



# ITALY

## TECHNICAL NOTE ON INTERCONNECTEDNESS AND SPILLOVER ANALYSIS

December, 2013

This Technical Note on Interconnectedness and Spillover Analysis 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 July 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

July 2013

# TECHNICAL NOTE

## INTERCONNECTEDNESS AND SPILLOVER ANALYSIS

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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## INTRODUCTION<sup>1</sup>

**1. Tracing the key channels of transmission across institutions, sectors, and countries in a tail risk scenario is an important element of systemic risk assessment.** In a systemic distress scenario, there could be unusual and disproportionately large feedback effects that may not be present during a normal time. For instance, in Italy, the domestic bank-sovereign linkage has been strong as the European debt crisis deepened and the high sensitivity of Italian sovereign yields to euro area-wide development exposes banks to euro area sovereign shocks through funding channels and direct losses from sovereign securities. Spillovers into and out of Italy could stem from other channels. The largest banks have cross-border exposures and face foreign credit and market risks. Disruptions to intra-banking-group liquidity transfers can also raise the overall cost of funding. At the same time, the largest banks have a significant presence in some Central European countries.

**2. An assessment of interconnectedness and spillovers can complement bank stress tests.** Bank stress tests<sup>2</sup> conducted in the context of the Financial Sector Assessment Program (FSAP) have evaluated the impact on banks from the Italian sovereign, the real economy, and the corporate and household sectors, including credit exposures to foreign borrowers, using granular bank balance sheet data. But they do not provide an assessment of outward spillover effects from Italy to other countries or from the banking sector to the rest of the economy. Spillover effects within financial markets, reflecting the perceptions of market participants, are another area that may provide different perspectives from balance-sheet based approach.

**3. The FSAP used a number of tools to assess interconnectedness and spillover effects.** The results are integrated to draw overall conclusions on (i) interconnectedness among Italian financial institutions; (ii) cross-sector interlinkages within Italy; (iii) inward cross-border spillover effects to Italian banks; and (iv) outward cross-border spillover effects from Italy. The tools used in the analysis are the following:

- ***Distress dependence analysis:***<sup>3</sup> This tool examines the patterns of dependence (“non-linear correlation”) of distress risk among Italian sovereign and financial institutions. Various measures of tail risk and interconnectedness among key institutions, using market measures of distress risk, illustrate how systemic risks (as perceived in financial markets) have evolved over time.
- ***Cross-border bank exposures analysis:*** Analysis using Bank of International Settlements (BIS) and Bank of Italy (BI) cross-border statistics, including network analysis,<sup>4</sup> can describe cross-country spillover risks from Italy through bank exposures. Both inward spillover risks to

<sup>1</sup> This technical note was prepared by Hiroko Oura, Senior Economist, Monetary and Capital Markets Department.

<sup>2</sup> See Technical Note on Bank Stress Testing (Kopp and Oura).

<sup>3</sup> Segoviano and Goodhart (2009) “Banking Stability Measures,” IMF WP/09/4.

<sup>4</sup> Based on the framework developed by Espinoza-Vega and Sole, 2010, “Cross-Border Financial Surveillance: A Network Perspective,” IMF Working Paper WP/10/105.

Italian banks and outward spillover risks from Italian banks, sovereign, and corporate are investigated. Risks from ring-fencing through its impact on intra-group liquidity are also discussed. Annex I describes the key characteristics of cross-border statistics and Annex II summarizes the network analysis framework.

- **Contingent claims approach- Global VAR (CCA-GVAR) analysis:**<sup>5</sup> The potential spillover effects from sovereign CDS or bond markets in Europe and from the Italian sovereign market to banks are well recognized. A Global VAR (GVAR) technique—a type of panel VAR approach—is applied for a system of 16 European countries and the U.S. to estimate these effects in an integrated manner.<sup>6</sup> The model estimates within country/cross-border and within sector/cross-sector relationships among measures of financial stress for sovereign, banks, the corporate sector, credit growth, and economic growth. Generalized impulse responses for a standardized shock on various sector indicators in Italy measure spillover effects from Italy. Annex III provides more details of the methodology.
- 4. The key findings of these analyses are as follows.**
- The market-based measures of tail risks and interconnectedness among key banks and insurance companies in Italy have declined from their peak but remain at elevated levels. Although, the stress on Banca Monte dei Paschi di Siena (MPS) has been manifesting on its own, the market perception about the condition of the banks appears to be increasingly contaminating the market views on other Italian financial institutions.
  - Exogenous factors, such as the Italian sovereign, are the key source of systemic risk for the market pricing of Italian financial institutions. Individual banks' distress is more closely related to the broader financial system conditions (of sovereign and insurance sectors) than to other banks.
  - On average over the past decade within Italy, the feedback effects from other sectors on banks are stronger than the feedback effects from banks to other sectors. For instance, the rise in Italian sovereign credit spreads noticeably increase Italian banks' credit spreads, but not vice versa. For credit growth, GDP growth rate—mostly capturing the demand side factors—have been on average more important than the health of the banking sector, which mainly represent supply side factors. However, there are some indications that supply constraints maybe increasingly affecting credit more recently.

<sup>5</sup> This analysis is based on the ongoing work by Gray, Gross, Sydow, and Paredes, (forthcoming), "Modeling the Joint Dynamics of Banking, Sovereign, Macro, and Financial Risk using CCA in a Multi-country Global VAR," IMF Working Paper.

<sup>6</sup> See for instance, Dees, Di Mauro, Pesaran, and Smith (2007) "Exploring the International Linkages of the Euro Area: A Global VAR Analysis" *Journal of Applied Econometrics*, Vol. 22, pp. 1–38.

- The risk from foreign exposures of Italian banks is limited. The majority of Italian banks' claims abroad are vis-à-vis core EU countries, where chances of distress are relatively low. Vulnerability to ring-fencing also appears limited: there are no signs of large existing funding inflows from foreign offices, including offices with funding cost advantages, to Italian head offices. Indeed, the balance usually shows existing funding flows from head office to foreign affiliates, much of which in the form of equity capital. This lack of funding flows can merely reflect the fact that ring fencing has already materialized in key host countries, though.
- Regarding outward cross-border spillovers from Italy, macroeconomic and corporate conditions in Italy are more important in transmitting shocks than though the direct exposures to Italian banks and sovereign. For instance, global banks have already reduced exposures to peripheral<sup>7</sup> sovereign and banks, including Italy, and the majority of their remaining exposures are vis-à-vis the corporate sector. However, adverse developments in Italian banks could be a very important source of spillover effects to some central and eastern European (CEE) countries, where Italian banks have systemically large presence in the host economies (as high as 40 percent of the local bank assets in Croatia, for instance).

**5. There are some limitations with all of these approaches, requiring cautious interpretations.** Network analysis, focusing on the direct exposures to various Italian sectors by global banks, does not account for potential transmission channel though confidence effects, for instance. CCA-GVAR framework illustrates the various spillover effects upon a standardized, one-period shock, whereas a more relevant scenario could be a larger, prolonged distress to banks.<sup>8</sup> The framework also relies on estimated coefficients that represent *average* historical relationship over a decade including long tranquil periods, rather than time-varying coefficients. For instance, the impact of a shock to Italian sovereign on GDP growth is almost zero, but this could stem from the fact that the credit risk indicator for Italian sovereign was negligible for most of the time in the estimation periods.

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<sup>7</sup> In this note, peripheral (European) countries include Greece, Ireland, Italy, Portugal, and Spain.

<sup>8</sup> The CCA-GVAR assessment is based on the impact of a standardized shock lasting for one period (i.e., one standard deviation shock to each of the variable in the model), rather than a combination of shocks to various sectors for extended periods.

## INTERCONNECTEDNESS AMONG ITALIAN FINANCIAL INSTITUTIONS

**6. In this section, the distress dependence framework developed by Segoviano and Goodhart (2009) is applied to selected Italian financial institutions to analyze their interlinkages in the recent past.** The sample includes Italian banks (UniCredit, Intesa Sanpaolo, Banca Monte dei Paschi Siena, Banca Popolare, UBI), an insurance company (Generali),<sup>9</sup> and the Italian sovereign.

### A. Framework

**7. Various tail risk and systemic risk measures are derived from estimated distress dependence among key institutions in a financial system using market data.** Distress dependence is similar to correlation, except that it allows non-linearity, i.e., the possibility that it becomes higher when there is more severe distress. First, each institution's financial distress is measured by the probability of distress (PD). In this exercise, PD is estimated from CDS spreads, by applying 40 percent recovery rates. Then, the joint probability of distress for the system of institutions is estimated using a non-parametric approach and allowing for time-variance. With this joint distribution, one can calculate the following measures.

- **Joint probability of distress (JPoD):** A measure of tail risk. The probability that all institutions in sample become distressed simultaneously.
- **Banking Stability Index (BSI):** A measure of interconnectedness. The expected number of institutions becoming distressed, given that at least one institution becomes distressed.
- **Conditional probability of distress:** Systemic relevance of individual institutions. The probability that institution X become distressed when another institution Y becomes distressed.

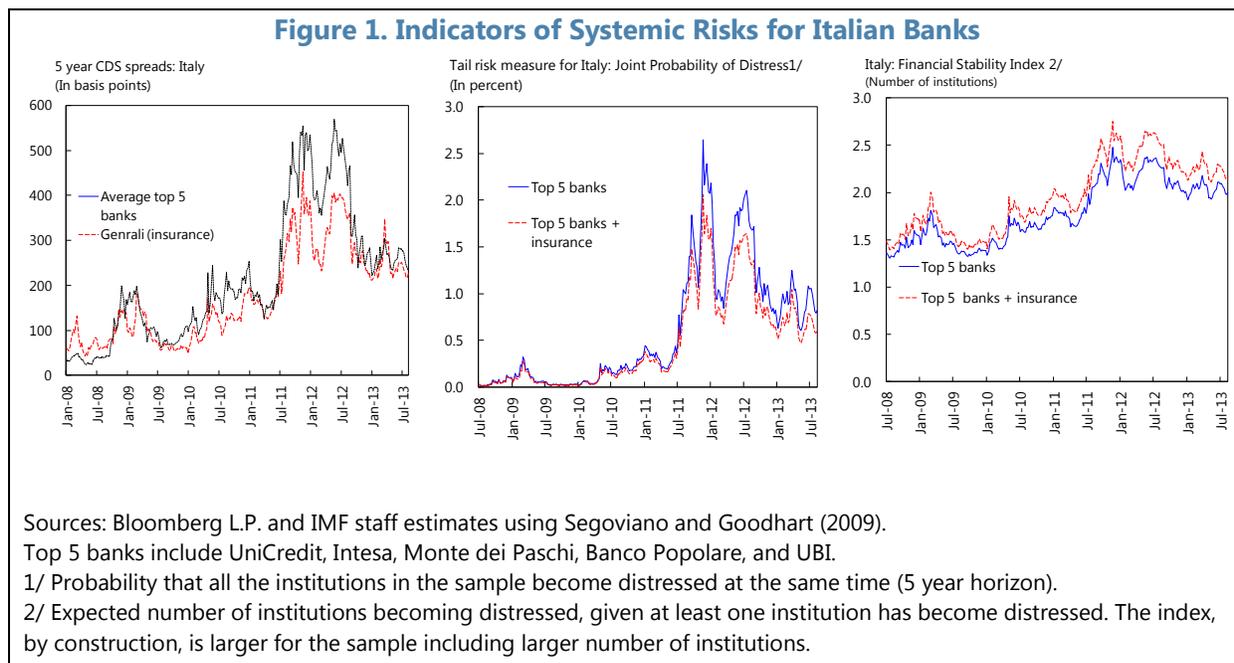
### B. Results

**8. Tail and systemic risks in the Italian financial system have declined from their peak but remains at elevated levels (Figure 1).**

- The tail risk of the system (JPoD) has declined appreciably since the peaks in late 2011 and mid 2012, but remains at high levels compared to the time before the European debt crisis deepened. JPoD has increased slightly since end February 2013, probably due to the uncertainty caused by the election results.

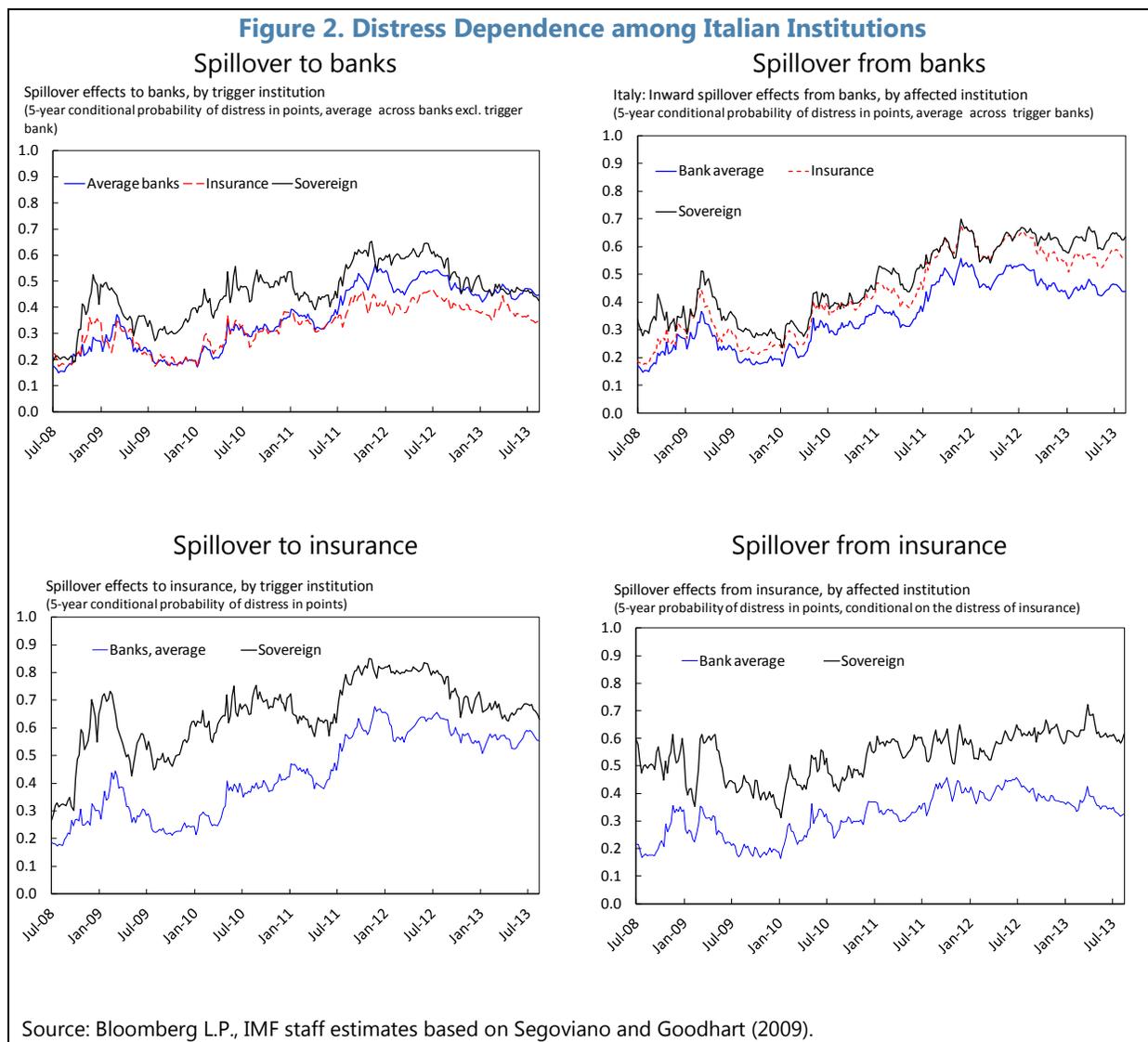
<sup>9</sup> Most of the top Italian insurance companies are privately held, except for Generali.

- The rise in JPoD closely follows the average CDS spreads of financial institutions, which are closely correlated with the Italian sovereign CDS, consistent with the view that tail risk in Italy is mainly driven by Italian sovereign performance.
- The measure of interconnectedness for Italian financial systems (BSI) has also declined from the peaks recently but remains at high levels.

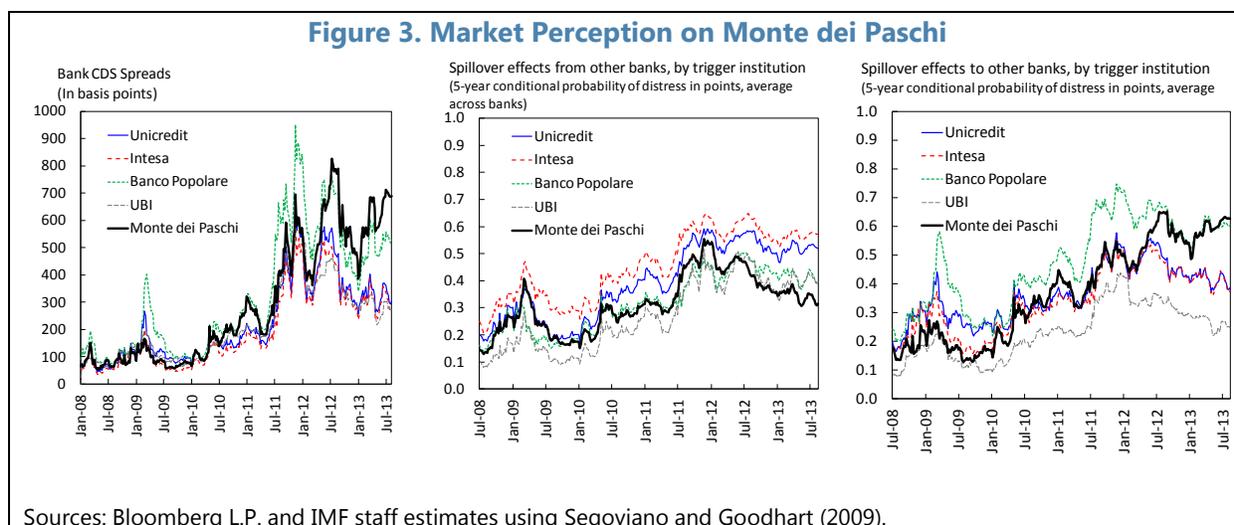


**9. The Italian sovereign is indeed the key source of systemic risk for the market pricing of Italian financial institutions (Figure 2).**

- For the banking sector, the spillover effects from sovereign are more important than the effects from the insurance sector. At the same time, individual banks’ distress is more closely related to the broader financial system conditions (sovereign + insurance) than to other banks.
- The insurance sector is more interlinked with the sovereign than with banks: the sovereign is more relevant both as the source and the destination of spillover effects.

**Figure 2. Distress Dependence among Italian Institutions**

**10. Market perception about the MPS remains weak and it is contaminating the perception about other Italian banks (Figure 3).** The CDS spreads of MPS, and to a lesser extent Banco Popolare, remain high throughout 2013, while CDS spreads for other banks have declined since 2012 as sovereign CDS spread stabilized. The stress on MPS appears to have been manifesting on its own, indicated by declining spillover effects from other banks through 2013 when the CDS of MPS has been rising. At the same time, the probability of bank distress conditional on the distress of MPS has risen to the level above that of other banks since 2012, implying that the weak market perception about the bank is, to some extent, increasingly contaminating the perception about other Italian banks.



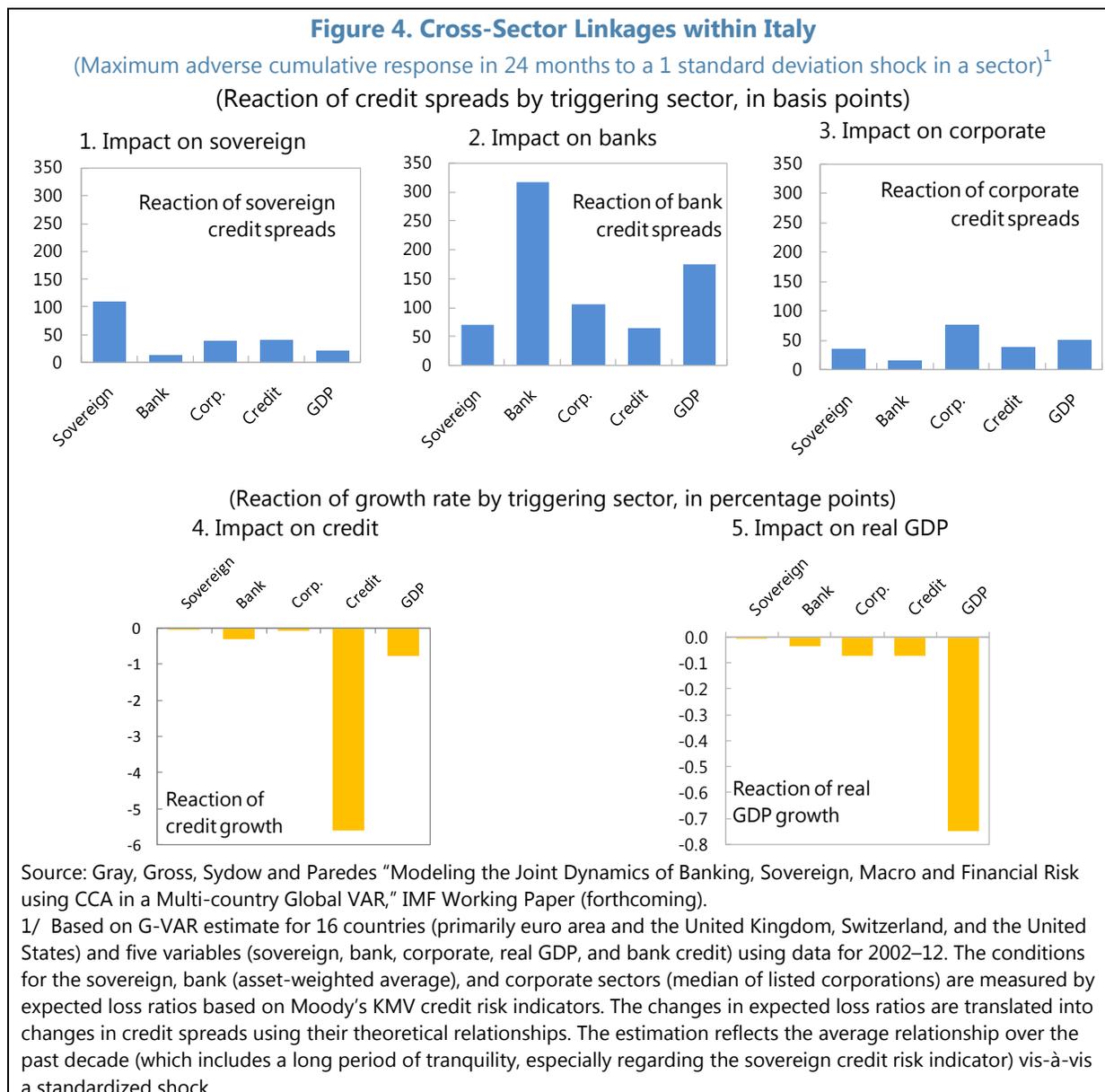
## CROSS-SECTOR INTERLINKAGES WITHIN ITALY

**11. CCA-GVAR framework is used to estimate cross-sector interlinkages within Italy.** The VAR includes credit indicators for banks, non-financial corporate, sovereign and then growth rates for bank credit and real GDP (see Box 1 for details). The model is estimated using “expected loss ratio” of the credit given to a debt issuer. Roughly speaking, “expected loss” represents the likelihood of losses multiplied by possible loss upon the default in percent of the value of debt, as calculated by Moody’s KMV. This expected loss ratio is closely related to “fair value” CDS spreads,<sup>10</sup> named “credit spreads” hereafter, and this is theoretical CDS spreads consistent with market value of the debt issuer’s equity and its volatility and balance sheet structure. Since CDS spreads, in principle, should be a good proxy for the yield the debt over risk-free rate, the “credit spreads” in the following analysis can be interpreted as proxy for the changes in funding cost of debt issuers. Cross-sector interlinkages within Italy, therefore, are measured by the responses of the credit spreads for banks, corporate, and sovereign and of the growth rate of credit and real GDP for a standardized shock to each sector in Italy.

**12. On average over the past decade within Italy, the feedback effects from other sectors on banks are stronger than the feedback effects from banks to other sectors.** CCA-GVAR results show that Italian banks’ credit spreads raise appreciably in case of distress in the real economy, the corporate sector, and the sovereign sector (Figure 4). A 110 basis point shock to sovereign credit spreads increases bank credit spreads by 69 basis points, a result broadly comparable to BI’s estimate (Figure 4, “sovereign” bar in panel 2). The G-VAR estimates also suggest that weak GDP and credit growth augment corporate sector vulnerabilities, further jeopardizing bank asset quality. On the other hand, the negative feedback effects from banks to the rest of the economy seem relatively limited: bank distress generally causes a smaller impact on sovereign, corporate, and growth compared to the shocks to sovereign, corporate, credit, and growth (“bank” bars across all

<sup>10</sup> Expected loss ratio =  $1 - \exp(-\text{fair value CDS spreads} \times \text{time to maturity})$ .

panels in Figure 4). Not surprisingly, one exception is credit, where bank distress is more relevant than that of sovereign or corporate. However, effects on credit from growth dominate, indicating that credit growth is generally influenced more by demand-side shocks (GDP) than supply-side shocks (banks). This is broadly consistent with BI estimates, suggesting that demand-side factors are the key drivers of credit flows, at least in early 2012.

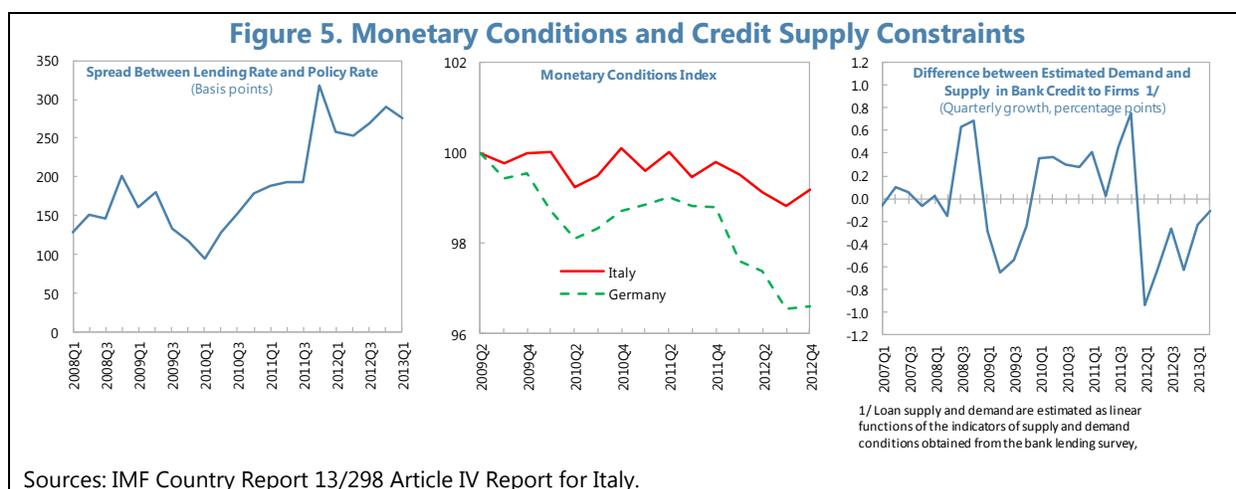


**13. It should be noted that the above analysis is not meant to account for what is happening during the current crisis.** The Figure 4 shows summary of impulse-response in VAR for an isolated and standardized shock to the triggering sector. A more "realistic" shock would be a (weighted) combination of sectoral shocks that could last for several periods (instead of just one period as in this exercise), which could generate responses that are likely to materialize in practice. Moreover, the impulse-response is calculated using estimated coefficients that represent the

average relationship between variables over the 2002–12 estimation periods. This could be one of the reasons why the impact from a sovereign shock to the real sector is negligible (Figure 4, panel 4 and 5), despite strong feedback effects observed during the European debt crisis.

#### 14. Focusing on more recent periods, there are signs that credit supply constraint is becoming more important.

- Despite cuts in the policy rate, monetary conditions in early 2013 have eased only marginally compared to 2009.<sup>11</sup> Over the period, the spread between the Italian lending and the policy rate has increased by nearly 160 bps. The tightening from higher real lending rates has largely offset the 4 percent real effective depreciation, leaving monetary conditions only marginally looser.
- An approach that uses bank surveys on credit demand and lending standards as proxies for unobserved demand and supply (Zoli,<sup>12</sup> 2013) finds that after the LTRO in 2012, demand for funds fell well short of supply. However since late 2012, supply factors are becoming more important and have caught up with weak demand in driving deleveraging. The surveys suggest that expectations of weak growth have been an important factor constraining supply.



<sup>11</sup> A Monetary Conditions Index (MCI) is defined as a weighted average of the interest rate and the exchange rate:  $MCI_t = 100 + a_1(r_t - r_0) + a_2(q_t - q_0)$ , where  $r$  is the real lending rate to non-financial corporations and  $q$  is the log of the CPI-based REER. The reference period is 2009Q2. The  $a_1/a_2$  ratio represents the exchange rate depreciation needed to offset the effects of 100bps increase in interest rates. Here, the ratio is set to 2.9 following Dornbusch et al. (1998) who estimated the parameters for Italy. Higher ratios as estimated by Peeters (1998) generate a smaller impact.

<sup>12</sup> Zoli, 2013, "Italian Sovereign Spreads: Their Determinants and Pass-through to Bank Funding Costs and Lending Conditions," IMF Working Paper, WP/13/84.

## INWARD CROSS-BORDER SPILLOVER EFFECTS TO ITALY

**15. This section examines the pattern of Italian banks' cross-border exposures to highlight the potential sources of vulnerability from these exposures.** BIS and BI's (consolidated)<sup>13</sup> cross-border statistics provide rich stylized facts about the nature of these exposures and how Italy compares to its peers. Network analysis is applied to further examine the risks from CEE exposures. In addition, potential risks from ring-fencing are assessed by looking at the patterns of existing intra-group liquidity sharing across borders, using BI's internal data and BIS locational statistics.

### A. Stylized Facts: Exposures vis-à-vis Nonresidents

**16. Italian banks have significant cross-border activities, though generally less than most of their peers (Figure 5).** These claims have shrunk slightly since the onset of the global financial crisis, though not as much as the other countries. The claims are mostly vis-à-vis the corporate sector.

- About 20 percent of Italian banks' assets are claims vis-à-vis nonresidents.<sup>14</sup> Most of these nonresident exposures are concentrated in the top banks. However, foreign claims are fairly moderate compared to comparator countries, relative to both total bank assets and GDP.
- The Italian banking system is relatively less "international" than its peers: its share of foreign claims in percent of total foreign claims held by all reporting banks from around the world is 2.7 percent, about the same as its share in world GDP in contrast to most of its peers whose share in foreign claims is above that of GDP.
- Italian banks have reduced their foreign claims (in percent of GDP) by 13 percentage points since 2007, but the decline is more moderate than in many other European countries, including Germany and France.<sup>15</sup> Most of this decline is vis-à-vis developed European counterparts. Italian banks' foreign claims in emerging European countries have marginally increased (by one percentage point of GDP). Since 2008, the exposures remained more or less flat.
- Over 60 percent of Italian banks' foreign claims are vis-à-vis the non-bank private sector, while the rest is equally split between the public sector and banks.

**17. Italian banks are "localized" in the host economies (Figure 6).**

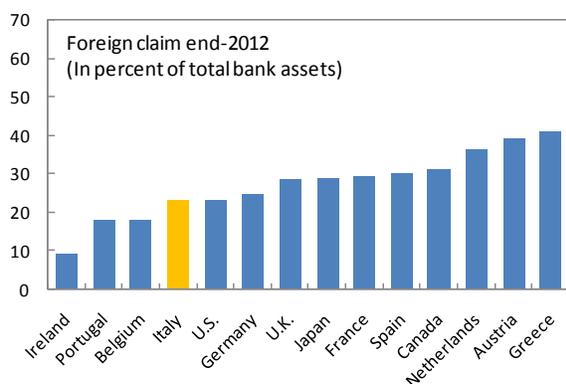
<sup>13</sup> See Annex I for the explanation of BIS and BI cross-border statistics, including definition of key concepts.

<sup>14</sup> This is measured by "foreign claims" in BIS consolidated statistics, including cross-border and local claims of foreign affiliates. See Annex I for the details of BIS statistics.

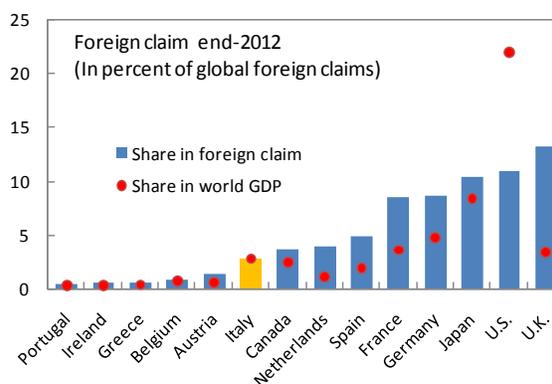
<sup>15</sup> Country classifications follow BIS consolidated statistics. Developing Europe includes Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Turkey, and Ukraine. Estonia, Slovakia, and Slovenia are part of developed Europe.

**Figure 6. Exposures vis-à-vis Nonresidents**

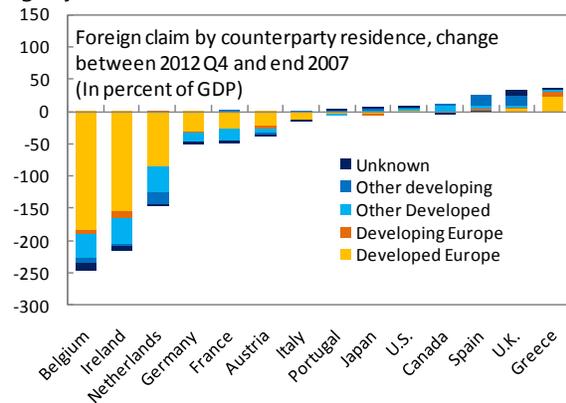
Exposures vis-à-vis non-residents are relatively less relevant for Italian banks



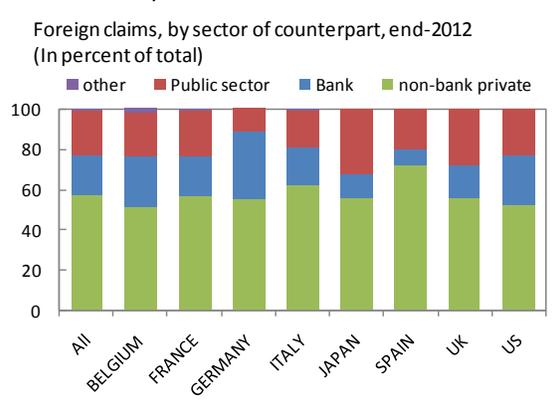
... and their share in global banks' cross-border exposures is in line with Italy's economic size.



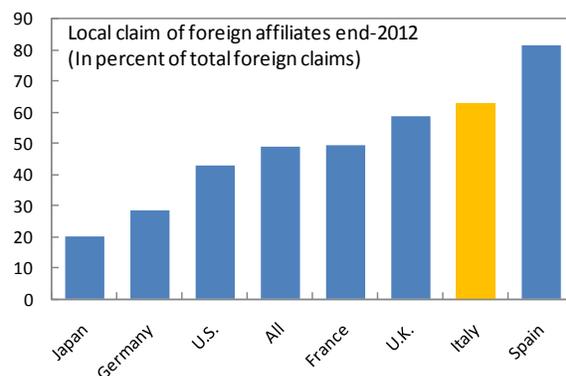
Italian banks reduced their overseas exposures only slightly since the crisis.



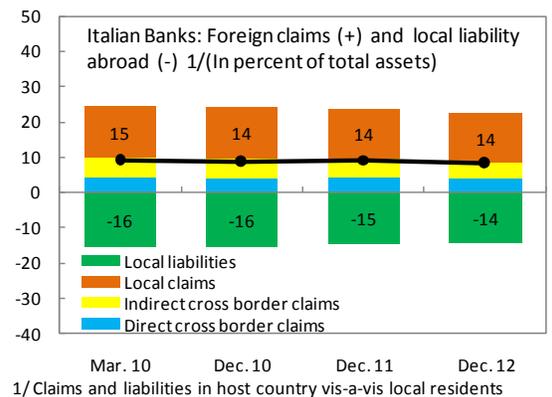
Most of global banks' exposures in Italy are vis-à-vis the non-bank private sector, as for other countries.



Italian banks are highly localized in host countries...



...and fund a large part of the local claims in host countries.



Sources: Bank of Italy, BIS (Consolidated Statistics), IMF (FSI statistics and World Economic Outlook), and IMF staff calculations.

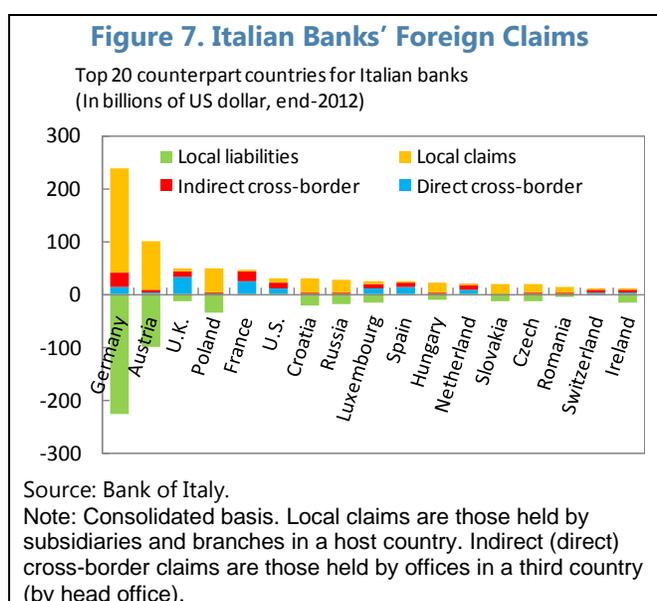
- Italian banks' foreign claims are more "localized": their share of local claims (claims held by their subsidiaries and branches in foreign countries vis-à-vis residents in the host country) is generally higher than its peers.
- In addition, Italian banks rely substantially on local funding. Overall, local claims are largely balanced by their local liabilities. As a result, net foreign claims are much smaller (8 percent of total assets, 309 billion dollars) than gross exposures (22 percent of total assets, 843 billion dollars). Furthermore, about a half of these net claims is indirectly funded by Italian banks' affiliates in a third country.<sup>16</sup> Therefore, the part of foreign claims that are funded by Italian headquarters is about 144 billion dollars (4 percent of total assets).

## B. Inward spillover risks from nonresident exposures

**18. Overall, the risk of a negative impact from the foreign exposures of Italian banks is limited.** About a quarter of Italian banks' total assets (US\$3.7 trillion as of September 2012) are vis-à-vis foreign counterparties. Two-thirds of these foreign claims are vis-à-vis developed economies, especially core EU countries, where chances of distress are relatively low (Figure 7). Moreover, a substantial share of foreign claims held by the affiliates of Italian banks in host countries is vis-à-vis the host country residents and are mostly funded locally.

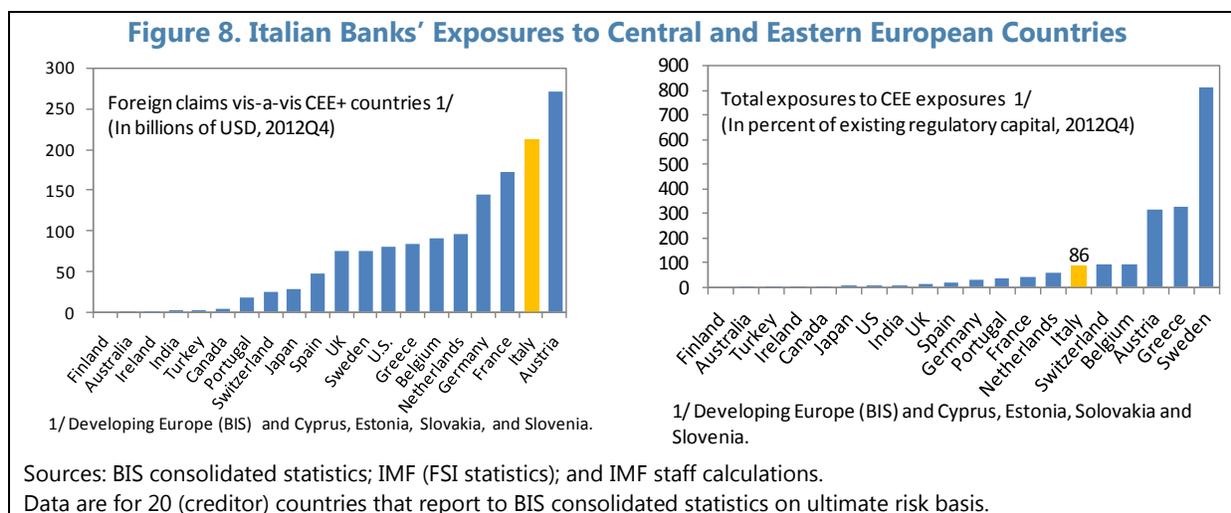
**19. Direct risks from exposures to CEE countries<sup>17</sup> are also manageable (Figure 8).**

Although Italian banks are one of the largest creditors to CEE countries, following only Austria, the exposures represent a small share relative to their total foreign exposures (about a quarter) and to their capital.



<sup>16</sup> As indicated by "indirect cross border claims" in the chart. This line includes, for instance, claims held by Italian banks' affiliates in Austria vis-à-vis a counterparty resident of Slovakia.

<sup>17</sup> CEE includes developing Europe (following BIS definition) and Cyprus, Estonia, Slovakia, and Slovenia.



**Table 1. Summary of Network Effects: Central and Eastern European Distress Scenario**

	Parameter assumptions 2/			Loss of capital for Italy 3/	Failed banking systems		Rounds 4/
	Credit loss rate	Roll over rate	Haircut on assets		Number	Countries	
<b>Direct impact 1/</b>	...	...	...	86%	3	Austria, Greece, Sweden	...
<b>Indirect impact</b>							
Credit effects	100%	0%	0%	91%	4	Austria, Greece, Sweden, Switzerland	1
Funding effects	0%	0%	50%	89%	5	Austria, Greece, Sweden, Switzerland, Finland	1
Credit + fundnig effects	100%	0%	50%	95%	6	Austria, Greece, Sweden, Switzerland, Finland, Belgium	2

Sources: BIS consolidated statistics and IMF staff estimates.  
1/ Assuming all the claims vis-à-vis CEE will be lost (100 percent loss rate).  
2/ Credit effects: Banking system B will incur credit loss amounting to credit loss rate × credit given to banking system A when A becomes distressed. Funding effects: When banking system C is borrowing S million dollars from A and A becomes distressed, C will experience funding gap of (1-roll over rate)×S million, which needs to be financed by selling asset at discount (haircut).  
3/ In percent of existing capital.  
4/ Number of contagion rounds. A banking system fails when the overall loss amounts to more than 100 percent of capital.

**20. However, there could be additional indirect losses due to the interlinkages among countries that are significantly exposed to CEE countries.** For instance, Figure 8 indicates that the banking systems in Austria, Sweden, and Greece would fail when all the CEE countries are distressed. Italian banks can incur additional losses through their credit exposures (e.g., loans and bonds) and/or funding exposures (i.e., funding from Austrian banks can be only partially replaced, and the gap needs to be filled by selling asset with haircut). In Table 1, the impact of these losses are

investigated with most extreme parametric assumptions for credit effects (i.e., 100 percent loss rate with the claims), funding effects (i.e., no rollover of funding from the distressed banking system and 50 percent haircut of assets), and the combination of the two effects.

### 21. It turns out that risks are manageable even when accounting for such indirect losses.

The network analysis shows that Italian banks can withstand such domino effects even though some other banking systems can fail (Table 1). The combined losses for the Italian banking system are always below 100 percent under various parameter assumptions. The additional losses from these domino effects for Italian banks are about 10 percent of capital and are much smaller than direct losses.

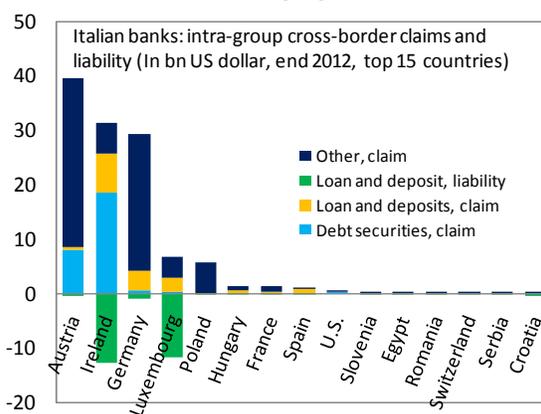
## C. Risks from Ring-Fencing

**22. Ring-fencing of liquidity in local systems by host supervisors could exacerbate the distress of cross-border banks.** Capacity to freely transfer liquidity across affiliates generally contributes to manage liquidity in a cost efficient manner for a financial group. It is particularly cost effective when funding costs are different across affiliates (operating in different markets) belonging to a same group. For instance, the funding costs in core markets (such as Germany) are lower than those in Italy for some banks. There could be acute risks from ring-fencing if Italian banks have existing large intra-group funding flows from these core markets and they need to be refinanced from somewhere else upon ring-fencing.

### 23. Italian banks' cross-border intra-group liquidity activity appears limited.<sup>18</sup>

Data suggest that head offices in Italy typically provide funds to foreign affiliates, as they usually serve as provider of equity capital for their affiliates (Figure 9). There is no strong sign of liquidity inflows from affiliates to Italian head offices, which may be explained by ring-fencing that is already in place by foreign regulators. Indeed, the BI has instructed banks with a significant cross-border footprint to limit their reliance on intra-group liquidity sharing even when it is cost effective.

**Figure 9. Indications of Intra-group Financial Flows**



Sources: Bank of Italy

Note: Liability side data are available only for loans and deposits.

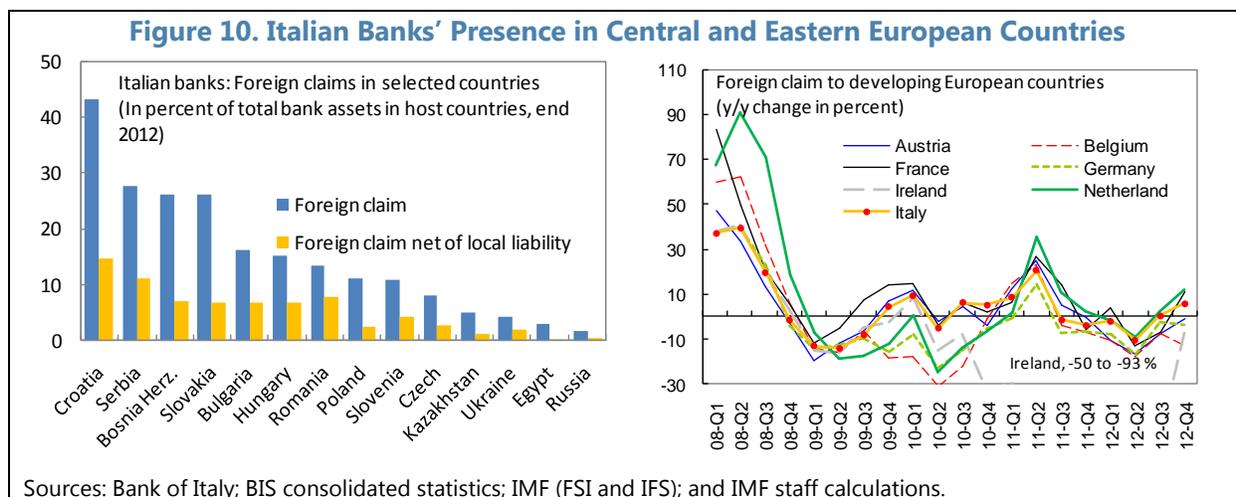
<sup>18</sup> Data showing the precise extent of intra-group liquidity sharing are limited, and only partial information is available. BI data for intra-group claims have limited information covering only deposit and loans component of the liability side vis-à-vis Italian head office. BIS locational statistics can include transactions across groups and include data for foreign banks operating in Italy.

# OUTWARD CROSS-BORDER SPILLOVER EFFECTS FROM ITALY

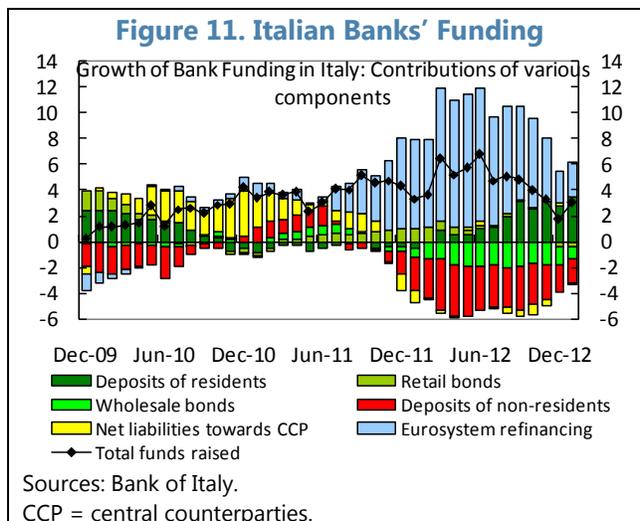
**24. Multiple tools are applied to analyze potential outward spillover effects from various sectors in Italy.** BIS and BI’s cross-border exposure data and network analysis examine (BIS reporting) global banks’ exposures and the nature of their risks vis-à-vis Italian entities (public sector, banks, and other private sector). It will also identify host economies where Italian banks have systemic presence. Furthermore, we draw on CCA-GVAR estimates to see key channels of outward spillovers from Italy.

## A. Outward Spillover Effects to Central and Eastern European Countries

**25. Italian banks’ local presence is systemically important in some CEE countries.** Italy is the second largest creditor, following Austria, to CEE countries (Figure 10). As a result, the local presence of Italian banks is large and has systemic importance in these countries. In nine CEE countries, the share of Italian banks’ gross foreign claims in percent of total bank assets of the host country is above 10 percent, reaching over 40 percent in Croatia.

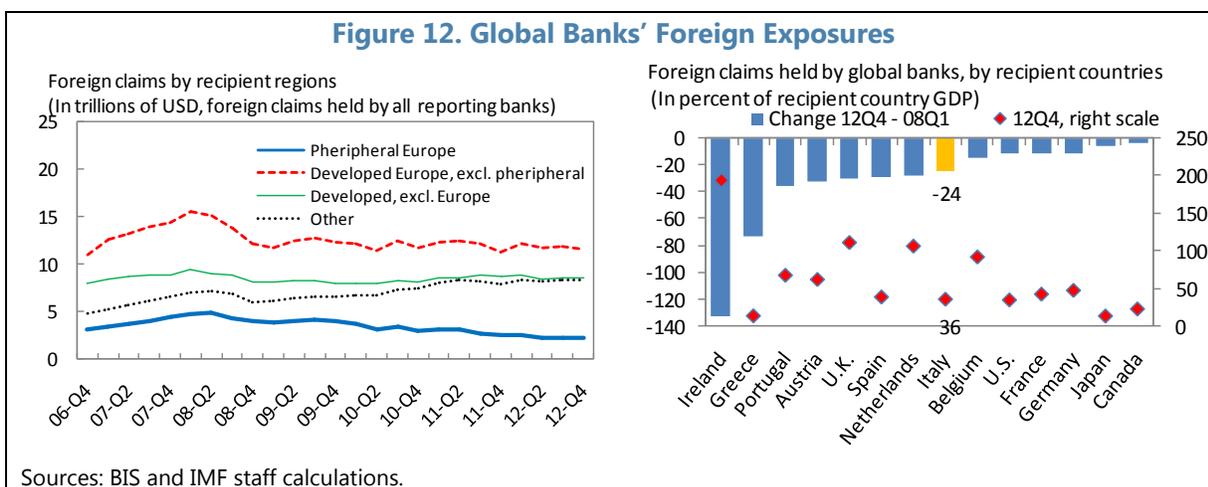


**26. The local nature of these exposures could somewhat cushion against the distress at the head offices in Italy, but would not eliminate the risks.** A large part of these exposures are extended by Italian banks' affiliates in the host economy using local funding, rather than directly financed by head offices. Such tendency would limit the spillover effects from the head offices. However, these exposures still face funding risks related to the performance of head offices if local deposits are withdrawn in fear of the distress of parent banks. Indeed, non-resident deposit outflow has been one of the major sources of funding loss for Italian banks (Figure 11). Moreover, if severe distress hits the head offices, they might draw down liquidity from foreign offices at the cost of foreign operations, although so far CEE exposures have been maintained since 2009 (Figure 10).

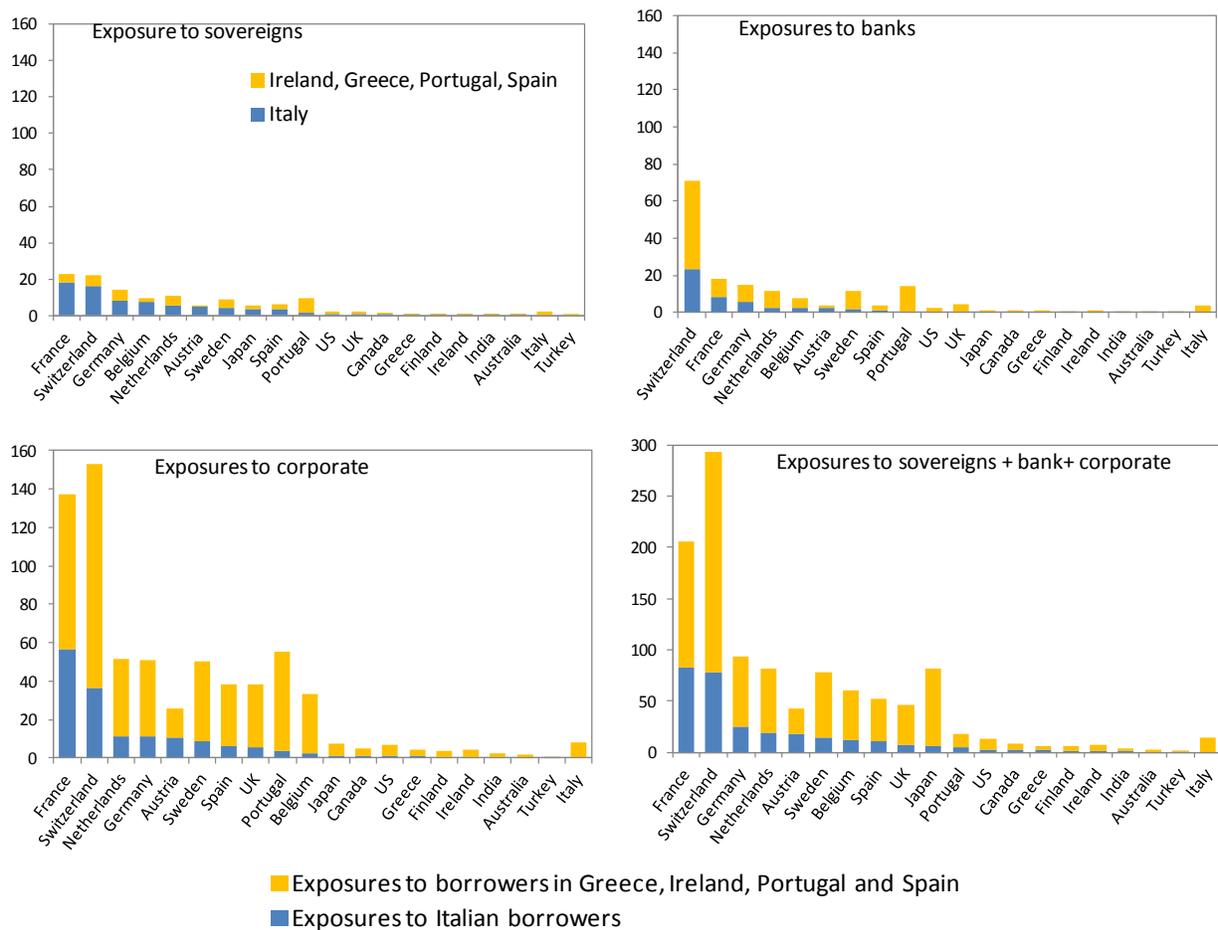


## B. Outward Spillover Effects to the Global Banking System

**27. Global banks have significantly reduced their Italian sovereign and bank exposures and residual risks stem from corporate exposures.** Since 2008, BIS reporting banks' exposures to peripheral European countries have steadily declined, while exposures to other developed economies have remained fairly stable and exposures to emerging markets edged up. In this context, global banks' exposure to Italy has declined by nearly 50 percent between Q1 2008 and Q4 2012 (amounting to about a quarter of Italian GDP, Figure 12). This retrenchment was mainly vis-à-vis the sovereign (about 70 percent decline for the period) and the banking sector (60 percent decline for the period) and about 60 percent of the remaining claims are vis-à-vis the corporate sector (up from 42 percent in Q1 2008). As of end 2012, the exposures are generally smaller than creditor countries' total capital in the system, except for French and Swiss banks (Figure 13).



**Figure 13. Foreign Claims vis-à-vis Italy and other Peripheral European Countries by Sector**  
(In percent of existing regulatory capital, as of end 2012)



Sources: BIS consolidated statistics, ultimate risk basis; IMF FSI statistics; staff calculation. Domestic claims are excluded.

**28. As a result, the potential spillover effects to global banks from an isolated shock in Italy are limited, even when taking into account domino effects through the web of interbank exposures.**

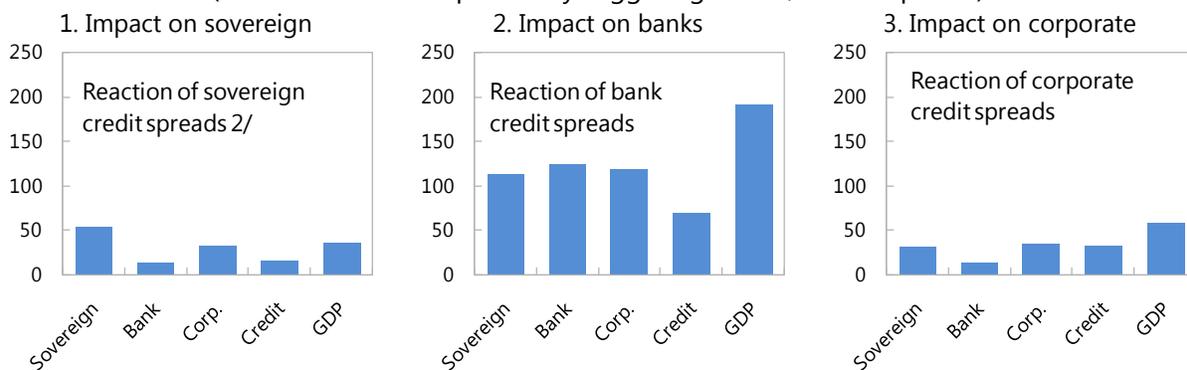
- Global banks are exposed to Italy through claims to Italian entities (sovereign, corporate, banks) and funding from Italian banks. Shocks to any of these exposures do not trigger domino effects through the network of interbank claims (Table 2), even when all sources of credit losses (corporate, banks, and sovereign) are deemed lost. No other financial system ‘fails’ even in the worst case scenario (case (A) in Table 2) when all global banks’ claims vis-à-vis Italian entities and all interbank funding vis-à-vis Italian banks are lost (in which case banks need to engage in “fire sales” of assets with steep haircuts to fill the funding gap).
- Similar results hold for other individual peripheral European countries as well. Domino effects start to emerge only when both the Italian and Spanish financial systems—the combination of the largest two countries among peripherals—‘fail’. Moreover, it is the exposure to the corporate



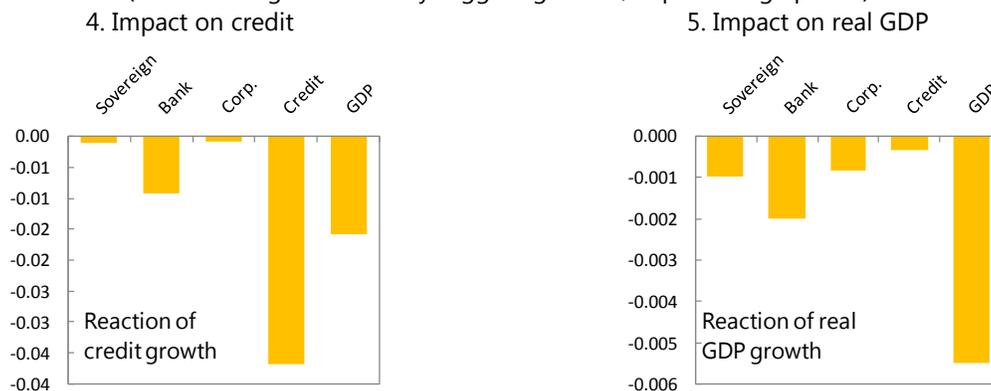
**Figure 14. Outward Spillover Effects from Italy to Other Peripheral Countries**

(Maximum adverse cumulative response in 24 months to a 1 standard deviation shock in a sector, average for Ireland, Portugal, Spain, and Greece)<sup>1</sup>

(Reaction of credit spreads by triggering sector, in basis points)



(Reaction of growth rate by triggering sector, in percentage points)



Source: Gray, Gross, Sydow and Paredes "Modeling the Joint Dynamics of Banking, Sovereign, Macro and Financial Risk using CCA in a Multi-country Global VAR," IMF Working Paper (forthcoming).

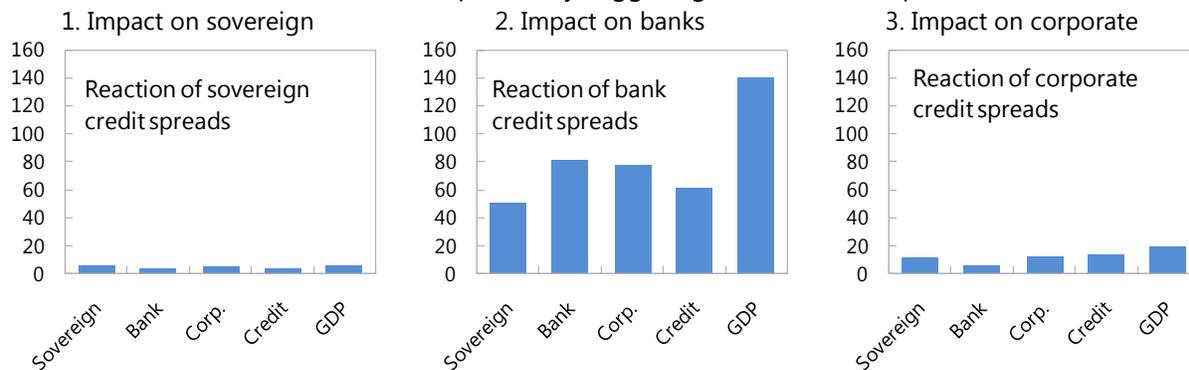
1/ Based on G-VAR estimate for 16 countries (primarily euro area and the United Kingdom, Switzerland, and the United States) and five variables (sovereign, bank, corporate, real GDP, and bank credit) using data for 2002-12. The conditions for the sovereign, bank (asset-weighted average), and corporate sectors (median of listed corporations) are measured by expected loss ratios based on Moody's KMV credit risk indicators. The changes in expected loss ratios are translated into changes in credit spreads using their theoretical relationships. The estimation reflects the average relationship over the past decade (which includes a long period of tranquility, especially regarding the sovereign credit risk indicator) vis-à-vis a standardized shock.

2/ Average for Ireland, Portugal, and Spain.

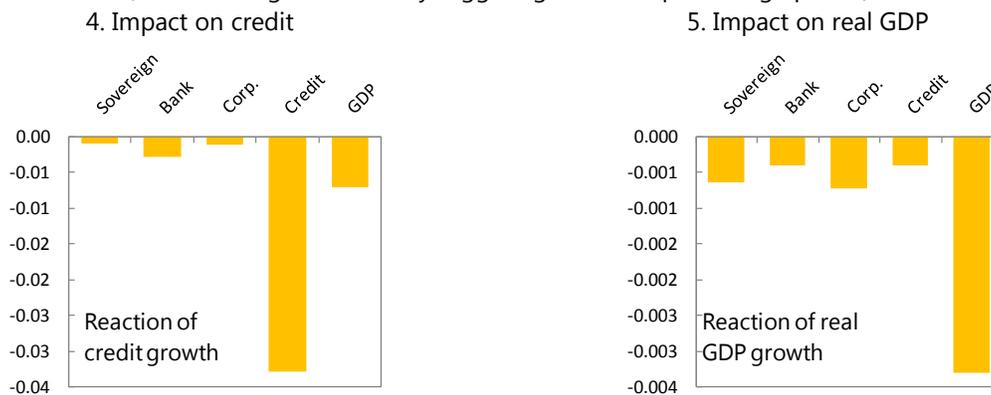
### Figure 15. Outward Spillover Effects from Italy to Other Countries, Excluding Peripheral Economies

(Maximum adverse cumulative response in 24 months to a 1 standard deviation shock in a sector, average across countries excluding peripheral economies)<sup>1</sup>

(Reaction of credit spreads by triggering sector, in basis points)



(Reaction of growth rate by triggering sector, in percentage points)



Source: Gray, Gross, Sydow and Paredes “Modeling the Joint Dynamics of Banking, Sovereign, Macro and Financial Risk using CCA in a Multi-country Global VAR,” IMF Working Paper (forthcoming).

1/ Based on G-VAR estimate for 16 countries (primarily euro area and the United Kingdom, Switzerland, and the United States) and five variables (sovereign, bank, corporate, real GDP, and bank credit) using data for 2002-12. The conditions for the sovereign, bank (asset-weighted average), and corporate sectors (median of listed corporations) are measured by expected loss ratios based on Moody’s KMV credit risk indicators. The changes in expected loss ratios are translated into changes in credit spreads using their theoretical relationships. The estimation reflects the average relationship over the past decade (which includes a long period of tranquility, especially regarding the sovereign credit risk indicator) vis-à-vis a standardized shock.

## Annex I. Key Characteristics of BIS International Banking Statistics

**30. The BIS collect two types of international banking statistics: locational and consolidated. Key items included in and excluded from the data are summarized in Table 3.**

### Locational statistics

**31. The data cover banks' unconsolidated gross international on-balance sheet assets and liabilities.** These data are based on the residence of the reporting institution and therefore measure the activities of all banking offices (both domestic and foreign-owned) in each reporting country. Such offices report exclusively on their own unconsolidated business, which thus includes international transactions with any of their own affiliates. These data corresponds to the compilation of national accounts, balance of payments, and external debt statistics.

### Consolidated statistics

**32. The consolidated banking statistics cover banks' worldwide on-balance sheet claims and selected off-balance items.** Positions are reported by head offices in their home country and include all branches and subsidiaries on a worldwide consolidated basis, net of inter-office accounts. There are three different types of claims (A, B, and C in the figure below) included in the data:

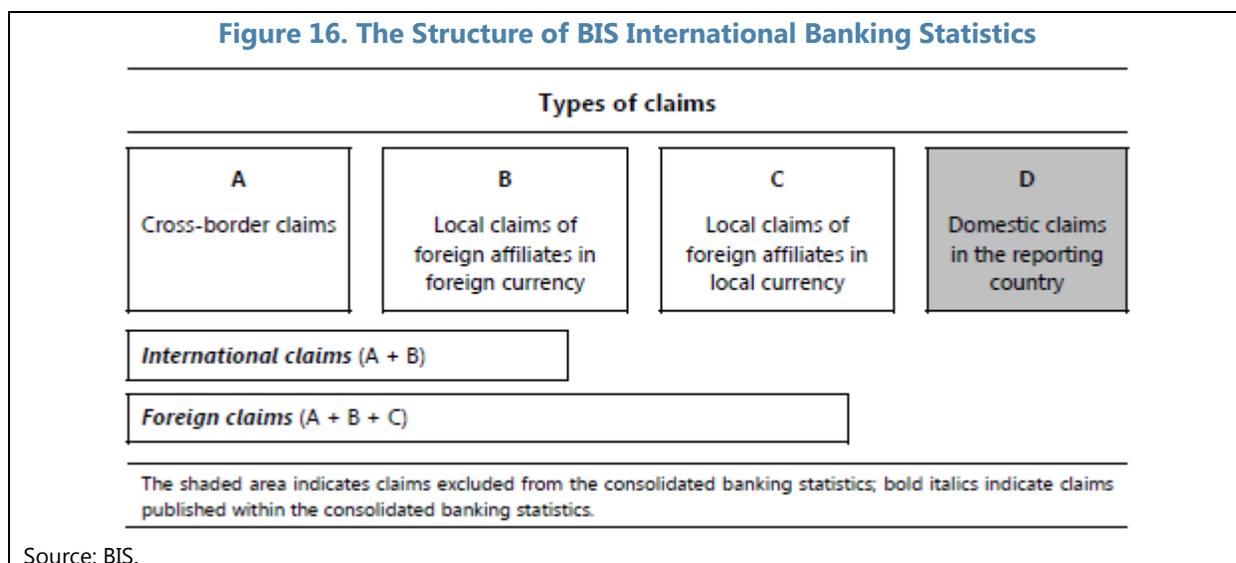


Table 3. Key Characteristics of BIS International Banking Statistics

	Included	Excluded
<b>Locational (bilateral data are confidential, need to request to BIS)</b>	<ul style="list-style-type: none"> <li>• Cross-border transaction within a financial group, 44 reporting countries</li> <li>• By sector (bank, v.s., non-banks)</li> </ul>	<ul style="list-style-type: none"> <li>• Domestic transaction between foreign and domestic banks and residents (e.g., loan from Unicredit's subsidiary in Germany to German households). This is part of consolidated statistics.</li> <li>• Off-balance sheet items</li> </ul>
<b>Consolidated (bilateral data publicly available)</b>	<ul style="list-style-type: none"> <li>• Cross-border, international and foreign claims</li> <li>• Immediate risk basis (e.g., Unicredit's lending to Santander UK will appear as Italian claims to UK), following contractual amount. Thirty reporting countries</li> <li>• Ultimate risk basis (e.g., the above claims will appear as Italian claims to Spain), net of risk mitigants (guarantees and collateral), 24 reporting countries</li> <li>• By sector (bank, public sector, non-bank private sector) on ultimate risk basis</li> <li>• Key off-balance items (guarantees extended, credit commitments and derivatives)</li> </ul>	<ul style="list-style-type: none"> <li>• Cross-border transactions within a financial group</li> <li>• Domestic claims in the reporting country (Unicredit's lending in Italy)</li> <li>• Data by sector on immediate risk basis</li> <li>• Off-balance sheet items excluding guarantees, credit commitments and derivatives</li> </ul>

Sources: IMF staff based on BIS.

## Annex II. Network Analysis Framework

**33. Various spillover effects to and from Italian banks are examined with network analysis following Espinoza-Vega and Sole (2010).<sup>19</sup>** A negative shock to a country's financial system could be propagated through the network of inter-bank claims across countries, and could distress banking system in other countries in the network beyond the direct losses from the initial shock.

**34. There are two main channels propagating shocks: credit and funding.**

- *Credit channel:* "Failure" of banking system A will incur credit losses to system B that has claims against A. The credit loss rate assumption controls for the severity of credit cost upon failure (i.e., 100 percent loss rate implies that all the claims vis-à-vis A are lost completely).
- *Funding channel:* When system C is borrowing from system A, A's "failure" will force C to find alternative sources of funding. When only part of the lost funding can be financed from somewhere else, C needs to sell liquid assets, possibly at fire sale prices, to fill the funding gap, and thereby incurs trading losses. The rollover rate for funding from the failed system (e.g., 0 percent implies all the funding is lost) and the haircut to liquid assets control for the severity of this trading loss.

**35. If any banking system incurs losses larger than their capital (due to shocks to outside of this network or some part of this network), the system "fails."** This failure can subsequently cause some other banking systems to fail, triggering domino effects, where a failure of a banking system in a network transmits to other banking systems in the same network.

**36. In this study, the above framework is applied to a network of global financial system using BIS consolidated statistics on ultimate risk banks.**

- The sample consists of 20 countries<sup>20</sup> that report to BIS consolidated statistics. A network of global banking system is represented by the matrix of inter-banking systems claims for these 20 countries. Total regulatory capital data are taken from IMF's FSI statistics.
- Initial triggers considered in this study include credit losses from outside this network (i.e., credit losses from sovereign or corporate in the 20 countries and/or some other countries (such as CEE)), in addition to shocks to some part of the network (i.e., credit or funding shocks to some banking systems in the network).
- In order to fully account for the impact from shocks outside of the network, consolidated statistics, rather than locational statistics, are used. Banks, especially Italian banks, hold most of

<sup>19</sup> IMF Working Paper WP/10/105, "Cross-Border Financial Surveillance: A Network Perspective."

<sup>20</sup> Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, India, Ireland, Italy, Japan, the Netherlands, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

their foreign claims through local affiliates in foreign host countries. These claims are included only in consolidated statistics (Annex I).

- This exercise used consolidated statistics on an ultimate risk basis (including the effects of risk transfer<sup>21</sup>) because claims by borrowers' sectors are available only for the statistics. Some countries (Australia, Austria, Canada, Finland, Greece, India, Ireland, Netherlands, Portugal and Sweden) do not report this subcomponent. For these countries, estimates based on the aggregate-based share by sector for each counterparty country (as shown in Table 9.C of BIS consolidated statistics) are used, following the similar exercise for Japan FSAP (2012).<sup>22</sup>

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<sup>21</sup> For instance, loans from Unicredit (irrespective of the location of the particular office) to Santander U.K. will be counted as loans from Italy to Spain in consolidated statistics on ultimate risk basis. If BIS consolidated data on immediate borrower basis is used instead, then the same claim will be counted as loans from Italy to U.K.

<sup>22</sup> Japan FSAP Technical Note on Financial System Spillovers—An Analysis of Potential Channels, IMF Country Report No. 12/263.

## Annex III. CCA-GVAR Framework

### 37. Cross-border and cross-sectoral interlinkages relevant for Italy are assessed using the framework and estimates by Gray and others (forthcoming).

- The interactions among indicators of financial and corporate sector risks and other sectors (sovereign and real economy) within and across countries are estimated using a Global Vector Autoregressive (GVAR) model—a type of panel VAR econometric approach—as in Dees and others (2007).<sup>23</sup> Generalized impulse responses<sup>24</sup> to a shock to a variable in a country (e.g., Italian sovereign) illustrate the impact on other sectors and other countries. The overview of the framework is summarized in Box 1 (see Gray and others (forthcoming) for details).
- Financial risks for banks and corporate are measured by the expected loss ratio (EL) as reported by Moody's KMV. EL is conceptually based on a version of the contingent claims approach (CCA) used by Moody's KMV and represents the share of expected loss (probability of default × loss given default) over a given amount of debt.<sup>25</sup> For the sovereign, EL is estimated from CDS spreads using their theoretical relationships. Credit growth and real GDP growth represent the conditions of the real economy included in GVAR.
- The GVAR model includes 16 countries (advanced European countries and the U.S.) and uses monthly data from January 2002 to end 2012. The system consists of EL for banks, corporates, and sovereign; and credit and real GDP growth rate for each country.
- The scenario simulation relies on generalized impulse response functions of an isolated, one-period shock to each variable in the sample countries. In order to assess the relative importance of each trigger on average, a standardized shock (i.e., one standard deviation shock using GVAR residuals) is considered, as is typical with standard VAR exercises. Gray et al. (forthcoming) examined the impact of a correlated shock among multiple variables (e.g., a simultaneous shock to Italian and Spanish sovereign EL) in order to describe the dynamics of the system for more extreme scenarios.

**38. This note considers shocks to each of the five sectors in Italy (banks, corporate, sovereign, credit, and GDP).** The output sheds some lights on domestic cross-sector interlinkages and outward spillover from Italy to other countries. As for the sovereign, banking, and corporate sectors, the impulse response of EL (in log differences) is converted to credit spreads or Fair Value CDS (FVCDS)<sup>26</sup> spreads using the end 2012 level data.<sup>27</sup>

<sup>23</sup> Dees, Di Mauro, Pesaran, and Smith (2007) "Exploring the International Linkages of the Euro Area: A Global VAR Analysis" *Journal of Applied Econometrics*, Vol. 22, pp. 1–38.

<sup>24</sup> As introduced by Pesaran and Shin, 1998, "Generalized Impulse Response Analysis in Linear Multivariate Models," *Economic Letters*, vol. 58, pp. 17–29.

<sup>25</sup> EL measures the expected loss over a five-year horizon due to default as a fraction of default-free debt.

<sup>26</sup> CDS spreads consistent with equity and balance sheet information, derived by CCA.

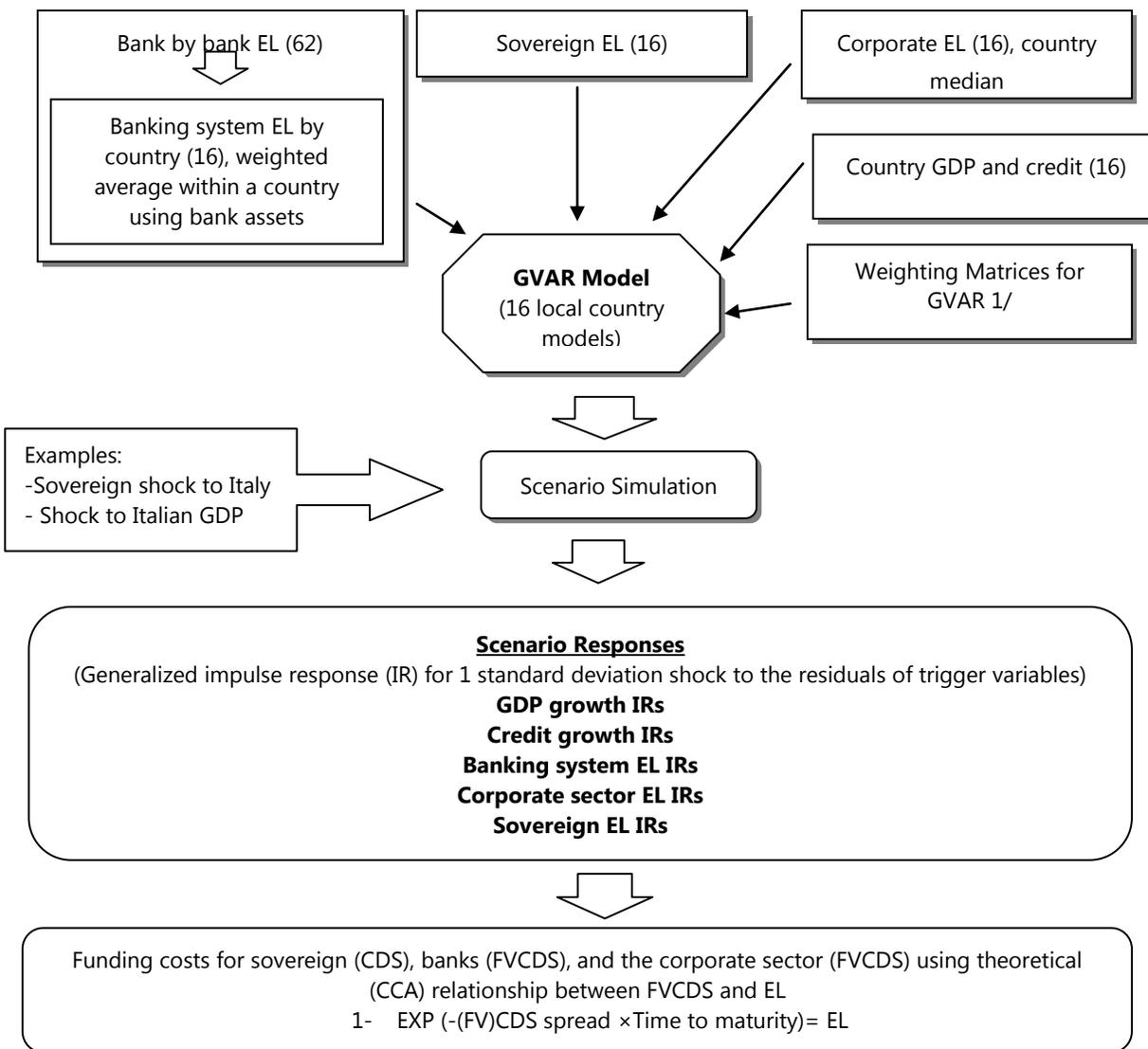
**Box 1. The Structure of BIS International Banking Statistics**

**EL:** Five year Expected loss ratio—a CCA credit risk indicator as reported by Moody's

**FVCDS:** Five year Fair Value CDS—CDS spreads consistent with equity and balance sheet information

**Sample Countries:** 16 (Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherland, Norway, Portugal, Spain, Sweden, Switzerland, U.K., and U.S.)

**Frequency and unit:** Monthly changes in natural logarithms of indicators, estimated using data from January 2002 to end 2012



Source: Modified by author, based in Gray and others (forthcoming)

1/ Foreign variables enters to a country A's VAR as weighted sum across all countries other than A.

<sup>27</sup> The model is estimated in log differences. Therefore, the model's implication in levels depends on the specific initial values.