five days horizon.	NT	ACPR/ECB
Start implementing dynamic bank solvency stress tests to better inform the state of the quality of capital under various macrofinancial conditions.	NT	ACPR/ECB
Include more granular data collection about collateral availability, cash flows by jurisdiction.	NT	ACPR/ECB
Further intensify monitoring of insurers' exposures towards parent banks and consider the possibility of setting concentration limits based on eligible capital.	NT	ACPR
Intensify data quality checks on insurers' supervisory reporting and enforce corrections and updates of mis-reported data.	I	ACPR
Step up developing macro stress testing of insurance and feeding results into insurers' Own Risk and Solvency Assessments.	NT	ACPR

* C = Continuous; I = Immediate (within one year); NT = Near Term (within 1–3 years); MT = Medium Term (within 3–5 years).

[2] Under the ownership framework of ECB-SSM.

BACKGROUND

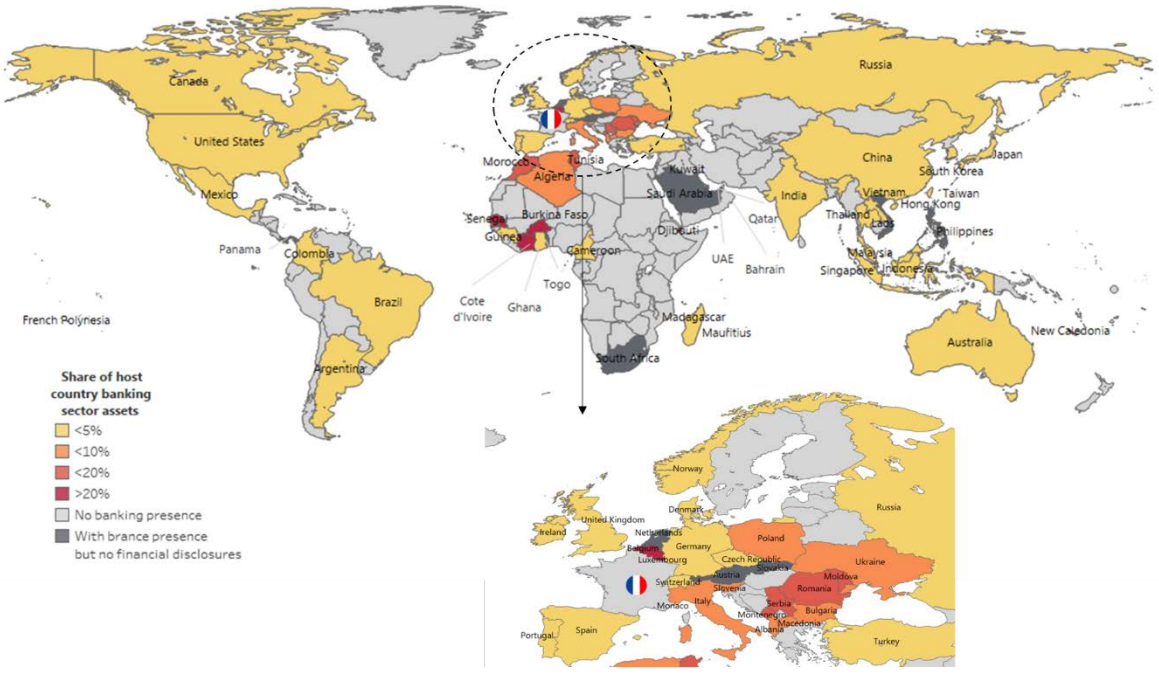
1. The objective of the FSAP systemic risk analysis is to assess the resilience of the financial system to adverse shocks. The assessment relies on simulations of the capacity of the financial system to withstand severe but plausible macrofinancial shocks. It assesses risks and vulnerabilities in the system and the channels through which adverse shocks are transmitted and amplified. Adverse scenarios are hypothetical and are used for exploring risks and should not be interpreted as macroeconomic forecasts.

A. Financial System Landscape

2. The financial system is large and diversified. The total financial system assets stand close to 600 percent of GDP, with more than 400 banks, 700 insurers and 130 asset managers operating in the system. France is also home to four G-SIB (BNP Paribas, BPCE, Credit Agricole, Société Générale) and one Global Systemically Important Institution (G-SII). There are extensive cross-sector and cross-border linkages to the rest of the world. The G-SIBs are active in around 80 countries globally. In several countries, the total assets of their subsidiaries comprise more than 20 percent of the host country's banking system assets. While cross-border exposures from banks have retrenched in recent years, the decline has been partly offset by expansions from the nonbank sectors (insurers and asset managers).

French Banks' Global Footprint

(Banking assets in each country as percent of host country total banking assets)



Sources: SNL Financials and IMF calculations.
Note: Based on French banks' material subsidiaries in each country.

3. The largest French banks dominate the domestic markets, but their business models are very different. Total assets of the largest six French Significant Institutions (Sis) add up to over 90 percent of the total banking system assets (Table 2). However, their business models vary across a wide spectrum. From the geographic perspective, BNP Paribas and Société Générale are most active in international markets. Credit Agricole and BPCE focus more on the euro area, while Credit Mutuel and La Banque Postale are predominantly geared towards domestic markets. From the business segment perspective, BNP Paribas, Société Générale, Credit Agricole, and BPCE are universal banks, while Credit Mutuel and La Banque Postale focus more on consumer and corporate lending.

4. Though less important than banks, insurance activity has grown in recent years. Life insurance is primarily written domestically while general insurance is written across numerous European countries, and even globally by some groups. Life insurance covers (mortality and morbidity) risk and savings products, but excludes annuity business, given the dominance of the Central Provident Fund that is a compulsory pension scheme. The assets of the insurance sector are concentrated in the "big" four insurers: American International Assurance (AIA), Great Eastern, National Trade Union Congress (NTUC) Income and Prudential. Reinsurance is active, but only represents about 7 percent of the assets of the sector.

B. Financial Sector Trends

Banking Sector Soundness

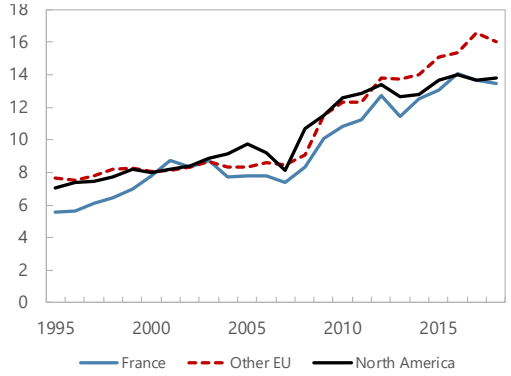
5. French banks have improved their capitalization and asset quality, but profitability remains challenged. Overall profitability measured by return on assets is low compared to European and US peers, especially in the domestic markets. Earnings expectations are pointing to continuing low levels. The return on assets has weakened for the domestic market, especially for the G-SIBs though they have improved their earnings from foreign markets (Figure 1).

6. Profitability is pressured on both the income and expense sides. Net interest margin is among the lowest in the EA despite some improvement since the global financial crisis.[3] Retail funding cost is relatively high compared to the peers—likely due to the regulated savings scheme and competition for market share from both banks and nonbank institutions. Despite favorable credit ratings, French banks' high reliance on wholesale funding could leave them vulnerable to changing market conditions, especially for the short-term wholesale funding. In addition, French banks face low cost efficiency due to high management cost and fixed cost from extensive banking networks in both domestic and foreign markets. Banks' ability to generate higher interest income is constrained by persistently low interest rates, and market businesses including trading activities have contracted in recent years. In response, banks have successively raised fees and commissions, launched restructuring plans and expanded their distributions of bancassurance products (Figure 1).

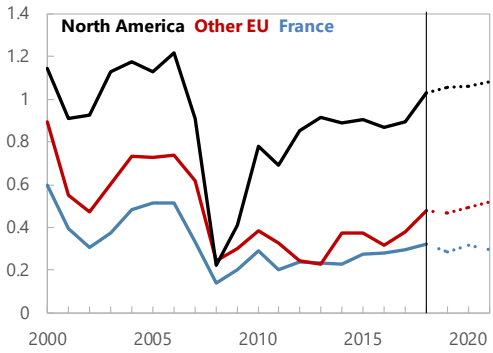
[3] Low net interest margins also suggest low cost of risks from improved quality of loan portfolios (see BdF 2018).

Figure 1. France: Financial Performance of Banks

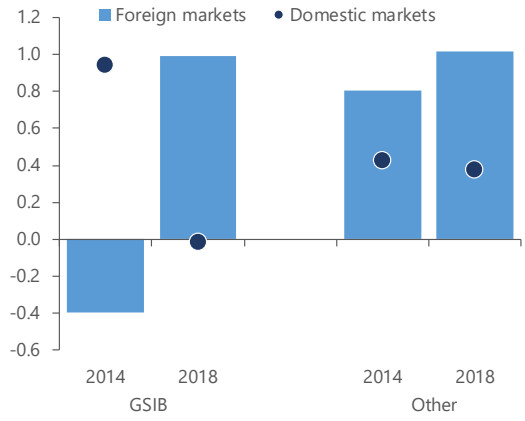
1. Capital Position



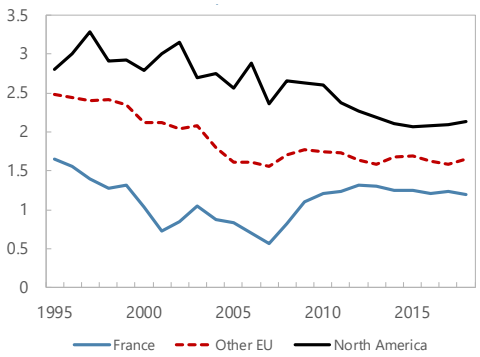
2. Overall Profitability and Outlook (Percent)



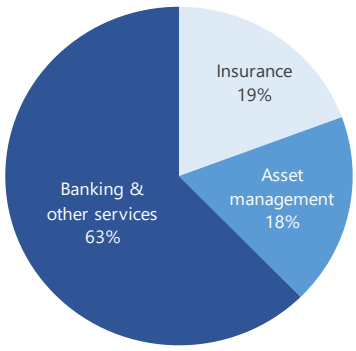
3. Return on Assets by Markets (Percent)



4. Net Interest Margin (Percent)



5. Fees and Commissions by Business Lines (As of 2018:Q4)



Sources: Bloomberg Finance L.P., FINREP, and SNL financials.
Note: in panel 2, dotted lines are weighted averages of analyst forecasts of RoA for each sample bank.

Insurance Sector Soundness

7. French insurers' solvency ratios have been increasing since the introduction of Solvency II, with heavy exposures to government and corporate securities. Despite small legacy business with high interest rate guarantees, life insurers have expanded further into guarantee-free and unit-linked business, reducing capital requirements. French insurers are well capitalized with all but one insurer meeting the 100 percent SCR ratio without recourse to transitional measures. There is a wide distribution of SCR ratios which is broadest among small insurers. The non-life insurance industry has shown a combined ratio above 100 percent in the last five years, which is unsustainable in the long run as investment income needs to compensate the underwriting losses, particularly in a low interest rate environment with short-term investment returns near zero percent. Still, in aggregate, the insurance sector has over the last five years recorded a return on equity between 6 and 8 percent.

C. Sample of Banks and Insurers Included in the Risk Analysis

8. The tests cover seven SIs which account for more than 90 percent of banking system's assets, and nine insurance groups which account for over 70 and 40 percent in the domestic life and non-life markets, respectively.

Table 2a. France: List of Banks Under the FSAP Risk Analysis

(End-2018)	Bank Assets (Billions of euros)	Bank Equity (Billions of euros	Share of Total Banking Sector Assets	Share of Total Banking Sector Equity	Cumulative Shares of Total Banking Sector Assets
				(Percent)	
BNP Paribas	2,041	106	25	23	25
Crédit Agricole	1,624	66	20	14	45
Société Générale	1,309	66	16	14	61
Groupe BPCE	1,274	73	16	16	76
Crédit Mutuel Group	853	55	10	12	87
La Banque Postale	245	10	3	2	90
HSBC France	181	7	2	1	92

Sources: ECB and company financial reports.

Table 2b. France: List of Insurers Under the FSAP Risk Analysis								
(End-2017, in millions of euros)	Life			Non-Life			Consolidated Group	
	Domestic Gross Written Premiums	Market Share	Cumulative Market Share	Domestic Gross Written Premiums	Market Share	Cumulative Market Share	Total Balance Sheet Assets	Eligible Capital to Meet the SCR
		(Percent)			(Percent)			
CA Assurances	22,043	14	14	3,927	4	4	370,038	23,562
CNP Assurances	21,977	14	27	975	1	5	428,352	26,088
BNP Paribas Cardif	11,984	7	35	602	1	5	210,286	12,061
AXA	11,403	7	42	13,435	13	18	618,941	57,764
Natixis	10,820	7	48	1,082	1	19	81,303	3,254
Sogecap	9,870	6	54	529	1	20	149,687	5,959
GACM	7,197	4	59	2,876	3	23	115,459	11,267
Covea	3,763	2	61	10,386	10	33	116,961	23,680
Groupama	2,639	2	63	8,491	8	41	98,605	12,682
Sources: ECB and company financial reports.								

D. Scenarios and Scope of Systemic Risk Analyses

Risks and Vulnerabilities

9. The main macrofinancial vulnerability relates to a subset highly leveraged corporates and to wholesale funding of banks.[4] Corporate debt has increased significantly in France since the global financial crisis, in contrast to what is observed in peer European countries. On a non-consolidated basis, the increase in corporate debt as a share of GDP can be explained mostly by intercompany loans and bond financing, and to a lesser extent by bank credit. While bank credit growth is broad-based, there is some concentration risk in the balance sheet of individual banks related to large exposures to individual large indebted corporate. For some of the G-SIBs, short-term wholesale funding has decreased but remains higher compared to their European peers. In particular, short-term funding from financial institutions and nonfinancial corporates constitutes a sizeable share of total funding. Risks stemming from wholesale funding are not only due to liquidity but also due to potential impact on funding cost were risk scenarios to materialize.

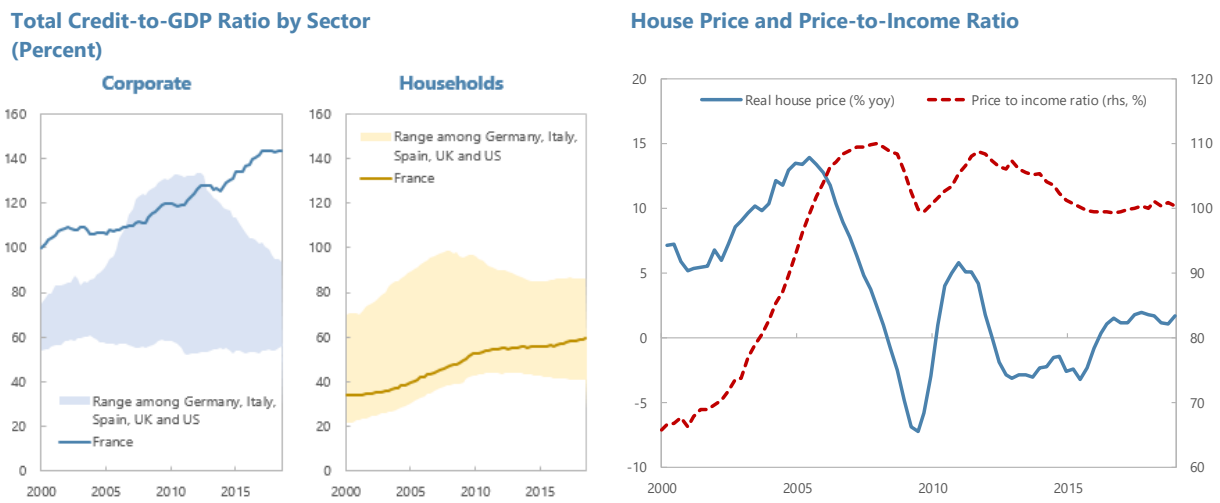
10. Households' balance-sheet vulnerabilities appear to be contained, though some households—lower income, younger—may have experienced a deterioration of their balance sheet along certain dimensions. Despite the increase in household indebtedness since the onset of the global financial crisis (GFC), aggregate households' balance sheet remains solid: households

[4] These are the summary of analysis described in a separate technical note on corporate and household vulnerabilities. See France: Financial Sector Assessment Program. Technical Note on Corporations and Households Vulnerabilities (IMF 2019)

continued to build their financial net worth by accumulating financial assets faster than debts (Figure 2). However, potential pockets of vulnerabilities should be further studied.

11. Residential house prices appear to be broadly aligned with fundamentals. The price dynamics are not excessive at the national level, and the recent price increase seems limited to local markets such as Paris. Despite the observed increase in households' debt-to-income ratios and loan-to-value ratios, affordability seems to have improved on average in recent years, and there is also an improvement in the return on the rental market. (Figure 2).

Figure 2. France: Corporate and Household Sectors



Sources: Bank for International Settlements, Organization for Economic Co-Operation and Development, and IMF calculations.

Macrofinancial Scenarios

12. The solvency stress test for the Systemic Institutions (SIs) includes a baseline and an adverse macroeconomic scenario. The baseline corresponds to the WEO projections as of February 2019. The severity of the adverse scenario is estimated using the Growth-at-Risk framework as well as simulations using the Global Macrofinancial Model (GMM), a structural macro-econometric model of the world economy that is disaggregated into forty national economies, as documented in Vitek (2018). The reference date for the exercise is December 31, 2018.

13. The scenarios cover a five-year horizon with a U-shape GDP profile under the adverse scenario. The stress horizon is between 2019 and 2023. The simulation is based on a narrative that captures the risks discussed in the Risk Assessment Matrix (RAM), with particular attention paid to the main vulnerabilities of French borrowers and banks (Appendix I). The adverse scenario is discussed in detail below. A range of sensitivity tests are also explored, which include asset and housing price shocks, shocks to LGD as well as valuation of Level 3 assets.

14. The macroeconomic model used to calibrate the scenario ensures consistency with other large country economies. The GMM model, the basis for IMF's scenario design, is the workhorse model for all FSAPs in larger economies. The model has been used in Spain, Japan, Netherlands, and another EA FSAPs. In addition, the approach used by the Fund to determine the severity of the scenarios, which considers several indicators, including impact on GDP observed in past crisis, volatility of the GDP (standard deviation) and Growth-at-Risk (GaR) measures, ensures consistency across countries.[5]

15. Overall severity and probability of the adverse scenario. FSAP stress tests are not regulatory and do not have any implications to banks in terms of capital requirements. Hence, the stress tests are of an exploratory nature and focus on a combination of both structural and cyclical risks. Therefore, the adverse scenario for GDP has a low 5 percent probability of occurrence.[6] Historical data confirms that estimated GaR lies at the tail of the growth distribution. The term structure of GaR reveals that a tightening of financial conditions produces effects on GDP at risk as that are comparable to those observed in 2008–2009. More details are presented in Appendix V.

16. GaR analysis shows that the biggest contributing factors to the risk of growth are cost of funding and stock market prices. Financial conditions continue to tighten gradually since mid-2017, though the overall conditions remain accommodative. French financial conditions are most sensitive to changes in cost of funding (corporate spread, interbank spread, sovereign yield over bund), housing market (housing price), valuation and volatility of the domestic stock markets, and external conditions (euro; Volatility Index (VIX)). The gradual tightening of financial conditions is most prominently driven by higher corporate spreads. On the other hand, there is a meaningful easing in the real long-term interest rates, as inflation accelerates faster than the sovereign yield. A rebound in both the domestic and global stock markets also helped to offset some of the tightening forces.

17. The adverse stress test scenario for France is driven by global secular stagnation, financial market disruptions and confidence losses. This scenario is simulated using the GMM, using GaR-based results as a severity benchmark under the 5 percent probability for the trajectory of GDP. The U-shaped scenario assumes that given financial conditions prevailing in 2018:Q2, real GDP growth would fall by 7.1 percent over three years, which also represents the lower bound of the simulated recession under the adverse scenario (see Appendix IV). The five-year duration of the adverse scenario aims at capturing uncertainty related to global trade and long-term stagnation. The global layer of the scenario is the same for all countries, while domestic layers differ. Therefore, it is not assumed that EA countries have the same adverse scenario paths across FSAPs.

[5] In the specific case of France and Italy, the severity of shocks being used in both FSAPs is compatible with a 5 percent GaR measure. Comparability across different EA FSAPs will be highly undesirable. This is for several reasons: first, the STs are conducted at different points in time and reflective of the shifts in risk outlook. Second, they capture the domestic conditions as well as STs can.

[6] Probability of occurrence is dependent on time horizon of sample included into FCIs, variables included into FCIs, as well as data dimensionality reduction methods chosen. To ensure consistency, we use GFSR methodology.

18. Under the adverse scenario, global trade disruptions generate financial market stress that are amplified by heightened uncertainty in Europe and United States. In particular, increases in tariff and nontariff trade barriers reduce exports and imports by 10 percent and productivity by 1.0 percent worldwide over five years. In addition, profitability concerns and heightened risk aversion reduce real equity and house prices by 20.0 and 10.0 percent worldwide over three years, respectively. Finally, confidence losses reduce business investment by an additional 8.0 percent worldwide over five years. De-globalization initiatives raise profitability concerns in the banking sectors, which experience stress represented by a widening of interbank spreads, by 120 basis points in the high spread Euro Area, 100 basis points in low spread Euro Area economies and the United Kingdom, and by 50 basis points in the United States. At the same time, global term premium decompression interacts with the re-emergence of sovereign stress in high-spread Euro Area economies, raises long term government bond yields by 360 basis points in high spread Euro Area economies, by 200 basis points in low spread Euro Area economies and the United Kingdom, and by 120 basis points in the United States and Japan. More details of the scenario and the transmission channels are presented in Table 3 and Figure 3.

19. In France, these adverse macrofinancial developments are amplified by loss in confidence and negative effects on corporate and household balance sheets. Global asset price adjustments induce balance sheet stress across sectors, leading to confidence losses that manifest through an additional 6.0 percent reduction in business investment over three years, while capital outflow pressure depreciates the euro by 5 percent in real effective terms over two years. Under this scenario, conventional monetary policy responds endogenously with nominal policy interest rate cuts subject to effective lower bound constraints worldwide, while we abstract from unconventional monetary policy responses. In addition, automatic fiscal stabilizers operate fully worldwide where fiscal consolidation reactions do not occur, while we abstract from fiscal stimulus measures.

20. Under this scenario, France experiences severe and sustained macrofinancial stress. Output falls 7.1 percent below baseline by 2021, reflecting a 7.4 percent fall in consumption, and a 15.1 percent fall in investment. This output loss has large cyclical and structural components, with consumption price inflation falling 1.9 percentage points below baseline by 2021, and the unemployment rate rising 3.8 percentage points above. Following a 120-basis point shock to term premium, sovereign risk premium increases up to 150 basis points by 2021 as safe haven flows help to partly contain the rise in interest rates. More details are presented in Appendix IV.

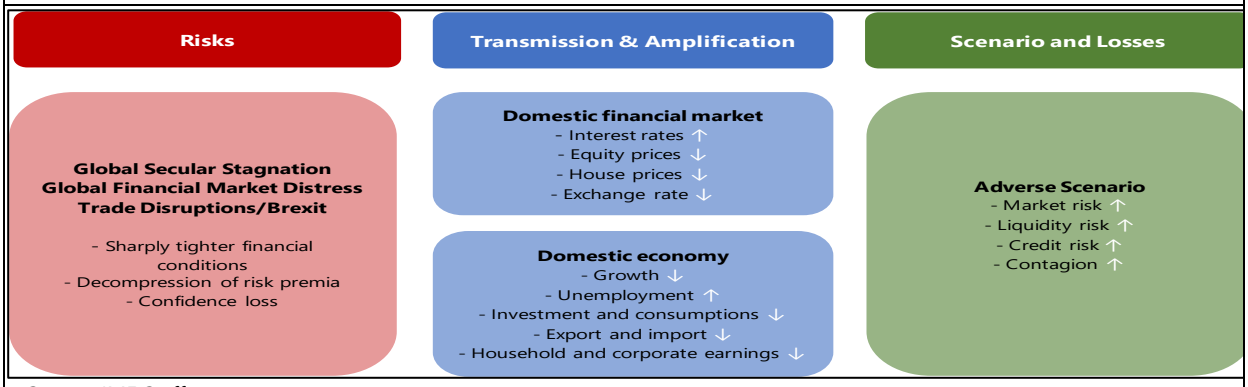
21. Other economies experience a wide range of output losses under this scenario. Indeed, output falls up to 8.5 percent below baseline in the rest of the Euro Area by 2021, and up to 6.9 percent in the rest of the world. This high dispersion in output losses reflects differences in shocks, exposures, vulnerabilities, and policy space. In aggregate, world output falls 6.1 percent below baseline by 2021, while energy and nonenergy commodity prices fall 26.6 and 15.4 percent below, respectively.

Table 3. France: Scenario Assumptions

Layer 1: Global trade disruptions/ De-globalization, 2019:Q1–2023:Q4	
Exports; Export demand shocks	-10 percent
Imports; Import demand shocks	-10 percent
Productivity; Productivity shocks	-1 percent
Layer 2: Global confidence losses, 2019:Q1–2021:Q4	
Business investment; Business investment demand shocks	-8 percent
Layer 3: Global asset market disruptions, 2019:Q1–2021:Q4	
Real equity price; Equity risk premium shocks	-20 percent
Real house price, Housing risk premium shocks	-10 percent
Layer 4: Financial Market Stress in Europe and United States, 2019:Q1–2021:Q4	
Interbank spread; Liquidity risk premium shock	
High Spread Euro Area	+120 basis points
Low Spread Euro Area, United Kingdom	+80 basis points
United States	+40 basis points
Term premium; Duration risk premium shocks	
High Spread Euro Area	+240 basis points
Low Spread Euro Area, United Kingdom	+120 basis points
Japan, United States	+80 basis points
Layer 5: Currency depreciation, 2019:Q1–2020:Q4	
Real effective exchange rate; Currency risk premium shocks	
Euro Area	+5 percent
Layer 6: Confidence losses in France, 2019:Q1–2021:Q4	
Business investment; Business investment demand shocks	-6 percent

Source: IMF.
Note: All scenario assumptions are expressed as deviations from the October 2018 World Economic Outlook baseline. Those endogenous variable adjustments that peak in 2020:Q4/2021:Q4 40/20 percent dissipate by 2023:Q4. High spread euro area economies include Greece, Ireland, Italy, Portugal, and Spain.
Low spread euro area economies include Austria, Belgium, Finland, France, Germany, and the Netherlands.

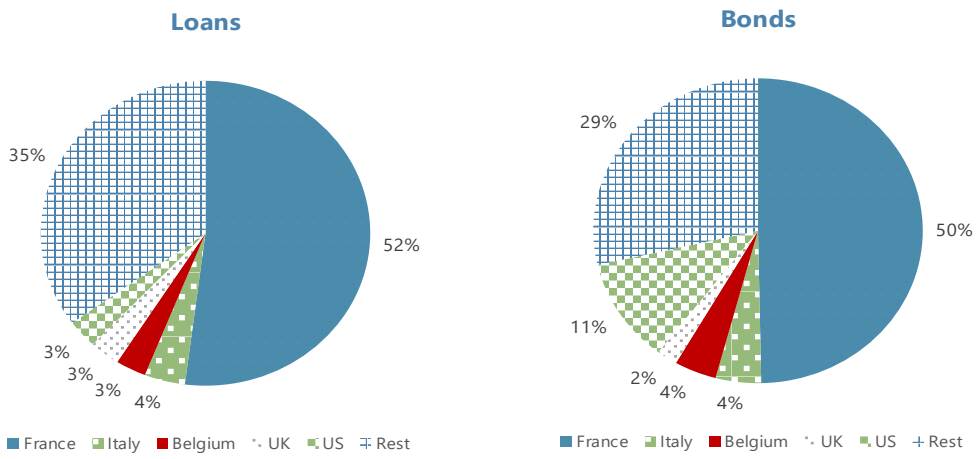
Figure 3. France: Transmission Channels of Adverse Shock



Source: IMF Staff.

22. The adverse macrofinancial development in Belgium, Italy, United Kingdom and United States are of particular interest in the stress test. The sample banks have the highest exposure to these 4 countries across sovereign, corporate and household sectors [Figure 4]. Italy, as one of the high spread euro area country, would see output falls 7.9 percent below the baseline and unemployment rate rises 7.3 percentage points above the baseline by 2021. Sovereign risk premium rises up to 450 basis points following the term premium decompression by 240 basis points. The severity of the scenario is slightly milder than what was observed during the euro area sovereign crisis. More details are presented in Appendix IV.

Figure 4. France: Loans and Bond Exposures by Geography



Source: FINREP, as of 2018:Q4.

SOLVENCY STRESS TESTING OF BANKS

A. Key Elements of Bank Solvency Stress Tests

23. The objective of the risk analysis component of the FSAP is to identify macro-financial vulnerabilities and is different from supervisory (EBA) approaches. The approach of the EBA exercise is that of a constrained bottom-up stress test where banks are required to project the impact of the scenarios on their projected capital position and P&L but subject to strict constraints defined in the common methodology. By contrast, the FSAP stress test is a top-down exercise with projections generated by in-house models developed by the FSAP team. While the FSAP and EBA scenarios broadly share a consistent narrative of risks, they differ in terms of the granularity of data used, and calibration of the various shocks. Hence, EBA and IMF TD ST results are not directly comparable.

24. The stress test was based on ECB confidential supervisory data post-June 2014. The ECB shared supervisory data templates including EBA's Implementing Technical Standards (ITS) which cover financial reporting templates (FINREP) and common reporting templates (COREP), as well as ECB's Short-Term Exercise (STE) with detailed quarterly reporting on interest rate risk in the

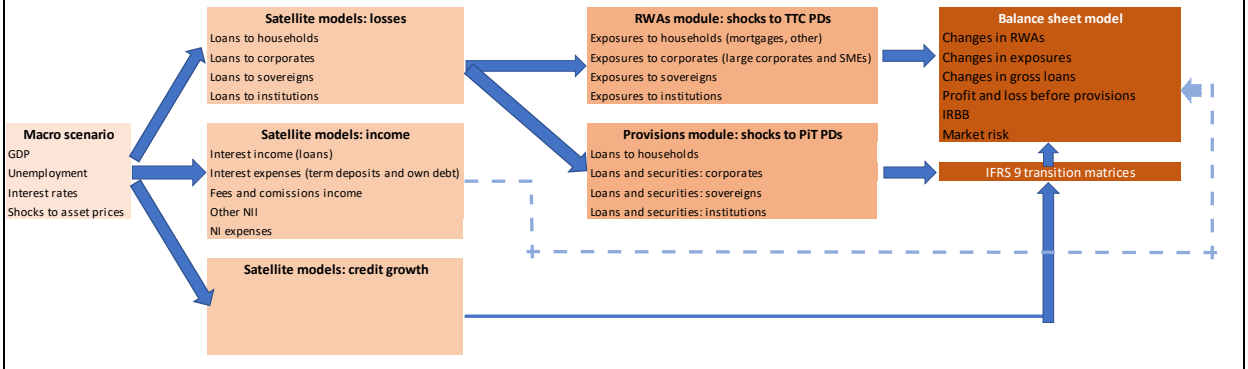
banking book, internal; capital and liquidity risk assessment and other data. The team also received some data (PDs, LGDs) from previous EBA stress testing exercises. Other public data sources included ECB's MIR statistics, financial data vendors (i.e., Bloomberg, Haver Analytics, Moody's KMV, Fitch), and IMF's World Economic Outlook (WEO).

25. The stress tests were conducted using end-2018 data at the highest level of consolidation in the euro area. The perimeter of consolidation of the banking group is specified in Capital Requirements Directive (CRD) IV. All deposit taking institutions (branches and subsidiaries) belonging to the group were included while insurance activities were excluded.

26. The stress tests followed a balance sheet approach and were based on accounting (IFRS9) and regulatory capital requirement calculations. Adoption of IFRS9 since 2018 required the team to distinguish between risk parameters used for accounting expected and incurred loss calculations (i.e., provisions) and regulatory expected loss calculations. Six banks in the stress test sample follow the Internal Ratings-Based approach (IRB) while the remaining one bank follows the Standardized Approach (STA). In line with this regulatory framework, banks' performance was assessed based on total capital adequacy ratio (CAR), Core Equity Tier 1 (CET1) capital and leverage ratios.

27. Bank solvency stress tests include a balance sheet model, satellite models for credit risk, accounting based models for loss provisions as well as models for pre-provisioning income and expenses. Following the geographical diversification and global presence of French banks, the team used geographical segmentation of exposure classes. Key risk parameters were stressed for exposures in France, Belgium, Italy, USA, and UK. Macro scenarios were translated into evolution of PDs and pre-provision income, credit growth. Shocked risk parameters drove Risk-Weighted Assets (RWAs) and provisions (via IFRS9 transition matrices). To obtain CET1, CAR and leverage ratios, a balance sheet model which simulates evolution of each bank's P&L as well as assets and liabilities is used. Figure 5 below summarizes key elements of the solvency framework.

Figure 5. France: Structure of Solvency Stress Testing Framework



Source: IMF.

28. Stress testing methodology considered differences between accounting and regulatory classification of assets/exposures. Accounting classification is based on balance sheet exposures, distinguishes between loans and securities, while regulatory classification is based upon on and off-balance sheet amounts of loans and securities combined. Granularity is also different: accounting classification is based on sectors and does not distinguish between different types of borrowers/loans, like large corporates, small- and medium-enterprises (SMEs), mortgage loans and credit card loans. The FSAP team had to map the accounting and regulatory portfolios using some generalizations and assuming similar risk characteristics. Table 4 below illustrates mapping which was used.

Table 4. France: Portfolio Mapping

Accounting and Regulatory Portfolio Mapping: 5 Countries (France, Belgium, UK, USA, Italy)	
Accounting	**Regulatory**
Loans and advances to central banks and governments (France, UK, USA, Italy, and Belgium)	PD Sovereign exposures (France, UK, USA, Italy, and Belgium)
Loans and advances to credit institutions (France, UK, USA, Italy, and Belgium)	PD Institutions (France, UK, USA, Italy, and Belgium)
Loans and advances to other financial corporations (France, UK, USA, Italy, and Belgium)	PD Institutions (France, UK, USA, Italy, and Belgium)
Loans to non-financial corporations (France, Belgium, Italy, USA, and UK)	PD Corporate (France, UK, USA, Italy, and Belgium)
Loans to households (Belgium, Italy, USA, and UK)	PD Retail mortgage Loans to households (Belgium, Italy, USA, and UK)
Own-Sovereign Debt securities, AC (France)	PD Sovereign exposures (France)
Own-Sovereign Debt securities, FVOCI (France)	PD Sovereign exposures (France)
Foreign-Sovereign Debt securities, AC (France, Italy, UK, and Belgium)	PD Foreign Sovereign exposures (France, Italy, UK, and Belgium)
Foreign-Sovereign Debt securities, FVOCI (France, Italy, UK, and Belgium)	PD Foreign Sovereign exposures (France, Italy, UK, and Belgium)
Corporate Debt securities, AC	PD Corporate (France)
Corporate Debt securities, FVOCI	PD Corporate (France)

Source: IMF.

B. Credit Risk Modeling

29. The FSAP team adopted a Bayesian Model Averaging approach for the satellite models. The approach is chosen because of its flexibility and comprehensiveness in terms of variable selections which is preferred to address modeling uncertainties. The model is used to generate forecasts under scenarios for a host of bank-specific variables as well as PD for retail, corporate, institutions and sovereign portfolios. The pool of explanatory variables aims to capture a wide range of macro and financial conditions.

30. The Bayesian Model Averaging (BMA) approach operates with a pool of models to which weights are assigned to reflect relative predictive performance measured by the Bayesian information criterion. The individual models are combined to a posterior model using these weights. The model space is constructed by considering all possible combinations of

predictors from a pool of K variables. When all combinations of variables with (1,2,…,L) predictors are considered, the number of models I can be computed as:

$$I = \sum_{l=1}^{L} \frac{K!}{l!\,(K-l)!}$$

31. From the initial set of determinants, the core set of drivers was chosen using a general-to-specific selection approach. For major portfolios, the final set of core determinants in the credit risk equations are shown in Table 5. The levels, qoq changes and yoy changes of the variables are all explored as potential explanatory variables in the BMA setting.

Table 5. France: Selected Explanatory Variables for Satellite Models

Variable Abbreviations	Definition
GDP	Real GDP growth
INF	Inflation
URX	Unemployment rate
RPP	Nominal residential house prices
STO	Equity prices
CRE	Private sector credit growth
ST	1-year government bond yield
LT	10-year government bond yield
SSTN	3-month Euribor rate over policy rate
TS	Term premia: LT over MMR
SLTN	Risk premia: 10-year French government bond yield over German yield

Source: IMF.

32. The model is complemented with sign restrictions on coefficients to be in line with economic intuitions. Each equation in the model space is subject to the set of sign constraints. Any equation that does not meet at least one constraint is assigned a zero posterior model weight.

Figure 6. France: Sign Restrictions on Coefficients

	GDP	INF	URX	RPP	STO	CRE	ST	LT	TS	SSTN	SLTN	Int_debt	PD_fin
Interest on loans	1	1	-1	1		1	0	0	1			1	
Interest on debt	-1	-1	1				1	1	-1	1	1		1
Fees & Commissions	1	1	-1		1	1	0	0	1				
Other non-interest income	1	1	-1	1	1		0	0	0				
Non-interest expense	0	0	0			0	0	0	0		0		
PD_corporate	-1		1	-1		-1	0	0	-1				
PD_fin	-1	-1	1	-1	-1		0	0		1	1		

INCLUDE	-1	negative sign
	1	positive sign
	0	without sign restrictions
EXCLUDE		

Source: IMF.

33. Historical and projected PD multipliers under scenarios were obtained and estimated by exposure class in France, Belgium, Italy, United Kingdom, and United States. Based on 2018 EBA Transparency Exercise, French banks have the largest exposures to these five countries across the sovereign, institution, corporate and household sectors.[7] The estimate was done on a top-down banking sector basis due to lack of bank-specific historical PD. After obtaining the PD evolution under scenarios, annual multipliers over the reference date, i.e., end-2018, were calculated and applied to the respective exposure class.

34. PDs for sovereign exposures were estimated based on CDS spreads. CDS evolution under scenarios was estimated using the BMA-based satellite models. A Merton-based transformation is then used to convert CDS spread into a PD proxy. Taking 5-year CDS spread for sovereign *i* and time to maturity *T-t*, and assuming LGD=45 percent, the implied risk-neutral PD under S_i^t is calculated as:

$$PD_{i,j}^{t} = \frac{1 - e^{-S_i^t (T-t)}}{LGD_i^j}$$

35. PDs for financial institutions and corporates were sourced from Moody's KMV using the one-year expected default frequency (EDF). The KMV categories used were financials group and corporate group. These categories were then mapped to the institutions and corporate (including SME and specialized lending) portfolios under the COREP definition.

36. PD multipliers for retail exposures were estimated based on nonperforming loan (NPL) ratios.[8] Based on historical mortgage NPL ratios from national sources, NPL ratios under scenarios were estimated using Ordinary Least Spheres (OLS) regression models for each of the 5 countries. The team then calculated the multipliers based on the projected NPL ratios using 2018 as the reference year and applied to the retail unsecured portfolio (including qualifying revolving, and other than secured lending). The time series specification for each country c takes the general form:

$$NPL_t^c = \alpha + \beta_i^c * \mathbf{X} + \varepsilon_c$$

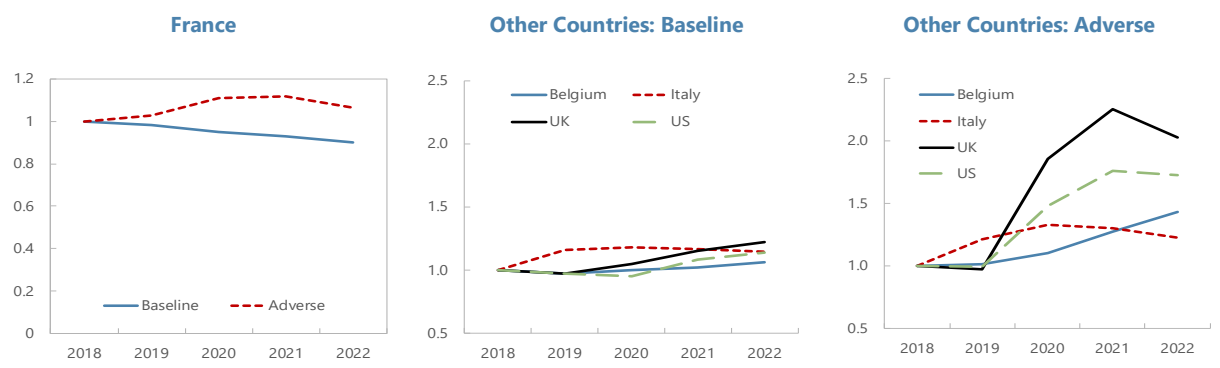
where X is a vector of i macro variables including the PD for institutions. More details are presented in Appendix V Table 1. Results showed that the mortgage portfolio in France has low and stable PD, which remains contained even under the stress scenario (Figure 7). See more details in Appendix VII.

37. A logit transformation was applied before conducting BMA/OLS estimates to address the truncated nature of default rate distribution. This transformation addressed biases and ensures that the projected rate is contained within the 0-1 bound once the logit forward path is applied to the forecast.

[7] The FSAP team excluded Germany from the list of significant countries to which French banks are exposed to due to a mild impact of the macro shock on risk parameters and flight to quality effects on sovereign securities. Germany's portfolio was then added to remaining portfolios which remained unstressed.

[8] Write-offs were not added to the ratios due to unavailability of historic data. At the same time, write-offs ratios observed in France are low also due to accounting policy of major banks.

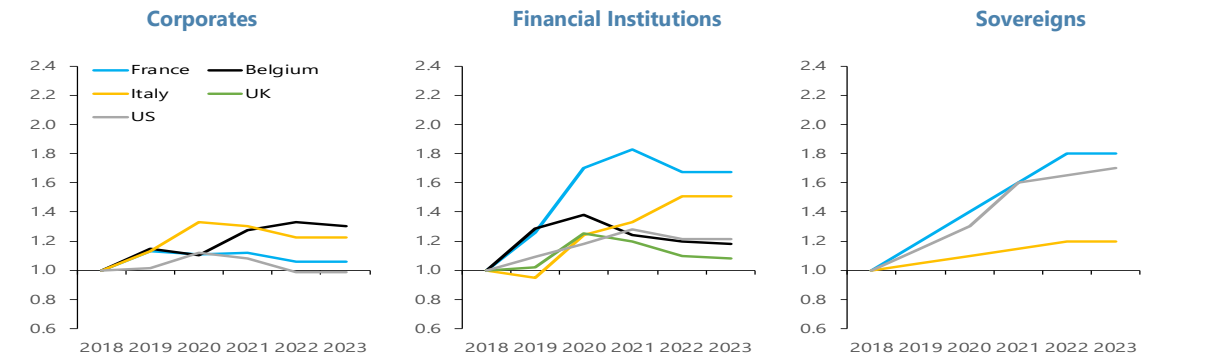
Figure 7. France: PD Multipliers Under Stress Scenario for Mortgage Exposures



Source: IMF.

38. Conditional, bank-by-bank PDs forecasts were generated based on the estimated model parameters. PDs in most exposure classes are expected to gradually increase under the baseline scenario and continue to worsen in the adverse scenario. The magnitude varies across exposure classes and countries, with notable worsening in domestic corporate exposures and large impact on Italian exposures (Figure 8). See more details in Appendix VII. Bank-by-bank specific PDs were obtained by multiplying last observed Point in Time (PiT) PD for each bank/exposure class and multiplier obtained from BMA/OLS regressions.

Figure 8. France: PD Multipliers Under Stress Scenario



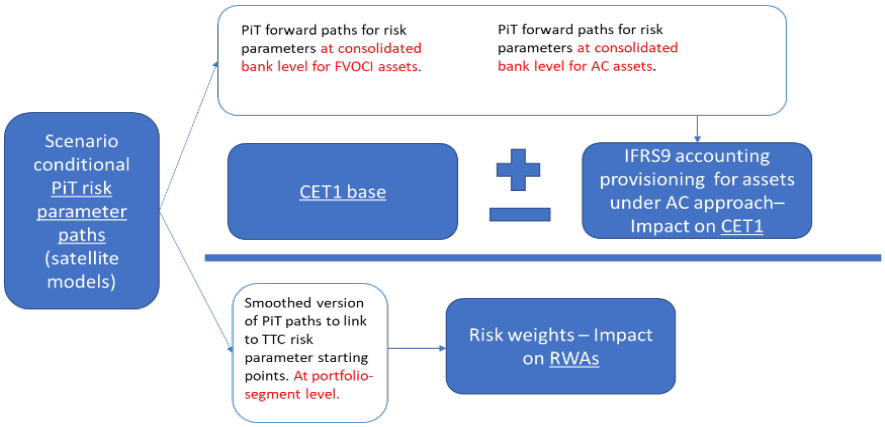
Source: IMF.

39. The impact of credit risk on banks' capital ratios depends on the regulatory approach used by banks to book credit exposures as well as accounting policy (IFRS9). For exposures booked under the IRB approach, credit risk evolves with the exposure at default (EaD), the PD, and the LGD. Updated weighted average through-the-cycle (TTC) PDs for non-defaulted exposures are used for RWAs calculations (with smoothing parameter 1/10), namely:

$$\Delta TTC\_PD_t = (\Delta PiT\_PD_t)/10$$

This reflects an assumption that adjustments to long-run average (TTC) PDs are based on the most recent ten years used in estimation of PDs as well as migration of exposures within the non-defaulted rating grades. Stressed PiT PDs are used to estimate flows of loan loss provisions (see Figure 9 for explanation).

Figure 9. France: Use of PiT and TTC PDs for RWAs and Provisioning



Source: IMF.

40. For exposures under the STA, a deterioration in credit risk is reflected in higher specific and collective allowances from higher default rates and lower creditworthiness of performing loans, as well as in higher capital requirements from credit risk downgrades of the underlying exposures. CET1 and capital surplus/shortfall is evaluated considering existing loss provisions and new provisions generated under the scenarios. IFRS 9 provisioning methodology is used to the largest extent possible, however absence of historic data prevents us from calibrating exact transition parameters. To overcome this issue, some high-level assumptions are made, for example, that loans under IRB and STA approaches will follow the same transitions among S1-S3 categories.

41. LGDs. The team did not stress LGDs due to the following reasons: i) there was little evidence of overvaluation of real estate markets, and LGDs for RWAs are already calibrated as downturn LGDs; ii) LGDs for accounting purposes were based on actual LGDs banks use to provision loans classified under Stage 1,2 assets; and iii) loans classified as Stage 3 (defaulted) had very high provisioning rates, often close to 100 percent.

42. The projection of exposure at default (EAD) was driven by balance sheet assumptions, structural FX risk in foreign geographies, and triggered credit lines and guarantees. Specifically, changes to EAD in the IRB portfolio were governed by:

$$EAD_{i,t}^{c,j} = EAD_{i,t-1}^{c,j} \cdot \left(1 + g_t^c + f_i^c \cdot \Delta FX_t^c\right) \cdot \left(1 - PD_{i,t-1}^{c,j}\right) + \Delta L_{i,t}^{c,j} \cdot UCL_{i,t-1}^{c,j}$$

where *i* denotes the bank, *j* denotes the portfolio, *c* denotes the country of exposure, g_t^c is credit growth in country *c* (where demand effects are incorporated but supply effects are disallowed), f_i^c is the fraction of foreign currency loans, ΔFX_t^c is the depreciation of the foreign currency relative to

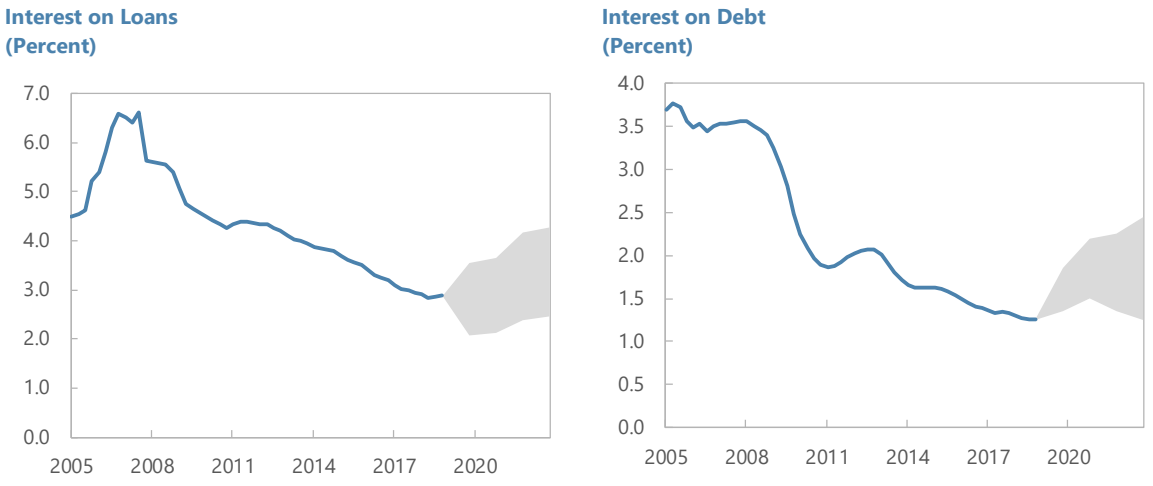
the euro, $\left(1-PD^{j}_{i,t-1}\right)$ represents the non-defaulted portfolio, $\Delta L^{j}_{i,t}$ is the shock to triggered credit lines and guarantees, and $UCL^{j}_{i,t-1}$ is the amount of undrawn guarantees. While paths for credit growth and FX shocks were generated by the scenario, stressed credit conversion factors on undrawn credit lines and guarantees were informed by historical behavior of off-balance sheet migration during stress periods drawing on banks' Pillar 3 disclosures.

43. To compute capital requirements, stressed risk parameters were projected and applied to Basel III formula for IRB exposures. The regulatory credit risk parameters (TTC PD, downturn LGD, stressed EaD) for banks' IRB models were used for derivation of RWAs under baseline and adverse scenarios. Thus, projected RWAs are dependent on stressed credit risk parameters, correlation assumptions, and effective maturity for each exposure. In line with the Basel III framework, RWAs were computed after applying the scaling factor of 1.06 to credit RWAs and using a 1.25 multiplier to the correlation parameter of all exposures to large regulated financial institutions and to all unregulated financial institutions. Difference in granularity of RWAs calculation were considered by applying original scaling factor, i.e., ratio of model calculated RWAs to reported RWAs at time t_0.

C. Market Risk Modeling Including Interest Rate Risk in the Banking Book

44. Bank-specific interest rate risks were estimated using satellite models. Interest rate on loans and interest rate on debt were sourced from Fitch for each of the sample bank, and their respective evolution under the scenarios were estimated with the BMA-based satellite models. The bank-specific specification allowed the team to capture the different lending and funding behaviors across the sample banks given their differences in funding structure and lending practices (Figure 10, Appendix VII).

Figure 10. France: Aggregate Historical Values and the Range of Bank-Specific Projection Under Adverse Scenario 1



Sources: Bankscope and IMF.

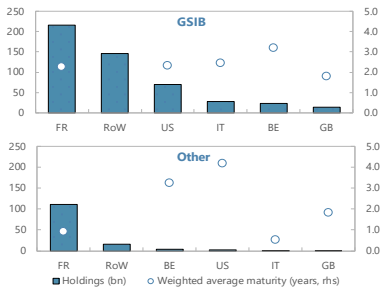
45. Relationship of funding and lending rates is also considered. To assess the degree of pass-through, funding cost was included as an explanatory variable in the lending rate specifications. Autoregressive terms of the lending rate are also included (up to 2 lags) to account for the back-book effects of the lending book. Indeed, the autoregressive coefficient suggests the relevance of the back-book effects. Results also show that the state of the local economy affects banks' lending rates with stronger GDP growth, lower unemployment rate and wider term premia contributing to higher lending rates. The pass-through of funding cost to customers was more pronounced for some banks and much less so for others, likely an indication of different funding profile (Figure 10, Appendix VII).

46. Exposures to equities. Immediate hit of 20 percentage points was assumed (as per adverse scenario). No hedges were taken into account assuming that they would not be effective at the time of significant market stress.

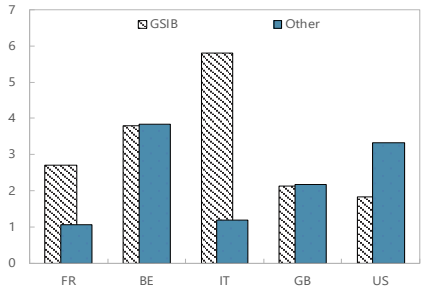
47. Exposures to sovereigns. Average duration of sovereign holdings reveals that banks' holdings are relatively short-term and do not exceed three years on average. Most significant sovereign holdings are shown in Figure 11, with higher haircut rates associated with longer maturity. Only bonds which were classified as Fair Value through Other Comprehensive (FVOCI) and Fair Value through Profit or Loss (FVPL) were included into market risk scenario. Bonds classified as Amortized Cost (AC) were subject to PD/LGD expected loss approach and treated under sovereign asset class. It should be noted, that following introduction of IFRS9, some G-SIBs reclassified a large portion of sovereign bonds under AC approach to avoid excessive volatility of prices and its effect on P&L. Under AC treatment, banks must increase provisions with increasing PD, however should the point-in-time PD be significantly higher than the PD at origination (based on evidence, such as two or three notch downgrade of sovereign credit rating), lifetime provisions must be booked.

Figure 11. Exposures to Sovereigns and Haircuts on Bonds
(Average)

Outstanding Stock and Duration of Sovereign Debt Holdings



Average Haircut on Sovereign Debt Holdings under Adverse Scenario (Percent)



Sources: ECB and IMF.

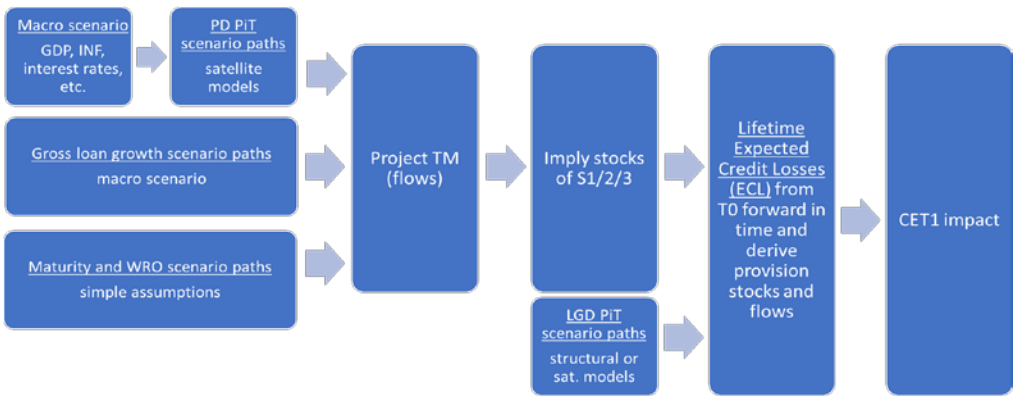
48. Exposures to other debt instruments as well as derivatives, including counterparty risk assessment were not stressed due to lack of data. Lack of granular data prevented the FSAP team from stressing corporate bond portfolios as well as exposures to derivatives (credit valuation

adjustment (CVA) risk). At the same time, the team used multipliers banks reported under EBA stress testing exercise (2018) to infer changes in RWAs for market and CVA risk. P&L impact of valuation shocks to corporate bond portfolios accounted under fair value were not evaluated.

D. Expected Losses and P&L Items

49. IFRS 9 application is based on the most recent submissions of European/harmonized templates (Finrep/Corep), banks Pillar III reports as well as high level assumptions. Harmonized templates provide information about initial classification of assets (stocks in S1/2/3 categories). One-year data provides a proxy for the migration of assets within these categories, including maturation of existing, write-offs and new business assets/loans. Transition matrices were constructed using loan growth, write-off assumptions, PiT PDs and LGD paths. High level assumptions were made on average maturity of loans (i.e., average maturities taken from COREP templates), mean reversion period (for lifetime PDs, five years was used to link reversion with scenario based recovery assumptions) as well as sensitivities of transition rates to default rates (0.5, -0.5) which is consistent with distance to default methodology and information entropy criteria (equal probability in the absence of any additional information about transition probabilities). Figure 12 below provides a high-level overview of IFRS9 implementation steps.

Figure 12. Application of IFRS 9



Source: IMF.

50. For the growth of the banks' balance sheet over the stress-test horizon, the FSAP team used a quasi-static and dynamic approaches. The stress test scenario spans for five years, hence additional assumptions about dynamics of banks' balance sheets were made. In a static approach, we assumed that loans will not be written-off through the horizon of the stress test (hence, there will be capital requirements for defaulted assets). Stage 3 assets are an absorbing category of defaulted loans. Asset allocation remain the same, though loans in the balance sheet are growing in line with the nominal GDP path/satellite models as specified in the stress test scenarios.

Assumptions about Balance Sheet Growth		
Stress Test	**Static**	**Dynamic**
Gross loan stocks, i.e., PL+NPL (S1+S2+S3), and gross of provisions	Constant	Moving
Provision stocks (liability side)	Increasing under stress (swap from residual equity into prov. stock); might fall when risk parameters fall (release of provisions); to fall when write-offs were allowed (dynamic balance sheet)	
Maturing vs. new business	The two are equal, for gross loan stocks to be constant	New business > maturing if gross loan stocks to grow (< if to shrink)
Write-offs	Zero, as otherwise gross loan stock (NPL portion of it) would shrink, along with provision stock on liability side	Allowed
Composition across PL/NPL (S1/2/3)	PiT PDs (transition rates) imply the move from PL to NPL (S1/2/3)	
Relative exposure profile across asset classes	Not allowed to change	Not allowed to change
Interest income	Capped	Not capped; depends on satellite equations as well as growth of new loans
Fees and commission income	Capped at previous year level	Not capped, moves in line with satellite models (in many cases counter-cyclical)

51. Credit growth under the adverse scenario is simulated by the GMM Model. The output is expressed as the deviation in growth rate from the baseline. Credit growth for the baseline is assumed to follow the nominal GDP path.

52. Migration of S1, S2, S3 assets under static and dynamic balance sheet Stress Test (ST). Migration of assets among stages is shown in Appendix VI. Overall, as expected, asset migration under dynamic ST results in lower S3 ratio compared to static assumptions.

53. To compensate for compressed net interest margins, French banks have adapted their business models towards more focus on fees and commissions (F&C). They've done so by introducing more banking services that generate F&C and by expanding into asset management

and insurance business utilizing their existing distribution networks. F&C as share of total assets averaged around 2 percent for domestic-focused banks compared to 1.3 percent for G-SIBs in 2018.

54. There was evidence of lagged response of F&C during the euro area sovereign crisis. While aggregate F&C as share of total assets declined 50 bps during the 2012–13 crisis period, F&C at a subset of sample banks increased in the first few quarters before eventually contracting. This is likely reflecting banks' efforts to increase F&C to offset the immediate shock to the other P&L items.

55. Bank specific F&C evolution was estimated using the satellite models. Results show that net F&C increases with higher GDP growth, lower unemployment rate, steepening of the yield curve, higher equity returns (higher volatility). The forecast path of net F&C under the stress scenario is consistent with the historical pattern, where net F&C increased in the first two years before falling in the following three years.

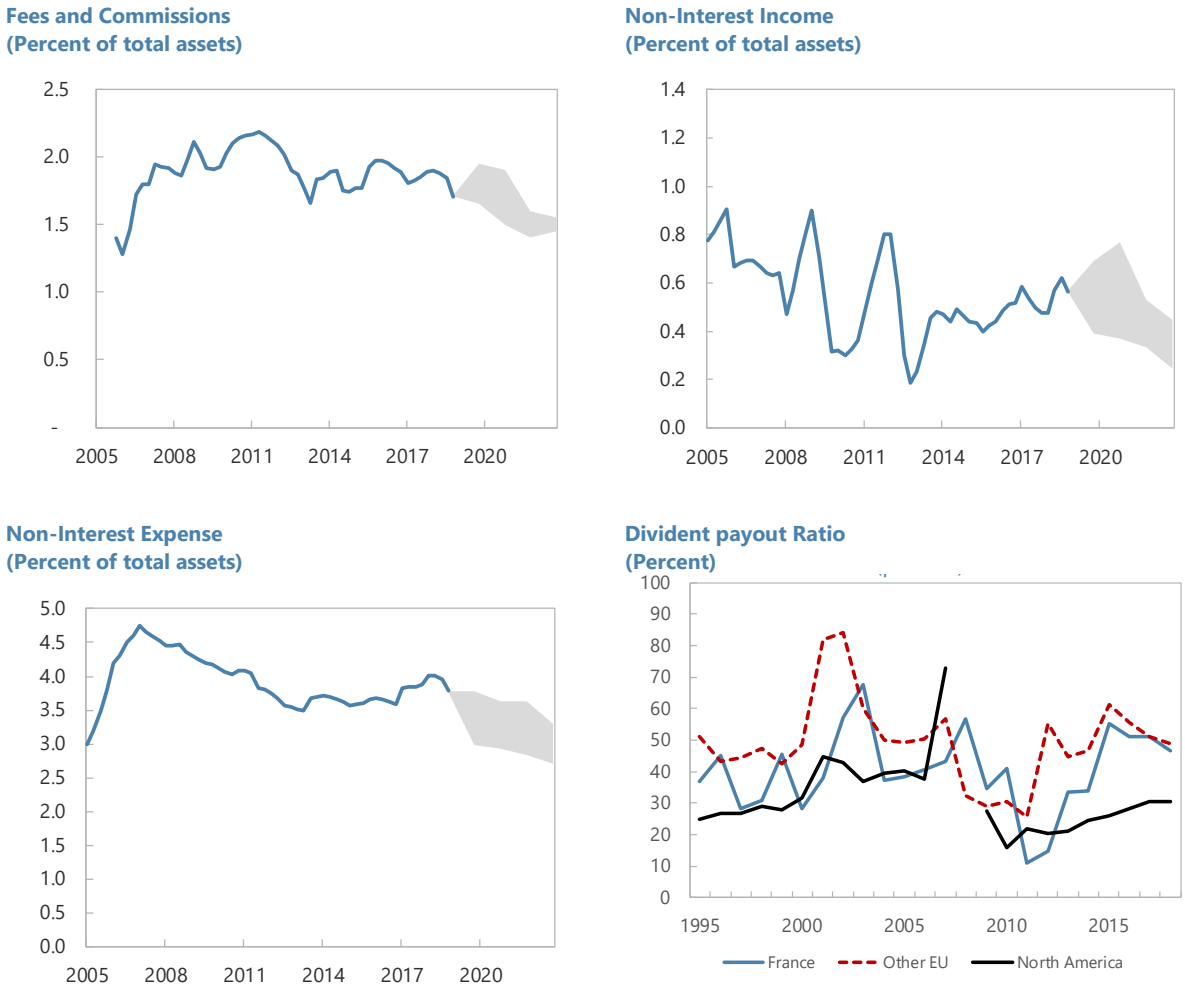
56. Non-interest income and expense were also projected using the satellite models. Behaviors of these items show more idiosyncratic patterns across sample banks as they're more sensitive to one-off or non-operating items. Nonetheless, model results show that higher non-interest income is generally associated with higher GDP growth, inflation, and term spread as well as lower unemployment rate. Non-interest expense typically increases with higher GDP growth, inflation, unemployment rate, long-term interest rate and term spread.

57. Behavioral assumptions. We assumed that banks do not issue new shares or make repurchases during the stress test horizon. Dividends are assumed to be paid out of current period net income after taxes (i.e., only if net income is positive) by banks that were in full compliance with supervisory capital requirements (including for Pillar II guidance), subject to Capital Conservation Buffer (CCB) and Counter Cyclical Capital Buffer (CCyB) schedule for Common Equity Tier I and a cap based on past dividend payout ratios or absolute dividend paid.

58. Dividend payout ratio and effective tax rate were assumed to be constant at the 2018 level over the stress horizon. Dividend payout ratio averaged around 45 percent for the banks in the sample in 2018, which is high compared to other countries (Figure 13). Effective tax rate averaged around 30 percent but showed close to 10 ppts variation across banks.

59. The definition of eligible capital considers CRDIV/Basel III regulatory minima on CET1 (4.5 percent), the CCB, CCyB, and includes any requirements for G/D-SIB. The capital definition is according to CRD IV, including CET1, Tier 1, and total CAR. Capital components that are no longer eligible for additional Tier 1 and Tier 2 capital components follow Basel III transitional path. The CET1 hurdle rate consisting of a 4.5 percent Pillar 1 requirement, fully loaded level of CCB applicable in 2019 (2.5 percent) and phased-in bank-specific G-SII. CCB and countercyclical buffers can be depleted in the adverse scenario. For sensitivity tests the CET1 hurdle rate also includes Pillar 2 requirement (P2R, including Pillar 2 guidance). In addition to the CET1, the capital adequacy ratio is evaluated against the 3 percent Basel III minimum requirement of the leverage ratio during the stress test horizon.

Figure 13. France: Aggregate Historical Values and the Range of Bank-Specific Projection Under Adverse Scenario 2



Sources: Bankscope and IMF calculations.
Note: In panel 4, dividend payout raito for North America banks in 2008 is omitted due to abnormal earnings number during the global financial crisis.

E. Results

60. The top-down stress tests demonstrate that the banking system has solid capital buffers to withstand simulated shocks. Additional buffers are provided through Pillar 2 Requirement (P2R) and Pillar 2 Guidance (P2G) imposed by the SSM. Overall, banks are primarily exposed to risks related to losses from lending to the corporate sector and a rise in funding costs associated with higher own-risk premiums. Risks stemming from loans to households (i.e., mortgages) seem to be contained over the short- to medium-term horizon, given relatively strong

households' balance sheets, no evidence of significant misalignment in house prices, social safety nets, and fixed interest rates.[9]

61. Capital depletions over adverse scenarios are relatively high, but no bank would face capital shortage below 7 percent of CET1 capital (Figure 14). Solvency stress testing results are based on: (i) baseline; (ii) adverse dynamic; (iii) adverse static; and (iv) adverse static with funding-cost loop projections. In the baseline, the system wide CET1 CAR would remain almost unchanged over the three-year horizon (i.e., decline by 20 basis points due to deteriorating baseline macro scenario), while in the adverse dynamic scenario, total CET1 capital ratio declines by 270 basis points. In the adverse static and adverse static with funding-cost loop tests, CET1 capital ratio would fall by 430 basis points and 540 basis points over three years, respectively.[10]

62. Overall, banks with a high share of retail funding, domestic loans (mortgages and retail), and high CET1 capital buffers demonstrated greater resilience to shocks. The FSAP results are broadly in line with the EBA stress tests, except that the dynamic version of the stress shows higher CET1 capital due to cure rates[11] and increase in non-interest incomes,[12] which may be attributed to banks' pricing power as a result of highly concentrated markets. The results need to be interpreted with caution, however, as the FSAP team was unable to conduct a granular stress test of trading books which takes into account issues such as portfolio hedges and short positions, and also incorporates potential changes in banks' balance sheets.

63. An exploratory study on solvency-liquidity feedback loop show that an increase in wholesale funding costs—potentially due to mediocre performance or increase in risk aversion in financial markets—could pose risks to profitability and solvency. Banks with a higher share of wholesale funding are more exposed to this risk. In case of persistent increase in funding costs, these banks' balance sheets would likely shrink due to a fall in operations with other financial institutions.

[9] Household risk is contained by a strong social safety net; thus, the FSAP team did not assume fiscal tightening and change in labor law in the scenario. At the same time, it was assumed that France sovereign risk premia would go up reflecting higher borrowing costs.

[10] Some banks would fall below the current P2R and P2G and additional buffer requirements (such as CCyB); however, the stress tests assume that these requirements would be relaxed during stress episodes.

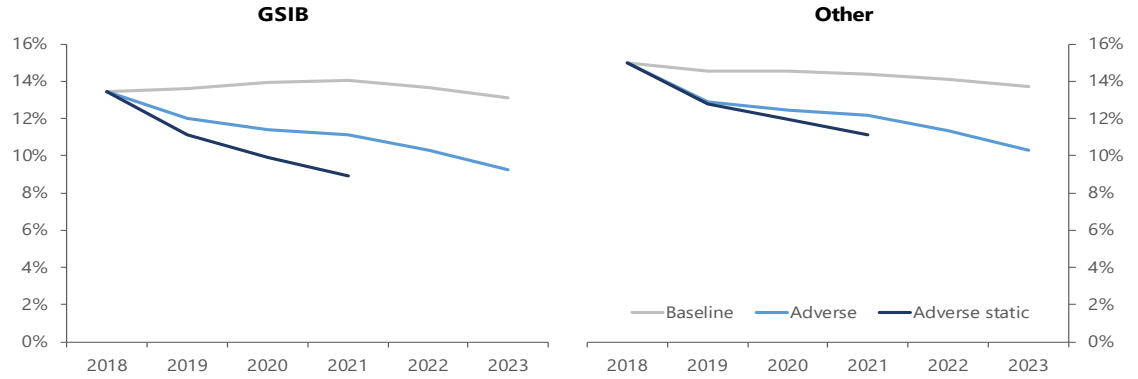
[11] It should be noted that for the EBA ST cure rates do not explicitly appear in transitions between IFRS9 stages but do implicitly have an impact on loss rates.

[12] This includes fees and commissions income.

Figure 14. France: Solvency Stress Test

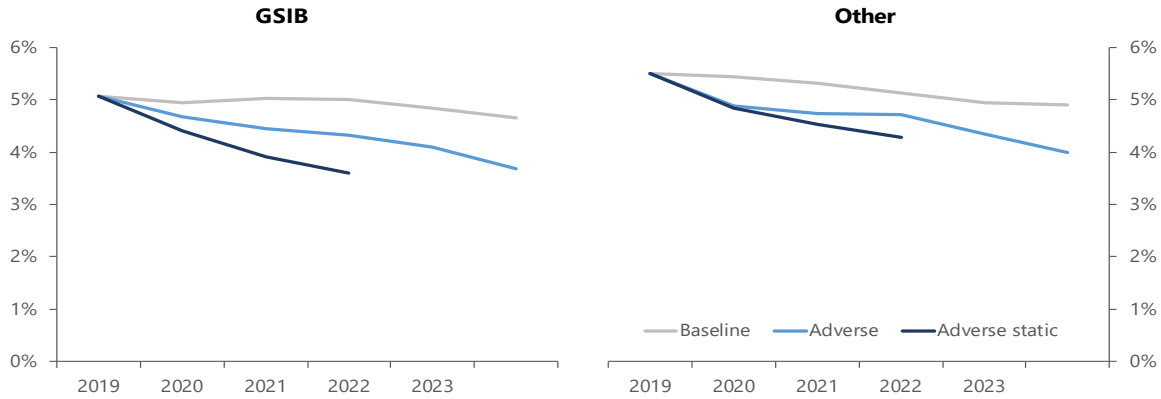
Aggregated CET1 capital ratio would rise slightly under baseline and fall by around 400 bps over 5 years under the adverse scenario, with larger impact on internationally active banks.

1. CET1 Ratio under Different Scenarios



Aggregate leverage ratio would fall by 100 bps under the adverse scenario.

2. Leverage Ratio under Different Scenarios



Changes in RWA would be predominantly associated with credit risk.

3. Cumulative Changes in RWA (Since 2018, in billions of euros)

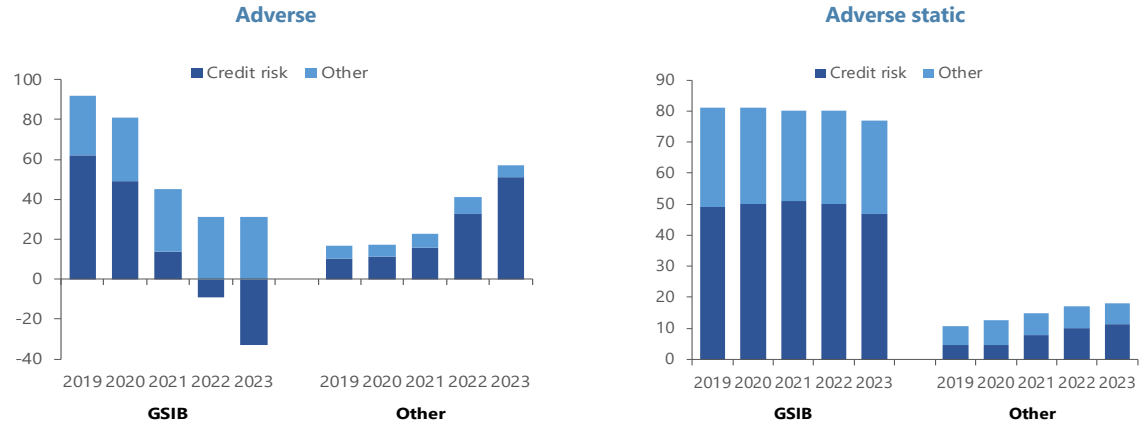
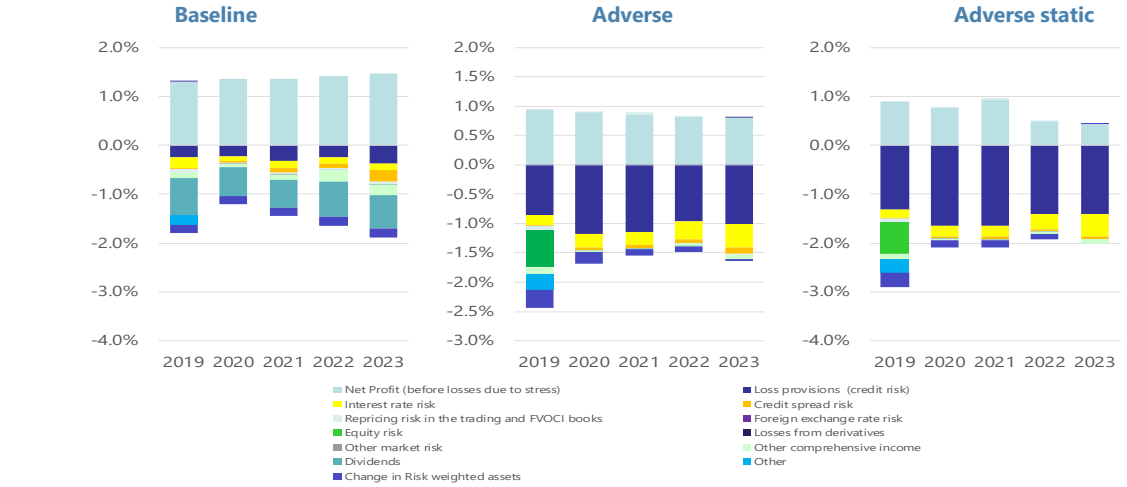


Figure 14. France: Solvency Stress Test (concluded)

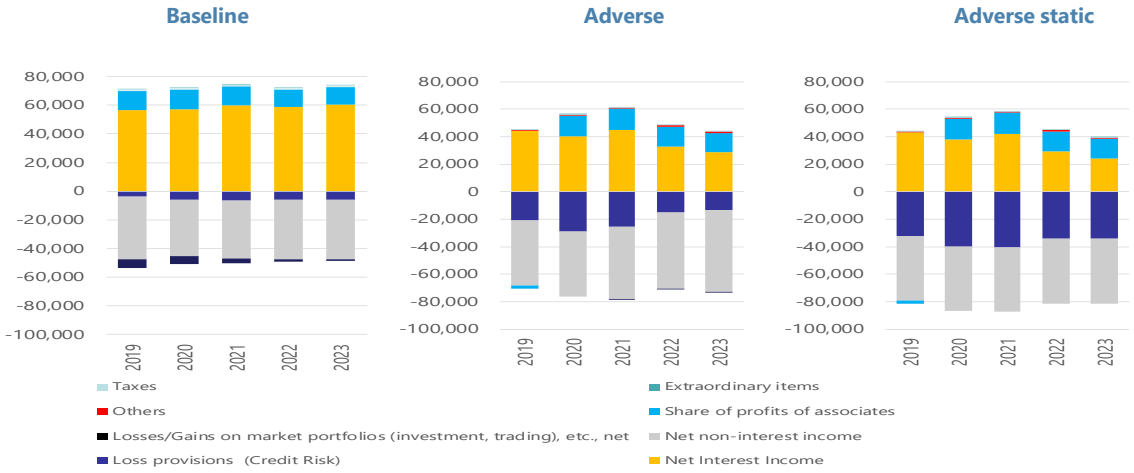
Increase in loss provision against credit risk would be the main driver of capital depletion.

4. Contributions to Changes in Capital Ratio



Higher loss provisions and lower non-interest income would be the main contributors to profit losses.

5. Net Profit Components (Millions of euros)



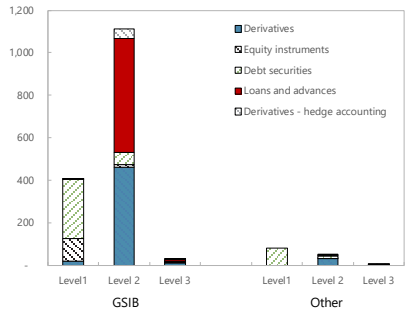
Sources: ECB and IMF.

64. The sensitivity analysis showed that shocks to real estate prices, or LGDs on mortgage portfolios did not lead to a significant fall in CET1 capital. Shocks to real estate prices by a decline of 20 percent were applied to Stage 3 assets on domestic mortgage exposures (households and SMEs). The motivation was based on assumptions that it would be more difficult to sell foreclosed assets during times of stress which remain on the balance sheet of banks, however valuation of mortgage collateral in Stage 1 and Stage 2 assets would not be affected due to risk transfer to mortgage insurance companies. Overall, CET1 capital would fall by 30 basis points with

domestic banks experiencing higher impact. Applying the EA average LGD rate of 18 percent[13] (instead of 14 percent) to French banks' exposure to retail mortgages in France and Belgium resulted in the reduction of CET1 capital ratio by 40 basis points on average.

65. Valuation of Level 2 and 3 assets is an important risk factor for banks with large portfolios of derivatives and Secured Financing Transactions (SFTs), however even full write-down of Level 3 assets has moderate impact on CET1 (Figure 15). Valuation of Level 2 and Level 3 assets represents an additional risk factor if pricing models are incorrect, or correlations change at times of stress. The FSAP did a simple sensitivity analysis, assuming up to 100 percent valuation loss of Level 3 assets. Overall, CET1 capital depletion can be as high as 200 basis points; however, no bank would fall below CET1 minimum requirements. Valuation of Level 2 assets may have higher impact on CET1 due to much larger size of the portfolios, however stress testing them is challenging due to business models of banks, such as loan portfolio hedging activities in interest rate swap markets. Moreover, centrally cleared Level 2 assets fall under a more limited valuation risk (parameter and model uncertainty) than other Level 2 assets. A quite large part of Level 2 assets are CCP cleared, however the FSAP team did not have access to this data.

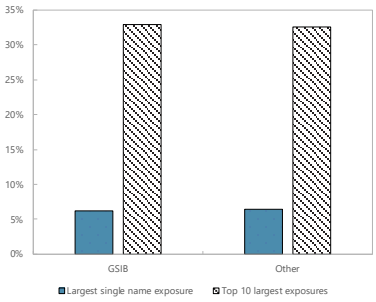
Figure 15. France: Holdings of Level 1, 2, 3 Assets
(Billions of euros)



Sources: ECB and IMF.

66. Single name credit concentration risks are high, although default of largest companies would be a tail risk event (Figure 16). Analysis of single name concentration risk revels that some banks may lose up to 10 percent of their CET1 capital base (assuming 100 percent write-off rates, i.e., no collateral). Since single name concentration risk is not a systemic, cyclical risk, it would be assumed that banks still need to maintain CCB, CCyB, P2R buffers. In this case, some banks would breach minimum CET1 requirements (including P2R, CCyB buffers). In case of ten largest exposures, most of them are related to companies with significant state participation, hence risk is contained.

Figure 16. France: Credit Risk Concentration
(Percent of CET1 ratio)



Sources: ECB and IMF.

67. Going forward, some of the banks examined would benefit from increasing the share of stable, longer-term funding to minimize potential risks to funding costs. French banks Despite shorter maturity, retail funding is still relatively cheap and deemed stable even for overnight.

[13] The number was derived from the sample of banks included into EA FSAP (2018) exercise. See reference above.

The high share of wholesale funding presents additional liquidity and profitability risks for some banks; reducing their reliance on short-term wholesale funding would increase resilience to these risks in times of stress.[14] Profitability risks would arise because of back-book effect, i.e., inability to reprice assets at the same time (due to maturity transformation, even if it is a very short term). Finally, while the stress tests were based on banking group consolidated statements, it also would be important to develop test on risks stemming from intragroup activities (e.g., insurance, asset management), taking into account dynamic adjustments in their incomes and balance sheets.

68. The FSAP mission did encounter data limitations, especially due to unavailability of EBA (2018) stress testing data submissions. Absence of historic IFRS9 data, which includes, inter alia, shocked loan transition matrices, PiT PDs, shocked LGDs etc. Many additional assumptions FSAP exercise had to make requires treatment of mission results with appropriate degree of caution. Some of the risks may not have been evaluated properly.

LIQUIDITY RISK ANALYSIS AND STRESS TESTS

A. Overview

69. The liquidity risk management and liquidity conditions have significantly improved since the last FSAP. Since the last FSAP in 2012, financial market turmoil in the EA and France in particular, raised awareness for funding and FX liquidity risk in the banking system, while reduced the liquidity risk tolerance by banks' management and shareholders. Establishment of SSM, the introduction of the liquidity coverage ratio (LCR) in Capital Requirements Regulation (CRR) (2013) and the potential introduction of Net Stable Funding Ratio (NSFR) have improved liquidity regulation and the availability of liquidity reporting data. The SSM has introduced a comprehensive set of standardized analysis tools, including liquidity stress tests based on supervisory data. At the same time, accommodative euro area monetary policies, including asset purchase programs and long-term refinancing operations have led to high level of excess reserves at the central bank which provide substantial cushion for banks in case of liquidity stress.

70. To assess current banking system liquidity risks, a comprehensive analysis of large banks' structural liquidity ratios is complemented with a variety of liquidity stress tests. The structural analysis considers the Basel III LCR and the NSFR. While the former measures short-term liquidity risks, the latter gauges more structural longer-term refinancing and funding risks. The FSAP team did not stress structural LCR/NSFR ratios as it is unlikely that during the times of stress these will be binding (i.e., bank must meet average LCR requirement over the calendar month time horizon, rather than daily). Instead the team focused on cash flow-based stress tests. Cash flow-based liquidity stress tests were conducted using supervisory data on contractual cash flows for different maturity buckets. This approach employs multiple scenarios of increasing severity covering several horizons (for example, 5 days, 4 weeks, 3 months) with varying assumptions regarding

[14] Nevertheless, increasing the share of longer-term funding may decrease profitability due to lower maturity transformation.

liquidity buffers and shocks to cash inflows and outflows. Also, given available data, FX (USD) cash flow-based stress test was conducted.

71. To deal with parameter uncertainty, the cash flow tests were conducted over a wide range of scenarios featuring different degrees of severity and central bank support. The calibration of the liquidity stress test drew on the assumptions built into the solvency stress test to ensure consistency among both tests. For example, stressed market values of securities or markets' reaction towards banks' ability to raise funding after drop in capital ratios. The tests also incorporated assumptions about gradual tightening of monetary conditions, such as changes in eligible collateral used to obtain liquidity from the central bank, and changes in interest rates.

72. Liquidity risk analysis used multiple data points to highlight structural changes in banks' funding structure. Data from 2014:Q4 to 2018:Q4 from supervisory data templates allowed the FSAP team to deep dive into structural liquidity risks of sample banks, in particular, to assess how liquidity risk bearing capacity of banks changed through the five-year period.

B. Structural Liquidity Risks

Liquidity Coverage Ratio

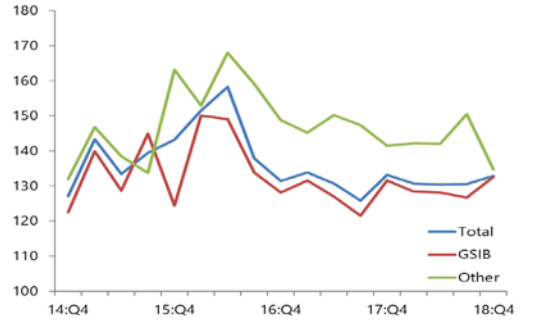
73. Liquidity analysis reveals that all banks in the sample meet the 100 percent minimum LCR requirement. LCR ratios are comfortably above minimum requirements (133 percent on average), highlighting large liquidity buffers banks accumulated since the GFC, including long-term funding from the ECB (Figure 17). Shorter maturity transformation by banks also played a role. Across business models, domestically-oriented banks have higher LCRs, partly due to lower reliance on short-term wholesale market funding but higher reliance on long-term central bank funding.

74. Short term overnight funding is a source of liquidity risk during times of market turbulences. Overall overnight funding is close to 42 percent (Figure 18), but large chunk of this funding is stable due to prevalence of retail deposits (26 percent). At the same time some G-SIBs have high share of short-term unsecured funding from financial corporations and non-operational deposits from non-financial corporates. This makes those banks more vulnerable to sudden market-wide liquidity dry-outs.

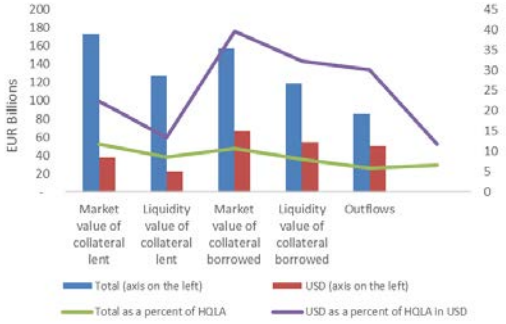
75. Retail funding, treated as more stable from the LCR perspective, in the sample of banks is 38 percent. While retail deposits are the core and stable base of funding for banks, it is typically very short term, especially as customers do not want to lock-in to low or zero interest rates. Banks' LCR disclosures show that 75 percent of these retail deposits are insured. From a funding risk perspective, deposit insurance provides additional stability by lengthening behavioral terms of these deposits.

Figure 17. France: Liquidity Coverage Ratio and Net Stable Funding Ratio[1]

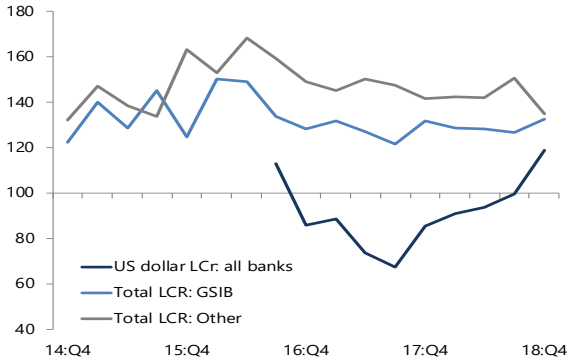
LCR ratios. *LCR are above 100 percent and reflect large liquidity buffers banks accumulated.*



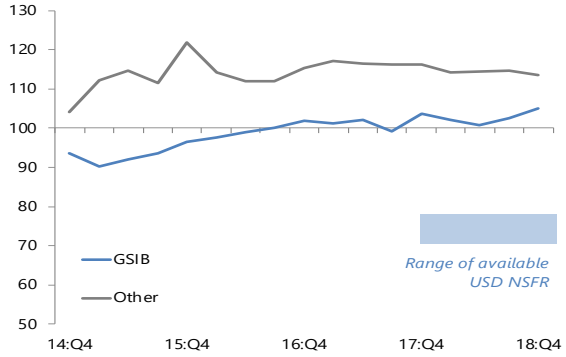
Collateral swaps. *Some banks use collateral swaps to improve LCR ratios in USD.*



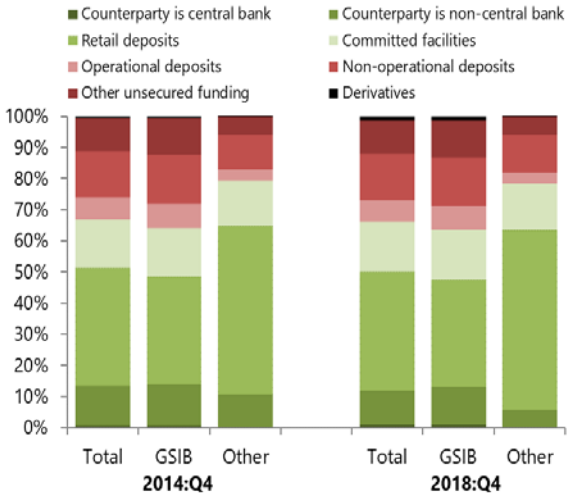
LCR ratios in USD. *But maintaining USD LCR above 100 percent is a challenge for some banks.*



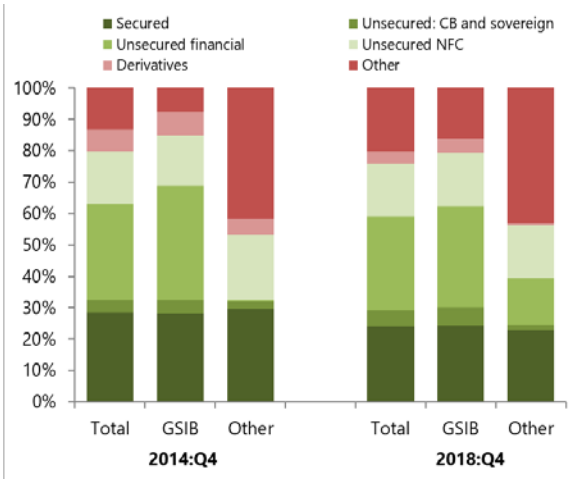
NSFR ratios. *Banks are above 100 percent of non-binding NSFR ratio, although NSFR is USD requires more longer-term and stable funding.*



Funding structure. *Other, domestic banks have higher share of retail funding.*



NSFR structure. *G-SIBS have high share of unsecured funding from financial institutions, but progress has beed made since 2014.*



Sources: ECB and IMF.
[1] 2018:Q4.

76. LCR in USD has increased to 120 percent. While aggregated LCR and LCR for G-SIBs is above 100 percent (which is a non-binding reference ratio), some domestic banks still need to increase their liquid assets in USD. While, in general, the use of collateral swaps (i.e., swap less liquid, non-high-quality liquid assets (HQLA) assets to liquid ones) does not reveal significant liquidity risk in the sample of banks, a few banks use collateral swaps for USD liquidity needs. These swaps allow banks to maintain higher liquidity buffers but come at a price as bank needs to pay fee to the counterparty. Moreover, counterparties may decide not to renew swap agreements at times of stress. Overall, banks appear to rely on ample EUR liquidity, smooth function of FX swap markets, and the backstop of central bank swap lines in the case of more turbulent market conditions.

Net Stable Funding Ratio

77. Banks are well placed for the introduction of 100 percent NSFR requirement (Figure 17), albeit challenges related to the change in monetary policy or market conditions remain. In the past four years NSFR ratios steadily went up and reached 106 percent for the entire sample of banks. This is mainly driven not by the stock of long-term market funding (exceeding one year), but by the large amounts of highly liquid short-term assets (sovereign bonds, deposits within central banks) and long-term repos with central banks. As shown in Figure 17, banks' funding structure did not change dramatically, except that other domestic banks attracted higher share of unsecured funding from other financial institutions. To firm the ratios banks would need to issue more longer term secured and unsecured bonds or attract other long-term funding.

78. G-SIBs rely on short-term wholesale funding more than domestic banks. The ratio of stable deposits to total liabilities in domestic banks stood at 24 percent in Q2 2018 versus 17 percent at G-SIBS. The ratio of unsecured funding from nonfinancial corporates and financial institutions was 29 percent for G-SIBS and 23 percent for domestic banks. There is a big difference between G-SIBS and domestic banks in terms of secured funding: almost one quarter of funding in domestic banks is secured compared to only one tenth for G-SIBs. All in all, different funding structure reveals different types of liquidity and funding cost risks banks are exposed to. While G-SIBs are more exposed to funding shocks from non-financial corporates and financial institutions, domestic banks rely more on retail, stable and secured market financing. In addition, G-SIBs have significant exposure to contingent funding liquidity risks, arising from market exposures such as derivatives, repo/reverse repos and swap positions.

Counterbalancing Capacity and Asset Encumbrance

79. Asset Encumbrance (AE) ratios are low, and reliance on secured financing leads to higher AE ratios among domestic banks (Figure 18). High AE ratios typically hinders banks' ability to further tap secured funding markets and is common to banks which issue covered bonds or Asset Backed Securities (ABS) to finance their mortgage portfolio. Banks with high level of asset encumbrance may not only face higher outflows from short-term market and deposit funding during idiosyncratic and systemic liquidity events, but also be unable to obtain additional liquidity in the markets or central banks (as central banks do typically require collateral for funding operations).

AE ratios among French banks remain rather low, highlighting additional liquidity generation ability in times of market turbulence.

80. Share of central bank eligible unencumbered assets reveals further liquidity buffers which could be quickly obtained in times of stress. Overall, about 10 percent of additional assets can be encumbered to the central banks. This ratio is higher among G-SIBs (11 percent) versus domestic banks (6 percent). This provides G-SIBs with additional liquidity buffer given their higher reliance on wholesale funding compared to domestic banks.

81. Contingent liquidity risks, such as exposure to derivatives, SFTs, may be a source of concern in case of severe market-wide stress. Contingent liquidity risks arise due to additional margin calls because of deterioration in collateral values. At the same time, banks not only provide additional collateral, but also receive collateral from their counterparties on off-setting positions. Collateral which is received can be rehypothecated for the period which is equal or less than corresponding derivatives/SFT contracts. Analysis of rehypothecation reveals that the primary collateral received by banks is government securities and that G-SIBs rehypothecate most of it (75 percent). Domestic banks rehypothecate slightly smaller share of collateral (62 percent on average). While sovereign bonds may be low risk items in rehypothecated collateral, equities may be a source of additional contagion risks were the banks' counterparties not able to provide additional collateral in times of equity market turbulence.

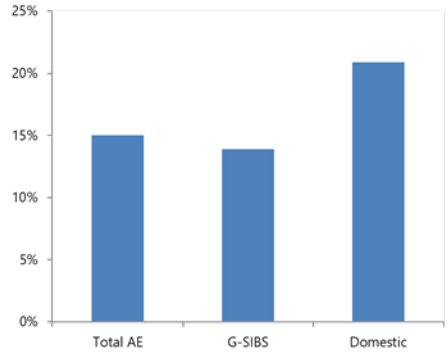
82. Banks have diversified securities included in CBC. Majority of CBC is based on withdrawable central bank reserves and Level 1 tradeable assets (sovereign bonds). Holdings of sovereign bonds are diversified; nevertheless, own sovereign securities dominate (but less than some other EU countries). Overall, central bank reserves and sovereign bonds constitute more than 60 percent of total CBC. Non-tradeable assets, which are still eligible for central bank financing, correspond to approximately 15 percent of CBC. This leads to solid liquidity buffers, as non-CB eligible assets represents a small share of CBC.

83. CBC in USD exhibits similar quality composition. Withdrawable central bank reserves and Level 1 assets (mostly US treasury securities) dominate. As in the case of total CBC, more than 70 percent of CBC in USD are highly liquid and central bank eligible assets.

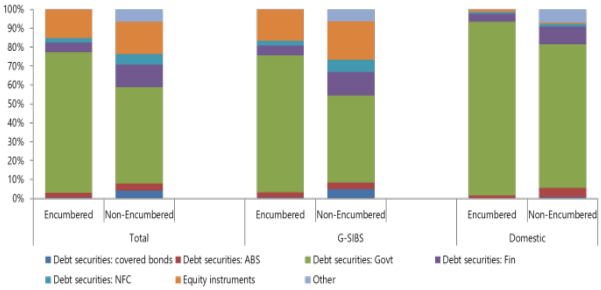
84. CBC analysis cannot capture collateral transfer risks. Collateral transfer risks arise because of legal restrictions to collateral transfer from one jurisdiction to another due to ringfencing activities, especially imposed by supervisors of branches and subsidiaries outside of the EU, and other risks related to international activities of banks. While this issue is not specific to French banks, data unavailability is an important issue in liquidity risk assessment. ECB and ACPR may need to collect additional liquidity data to close this gap.

Figure 18. France: Counterbalancing Capacity and Asset Encumbrance

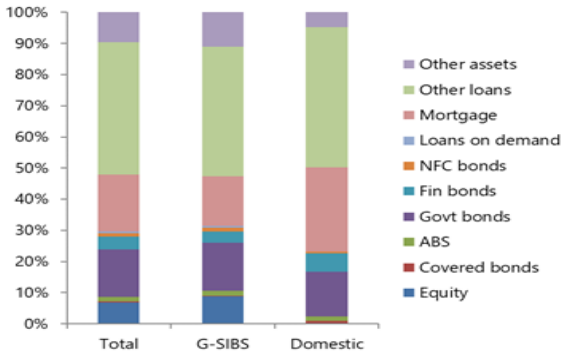
Overall, AE ratios remain low.



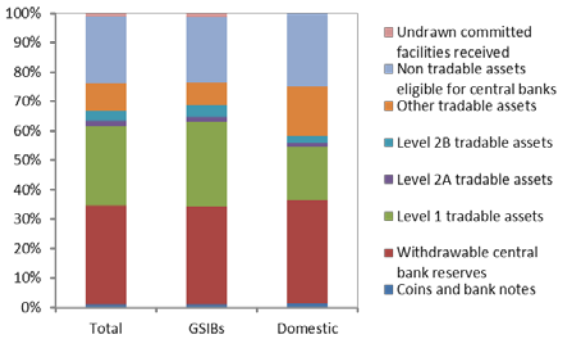
Key rehypothecated items are government bonds with equities being more important for G-SIBs.



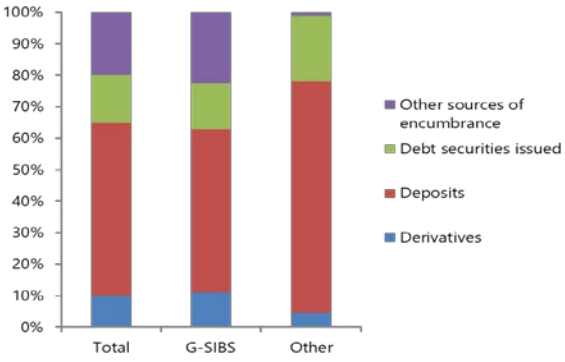
Domestic banks have relatively higher share of encumbered mortgages, which reflects their business model to rely more on secured financing.



High share of central bank-eligible assets reveals high quality and diversified counterbalancing capacity (CBC).



Collateralized deposits are main source of encumbrance for both, G-Sibs and domestic banks.



CBC in USD reveals similar composition to total CBC.

Sources: ECB and IMF.

C. Cash Flow-Based Liquidity Stress Tests

Methodology

85. The cash flow-based liquidity stress test (CFLST) analyses the liquidity risk exposure and risk bearing capacity of the sample of 7 banks in France. CFLSTs incorporate a set of embedded scenarios that allowed the FSAP team to estimate the order of magnitude of potential liquidity needs of individual banks and the banking system (comprising the sample of 7 banks) under a baseline and multiple stress scenarios. CFLST reveal levels of liquidity risk tolerance, i.e., under which circumstances banks would need additional liquidity support because of the mismatch of cash flows and absence of available CBC for which level of stress banks hold an adequate CBC. In addition, the CFLST contribute to the assessment of common liquidity risk exposures of banks in the banking system, such as reliance on unsecured short- term funding, also holdings of similar less-liquid assets in the CBC. The CFSTs does not consider potential redistribution of liquidity within the banking system, i.e., migration of deposits from banks which experience capital shortfall to the banks which have strong capital buffers. This redistribution of flows was observed during the GFC.

86. Cash-flow based liquidity stress tests transform reported cash-flow data for total currencies and USD into stressed cash-flows and security flow data based on a matrix of scenario dependent stress factors. They focus on two key indicators, namely, liquidity risk exposure and liquidity risk bearing capacity of banks. The first indicator is defined as the difference between cash-inflows and cash-outflows in each time bucket (the net-funding gap NFG) and the sum of these differences across buckets (i.e., the cumulated net-funding gap CNFG). The second indicator is the CBC, defined as the sum of cash inflows banks can generate under stress at reasonable prices in the respective bucket after considering securities flows. The cumulated counterbalancing capacity (CCBC) is the sum of the counterbalancing capacities across time buckets and the current one. The analysis builds on data collected within the ITS: especially, but not limited to, Maturity Ladder, (template C66.00) and Short-Term exercise templates from 2014:Q4 to 2018:Q4.

87. The contractual liquidity gap (all currencies combined) of sample banks would reach 11 percent of total assets in the first four weeks. Contractual outflows within the first four weeks amounts to about 49 percent of total assets (weighted average; excluding open maturity and overnight retail deposits (26 percent of TA) and open maturity and overnight corporate deposits (9 percent of TA)) (see Figure 19). G-SIBs exhibit higher outflows, especially due to higher share of wholesale corporate deposits (15 percent versus 8 percent for domestic banks). The contractual inflows amount to about 38 percent of TA (excluding inflows from Central Bank deposits (10 percent of TA) due to reporting conventions). Thus, the cumulated net funding gap over the first four weeks reaches about 11 percent of total assets or 746 billion EUR. The main drivers of the net outflows (except retail funding) are:

- Outflows from deposits of financial institutions (-3 percent of TA, net of inflows from financial institutions);
- Corporate deposit outflows (-13 percent of TA, net of corporate deposit inflows);

- Repos collateralized with 0 percent risk-weight bonds (-1.5 percent of TA, net of similar reverse repos); and

- Central bank inflows (10 percent of TA) cover most of the contractual liquidity gap.

Figure 19. France: Heatmap of Contractual Cash Flows—Total Currencies

(In terms of total assets)

Most of the contractual cash outflows are concentrated within first month, and open maturity deposits dominate.[1]

	Overnight	Greater than overnight up to 2 days	Greater than 2 days up to 3 days	Greater than 3 days up to 4 days	Greater than 4 days up to 5 days	Greater than 5 days up to 6 days	Greater than 6 days up to 7 days	Greater than 7 days up to 2 weeks	Greater than 2 weeks up to 3 weeks	Greater than 3 weeks up to 4 weeks	TOTAL
Outflows - LT unsecured issuances	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.7%
Outflows Secured Issuances	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Outfows - ST paper due	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%
Outflows - Repo's against 0% RW securities	1.0%	4.8%	1.8%	1.7%	0.0%	0.0%	0.7%	1.5%	0.6%	0.6%	12.7%
Outflows - Repo's against 20% RW securities	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.2%
Outflows - Repo's against covered bonds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Outflows - Repo's against corporate bonds	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Outflows - Repo's against RMBS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Outflows - Repo's against other CB eligible assets	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Outflows - Repo's against non-CB elig. equities	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%
Outflows - Repo's against non-CB elig. equities	0.4%	0.3%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	0.3%	1.4%
Outflows - Retail dep. Outflows	25.7%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%	30.7%
Outflows - Corporate dep. outflows	9.4%	0.6%	0.1%	0.1%	0.0%	0.0%	0.1%	0.2%	0.1%	3.6%	14.4%
Outflows - Central Bank dep. outflows	0.1%	0.2%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.8%
Outflows - Other dep. outflows	0.6%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	1.1%
Outflows - Fin. Inst. (not within IPS) dep. outflows	2.2%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.9%	3.9%
Outflows - IPS outflows	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.5%
Outflows - FX-swap outflows	1.0%	1.1%	1.1%	1.3%	0.1%	0.3%	1.1%	2.0%	2.2%	3.8%	14.0%
Outflows - Derivative outflows	0.5%	0.1%	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	1.2%
Outflows - Other outflows	0.3%	0.6%	0.2%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	1.4%
TOTAL	41.5%	9.0%	3.9%	3.9%	0.2%	0.4%	2.4%	4.8%	3.4%	14.9%	84.3%

Most of the contractual cash inflows are concentrated outside of the 30-day horizon, but inflows from deposits at central bank dominate.

	Overnight	Greater than overnight up to 2 days	Greater than 2 days up to 3 days	Greater than 3 days up to 4 days	Greater than 4 days up to 5 days	Greater than 5 days up to 6 days	Greater than 6 days up to 7 days	Greater than 7 days up to 2 weeks	Greater than 2 weeks up to 3 weeks	Greater than 3 weeks up to 4 weeks	TOTAL
Inflow - Rev. repo's against 0% RW securities	0.8%	3.4%	1.7%	1.5%	0.1%	0.0%	0.5%	1.3%	0.9%	1.1%	11.2%
Inflow - Rev. repo's against 20% RW securities	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Inflow - Rev. repo's against covered bonds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflow - Rev. repo's against RMBS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.3%
Inflow - Rev. repo's against other CB eligible assets	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflow - Rev. repo's against other CB eligible assets	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%
Inflow - Rev. repo's against non-CB elig. equities	0.2%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%	0.6%
Inflow - Rev. repo's against other non-CB elig. Assets	0.3%	0.4%	0.1%	0.1%	0.0%	0.0%	0.2%	0.1%	0.1%	0.4%	1.7%
Inflows - Retail inflows	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.3%	0.7%
Inflows - Corporate inflows	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%	0.2%	0.1%	0.5%	1.3%
Inflows - Central Bank inflows	7.0%	0.1%	0.2%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	2.6%	10.3%
Inflows - Other entities inflows	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.3%	1.6%
Inflows - Fin. Inst. (not within IPS) inflows	0.5%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.9%
Inflows - IPS inflows	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflows - FX-swap inflows	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflows - Derivative inflows	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflows - Other inflows	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	9.5%	4.4%	2.2%	1.9%	0.1%	0.1%	0.9%	3.3%	1.3%	5.5%	29.2%

Sources: ECB and IMF.

[1] 2018:Q4.

88. The composition of repo collateral (ex 0 percent risk-weight bonds) is similar to the composition of collateral for reverse repos within the first four weeks. Gross encumbrance due to repos across all asset categories accounts for about 15 percent of TA; gross reverse repos account for about 14 percent of TA.

89. USD flows are concentrated within one-month horizon, and contractual liquidity gap is relatively small in terms of TA (Figure 20). Most of the USD funding is overnight, based on repos (3.6 percent of TA) and corporate deposits (1.7 percent of TA). Total USD funding outflows over one-month horizon constitute 15.1 percent of total assets. Corresponding contractual inflows over one-month horizon are 12.6 percent of total assets, hence overall gap is 2.5 percent of total assets. This gap would be the largest possible liquidity shortage banks would experience within one-month horizon without considering any counterbalancing capacity.

90. Cash flow mismatch in USD is mainly due to different maturities of repos and reverse repos, which itself reflects the business model of some French G-SIBs. Business model of such G-SIBs engaged in USD operations is based on short-term borrowing (repos) and longer-term lending (reverse repos), earning corresponding term spread due to differences in borrowing/lending rates. These operations are typically secured with high quality collateral, such as US treasury securities or other high-quality bonds. Therefore, valuation and subsequent contingent liquidity risks due to volatility of collateral prices from such operations are very limited. At the same time, some residual risks remain within the very short period of one week in case repos are not rolled over, and wholesale funding is withdrawn.

91. The CBC in the first month fully covers the system-wide cash flow gap. The total sum of assets in the counterbalancing capacity amounts to 20 percent of TA. It is higher than the net funding gap in the unstressed reported data (excl. retail and corporate deposits), which amounts to about 11 percent of TA over the first four weeks. While banks as a group have enough CBC to cover the gap, its distribution is uneven and some banks face shortfalls under extreme scenarios.

92. Cash and deposits at the central bank dominate the composition of the CBC (Table 6). Central bank deposits and 0 percent risk-weight securities account for about 65 percent of the CBC. Credit claims and other non-HQLA are the third largest position with roughly 25 percent of the CBC. In terms of USD CBC, CBC quality is even higher with cash, central bank reserves and 0 risk weighted securities comprising 75 percent of liquidity buffers.

93. Most of the securities included in CBC have low to very low credit risk. Analysis of unencumbered assets by credit quality steps (CQS) reveals that most of the unencumbered assets (i.e., excluding cash, central bank reserves, credit claims and other non-marketable securities) fall into the lowest credit risk category (CQS1) thus can be quickly converted into cash and/or used for collateral management purposes. In terms of USD liquidity, banks that are active in FX funding market accumulated large amounts of US sovereign debt securities and US government-sponsored enterprise issued papers, which also fall under CQS1 category.

Figure 20. France: Heatmap of Contractual Cash Flows—USD

(In terms of total assets)*

Most of the contractual cash outflows are concentrated within overnight, and up to two weeks horizon.[1]

	Overnight	Greater than overnight up to 2 days	Greater than 2 days up to 3 days	Greater than 3 days up to 4 days	Greater than 4 days up to 5 days	Greater than 5 days up to 6 days	Greater than 6 days up to 7 days	Greater than 7 days up to 2 weeks	Greater than 2 weeks up to 3 weeks	Greater than 3 weeks up to 4 weeks	TOTAL
Outflows - LT unsecured issuances	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Outflows Secured Issuances	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Outfows - ST paper due	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Outflows - Repo's against 0% RW securities	3.6%	0.0%	0.0%	0.3%	0.1%	0.1%	0.3%	1.2%	0.1%	0.1%	5.7%
Outflows - Repo's against 20% RW securities	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Outflows - Repo's against covered bonds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Outflows - Repo's against corporate bonds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Outflows - Repo's against RMBS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Outflows - Repo's against other CB eligible assets	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.3%
Outflows - Repo's against non-CB elig. equities	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.3%
Outflows - Repo's against non-CB elig. equities	0.8%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	1.0%
Outflows - Retail dep. Outflows	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%
Outflows - Corporate dep. outflows	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	2.3%
Outflows - Central Bank dep. outflows	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
Outflows - Other dep. outflows	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Outflows - Fin. Inst. (not within IPS) dep. outflows	0.6%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.8%
Outflows - IPS outflows	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Outflows - FX-swap outflows	0.3%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	1.1%
Outflows - Derivative outflows	0.4%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%	0.0%	0.1%	0.9%
Outflows - Other outflows	0.4%	0.0%	0.0%	0.1%	0.2%	0.0%	0.0%	0.0%	0.1%	0.0%	0.8%
TOTAL	9.3%	0.1%	0.0%	0.7%	0.7%	0.4%	0.6%	2.0%	0.5%	0.8%	15.1%

Half oft of the cash inflows are concentrated outside of the one-week horizon, thus creating short-term maturity mismatch within one-month horizon.

	Overnight	Greater than overnight up to 2 days	Greater than 2 days up to 3 days	Greater than 3 days up to 4 days	Greater than 4 days up to 5 days	Greater than 5 days up to 6 days	Greater than 6 days up to 7 days	Greater than 7 days up to 2 weeks	Greater than 2 weeks up to 3 weeks	Greater than 3 weeks up to 4 weeks	TOTAL
Inflow - Rev. repo's against 0% RW securities	2.4%	0.0%	0.0%	0.1%	0.1%	0.1%	0.2%	0.3%	0.4%	0.3%	3.7%
Inflow - Rev. repo's against 0% RW securities	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflow - Rev. repo's against covered bonds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflow - Rev. repo's against RMBS	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Inflow - Rev. repo's against other CB eligible assets	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflow - Rev. repo's against other CB eligible assets	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.2%
Inflow - Rev. repo's against non-CB elig. equities	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.4%
Inflow - Rev. repo's against other non-CB elig. Assets	0.6%	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%	0.1%	0.1%	0.1%	1.2%
Inflows - Retail inflows	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflows - Corporate inflows	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.6%
Inflows - Central Bank inflows	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%
Inflows - Other entities inflows	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflows - Fin. Inst. (not within IPS) inflows	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%
Inflows - IPS inflows	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inflows - FX-swap inflows	0.4%	0.0%	0.0%	0.4%	0.3%	0.0%	0.1%	0.6%	0.8%	1.0%	3.6%
Inflows - Derivative inflows	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.7%
Inflows - Other inflows	0.6%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	1.0%
TOTAL	5.7%	0.0%	0.0%	0.8%	0.6%	0.1%	0.6%	1.4%	1.5%	1.9%	12.6%

Sources: ECB and IMF.

[1] 2018:Q4.

* - ratios are based on total assets in all currencies, not just USD assets.

94. Euro area and U.S. sovereign securities are the most prevalent debt assets included in the CBC. Five countries (France, Italy, Belgium, UK, and US) cover roughly 70 percent of sovereign exposures in the sample of banks (Figure 4 and 10). As most of the banks are exposed to these securities, in the event of a large market shock (such as sovereign crisis in 2012), market liquidity of some of these assets may be severely affected by the typical flight to quality effect with investors selling bonds with lower credit rating but buying higher credit rating securities. At the same time,

risk mitigating factor is that average remaining maturity of these sovereign securities is close to two years, hence the impact of changes in interest rates and sovereign risk premiums is relatively lower compared to impact on holdings of long-term debt securities.

Scenarios

95. Parameter uncertainty is an integral component of any liquidity stress test. Regardless of the sophistication of parametrization, liquidity stress situations can be unexpected and last for various time periods (from a few days to the slow drain of liquidity over many months). The best way to address the inherent parameter uncertainty is to run a large set of embedded scenarios of increasing severity.

96. Cash flow stress tests were based on multiple scenarios (see Table 6). The analysis employs a set of 30 embedded scenarios for a 4-week, 3 months as well as a 5-day time horizon, respectively: a baseline scenario and 4 stress scenarios with increasing severity (mild market stress, medium market stress, severe market stress and an extreme, market-wide stress). Contractual cash flows represent the worst realization of cash flows when roll-over rates are zero. Stress scenarios are combined with three different approaches to the counterbalancing capacity:

- Full CBC without haircuts (HCs): fully endogenous liquidity supply by the central bank as long as banks have unencumbered eligible collateral;
- Full CBC with simulated market price shock haircuts: fully endogenous liquidity supply by the central bank as long as banks have unencumbered eligible collateral, but market price effects derived from the solvency stress test are used for assets that are liquid in private markets; and
- Liquid, central bank eligible CBC: non-marketable components of the counterbalancing capacity (i.e., credit claims and committed lines provided to the banks) are disregarded.

97. Cash flow ST was performed for both, total currencies and USD. The scenarios for USD 5-day CFST differed from total currencies 5-day scenario. Stress test assumed that banks would not face retail deposit withdrawals, instead, only wholesale funding from corporates and institutions (non-operational deposits) will be withdrawn with increased level of severity, i.e., 50,75 and 100 percent.

98. Embedded scenarios allow to simulate different degree of banks' dependence on central bank's support under liquidity stress (Figure 21). To ensure consistency with solvency stress tests, the calibration of haircuts under the liquid CBC approach draws on the asset prices (sovereign and corporate bonds) under the adverse scenario of the solvency stress tests.

Table 6. France: Composition of the CBC
(Weighted average across all banks, in percent of TA)

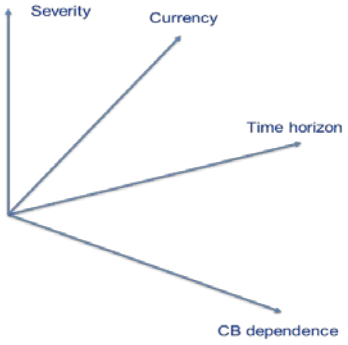
Compared to HQLA	Compared to ST Assumptions	Asset Category in the CBC	Value in Percent of TA (all Currencies)	Value in Percent of TA (USD)
HQLA I	Marketable liquid assets	Cash	0.2	0.04
		Central bank deposits	8.4	3.28
		0 percent risk-weight securities	4.2	3.13
HQLA II		20 percent risk-weight securities	0.1	0
		Covered bonds	0.4	0.01
		Corporate bonds	0.2	0.06
		RMBS	0.1	0.03
Non-HQLA assets	Non-Marketable liquid assets	Other eligible assets (i.e., Credit Claims)	4	0.28
		Non-eligible equity	0.5	0.22
		Other non-eligible assets	1.9	1.53

Sources: ECB and IMF.

Figure 21. France: Stress Test Scenarios

To deal with parameter uncertainty, CFLST was based around multiple scenarios.

Which were grouped according to the four dimensions: severity, time horizon, currency and dependence on central bank support.



Source: IMF.

99. This approach to parameter uncertainty shifts discussions from parameter calibration to liquidity risk tolerance of banks. The goal of the liquidity tests is to determine a banks' risk tolerance for liquidity risk, that is, determine the maximum degree of risk that the bank is willing to accept under stress conditions. The choice of "threshold" itself is based on multiple parameters, for example, percentage of funding outflow, haircuts on CBC assets. If many banks fail under a very mild outflows or haircuts scenario, this reveals a high liquidity risk tolerance and vice versa. In addition, the broad set of scenarios allows for effective comparisons of liquidity risk exposure and liquidity risk tolerance across banks beyond the simple pass/fail dichotomy.

100. Scenario calibration builds on event studies of system-wide and idiosyncratic liquidity stress events and is broadly consistent with the literature. For example:

- *Retail deposit outflows* within one week reached 11percent in the banking system of for Banesto (ES, 1994) 8 percent, and for IndyMac (USA, June 2008) 7.5percent. For Washington Mutual (USA, September 2008) retail deposit outflows amounted to 8.5 percent in 10 days and for DSB Bank (NL, 2009) they reached 30 percent in 12 days (Schmieder et al. 2012, Table 3). In their severe scenario (comparable to the Lehman crisis), the outflow rates for retail term deposits amount to 10 percent over the 30-day horizon and for 20 percent for demand deposits. Open maturity retail deposit outflows in countries which experienced bank crisis, such as Italy, Spain, Ireland, Portugal, etc. retail deposit outflows from stable deposits reached up to 18 percent over six-month horizon;

- Outflows from open maturity operational deposits in countries which experienced bank crisis reached up to 20 percent over three-month horizon; withdrawals from non-operation deposits reached 20 percent over one-month horizon;

- Unsecured short-term wholesale funding run-off rates amounted to 100 percent;

- For secured wholesale funding the outflow rate is up to 50 percent; and

- In Halal, Laliotis (2017, Severely adverse scenario) the run-off rates amount to 10 percent for stable deposits, 20 percent non-stable deposits, 100 percent (net unsecured interbank funding), 50 percent (net secured interbank funding), and 100 percent (other wholesale funding, except ABS 50 percent).

101. Run-off rates are higher for unsecured than for secured wholesale funding, as well as for non-stable, nonoperational deposits compared to stable, operational deposits. Table 7 summarizes the calibration of the inflow and outflow parameters.[15] The inflows parameters are in principle 100 percent of the contractual inflows, except for inflows from loans to retail and for corporate customers (inflows 0 percent). This is in line with the objective of the CFLST to assume that banks will continue business as normal, i.e., analyze the ability of banks to cope with liquidity stress while maintaining their ability to lend to the real economy. In fact, when bank cuts credit lines and/or stops granting loans, it may send the negative signal to the markets about its financial situation, which leads to further outflows from that bank.

[15]Further references can be found: BCBS (2014), "Liquidity stress-testing: a survey of theory, empirics and current industry and supervisory practices," BCBS Working Paper 24. BCBS (2014), "Literature review of factors relating to liquidity stress—extended version" and the literature cited therein. Schmieder et al. (2012). Hałaj, G., D. Laliotis (2017), "A top-down liquidity stress test framework," In: Dees, S., J. Henry, R. Martin (eds.), "Stress-Test Analytics for Macroprudential Purposes in the euro area," ECB, 168–191. Commission Implementing Regulation (EU) 2016/322 of 10 February 2016 amending Implementing Regulation (EU) No 680/2014 laying down implementing technical standards with regard to supervisory reporting of institutions of the liquidity coverage requirement.

102. For the impact of market prices on CBC, haircuts on unencumbered sovereign debt as well as corporate securities were calculated under the adverse scenario of the solvency stress test. Adverse scenario produced two components: changes in risk free-rates (yields of German sovereign bonds) and risk premiums over the reference rate of the German sovereign bonds. The risk-free rates changed in line with the adverse scenario. Information on the composition of each bank's CBC was derived from the CBC concentration template, and the data then merged with EBA transparency exercise data (maturity of exposures). ECB haircuts were obtained from the ECB eligible assets database (by CQS).[16]

Table 7. France: Scenario Parameters: Run-off Rates for the Major Components of In- and Outflows

Outflows/Inflow	Range of Run-Off Factors (In Percent) Across Mild, Medium, Severe and Extreme Scenarios
Unsecured LT/ST Issuances and financial deposits	30–100
Secured issuances	10–50
Stable retail deposits	2–10
Unstable retail deposits	3–24
Operational corporate deposits (NFCs)	10–50
Non-operational corporate deposits (NFCs) & other deposit outflows	20–100
Repo across all collateral classes*	0
Deposits FI	30–100
FX-Swaps in-/outflows	15–100
Derivative in-/outflows	25–100
Retail / corporate inflows	0
Central bank inflows	100
Other entities inflows	0–30
FI inflows	30–100
Other inflows	100
Committed lines provides by the bank (FI)	25–75
Committed lines provides by the bank (non-FI)	3–10
Margin calls (derivatives)	2–10
Adverse market outflows (derivatives, HLBA)	0–100
Outflows due to rating downgrades	0–100

Source: IMF.
Note: * Stressed outflow rates for repos are captured by increasing haircuts for the underlying collateral class. Calibration based on: BCBS (2014), "Liquidity stress-testing: a survey of theory, empirics and current industry and supervisory practices," BCBS Working Paper 24. BCBS (2014), "Literature review of factors relating to liquidity stress—extended version" and the literature cited therein. Schmieder et al. (2012). Hałaj, G., D. Laliotis (2017), "A top-down liquidity stress test framework," In: Dees, S., J. Henry, R. Martin (eds.), "Stress-Test Analytics for Macroprudential Purposes in the euro area," ECB, 168-191. LCR Delegated Act - Commission Implementing Regulation (EU) 2016/322 of 10 February 2016 amending Implementing Regulation (EU) No 680/2014.

103. Banks can also obtain liquidity in the markets using repos subject to market haircuts. Banks are subject to market haircuts when they need to obtain funding under market terms, for example, by entering into repo transactions. The FSAP team used market data to compare

[16] See: https://www.ecb.europa.eu/paym/coll/assets/html/list-MID.en.html. Data cut-off was March 5, 2019.

various haircuts (Figure 10 and 21). FSAP team estimates of haircuts were broadly in line with market haircuts on respective securities.

D. Results and Recommendations

Time Horizon Five Days

104. The banks hold adequate liquidity buffers to absorb shocks simulated over five-day horizon, albeit they would face challenges in scenarios where a large amount of wholesale funding is withdrawn. Significant withdrawal of wholesale funding from institutions and corporates present vulnerabilities over a short run, especially in U.S. dollars. While the resulting liquidity gap in U.S. dollars appears to be small (i.e., only up to 1 percent of total assets), it is important to consider minimizing liquidity contagion risks arising from short-term funding stress in U.S. dollars.

105. G-SIBs are most vulnerable to liquidity shocks due to wholesale funding withdrawal. G-Sibs are more dependent on short-term wholesale funding from financial and nonfinancial corporates, thus experience higher funding outflows in the tests. Domestic banks have high share of stable retail funding, thus are hit less by assumptions about wholesale funding withdrawals.

Time Horizon 30 days and Three Months

106. The liquidity shocks simulated in the 30 scenarios for the four-week and three months' time horizon generated large effects, but all banks have enough liquidity to cope with 30 days of simulated shocks and most banks were able to cope without exhausting buffers in a three month horizon. The interaction between scenarios and their parametrization is presented in a Figure 22 below. The chart with liquidity surplus/deficit measures systemic stress, e.g., the banking system's cumulated counterbalancing capacity at the end of the specific scenario horizon. The severity of the scenarios increases, e.g., from the baseline scenario to an extreme, system-wide market stress. The chart represents results for both, all currencies combined ("Total currency") and USD liquidity stress tests separately.

107. The liquidity risk exposure of the sample when combining all currencies is moderate, as even the mild market scenario leads to a reduction of the aggregate CBC of 5 percent of total assets (Figure 23). In a one-month scenario average CBC surplus is 5 percent of TA and no one bank has negative CBC. In a three-month horizon, under the most severe scenario, the impact of the shock amounts to 12 percent of total assets or almost 80 percent of the initial CBC. Some banks have negative CCBC throughout the stress horizon under the full CBC approaches (with and without HC). Further disregarding non-liquid components of the CBC leads to a few banks with negative CCBC with an average shortfall of 7 percent of total assets. From a system-wide perspective, the aggregate shortfall of 7 percent of the total assets of the entire sample is small, also given that 3-month stress horizon would be an extreme case as such.

108. The contractual liquidity gap in USD over 30 days horizon is minus 2 percent of TA of banks in the sample. Given that total USD liquidity exposure over the same horizon is 2 percent of

TA, net effect is 4 percent of TA. This gap does not change much when moving to shorter (five days) horizon. For longer three months horizon, contractual gap reaches minus 4 percent of TA. Overall, difference between five days and one-month stress test results is small, given the fact that most of the wholesale funding is lost within the first week of the stress (see Figures 22 and 23).

109. The major drivers of liquidity stress in both, total currencies and USD are net unsecured, non-operational deposits of financial institutions, nonfinancial corporates and net repos. Retail and other deposit outflows as well as the impact of scenario-based haircuts on the CBC are substantial only in the most adverse case. Under the baseline scenario, funding liquidity would be affected mainly via changes in market haircuts on these assets; without changes in haircuts and eligibility of assets as collateral, the total effect on CBC is negligible. The total contribution to decline in CBC if only a liquid collateral is used, and respective market price shocks applied is 2 percent of total assets of 10 of total CBC. To cover the outflows, banks would use cash as well as deposits at the central bank. Repos and reverse repos also form a sizable portion of inflows and largely compensate for the outflows from repos.

110. While number of banks with negative CBC in USD is four in the worst three-month scenario, overall liquidity shortfall would be small, also taken into account normal functioning of USD/EUR swap markets. Normal functioning of swap markets allows banks to swap excess liquidity in EUR to USD. In case of systemic crisis when swap markets would not be available, markets expect central bank interventions (for example, there is a USD/EUR swap lines between CBs). In the case of idiosyncratic shocks (i.e., France or a bank specific liquidity shocks) currency swap markets would remain operational. The risk of systemic or idiosyncratic crisis in USD markets does not need to be downplayed though, as a given bank facing liquidity challenges in one currency may experience "precautionary" wholesale funding withdrawals in other currencies as well.

111. Additional liquidity buffer would help address residual liquidity risks. The competent authorities may wish to consider options to minimize the impact of potential disruptions in the wholesale funding markets in all major currencies, including U.S. dollars, by imposing a liquidity buffer to cover predetermined threshold of at least 50 percent of outflows over a horizon of up to five days from wholesale funding providers in all currencies. These buffers may be linked with monitoring of banks' use of collateral swaps to improve their liquidity ratios.

112. The FSAP team was not able to perform fully fledged contingent and intragroup liquidity stress tests. The competent authorities may wish to gather data and perform stress tests on contingent liquidity flows stemming from secured financing, derivatives, and other related transactions. It may also be worth performing liquidity stress tests that take into account intragroup liquidity needs (banking, insurance, asset management).

Figure 22. France: Comparable Banks and Market Haircuts on CBC

*Average haircuts for tri-party repos reflect liquidity value banks are getting by entering market transactions (in contrast to repos with central bank)**

Haircuts by the Type of Collateral
(Percent)

Type of Collateral	Repo Haircuts (Duration of Repo)			
	1 m	3 m	1 y	> 1 y
government securities	1.6	1.9	2.1	2.4
public agencies / sub-national governments	2.0	2.3	2.6	2.9
supranational agencies	1.8	2.2	2.4	2.7
corporate bonds (financial)	4.3	5.1	5.6	6.4
covered bonds	2.6	3.1	3.4	3.9
RMBS/CMBS	3.8	4.6	5.0	5.7
Other asset backed	3.4	4.0	4.4	5.0
CDO, CLN, CLO	3.6	4.3	4.8	5.4
convertible bonds	6.0	7.1	7.8	8.9
equity	4.8	5.7	6.2	7.1
other	3.4	4.1	4.5	5.1

*By the type of sovereign, FSAP team estimates are close to the haircuts applied by markets***

Haircuts by Sovereign
(Percent)

Sovereign	LCH Clearnet Margin Collateral Haircuts (by Term of Security)					
	4-10 bus. day <= 1yr	> 1yr <= 3yrs	> 3yrs <=7 yrs	> 7yrs <= 11yrs	> 11yrs <= 30yrs	> 30yrs
Austria	5.5	6.3	8.0	8.3	11.5	13.6
Belgium	6.1	7.0	8.8	10.0	13.3	17.1
Finland	5.5	6.3	7.3	8.0	11.5	NA
France	5.8	6.3	7.3	8.1	11.8	13.9
Germany	5.5	6.1	7.3	8.0	12.3	12.8
Italy	8.0	10.5	14.1	15.9	19.8	21.6

Banks report haircuts on CBC items they hold applying LCR as well as own haircuts.

Haircuts by CBC Categories
(Billions of euros and percent)

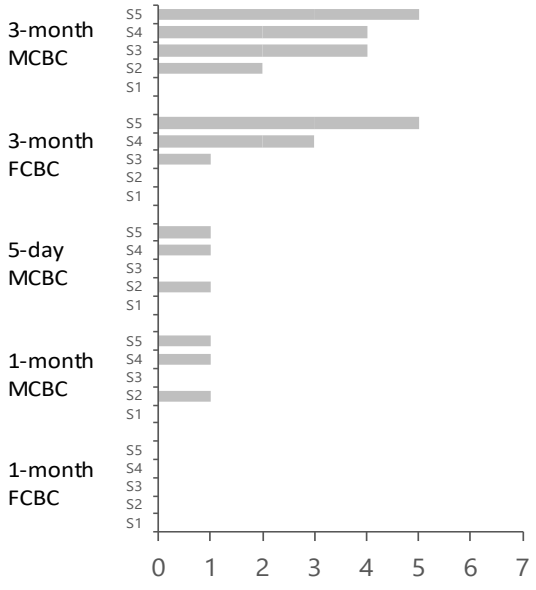
Type of Security	Total Amount (Billions of euros)	Central Bank Eligible Amount (Billions of euros)	Haircuts (Percent)
Securities issued by general governments	706	634	10
Securities issued by corporations	101	85	16
Asset-backed securities	32	25	22
Equity instruments	8	0.4	96

Sources: ECB and IMF.
* International Capital Market Association. European Repo Market Survey. October 2017.
** LCH Clearnet.

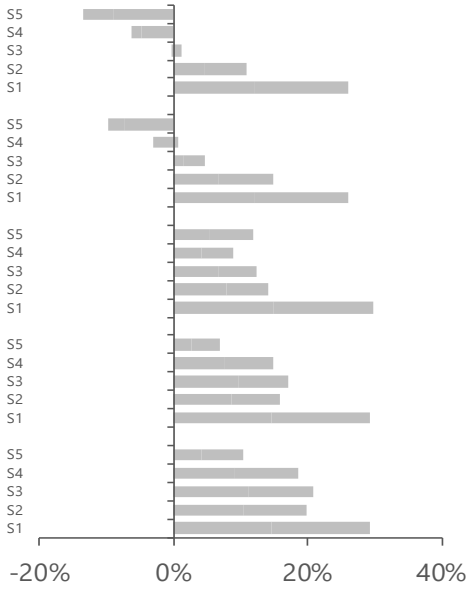
Figure 23. France: Liquidity Stress Test 1

Results: Total currency

Number of Banks with negative CBC

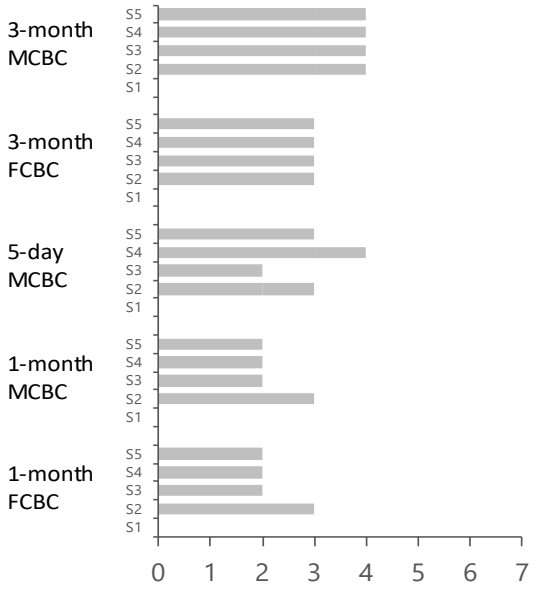


Liquidity Surplus/Deficit (Percent of total assets)

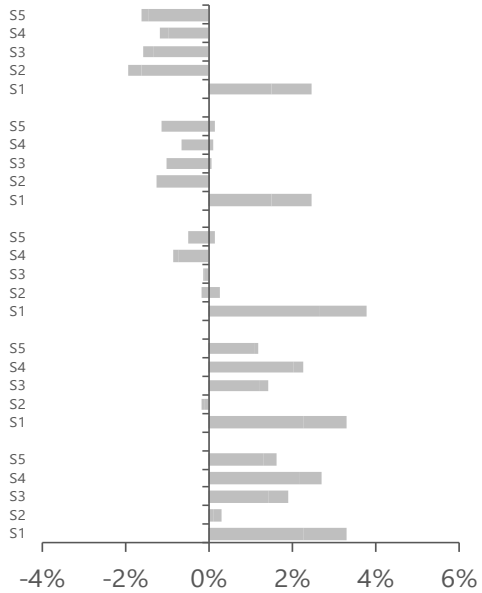


Results: U.S. dollars

Number of Banks with Negative CBC



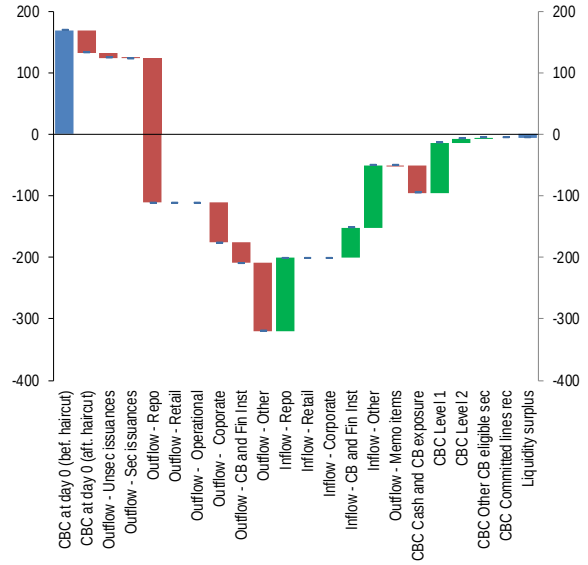
Liquidity Surplus/Deficit (Percent of total assets)



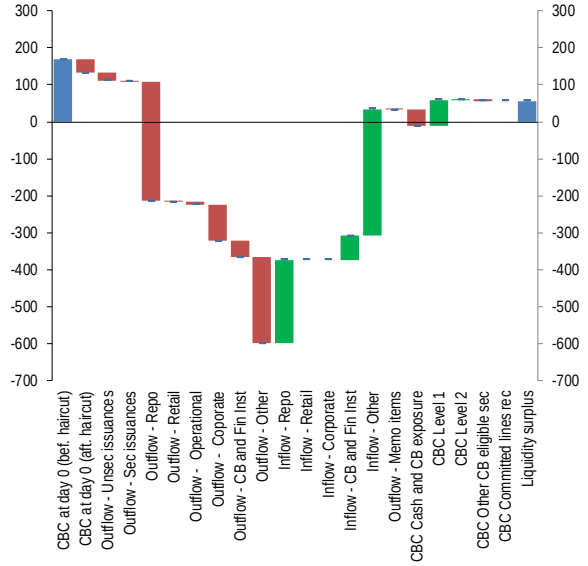
Sources: ECB and IMF.
Note: S1 to S5 refers to baseline, mild, medium, severe and extreme severe scenarios. MCBC: marketable CBC. FCBC: full CBC.

Figure 24. France: Liquidity Stress Test 2

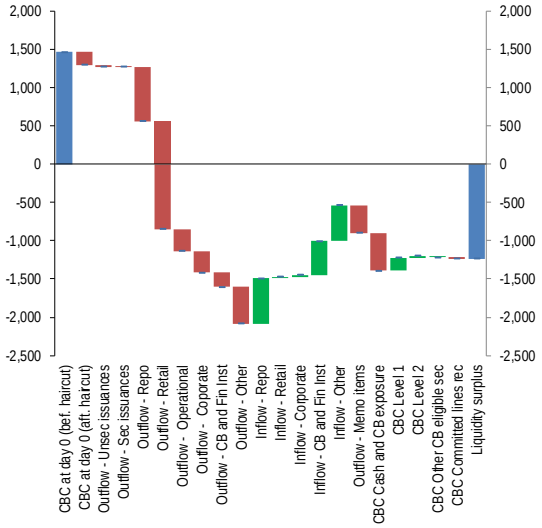
Factors Driving Liquidity Positions under Wholesale Outflow Scenario: 5-day, US dollars (Billions)



Factors Driving Liquidity Positions under Wholesale Outflow Scenario: 1-month, US dollars (Billions)



Factors Driving Liquidity Positions: Contractual: 1-Month, US Dollars (Billions)



Sources: ECB and IMF.

INSURANCE STRESS TESTS

A. Scope and Sample of the Stress Test

113. A top-down (TD) stress test was performed for the insurance sector, which included nine insurance groups, on a consolidated basis, accounting for a representative sample of the life sector. Based on gross written premiums, the stress test reached a market coverage of 70 and 40 percent in the domestic life and non-life sector, respectively. Given the rather modest concentration in the non-life market, a considerably larger number of non-life companies would have to be included to lift the coverage above the IMF's target of 70 percent. Most groups in the sample pursue both life and non-life business, and some of them have significant operations abroad. Six groups are part of a financial conglomerate subject to a supplementary layer of supervision according to the EU Financial Conglomerates Directive (FiCoD).[17]

114. Investment holdings of participating groups are characterized by a high share in fixed-income securities, while equity and real estate are of minor importance. Corporate bond investments are of a good credit quality with 68 percent being rated A or better, and 94 being investment grade. Sovereign bond exposures are dominated by domestic exposures (50 percent), but also a sizable share in bonds issued by high-yield sovereigns in the Euro Area, mostly Italian and Spanish government bonds (Figure 25).

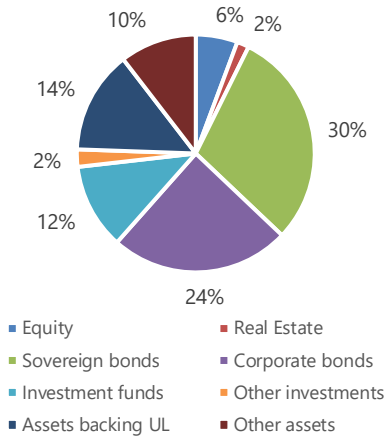
115. All nine participants record SCR ratios before stress well above the regulatory threshold of 100 percent, even without long-term guarantee measures and transitionals. Seven insurers calculate their capital requirements with the Solvency II standard formula, while two use a partial internal model. Market risks are the dominant component of insurers' solvency capital requirements, and diversification at the level of the Basic Solvency Capital Requirements (BSCR) is only modest (Figure 26). The loss-absorbing capacity of technical provisions (LAC TP), however, is very large in the French market, effectively reducing the BSCR by half. Three quarters of eligible own funds are unrestricted Tier 1 capital, while only 2 percent is comprised of Tier 3. The Long-Term Guarantee (LTG) measures and transitionals have only a minor role for the market on an aggregate level: French companies use mainly the Volatility Adjustment (VA), including eight of the stress test groups. Furthermore, two insurers in the sample use the Transitional on Technical Provisions (TTP). Both measures have a limited impact on the SCR of those groups included in the stress test as of end-2017: Technical provisions would be 0.4 percent higher without these measures, eligible own funds 3.0 percent lower and the SCR 9.6 percent higher. Accordingly, the median SCR ratio of the sample would be 26 percentage points lower (169 instead of 195 percent).

[17] Directive 2002/87/EC of the European Parliament and of the Council of 16 December 2002 on the supplementary supervision of credit institutions, insurance undertakings and investment firms in a financial conglomerate

Figure 25. France: Insurers' Balance Sheets and Fixed-Income Portfolios

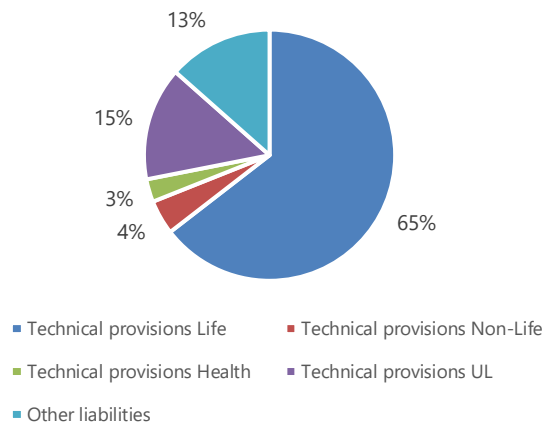
Insurers are strongly exposed to fixed-income assets (30 percent of balance sheet assets are sovereign bonds and 24 percent corporate bonds). Equity and real estate with 6 and 2 percent, respectively, play only a minor role.

Breakdown of Assets



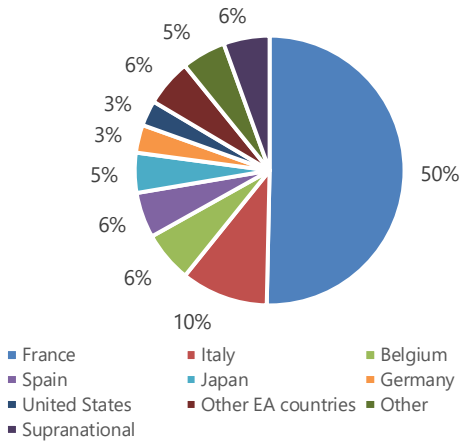
Insurance liabilities are dominated by technical provisions for life business with 65 percent and another 15 percent for unit-and index-linked life business.

Breakdown of Liabilities



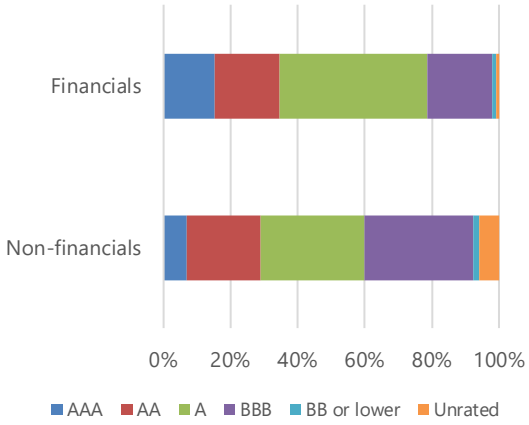
Sovereign bond holdings are characterized by a strong home bias (50 percent), and 16 percent invested in high-yield EU countries, mostly Italy and Spain.

Breakdown of Sovereign Bonds



Corporate bond investments are of high quality with 68 percent being rated A or better. Exposures towards financial issuers carry even higher ratings.

Rating Breakdown of Corporate Bonds

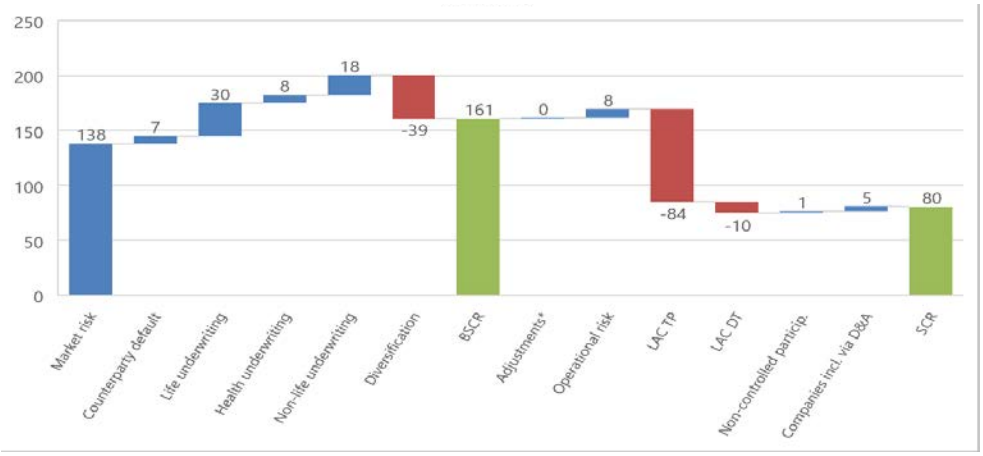


Source: IMF Staff calculations based on ACPR data.
Note: Stress test participants only. The breakdown of sovereign and corporate bonds excludes unit-linked and index-linked insurance. High-yield EU countries include Cyprus, Greece, Italy, Spain, and Portugal.

Figure 26. France: Solvency Capital Requirement and Own Funds

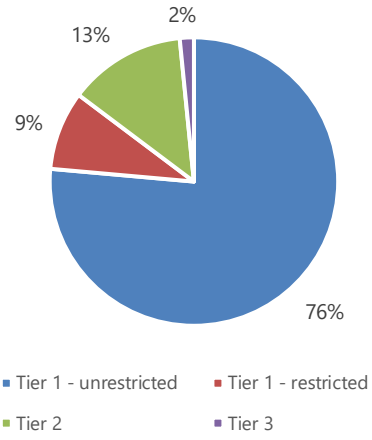
Market risks are the dominant component of insurers' solvency capital requirements, and diversification at the level of the BSCR is only modest. The LAC TP, however, is very large in the French market.

Composition of the Solvency Capital Requirement
(Billions of euros)



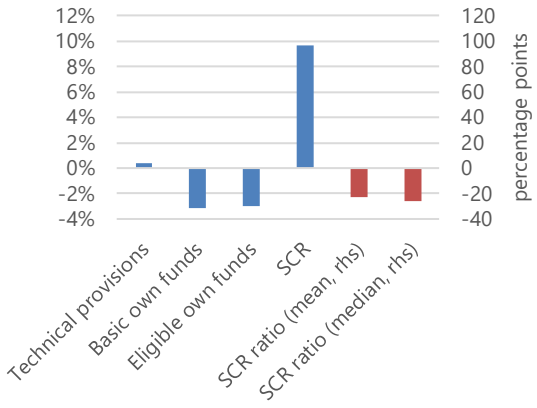
Three quarters of eligible own funds are unrestricted Tier 1 capital, while only 2 percent is comprised of Tier 3.

Quality of Eligible Own Funds



Eligible own funds would be 3 percent lower without LTG measures and transitionals, and the SCR 10 percent higher. Accordingly, the median SCR ratio would be 169 instead of 195 percent.

Impact of LTG Measures and Transitionals (As of end-2017).



Source: IMF Staff calculations based on ACPR data.
Note: Stress test participants only, except for the panel on LTG measures which shows all French insurers on an unconsolidated basis. The upper panel also includes SCR components of internal model users. The scope of their SCR modules can differ slightly from the modules used in the Solvency II standard formula. Specifically, the loss-absorbing capacity of deferred taxes (LAC DT) and LAC TP of internal model users is either calculated by them in a separate module or as part of the relevant risk modules. The graph includes LAC DT and LAC TP whenever a separate module for those exists or when companies were able to provide an estimate of the loss-absorbing capacity already included in one of the risk modules.
For one of the ST companies, ACPR authorized the use of the TTP with effect only as of 2018. Hence, the impact of this measure on that group is not included in the lower-right panel.

B. Scenario

116. The macrofinancial scenario specified by the IMF for the banking sector stress test was in some aspects slightly adjusted and amended for the purpose of the insurance stress test. The scenario's narrative, which centers around

- global trade disruptions generating financial market stress that are amplified by heightened uncertainty in Europe and the United States, and
- these adverse macrofinancial developments being amplified in France by a loss in confidence and negative effects on corporate and household balance sheets, is highly relevant also for the insurance sector. Nevertheless, some adjustments were made in order to make the scenario directly applicable to an insurer's balance sheet. While the scenario includes a projection of macro and market variables for the next five years, for the insurance stress test all shocks were assumed to occur at the beginning of the first year (instantaneous shock). Market shocks, like e.g., on equity and property prices, have therefore been front-loaded so that the maximum drawdown during the projection horizon of the macrofinancial scenario is already realized right after the reference date (June 30, 2018).

117. To cover the most relevant risk factors for an insurer's balance sheet, specifically the market risk stresses have been defined more granularly. The scenario includes shocks to the risk-free interest rate, equity and property prices, as well as credit spreads of corporate and sovereign bonds (Table 8).[18] Given the increase of credit spreads in the scenario, also the VA increases, following the Solvency II calculation method. In effect, this offsets to some degree the negative impact of the credit spread shock.

118. An additional single-factor shock, assuming the default of the largest banking counterparty, complemented the stress test. It was assumed that equity exposures need to be fully written off (i.e., a 100 percent haircut). Furthermore, a LGD of 50 percent was applied to bonds, and an LGD of 20 percent to other on-balance sheet exposures. The result of this sensitivity analysis was not added to the results of the scenario.

[18] For more details, refer to the Insurance Stress Testing Matrix (STeM) in Appendix III.

Table 8. France: Insurance Stress Test Specification

			Change in percent	Change in basis points
Equity	France		-15.0%	
	Other advanced economies		-15.6%	
	Emerging and developing economies		-15.4%	
	Private equity		-10.0%	
	Infrastructure		-8.0%	
	Hedge funds		-8.0%	
Property	Domestic	residential	-9.2%	
		commercial	-11.1%	
Corporate bond spreads	Non-financials	AAA		50
		AA		65
		A		95
		BBB		155
		BB		255
		B and lower		350
		Unrated		200
	Financials	AAA		70
		AA		85
		A		125
		BBB		200
		BB		400
		B and lower		465
		Unrated		265
Sovereign bond spreads	Switzerland			80
	Euro area, low-yield			80
	Euro area, high-yield			160
	Other countries			56
	Suprationals			0
Other fixed-income assets	Structured notes		-5.0%	
	Collateralized securities		-5.0%	
Risk-free interest rates 1/	Short-term (1 year, without VA)	EUR		-45
		USD		-33
		GBP		-160
	Long-term (10 years, without VA)	EUR		-7
		USD		-9
		GBP		-75

Source: IMF.

[1] More details on the shock to the risk-free interest rates can be found in Appendix VIII.

C. Capital Standard and Modeling Assumptions

119. Solvency II[19] was implemented in the European Union in 2016 and forms the basis for the insurance stress test. As a general principle of Solvency II, assets and liabilities are valued mark-to-market. However, some notable deviations from the market-consistent framework are allowed for the liabilities, especially with regard to the discount rate which can incorporate LTG measures and transitional measures.

120. The main output of the stress test calculations is the effect on available own funds, eligible for the coverage of the SCR. As the stresses also affect the capital requirement, the SCR was partially recalculated after stress.

121. Data for the TD stress test was gathered from the Solvency II quantitative reporting templates:

- Balance sheet (S.02.01),
- Asset-by-asset investment holdings (S.06.02),
- Own funds (S.23.01), and
- Technical provisions (S.12.01) and cash-flow projections (S.13.01).[20]

122. For the TD stress test, the shocks specified in the scenario were applied to the investment assets and insurance liabilities. Haircuts in line with the adverse scenario were applied to the market value of directly held assets. A look-through was not applied, so investment fund holdings were stressed with the corresponding shocks for the underlying asset classes. Fixed-income assets were re-valued with the stressed term structure (per currency). Similarly, technical provisions (except for unit-linked business) after stress were approximated with the stressed term structure including the volatility adjustment.[21] For unit-linked business, the decline in liabilities mirrored the market value loss of underlying assets.

123. The re-calculation of the SCR after stress was limited to selected risk modules. In the market risk module, the capital charges for equity risk, spread risk and property risk were proportionately adjusted in line with the change in exposures due to the stress. Furthermore, the equity risk capital charge was corrected for the symmetric equity adjustment which changes from -0.1 to -8.4 percentage points after the fall in equity prices. The capital charge for life underwritings risk and health underwriting risk was assumed to change proportionately with the technical

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

[20] As both templates are not reported on a group level, the solo templates of the largest domestic life subsidiaries as of end-2017 were used as a proxy.

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

provisions after the application of the stressed discount curve. All other components, including the capital charge for counterparty default risk, non-life underwriting risk and operational risk were assumed unchanged. For internal model users, the TD calculations including the aggregation of capital charges in the SCR calculation were made in a simplified approach broadly in line with the standard formula.

124. Insurance companies have a broad range of risk-mitigating mechanisms in place which add further complexity to a TD stress test. The dynamics of the loss-absorbing effects of technical provisions, which is of substantial size in France, cannot be deduced, based on the Solvency II regulatory reporting, as it depends on management actions regarding future discretionary benefits—any such management action would however build on assumptions on how policyholders might react to changes in those benefits, in particular whether might lapse their policies. For the stress test, it was assumed that insurance companies would cut future discretionary benefits only over a more medium term in order to limit policyholders' incentives to lapse—benefits being projected for years 5 to 8 after the reference date were assumed to be decreased by 15 percent, and by 25 percent beyond this period. The loss-absorbing capacity of deferred taxes was assumed to remain constant in the adverse scenario, which is a conservative simplification.

D. Results of the Scenario Analysis

125. The adverse scenario reduces both the value of assets and liabilities of the insurers in the stress test sample. The ratio of assets over liabilities declines, for the median company, from 108.0 to 106.8 percent in the adverse scenario. Assets (excluding unit-linked) decline by 5.5 percent, compensated partially by a decrease in liabilities (mostly technical provisions) by 3.2 percent, corresponding to 105 billion of euros and 58 billion of euros, respectively. For unit-linked business, the decline in assets, which corresponds to a roughly equal decline in liabilities amounts to another EUR 41 bn (-13.2 and -14.7 percent for assets and liabilities, respectively).

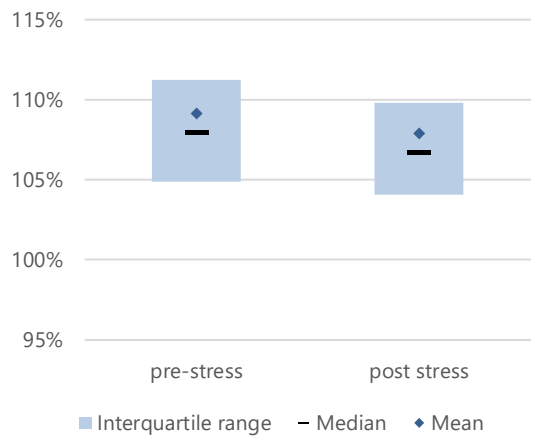
126. The main direct impact stems from higher credit spreads, both for sovereign and corporate bonds. The interest rate shock, with lower rates for the Euro at shorter maturities and higher rates at longer maturities, benefits insurers as not only liability valuations decrease, but also fixed-income assets increase in value, albeit very modest. In general, the impact of the tested scenario is more pronounced for companies being more exposed to life business and savings products where bond investments have longer maturities and sensitivities to spread changes are accordingly higher.

127. In the adverse scenario, the median SCR ratio drops from 204 to 166 percent, and no company records a ratio below the 100 percent regulatory threshold (Figure 27). A notable risk-mitigating impact—larger than in many other EU countries—stems from the loss-absorbing capacity of technical provisions: by reducing future discretionary benefits, French insurers can pass on some of the losses to their life insurance policyholders. This flexibility results from the relatively low guaranteed rates; policyholder returns depend more on the actual investment performance.

Figure 27. France: Insurance Stress Test Results

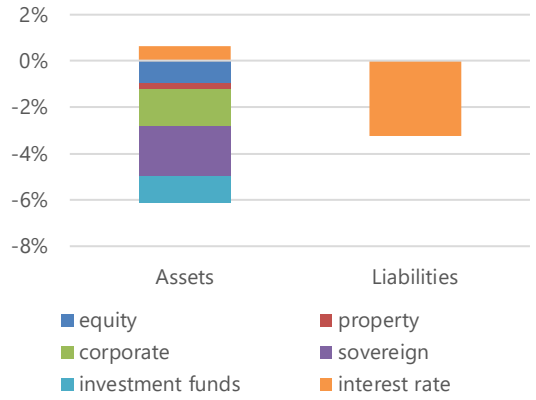
The ratio of assets over liabilities declines, for the median company, from 108.0 to 106.8 percent in the adverse scenario.

Assets over Liabilities



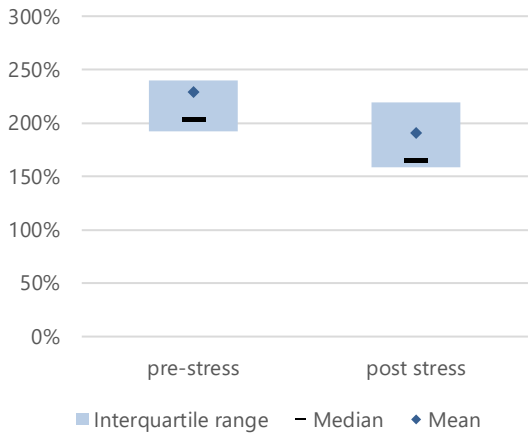
The combined impact of higher sovereign and corporate spreads is the dominant factor in reducing asset values. Higher long-term interest rates reduce the value of liabilities.

Impact of Shocks on the Value of Assets and Liabilities (Excluding unit-linked assets and liabilities)



The median SCR ratios drops from 204 to 166 percent, and the dispersion of ratios across the sample increases slightly.

SCR Coverage Ratio



Source: IMF Staff calculations based on ACPR data.

128. The stress test does neither reveal a higher nor a lower vulnerability of insurers belonging to a financial conglomerate in the tested scenario. Before stress, the SCR ratios of insurers being part of a financial conglomerate tend to be lower than for the other insurers, but the sub-samples are too small and, especially in the case of those insurers not being part of a financial conglomerate, too heterogenous to draw a direct comparison. In particular, among the non-conglomerate insurers there are more users of (partial) internal models and transitionals, and one company is a mutual insurer.

E. Challenges in a Prolonged Low-Yield Environment

129. Over a medium-term horizon, insurers are likely to face declining investment returns as bonds with higher coupons expire. The implementation of Solvency II has improved asset-liability matching amongst French life insurers and investment horizons have lengthened, so that a low-for-long scenario could be weathered better than in other advanced economies. This is also confirmed by the results of the 2018 European Insurance and Occupational Pensions Authority (EIOPA) stress test. Accordingly, reinvestment risks in the short term are limited. Nevertheless, if ultra-low interest rates persist, insurers are likely to face declining investment returns as higher-coupon bonds will expire. Almost 50 percent of fixed-income investments will expire by 2024, and for those the average coupon rate amounts to only 2.0 percent. Projecting a roll-over of maturing bonds at a constant future coupon of 1.0 percent will reduce the average coupon earned to 1.5 by the year 2025 (Figure 28).

130. With very low levels of guaranteed interest rates in domestic business, French insurers can still very comfortably generate positive investment spreads. While technically life insurers could therefore sustain the current low-yield environment for a prolonged period, the question of the long-term viability of traditional life insurance policies as savings vehicles could arise. The demand for classic savings-type life insurance policies is expected to decline in such a scenario.

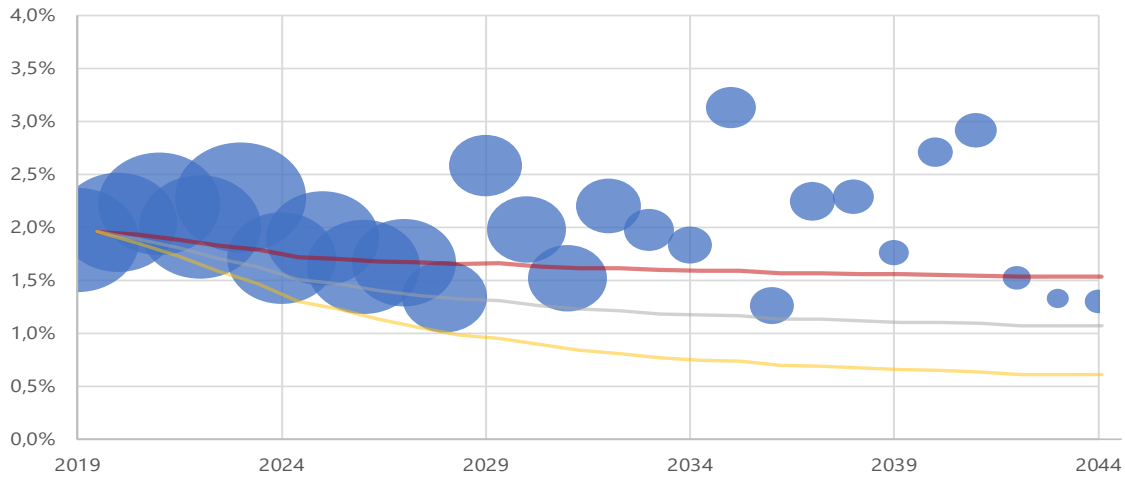
F. Liquidity Risks

131. French insurance groups are more vulnerable to a combination of higher interest rates and a mass lapse event than a low-for-long scenario. This risk stems from the specific combination of features of the French life insurance market whereby: (i) the savings product is liquid (ii) the tax advantage is fully beneficial after eight years and is also retained in case of inheritance (which largely explains the stability of the product); and (iii) policy holders have full and entire ownership of past returns. On the contrary, the implementation of Solvency II has improved asset-liability matching amongst French life insurers and investment horizons have lengthened, so that a low-for-long scenario could be weathered better than in other advanced economies. This is also confirmed by the results of the 2018 European Insurance and Occupational Pensions Authority (EIOPA) stress test. At the same time, if interest rates remain low over a medium-term horizon, insurers are likely to face declining investment returns as higher-coupon bonds will expire. While insurers could sustain the current low-yield environment for the medium term, they are likely to experience a drain on their profitability.

Figure 28. France: Maturity and Average Coupon Rate of Insurers' Fixed-Income Investments

Coupons of fixed-income investments are already rather low—this reduces reinvestment risks in times of low interest rates but cannot shield away completely from lower investment returns in the future.

Maturity and Coupon of Fixed-Income Assets



Source: IMF Staff calculations based on ACPR data.

Note: Stress test participants only. Each bubble represents the nominal value (size) and the coupon of fixed-income instruments expiring in a given year. The orange, grey and yellow lines show a projection of the average coupon, assuming that all maturing instruments are reinvested at a rate of 1.5, 1.0, and 0.5 percent, respectively.

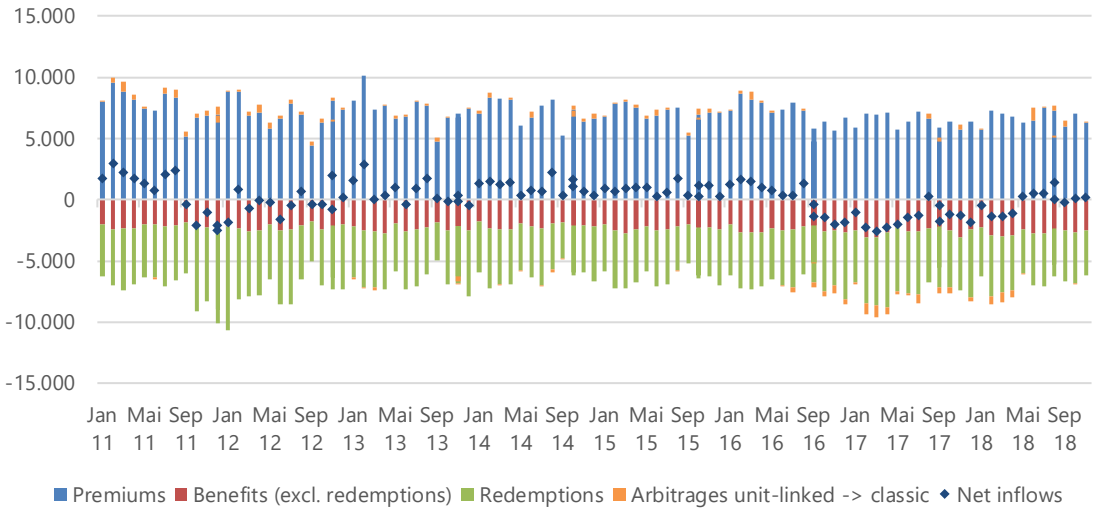
132. The ACPR monitors lapse risks and associated liquidity risks through a weekly reporting. Lapse rates in France are a bit higher than the EU average which EIOPA reports to be around 3 percent per year. Nevertheless, in 2018, lapse rates were lower than in previous years, and since 2013 no major spikes have been observed. The lapse rate follows a seasonal pattern, with rates being higher between January and April, and again in December (Figure 29).

133. In the past, outflows related to lapses could easily be covered by regular investment income from coupon payments, dividends and rents. Including regular outflows related to benefits, net outflows in life insurance have never exceeded 3.1 billion of euros over any four-week period since 2011. This amount relates to life insurers' investments of 8.6 billion of euros in cash and cash equivalents, and another 202 billion of euros in highly liquid French government bonds. Hence, even while in case a large mass lapse event the need for a sale of some investment assets cannot be excluded, the amount of cash, cash equivalents and highly-liquid sovereign bonds held by insurers is very likely sufficient to meet any liquidity need. Insurance companies indicated that the most likely trigger for higher lapse rates would be the inability to pay competitive yields on savings policies. However, it would take policyholders some time to take note of lower returns and to search for possible substitutes, i.e., higher lapses would be observed over a period of several months and maybe even years, reducing the immediate liquidity risk. A more remote trigger, albeit with much more significant consequences, could be the financial distress of an insurer's parent bank resulting in a run on the bank and potentially also on the life insurer.

Figure 29. France: Surrender Risks

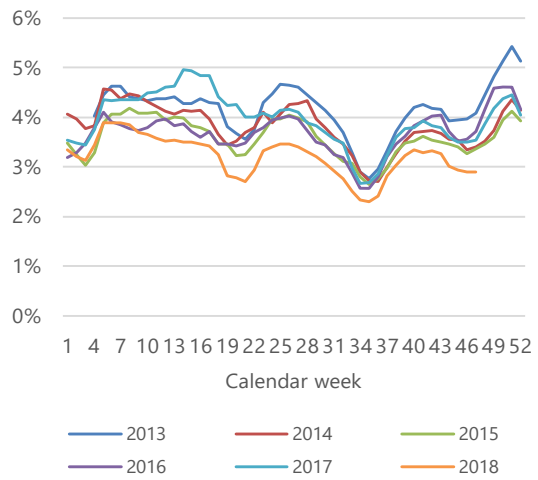
The period from late 2016 to early 2018 was characterized by net outflows from traditional life insurance products, mostly driven by higher demand for unit-linked products and even a switch of existing policies into unit-linked.

Life Insurance: In- and Outflows
(Millions of euros)



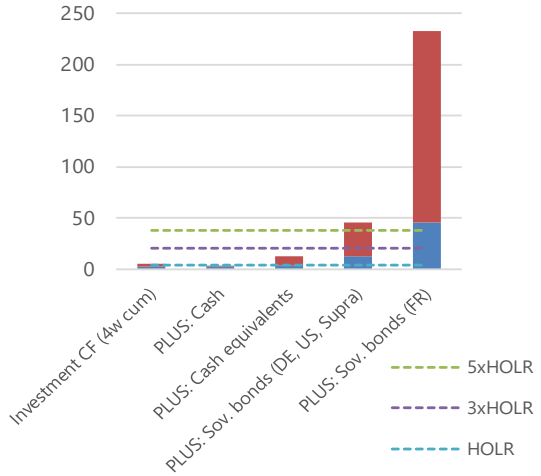
Life insurance lapse rates follow a seasonal pattern and were lower in 2018 than in previous years.

Seasonal Pattern of Annualized Lapse Rates
(Four-week moving average)



Regular investment income and a significant stock of highly liquid assets enable the life insurance sector to meet outflows from lapses which are a multiple of those observed in recent years.

Potential Outflows from Redemptions versus Investment Inflows and Stock of Highly Liquid Assets
(Billions of euros)



Source: IMF Staff calculations based on ACPR data.
Notes: Potential outflows from redemptions show the net of the highest observed lapses (HOLR, cumulated over a four-week period) and the and average premium inflows and benefit outflows over 2011-18, against regular cash inflows from investments (dividends, rents, interest; cumulated over a four-week period) and additionally the stock of different highly liquid asset classes which could easily be liquidated to meet cash outflows. "3xHOLR" and "5xHOLR" assume the lapse rate to be higher by a factor of 3 and 5, respectively, with premium inflows and outflows kept at the same level as for the HOLR.

G. Exposures Towards Parent Banks

134. French insurers have a rather pronounced home bias in their exposures to sovereigns and banks. The combined exposure equals 36 percent of total assets which is the fifth highest share in the Euro area, and only topped by Spain, Italy, Slovakia and Portugal (Figure 30).

135. Insurance groups being part of a conglomerate are typically holding very large exposures towards their parent bank which presents a major channel for the spillover of systemic risks. French insurers which are part of a financial conglomerate tend to have high exposures towards their banking parent. The market value of on-balance sheet exposures towards the parent bank can reach more 50 percent of the insurer's eligible capital. Vice versa, the relevance of bank funding from its insurance subsidiaries is substantially less distinct. In particular, the concentration in deposits held with the parent bank can be very substantial for some insurers. Adding to that, further financial interlinkages exist, e.g., via derivatives or securities financing transactions.

136. The sensitivity analyses assuming the default of the parent bank reveals a substantial spillover effect for some of the insurers being part of a financial conglomerate. With a haircut of 100 percent on equity exposures and 50 percent on bonds and deposits, two insurers would see a decline in the value of their assets by an amount equivalent close to 30 percent of their eligible capital. As equity holdings and deposits are to the parent bank are generally small in absolute numbers, the largest impact stems from bond holdings.

H. Recommendations

137. ACPR is encouraged to monitor closely insurers' exposures towards parent banks and to consider setting concentration limits. Solvency II does not include a cap on large exposures—only the concentration risk sub-module introduces an additional capital charge under certain conditions. Based on Solvency II regulatory reporting and supplemented by the reporting according to the FiCoD, ACPR should assess on- and off-balance sheet exposures towards the parent bank on a regular basis. In case of undue concentrations, the use of outright concentration limits based on eligible capital or, as a fallback, a Pillar 2 capital add-on should be evaluated.

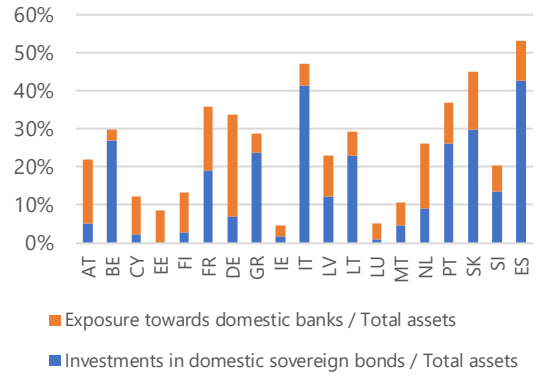
138. The FSAP recommends the ACPR to step up its development of macro stress tests for the insurance sector. The ACPR is already actively participating at the European level in the preparation and analysis of EIOPA's insurance stress tests and exploring innovative modelling approaches. Future stress test should incorporate a multi-period perspective, analyzing the potential of insurers to re-establish target solvency and profitability levels after stress. The results of stress tests should subsequently be used to challenge the companies' Own Risk and Solvency Assessment (ORSA) and underlying projections for future business, specifically the expectations for premium growth and investment returns.

139. ACPR should intensify its data quality checks and enforce high-quality supervisory reporting. As a basis for ACPR's risk analysis work, supervisory reporting should be thoroughly scrutinized, and companies should be required to re-submit corrections of misreported data without undue delay.

Figure 30. France: Insurers' Exposures to Banks

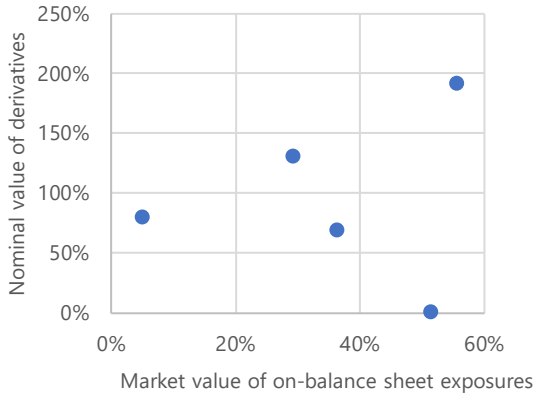
The home bias of French insurers in their sovereign and banking exposures is high, being more pronounced only in four other Euro area countries.

Insurers' Exposures towards Domestic Sovereigns and Banks
(Percent of assets)



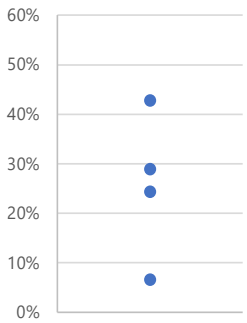
On-balance sheet exposures towards the parent bank are diverse, but they can reach more than 50 percent of eligible capital of some insurers.

Exposure towards Parent Bank
(Percent of capital)

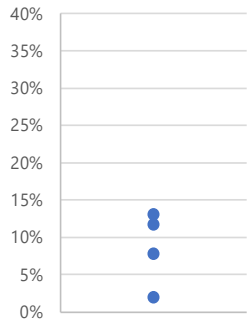


A very high concentration of exposures with the parent bank can be observed in particular for deposits, which however represent only a very small portion of assets. Losses in insurers' asset values caused by a simulated default of the parent bank can amount up to an equivalent of 30 percent of eligible capital.

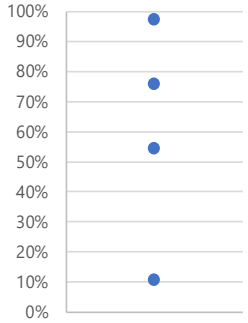
Exposure towards Parent Bank to Exposure towards French Bank



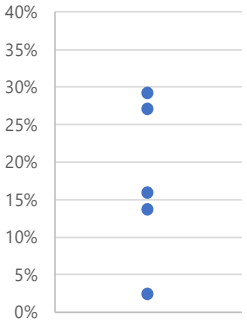
Bonds Issued by Parent Bank to Total Bank Bonds



Deposits with Parent Bank to Total Bank Deposits



Simulated Loss Due to Default of the Parent Bank (As percent of eligible capital)



Source: IMF Staff calculations based on ACPR data.
Notes: Sub-sample includes those insurers which are part of a financial conglomerate and have a majority banking parent.

EXPLORATORY STUDIES: SOLVENCY LIQUIDITY INTEGRATION

A. Motivation

140. French banks have relatively higher retail funding cost compared to EA peers and higher reliance on wholesale funding. An increase in the funding cost, especially for the wholesale portions, could provide further headwinds to profitability and potentially create pressure on solvency. To gauge the magnitude of this funding-solvency feedback loop, the FSAP team added an extra layer of funding shock as an exploratory study in the stress test.

141. The exercise starts by establishing the relationships between banks' funding costs and their respective profitability and balance sheet conditions. It then estimates the impact on funding cost based on the projected profitability and balance sheet evolution under the stress scenario. This funding shock ultimately adds an extra layer of depletion in the capital positions.

142. The COREP template C69 provides granular time series of funding cost submitted by individual banks. Funding cost, measured as basis points over interbank swap rates, are broken down by categories and by maturity. The categories include retail funding, unsecured wholesale funding, secured wholesale funding, senior secured wholesale funding, covered bonds and ABS. The maturity covers a wide spectrum from overnight, 1-week, all the way up to 10-year. The team collected monthly data for the seven French banks and 21 other euro area banks[22] from January 2016. Profitability and balance sheet indicators are collected separately from the FINREP and COREP reports on a quarterly frequency. In total, there are over 30,000 observations collected for this exercise.

B. Insights from the Funding Cost Feedback Loop

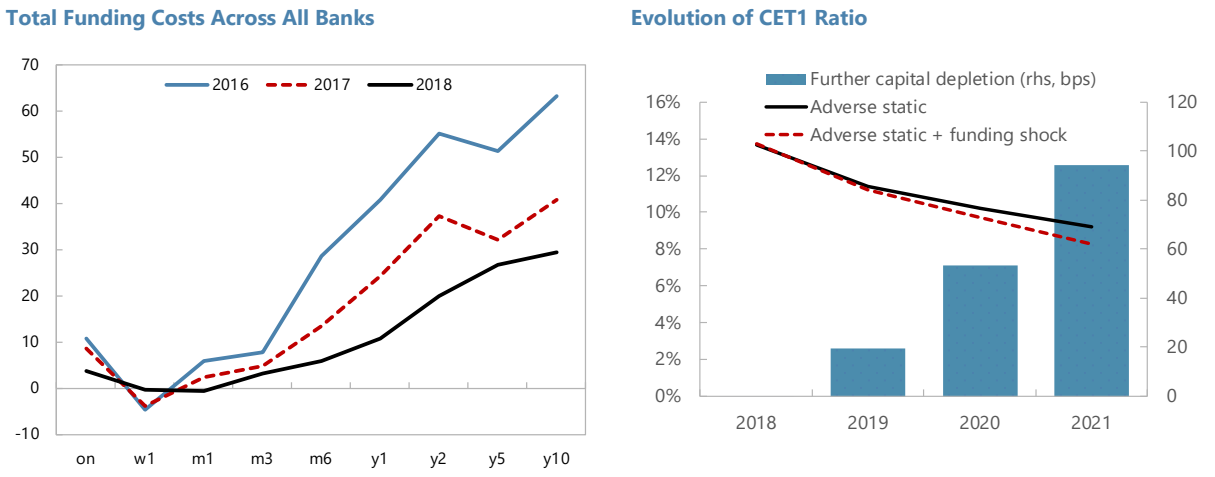
143. Overall funding costs have declined for all euro area banks thanks to the extraordinary monetary easing in the G3 economies. The entire funding curve has shifted lower, especially in the medium to long-term part. Compared to banks from other euro area countries, French banks are relatively disadvantaged on the retail funding. On the wholesale part, French banks are paying less for the medium and long-term portion, reflecting their overall good credit ratings, but short-term funding costs could be volatile depending on market conditions.[23]

144. Banks' with higher profitability, cash holdings and deposit funding are found to be associated with lower wholesale funding cost. A one percentage point increase in return on assets, cash to total assets, and deposit to total liabilities can reduce the long-term secured funding

[22] The sample is the same as included into 2018 Euro Area FSAP. See IMF (2018): Euro Area Policies: Financial Sector Assessment Program-Technical Note-Stress Testing the Banking Sector.

cost by over 50 basis points. Based on this relationship, the additional shock on the wholesale funding costs could further reduce CET1 ratio by 100 basis points by 2021 under the adverse scenario, compared to the adverse static scenario (see Figure 31).

Figure 31. France: Funding-Solvency Feedback Loop



Sources: ECB and IMF.
Note: In panel 1 and 2, weighted spread over interbank swap rate by issuance volume.

Appendix I. Risk Assessment Matrix

Table 1. France: Risk Assessment Matrix

Risk	Overall Level of Concern	
	Relative Likelihood	Expected Impact if Materialized
Sharp tightening of global financial conditions and distress in U.S. dollar funding market	**High** Higher debt service and refinancing risks; stress on leveraged firms and vulnerable sovereigns; house affordability problems for first-time buyer households; and a broad-based downturn. The tightening could be a result of: market expectation of tighter U.S. monetary policy triggered by strong wage growth and higher than-expected inflation. Sustained rise in risk premium in reaction to concerns about debt levels in some euro area countries; a disorderly Brexit; or idiosyncratic policy missteps in large emerging markets. Tighter financial conditions could lead to abrupt changes in U.S. dollar availability and capital outflows.	**High** Less favorable borrowing conditions could weigh on private-sector and public sector balance sheets, with implications for growth. Higher funding costs for banks and large corporations, especially those regarded as less sound. Valuation losses on financial institutions' assets, reduced value of collateral, and lower recovery in default cases, which could be amplified through exposures to high spread EA countries. Loss of market confidence. Negative shocks to growth, worsening growth outlook. Impact on FX liquidity of financial institutions.
Rising protectionism and retreat from multilateralism	**High** In the near term, escalating and sustained trade actions threaten the global trade system, regional integration, as well as global and regional collaboration. Additional barriers and the threat of new actions reduce growth both directly and through adverse confidence effects (increasing financial market volatility). In the medium term, geopolitical competition and fraying consensus about the benefits of globalization lead to economic fragmentation and undermine the global rules-based order, with adverse effects on growth and stability.	**High** A retaliatory cycle of trade restrictions could hurt France's exports and investment, impairing the growth momentum. Increase in policy-related risk premia, as well as mark-to-market losses on holdings of sovereign securities carrying higher risk.
Weak global growth. The global growth slowdown could be synchronized as weakening outlooks in the U.S., Europe and China feed off each other and impact on earnings, asset prices and credit performance	**High** In the near term, weak foreign demand makes euro area businesses delay investment, while faltering confidence reduces private consumption. Adverse financial market reaction to debt sustainability concerns further dampen growth. In the medium term, disregard for the common fiscal rules and rising sovereign yields for high-debt countries test the euro area policy framework, with adverse impact on confidence and growth.	**Medium** Lower growth would weigh on private sector and public-sector balance sheets, with feed-back effects on growth Lower profitability of nonfinancial corporations would aggravate debt service with adverse effects on fixed investment and productivity. Deterioration in public finance would adversely impact confidence.

Table 1. France: Risk Assessment Matrix (Concluded)		
Weakening of reform implementation in France, including due to increased resistance and lack of social consensus	**High** Non-implementation of remaining structural and fiscal reforms could undermine confidence and lead to lower growth and higher financing costs.	**Medium** Lower medium-term growth due to weaker investment, low productivity, and persistent unemployment. Further deterioration in public finance and private balance sheets.
Further pressure on traditional bank business models	**Medium** Loss of confidence if profitability challenges to banks are not addressed could increase the risk of distress at one or more major banks.	**Medium** Given insufficient progress in balance sheet repair in some countries and broader profitability concerns, such an event could reverberate through the entire financial sector and widen sovereign yield spreads within the banking union.
Capital outflows and significant slowdown in China and other large emerging market economies	**Medium** Capital outflows from emerging markets and turning of domestic credit cycle in addition to lower potential growth leads to disruptive deleveraging. In China, disruptive drying up of interbank liquidity for weak borrowers.	**Medium** Losses due to French banks' exposures to emerging market economies. Slower export growth, resulting in higher negative output gap.

Appendix II. Stress Testing Matrix (STeM)

A. Banking Sector: Solvency Test		
Domain		**Framework** **TD by FSAP Team**
1. Institutional perimeter	Institutions included	Seven major banks. The criteria used to determine the institutional perimeter include: 2018 EU-wide stress test sample of French banks; firm's balance sheet (size), and firms' share in the domestic market.
	Market share	About 95 percent of total banking sector assets.
	Data and horizon	Effective date: December 2018. Data: Supervisory data: ITS files (FINREP, COREP) and STE files (Interest Rate Risk in the Banking Book (IRRBB) and Market Risk Sensitivities); EBA ST Submissions (2014) Public data sources: 2016 and 2017 EBA Transparency Exercise, Pillar 3 disclosures, ECB MIR statistics, Bloomberg, Dealogic, Haver Analytics, Moody's KMV, Fitch, MTS, IMF Global Assumptions (GAS), and IMF WEO. Scope of consolidation Consolidated group basis. Perimeter of the banking group (CRD IV). Insurance activities are excluded; banking associates are included. Three to five-year stress testing horizon.
	Stress testing process	The FSAP team conducted its own TD macroprudential stress test using December 2018 WEO forecast paths (baseline) and forecast paths generated by IMF's in-house models (adverse) for all material geographies (5) of participating banks, namely France, Italy, Belgium, UK, and USA. The FSAP team generated additional variables required to generate risk projections in a way which was consistent with the scenario (e.g., swap rates, yield curves, real estate prices, credit growth, equity prices, European corporate bond yields, Moody's corporate spreads).
2. Channels of risk propagation	Methodology	**RWA calculation.** Credit risk parameter (PD, LGD, EAD) projections generated by geographical breakdown (5jurisdictions) and product (6 asset classes: retail unsecured, retail secured, large corporates, SME, institutions, and central banks and central governments). Loan growth paths capture reduced credit demand in material jurisdictions and FX shocks from revaluation effects on foreign currency loans.
		Robustness: empirical strategies to project baseline/adverse forecasts using country drivers, regional variables, and global factors based on (i) country level/bank-level/ regressions over different lag structures; and (ii) BMA. For internally-modelled exposures (IRB), projection of TTC PDs, LGD, RWA, EaD. For standardized (STA) exposures, projection of new flows of defaulted exposures, coverage ratio for defaulted loans, and risk weight downgrade for performing exposures. Credit risk projections for IRB and STA exposures include credit loss impairment charges and shifts to RWAs due to capital charges for defaulted assets. Traded risk impact from the revaluation of trading assets (FVPL), assets at fair value (FVO), and securities classified as fair value thorough other comprehensive income (FVOCI) securities by counterparty: central government (including 5sovereign issuers), credit institutions, other financial institutions, and nonfinancial corporates. Credit spreads on sovereign securities interpolated using bank-specific residual maturity at the book and issuer level. Credit spreads on other securities estimated on a hypothetical portfolio using a duration proxy. Valuation effects assessed using a modified duration approach. Hedges are considered as ineffective under stress. **Provisioning:** Provisioning for IRB and STA was modeled using IFRS9 transition matrix approach. Transition matrices, PiT PDs, LGDs for different loan and securities classes were modeled on a consolidated basis using FINREP data and EBA submissions. **Other P&L items:** Funding costs projected at the bank level using bank-specific funding structure by product (deposits and debt securities issued), counterparty (central banks and general governments, financial institutions, retail customers and corporates), and maturity bucket overnight, 1-3m, 3-6m, 6-12m, 1-2y, 2-3y, 3-4y, 4-5y). Funding projections capture systematic risk (linked to the scenario) and idiosyncratic risk (for spreads on debt instruments issued over benchmark). Funding cost projections utilized bank level data on 30 EA banks from COREP templates. Lending rates projected at the bank level using bank-specific loan book composition (loans and advances to central banks, general governments, financial institutions, households and corporates).

A. Banking Sector: Solvency Test (Continued)		
Domain		**Framework**
		TD by FSAP Team
3. Tail shocks	Scenario analysis	The adverse scenario is calibrated using the IMF's Global Macrofinancial Model and auxiliary models to estimate stressed paths for residential real estate prices, benchmark curves, and corporate spreads. This scenario is characterized by a tightening of global financial conditions, term premium decompression, heightened uncertainty in the European Union and the United States on the back to de-globalization initiatives, sovereign risk concerns in high spread euro area economies, balance sheet vulnerabilities in EMEs linked to debt at risk, and a reductions of trade flows and productivity losses. This scenario constitutes a 2.24 standard deviation move in two-year cumulative real GDP growth rate, calculated over 1990–2018.
	Sensitivity analysis	Sensitivity tests identify potential vulnerabilities to standardized shifts to risk-factors. These tests are focused on estimating the additional capital loss from replacing model-based shocks by six separate single-factor shocks: • ***Tighter LGD floor on mortgage loans:*** *A* policy shock leading to an LGD floor of 18 percent on retail mortgages in home jurisdiction and Belgium; • ***Reverse stress test on valuation risk:*** For complex banks (G-SIBs) effect of soft mispricing of L2 and L3 assets. Quantification of the mispricing which could theoretically result in a breach of CET1 minimum requirement including Pillar 1 requirements, Pillar 2 requirement, and phased-in buffers; and • ***Solvency-funding cost feedback***: Exploration of compounding effect on bank capital depletion from the interaction of solvency risk and funding shocks. Funding cost projections on wholesale customer deposits and debt instruments are linked to projected bank capital ratios under stress using an iterative process over the stress testing horizon.
4. Risks and buffers	Positions/risk factors assessed	Traded risk losses recognized the year that the shock hits (over the five-year horizon), except for sensitivity tests (instantaneous shocks excluding low-for-long). Net trading income from equity positions, debt instruments, and trading derivatives. No interest income accrual from defaulted (Stage 3) assets. Interest income from non-defaulting loans is estimated according to satellite models. Interest expenses increase due to rising funding costs linked to banks' funding structure and market shocks, with model-based pass-through on corporate and household loans. Net fee and commission income, non-interest income (e.g., insurance income, dividend income, other income), and operational expenses evolve with the scenario. No change in business models (no rebalancing of portfolio is allowed).
	Tax and regulatory impact	**Tax Rate** Effective tax rate for each bank. **Regulatory impact** The effects of the phase-out of no-longer-eligible additional Tier 1 and Tier 2 capital are included. No conversion of additional Tier 1 capital is assumed during the stress horizon.
5. Other adjustments and calibrations	Behavioral adjustments	**Dynamic Balance Sheet** Credit demand shocks are included while credit supply effects are allowed. EaD from off-balance sheet exposures increases under stress, reflecting higher use of undrawn credit and liquidity facilities. EaD evolves with structural foreign exchange risk. Maturing assets are replaced by exposures of the same type and increase performing loans S1. Write-offs are allowed. Loans cure (i.e., migrate from S3 to S2 and S1). Fees and commissions, interest income modeled according to satellite models. **Static balance sheet** Credit demand shocks are included while credit supply effects are not allowed. EaD from off-balance sheet exposures increases under stress, reflecting higher use of undrawn credit and liquidity facilities. EaD evolves with structural foreign exchange risk. Maturing assets are replaced by exposures of the same type. Write-offs are not allowed. Loans do not cure (i.e., do not migrate from S3 to S2 and S1). Fees and commissions, interest income is capped at max of previous year level.

A. Banking Sector: Solvency Test (Continued)		
Domain		**Framework**
		TD by FSAP Team
	Dividend policy	Dividend payout ratio linked to banks' profits, historical payout ratios, capital ratios, subject to the following constraints.
	Parameter calibration	Initial regulatory PD and LGD parameters (hybrid PiT and TTC models) using COREP supervisory data by geographic and portfolio breakdown on the obligor pool. Calculations performed to extract PD and LGD for non-defaulted exposures using information related to gross defaulted exposures (09.01 and 09.02 templates) and breakdown by obligor grade (08.02). Shifts to IRB and STA exposures.
		Historical PDs informed by Moody's EDF proxies, Merton-model approach for sovereign spreads, and bank-specific PDs from Pillar 3 disclosures. Transition matrices for accounting PDs, LGDs from FINREP templates. PiT PDs/LGDs for some exposure classes from 2014 EBA submissions.
	Regulatory standards	Capital definition according to CRD IV rulebook, including CET1, Tier 1, and total CAR. Capital components that are no longer eligible for additional Tier 1 and Tier 2 capital components follow Basel III transitional path. No hurdle rates applied, though indicative CET1 ratio (which includes CCyB, G and D-Sib buffers where applicable) of 10 percent is used.
6. Reporting format for results	Output presentation	• Distribution of capital ratios under baseline/adverse scenario; • Contribution to profitability and capital depletion by driver; and • Average CET1, CAR, and Tier 1 leverage ratio.

B. Banking Sector: Liquidity Test		
Domain		**Framework**
		TD by FSAP Team
1. Institutional Perimeter	Institutions included	Seven banks on the consolidated basis.
	Market share	95 percent of total banking sector assets.
	Output presentation	Supervisory data (Corep, Finrep and STE templates). Consolidated basis. Baseline date: September 30, 2018.
2. Channels of risk propagation	Methodology	Cash flow-based analysis using contractual and behavioral (where available) cash flow data for significant currencies with assumptions about combined interaction of funding and market liquidity and different degrees of central bank support. LCR and NSFR analysis using granular data templates. Liquidity stock (maturity transformation) analysis using NFSR data. Five days collateral freeze scenario if collateral received is not available for rehypothecation. Asset encumbrance analysis. Funding concentration analysis.
	Feedback loops and links with solvency analysis	Exploratory scenario: Solvency-Funding cost loop.
3. Sensitivity analysis	Perimeter and type of analysis	LCR distribution and volatility across banks and significant currencies. NSFR distribution across banks.

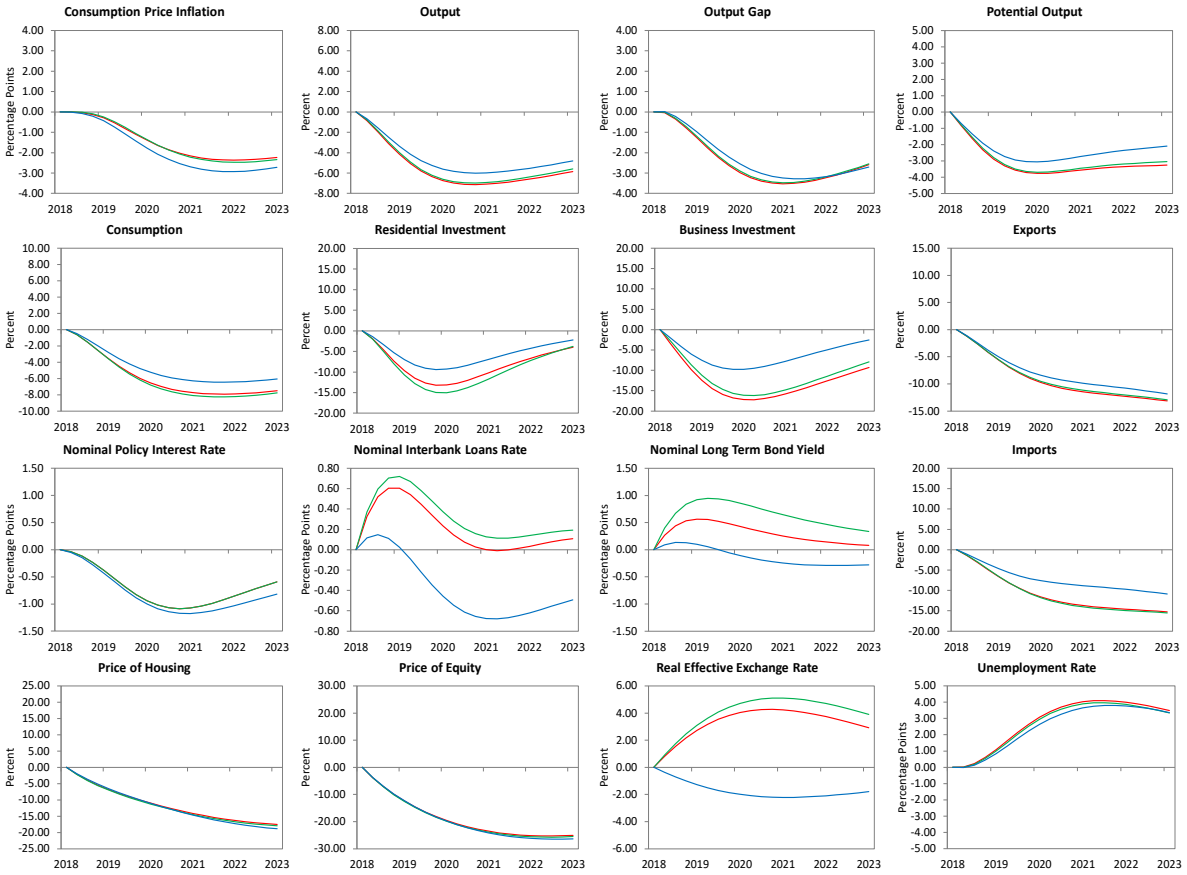
B: Banking Sector: Liquidity Test (Concluded)		
Domain		**Framework**
		TD by FSAP Team
4. Tail Shocks	Size of the shock	Baseline: business as usual (as reported by banks under normal market conditions). Behavioral assumptions: all maturing liabilities are rolled-over. • five-day collateral freeze scenario (due to cyber-risk related event at CCP); • one-month intermediate/severe market stress scenario: higher run-off rates on unsecured wholesale funding (incl. FX swaps), and undrawn committed credit/liquidity lines on top of the mild stress scenario; • one-months severe combined (market/idiosyncratic) scenario; • three-months intermediate/severe market stress scenario: higher run-off rates on secured wholesale funding (particularly FX swaps) on top of the intermediate stress scenario; and • three-months severe combined (market/idiosyncratic) scenario. Each scenario provides for three approaches to the CBC with decreasing reliance on the central bank and increasing focus on market liquidity (e.g., asset liquidation, asset encumbrance and collateral swaps).
		All scenarios are EUR-based (acc. across all currencies) and U.S. dollar-based. In sum, the total number of scenarios is 40 (four sets of embedded scenarios of increasing severity). Liquidity concentration test: loss of funding from the largest providers.

Appendix III. Insurance Sector Stress Testing Matrix (STeM)

		Bottom-Up by Insurance Undertakings (EIOPA)	Top-Down by IMF
Insurance Sector: Solvency Risk			
1. Institutional perimeter	Institutions included	• Nine insurance groups (AXA, BNP Paribas Cardif, CNP Assurances, Covéa, Crédit Agricole Assurance, Groupama, Groupe des Assurances du Crédit Mutuel, Natixis Assurances, Sogecap).	• Nine insurance groups (AXA, BNP Paribas Cardif, CNP Assurances, Covéa, Crédit Agricole Assurance, Groupama, Groupe des Assurances du Crédit Mutuel, Natixis Assurances, Sogecap).
	Market share	• Life: 70 percent (gross written premiums). • Non-life: 40 percent (gross written premiums).	• Life: 70 percent (gross written premiums). • Non-life: 40 percent (gross written premiums).
	Data	• Regulatory reporting.	• Regulatory reporting.
	Reference date	• December 31, 2017.	• June 30, 2018.
2. Channels of risk propagation	Methodology	• Investment assets: market value changes after price shocks, affecting the solvency position. • Sensitivity analysis: effect on available capital and solvency position.	• Investment assets: market value changes after price shocks, affecting the solvency position. • Sensitivity analysis: effect on available capital and solvency position.
	Time horizon	• Instantaneous shock	• Instantaneous shock
3. Tail shocks	Scenario analysis	• "Yield down" scenario: EUR interest rates declining between -11 basis points (1y) and -80 basis points (10y); sovereign bond spread +41 basis points (France), between +30 basis points and +60 basis points for other major Euro Area countries; stock prices -17.1 percent (France), -15.9 percent (average for EU), private equity -13.0 percent (EU), hedge funds. -15.8 percent (EU); corporate bond spreads of 10y nonfinancials between +51 basis points (AAA) and +82 basis points (CCC), and for 10y financials between +53 basis points (AAA) and +68 basis points (CCC); 15 percent decrease in mortality rates.	• Adverse scenario: EUR interest rates (without VA) declining between -45 basis points (1y) and -7 basis points (10y); sovereign bond spread +80 basis points (France and other low-yield Euro Area countries), +160 basis points for high-yield Euro Area countries; stock prices -15.0 percent (France), -15.6 percent (other advanced economies), private equity -10.0 percent, hedge funds and infrastructure -8.0 percent; corporate bond spreads between +50 basis points (AAA) and 350 basis points (B and lower) for non-financials, and between +65 basis points (AAA) and 465 basis points (B and lower) for financials; residential real estate prices -9.2 percent; commercial real estate prices -11.1 percent.

		Bottom-Up by Insurance Undertakings (EIOPA)	Top-Down by IMF
Insurance Sector: Solvency Risk			
		• "Yield up" scenario: EUR interest rates increasing between +49 basis points (1y) and +85 basis points (10y); sovereign bond spread +64 basis points (France), between +30 basis points and +140 basis points for other major Euro Area countries; stock prices -42.6 percent (France), -39.0 percent (average for EU), private equity -40.2 percent (EU), hedge funds -41.3 percent (EU); residential real estate prices -16.9 percent (France), -20.2 percent (average for EU); commercial real estate prices -30.5 percent (France), -31.4 percent (average for EU); corporate bond spreads of 10y nonfinancials between +53 basis points (AAA) and +225 basis points (CCC), and for 10y financials between +62 basis points (AAA) and +269 basis points (CCC); mass lapse shock (+20 percent); increase in annual claims inflation +2.24 percent • Natural catastrophe scenario: series of four Northern European windstorms, two Central and Eastern European floods, and two earthquakes in Italy (total insured loss of EUR 48 billion).	
	Sensitivity analysis	• None.	• Default of parent bank (if applicable).
4. Risks and buffers	Risks/factors assessed	• Market risks: interest rates, share prices, property prices, credit spreads. • Underwriting risks: longevity, catastrophic events. • Summation of risks, no diversification effects.	• Market risks: interest rates, share prices, property prices, credit spreads. • Credit risks: default of largest financial counterparty. • Summation of risks, no diversification effects.
	Buffers	• Product-specific	• Loss-absorption capacity stemming from policyholder participation.
	Behavioral adjustments	• Management actions limited to non-discretionary rules in place at the reference date.	• None.
5. Regulatory standards and parameters	Regulatory/accounting standards	• Solvency II. • National GAAP.	• Solvency II. • National GAAP.
6. Reporting format for results	Output presentation	• Impact on solvency ratios (including and excluding the effect of long-term guarantee measures). • Contribution of individual shocks • Dispersion measures of solvency ratios and net income.	• Impact on solvency ratios. • Contribution of individual shocks. • Dispersion measures of solvency ratios.

Appendix IV. Adverse Scenario and Comparison with EBA (2018)
Aggregated Simulated Paths

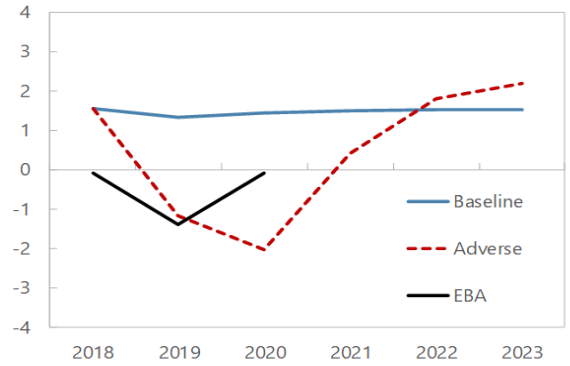


Source: IMF.

Note: Depicts variable paths for France ■, the Euro Area ■ and the rest of the world ■, expressed as output weighted average deviations from baseline. Real effective exchange rate increases represent currency depreciations in real effective terms.

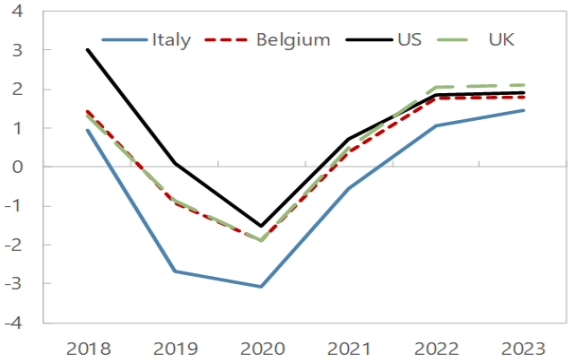
France

Real GDP Growth
(Percent)

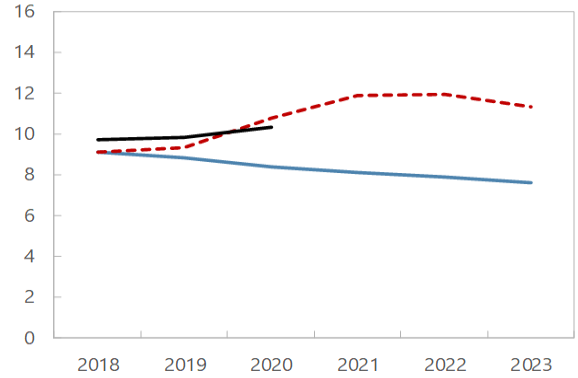


Other Selected Countries

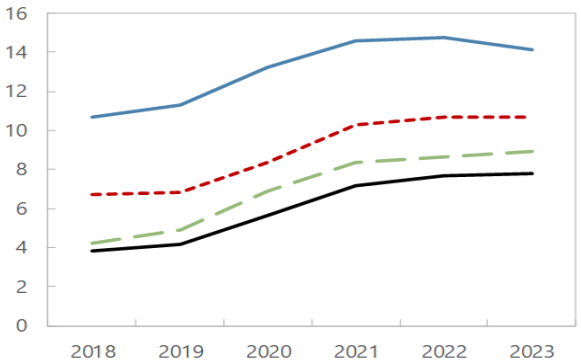
Real GDP Growth
(Percent)



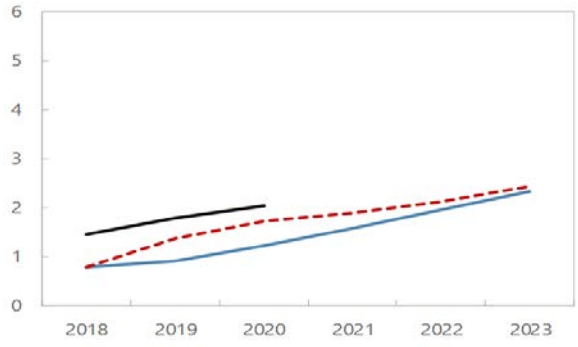
Unemployment Rate
(Percent)



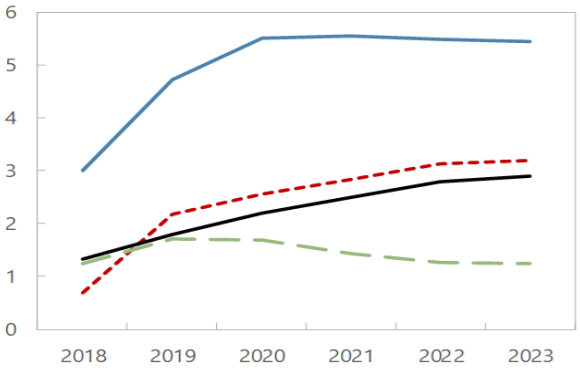
Unemployment Rate
(Percent)



Long-Term Government Bond Yield
(Percent)



Long-Term Government Bond Yield
(Percent)



Source: IMF.
Note: Baseline based on February 2019 WEO.

Appendix V. GAR Analysis for France

1. Variables Included into Financial Condition Index (FCI)

	Loadings		Loadings
Corp spread	1.72	Credit growth	-0.06
Interbank spread	1.69	FX changes	-0.43
VIX	1.48	Stock returns	-0.89
MOVE	1.23	Bond market cap	-1.04
Sov spread	1.10	House price returns	-1.08
Stock vol	0.94	Stock market cap	-1.52
Comm price	0.88		
Bank EDF	0.68		
Credit to GDP ratio	0.52		
Real LT rate	0.40		

2. Quantile Regressions

The estimation of the conditional density forecast is conducted through quantile projections. The conditional quantiles (q) of the forecast distribution of GDP growth (y) in quarters ahead, is a function of both its current level and current financial conditions (FCI):

$$y_{t+h,q} = \alpha^h_{t,q} + \beta^h_{f,q} FCI_t + \beta^h_{y,q} y_t + \varepsilon^h_{t,q}$$

5th percentile coefficients:

	FCI		GDP	
	Coef	Std	Coef	Std
1-year ahead	-1.31	2.56	-0.41	0.56
2-year ahead	1.02	1.95	-0.10	0.55
3-year ahead	1.38	1.73	0.17	0.46

3. GaR Projections Three Years Ahead

Figure 1. France: Histogram of Read GDP Growth Rates and GaR at 5 Percent

Distribution of Real GDP (Percent yoy)

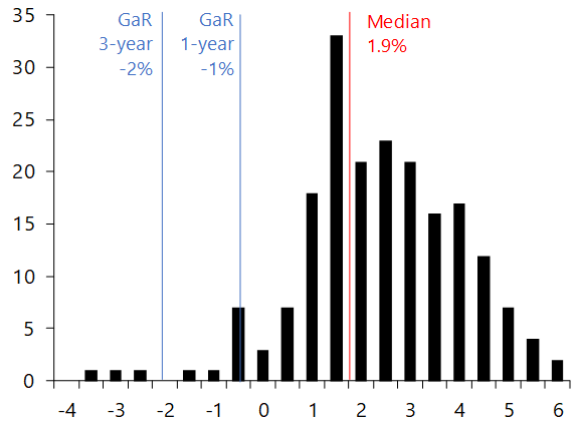


Figure 2. France: Real GDP Growth Rates

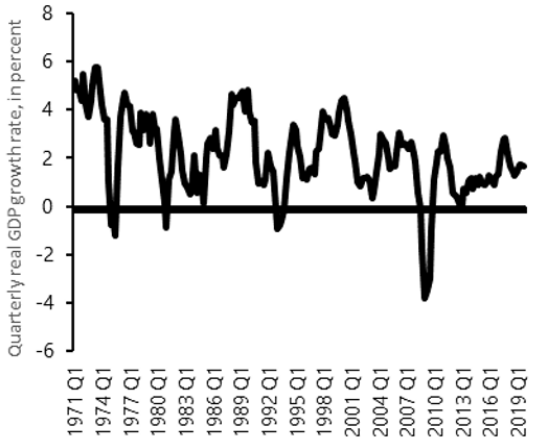


Figure 3. France: Growth at Risk: 2018:Q2

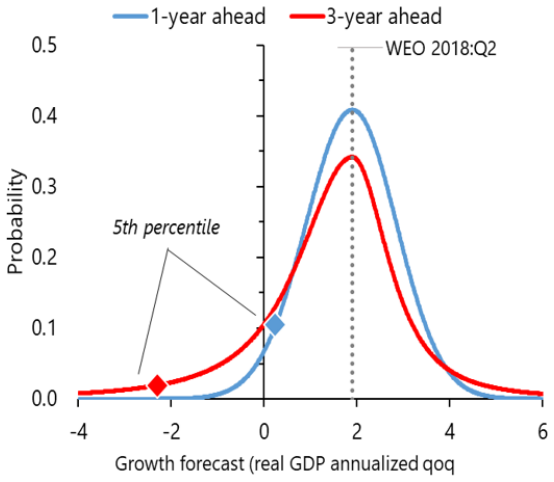
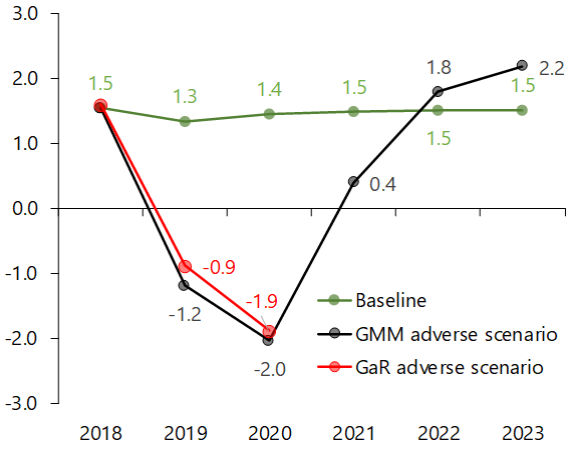


Figure 4. France: Real GDP Growth under the Baseline and Adverse Scenarios (Percent)[1]

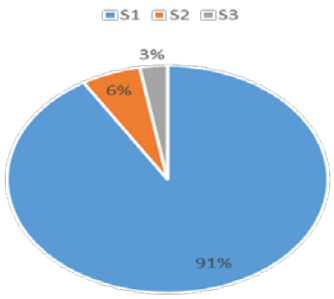


Source: IMF.

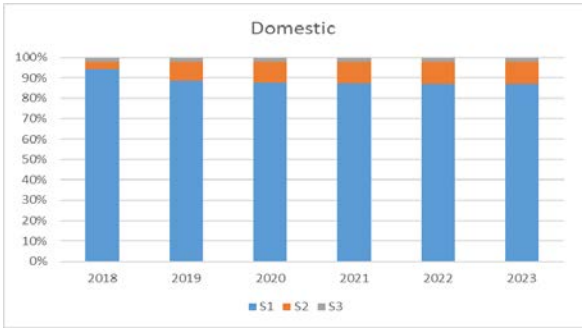
[1] End of the year projections (Q4) versus mid-year projections (Q2) in Figure 3.

Appendix VI. Migration of Assets Under Scenarios

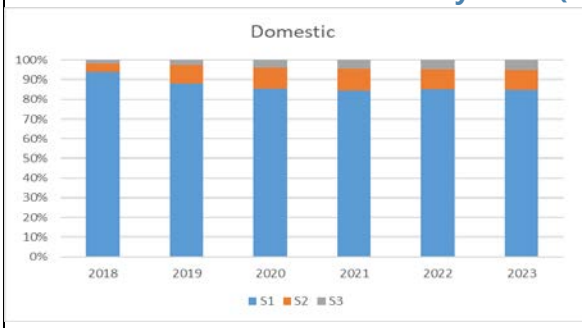
Initial Composition (2018:Q1)

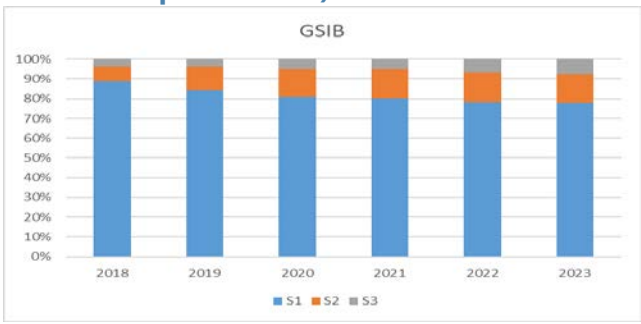


Baseline (End of the Respective Year)

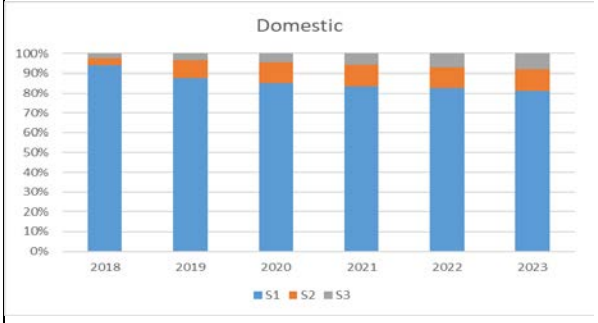


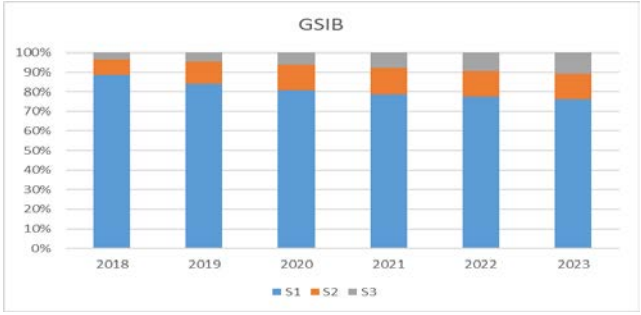
Adverse Dynamic (End of the Respective Year)





Adverse Static (End of the Respective Year)





Source: IMF.

Appendix VII. Model Specifications

Table 1. France: Determinants of PDs

	PD_FIN		PD_NFC		PD_Sovereign	
	Posterior Mean Coefficient	Posterior Inclusion Probability (Percent)	Posterior Mean Coefficient	Posterior Inclusion Probability (Percent)	Posterior Mean Coefficient	Posterior Inclusion Probability
Intercept	-0.7751		-0.9590			
AR1	1.0350		0.8430			
GDP1	-0.0067	14.1	-0.0391	35.0		
GDP4	-0.0121	29.4	-0.0002	0.8		
INF1	-0.0015	7.3				
URX1	0.0736	29.9	0.2929	79.9	2.3122	9.55%
URX4	0.0094	15.9			12.345	51.16%
RPP1	-0.0047	16.7	-0.0005	1.2		
RPP4	-0.0015	14.7	0.0000	0.6		
SSTN	0.0057	14.3				
SLTN	0.0000	2.2			0.6699	99.99%
SLTN (-1)					0.5924	
TS			-0.0027	15.5		
TS (-1)			-0.0020			
STO1	0.0000	0.7			-0.0343	8.69%
STO4	-0.0004	20.9	-0.0001		-0.4058	51.51%
CRE1				0.6		
R^2	87%		87%		85%	
DW stats	1.81		1.97		2.06	

Source: IMF.
Note: AR1 is first order autoregressive process; 1 and 4 denote qoq and yoy changes; (-1)(-2) denote number of lags. See table 3 in main text for variable definition.

Table 2. France: Determinants of NPL Ratios

	France	Belgium	Italy	United Kingdom	United States
l_pd_fin		0.83	0.56	0.88	0.93
		(0.00)	(0.00)	(0.00)	(0.00)
GDP	-0.04	-0.01	-0.02	-0.06	-0.04
	(0.00)	(0.04)	(0.01)	(0.00)	(0.03)
URX		0.02	0.03	0.04	-0.04
		(0.02)	(0.21)	(0.12)	(0.02)
d_URX	0.02				
	(0.00)				
L_LT		0.01			
		(0.09)			
L_RPP		0.01			
		(0.11)			
ST			-0.06	0.03	0.02
			(0.01)	(0.00)	(0.28)
L_CRE			0.02	0.01	-0.01
			(0.07)	(0.03)	(0.21)
INF					0.04
					(0.07)
STO					0.00
					(0.07)
_cons	0.00	0.03	0.32	-0.06	0.47
	(0.41)	(0.79)	(0.24)	(0.22)	(0.00)
Frequency	Annual	Quarterly	Quarterly	Quarterly	Quarterly
Observations	17	44	52	44	54
R-squared	42%	88%	76%	99%	99%
DW stats	--	1.64	2.3	2.11	1.79

Source: IMF.
Note: P-value in parentheses. l_ for lag, d_ for first difference. See table 3 in main text for variable definition.

Definitions and sources of mortgage NPL ratios:

- France: Poids des douteux dans l'encours, Enquête annuelle du SGACPR sur le financement de l'habitat. Provided by ACPR. Annual, 2001 to 2017.
- Belgium: overdue rate on new credit. National Bank of Belgium. Monthly, 2007:M1 to 2019:M2.
- Italy: new bad loan rate. Bank of Italy. Quarterly, 1990:Q1 to 2018:Q1.
- United Kingdom: share of loans with balances in arrears of 1.5 percent or more of outstanding balance. FSA Mortgage Lending and Administration Statistics. Quarterly, 2007:Q1 to 2018:Q1.
- United States: Delinquency rate of consumer loans. Federal Reserve. Quarterly, 1987:Q1 and 2018:Q3.

Table 3. France: Determinants of Bank-Specific Interest Rate on Debt

Posterior Mean Coefficient

	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6
Intercept	1.6015	2.8164	1.7817	1.7022	1.8049	1.1025
GDP1	-0.0013	-0.1027	-0.0002	-0.0002		
GDP1 (-1)	-0.0022	-0.1426		-0.0022		
GDP4	-0.1256	-0.0239	0.0262	-0.0133	-0.1638	
GDP4 (-1)		0.0154	-0.0540			
INF1	0.0001			-0.0101		-0.0034
INF1 (-1)	-0.0002			-0.0278		
INF4	-0.0003		0.0614	-0.0812	-0.0012	
INF4 (-1)			-0.0828			
URX1		0.0031	0.0080	0.0067		0.0296
URX1 (-1)		0.0008	0.0007	0.0002		
URX4		0.4163	0.1918	0.2052		0.1890
URX4 (-1)		0.1616	0.0170			0.2559
LTN1	0.1527	0.2524	0.0464	0.2991	0.2487	0.2180
LTN1 (-1)	0.3139	0.3358	0.2007	0.2798	0.2894	0.2004
TS	-0.1152	-0.0001		-0.0910		
SSTN	0.0020	0.0017	-0.0448			
SSTN (-1)			0.0591			
SLTN		-0.0001	0.0004		-0.0001	-0.0001
SLTN (-1)		0.0004	0.0005		0.0003	0.0031
pd_fin		-0.0011	0.0007			
pd_fin (-1)		0.0020				
Observations	56	56	38	56	56	50
R-squared	99%	98%	98%	99%	99%	97%
DW stats	1.31	1.43	2.33	1.01	1.78	1.60

Posterior Inclusion Probability

	GDP1	GDP4	INF1	INF4	URX	URX1	URX4	LTN1	TS	SSTN	SLTN	pd_fin
B1	1.4%	99.1%						100.0%	95.4%	12.3%		
B2	73.2%	17.3%				2.2%	100.0%	100.0%		2.9%	14.0%	71.5%
B3		38.7%		46.8%		4.2%	79.2%	100.0%		17.3%	38.7%	50.8%
B4	3.8%	22.6%	14.7%	63.8%		2.4%	75.6%	100.0%	49.0%			
B5		100.0%		13.0%				100.0%			15.1%	11.4%
B6			11.6%			16.3%	100.0%	100.0%			99.1%	

Source: IMF.
Note: AR1 is first order autoregressive process; 1 and 4 denote qoq and yoy changes; (-1)(-2) denote number of lags. See Table 3 in main text for variable definition.

Table 4. France: Determinants of Bank-specific Interest Rate on Loans

	Posterior Mean Coefficient					
	Bank 1	**Bank 2**	**Bank 3**	**Bank 4**	**Bank 5**	**Bank 6**
Intercept	-0.0011	-0.0062	-0.0902	0.0004	0.0135	0.0124
AR1	1.0826	1.2601	0.1430	0.9427	0.1656	0.0923
GDP1		0.0002		0.0003	0.0205	0.0104
GDP4	0.0093	0.0028		0.0001	0.0000	0.0001
GDP4 (-1)	-0.0447				0.0001	
GDP4 (-2)	0.0385				0.0002	
INF1		0.0002		0.0001	0.0000	0.0001
INF4		0.0000		0.0000	-0.0004	
INF4 (-1)					0.0005	
URX		-0.0016		-0.0074	-0.0028	-0.0002
URX (-1)		0.0001		0.0050		
URX1		-0.0018	-0.0675	-0.0278	-0.0252	-0.0244
URX1 (-1)		-0.0001				
URX1 (-2)		-0.0002				
URX4	0.0001	0.0004	-0.0057	-0.0061	0.0756	-0.0019
URX4 (-1)		-0.0032	0.0040	0.0055	-0.1081	
URX4 (-2)	-0.0001	-0.0051				
RPP1		0.0011	0.0004	0.0004	0.0012	0.0005
RPP4		0.0003	0.0012	0.0001	-0.0002	0.0001
RPP4 (-1)			-0.0011	0.0000	0.0007	
TS		0.0000	0.0010	0.0004		0.0064
CRE1		0.0002		0.0004	0.0000	0.0062
CRE4	0.0000	0.0001		0.0002	0.0008	0.0007
CRE4 (-1)	0.0000					-0.0002
Int_debt	-0.0001	-0.0035	0.0573	0.0206	0.0147	0.0131
Observations	52	52	37	52	52	52
R-squared	98%	97%	94%	99%	88%	99%
DW stats	1.51	2.02	1.66	1.67	1.50	1.70

Posterior Inclusion Probability

	GDP1	GDP4	INF1	INF4	URX	URX1	URX4	RPP1	RPP4	TS	CRE1	CRE4	int_debt
B1		97.5%			5.1%		21.3%					12.7%	31.5%
B2	5.9%	43.9%	7.9%		23.1%	13.7%	61.0%	22.7%	24.6%	1.2%	11.4%	10.0%	93.7%
B3						68.9%	9.2%	13.7%	9.4%	9.9%			80.6%
B4	3.5%	2.3%	1.3%		22.1%	48.6%	15.0%	10.9%	3.0%	8.3%	6.9%	7.7%	88.0%
B5	38.5%	3.3%		1.3%	13.3%	19.6%	84.4%	10.5%	14.9%		0.6%	12.5%	48.8%
B6	29.8%	4.4%	3.3%		5.7%	26.4%	10.3%	7.7%	4.2%	28.0%	31.7%	12.3%	33.5%

Source: IMF.
Note: AR1 is first order autoregressive process; 1 and 4 denote qoq and yoy changes; (-1)(-2) denote number of lags. See Table 3 in main text for variable definition.

Table 5. France: Determinants of Bank-Specific Fees and Commissions

	Posterior Mean Coefficient					
	Bank 1	**Bank 2**	**Bank 3**	**Bank 4**	**Bank 5**	**Bank 6**
Intercept	-0.8164	-1.2061	-0.6929	-0.7850	-0.4259	-0.4155
AR1	0.8254	0.7278	0.8258	0.8123	0.8778	0.8814
GDP1	0.0029	0.0137	-0.0392	0.0014		
GDP1 (-1)	0.0031		0.0655			
GDP4	0.0060	0.0011	0.0017	0.0047		
INF1	-0.0017	0.0011	0.0012	0.0005	0.0059	
INF1 (-1)	0.0066			0.0010		
INF4	0.0033			0.0010		
URX	-0.0008	-0.0008		-0.0001	-0.0094	-0.0022
URX1	-0.0009	-0.0252	-0.0406	-0.0050		-0.0051
URX4	-0.0014	-0.0017	-0.0042	-0.0010		-0.0039
TS	0.0439	0.0261		0.0294	0.0099	
TS (-1)	-0.0123				-0.0027	
STO1		0.0007	0.0014			0.0001
STO4			0.0019	0.0001		
CRE1		0.0024	0.0001		0.0009	0.0007
CRE1 (-1)						0.0006
CRE4	0.0002	0.0004		0.0002	0.0004	0.0042
CRE4 (-1)		-0.0001				
Observations	56	56	29	56	56	49
R-squared	92%	90%	84%	79%	85%	97%
DW stats	1.74	2.02	2.07	2.08	2.06	1.91

Posterior Inclusion Probability

	GDP1	GDP4	INF1	INF4	URX	URX1	URX4	TS	STO1	STO4	CRE1	CRE4
B1	15.1%	38.1%	11.9%	23.6%	9.5%	5.5%	7.6%	93.0%				8.8%
B2	41.9%	13.0%	7.7%		4.4%	35.3%	10.3%	94.2%	50.4%	6.2%	23.0%	11.8%
B3	56.5%	9.3%	3.3%			25.7%	11.5%		33.9%	63.0%	2.2%	
B4	13.9%	24.0%	11.7%	15.5%	3.0%	7.2%	6.3%	67.4%		15.9%		8.0%
B5			24.8%		42.9%			39.4%	9.6%		17.5%	17.7%
B6				1.3%	13.4%	18.9%	26.2%		21.5%		15.3%	61.9%

Source: IMF.
Note: dependent variables are fees and commission income as share of total assets. AR1 is first order autoregressive process; 1 and 4 denote qoq and yoy changes; (-1)(-2) denote number of lags. See Table 3 in main text for variable definition.

Table 6. France: Determinants of Bank-Specific Non-Interest Expense

	Posterior Mean Coefficient					
	Bank 1	**Bank 2**	**Bank 3**	**Bank 4**	**Bank 5**	**Bank 6**
Intercept	-0.1606	0.1694		0.1303	0.2642	0.1660
AR1	0.9041	0.7655		0.8957	0.8173	0.9238
GDP1	0.0020	0.0149		-0.0003	-0.0003	-0.0006
GDP1 (-1)	0.0005				0.0009	
GDP4	0.0012	0.0004		0.0001	0.0016	-0.0088
INF1	0.0045	0.0064		0.0007	0.0017	-0.0021
INF1 (-1)	0.0002	-0.0044		-0.0001	0.0006	-0.0018
INF4	0.0011	0.0113		0.0013	0.0062	0.0020
INF4 (-1)	-0.0006	-0.0009				0.0001
URX	0.0248	0.0060		-0.0012	-0.0072	-0.0032
URX (-1)	0.0003	0.0040			0.0021	0.0004
URX1	-0.0035	-0.0116		-0.0003	-0.0043	-0.0087
URX1 (-1)	-0.0020	0.0002			-0.0005	0.0003
URX4	0.0029				0.0198	-0.0273
TS	0.0016	0.0111		0.0024	0.0031	0.0038
TS (-1)	0.0043			-0.0017	-0.0001	0.0014
TS (-2)	0.0111				0.0001	-0.0074
SLTN	-0.0001	0.0002		-0.0002	-0.0001	
SLTN (-1)	-0.0001				-0.0001	
CRE1	0.0001	0.0010		0.0004	0.0006	0.0005
CRE4	0.0050	0.0003		0.0009	0.0001	0.0012
CRE4 (-1)		-0.0001				-0.0002
Observations	56	56		56	56	49
R-squared	98%	90%		98%	97%	98%
DW stats	2.14	1.13		1.22	2.41	1.83

Posterior Inclusion Probability

	GDP1	GDP4	INF1	INF4	URX	URX1	URX4	TS	SLTN	CRE1	CRE4
B1	14.5%	15.8%	21.6%	11.5%	89.7%	9.9%	12.5%	60.0%	49.4%	5.2%	71.2%
B2	46.0%	12.3%	22.1%	44.1%	42.2%	21.1%	11.8%	48.7%	41.9%	13.1%	15.0%
B3											
B4	12.4%	13.2%	13.6%	24.8%	17.4%	11.5%	14.5%	23.1%	88.0%	15.2%	36.1%
B5	11.7%	25.1%	14.7%	56.0%	37.8%	17.4%	82.1%	31.7%	55.3%	12.7%	9.1%
B6	13.4%	56.4%	14.9%	20.1%	17.6%	20.6%	60.4%	29.9%	12.0%	12.8%	23.8%

Source: IMF.
Note: dependent variables are fees and commission income as share of total assets. AR1 is first order autoregressive process; 1 and 4 denote qoq and yoy changes; (-1)(-2) denote number of lags. See Table 3 in main text for variable definition. The team judged that the historical data for bank 3 was erroneous from the data source, hence banks 3 was dropped from the satellite model. Instead, the team used average multipliers based on the forecasts for the other 5 banks.

Table 7. France: Determinants of Bank-Specific Non-Interest Income

	Posterior Mean Coefficient					
	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6
Intercept	-0.0619	0.0101	-0.5429		-0.2519	-0.1756
AR1	0.7791	0.9140	0.6999		0.6565	0.8617
GDP1	0.0007	0.0024				0.0002
GDP1 (-1)	-0.0039					
GDP1 (-2)	0.0141					
GDP4	0.0057	0.0006				0.0023
INF1	0.0038	0.0001	0.0607			0.0049
INF4	0.0037		0.0081			0.0037
URX	0.0000		-0.0011			-0.0003
URX1	-0.0004	-0.0141			0.0145	-0.0184
URX1 (-1)					-0.0221	
URX4	-0.0041	-0.0013			-0.0005	-0.0050
URX4 (-1)		0.0004			-0.0008	-0.0139
RPP1	0.0002	0.0001	0.0001		0.0089	
RPP1 (-1)					-0.0052	
RPP4	0.0002		0.0005		0.0001	-0.0013
RPP4 (-1)						0.0013
TS	0.0402	0.0047	0.1164		-0.0036	-0.0090
TS (-1)	-0.0165					
STO1	0.0001		0.0001			0.0001
STO1 (-1)						0.0003
STO4					0.0001	0.0001
Observations	56	56	41		56	49
R-squared	83%	94%	77%		55%	89%
DW stats	1.72	1.14	1.25		1.27	1.34

Posterior Inclusion Probability

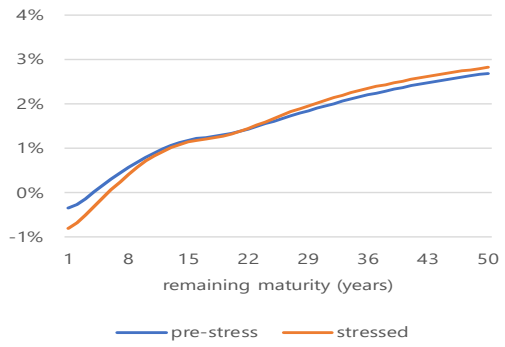
	GDP1	GDP4	INF1	INF4	URX	URX1	URX4	RPP1	RPP4	TS	STO1	STO4
B1	23.24%	33.12%	16.49%	26.67%	1.00%	2.08%	15.97%	4.97%	7.38%	70.58%	2.33%	
B2	17.39%	14.63%	2.71%			26.67%	8.78%	3.65%	4.26%	36.33%	34.21%	38.85%
B3			27.04%	19.56%	2.93%			2.20%	11.06%	64.12%	1.24%	
B4												
B5		15.79%				5.43%	19.61%	31.17%	15.88%	24.05%		1.26%
B6	4.39%	15.36%	14.34%	18.86%	6.49%	15.83%	28.59%		3.47%	26.53%	4.92%	11.45%

Source: IMF.
Note: dependent variables are fees and commission income as share of total assets. AR1 is first order autoregressive process; 1 and 4 denote qoq and yoy changes; (-1)(-2) denote number of lags. See Table 3 in main text for variable definition. The team judged that the historical data for bank 4 was erroneous from the data source, hence banks 4 was dropped from the satellite model. Instead, the team used average multipliers based on the forecasts for the other 5 banks.

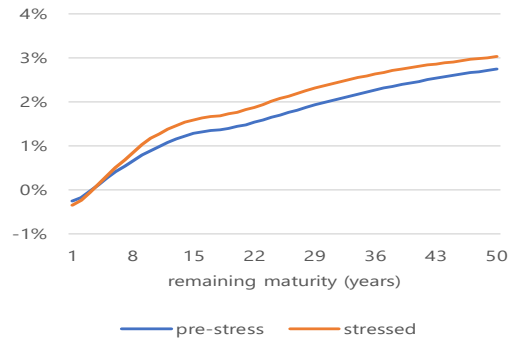
Appendix VIII. Insurance Sector Stress Test—Interest Rate Shocks

France—Interest Rate Shocks

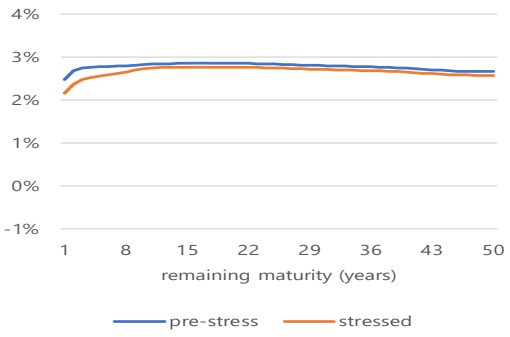
EUR Term Structure (Without volatility adjustment)



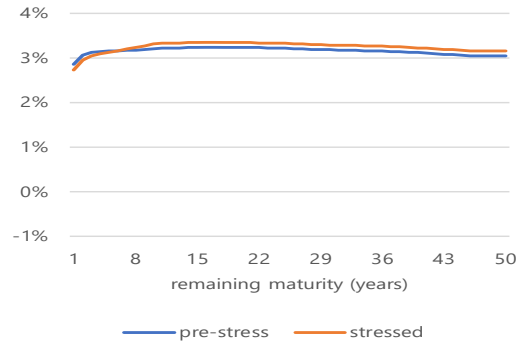
EUR Term Structure (With volatility adjustment)



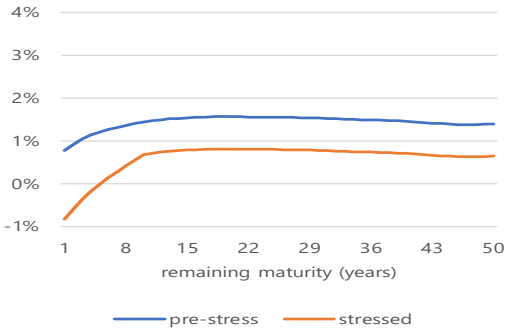
USD Term Structure (Without volatility adjustment)



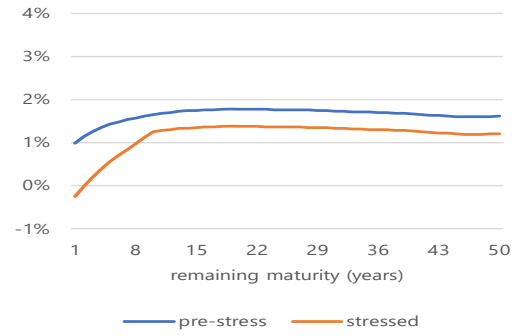
USD Term Structure (With volatility adjustment)



GBP Term Structure (Without volatility adjustment)



GBP Term Structure (With volatility adjustment)



Source: IMF.

Note: The risk-free term structures, as determined under Solvency II, are based on observed market rates up to a maturity of 20 years in the case of the EUR, and 50 years for the U.S. dollar and the Pound Sterling (the so-called last-liquid point). After these 20/50 years, the term structure converges towards an ultimate forward rate set at 3.9 percent.