



ITALY

TECHNICAL NOTE ON STRESS TESTING THE BANKING SECTOR

December, 2013

This Technical Note on Stress Testing The Banking Sector on Italy was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed in June 2013. The views expressed in this document are those of the staff team and do not necessarily reflect the views of the government of Italy or the Executive Board of the IMF.

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ITALY

FINANCIAL SECTOR ASSESSMENT PROGRAM

June 2013

TECHNICAL NOTE

STRESS TESTING THE BANKING SECTOR

Prepared by
**Monetary and Capital Markets
Department**

This Technical Note was prepared by IMF staff in the context of the Financial Sector Assessment Program in Italy. It contains technical analysis and detailed information underpinning the FSAP's findings and recommendations. Further information on the FSAP can be found at:

<http://www.imf.org/external/np/fsap/fssa.aspx>.

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Glossary

AFS	Available for sale
BI	Bank of Italy
BIS	Bank of International Settlements
CEE	Central and Eastern Europe
CCF	Credit Conversion Factor
CCP	Central counterparty
CDP	<i>Cassa Depositi e Prestiti</i>
CDS	Credit default swap
CET1	Common Equity Tier 1
CT1	Core Tier 1
CRD-IV	EU Capital Requirements Directive IV
EaD	Exposure at Default
EBA	European Banking Authority
ECB	European Central Bank
FSAP	Financial Sector Assessment Program
FSSA	Financial System Stability Assessment
FVO	Fair value option
G-SIFI	Global systemically important financial institution
GVAR	Global vector auto-regression
HFT	Held for trading
HTM	Held to maturity
IRB	Internal ratings-based
LCR	Liquidity Coverage Ratio
LGD	Loss Given Default
LTRO	Long-term refinancing operation
MPS	<i>Banca Monte dei Paschi di Siena</i>
MTM	Mark to market
NLP	Net liquidity position
NPL	Non-performing loan
NSFR	Net stable funding ratio
OMT	Outright monetary transactions
PD	Probability of default
RWA	Risk-weighted assets
SME	Small and medium-size enterprise
TTC	Through the cycle
VAR	Vector auto-regression

EXECUTIVE SUMMARY¹

The Italian financial system is coping with a severe and prolonged recession at home and the crisis in Europe. The system has managed to build up additional capital, mostly without state support, in the face of a severe and prolonged recession at home and a major crisis in Europe. The announcement of outright monetary transactions (OMT) and steps toward a banking union have blunted the impact of the sovereign debt crisis on banks, and the expansion of European central Bank (ECB) liquidity facilities has temporarily shielded Italian banks from wholesale funding volatility. However, the weak baseline economic outlook and the large exposure to the highly-leveraged Italian corporate sector constitute challenges. Loan quality and profitability have already deteriorated appreciably. Moreover, large holdings of sovereign securities expose banks to direct mark-to-market losses and higher funding costs if sovereign yields surge. While Italian sovereign yields have declined from their peaks, the crisis in Europe has not ended, and further distress from the Italian sovereign bond market remains a central risk.

As part of the FSAP, comprehensive solvency and liquidity stress tests were performed to analyze the resilience of the banking system to the main vulnerabilities identified above. The Bank of Italy (BI) and the FSAP team ran parallel solvency stress tests using different methodologies but the same data and macroeconomic scenarios. The liquidity stress tests were performed by the BI based on agreed assumptions with the FSAP team. The banks were evaluated against Basel III requirements for Common Equity Tier 1 (CET1) and Tier 1 capital (from 2013), and included the phase-in of increasing hurdle rates and the phase-out of capital components no longer eligible under Basel III. The scenario-based solvency stress tested for capital adequacy under the baseline and two stress scenarios. Macro scenario tests examined the impact of medium-term “slow growth” scenario and the effects of an “adverse scenario” simulating an acute intensification of the euro area crisis. The scenario tests were also accompanied by single-factor (sensitivity) tests. The resilience of Italian banks to funding and market liquidity shocks were tested based on scenarios that included the withdrawal of market and deposit funding, the downgrade of the Italian sovereign and banks, as well as valuation shocks to liquid assets.

The results show that the potential stress on banks could be significant, albeit substantially cushioned by their own capital buffers and the availability of ECB liquidity. Solvency stress test results suggest that the Italian banking system is able to withstand both the already weak baseline macroeconomic outlook and the protracted slow growth scenario. The capital buffers built up during the crisis would also offset most of the losses resulting from the “adverse” macroeconomic scenario, even taking into account the phase-in of Basel III requirements, but the system would find almost all of its extra buffers depleted, pushing the aggregate capital ratios to slightly above minimum Basel III requirements. Cooperative banks as well as the banks under considerable influence of banking foundations showed distinctive weaknesses, the latter already under the baseline scenario, and are clearly the weakest link of the banking system. Since long-term ECB

¹ This technical note was prepared by Hiroko Oura and Emanuel Kopp, both from the Monetary and Capital Markets Department, IMF.

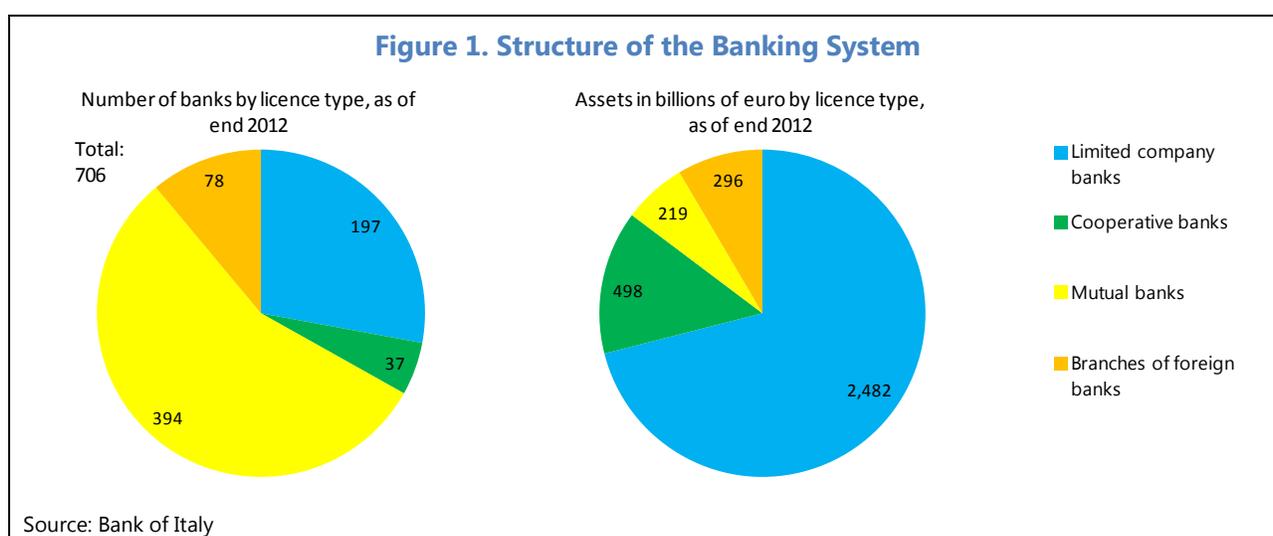
funding has already replaced a large amount of market funding, banks would be able to absorb additional market liquidity shocks by the remaining collateral. Therefore, sizeable deposit outflows and further downgrades of Italian banks were found to be the most important source of liquidity risk.

INTRODUCTION

A. Background

Recent development

1. Banks are dominant part of the Italian financial system, accounting for almost 85 percent of total financial sector assets. At end-2012, there were 706 banks with total assets of about 220 percent of GDP, of which 169 were part of 75 banking groups (Figure 1). The system's assets are concentrated in limited company banks (over 70 percent of the system by assets). Nonetheless, there are still many small cooperative and regional banks operating under different local economic environments. Banking foundations are key shareholder groups for banks, and at least 20 percent of banking system assets are controlled or under the significant influence of one or more foundations.

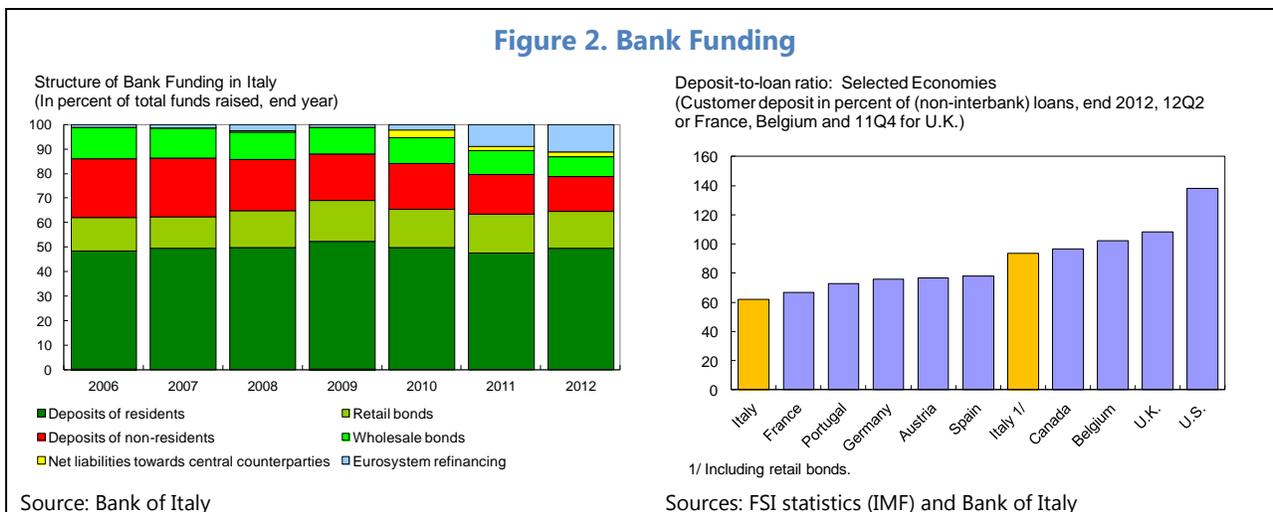


2. Banks weathered the initial impact of the global financial crisis in 2008 relatively well thanks to their “traditional” business model, but were hit by the subsequent sovereign debt crisis and the double-dip recession.

- Banks' balance sheets reflect their “traditional” banking model of providing loans with customer funding. At end-2012, loans accounted for about 65 percent of total assets and 37 percent of loans are to resident non-financial corporations (Table 1)—the highest share in any G-7 country. Italian banks are crucial for the financing of small and medium-sized enterprises (SMEs) which account for 68.3 percent of business value added. Loans to non-residents, mainly in Germany and Austria, account for a quarter of total loans and exposures are concentrated in large banks.
- The relatively low level of exposure to structured finance products shielded Italian banks from the initial phase of the crisis. At 9 percent of total assets, however, the banks' sovereign security

holdings (mostly Italian sovereign bonds) are substantial and exposure the banks to considerable sovereign risk.

- Banks are funded primarily by resident customer deposits and retail bonds² (Figure 2), and their funding gap is lower than that of other European banks. Taking into account also retail bonds, an asset class that in Italy could be understood as a substitute for term deposits, medium-sized banks have the largest funding gap, followed by large banks and deposit-rich small banks (Table 2).



- But as the Italian economy plunged into recession in 2008–09 and again in 2011, and Europe in a sovereign debt crisis, the impact on Italian banks’ balance sheets was considerable (Figure 3). The average non-performing loan (NPL) ratio climbed from 5½ percent in 2007 to about 14 percent at end-2012, and the flow of new NPLs is considerable. Return on assets dropped from 0.7 percent in 2007 to -0.1 percent at end-2012, owing to increased credit impairment costs for large and medium-sized banking groups (Table 2).
- The rise in Italian sovereign spreads has also had a strong negative effect on bank funding costs: according to BI estimates, a 100 bps increase in the sovereign spread results in an equivalent hike in bank bond yields, with a one-quarter lag, and a 60 bps hike in interest rates on new term deposits and repos within 3–4 quarters. As a result of these higher funding costs, credit growth started contracting in mid-2012 (Figure 3).

² Bonds held by households. These bonds have been popular alternatives for term deposits due to favorable tax treatment compared to deposits that had existed until 2012.

Table 1. Financial Soundness Indicators for 63 Banking Groups: 2007–12^{1/}

	2007	2008	2009	2010	2011	2012
Basic data						
Total assets, in billions of euro	2,709	2,816	2,711	2,765	2,800	2,849
In percent of GDP	174	179	178	178	177	182
Total deposits, in billions of euro	1,542	1,431	1,358	1,458	1,436	1,513
In percent of GDP	99	91	89	94	91	97
Number of institutions	70	68	62	62	69	63
GDP, in billions of euro (WEO)	1,554	1,575	1,520	1,553	1,580	1,566
Financial Soundness Indicators						
Capital adequacy						
Total capital ratio, in percent 2/	9.8	10.4	11.6	12.1	12.7	13.4
Tier 1 ratio, in percent	6.8	7.0	8.3	8.7	9.5	10.5
Core tier 1 ratio, in percent 2/	6.3	6.3	7.4	7.5	8.7	10.0
Tier 1 capital to assets, in percent	4.5	4.2	4.8	5.0	5.5	5.4
Core tier 1, in billions of euro	111	106	118	119	139	146
Risk-weighted assets, in billions of euros	1,763	1,681	1,583	1,589	1,602	1,463
Credit Risk, in percent						
Large exposures to capital 3/ 4/	20	20	12	89	86	92
NPL net of provisions to capital 3/	27	36	55	60	65	79
NPL to gross loans	5.6	6.3	9.5	10.6	11.9	14.0
Provisions to NPL	50	46	40	40	40	40
Share of loans to top 5 borrowers	1.7	3.5	3.1	4.2	4.8	4.3
Share of loans to top 10 borrowers	2.4	5.1	4.6	6.5	7.2	6.4
Credit cost to total loans	0.4	0.7	1.1	0.9	1.0	1.5
Sectoral distribution of loans						
Residents	72	72	73	75	75	75
<i>of which</i>						
Deposit takers	4	5	3	2	2	2
Central bank	2	1	1	1	1	1
Other financial corporations	7	3	5	5	4	6
Government	2	2	3	3	3	3
Corporations	36	37	38	38	39	37
Other	20	23	23	26	27	26
Nonresidents	28	28	27	25	25	25
Profitability, in percent						
Return on assets 2/	0.7	0.3	0.3	0.3	-0.9	-0.1
Return on equity 5/	9.2	4.9	4.0	3.7	-12.9	-0.9
Return on equity, excluding impairment on goodwill 5/ 6/	...	...	...	...	2.2	0.2
Interest margin on gross income	55	66	60	58	57	54
Trading income to gross income	3	-7	4	1	3	9
Non-interest expenses to gross income	61	66	60	63	65	63
Personnel expenses to non-interest expenses	57	57	58	58	56	57
Cost to income ratio 2/	61	66	60	63	65	63
Liquidity, in percent						
Liquid asset to total asset	...	7	11	12	12	15
Liquid asset to short-term liabilities	...	42	86	85	72	90
Customer deposits to non-interbank loans	72	64	64	64	59	62
Customer deposits+retail bonds to non-interbank loans	109	98	99	96	93	94
FX and derivative risks, in percent						
Net open FX position to equity 5/	...	2.0	1.5	1.6	1.7	1.2
Gross financial derivative assets to equity 5/	...	105	75	74	111	100
Gross financial derivative liabilities to equity 5/	...	107	76	78	117	106
FX loans to total loans	9	11	10	10	9	9
FX liabilities to total liabilities	...	7	10	9	6	6

Sources: Bank of Italy, WEO, and IMF staff calculations.

1/ The data in the table refer to all banking groups that report to the Bank of Italy on a consolidated basis. Data for the remaining 12 banking groups and the 537 individual banks (as of end 2012) are not included in this table.

2/ Excluding overseas subsidiaries.

3/ Total regulatory capital.

4/ Break in 2010 due to the new EU regulatory framework (increase of risk weights for exposures to other regulated entities, mainly interbank exposures).

5/ Equity includes total capital and reserves.

6/ In 2011, several banks wrote-off good-will related to their past mergers.

Table 2. Financial Soundness Indicators by Size of Banking Groups: 2008 and 2012^{1/}

	2008, December				2012, December			
	All	Large	Medium	Small	All	Large	Medium	Small
Basic data								
Total assets, in billions of euro	2,816	2,391	300	125	2,849	2,318	458	73
Share in total, in percent	100	85	11	4	100	81	16	3
Total deposits, in billions of euro	1,431	1,180	185	66	1,513	1,171	297	44
Share in total, in percent	100	82	13	5	100	77	20	3
Number of banking groups included	68	10	23	35	63	10	24	29
Financial Soundness Indicators								
Capital adequacy								
Total capital ratio, in percent 2/	10.4	10.5	10.2	10.0	13.4	13.9	11.3	13.6
Tier 1 ratio, in percent	7.0	6.8	7.3	7.9	10.5	11.0	8.4	12.0
Core tier 1 ratio, in percent 2/	6.3	6.0	7.2	7.8	10.0	10.3	8.2	11.9
Tier 1 capital to assets, in percent	4.2	3.9	5.3	5.7	5.4	5.4	5.0	7.4
Core tier 1, in billions of euro	106	83	16	7	146	118	23	5
Credit Risk, in percent								
Large exposures to capital 3/ 4/	18	15	38	13	92	85	116	149
NPL net of provisions to capital 3/	36	34	35	70	79	79	85	68
NPL to gross loans	6.3	5.9	5.7	29.4	14.0	14.2	13.2	19.1
Provisions to NPL	46	49	39	29	40	41	34	32
Share of loans to top 5 borrowers	3.5	4.1	...	...	4.3	3.7	5.7	15.2
Share of loans to top 10 borrowers	5.1	5.9	...	...	6.4	5.7	8.6	21.8
Credit cost to total loans	0.7	0.6	0.8	4.1	1.5	1.4	1.8	1.4
Sectoral distribution of loans								
Residents	72	69	94	83	75	71	93	96
of which								
Deposit takers	5	5	4	11	2	1	2	8
Central bank	1	1	2	2	1	1	1	8
Other financial corporations	3	3	4	3	6	6	6	4
Government	2	2	1	1	3	3	1	3
Corporations	37	36	49	41	37	36	45	38
Other	23	22	34	26	26	24	38	35
Nonresidents	28	31	6	17	25	29	7	4
Profitability, in percent								
Return on assets 2/	0.3	0.4	0.3	-0.8	-0.1	-0.1	-0.1	0.5
Return on equity 5/ 6/	4.9	6.0	3.4	-10.8	-0.9	-1.1	-1.6	6.4
Interest margin on gross income	66	67	65	63	54	54	53	44
Trading income to gross income	-7	-7	-2	-23	9	9	8	9
Non-interest expenses to gross income	66	65	66	72	63	63	60	62
Personnel expenses to non-interest expenses	57	58	53	56	57	57	53	54
Cost to income ratio 2/	66	65	66	72	63	63	60	62
Liquidity, in percent								
Liquid asset to total asset	7	7	5	8	15	14	16	28
Liquid asset to short-term liabilities	42	45	26	49	90	94	67	201
Customer deposits to non-interbank loans	64	63	63	182	62	60	64	122
Customer deposits+retail bonds to non-interbank loans	98	96	96	214	94	93	88	153
FX and derivative risks, in percent								
Net open FX position to equity 4/	2.0	2.0	0.7	1.1	1.2	1.3	0.5	2.6
Gross financial derivative assets to equity 5/	105	123	13	5	100	118	17	13
Gross financial derivative liabilities to equity 5/	107	126	13	5	106	123	27	14
FX loans to total loans	11	12	3	2	9	10	3	1
FX liabilities to total liabilities	7	7	4	1	6	7	2	1

Sources: Bank of Italy and IMF staff calculations.

1/ Large: top 1-10; Medium: top 11-35; Small: remaining banks. The data in the table refer to all banking groups that report to the Bank of Italy on a consolidated basis. Data for the remaining 12 banking groups and the 537 individual banks (as of end 2012) are not included in this table.

2/ Excluding overseas subsidiaries.

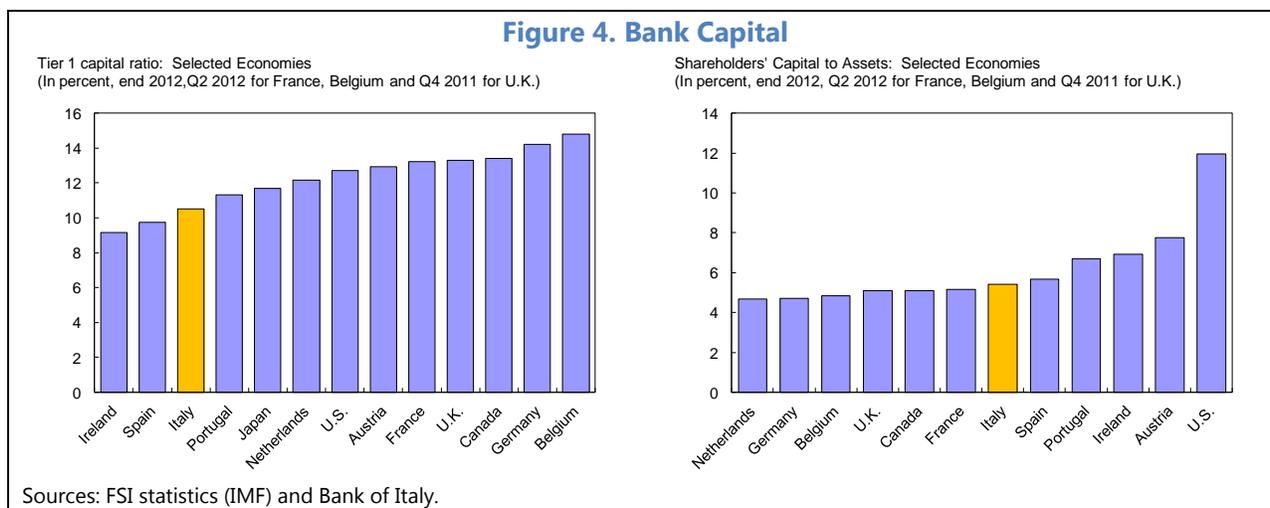
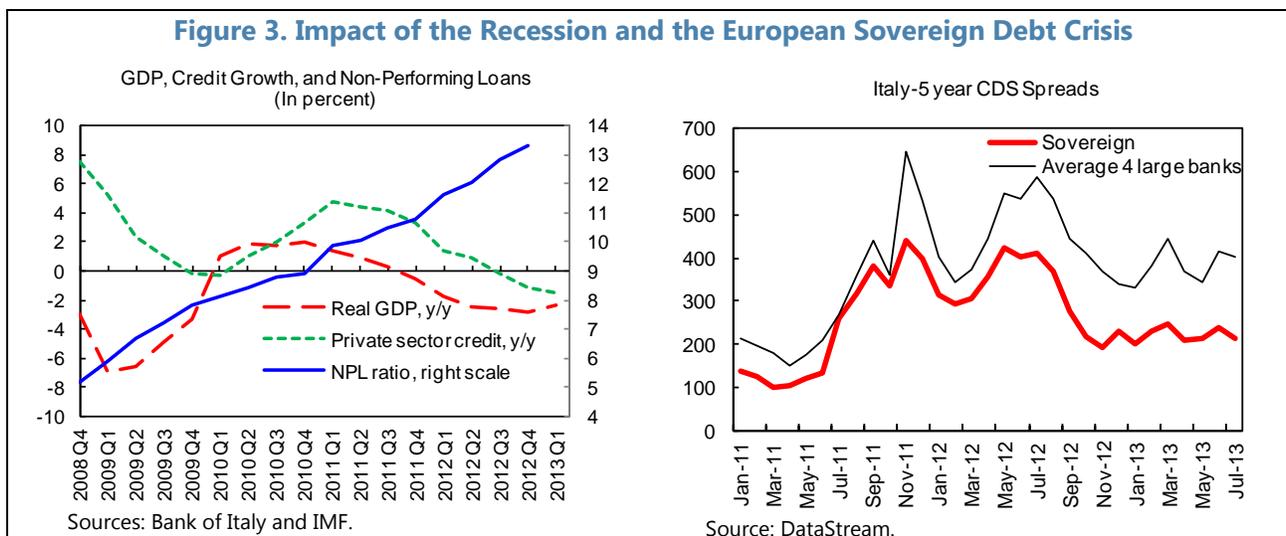
3/ Total regulatory capital.

4/ Break in 2010 due to the new EU regulatory framework (increase of risk weights for exposures to other regulated entities, mainly interbank exposures).

5/ Equity includes total capital and reserves.

6/ In 2011, several banks wrote-off good-will related to their past mergers.

- Italian banks' funding gap has increased since 2007. The deposit-to-loan ratio (including retail bonds, Table 2) declined from 109 percent in 2007 to 94 percent at end-2012 due to withdrawals of nonresident deposits, while positive credit growth continued until mid-2012.



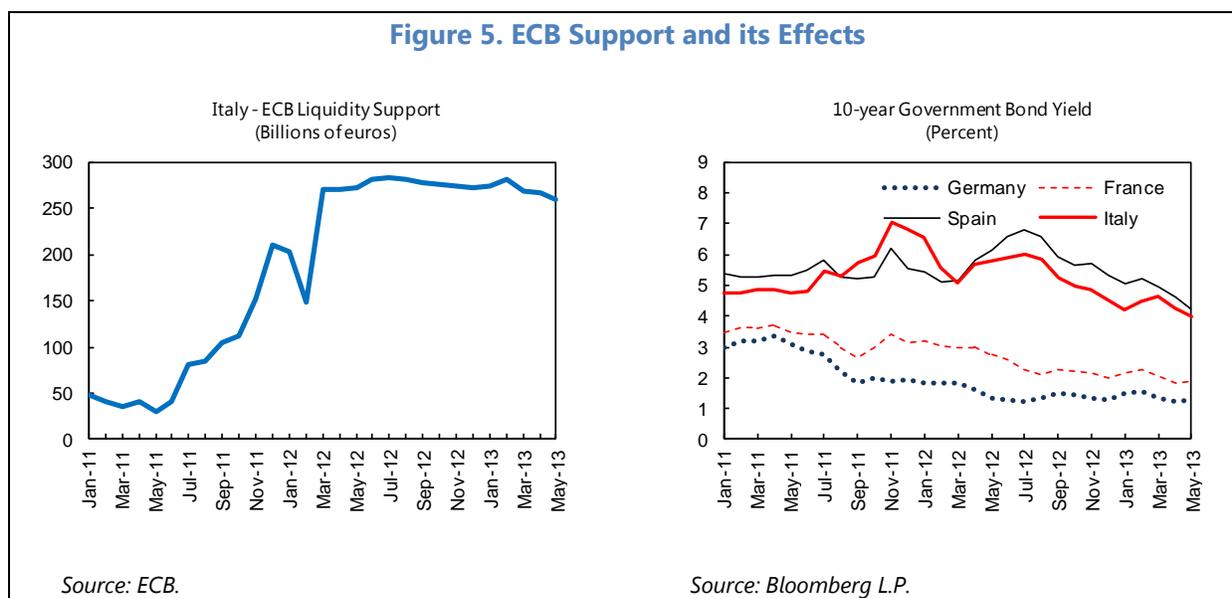
3. Despite these challenges, banks improved their solvency ratios. Core Tier 1 (CT1) capital rose by over EUR 40 billion since 2008, raising the average CT1 ratio to 10 percent by end-2012, while the decline in RWA was limited. Improved solvency ratios partly reflect Pillar 2 capital add-on charges requested by the BI—in preparation for Basel III and reflecting individual banks' risk profile—as well as additional capital buffers required by the European Banking Authority (EBA).³

³ The EBA requested the main European banks to constitute a temporary capital buffer against their exposures to sovereign issuers so as to bring their EBA CT1 ratio to 9 percent by June 2012. Four (Unicredit, Banco Popolare, UBI, and Banca Monte dei Paschi di Siena) out of five Italian banks included in the exercise were required to add EUR 15 billion. In the event, they added EUR 18 billion, of which EUR 12 billion was new capital, liability management exercises, and contingent capital, and EUR 6 billion reflected risk-weighted assets (RWA) measures (including

(continued)

Italian banks' solvency ratios appear relatively low compared with their peers, but this partly reflects their larger exposures to corporate loans which carry higher risk weights. The comparison of Italian banks improves when solvency is measured by the leverage ratio, which does not account for risk weights (Figure 4).

4. Liquidity pressures, including from the impact of higher Italian sovereign spreads, have been mitigated by the ECB's expanded monetary policy framework. Funding pressures led banks to tap Eurosystem refinancing facilities heavily (Figure 2). After two three-year Long-Term Refinancing Operations (LTROs), ECB financing of the Italian banking system peaked at EUR 283 billion in July 2012 before declining to EUR 259 in May 2013 (Figure 5). This amount exceeds Italian banks' total maturing wholesale debt during the next three years, and is equivalent to one-quarter of the total euro system take-up. The announcement of the Outright Monetary Transactions (OMT) also helped bring down sovereign yields in Italy, from 6.7 percent on 10-year government bonds in July 2012 to 4.5 percent at end-December 2012. In 2013, yields have remained low, though current global trends are exerting some upward pressures.



validation of new advanced models or recalibration of existing ones). In July 2013—following the FSAP—this guidance was superseded by EBA's recommendation on "preservation buffers:" the main European banks were asked to maintain capital at the level of the June 2012 EBA requirement till the implementation of the EU CRD-IV.

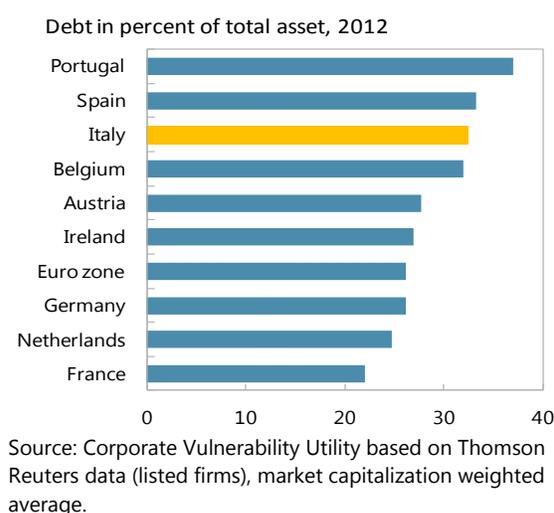
5. The economic outlook suggests a continuing difficult operating environment for Italian banks. The positive contribution from net exports is likely to persist, but domestic demand is not projected to recover before late 2013 at the earliest. The IMF forecasts real GDP to decline by 1.7 percent in 2013, followed by moderate growth of 0.8 percent in 2014. Elevated uncertainty around growth prospects in Italy and Europe means that downside risks dominate this short-term forecast. Over the medium term, low trend productivity growth is likely to keep economic growth modest—and thus investment and profit opportunities for Italian banks.

B. Risks to the Banking Sector

Risks to bank solvency

6. Loan quality, reflecting the weak economy, is the most pressing vulnerability affecting Italian banks. The sharp hike in NPL (nearly 8 percentage points since 2007 and rising) was concentrated especially in the corporate sector—23 percent NPL ratio as of January 2013.⁴ The Italian corporate sector is highly leveraged (Figure 6). About half of corporate sector debt, largely to banks, is from highly leveraged firms, with interest expense accounting for over half of gross operating profit. Conversely, credit risk from households appears limited, given their modest debt burden and substantial positive net wealth.⁵

Figure 6. Corporate Sector Vulnerability



7. Provision adequacy is a challenge. Comparing the level of provisions in Italy to that in other countries may be misleading: loan classification rules in Italy are more conservative, supervisory practices more stringent, and the tax deductibility of provisions less generous than elsewhere in Europe.⁶ Moreover, collateral—which was increased during the crisis—provides an additional, yet uncertain, buffer. But even after adjusting, where possible, for these factors, there is no doubt that the level of NPL coverage in Italy (across all categories of NPLs, with or without collateral) has deteriorated in recent years. This led to a special targeted inspection program by BI focused on provisions in late 2012–early 2013 on a sample of 20 mid-size and large banks. The inspection covered 40 percent of system NPLs and revealed deficiencies in provisioning practices in a number of banks (that are now subject to more in-depth inspections). The ensuing supervisory

⁴ In response to the crisis, debt moratoria (payment suspension) for up to one year were introduced in 2009. These moratoria currently cover EUR 22 billion of SME and EUR 10 billion household loans. The BI estimates that about 60 percent of these loans become performing within a year, dampening the impact on new impaired loans when the program expires in 2013.

⁵ See the Financial System Stability Assessment (FSSA) report for further details.

⁶ In particular, see Box 3 of the FSSA.

action led to an increase of about EUR 7½ billion in provisions reflected in the end-2012 financial statements,⁷ and a slight increase in the level of provisioning coverage for the system as a whole. But further raising the overall coverage level substantially will remain a challenge in the near term, given the continuing deterioration of asset quality as well as the Italian banks' low profitability.

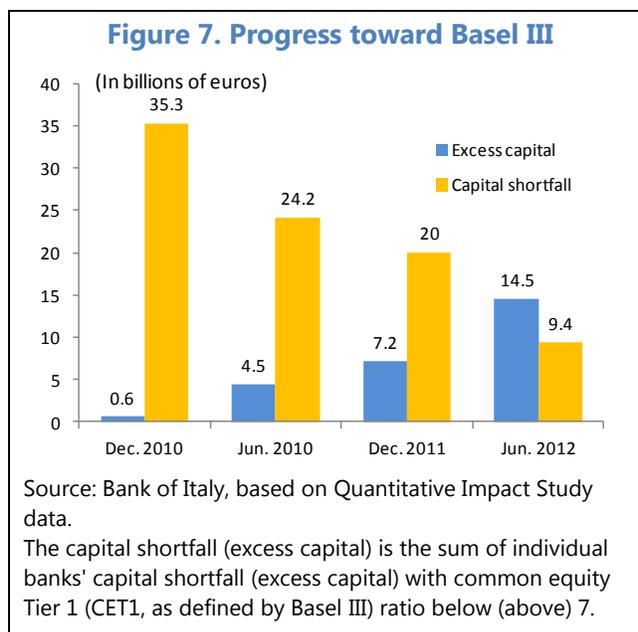
8. Renewed pressures on sovereign yields would impact bank solvency and liquidity.

Banks have Italian sovereign exposures amounting to about 9 percent of the assets, mostly in trading and available-for-sales accounts. This exposure is relatively large compared to other advanced economies, and Italian sovereign spreads have been experienced periods of above-average volatility. Mark-to-market valuation losses could affect bank solvency, while lower market prices for sovereign bonds would reduce their collateral value for secured funding, including from the ECB. Besides direct effects, the experience of the European debt crisis suggests that acute sovereign distress can have a broader impact on the economy, further aggravating pressures on the financial sector.

9. On the positive side, the capital buffers built by banks in recent years have strengthened considerably their solvency position. These buffers can shield banks from additional shocks and allow them to cope with the phase-in of Basel III requirements.⁸ As in other jurisdictions, Basel III is expected to induce declines in the banks' capital ratios.⁹ The effect on RWAs is expected to be relatively small, as Italian banks' trading activities are relatively limited. Nevertheless, the existing buffers should help Italian banks absorb the impact of Basel III on capital (Figure 7).

Risks to bank liquidity

10. The expanded ECB monetary policy framework has contributed to shielding Italian banks against these market shocks. Market funding by Italian banks has already been markedly reduced and replaced by the LTRO proceeds, lowering the amount of maturing wholesale funding subject to roll-over risks (Figure 2). At the same time, the value of unencumbered eligible collateral has increased, totaling to EUR 302 billion as of February 2013 despite of larger haircuts (Figure 8).



⁷ This reflected both collateral value adjustments and, to a lesser extent, loan re-classification. Collateral values were adjusted for changes in market valuation and additional haircuts to account for the risk of fire sales.

⁸ Basel III is expected to lead to substantial declines in capital ratios for Italian banks, as in other systems. Quantitative impact studies indicate notable impact on capital ratios, primarily owing to the phase out of some capital components. The rise in RWA is expected to be small, as Italian banks have relatively small trading activities.

⁹ Quantitative impact studies indicate notable impact on capital ratios, primarily owing to the phase out of some capital components.

This is partly because the ECB has widened the definition of eligible collateral for Eurosystem operations.¹⁰ Additional contribution comes from the release of securities previously encumbered for (private) repos and net purchase of securities, especially Italian sovereign bonds. Banks have also issued covered bonds, in part to retain them so that they can be pledged for ECB facilities if needed.¹¹ About a half of the eligible collaterals are government bonds, and they are mostly kept as freely available (“other unencumbered” in Figure 8) assets. Bank bonds follow (30 percent of total eligible collaterals), including those held by issuing banks themselves such as government guaranteed bonds.

11. However, banks continue to face potential liquidity risks from lower market valuation and potential downgrades of their Italian sovereign securities holdings.

- Lower market prices of sovereign bonds reduce their collateral value for secured funding, including those from the ECB. Sovereign downgrades to a BBB-rating by all four rating agencies recognized in the ECB collateral framework would trigger a cliff effect on ECB haircuts, raising them by about 5 percentage points across maturities. The Italian sovereign has already been downgraded by Fitch (from A- to BBB+) and DBRS (from A to A-) in early 2013. Further downgrades by DBRS would trigger the cliff effect, which would reduce the value of eligible collateral by EUR 39 billion (about 13 percent of the existing eligible collateral value).¹²
- Sovereign downgrades may in turn affect the banks’ credit ratings, just like in early-2013. Lower issuer ratings would reduce the collateral value of bank-issued securities, including covered bonds and other securitized assets (through higher haircuts). For instance, a one notch downgrade of the banks and, respectively, the structured products they issue, would reduce the value of ECB-eligible collateral by an additional EUR 6 billion (about 1½ percent of existing collaterals).¹³
- Just like in the past, higher counterparty risk due to bank downgrades and increased volatility in Italian sovereign debt could also alter margins required by central counterparty clearing houses (CCPs).

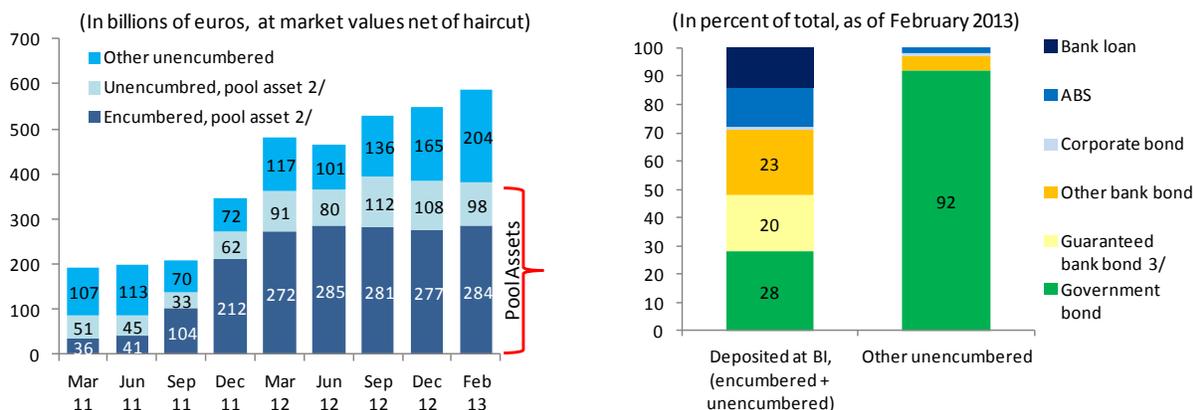
¹⁰ For instance, some of the “guaranteed bank bonds” in Figure 8 are “own-use,” which are bonds issued by the bank that uses them as ECB collateral. The ECB decided to exclude such bonds from the set of eligible assets starting March 2015. As of end February 2013, these bonds were worth about 78 billion euro (at market values, net of haircut), of which 73 billion euro (about 19 percent of existing collaterals) were deposited at BI for Eurosystem facilities (some are unencumbered). The amount is expected to decline to 42 billion euro until they mature by March 2015. From that time on such bonds will no longer be ECB-eligible.

¹¹ About 72 percent of the covered bonds issued by Italian banks in 2012 were retained by issuers (staff estimate using *Dealogic*).

¹² According to the published haircut matrix by the ECB, the same haircut is applied when the rating remains within a range from AAA to A- and another range from BBB+ to BBB-. The haircut for sovereign is determined based on the best rating of the four rating agencies (Moody’s, S&P, Fitch, and DBRS). If all the four agencies downgrade below investment grade (BB+ and below), the security becomes ineligible for ECB facilities, except for sovereign securities issued by program countries.

¹³ These are ECB eligible assets that are deposited at the Bank of Italy for Eurosystem’s operations.

Figure 8. ECB Eligible Collaterals, Banks in Italy¹



Source: Bank of Italy.

1/ Banks that qualify as counterparty for Bank of Italy's monetary policy operations, including foreign banks in Italy. Collateral assets are assessed at market values, net of ECB-set haircuts.

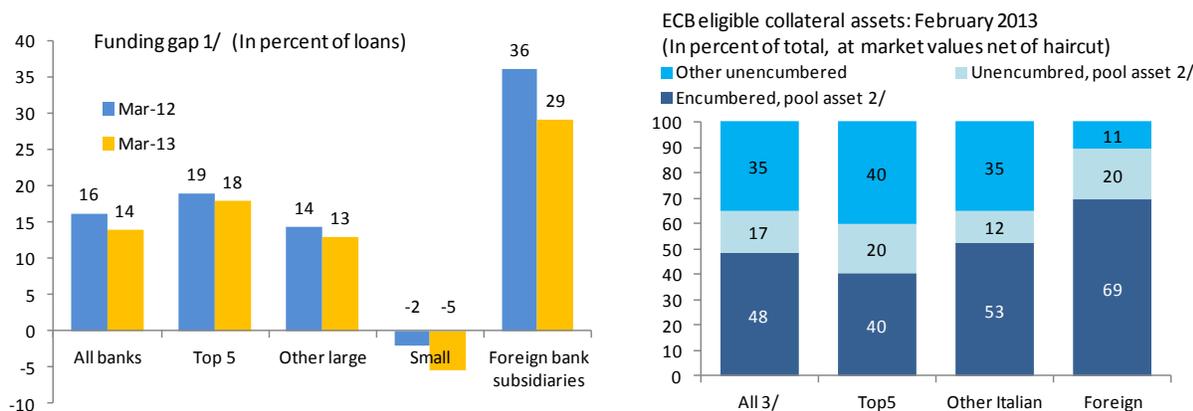
2/ Pool assets indicate a part of eligible assets that are deposited (but not necessarily encumbered) at the Bank of Italy for Eurosystem's operations.

3/ Bank bonds guaranteed by government, including bonds issued by the bank that uses them as collateral.

12. Existing funding gap is the largest for foreign banks, followed by larger banks.

Subsidiaries of foreign banks in Italy do not have strong deposit base, leading to larger funding gap. Top five banks and other large banks follow. Small banks typically have strong deposit base tied to the local economy where the banks are operating. Due to credit contractions and steady (domestic) deposit growth, the funding gap has narrowed in the year until March 2013. Foreign banks also have relatively smaller amount of unencumbered collateral assets eligible for ECB facilities.

Figure 9. Funding Gap and Collateral Assets, Across Bank Groups



Source: Bank of Italy.

1/ Funding gap are measured as the difference between loans and deposits, adjusted for retail bonds, loan-loss provisions, and repos with CCP.

2/ Pool assets indicate a part of eligible assets that are deposited at the Bank of Italy for Eurosystem's operations.

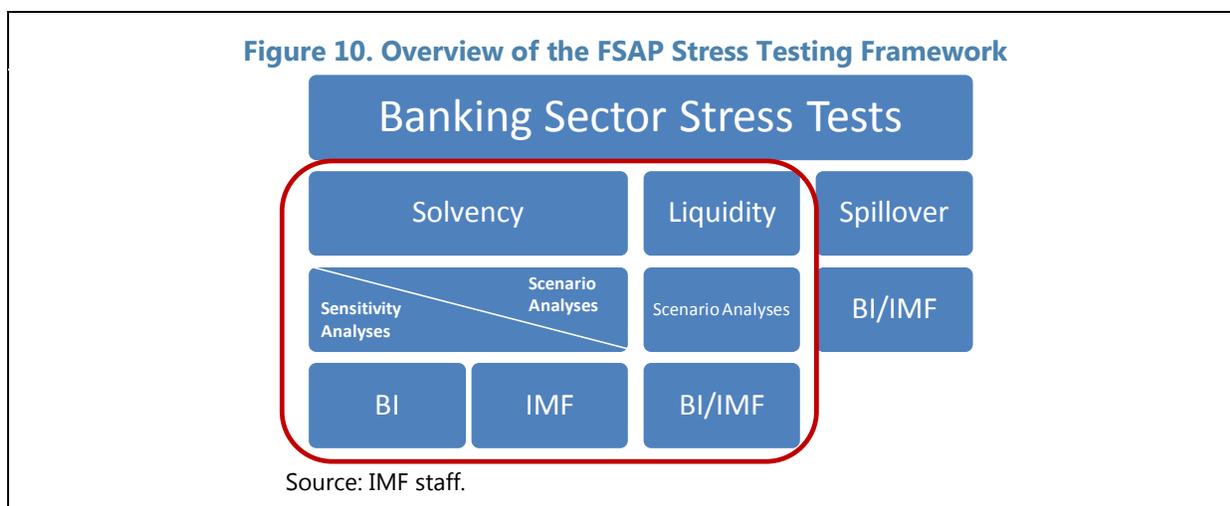
3/ Banks that qualify as counterparty for BI's monetary operations, including foreign banks.

C. Stress Testing Practices at the Bank of Italy

13. The BI has a well developed stress testing program, which is strongly integrated into banking supervision and macroprudential oversight. Its top-down solvency and liquidity tests cover banks accounting for more than 90 percent of the Italian banking system's total assets. The solvency stress testing framework relies on a broad spectrum of data (including from the well-established credit registry in addition to supervisory data) and includes macro-financial models that link credit and market risks and income components to macroeconomic developments. Liquidity stress testing uses BI's weekly liquidity reporting and monitoring of individual banks, stepped up since the onset of the 2008 crisis. BI's results from the stress testing program directly feed into on and offsite banking supervision. The collaboration between different sections of the central bank is notably strong.

D. FSAP Stress Testing Framework

14. Both solvency and liquidity stress tests are used to analyze the banking system's resilience to a wide range of shocks (Figure 10). The tests aim at determining the banks' resilience against key macro-financial shocks. The FSAP team has performed its own solvency stress tests using BI's supervisory data, in parallel to the authorities' test, while liquidity tests are performed by the BI using agreed assumptions with the FSAP team. Solvency tests consist of macro scenario tests and some sensitivity tests. Cross-border and cross-sector spillover effects are analyzed more in detail separately, outside of stress testing framework.¹⁴



¹⁴ See Technical Note on Interconnectedness and Spillover Analysis.

SOLVENCY STRESS TESTS

A. Framework

15. The sample includes 32 banking groups and banks, representing around 90 percent of total banking sector assets. Consolidated data at the banking group level (excluding the insurance arms but including other non-bank and subsidiaries abroad) are used, except for two Italian banks, which are assessed using unconsolidated data at subsidiary levels. Four banking groups are subsidiaries of foreign entities. The tests do not cover *Cassa Depositi e Prestiti* (CDP), a specialized lending entity majority-owned by the government.¹⁵

16. The tests are based on the BI's confidential supervisory data as of end 2012. The BI shared their detailed bank-by-bank data with the FSAP team for the solvency test, including sectoral credit risk information, sovereign and other market risk exposures, and regulatory capital.

17. The assessment criteria follow the Basel III capital framework and its phase-in and phase-out arrangements. Starting in 2013, the new minimum capital ratios, including the capital conservation buffer, gradually increase over the stress tests' horizon up to the full implementation in 2019. In parallel, capital components no longer eligible for CET1 and Tier 1 are phased-out following the schedule set by the Basel Committee. These effects are estimated by the BI in cooperation with the commercial banks,¹⁶ and reflected in the stress tests performed by the BI and the IMF.

18. The tests have examined a wide range of credit and market risk exposures. For credit risk, both domestic and foreign customer credit exposures, including off-balance sheet exposures, are examined (excluding interbank loans). Market risk is analyzed in scenario and sensitivity tests, covering equity price risk, foreign exchange rate risk, and interest rate risk, including from sovereign securities.

19. The exercise explicitly evaluates the impact of potential valuation losses from Italian sovereign securities:

- *Country scope.* Unlike some other stress tests, this FSAP exercise reflects the potential losses from the banks' exposure to their own (Italian) sovereign. However, exposures to foreign sovereign debt holdings is not stressed, because the majority of them are German bunds, which are likely to have valuation gains in a realistic stress scenario due to flight-to-quality effects (Figure 11).

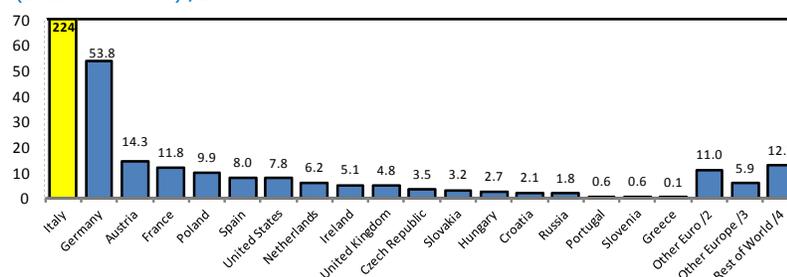
¹⁵ The CDP funds itself mostly with postal and customer deposits, and it is required to deposit the liquidity provided by postal savings on an account at the treasury, which makes up nearly half of its assets (see appendix 2 for further details on CDP). Just like *Kreditanstalt für Wiederaufbau* in Germany, *Caisse de Dépôts et Consignations* in France, and Japan post bank, the CDP is not included in the FSAP stress tests.

¹⁶ Indeed, the quantitative impact study by the Basel Committee for Banking Supervision covers the largest banks in the stress test sample.

- *Security coverage.* In macro scenario tests, marked-to-market (MTM) losses from sovereign securities in held-for-trading (HFT), available-for-sales (AFS) and fair value option (FVO) portfolios are accounted.¹⁷ Losses from securities in held-to-maturity (HTM) account are excluded from macroeconomic scenario tests. However, as of December 2012 the share of Italian sovereign securities in HTM account amounts to only 12 percent of total exposures to the Italian public sector.
- *Prudential filter.* Under Basel II, the AFS filter allows a partial pass-through of unrealized MTM gains and losses in the AFS portfolio to capital. This will be gradually phased out with the introduction of Basel III, which would require full pass-through by 2019.¹⁸
- *Sensitivity test.* Separate sensitivity tests are applied to consider MTM losses from all securities regardless of their regulatory or accounting treatment in order to further explore bank vulnerabilities from Italian sovereign risks. The losses affect bank capital without AFS filter.

Figure 11. Sovereign Exposure Held by Italian Banks

Sovereign Exposure held by Italian Banks (Dec 2012)
(In Euro billion) /1



Source: Bol.

Notes:

/1 Market values of securities on ultimate risk basis vis-à-vis public sector (in Euro billion).

/2 Belgium, Cyprus, Estonia, Finland, Luxembourg, Malta.

/3 Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Denmark, Faeroe Islands, Iceland, Latvia, Liechtenstein, Lithuania, Macedonia, Moldova, Norway, Romania, Serbia, Sweden, Switzerland, Ukraine.

/4 All other countries.

B. Scenarios

20. The solvency tests examine three macroeconomic scenarios and two separate sensitivity tests. The three scenarios are baseline, protracted “slow growth”, and “adverse” scenarios. Baseline scenario is as agreed by the BI and the FSAP team and is very similar to April 2013 World Economic Outlook forecast. The projected GDP growth rates and output gap in these

¹⁷ The MTM losses are calculated using modified duration and convexity measures.

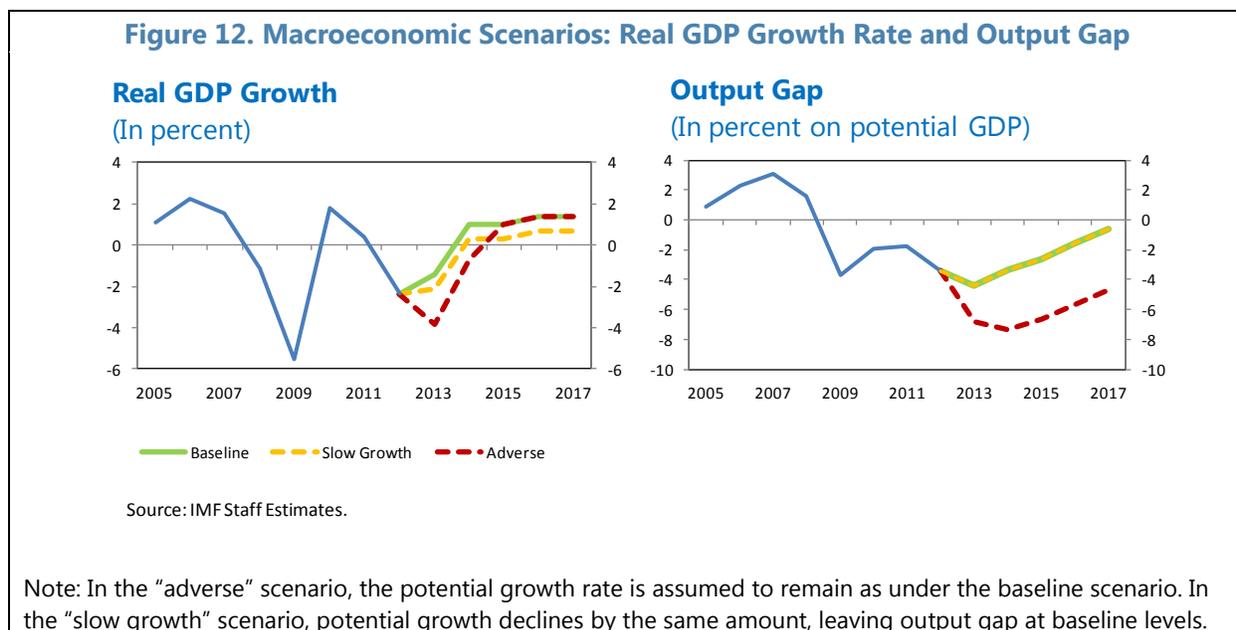
¹⁸ Prudential filter is also applied for other debt in AFS, while losses from equities and funds in AFS accounts are assessed without this filter.

scenarios are given in Figure 12. Other key macroeconomic variables¹⁹ are projected consistently with economic growth patterns and the nature of shocks using the BI's macroeconomic model. Sensitivity tests examine sovereign risk and credit concentration risk in isolation.

Macroeconomic stress scenarios

Slow growth scenario

21. The “slow growth” scenario examines the potential effects of Italy-specific issues that could hamper medium-term growth. In this scenario, domestic growth would be 0.7 percentage points below the baseline forecasts during 2013–2017, leaving the five-year cumulative GDP growth rate at -0.1 percent. Several factors could contribute to this. First, structural reform may be delayed by policy complacency and/or social opposition. The positive short-term effects of these reforms on growth may be less pronounced than originally anticipated or potential growth may decline due to hysteresis effects. Second, the implementation of the fiscal policies to meet structural balance targets may go off track or fiscal multipliers can be higher than expected, further fueling the downturn. Third, the weak growth rates would further hamper the stabilization of public debt, causing market interest rates to rise and refinancing conditions to worsen.



Adverse scenario

22. The “adverse” scenario considers an intensification of the euro area crisis. This scenario involves a decline in global trade along with a substantial drop in domestic demand due to further

¹⁹ The variables include real and nominal GDP, loans to nonfinancial sectors, short-term and long-term interest rates on government securities, interbank lending rate, oil price, USD/EUR exchange rate, private consumption deflator, unemployment rate, and house prices.

reduced lending to the real economy (credit crunch). As the euro area crisis intensifies, Italy experiences contagion because of the country's vulnerabilities, primarily due to the high sovereign debt burden and considerable roll-over needs. Elevated sovereign refinancing costs cause the banks' funding costs to increase, which discourages new lending. High interest rates and weak market sentiment causes consumer confidence and disposable household income to decline. This in turn reduces private consumption and investment. Demand-side shocks in Europe negatively affect Italian companies' export volumes, and reduce domestic output considerably by almost 6 percent over two years (Figure 12).

23. The resulting "adverse" scenario results in a severe overall contraction of GDP, including the contraction in the baseline forecast. The scenario assigns a 1¼ standard deviation shock (-4.2 percentage points) to the two-year cumulative real GDP growth rate for 2013–14 compared to the baseline. Since Italy is already in recession, it would result in the worst three-year cumulative growth rate and the highest negative output gap in the post-war period. The shocks are broadly comparable to other FSAPs that were conducted in the middle of distressed periods or severe recessions.

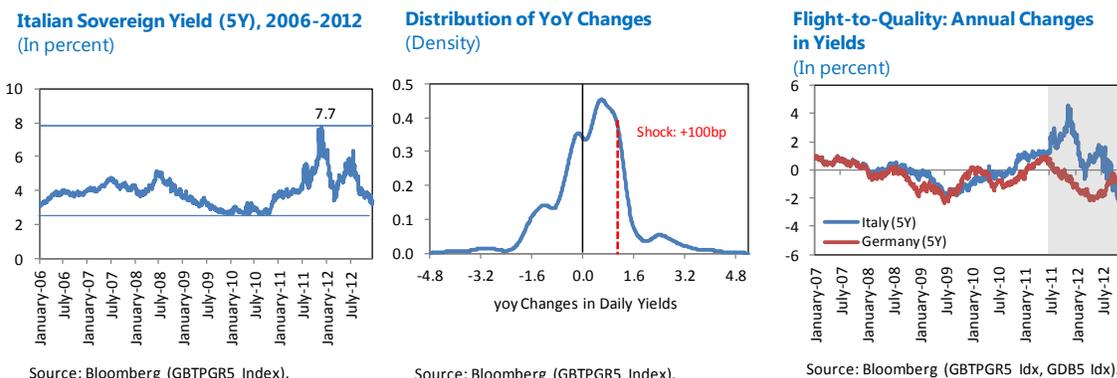
24. Sovereign yield shocks are determined based on their historical volatility (Figure 13).

- Baseline sovereign yields are set at forward rate as of end 2012. This forecast already implies a considerable rise in Italian sovereign yields, ranging from 30 to 160 basis points across maturities.²⁰ In the "slow growth" scenario the same assumptions are applied.
- The additional increase in Italian sovereign yields under the "adverse" scenario is derived from the historical distribution of daily year-on-year changes in bond yields for the 2006–2012 periods. A shock corresponding to the 80th percentile of the distribution, ranging from 80 to 110 basis points across maturities, is applied to the baseline yields. This will lift the five-year yields to the peak of 5.6 percent in 2014 (Figure 13, upper middle panel). Because baseline projection already includes considerable rise in yields, the overall increases of the yields in the "adverse" scenario compared to the end 2012 levels climb to 110–270 basis points across maturities, corresponding to the 95th percentile of the daily historical distribution during the 2006–2012 periods.

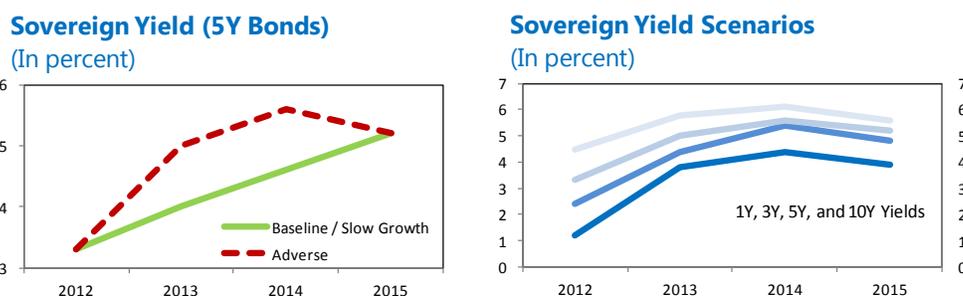
²⁰ Between January and mid-August 2013, the five-year yield has averaged 3.1 percent, 20 basis points lower than in the Baseline projection.

Figure 13. Sovereign Yields: Historical Development, Scenarios, and Implied Haircuts

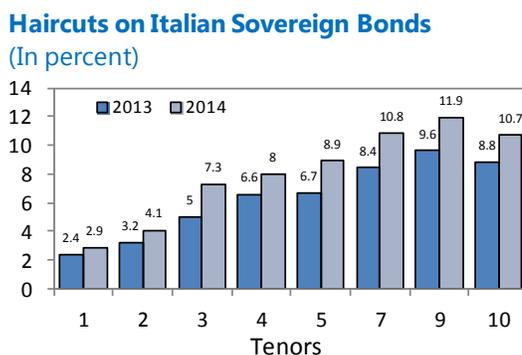
Historical development



Adverse scenario



Implied haircuts

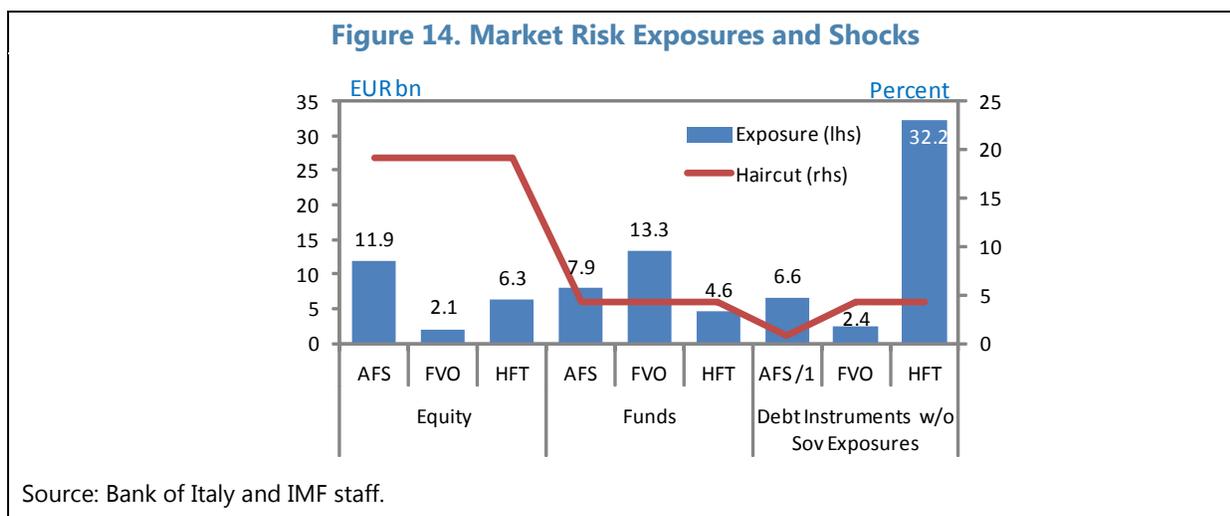


Sources: Bank of Italy, Bloomberg L.P. and IMF staff calculations.

25. Shocks from market risk exposures other than sovereign debt are assumed to materialize immediately and be permanent. Losses from market risk exposures are calculated by applying haircuts on these exposures. The haircuts on equities, investment funds, and corporate debt instruments²¹ are determined based on their historical volatilities, taking the 80th percentile of

²¹ These comprise debt instruments from Italian and foreign financial institutions and insurance companies, public companies, and any other bonds not issued by public companies or institutions.

the empirical distribution of their daily year-on-year changes (Figure 14). For equity, the distribution of a synthetic index (consisting of EUROSTOXX50, FTSE MIB, MSPE Idx, S&P500, NIKKEI) is applied over the period 2007–12, resulting in a haircut of 19.1 percent. For funds and non-sovereign debt instruments, the haircut represents both an interest rate risk component (approximated by annual changes of five-year Italian sovereign bond yields, accounting for a 2.5 percent haircut, corresponding to the 80th percentile of the historical distribution) and a liquidity risk component (approximated by the distribution of bid-ask spread of Italian covered bond yields, resulting in a 1.75 percent haircut), resulting in a 4¼ percent haircut.²² It is assumed that the shock materializes immediately and is permanent (i.e., bond prices do not recover).



Sensitivity tests

26. Sensitivity analyses focuses on Italian sovereign risk and credit concentration risk. In contrast to the scenario tests that examine the effects of multi-factor shocks over three to five years, sensitivity analyses consider single-factor shocks that are assumed to materialize immediately and to directly reduce capital. In addition, profits cannot be used as buffers. The tests are based on end-2012 data and, therefore, the capital definition and hurdle rates follow Basel II.

- **Sovereign risk.** The test assumes a 100 basis point parallel shift of Italian sovereign yield curve. This contrasts with a hike in sovereign spreads in the “adverse” scenario, ranging from 110 to 270 bps across maturities compared to end-2012 levels.
- **Credit concentration risk.** Concentration analysis investigates the effects of the default of each bank’s “large exposures,” as defined in the IMF’s Financial Stability Indicators (FSI), assuming an LGD of 45 percent.

²² Both haircuts are derived by calculating the changes in bond valuation for a given changes in yields using modified duration and convexity measures.

C. Credit Risk Models

27. Losses from credit risk depend on exposure at default (EaD), probability of default (PD), and loss-given default (LGD).

- When distressed, borrowers may try to withdraw a larger share of committed (but undrawn) credit lines, increasing EaD to levels above the outstanding amount of credit. This effect is incorporated by means of scenario-dependent credit conversion factors, which is 75 percent in the “adverse” scenario.
- PD is extracted from data on borrower defaults obtained from Italy’s central credit registry (CCR).²³ Default rates are grouped into eight sectors of economic activity.²⁴ For each sector, PD is measured as the annualized quarterly flow of “adjusted bad debt” relative to the total stock of loans. Borrowers with loans from different banks are considered “adjusted bad debt” when they are reported to the CCR as non-performing by at least one bank.
- Starting point levels of LGD are approximated by the coverage ratio for each of the (four) categories of NPLs as of end 2012, which includes the additional provisions set aside as a result of the BI inspection.

28. The BI and the FSAP team applied different approaches to estimate the PD and LGD in stress scenarios. Macrofinancial linkages are established by econometric credit risk models, using the same data covering the 1990–2012 periods.²⁵ The BI uses a Seemingly Unrelated Regression (SUR) model that estimates parameters for macroeconomic variables and a number of systematic risk factors. The FSAP team applied a dynamic state space regression model that incorporates a set of macroeconomic variables and an unobservable, latent credit risk factor that can be interpreted as a credit cycle. Both the BI’s and FSAP team’s tests consider increases in LGDs conditional on the scenario, but using different methodologies.

29. In both approaches, no mitigating managerial actions are incorporated. Managerial actions that can potentially soften the impact of shocks are disregarded, including deleveraging or divestment strategies, as well as any changes in business models (to generate new, additional income) or business mix (in response to stress).

²³ *Centrale dei Rischi*.

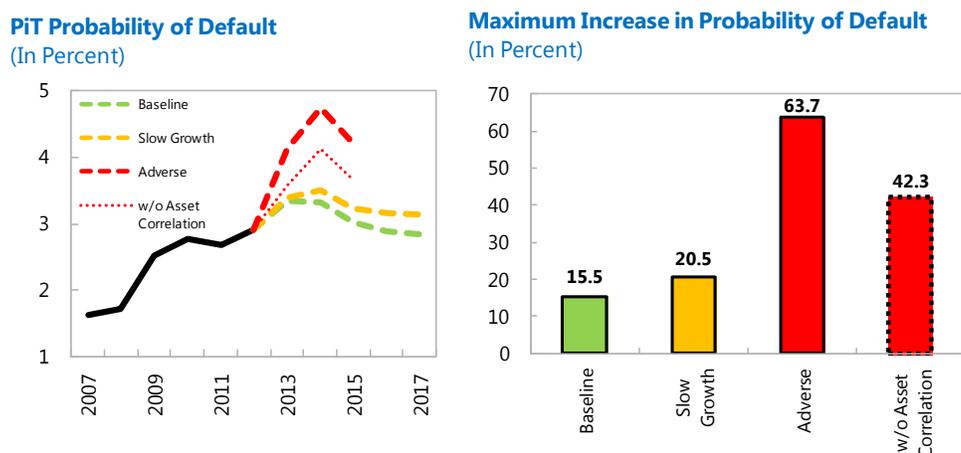
²⁴ The sectors under consideration were: agriculture; mining and quarrying; manufacturing; electricity, gas and water supply; construction; trade, hotels and restaurants; transportation, storage and communication; and other services. In addition to these corporate sectors, which include also producer households, consumer households constituted a separate class.

²⁵ The elasticity of PDs vis-à-vis macroeconomic variables are estimated using narrower definition of PD, measured by inflows to bad debt only in both of the IMF and BI models. This is because the data for broadly defined PD (inflows to all four NPL categories) are available only from 2005 when Basel II was implemented. However, the starting point PD is measured using the broader definition, and the predicted marginal rise in PD in the adverse scenario is severer than the actual rise during the 2008–09 recession periods, indicating that this approach is unlikely to underestimate the projected PD.

The BI's credit risk model and stress testing methodology

30. The BI credit risk model incorporates systematic macroeconomic factors and contagion factors.²⁶ Economy-wide default rates for each economic sector are assumed to be driven by 22 macroeconomic risk factors and an idiosyncratic component. Factor analysis is applied to obtain seven systematic latent factors, namely macroeconomic factors.²⁷ The idiosyncratic component is then measured by the residuals of this model for each of the eight economic sectors. Correlations between residuals for different sectors signal a cross-sectoral contagion effect. Factor analysis on the sectoral residuals indicates there are three common latent factors representing such contagion effects. Therefore, the first model is estimated again including these contagion factors. The final model estimates the default rates for each of the eight sectors using their lagged values, seven macroeconomic factors, and three latent factors capturing the contagion effects. In the “adverse” scenario, the forecasted PDs are further raised by 15 percent (chosen based on historical experience) in order to account for higher asset correlation during stress period. The IMF team’s stress testing framework considers this effect more traditionally by means of RWA changes.

Figure 15. Probability of Default in Stress Scenarios, BI Estimates



Source: Bank of Italy.

31. In the “adverse” scenario, the model implies substantial increases in PDs beyond what was observed between 2008 and 09. Figure 15 gives the projections of PDs under the three macroeconomic scenarios (left chart). Even under the baseline scenario, PDs continue to rise due to the weak expected economic growth in the short-term. As GDP recovers over the medium-term, PDs

²⁶ See Fiori, R., A. Foglia, and S. Iannotti, 2008, “Beyond macroeconomic risk: The role of contagion in corporate default correlation,” CAREFIN Research Paper No. 12/09 for further details on the methodology.

²⁷ Estimated latent factors are used instead of macroeconomic variables per se in order to balance the need for including as much as information and multicollinearity issues.

should come down but likely remain elevated at 2.8 percent. The protracted “slow growth” scenario suggests that PDs may remain above 3 percent even in 2017, well above the actual peak since the onset of the crisis. Under the “adverse” scenario, PDs may increase substantially to 4.7 percent in the near-term (including the 15 percent add-on for asset correlation).

32. LGDs increase as loans are re-classified to weaker NPL categories. The forecasted PDs are used to further estimate transitions of loans across different NPL categories (bad debt, substandard, restructured, and overdue loans). While LGDs for each category are assumed to remain constant, the average LGD for total loans increases as more loans are classified in weaker NPL categories with higher LGDs. Depending on the scenario, LGDs increase between 17.5 and 21.8 percent.

33. The balance sheet is assumed to be constant, except for the effects of Basel III. According to the Basel standards, RWAs decline if defaulted loans are written off and increase if the loan portfolio becomes riskier. The constant balance sheet assumption implicitly presumes the two effects cancel out. This is a conservative assumption, in particular for portfolios subject to the Basel standardized approach. However, RWAs change over time to incorporate Basel III impact. Tests have shown that in the case of the Italian banking system, a constant balance sheet assumption appears conservative.

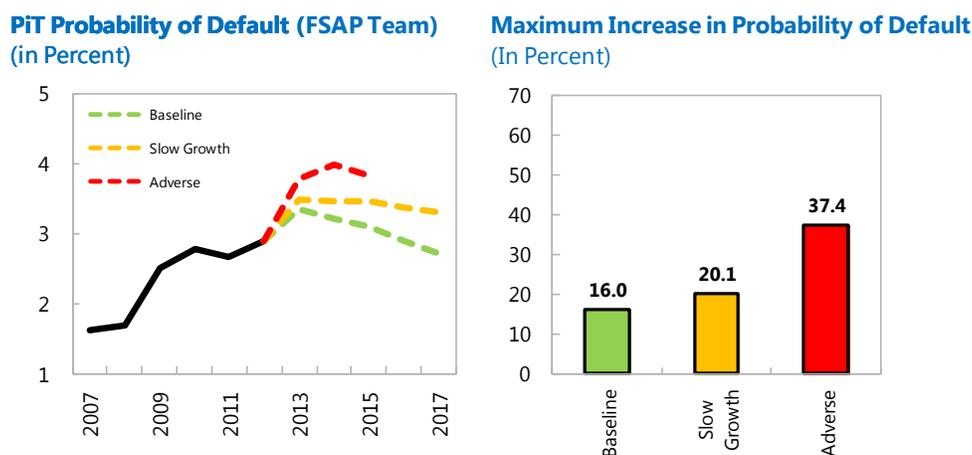
34. The BI uses an econometric profit model that forecasts banks’ gross operating profits conditional on macroeconomic variables. A reduced form model estimates net interest income and, separately, non-interest income as a function of macro and financial variables, including short and long-term interest rate, GDP, and stock prices. Half of all positive net operating income, if there is any after subtracting loan-loss provisions, is assumed to be retained for building up capital. The other half of positive net operating income is assumed to be absorbed by dividend payout and banks’ income taxes.

The FSAP team’s credit risk model

35. Separately, the IMF has estimated its own model for projecting PD. The team has applied a dynamic state space model that includes a time trend component that can be attributed to a unobservable aggregate credit cycle. The credit cycle is extracted from aggregate credit risk information using Kalman filtering techniques. Appendix 3 gives the details of this model.

36. BI and IMF credit risk model provide very similar and consistent outputs. In the baseline and “slow growth” scenarios, the projected PDs (Figure 16) are in line with those resulting from the BI’s model. Using the IMF’s model, the rise in PD in the “adverse” scenario is however slightly less pronounced (37 versus 42 percent increase when not corrected for the 15 percent add-on).

Figure 16. Probability of Default in Stress Scenarios, IMF estimates



Source: IMF staff estimates.

37. LGDs are driven by changes in collateral values. The reduction of collateral values in stress scenarios is approximated by the declines in house prices. In line with the macroeconomic scenarios, house prices are forecasted to decline by 7.5 percent in the “slow growth” and by 12.4 percent in the “adverse” scenarios. These compare to about a 4 (3½) percent actual cumulative decline since 2010 (2008). LGD changes are assumed permanent over the forecasting time-horizon.

38. Gross profits are projected focusing on interest income shocks. Rising interest rates increases both interest income and expenses. With limited pass-through, rising funding costs can reduce net interest income. The IMF model assumes this is indeed the case, using the elasticity found by a BI’s empirical study (Albertazzi and others, 2012),²⁸ which finds that a 100 basis points increase in the sovereign yields lead to 4 percent reduction of net interest income. Net interest income also declines when non-performing loans rises, as interest income reduces with rising nonperforming loans and lowered debt service. Other income (including fees and commissions) are kept at constant at 2012 levels. Overall, the IMF profit projection is less macro-sensitive than the BI model. Moreover, when a bank earns positive net income, after loan-loss provisions, the IMF model assumes that it is taxed at (flat) 25 percent rate. Dividend payout ratio for (positive) post-tax profit is assumed at 50 percent.

D. Results

39. The results suggest that the Italian banking system as a whole is able to withstand both the weak baseline outlook and the phase-in of Basel III, but its extra capital buffers would be depleted in the “adverse” scenario.

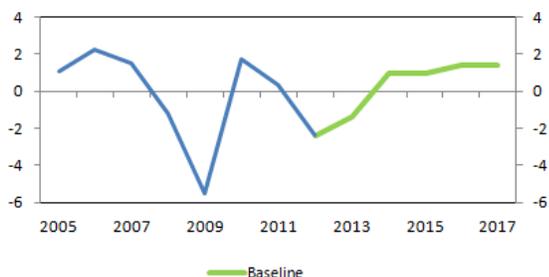
²⁸ Albertazzi, U., T. Ropele, G. Sene and F. M. Signoretti, 2012, “The Impact of the Sovereign Debt Crisis on the Activity of Italian Banks,” Banca d’Italia, Occasional Papers, No. 133, 2012.

- **Capital adequacy would remain well above the Basel III regulatory minima in the baseline for the system as a whole** (Figure 17). In contrast to the Fund team’s tests, BI results show rebounding capital ratios toward the end of the forecast period, mainly reflecting different approaches to projecting pre-impairment profits, where BI model shows stronger recovery in pre-impairment profit as GDP recovers. Ten banks (about one-seventh of system assets) would need to increase their capital to comply with Basel III requirements, but the shortfall—the sum of capital needed to bring each individual bank’s capital ratio to at least regulatory minima—would be very small (EUR 1.1 billion to the CET1 minimum requirement and EUR 3.4 EUR billion for the Tier 1 hurdle rate, or 0.1–0.2 percent of GDP) by the end of 2017.
- **The exact additional capital need depends on the quality of the capital.** Because of nonlinear substitution effects between Common Equity Tier 1 and Tier 1 capital under Basel III, the shortfall to the Tier 1 minimum requirement would be smaller than the estimates suggest if CET1 capital is used to fulfill the Tier 1 shortfall. The Tier 1 shortfall should therefore be seen as an upper bound.
- **In the “slow growth” scenario, system-wide capital ratios would decline over the medium term in both sets of tests, but would also remain well above Basel III minima** (Figure 18). In this scenario, 15 banks (about a quarter of the system by assets) would see their solvency ratios slip below regulatory minima, including some of the larger credit institutions. However, the total shortfall would again be small (EUR 5 billion for CET1 and EUR 10 billion for Tier 1, up to 0.7 percent of GDP) by 2017.
- **Losses under the “adverse” scenario would be more substantial, reducing system capital ratios by almost 40 percent, and the system-wide Tier 1 capital ratio would fall to just above the 6 percent Basel III minimum in 2015** (Figure 19). Credit losses would be the main driver of the shortfall in this scenario, while sovereign and other market losses and weak profitability²⁹ also contribute to the decline. The capital ratio for 20 banks (about one-third of the system) would fall below the minimum. However, for most of these, the shortfall would be very small, limiting the total shortfall for CET1 to EUR 6 billion, and to EUR 14 billion in terms of Tier 1 (up to 0.9 percent of GDP). This should be a manageable level for Italian banks, given the EUR 40 billion of new capital they raised since 2008, under very adverse conditions, and the EUR 7½ billion of additional provisioning they set aside in late 2012, following BI’s asset quality review.

²⁹ As indicated by the drivers of changes in CET1 ratio in Figure 17, the gross operating profit is forecasted conservatively, and remains below the already weak 2012 levels throughout the test’s forecasting time horizon.

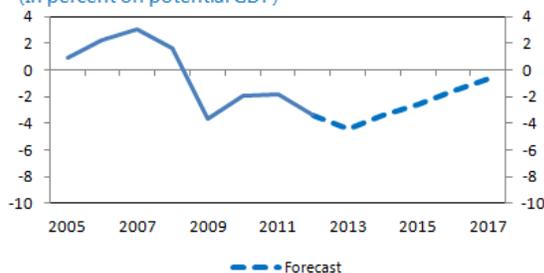
Figure 17. Solvency Stress Tests: Baseline Scenario

Real GDP Growth
(In percent)



Source: IMF staff estimates.

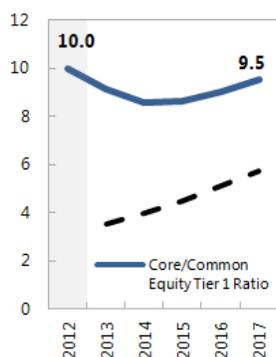
Output Gap
(In percent on potential GDP)



Source: IMF staff estimates.

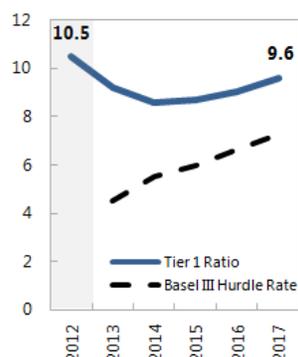
Bank of Italy Calculations

Core/Common Equity Tier 1
(In percent of RWA) /1



Source: Bank of Italy.

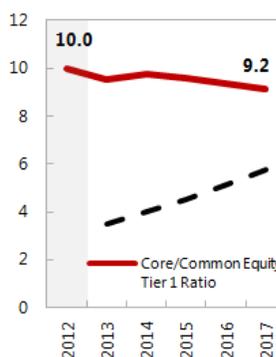
Tier 1 Capital
(In percent of RWA) /1



Source: Bank of Italy.

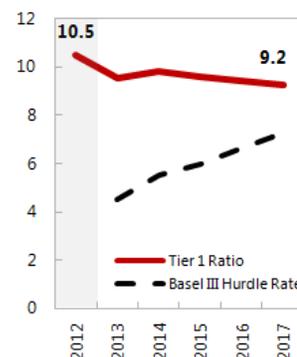
IMF Staff Calculations

Core/Common Equity Tier 1
(In percent of RWA) /1



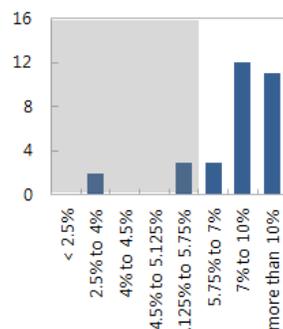
Source: IMF staff calculations.

Tier 1 Capital
(In percent of RWA) /1



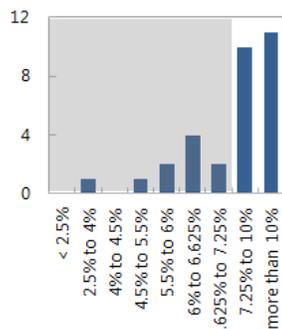
Source: IMF staff calculations.

Common Equity Tier 1 Ratios
(By number of banks, in 2017)



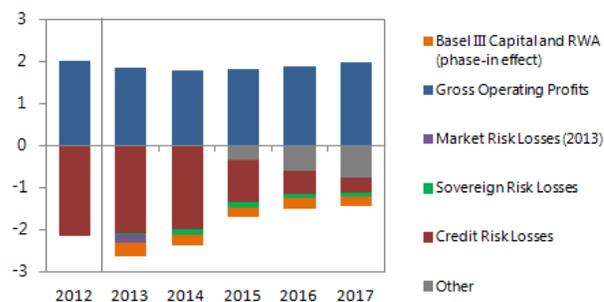
Source: Bank of Italy.

Tier 1 Ratios
(By number of banks, in 2017)



Source: Bank of Italy.

Drivers of Changes in Common Equity Tier 1 Ratio
(In percentage points)



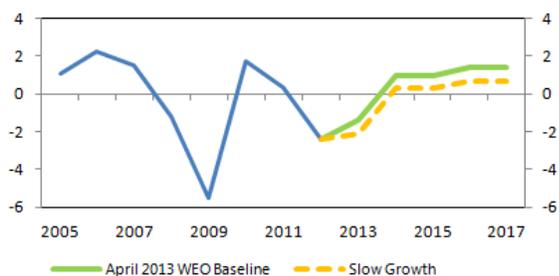
Source: Bank of Italy.

Notes:

/1 Ratios in 2012 according to CRD III (Basel 2.5). From 2013, capital definitions follow Basel III.

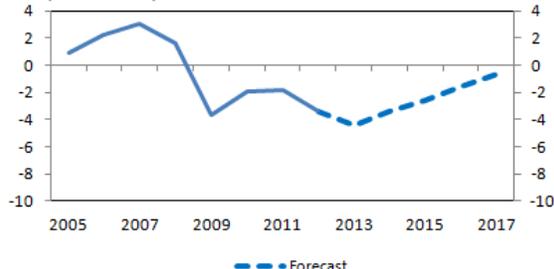
Figure 18. Solvency Stress Tests: "Slow Growth" Scenario

Real GDP Growth
(In percent)



Source: IMF staff estimates.

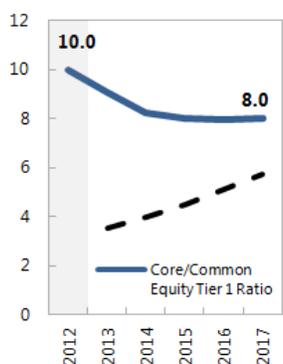
Output Gap
(In percent on potential GDP)



Source: IMF staff estimates.

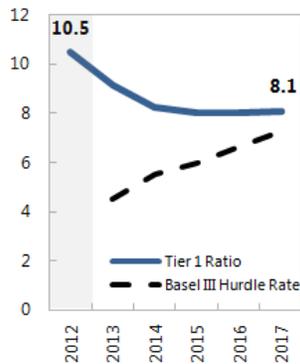
Bank of Italy Calculations

Core/Common Equity Tier 1
(In percent of RWA) /1



Source: Bank of Italy.

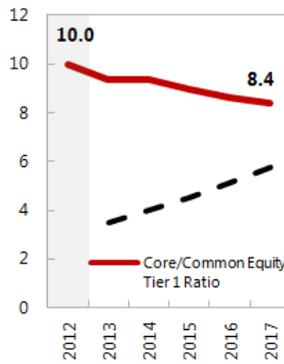
Tier 1 Capital
(In percent of RWA) /1



Source: Bank of Italy.

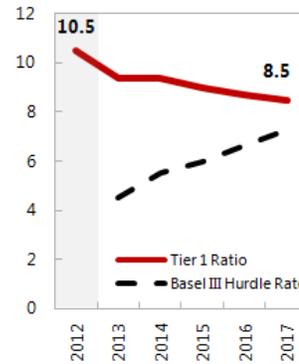
IMF Staff Calculations

Core/Common Equity Tier 1
(In percent of RWA) /1



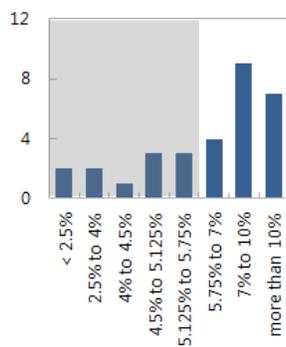
Source: IMF staff calculations.

Tier 1 Capital
(In percent of RWA) /1



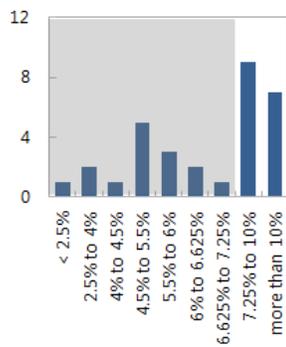
Source: IMF staff calculations.

Common Equity Tier 1 Ratios
(By number of banks, in 2017)



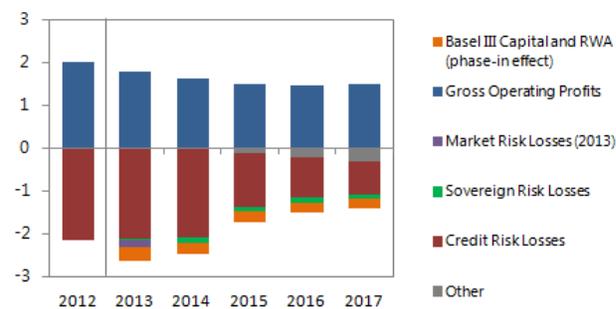
Source: Bank of Italy.

Tier 1 Ratios
(By number of banks, in 2017)



Source: Bank of Italy.

Drivers of Changes in Common Equity Tier 1 Ratio
(In percentage points)



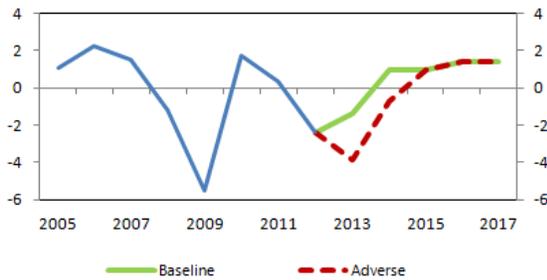
Source: Bank of Italy.

Notes:

/1 Ratios in 2012 according to CRD III (Basel 2.5). From 2013, capital definitions follow Basel III.

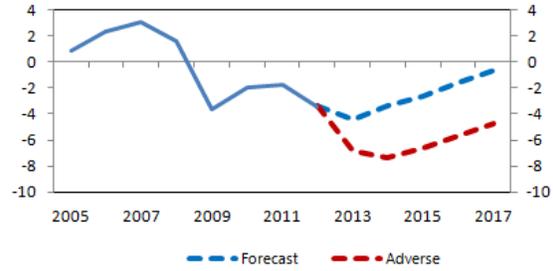
Figure 19. Solvency Stress Tests: "Adverse" Scenario

Real GDP Growth
(In percent)



Source: IMF staff estimates.

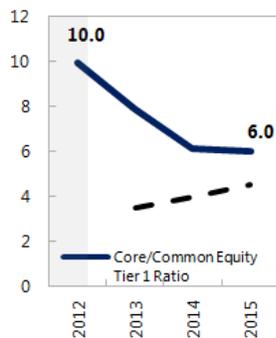
Output Gap
(In percent on potential GDP)



Source: IMF staff estimates.

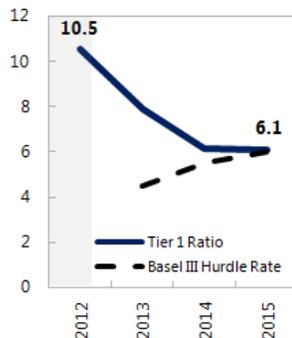
Bank of Italy Calculations

Core/Common Equity Tier 1
(In Percent of RWA) /1



Source: Bank of Italy.

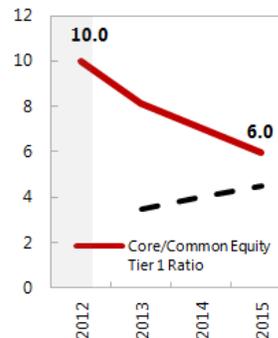
Tier 1 Capital
(In Percent of RWA) /1



Source: Bank of Italy.

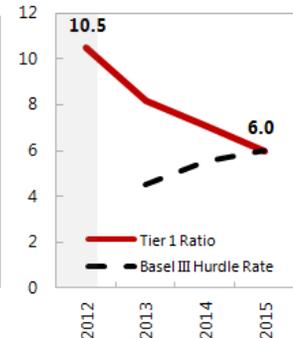
IMF Staff Calculations

Core/Common Equity Tier 1
(In Percent of RWA) /1



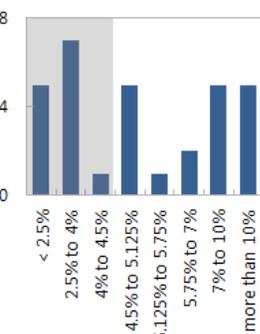
Source: IMF staff calculations.

Tier 1 Capital
(In Percent of RWA) /1



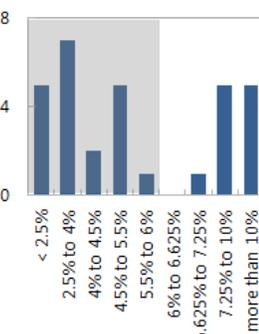
Source: IMF staff calculations.

Common Equity Tier 1 Ratios
(By number of banks, in 2015)



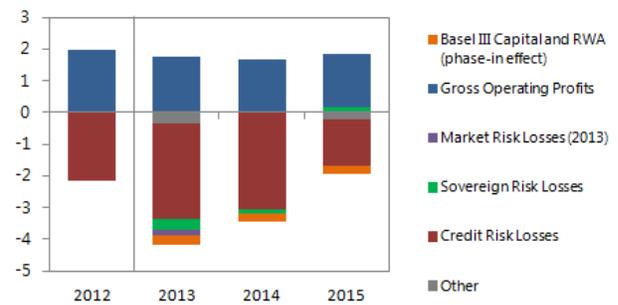
Source: Bank of Italy.

Tier 1 Ratios
(By number of banks, in 2015)



Source: Bank of Italy.

Drivers of Changes in Common Equity Tier 1 Ratio
(In percentage points)



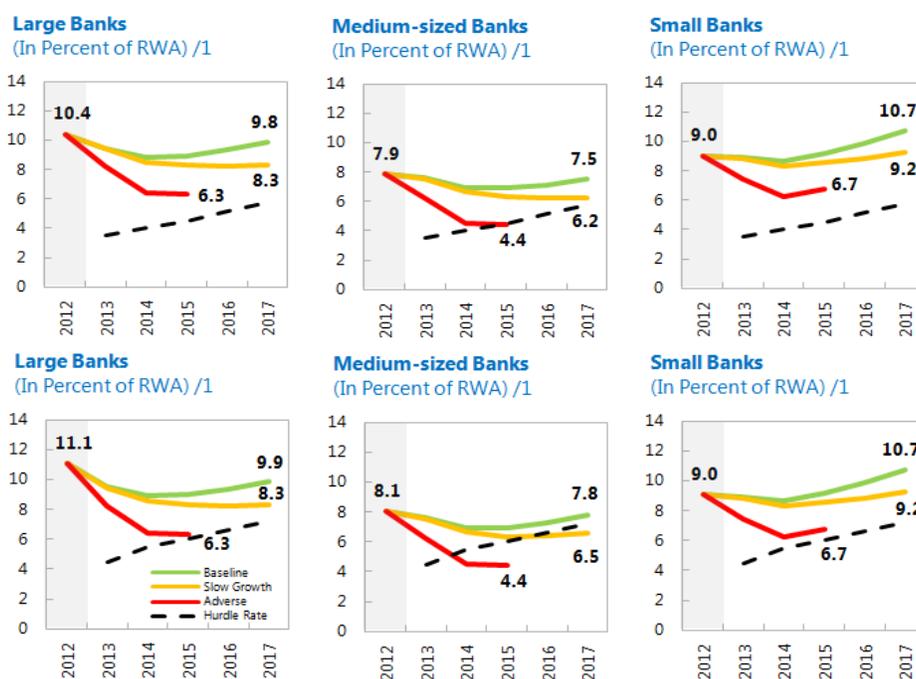
Source: Bank of Italy.

Notes:

/1 Ratios in 2012 according to CRD III (Basel 2.5). From 2013, capital definitions follow Basel III.

40. Examining the results by bank size shows that mid-size banks are relatively more vulnerable to stress (Figure 20).³⁰ These banks made the least progress in adding extra capital buffers in recent years (Table 2). Therefore, the combination of weak initial capital ratios at end-2012, relatively low operating profits under stress, and—to a lesser extent—higher impact from Basel III phase-in implies that the aggregate capital ratios for the mid-size bank group (banks ranked 11–20) would drop below hurdle rates in both the “slow growth” and the “adverse” scenarios. In contrast, both large (top 10) and small banks (the rest of the sample) as a group would maintain capital ratios at or above hurdle rates even in the “adverse” scenario (although some of the largest Italian banking groups would find themselves very close to regulatory minima in the latter).

Figure 20. CET 1 Ratios (Top) and Tier 1 Ratios (Bottom) According to Bank Size



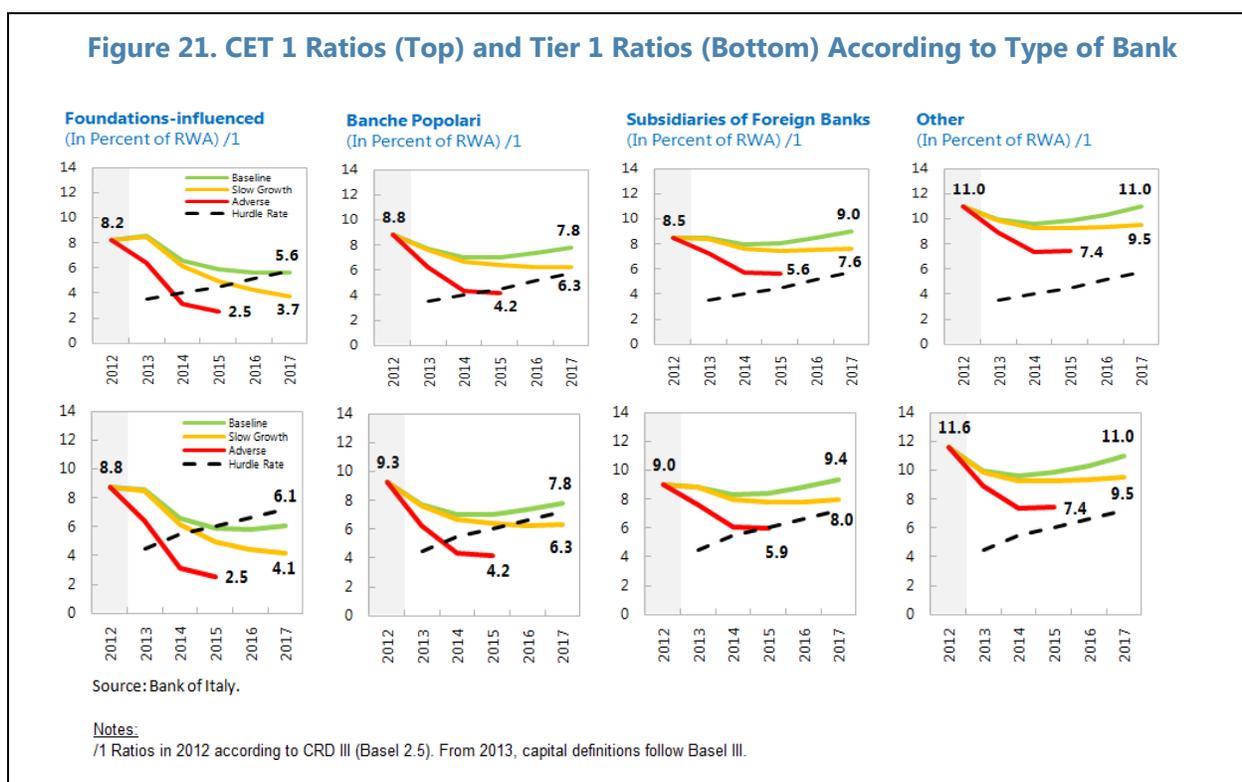
Source: Bank of Italy.
 Notes: /1 Ratios in 2012 according to CRD III (Basel 2.5). From 2013, capital definitions follow Basel III (CRD IV).

41. Grouping the results by type of ownership suggests that banks influenced by banking foundations³¹ and cooperative banks appear particularly vulnerable (Figure 21). Banks with a

³⁰ The grouping according to size and institutional ownership is done along two dimensions and, therefore, not exclusive. For instance, many of the medium-sized banks are cooperative banks and banks under considerable influence of foundations.

³¹ Banking foundations (*fondazioni*) are a distinctive feature of the Italian system. They were created in the 1990s during the process of bank privatization, when several state-owned banks were transformed into joint stock companies with the shares transferred to non-profit, typically locally-based foundations, private legal entities intended to pursue public interest or socially-oriented activities. Foundations were expected to diversify their holdings over time—and most did—but still have a significant presence in the Italian banking system. For more details, see section on Financial Sector Governance.

significant presence of banking foundations—defined as those in which foundations control at least 20 percent of shares—are the weakest link of the system. Even in the baseline, the aggregate capital ratio for this group would fall below hurdle rates. In the “adverse” scenario, the shortfall for this group would be up to EUR 3.2 billion (CET1) or EUR 5.4 billion (Tier 1), or up to 0.3 percent of annual GDP). The group of cooperative banks (*banche popolari*) would also not pass the test under the “adverse” scenario. Between them, these two groups of banks account for more than three-quarters of the total shortfall for the system as a whole in the “adverse” scenario. These results are attributable to the relatively lower profitability and weaker initial capital position of these banks, as well as a somewhat higher fraction of capital that is not eligible for Basel III CET1 and Tier 1 compared to the rest of the system.



42. In addition to scenario-based solvency tests, sensitivity tests were used to further explore bank vulnerabilities from Italian sovereign risk (Figure 22). The “adverse scenario” in the multi-factor stress test already includes a hike in sovereign spreads ranging between 110–270 bps across maturities compared to end-2012 levels. The direct impact on capital ratios from this hike amounts to 50 bps. This result reflects the fact that the stress is applied only to HFT and AFS portfolios of sovereign securities, and the impact on the latter is mitigated by the AFS filter,³² in line

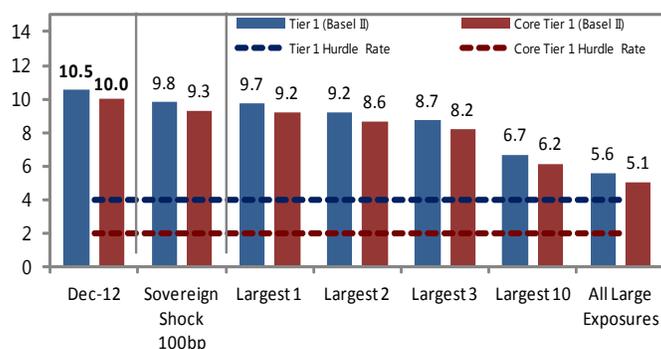
³² Under Basel II, the AFS filter allows a partial pass-through of unrealized mark-to-market gains and losses in the AFS portfolio to capital. This will be gradually phased out with the introduction of Basel III, which would require full pass-through.

with current regulations. To illustrate the full economic impact of sovereign distress regardless of regulatory treatment, this sensitivity test stressed the entire portfolio without applying the AFS filter. The impact is predictably higher: a 100 bps hike across all sovereign maturities would imply a 70 bps decline in capital ratios.

43. A separate sensitivity test on credit concentration suggests this risk is moderate (Figure 22). Credit concentration risk was assessed by simulating the default of the largest borrowers. In international perspective, credit concentration in Italian banks' loan portfolios is moderate, and the banks could digest the default of their largest clients (the default of *all* large exposures would reduce the banking system's capital by less than half).

Figure 22. Sensitivity Analyses for Sovereign and Credit Concentration Risk

Sovereign Shock and Credit Concentration Tests
(Capital in percent of RWA) /1



Source: Bank of Italy; IMF Staff Calculations.

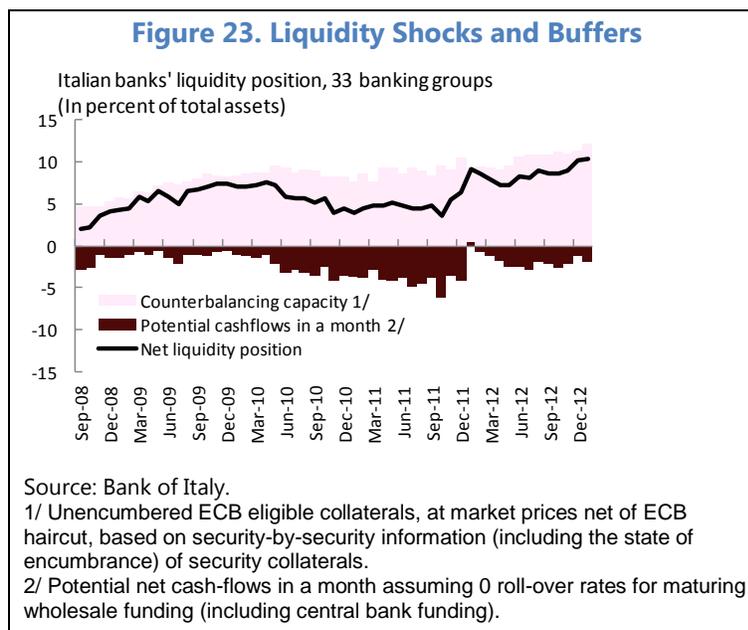
Notes:

/1 Capital ratios as of December 2012 (Basel II). Losses are directly calculated towards capital (i.e., profits do not mitigate the impact).

LIQUIDITY STRESS TESTS

A. Framework

44. Liquidity stress test builds on BI's weekly liquidity monitoring framework. The BI's regular weekly (sometimes daily) monitoring examines whether banks have enough eligible collateral (counterbalancing capacity) to prepare for the complete dry-up of wholesale funding for 30 days (potential cash-flows) for the largest 33 banks (Figure 23). The potential cash-outflows dropped visibly since the take up of the two LTROs in early 2012, which reduced the amount of maturing wholesale funding in the short-term horizon. The expansion of eligible collaterals has contributed to raise the counterbalancing capacity as well. The BI works with security-by-security level information to estimate the counterbalancing capacity, evaluated at market prices and net of ECB haircut.



45. The BI performed liquidity stress tests based on its existing liquidity monitoring and stress testing framework. A bank's ability to withstand a liquidity shock over a one-month time horizon is measured by its net liquidity position (NLP), as defined in BI's weekly liquidity monitoring template. This framework is very similar to the Basel III Liquidity Coverage Ratio (LCR),³³ and the main difference is scenario (namely, the assumptions on haircut for liquid assets and withdrawal rates for various liability items). BI's standard stress testing considers cash outflows (refinancing risk with wholesale funding, deposit outflows, and additional margin requirements for repo securities when their value declines) and reduction in counterbalancing capacity due to higher ECB haircut on sovereign and bank-issued securities because they are downgraded and their market values decline. The stress tests incorporate all the key liquidity risks for Italian banks and apply more conservative assumptions than the LCR (for instance, none of the maturing wholesale funding is assumed to be rolled over in our stress tests).

³³ Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tool, Basel Committee on Bank Supervision, January 2013.

B. Scenarios

46. The FSAP test considers two scenarios (see Appendix I for details).

- **Adverse scenario.** The scenario is motivated by the sovereign distress episode at end 2011, and applies similar or severer assumptions. Combined, these shocks are more extreme than the severe liquidity stress experienced at end-2011.
 - a) All maturing wholesale funding is assumed not to be rolled-over.³⁴
 - b) Deposits are withdrawn, following the maximum withdrawal rate experienced by each bank during the 2011–12 periods,³⁵ combined with the LCR-prescribed rates as floors.
 - c) Counterbalancing capacity declines with sovereign and bank downgrades. Italian sovereign is downgraded by one-notch by all four rating agencies recognized by the ECB, raising the ECB haircuts applied to Italian sovereign securities to the maximum possible level of investment grade sovereign securities. The scenario assumes two-notch downgrades to banks and their securities (including covered bonds), which would bring several Italian banks, including large banks, to below investment grade, making their securities ineligible for ECB operations.
 - d) The scenario also assumes a 150 bps jump in sovereign spreads, reducing counterbalancing capacity as well as increasing cash outflows due to additional margin requirements for repo positions (using sovereign securities as collaterals).
- **Alternative scenario.** The scenario focuses on market factors: it assumes the same shock to the adverse scenario, excluding deposit outflows but assuming severer shock on valuation losses (a 180 bps jump in sovereign yields).

C. Results

47. The results confirm that the ECB's long-term refinancing facility has reduced Italian banks' vulnerability to wholesale funding volatility substantially. The banking system can withstand the shocks in the adverse scenario (Figures 24), maintaining positive net liquidity position comfortably. Five small and medium-sized Italian and two foreign banks do not pass the test, mainly because of deposit withdrawal, but they represent an only small share of the system. Therefore, when only market factors are considered (Figure 25), almost all the banks, except for one Italian and one foreign bank, pass the test. The impact from the wholesale funding dry-up is small for the system and especially for top five banks, as LTROs have largely replaced their short-term wholesale funding (Figure 22).

³⁴ This compares to the minimum roll-over rate actually observed in the past since may 2011 over a one month horizon amounting to 70 percent for unsecured interbank funds and 45 percent for CD/CPs. Maturing central bank funding would not be rolled over, either. However, banks retrieve the collaterals, increasing counter-balancing capacity.

³⁵ Outflow rates of 5 percent for retail customers, 20 percent for corporate depositors, and 33 percent for sovereign and public sector entities.

48. Medium-sized and small banks, as well as foreign banks, are relatively more vulnerable—primarily because of higher deposit outflow risk. For the system, deposit outflows contribute the most to the declines in net liquidity position, followed by sovereign and bank downgrades. Downgrade risk is a key concern for all types of banks. Banks, other than top five, are generally more exposed to deposit outflows, in particular smaller banks. Medium-sized banks continue to face notable wholesale funding risks as well, making them the most vulnerable group among Italian banks. Overall, foreign banks are more sensitive to liquidity stress than Italian banks, owing to their weaker initial liquidity position and deposit withdrawal.

Figure 24. Liquidity Stress Tests: Adverse Scenario

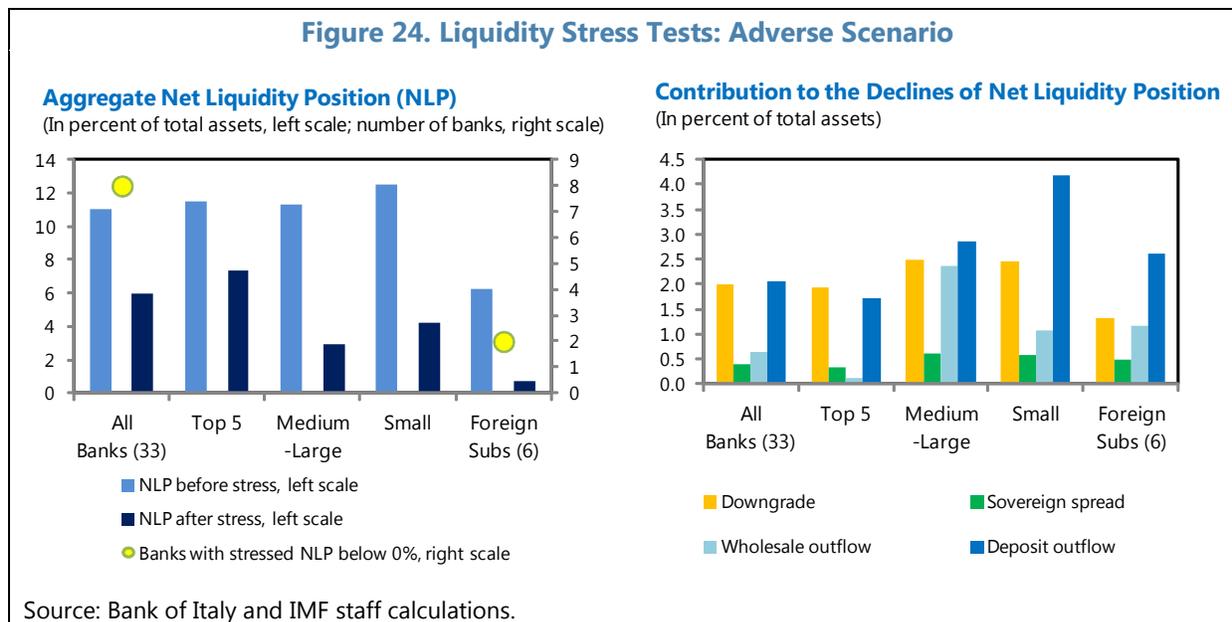
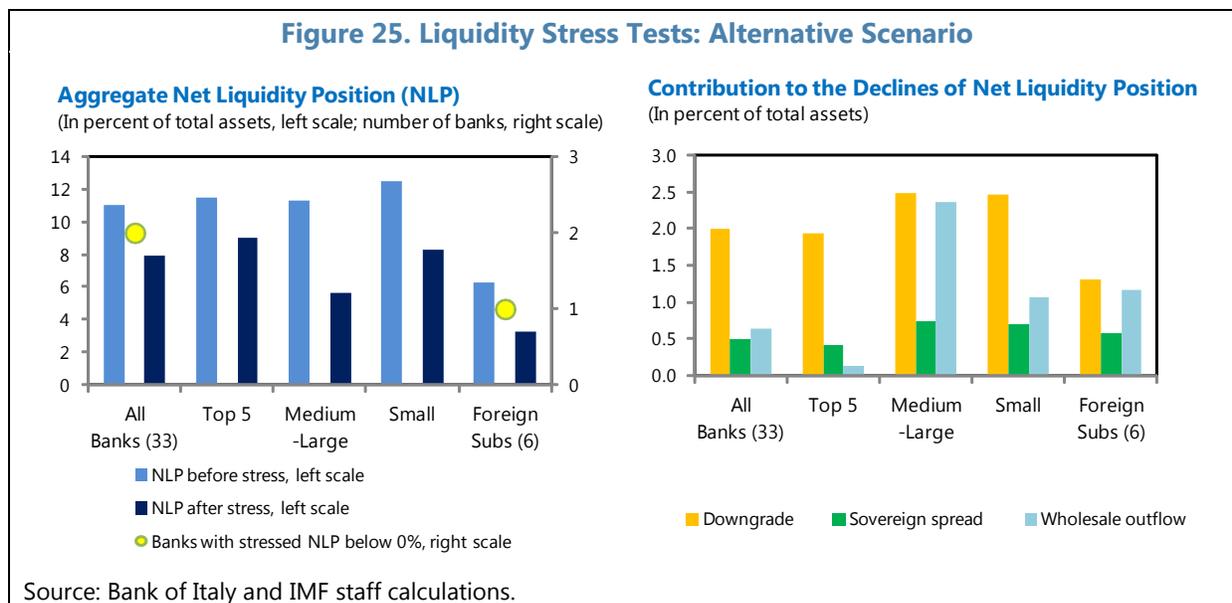


Figure 25. Liquidity Stress Tests: Alternative Scenario



OVERALL ASSESSMENT

49. FSAP stress tests are surveillance (macroprudential) stress tests, focusing on system-wide vulnerability against major tail risks, and are distinct from supervisory exercises.³⁶ FSAP stress tests are not meant to analyze individual financial institutions, but to identify potential (structural) weaknesses. Even though results may show the number of banks failing to meet hurdle rates, along with the corresponding capital shortfall, these results should only be interpreted as indicators of systemic vulnerability and not as an attempt to estimate actual recapitalization needs for these institutions. Individual banks that do not pass FSAP stress tests are not obliged to take remedial actions either.

50. Stress test results should always be interpreted with caution, especially in light of ongoing asset quality reviews. FSAP stress tests are based on market and supervisory data available at a certain point in time, without independent validation of these data. The results could be different if the ongoing inspections by BI or the forthcoming asset quality review by the ECB result in significant changes in the credit risk assessment of banks' current loan portfolio. More generally, stress tests provide estimates of the potential capital or liquidity shortfalls under hypothetical scenarios based on a number of simplifying assumptions, and do not fully incorporate second-round effects or the impact of policy responses to shocks. While some non-linear effects can be captured in such tests, it is always possible that unknown patterns emerge, especially if extreme shocks materialize. Renewed distress on the sovereign, for instance, could have more pervasive effects on financial stability beyond its direct impact on bank solvency and liquidity measured in stress tests. Last but not least, as in other FSAPs, these stress tests use Basel III regulatory minima as hurdle ("pass-fail") rates. But in fact, markets and regulators (through Pillar 2) may demand—and banks may have an incentive to target—higher capital ratios in order to keep funding costs below a certain level.

51. The fragile financial situation of the Italian corporate sector adds another layer of uncertainty. If the recovery is delayed or the economy weakens further, the corporates that are already over-leveraged—a significant share in the case of Italy—may face difficulty servicing existing bank debts, potentially forcing banks to increase the pace of write-offs and eroding their already thin profits.

52. With these caveats, the FSAP stress test results for Italy underscore the value of extra capital buffers above regulatory minima and ECB liquidity support in an uncertain economic environment. They validate the difficult and costly effort of those Italian banks that raised additional capital in the middle of the crisis. They also underscore the crucial role of ECB backstops that has reduced the exposure of Italian banks to volatile wholesale funding. These backstops need to continue until the European crisis is convincingly over and the Italian economy and financial system are on the path of sustainable recovery.

³⁶ See IMF Policy Paper "Macrofinancial Stress Testing: Principles and Practices," (2012) for details.

53. Based on this analysis, there is room for additional targeted financial sector action to shore up further the defenses of Italian banks. To be sure, the most important precondition for financial stability is to ensure macroeconomic stability, maintain prudent public finances—the only way to reduce sovereign risk permanently—and persevere with the structural reforms that will raise Italy’s growth rate. But until these policies bear fruit, targeted financial sector action, some of which have already been initiated by BI, can make an important contribution. Strengthening bank resilience would also help boost confidence and ultimately support the economic recovery.

- **Increase provisions.** Increasing provision coverage would not only strengthen Italian banks’ capacity to absorb losses, it would also bolster their credibility and ultimately improve market access. The BI targeted inspections already had an impact on bank provisions, and BI plans to extend this program. The forthcoming ECB asset quality review, likely to cover a broader sample of loans, will provide another opportunity to probe loan classification and collateral valuation practices. Changing the tax treatment of loan loss provisions to allow deductibility in the same tax year could also provide an important incentive in this regard. BI should also issue guidelines to ensure a minimum level of harmonization and strengthen prudential considerations in loan loss provisions and write-off practices.
- **Improve efficiency and profitability.** Following a wave of mergers during the last decade, Italian banks are yet to reap the full benefits of consolidation. In addition, the number of banks is still large, and Italy has more branches per capita than other European countries. There is thus room to improve further the cost structure in the short term. And over the longer term, further consolidation in the sector could generate more economies of scale.
- **Dispose of impaired assets.** Accelerating the disposal of impaired assets, for instance through NPL sales, would help clean up bank balance sheets. There is scope—and indeed considerable potential—for supporting market-based solutions that would allow banks to unburden their balance sheets. Although there are no legal or institutional impediments to the development of this market, accelerating the judicial process for foreclosing and debt restructuring could make a major contribution. However, for banks to realize the benefits to any such scheme, the key would be to ensure an effective transfer of credit risk to the buyer.
- **Strengthen capital plans, where needed.** At present, the Italian banking system as a whole appears to be able to meet comfortably regulatory minima under baseline projections. Stress test results underscore the benefit of extra capital buffers above regulatory minima in case of unforeseen shocks. These capital buffers should, as a minimum, be maintained.³⁷ In addition, some of the weaker banks—in particular among the cooperative banks and banks under considerable influence of banking foundations—need prompt capital planning aimed at building additional buffers, as several of them, without any action, would face difficulty complying with Basel III requirement even under the baseline. The BI has already taken

³⁷ This would also be consistent with the EBA recommendation issued in July 2013, subsequent to the FSAP.

action in this direction, including requiring additional Pillar 2 capital buffers (for Basel III and asset quality) and issuing guidelines on remuneration and dividend policy.

- **Strengthen medium-term funding plans.** The resilience shown in the liquidity tests largely reflects their short-term nature. Over the medium term, many banks will need to reduce further the funding gap and find viable alternative funding sources to prepare for the eventual expiration of the LTROs.

Appendix I. Stress Test Matrix (STeM): Solvency and Liquidity Risks

Banking Sector: Solvency Test			
Domain		Framework	
		Top-Down by Authorities	Top-Down by FSAP Team
1. Institutional Perimeter	Institutions included	<ul style="list-style-type: none"> • Bank by bank analysis for top 32 banking groups. • Excluding <i>Cassa Depositi e Prestiti</i>.¹ 	
	Market share	<ul style="list-style-type: none"> • Approximately 90 percent of total domestic and foreign banking sector assets. 	
	Data	<ul style="list-style-type: none"> • Cut-off date for balance sheet data: December 2012 (reflecting the increased provision as per BI's special inspection). • Consolidated, bank-by-bank supervisory data. • Scope of consolidation: banking group level (excluding the insurance arms but including other non-bank and cross-border subsidiaries). Two foreign banks' data are on unconsolidated basis. 	
	Exposures to be assessed	<p><u>Credit risk exposure</u></p> <ul style="list-style-type: none"> • Consolidated credit exposures to domestic and foreign customers, excluding interbank and public exposures. <p><u>Sovereign risk exposures</u></p> <ul style="list-style-type: none"> • Scenario analysis: Italian sovereign exposures in AFS, FVO and HFT, with AFS filter. • Sensitivity test: all Italian sovereign exposures regardless of the accounting treatment without AFS filter (phased out gradually following Basel III schedule). • Risks from foreign sovereign exposures are excluded. Most of the foreign sovereign securities are from Germany and other core euro area countries, where downside risks are minimal due to flight-to-quality effects. <p><u>Other market risk exposure</u></p> <ul style="list-style-type: none"> • Equity exposures. • Funds. • Sovereign and corporate debt instruments. • FX risk (endogenously modeled in macroeconomic scenarios). 	
2. Channels of Risk Propagation	Methodology	<ul style="list-style-type: none"> • BI top-down solvency stress testing framework; balance sheet-based approach. • Marked-to-market losses from securities including Italian sovereign. 	<ul style="list-style-type: none"> • Balance sheet-based solvency stress test for individual banks specifically developed for Italy FSAP. • Marked-to-market losses from securities including Italian sovereign.

	Satellite Models for Macro-Financial linkages	<ul style="list-style-type: none"> • <u>Econometric credit risk model</u>: Seemingly Unrelated Regression models including systemic components (Fiori and others, 2008). • <u>Gross Operating Profit</u>: Pre-impairment profit is forecasted based on GDP and other macroeconomic variables. 	<ul style="list-style-type: none"> • <u>Macro-financial model for credit risk</u>: Multi-factor dynamic state space model taking into account dynamic lag structures for macro variables. The credit cycle is explicitly modeled as an unobservable, latent factor, and integrated as an autoregressive state space process that evolves over time. • <u>Net interest income</u>: Interest margin declines in part due to increases in banks' funding costs (reflecting their empirical relationship with sovereign yields).
		<ul style="list-style-type: none"> • <u>Sovereign risk</u>: Marked-to-market losses are calculated by applying haircuts, calculated using modified duration (with convexity adjustment) corresponding to the yield changes. Possible marked-to-market gains from some sovereigns (e.g., due to flight-to-quality effects) are not incorporated. In sensitivity tests, valuation effects are proportional to the shock size (namely, the impact of a 200 bps shock is a double of the impact of a 100 bps shock). 	
	Stress test horizon	<ul style="list-style-type: none"> • 5 years for baseline and slow growth scenario. • 3 years for adverse scenario. • Instantaneous shocks in sensitivity analyses. 	
3. Tail shocks	Scenario analysis	<p><u>Macroeconomic variables are projected</u> using the BI macroeconomic forecasting model and IMF projection models for Italy and other countries/regions. Stress assumptions on sovereign yields, corporate debt yields, and equity as well as fund prices are calibrated from historical volatilities during 2006-2012.</p> <ul style="list-style-type: none"> • <u>Baseline scenario</u>: BI baseline projections (GDP growth very similar to WEO in April 2013). Sovereign yields are set at forward rates as of end 2012 (30-160 bps increases across maturities). • <u>Protracted slow growth scenario</u>: Growth is assumed 0.7 percentage points weaker than baseline each year during 2013-17 (resulting in growth rates of -2.4, -0.7, 0.3, 0.7, and 0.7 percent); cumulative growth over 5 years at -0.1 percent. Sovereign yields are set at forward rates as of end 2012 (30-160 bps increases across maturities). • <u>Adverse scenario (double-dip)</u>: Growth rates of -4.2 percent in 2013, -1.7 percent in 2014, and 1.0 percent in 2015; cumulative growth over 2 (3) years at -4.6 (-3.6) percent. Double-dip shock constitutes a 1¼ standard deviation move in two-year cumulative real GDP growth rate for 2013-14. While growth recovers in the third year, output gap remains. Sovereign yields increase by 80-110 bps across maturities compared to the baseline, corresponding to the 80th percentile of the empirical distributions for annual yield changes. This amounts to a 110-270 bps increase across maturities compared to end 2012, and this corresponds to the 95th percentile of the empirical distribution for annual yield changes. 	

	Sensitivity analysis	<ul style="list-style-type: none"> • <u>Sovereign risk</u>: a 100 basis point parallel shift in the Italian sovereign yield curve compared to end 2012 levels. • <u>Credit concentration risk</u>: Default of the largest, the largest three, five, ten, and all large exposures (according to FSI definition). LGD is set at 45 percent. 	
4.Risks and Buffers	Risks/factors assessed	<p><u>Exposures to sovereign</u></p> <ul style="list-style-type: none"> • Sovereign risks (Italy): mark-to-market valuation of securities in HFT and AFS/FVO. • In sensitivity test, HTM exposures were stress tested, too (banking and trading book). <p><u>Credit risk</u></p> <ul style="list-style-type: none"> • Estimated according to Basel II/III framework, i.e., $EaD \cdot PD \cdot LGD$. • Increasing asset correlations proxied by expert judgment (15% add-on to PDs under the adverse scenario). <p><u>Market risk other than sovereign</u></p> <ul style="list-style-type: none"> • Equity and funds price shock. • Debt instruments issued by private sector <p><u>Profits</u></p> <ul style="list-style-type: none"> • Estimated according to evolution of macroeconomic variables (satellite model). <p><u>Off-balance sheet (OBS) items</u></p> <ul style="list-style-type: none"> • Included using Credit Conversion Factor; • In adverse scenario, higher fraction of OBS exposures faces stress. • Securitization exposures are excluded as analysis revealed that the exposures no longer pose a threat to banks. <p><u>Cross-border exposures</u></p> <ul style="list-style-type: none"> • Credit risks from cross-border loan exposures in all economies, excluding interbank and 	<p><u>Exposures to sovereign</u></p> <ul style="list-style-type: none"> • Sovereign risks (Italy): mark-to-market valuation of securities in HFT and AFS/FVO. • In sensitivity test, HTM exposures were stress tested, too. <p><u>Credit risk</u></p> <ul style="list-style-type: none"> • Loan losses estimated according to Basel II/III framework, i.e., $EaD \cdot PD \cdot LGD$. • Asset correlations are reflected in changes of RWA as per Basel formula. <p><u>Market risks other than sovereign</u></p> <ul style="list-style-type: none"> • Equity and funds price shock. • Debt instruments issued by private sector <p><u>Profits</u></p> <ul style="list-style-type: none"> • Interest income declines for the amount of lost income from defaulted loans. • Interest expenses increase due to rising funding costs (in line with higher sovereign yields). • Net fee and commission income, and other income are kept constant at 2012 levels • No change in business models (i.e., no new income). <p><u>Off-balance sheet (OBS) items</u></p> <ul style="list-style-type: none"> • Included using Credit Conversion Factor; • Securitization exposures are excluded as analysis revealed that the exposures no longer pose a threat to banks. <p><u>Cross-border exposures</u></p>

		<p>public loans.</p> <p><u>Basel III phase-in</u></p> <ul style="list-style-type: none"> The effects on capital components and RWA are estimated by BI in consultation with individual banks for each year of the forecasting time-horizon. 	<ul style="list-style-type: none"> Credit risks from cross-border loan exposures in all economies, excluding interbank and public loans. <p><u>Basel III phase-in</u></p> <ul style="list-style-type: none"> The effects on capital components and RWA are estimated by BI in consultation with individual banks for each year of the forecasting time-horizon.
	Behavioral adjustments in macro scenario tests	<p><u>Balance sheet</u></p> <ul style="list-style-type: none"> Constant balance sheet and RWA, except for the impact of Basel III EaD under stress increases about 20 percent, reflecting higher use of committed but previously unused credit lines (using a CCF of 75 percent). Maturing assets are replaced by exposures of the same type and risk. No changes to credit portfolio or funding structure. No credit growth. <p><u>Retained earnings</u></p> <ul style="list-style-type: none"> No payout or tax effects. <p><u>Realization of Losses</u></p> <ul style="list-style-type: none"> Losses are recognized in the same year when a shock hits (no gradual recognition over time is allowed). Elimination of prudential filter on AFS portfolio (unrealized gains and losses) as foreseen under Basel III (20 percent a year). 	<p><u>Balance sheet</u></p> <ul style="list-style-type: none"> Time-varying RWA according to regulatory Basel II/III framework. No changes to credit portfolio or funding structure. No credit growth. No strategic asset disposals or other managerial responses are allowed. Maturing assets are replaced by exposures of the same type and risk. <p><u>Retained earnings</u></p> <ul style="list-style-type: none"> Dividend payout: 50 percent payout ratio. Positive net operating income is taxed at 25 percent. <p><u>Realization of Losses</u></p> <ul style="list-style-type: none"> Losses are recognized in the same year when a shock hits (no gradual recognition over time is allowed) Elimination of prudential filter on AFS portfolio (unrealized gains and losses) as foreseen under Basel III (20 percent a year).
5. Regulatory and Market-Based Standards and Parameters	Calibration of risk parameters	<p><u>Parameter definition</u></p> <ul style="list-style-type: none"> Point-in-time (PiT) PDs and LGDs. Starting point RWA is measured with through-the cycle (TTC) approach. 	<p><u>Parameter definition</u></p> <ul style="list-style-type: none"> Point-in-time (PiT) PDs and LGDs. Starting point RWA is measured with through-the cycle (TTC) approach. Additional changes are driven by point-in-time (PiT) PDs and LGDs.

		<p><u>Parameter calibration</u></p> <ul style="list-style-type: none"> Starting point PD is proxied by inflows into four NPL categories over total loans, including transitions across different categories. Evolution of PDs under stress determined by SUR model incorporating three systematic factors. Initial LGDs are approximated by actual coverage ratios. The coverage ratios as of December 2012 data reflect the results of the BI's on-site inspections performed in early 2013. In each scenario, loan migrations across different NPL categories increase LGDs (at least 20 percent on average across banks). 	<p><u>Parameter calibration</u></p> <ul style="list-style-type: none"> Starting point PD is proxied by inflows into four NPL categories over total loans, including transitions across different categories. Evolution of PDs under scenarios is forecasted using dynamic credit risk model estimates incorporating latent aggregate credit cycle. Initial LGDs are approximated by actual coverage ratios. The coverage ratios as of December 2012 data reflect the results of the BI's on-site inspections performed in early 2013. LGDs remain constant in baseline scenario. They increase in stress scenarios in line with house prices, as projected in macroeconomic scenarios. Bank specific LGDs increase by 7.5 and 12.4 percent under the slow growth and the adverse scenario, respectively. These shocks are assumed instantaneous and persistent.
	Regulatory standards	<p><u>Scenario analysis</u></p> <ul style="list-style-type: none"> Capital definition according to Basel III / CRD IV, including Common Equity Tier 1, and Tier 1. Capital components that is no longer eligible for CET1 and Tier 2 capital components are phased out gradually, as in other stress tests in recent G7 and euro area FSAPs. Hurdle rates (including conservation buffer) follow Basel III minimum and phase-in arrangements, including Capital Conservation Buffer on top of all capital definitions. No SIFI surcharges were applied. Treatment of prudential AFS filter according to Basel III phase-in, i.e. 20% a year. <p><u>Sensitivity analysis</u></p> <ul style="list-style-type: none"> Since the reference date was Dec-2012, Basel II capital definitions were applied. Unrealized losses from AFS portfolio is assessed without AFS filter. 	
6. Reporting Format for Results	Output presentation	<p><u>Scenario analysis</u></p> <ul style="list-style-type: none"> Evolution of CET1 and Tier 1 capital ratios over time, for system as a whole and specific groups of banks (by size: top 10 banks, top 11-20, and top 21-32; by type of institutions: cooperative banks (<i>banche popolari</i>), banks under considerable influence of banking foundations, subsidiaries of foreign banks). Evolution of risk parameters resulting from satellite models. Contribution of key drivers to aggregate results, expressed in terms of CET 1 ratio. Distribution of individual banks' capital ratios; Number of banks and share of total assets below hurdle rates. Capital shortfall under each scenario resulting from the aggregation of each bank's individual capital 	

		<p>shortfall (in absolute terms and in relation to annual GDP).</p> <p><u>Sensitivity analysis</u></p> <ul style="list-style-type: none"> • Changes in capital ratios for banking system as a whole. • Associated recapitalization costs, if any.
<p>Notes: CRD IV, Capital Requirements Directive IV; CCF, Credit Conversion Factor; EaD, Exposure at Default; LGD, Loss Given Default; TTC, Through-the cycle; PD, Probability of Default; PIT, Point-in-time.</p> <p>1/ The CDP is a specialized lending entity majority owned by the government. It funds itself mostly with postal and customer deposits, and it is required to deposit the liquidity provided by postal savings on an account at the treasury, which makes up nearly a half of its assets.</p>		

Source: IMF staff.

Banking Sector Liquidity Risk		
Domain	Bank of Italy in collaboration with FSAP team	
1. Institutional Perimeter	Institutions included	<ul style="list-style-type: none"> • Top 33 banks, including 6 foreign banks' subsidiaries, bank by bank analysis. • Excluding <i>Cassa Depositi e Prestiti</i>.¹
	Market share	<ul style="list-style-type: none"> • Together more than 90 percent of the sector's total assets.
	Data and base date	<ul style="list-style-type: none"> • BI's standard weekly liquidity monitoring data on consolidated basis (except for foreign banks), covering short, medium and long term maturities for both retail deposits and wholesale funding, including durations. • Supervisory information/ data on sovereign risk, collaterals, and retail deposit volatility in weekly/monthly time intervals. • Base date: Liquidity position data as of end 2012. Rating and other market valuation data as of March 2013.
2. Channels of Risk Propagation	Methodology	<ul style="list-style-type: none"> • Liquidity stress for 30 days. • Cash outflows due to refinancing risks with wholesale funding and deposit outflows. • Reduction of liquidity buffer owing to sovereign and bank downgrades (which can increase haircuts set by the ECB) and declines of market valuation of sovereign securities.
3. Risks and Buffers	Risks	<ul style="list-style-type: none"> • Funding liquidity shock, involving deposit withdrawal and complete loss of wholesale funding.
	Buffers	<ul style="list-style-type: none"> • Unencumbered securities eligible for ECB collaterals, assessed at market values net of ECB haircut at security-by-security levels (i.e., "counterbalancing capacity").
4. Tail shocks	Size of the shock	<p><u>Adverse scenario (motivated by actual distress experience at end 2011)</u></p> <ul style="list-style-type: none"> • Refinancing risk with wholesale funding: 0 percent roll-over rate for maturing wholesale funding (including central bank funding). • Changes of ECB haircut caused by multiple downgrades: one-notch downgrade to sovereign by all four rating agencies (causing jumps in ECB haircut to the highest possible levels for sovereign securities that remain eligible for ECB operation without a program); and two-notch downgrade to banks by all four rating agencies (some banks, including large ones, lose investment grade as a result, and therefore their securities become ineligible for ECB operations) including their covered bonds and asset backed securities. • Increased volatility of deposits: deposit outflows (5 percent for retail customers, 20 percent for corporate depositors, and 33 percent for sovereign and public entities). Outflow rates are estimated as the maximum experienced by each bank in 2011-12 periods with LCR-prescribed outflow rates as floors. • Widening credit spreads: a 150 bps jump in Italian sovereign yields, which increases haircut as well as margin requirements for repo positions.

		<p><u>Alternative scenario focusing on market factors</u></p> <ul style="list-style-type: none"> • Same assumption on refinancing risks and changes with ECB funding as in adverse scenario. • No deposit outflows. • Widening credit spreads: a 180 bps jump in Italian sovereign yields.
5. Regulatory and Market-Based Standards and Parameters	Regulatory standards	<ul style="list-style-type: none"> • Maintaining net positive liquidity position (i.e., counterbalancing capacity above potential cash outflows in stress scenario in 30day horizon).
6. Reporting Format for Results	Output presentation	<ul style="list-style-type: none"> • Changes in net liquidity position and counterbalancing capacity for each scenario. • Results drivers of banks' liquidity position and counterbalancing capacity, for each scenario. • Number of banks (pass rates) below minimum requirement, for each scenario. • Differentiation between foreign-owned banks operating in Italy and Italian banks (top five, large-medium sized and small-sized).
<p>1/ The CDP is a specialized lending entity majority owned by the government. It funds itself mostly with postal and customer deposits, and it is required to deposit the liquidity provided by postal savings on an account at the Treasury, which makes up nearly a half of its assets.</p>		

Source: IMF staff.

Appendix II. Cassa Depositi e Prestiti

53. Cassa Depositi e Prestiti (CDP) plays a unique role in the Italian financial system. From 1983 to 1999, the CDP was a government department with separate legal personality and full independence, engaging in activities of general economic interest. In 2003, CDP was transformed into a joint stock company (CDP SpA). Since 2006, the company has been subject to reserve requirements. Three years later, regulatory changes expanded the scope of operations significantly, including direct financing of projects of public interest, social housing, SME support, export finance, investments in private equity funds, and project finance. In 2011, the CDP established the *Fondo Strategico Italiano*, which can take equity stakes in companies that are of major national interest.

54. CDP has become the main shareholder of Italian companies operating both domestically and abroad. Corporate governance is undertaken by a board of directors and a board of auditors, flanked by a steering committee and the Preference Shareholders Support Committee. The liability structure is conservative, with 83 percent of total funding from postal and customer deposits, 7 percent from banks, and 3 percent from the company's bond holdings. The CDP is required to deposit the liquidity provided by postal savings on an account at the Treasury, and this balance makes up 44 percent of the asset side. Together with cash, cash equivalents and interbank deposits this constitutes almost half of total assets. Loans to customers constitute 36 percent of the asset side, debt securities 6 percent, and equity investments and shares 7 percent.

55. The Republic of Italy is legally required to hold majority ownership in CDP, and to unconditionally guarantee postal savings products. 70 percent of the company's equity is owned by the state. The rest is held by a broad group of domestic bank foundations. Bank of Italy, in turn, is asked to supervise CDP's activities that are of public interest—based on the regulatory and control powers according to the banking law for nonbank intermediaries (Law Decree No. 269/2003, Art. 5, Para. 6), taking into account the characteristics of the institution. CDP is also subject to on-site inspections and weekly liquidity monitoring by the central bank.

56. The market understands the state would support CDP in case capital or liquidity needs arise, generating fiscal liabilities. Like the German *Kreditanstalt für Wiederaufbau* (KfW) and the French *Caisse des Dépôts et Consignations* (CDC), CDP is a nonbank public lending entity that does not enter the public debt definition. CDP's close ties with the Italian state are reflected by its credit rating; agencies typically assign the CDP and the Republic of Italy the same credit worthiness.

Appendix III. IMF Credit Risk Model

57. IMF staff projects PDs using a dynamic state space model. The dynamic state space model incorporates an unobserved, latent state variable that can be interpreted as the credit cycle. In order to track the dynamics of the banking system's credit cycle, the latent state variable is assumed to follow an autoregressive process. The dynamic model consists of a credit risk (measurement) equation and the credit cycle (state space) equation:

$$\begin{aligned} y_t &= \Omega X_t + F_t \theta_t + v_t & v_t &\sim iid N(0, V_t) \\ \theta_t &= G_t \theta_{t-1} + w_t & w_t &\sim iid N(0, W_t) \end{aligned}$$

$X_{j,t}$ is a vector of macroeconomic and financial predictor variables and $t \in \{1, 2, \dots, T\}$. θ_j is the vector of state variables representing credit cycle. v_j and w_j are the error terms. To estimate the state vector, the conditional densities $\pi(\theta_t | y_{1:t})$ have to be computed.

58. In the expectations step, the credit cycle is extracted using Kalman filtering techniques. The likelihood of the measurement equation is maximized with respect to the parameter set. The Kalman filter (smoother) is a set of recursion equations that determines optimal estimates of the state vector, conditional on the information available at time t . In order to describe the Kalman filter, let m_t be the optimal estimator of θ_t conditional on $y_{1:t}$ and the *mean square error* (MSE) matrix of the optimal estimator of state vector C_t be given by

$$E[(\theta_t - m_t)(\theta_t - m_t)' | y_{1:t}].$$

Then, given m_{t-1} and C_{t-1} , the optimal predictor of θ_t and the associated MSE matrix are:

$$\begin{aligned} m_{t|t-1} &= E[\theta_t | y_{1:t-1}] = G_t m_{t-1} \\ C_{t|t-1} &= E[(\theta_t - m_{t|t-1})(\theta_t - m_{t|t-1})' | y_{1:t-1}] \\ &= G_t C_{t-1} G_t' + W_t \end{aligned}$$

The corresponding optimal predictor of y_t is given by $y_{t|t-1} = E[y_t | y_{1:t-1}] = F_t m_{t|t-1}$. The prediction error and its MSE matrix are then

$$\begin{aligned} e_t &= y_t - y_{t|t-1} = y_t - F_t m_{t|t-1} \\ &= F_t (\theta_t - m_{t|t-1}) + v_t \\ E[e_t e_t'] &= F_t C_{t|t-1} F_t' + V_t = Q_t \end{aligned}$$

Each time new observations become available, the optimal predictor of $m_{t|t-1}$ and the associated MSE matrix are updated by:

$$\begin{aligned}
m_t &= m_{t|t-1} + C_{t|t-1} F_t' Q_t^{-1} (y_t - F_t m_{t|t-1}) \\
&= m_{t|t-1} + C_{t|t-1} F_t' Q_t^{-1} v_t \\
C_t &= C_{t|t-1} - C_{t|t-1} F_t' Q_t^{-1} F_t C_{t|t-1}
\end{aligned}$$

Using Kalman smoothing recursions, and proceeding backwards for $t = T - 1, \dots, 1$, the optimal estimates of $E[\theta_t | y_{1:T}]$ can be calculated by:

$$\begin{aligned}
E[\theta_t | y_T] &= m_t + C_t^* (m_{t+1|T} - G_{t+1} m_t) = m_{t|T} \\
E[(\theta_t - m_{t|T})(\theta_t - m_{t|T})' | y_T] &= C_t + C_t^* (C_{t+1|T} - C_{t+1|T}) C_t^{*'} = C_{t|T} \\
C_t^* &= C_t G_{t+1}' C_{t+1|T}^{-1}
\end{aligned}$$

59. In the State Space model, the parameter vector λ for the system matrices is estimated based on maximum likelihood using the *prediction error decomposition (PED)* of the log-likelihood. Let $f(y_t | y_{t-1}; \lambda)$ be the conditional density of y_t , given the data y_{t-1} , the maximum likelihood estimate of the parameter vector can be described by

$$\lambda = \arg \max_{\lambda} \ln L(\lambda | y) = \sum_{t=1}^T \ln f(y_t | y_{t-1}; \lambda),$$

and the PED of the Gaussian log-likelihood function is given by:

$$\ln L(\lambda | y) = -\frac{NT}{2} \ln(2\pi) - \frac{\sum_{t=1}^T \ln |Q_t(\lambda)|}{2} - \frac{\sum_{t=1}^T e_t'(\lambda) Q_t^{-1}(\lambda) e_t(\lambda)}{2}.$$