

Analyzing Systemic Risk of the European Banking Sector

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Abstract

Since the summer of 2007, the financial system has faced two major systemic crises. European banks have been at the center of both crises, particularly of the European sovereign debt crisis. This article analyzes systemic risk of European banks across both crises exploiting the specific institutional nature of the European banking system. We employ the “Systemic Expected Shortfall” concept developed in Acharya et al. (2010) which creates a systemic risk index among financial institutions based on their individual contribution to the capital shortfall of the financial system. We analyze what banks are most systemic in Europe using cross-sectional tests. We then construct a ranking of European banks and European countries as of June 2007 and calculate an estimate of the expected capital shortfall at that time. European governments have supported the banking sector with EUR 4.1 trillion using various support schemes and virtually all banks have raised capital, many of them, however, at steep discounts. We find that markets demand more capital from banks with high exposures to particularly peripheral countries in Europe, that is, banks’ sovereign debt holdings are a major contributor to systemic risk. Using hand-collected data of sovereign debt holdings and impairments, we provide estimates how much capital is needed to restore confidence in the banking sector.

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1. Introduction

Since the summer of 2007, the financial system has faced two major systemic crises. While the financial crisis of 2007 to 2009 had its origin in the US housing market, the European sovereign debt crisis that started in 2010 is the result of excessive sovereign debt financed by the banking system.

Academics and regulators have developed different concepts and proposals as to how to measure systemic risk, classify systemically important financial institutions (SIFIs) and trace the determinants of systemic risk. For example, the G-20 has just released the names of 29 globally systemic institutions that will be required to hold an additional capital buffer. In Europe, regulators require 70 European banks to increase their core capital ratio to 9% until June 2012 and hold a temporary capital buffer against additional write-downs of their sovereign debt holdings.

Acharya, Pedersen, Philippon and Richardson (2010) measure systemic risk as the amount by which a bank is undercapitalized in a systemic event in which the entire financial system is undercapitalized, and they call this concept the systemic expected shortfall (SES). This concept is appealing as it uses market data that are readily available to regulators and market participants. In this article, we use this concept in our empirical analysis.

The first part of this article analyzes systemically important European banks during the 2007 to 2009 financial crisis using the SES. What were the SIFIs in Europe when the crisis hit? How much capital should have been raised by these institutions in July 2007 to cover their expected capital shortfall? We use the SES not only to identify systemic institutions but also to rank countries according to the SIFIs domiciled in each country and to construct future risk rankings. We then analyze how regulators and institutions responded to the crisis. Within 24 months after the default of Lehman Brothers, the European Commission approved approximately EUR 4.1 trillion in support to financial institutions. Using information about state-aid support at the country level, we find that the systemic risk measure (calculated as of June 2007) explains a significant fraction of the government support. In other words, the most systemic institutions, according to this metric, were also the ones that obtained most of this support. Banks also reacted to the crisis and the substantial write-downs of their mortgage portfolios. Approximately EUR 98 billion of common equity was raised by European banks in 2008 alone. In most cases, banks were able to raise capital in private markets. The British government, however, took over most of the shares issued by, for example, the Royal Bank of Scotland Plc, thereby nationalizing several of its major banks.

In the second part of this article, we extend our analysis to the European sovereign debt crisis. Using the SES to construct risk rankings at different points in time, we find that banks with high exposure to peripheral states in Europe are riskier according to this metric in 2010 and 2011, thus suggesting that banks' sovereign debt holdings are a major source of systemic risk. We show that our systemic risk measure can, to some extent, be explained by sovereign exposure.

The sovereign debt crisis peaked in July and August 2011 when interbank markets shut down, similar to what occurred in 2008. Volatility in financial markets also reached its highest level after the Lehman default. An important concern is the high level of leverage with which banks are operating. The average leverage ratio (defined as market value of equity as a percentage of total assets) of the banks in our sample was 2.1% as of September 2011. For comparison, for the same banks, this ratio was 7.2% in the summer of 2007. To restore market confidence and to prevent a credit crunch, banks need to be re-capitalized. In the last section of this article,

we empirically analyze how confidence can be restored. Using hand-collected data from banks' semi-annual reports in 2011, we know the extent to which banks have already impaired their sovereign bond portfolio; thus, we calculate each bank's capital shortfall using different benchmark capital ratios and sovereign shocks. Our estimates show that European banks have an aggregate shortfall of EUR 600 to EUR 1,000 billion. As in the 2007 to 2009 financial crisis, there are different ways to address this shortfall, including private sector re-capitalizations or public interventions, such as debt-guarantee schemes, government sponsored re-capitalizations, support for bad assets schemes and liquidity support.

This article relates to the broader literature on systemic risk. Recent papers that proposed measures of systemic risk are Acharya et al. (2010), Brunnermeier and Adrian (2010), Allen, Bali and Tang (2010), Billio et al. (2010), Brownlees and Engle (2010), Chan-Lau (2010) and Huang, Zhou and Zhu (2010) and Tarashev, Bori and Tsatsaronis (2010). It is also related to papers that analyze the factors that contribute to systemic risk. For example, Brunnermeier, Dong and Palia (2011) find that banks' noninterest income explains some of the variations in their systemic risk proxies.

The rest of this article is structured as follows. Section 2 introduces the methodology, section 3 presents data and summary statistics and section 4 analyzes systemic risk during the 2007 to 2009 financial crisis, presents country risk rankings and calculates the expected shortfall of banks as of June 2007 using the SES metric. Section 5 analyzes the response of policymakers and banks to the financial crisis. Section 6 focuses on sovereign debt holdings as a source of systemic risk. Section 7 concludes.

2. Methodology – Measuring systemic risk

The empirical analysis in this article is based on the theory of systemic risk regulation presented in Acharya, Pedersen, Philippon and Richardson (2010).³ Measuring and regulating systemic risk is important because of the externalities associated with the failure of an institution, that is, the costs due to deposit insurance, bailout costs and a loss of intermediation to the real sector. Systemic risk occurs if and only if there is an aggregate shortage of capital in the financial sector such that a reduction in lending by the failure of one bank cannot be offset by other financial institutions.⁴ A good indicator of a loss of intermediation to the real sector is the EURIBOR-OIS spread. Large spreads indicate problems in the interbank market. Figure 1 shows the EURIBOR-OIS spread for 4 different maturities, 1 m, 3 m, 6 m and 1 y, from the summer of 2007 through July 2010. The spreads were almost zero for all maturities before the crisis hit. We observe a sudden increase in the spreads in July and August 2007 and a spike in the fall of 2008 after Lehman Brothers' collapse.

Acharya, Pedersen, Philippon and Richardson (2010) show that SES is the market value amount of equity a bank drops below its target value conditioned on the aggregate capital falling below a target value (which is the definition of an extreme tail event). They demonstrate that SES can be explained by two factors. The first is the ex-ante leverage ratio of the bank, and the second is a term that captures the performance of the bank when an

³ A publicly available implementation of this approach for US financial institutions is provided in real time (updated weekly) on the vlab website at NYU-Stern. The website is available at <http://vlab.stern.nyu.edu/welcome/risk>.

⁴ Ivashina and Scharfstein (2010) and Puri, Rocholl and Steffen (2010) show that banks decrease credit supply to both corporate and retail borrowers, which in turn leads to a decrease in corporate investment, as shown by Duchin, Ozbas and Sensoy (2010).

extreme tail event happens. Intuitively, a bank that is already undercapitalized once a systemic crisis occurs needs more capital (for example, capital injections or bailouts for depositors), as does a bank with a high sensitivity to an extreme event. Ideally, a bank with a business model that is highly sensitive to extreme market movements should operate with significantly lower leverage ratios relative to a bank that is less sensitive.

To operationalize the above described framework, we identify the two factors that have strong predictive power for the bank's stock price return during a full-blown financial crisis, namely, the marginal expected shortfall (MES), which measures the performance of a bank when the market return as a whole (MSCI Europe index) experiences its worst 5% trading days within a year, and the bank's (quasi-) market leverage ratio (LVG), which is its (quasi-) market value of assets⁵ divided by market value of equity. We measure SES as the stock price returns during the financial crisis and calculate realized returns over the July 2007 to December 2008 period.

3. Data and summary statistics

We construct a sample of publicly listed banks, including all listed banks from the official European stress tests in both 2010 and 2011 and add large, publicly listed European banks that either are not EU members (for example, UBS and Credit Suisse) or that had already failed by the summer of 2010 (for example, the Anglo Irish Bank). Overall, 63 banks are analyzed as part of the sample, and a list of these banks is provided in Appendix 1. Approximately 60% of all banks come from the following 6 countries: Spain (8), Italy (7), Germany (6), Greece (6), the UK (6) and France (4). Stock prices, indices and balance sheet information are downloaded from Bloomberg.

Table 1 shows summary statistics for these banks. On average, their stock prices dropped by more than 71% during the July 2007 through December 2008 period (the realized SES). We construct 4 market-based measures that can potentially explain stock price returns over the preceding 12 month period, that is, June 2006 to June 2007, including the expected shortfall (ES) of a stock at the fifth percentile, its annualized daily return volatility (Vol) and its correlation with the market (Beta). The fourth measure is the MES, which, in contrast to the previous three measures, explicitly incorporates the sensitivity to the market in the left tail. The LVG, total assets (shown as the natural logarithm (Log-Assets)) and market equity (MV) are as of June 2007.

The average LVG is 14.44 (median 11.46) spanning values from approximately 2 through 40. The 5 banks with the highest leverage ratios in the summer of 2007 are Banca Italease SpA, Deutsche Bank AG, Natixis, Credit Agricole SA, SEB AB and Commerzbank AG. The quantitative analysis covers both small listed banks (the smallest bank is FHB Mortgage Bank, with EUR 2 billion in assets) and very large listed banks (the largest bank is UBS AG, with EUR 2,000bn in assets). The mean (median) MV is 24.91bn (12.42bn). Table 1 also reports the correlations between these variables. MES and LVG have the highest negative correlation with the realized SES.

Figure 2 shows graphically how well MES, measured using one year of data up to June 2007, explains the stock price returns between July 2007 and December 2008. We construct a

⁵ Measured using balance-sheet data as Book value of assets – Book value of equity + Market value of equity.

second measure of tail dependence (F-MES), which is the performance of each bank when the financial sector (MSCI Europe Banks index) experiences its worst days in the year prior to the financial crisis. The second figure shows stock returns against F-MES, again suggesting that MES/F-MES meaningfully predicts stock performance in the financial crisis.

To get a sense of the effect of leverage, we also plot stock returns against banks' leverage ratios. Figure 3 shows that LVG explains a significant part of the variation in realized returns. Moreover, as a robustness test, we plot MES over the period June 2006 to June 2007 against the MES measured over the period June 2005 to June 2006 in Figure 4. The results suggest a high positive correlation between MES over time.

4. Measuring systemic risk of European banks

4.1. Identifying systemically important financial institutions (SIFIs) as of June 2007

In a next step, we construct a ranking of systemically important European banks as of June 2007 using the measures described above. Table 2a shows the results relating realized stock returns to these measures individually and then collectively. Vol and Log-Assets do not significantly explain stock returns. The ES is weakly significant, and the sign of its coefficient is intuitive as banks with high negative stock returns also perform worse when the market experiences a negative shock as a whole. Moreover, Beta is also negatively related to stock returns. The impact of our tail risk measure is much stronger. The coefficient of MES is -11 and significant at the 1% level. The coefficient is also economically meaningful; a one standard deviation increase in MES reduces stock returns by approximately 5.6 percentage points. Furthermore, banks with higher leverage ratios exhibit significantly lower stock returns. A one standard deviation increase in the LVG decreases stock returns by 4.5 percentage points. Both the MES and LVG explain the largest part of the variation in the SES, comparing the R²s of models (1) through (6).

We provide various model specifications using MES and LVG together in columns (7) through (10). Overall, the magnitude of the coefficients of the MES and LVG remain unchanged.⁶

Our set of banks is headquartered in 19 different countries from both core and peripheral Europe. The countries vary in terms of their debt to GDP ratios with which they enter the financial crisis in 2007. While Ireland has the lowest leverage with a debt to GDP ratio of approximately 25%, Greece and Italy's debt levels exceed 100% of their GDP. Some countries may be less able or (perhaps for other reasons) less willing to support their banks in times of stress. Thus, the coefficients of the MES and LVG may be overstated. In further regressions, we add country fixed effects to our models. We exclude those countries from our tests that headquarter only 1 bank in our sample, as the coefficient of the country fixed effect would absorb the effect of the respective bank. Overall, we exclude 4 banks (countries): Bank of Valetta (Malta), DnB NOR Bank SA (Norway), PKO Bank Polski SA (Poland) and Banco Comercial Portugues SA (Portugal). The results are reported in Table 2b. While the

⁶ We performed several tests to support the robustness of our results. As returns are bounded between 0 and 1, we use tobit models to relate MES and LVG to stock returns. In further tests, we set the return of some banks to -1 if they were finally taken over by the government or by other banks. These banks are Banca Italease, Commerzbank, Hypo Real Estate, IKB, Royal Bank of Scotland, HBOS, Anglo Irish Bank, Allied Irish Banks. The results are not different from those that are reported in Table 2a.

coefficients in all 3 models turn out to be marginally smaller compared with the models in Table 2a, all the results continue to hold.

We employ the best fit of realized returns during the financial crisis (July 2007 to Dec 2008), as explained by both MES and LVG to construct a fitted systemic risk measure and rank firms using this fit. More precisely, we use the coefficients from model (10) of Table 2a to calculate the SES (Fitted). Thus, the ranking is based on the following model:

$$\text{SES (Fitted)} = -0.73 - 10.41 * \text{MES} - 0.005 * \text{LVG} + 0.02 * \text{Log Assets} \quad (1)$$

Table 3 shows the top 20 systemic banks in Europe at the end of June 2007 using this fit. Five out of the top 10 banks were either bailed out by the government or by private bank syndicates during or after the crisis, or they were taken over by other banks. For example, Hypo Real Estate (ranked No. 5) received approximately €150 billion of capital and guarantees between September 2008 and November 2009 by the German government and is now completely nationalized. Another German bank, Commerzbank AG (ranked No. 4), received approximately €18 billion capital support, and the government now owns 25% (+1) of the common stock. Remarkably, 4 out of the 10 most systemic banks are German, though Allied Irish Banks, Dexia SA, Credit Suisse and HBOS Plc received substantial government support and/or were taken over.⁷ Overall, constructing systemic risk measures based on MES and LVG appears to coincide well with actual government support and interventions. We test this more formally in section 5. Notably, the ranking is based on market data to compute downside risk and leverage from June 2007.

4.2. Capital shortfall

To what extent are banks undercapitalized in the summer of 2007? Using MES and LVG, we can calculate an expected decline in market equity during the crisis using the above model (the fitted SES). We also need a benchmark capital ratio that banks are supposed to maintain. We chose various scenarios in which banks are required to have a 4%, 6%, 8%, 10% or 12% ratio of market equity to total assets (MV/TA).⁸ If banks have an MV/TA ratio below this benchmark before the crisis, they already face a positive shortfall.

Table 4 shows the aggregated capital shortfall for each scenario and lists the top 10 banks sorted by asset size.⁹ The adjusted MV is the market value of equity after the crisis calculated as $MV \times (1 + \text{SES})$. The market value of equity of all banks is approximately EUR 1.6 trillion in June 2007. The expected market value is EUR 470 billion corresponding to a decline of approximately 70%.

⁷ Dexia received EUR 6.4bn in capital and EUR 150bn in guarantees from the government in September/October 2008 (see Appendix 2). During the latest sovereign debt crisis, Dexia finally collapsed and was broken up in October 2011. The retail bank was nationalized by the Belgium government, other parts have been taken over by other institutions or are going to be sold. Other assets are placed into a “bad bank”.

⁸ The average MV/TA ratio was 6.5 as of June 2007.

⁹ Appendix 2 reports the capital shortfall for all of our sample banks, sorted by asset size. We report TA and MV as of June 2007 and the expected percentage decline in market equity using the above model.

We also present the aggregate shortfall in capital in each of the five scenarios. For example, if banks are required to maintain a 4% MV/TA ratio, they would need to raise EUR 577 billion capital. If the benchmark is set at 12%, the shortfall would increase to EUR 2,600 billion.

The choice of the benchmark capital ratio does not affect the ranking as to which financial institutions are systemic according to their percentage contribution of capital shortfall to the financial sector. The 10 most systemic banks according to this metric are the Deutsche Bank AG, UBS AG, BNP Paribas, Credit Agricole SA, Commerzbank AG, Barclays Bank Plc, ING Groep NV, Societe Generale, Credit Suisse Group AG and Natixis.

4.3.Ranking the countries according to their SIFI's

The national governments in Europe are responsible for supporting their banks, if necessary. As presented above, 4 of the top 10 most systemic banks are from Germany. If the banks themselves cannot raise capital in private markets and need to be bailed out by their government, the expected cost to taxpayers depends on the expected shortfall of the SIFIs of that country.

The methodology used to identify the SIFIs can be used to rank each country according to the average SES of its institutions.¹⁰ Governments eventually have to bail out their SIFIs, which is an important concern. For example, Ireland had a debt/GDP ratio of 25 in the summer of 2007. Because of unwise investments (such as investments in US subprime mortgages), the Irish government had to bailout and partly nationalize its three largest banks, Allied Irish Banks, Anglo Irish Bank and Bank of Ireland. The nationalization of Irish Life and Permanent followed in December 2010. In 2010, Ireland's debt to GDP ratio increased by 68.8 percentage points to 92.6%. Acharya, Drechsler and Schnabl (2011) empirically examine whether there is feedback from excessive sovereign debt to the banks that has to be taken into account. First, if sovereign debt is risky, the market value of sovereign bonds already on the banks' balance sheets is reduced. Banks are the largest holder of domestic sovereign debt, but sovereign debt is also an important component of banks' foreign lending activities because of their low regulatory risk weight. Second, government guarantees and the value of governments as lenders of last resort are reduced. Ireland was one of the first countries that eventually needed support from the European Financial Stabilization Mechanism (ESFM).

We provide a ranking of the countries sorted by their contribution to the overall (predicted) capital shortfall in our sample in Table 5.¹¹ We report the average MES and LVG ratios as of June 30th, 2007 and the sum of TA, MV and BV across all banks within each country. The number of banks in each country is also reported. The banking market, as represented by our sample, has EUR 25 trillion in assets in June 2007. The UK has the largest banking market according to all 3 metrics, TA, BV and MV, and France is a close second. Banks in the UK, France, Germany and Switzerland represent more than 60% of all assets in the banking market in our sample. Interestingly, while UK banks have, on average, a MV/TA ratio of 8.34%, French, German and Swiss banks have ratios in the range of 3% to 4%.

UK ranks first on the list of systemic countries contributing 25.9% of the overall capital shortfall. France and Spain come next. These 3 countries account for 50% of the overall capital shortfall. Evidently, banks in France, Germany and Switzerland have the highest

¹⁰ Note that this exercise does not account for the fact that some governments in the EU area provide billions of Euros for stability mechanisms to support (mostly peripheral) European countries.

¹¹ The predicted capital shortfall is calculated multiplying SES (Fitted) with the MV as of June 30th, 2007.

leverage ratios, and Norway, Belgium and Ireland have the highest sensitivity to extreme market movements.

4.4. Comparing risk rankings over time

The empirical methodology can be readily used to construct risk rankings at different points in time. We can observe LVG and calculate MES over the previous 12 months. Note that we can only observe the average loss of a bank's share price in, perhaps, the worst 5% of the trading days of the market, which is different from a real crisis. Our model, as shown in equation (1), is adjusted to a real systemic event and can, thus, be used to estimate the expected systemic shortfall of banks if a crisis akin to the 2007 to 2009 financial crisis occurs.

We use this methodology to rank financial institutions at different points in time: (1) May 5th, 2009 (when the US stress test results were released), (2) July 23rd, 2010 (when the EBA stress test results were released), (3) July 12th, 2011 (when the second EBA stress test results were released), and (4) September 30th, 2011 as the most recent ranking. The results are reported in Tables 6a and 6b. Banks are sorted according to their fitted SES.

Noticeably, Commerzbank moves to the top of the systemic institutions by May 2009 as shown in Table 6a. The Bank of Ireland and Allied Irish Banks rank 2 and 3, and ING ranks 4 in the May 2009 ranking. All four banks received substantial government support during the financial crisis. Commerzbank received approximately EUR 18 billion, the Bank of Ireland and Allied Irish Banks were partly nationalized after the Irish government committed EUR 3.5 billion to the Bank of Ireland and EUR 6.6 billion to Allied Irish Banks in May 2010, and the Dutch government purchased EUR 10 billion preferred shares in ING and provided a EUR 35 billion backup facility for their mortgage portfolio. By July 2010, the Irish banks led the list of systemically risky financial firms.¹² Ireland requested financial assistance from the European Union, the euro-member states and the IMF in November 2010 and received an overall support package of EUR 67.5 billion disbursed over a 3-year period.¹³

In the 2010 and 2011 rankings, Belgium and French banks, specifically Dexia SA, Credit Agricole SA and Societe Generale, moved to the top of Europe's systemic financial institutions. In June 2010, Dexia exited the state guarantee program under which it could issue state guaranteed short- and long-term debt. Dexia had entered the program in October 2008, after they have been bailed out. In October 2011, after having reported EUR 4 billion losses largely due to investments, such as in GIPSI bonds, the bank was broken up.

Table 6b shows the top 20 most systemic banks as of September 30th, 2011, reporting MV, TA, BV and LVG for that time as well as for June 2007 to facilitate a direct comparison. The bottom row reports the sum (or average) across all banks in our sample. Interestingly, total assets increased by approximately 7% to EUR 25 trillion with BV increasing by 35%. At the same time, the MV of all banks dropped by 53%.

¹² Irish Life and Permanent (ranks number one in the July 2011 ranking) was nationalized in October 2011.

¹³ A detailed analysis of the financial assistance package for Ireland and other states is provided on the website in the Economic and Financial Affairs section of the European Commission (http://ec.europa.eu/economy_finance/eu_borrower/ireland/index_en.htm).

5. Responses to the Financial Crisis of 2007-2009

Since the onset of the crisis in the summer of 2007 and particularly after September 2008, a sharp decline in stock prices and write-downs of bad assets left banks even higher levered compared with the before-crisis period. Interbank markets froze and banks were unable to finance themselves. The economic activity was expected to decline by 4% in 2009. To contain the effects of the financial crisis, a large number of measures were taken in the EU both by banks and policymakers.

5.1. Policy response

Policy responses took the form of direct bank support, monetary policy and fiscal policy. The first set of measures aimed to directly support the banking system. Starting with the Irish Credit Institutions Financial Support scheme in September 2008, the European Commission approved a total of over EUR 4.1 trillion by mid-2010 (CEPS (2010)). Support schemes can be classified as (1) debt guarantees¹⁴, (2) re-capitalizations, (3) liquidity support and (4) support for bad assets.¹⁵ Of the state aid, 76% was in the form of debt guarantees and approximately 10% (12%) was in the form of bad asset support (re-capitalizations).

There is substantial variation as to the amount of state aid provided to each country. Ireland, for example, committed more than twice its GDP for direct bank support. Some factors that determine the size of the rescue packages are the relative size of the banking sector (which is larger in the UK or Ireland) and the assets to which banks are particularly exposed. For example, the UK and Germany are exposed to impaired assets originating in the US, whereas Ireland, Spain and Denmark (and the UK) are more exposed to a potential collapse of the national real estate market. Other countries, in turn, are more exposed to Central and Eastern Europe; examples include Austria and Belgium (EC (2009)).

It is an interesting question whether the more systemic banks (as measured using the approach above) also receive more state aid. To answer this question, we use the data provided in EC (2009), disclosing public intervention schemes on a country-by-country basis, and we identify 15 countries that we can match to our sample.¹⁶ Figure 5 plots the SES (Fitted) as of June 2007 aggregated per country against the public interventions measured in percent of GDP. The SES data (Fitted) are reported in Table 5. We find a significant negative correlation, that is, countries with the most systemic banks as of June 2007 were also providing the most public support for the banking sector (the R^2 is 27.4%).

In addition to direct bank sector support, central banks in Europe (ECB, Bank of England, Sveriges Riksbank) responded with expansionary monetary policy and credit support. Between October 2008 and the summer of 2009, the ECB reduced its benchmark policy rate from 4.25% to 1%. It cut the deposit facility rate in early 2009, expanded the list of assets eligible as collateral in Eurosystem credit operations, enhanced the provision of longer-term financing and offered USD liquidity through foreign exchange swaps. In May 2009, the ECB started to purchase EUR 60 billion covered bonds to enhance the provision of liquidity.

¹⁴ Guarantees were usually provided in national schemes. To mitigate incentives to move capital to countries with the highest level of protection, the European Commission set up requirements for national guarantees on bank liabilities (EC (2009)).

¹⁵ Deposit insurance was also increased across Europe.

¹⁶ Norway and Switzerland are not EU members and, therefore, are not in the report by the European Commission. Information for Cyprus and Denmark was not disclosed or is not available (for some of the interventions).

The EU also provided a significant amount of fiscal support through its European Economic Recovery Plan (EERP), which was estimated at a total of 2% of the GDP over the 2009 to 2010 period (EC (2009)).

5.2. Equity and rights issues of European banks

How did European banks respond? They lost, on average, 72% of their market value during the July 2007 through December 2008 period, and some banks were struggling with deteriorating Tier 1 capital ratios because of write-downs of bad investments. During 2010, some banks were also trying to raise capital to repay state aid that they had received in the aftermath of the Lehman default.

We collect additional data on equity and rights issues of European banks between July 2007 and September 2011. For 49 banks, we are able to track their offerings and identify 122 offerings in total.¹⁷ Ten of these offerings were in 2007. More than 50%, however, were in 2008 and 2009.

Panel A of Table 7 reports the top 10 banks that raised capital during the July 2007 to September 2011 period sorted by the amount of capital raised. In total, all 49 banks raised EUR 243 billion capital. Note that this amount only comprises common equity issues. It does not consider preferred equity or, for example, convertible debt issues that can be converted into common equity. The top 10 banks account for approximately 65% of all issues. The Royal Bank of Scotland Group leads these banks with a total of EUR 40 billion raised in 3 offerings, followed by Lloyds Banking Group with EUR 26 billion and UBS AG with EUR 16 billion. Interestingly, all 5 UK banks are in the top 10 group. Deutsche Bank AG (EUR 12 billion) and Commerzbank AG (EUR 11 billion) are also on that list but for different reasons. Deutsche Bank, for example, needed capital to take over Postbank AG, a German retail bank. Commerzbank needed capital in 2011 to repay state aid that they had received after taking over Dresdner Bank in January 2009.

To better understand the immediate reaction of banks to the crisis, we focus on rights issues in 2008, before and after the Lehman default. Panel B of Table 7 shows who raised capital in 2008. Overall, EUR 98 billion of common equity was raised in 2008, which corresponds to 40% of the total capital raised between July 2007 and September 2011, EUR 46 billion after the Lehman default.

Before the Lehman default in September 2008, almost half of all capital had been raised by the Royal Bank of Scotland and UBS. Both banks used deeply discounted rights issues having been forced into these emergency capital-raising exercises by their losses during the crisis. In April 2008, the Royal Bank of Scotland was one of the least capitalized banks as a direct consequence of the GBP 48 billion takeover of ABN Amro in the fall of 2007 and large write-downs. Barclays followed in June 2008, raising EUR 5 billion in ordinary shares (but their rights issue was not deeply-discounted). Three major French banks also raised capital during the first 9 months of 2008: Credit Agricole (EUR 5.9 billion), Societe Generale (EUR 5.5 billion) and Natixis (EUR 3.7 billion). Rights were offered at a discount of approximately 40% of the prevailing share price in all 3 transactions.

¹⁷ The only banks for which we could not identify equity or rights offerings are Allied Irish Bank, DnB NOR Bank ASA, Hypo Real Estate Holding, Landesbank Berlin, KBC Group SA, OTP Bank Nyrt and Svenska Handelsbanken AB.

Post-Lehman, the Royal Bank of Scotland Group issued EUR 19 billion in capital followed by Banco Santander S.A. with EUR 7.2 billion. Credit Suisse, for example, raised EUR 2 billion common equity as part of a voluntary recapitalization package with net proceeds of approximately EUR 6.6 billion. Deutsche Bank needed capital to finance a minority stake in Postbank AG.

Interestingly, all the UK banks in our sample except HSBC issued capital after Lehman's default.¹⁸ The Royal Bank of Scotland placed EU 19 billion of ordinary shares fully underwritten by the UK Government, which finally took up 99.8% of these shares. Lloyds carried out 2 rights issues in September and October 2008 of EUR 6.7 billion in total. Similar to the Royal Bank of Scotland, the October rights issue (EUR 5.7 billion) was underwritten by the government, and it took up 99.5% of the shares. Both the Royal Bank of Scotland and Lloyds have been recapitalized under the Bank Recapitalization and Guarantee Scheme of October 2008. As of September 2011, the UK government owns 83% of the Royal Bank of Scotland and 41% of Lloyds. Barclays already issued ordinary shares of EUR 888mn in September 2008 without the involvement of the UK government. Standard Chartered carried out a rights issue in November 2008 raising EUR 2.1 billion common equity that was not under the recapitalization scheme.

Taken together, most of the 22 banks that raised capital in 2008 reacted directly to losses incurred during the financial crisis by issuing heavily discounted rights. Interestingly, the UK was the only country in which governments immediately (at least in parts) nationalized some of their SIFIs in 2008.

6. After the Crisis Is Before the Crisis – The Sovereign Debt Crisis of 2010 –

6.1.Sovereign debt exposure as a source of systemic risk

Figure 1 shows that the markets eventually calmed down in 2009, that EURIBOR-OIS spreads returned to lower levels (however, they never returned to pre-crisis levels, and they now show greater sensitivity toward maturities) and that economic conditions improved in countries around the globe.

Europe and European banks were heading toward a new crisis. While the 2007 to 2009 financial crisis originated through troubles in the US housing market, an increase in sovereign risk caused by high levels of debt was at the root of the current sovereign debt crisis. Greece was the first country that needed support in 2009. The crisis became much worse in July 2011 when interbank markets began to freeze again. The EURIBOR-OIS spreads increased to the highest level since the Lehman default (see Figure 1). The large spreads indicate the problems on the term interbank market beginning in July 2011. The funding problems are a sign of the dysfunctional European banking system. Even banks themselves do not trust each other and withhold lending. This is usually a precursor to a full-blown crisis with a credit crunch and a general loss of intermediation. Remarkably, there has been no senior unsecured bond offering of European banks in July and August 2011. Even large American funds pulled away from Europe, leaving a shortage of US funds for European banks.

¹⁸ HSBC Holdings Plc followed eventually and raised approximately EUR 14bn in March 2009. Their US household finance unit (primarily invested in US subprime mortgages), which was bought by HSBC in 2003, lost approximately USD 10bn in market value.

We identify five important aspects that are at the root of the current crisis. First, some countries already had very high debt levels before 2007. Among the Euro-area countries, Greece and Italy had the highest levels of debt to GDP at 105.4% and 103.6%, respectively, in 2007.¹⁹ Belgium (84.2%), Portugal (68.3%) and Hungary (66.1%) had the next highest levels. Overall, 9 member states had debt to GDP ratios above 60%, thus violating the Maastricht criteria. Second, most countries incurred significant public sector deficits because of public interventions in the banking sector, tax shortfalls and expenditure programs. Ireland, for example, increased its debt to GDP ratio by 71.2 percentage points between 2007 and 2010, more than 30 percentage points alone between 2009 and 2010 as a consequence of the recapitalization and nationalization of its large banks. The other 4 banks with the highest increase in debt were Greece (37.4), Portugal (24.7), Spain (24) and Germany (18.3). Italy's debt to GDP ratio increased by 15.4 percentage points. Third, European banks still had high leverage ratios in 2010 even though most of them increased capital until then, at least in market value terms. BV/TA and MV/TA ratios were 4.1% and 3.4%, respectively. For comparison, in June 2007, the average BV/TA and MV/TA ratios were 3.6% and 6.2%, respectively. Interestingly, banks increased their balance sheets and their book equity ratios by, on average, 0.5 percentage points; however, this increase is not reflected in their market value. Apparently, markets are discounting some of their portfolio holdings. Fourth, banks are heavily invested in domestic sovereign debt. Fifth, the incentives for regulatory arbitrage continue as the Basel II (and Basel III) assign zero-risk weights to most sovereign debt, that is, banks do not have to hold capital against these assets. In other words, banks can simply increase regulatory capital, shifting from high to low or zero-risk weight sovereign debt and giving them an incentive to hold sovereign debt.

Data released after the official EBA stress test confirm that banks have substantial exposure to the GIPIS countries (Greece, Ireland, Portugal, Italy and Spain) and sovereigns in general.

Banks' stock returns declined, on average, by 50% since October 2010. Figure 6 shows that markets are able to differentiate between banks with high versus low sovereign debt exposure. We plot each bank's total return against the GIPSI/MV. Banks with high sovereign debt relative to book value of equity exhibit significantly lower returns over the October 2010 to September 2011 period. In other words, markets are already discounting the GIPSI exposure of banks even though this is not yet reflected in balance sheet measures. Sovereign risk can affect banks in various ways. First, banks can be affected through write-downs and depletion of (book) equity if asset value declines are permanent. Second, banks may have problems with financing themselves. One reason may be that (e.g., due to a decline in ratings) banks are not able to use the assets as collateral to receive ECB funding. Another reason could be that banks are not be able to borrow in wholesale markets as investors are concerned about the value of their assets. Third, and related to the last issue, sovereign guarantees are worth less which can even aggravate the funding problem, particularly if banks are poorly capitalized. For example, Acharya, Drechsler and Schnabl (2011) find a co-movement of sovereign and bank CDS spreads after the bailouts occurred. These funding problems become apparent in the increasing EURIBOR-OIS spread, as explained above.

Overall, this suggests that interconnectedness of banks because of their sovereign debt holdings is an important source of systemic risk. To measure this more formally, we use the same methodology as explained in section 2. More precisely, we construct a fitted systemic risk measure using MES and LVG as of September 2010. We proceed in 3 steps. First, we regress realized returns during the October 2010 to September 2011 period on the MES, LVG and Log-Assets, similar to the above. We then use the coefficients from this model to

¹⁹ Sovereign debt to GDP ratios are from Eurostat.

calculate the SES (Fitted). In a third step, we relate the SES (fitted) to the GIPSI/MV using the most recent information about sovereign debt holdings as of December 2010. Equation (2) shows the best fit:

$$\text{SES (Fitted)} = - 0.71 - 6.86 * \text{MES} - 0.001 * \text{LVG} + 0.05 * \text{Log Assets} \quad (2)$$

In Figure 7, we plot SES (Fitted) against GIPSI/MV and find a significant negative correlation. Approximately 69% of the variation in the systemic risk measure is explained by GIPSI exposure.

6.2. Restoring market confidence

To restore confidence in financial markets, the European Banking Authority (EBA) conducted 2 stress tests in 2010 and 2011.^{20,21} In July 2010, the EBA assessed the resilience of the banking sector using a sample of 91 European banks (of these, 38 banks received approximately EUR 197 billion capital support to that date representing approximately 1.2 percentage points of the aggregate Tier 1 ratio). Instead of the Basel II 4% Tier 1 ratio, the stress test required banks to pass a 6% Tier 1 ratio in all scenarios. The adverse scenario simulated a cumulative 3 percentage point deviation in GDP over the test horizon (2010–2011) compared with forecasts from the EU Commission, and it also applied haircuts on sovereign debt. Haircuts are based on bond yields to reflect market values. For example, the haircut on Greek sovereign debt was 23.1%. However, the haircuts were only applied to sovereign debt held in the trading portfolio of each bank. Furthermore, the adverse scenario did not consider an actual default of Greece. Overall, 7 banks did not clear the 6% hurdle and were subsequently asked to raise capital.

One year later, on July 23rd, 2011, the EBA released the results from a second stress test. However, again, the scenarios did not include sovereign defaults. This time, only 4 banks did not pass the stress test. Overall, the official stress test did not convince market participants that the banking sector is sufficiently capitalized.

To restore confidence in the financial sector, it is, therefore, of first order importance to address the capital shortfall among European banks in a way that allows banks to finance themselves. We estimate the capital shortfall of European banks using the most recent data of sovereign bond holdings.²² As the official EBA stress test results give holdings as of December 2010 and given that most banks have agreed to share some economic losses as part of the second Greece rescue package in July 2011, we collected the most recent sovereign debt holdings from semi-annual reports of all banks and the impairments that have already been recognized.

²⁰ The EBA started operating as of 1 January 2011 taking over the responsibilities from the Committee of European Banking Supervisors (CEBS).

²¹ There was a first stress test in October 2009; however, no information (not even the name of the participating 22 financial institutions) has been disclosed. Authorities simply revealed that all banks were adequately capitalized.

²² Compare also our analysis in Acharya, Schoenmaker and Steffen (2011).

For 51 of the banks (37 public and 14 private banks) included in the stress test, we are able to retrieve the most recent reports. We collect information on current GIPSI holdings and impairments (as of June 2011).

Overall, we find that most banks have only impaired the “eligible” part of their Greek bond holdings, that is, holdings with a maturity of less than 2020 without recognizing that the remaining exposure is also worth less in market value terms. Furthermore, most of the banks have only written-off 21% of their eligible exposure. Consequently, only EUR 8 billion have been written-off in the second quarter of 2011 on holdings that have not already been recorded at fair value through profit and loss. As of December 2010, EBA data show approximately EUR 64 billion in exposure to Greece across these 51 banks. Our data indicate that these banks still have EUR 59 billion in exposure as of June 2011. Given EUR 8 billion in impairments, these numbers imply a net increase in Greek debt exposure across these banks.

Apparently, not all banks have taken the full loss on their sovereign holdings. Even if they report on a fair value basis, this is not necessarily reflected in income.²³ We report the 10 banks with the largest expected shortfall on Greek sovereign debt in Table 8. The calculations assume a 60% haircut on Greek sovereign debt. Total sovereign shortfall assumes that all GIPSI sovereign debt exposure is written down to market value using the following haircuts: 60% for Greece, 47% for Ireland, 45% for Portugal, and 25% for Spain and Italy. The haircut for Greece is within the range of what European regulators are considering in their approach to renegotiate the July 2011 bailout package. We take into account the relative increase in sovereign risk as reflected in the increase of the sovereign CDS spreads since the official EBA stress tests when applying the haircuts for the remaining GIPSI countries. Not surprisingly, all 4 Greek banks are on top of that list with a combined shortfall of EUR 23 billion in Greek debt. Moreover, the 2 Cyprian banks would have to charge EUR 3.4 billion in losses against income if their Greek debt is to be written down to market value. Two French banks are also on that list, BNP Paribas and Société Générale, with a combined shortfall of EUR 3.7 billion. The total shortfall of all banks is EUR 167 billion.

Stock prices have already discounted the banks’ sovereign debt holdings. Figure 5 shows a significant negative correlation between stock returns and exposure, that is, markets are requiring more capital from banks with higher exposure. We can describe each bank’s capital shortfall as the difference between its current capitalization and a benchmark or target level of capitalization, which is required if they are to be able to finance themselves. A good benchmark MV/TA ratio is the average ratio of competitors that are well capitalized and can finance themselves without problems. Two such competitors are HSBC Plc and JPMorgan, who have an average MV/TA ratio of approximately 6.67% and an average BV/TA ratio of 6.87% as of September 2011. Note that this is also very similar to the pre-crisis average leverage ratio of our sample banks.

We calculate the shortfall using our sample of public banks and exclude those banks from the analysis for which we have no current market values and sovereign exposures. As a result, 49 banks remain part of the analysis. The results are reported in Table 9, which shows the shortfall for the 10 largest banks (sorted by total assets). We show a range of capital ratios using both book and market values. We consider impairments as of June 2011 when

²³ There are three ways to recognize assets in the banking book. First, assets held to maturity (HTM), which are reported at costs and which are not impaired. Second, assets recognized as available-for-sale (AFS) are reported at fair value, but changes in fair value are not recorded as losses in the income statement. These changes are recorded in a reserve account, which is released once the assets are impaired. Third, assets reported at fair value through profit and loss (FVTPL). These assets are impaired and recorded as losses.

calculating the shortfall in book values. Interestingly, while, for example, the Royal Bank of Scotland and Banco Santander are well capitalized in book value terms and comparable to HSBC, their equity value trades are at a steep discount relative to HSBC. The aggregate shortfall (using above benchmark leverage ratios) is approximately EUR 600 billion (EUR 1,000 billion) using book (market) values. As during the 2007 to 2009 financial crisis, there are different ways to address this shortfall including private sector re-capitalizations or public interventions such as debt-guarantee schemes, government sponsored re-capitalizations, support for bad assets schemes and liquidity support.

On October 26th, 2011, the EBA announced different measures as part of a “broader package aimed at addressing the current situation in the EU by restoring stability and confidence in the markets”.²⁴ As part of this package, banks are now required to build 2 capital buffers. The first buffer ensures that the core Tier 1 capital exceeds 9% of risk-weighted assets, and the second buffer is a temporary buffer against sovereign shocks that reflect current market prices. The second buffer is reduced if the bank’s core Tier 1 capital ratio is already above 9%. Banks are required to build these buffers by the end of June 2012. Current estimates show that banks have to raise approximately EUR 106 billion in private markets. According to the EBA, however, strengthening banks’ capital positions is only one measure to restore market confidence. To ensure that banks are able to finance themselves in 2012²⁵, EBA announced a “term funding guarantee scheme” whose details have not yet been released. It is worth noting that during the previous crisis, debt guarantee schemes were as much as 6 times the amount injected through re-capitalizations (CEPS, 2010).

7. Conclusion

This article uses the systemic risk measure proposed by Acharya, Pedersen, Philippon and Richardson (2010) to analyze systemic risk in the European banking sector. We find that the SES is a useful measure to identify systemically relevant financial institutions, construct country risk rankings and calculate to what extent banks are undercapitalized in case of extreme crises. We argue that the most systemic banks were also the ones that obtained most of the government support after 2008. An interesting question that is beyond the scope of this article is what restrictions will be imposed by competition regulators and how will they affect the banks’ activities and propensity to repay state aid.

We also find evidence that sovereign debt holdings contribute significantly to systemic risk and calculate to what extent banks are undercapitalized. Thus far, regulators have reacted by requiring that banks raise capital even though this falls short of what is necessary to re-capitalise the banking sector. However, aside from the focus on current bank capital and funding needs, there are other issues that need to be addressed and that should be a part of a “broader package”. In contrast to current regulations, banks need to hold capital for investing in sovereign debt going forward. It is inevitable to recognize that sovereign debt is not riskless; this is a direct consequence of the necessary sovereign bailouts that we are currently observing. Moreover, sovereign debt levels need to be brought back to levels put forth in the Maastricht criteria, and rules must be put in place to achieve just that. Furthermore, the rules must be credible, and EU officials must be equipped so that they enforce these rules.

²⁴ EBA provides more information on their website (<http://www.eba.europa.eu/News--Communications/Year/2011/The-EBA-details-the-EU-measures-to-restore-confide.aspx>).

²⁵ Note that European banks have to refinance about EUR 700 billion in bonds in 2012.

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Figure 1: EURIBOR-OIS

This figure shows the EURIBOR-OIS spread for different maturities over the July 2007 to July 2010 period.

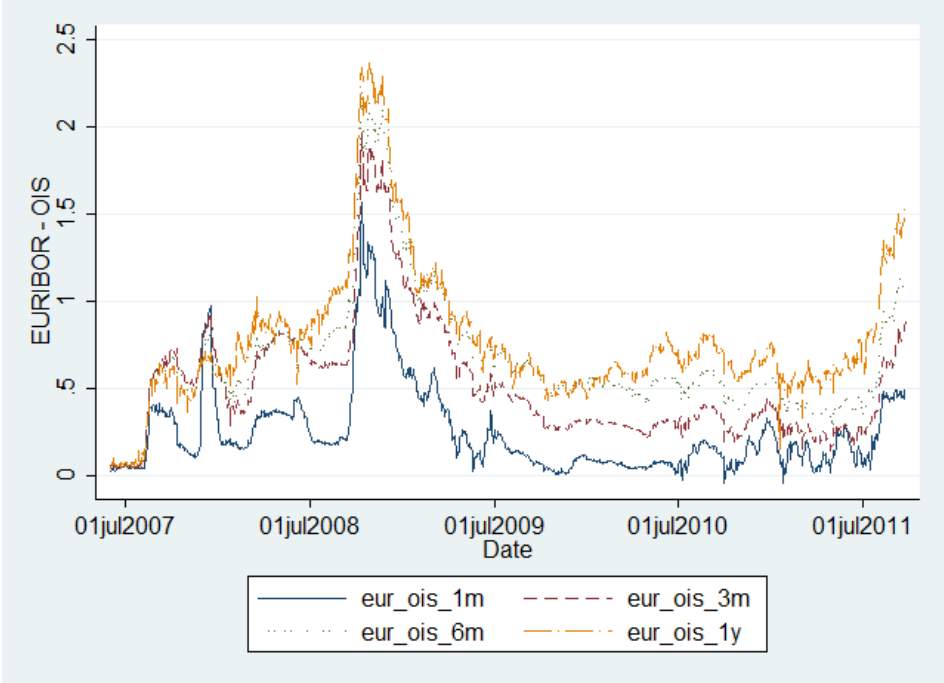


Figure 2: MES (F-MES) predicts realized stock returns during the financial crisis

The MES of an individual bank’s stock is plotted against the realized stock return during the July 2007 to December 2008 period. MES is the marginal expected shortfall of a stock given that the market return is below its fifth percentile. MES is measured for each individual bank’s stock using the June 2006 to June 2007 period. MSCI Europe is used to calculate market returns. The R^2 of a regression of SES on MES is 13.22%. The coefficient of MES is -11 ($p < 0.001$). F-MES is similarly constructed using the MSCI Europe Banks as benchmark. The R^2 of a regression of SES on F-MES is 9.27%. The coefficient of F-MES is -7.90 ($p = 0.006$).

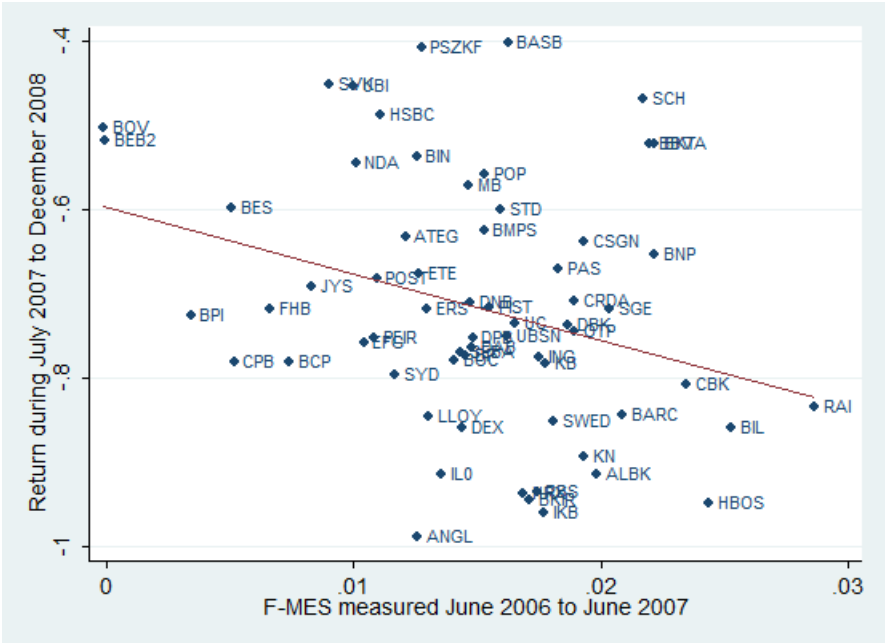
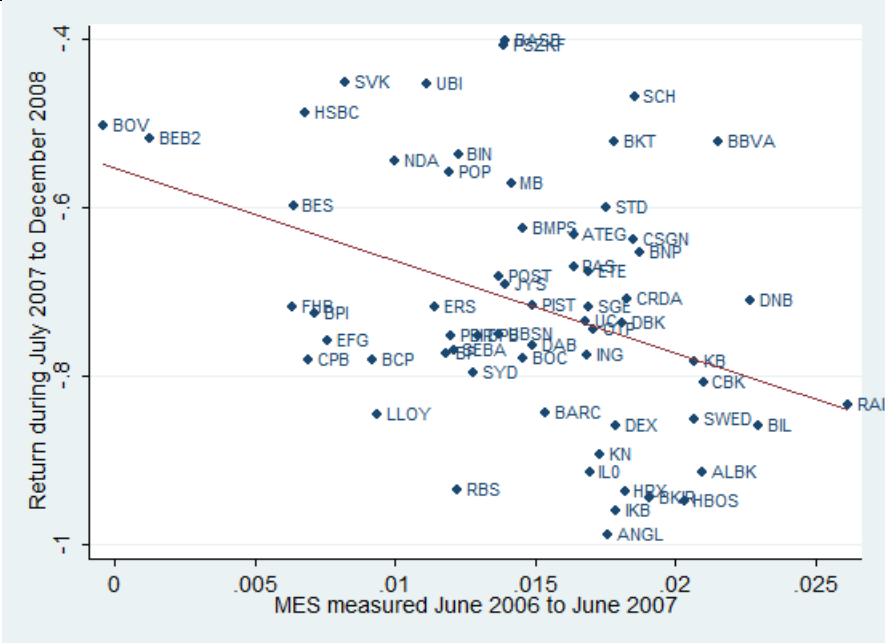


Figure 3: LVG predicts realized stock returns during the financial crisis

The leverage ratio (LVG) of an individual bank is plotted against the realized stock return during the July 2007 to December 2008 period. LVG is a leverage ratio measured as quasi-market value of assets divided by market value of equity, where quasi-market value of assets is book value of assets minus book value of equity + market value of equity. LVG is measured end of June 2007. The R^2 of a regression of SES on LVG is 7.06%, the coefficient of LVG is -0.005 (p-value < 0.001).

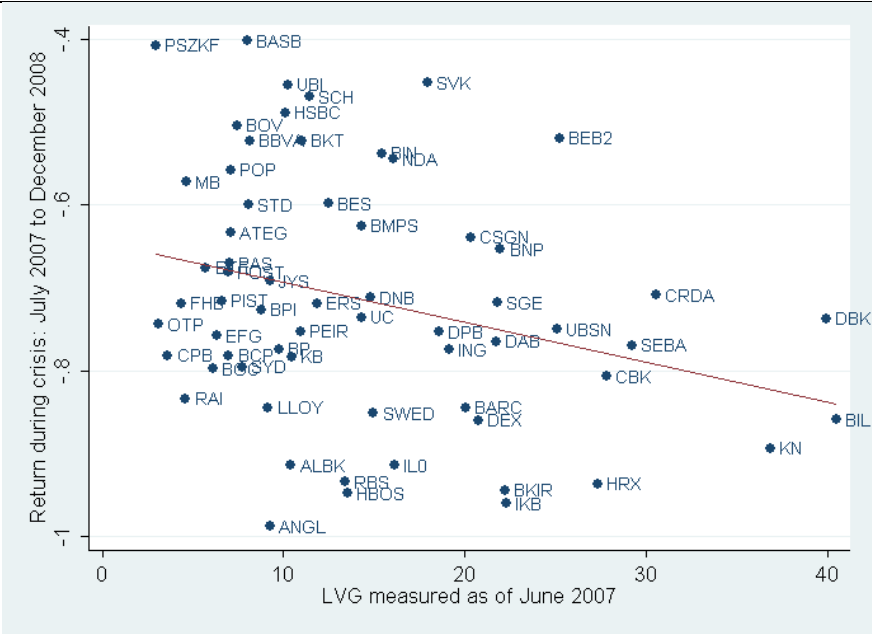


Figure 4: Stability of MES

The MES of an individual bank’s stock measured in the June 2006 to June 2007 period is plotted against the MES measured in the June 2005 to June 2006 period. MES is the marginal expected shortfall of a stock given that the market return is below its fifth percentile. MSCI Europe is used to calculate market returns. The R2 of the regression of MES (July 2006 – June 2007) on MES (July 2005 – June 2006) is 28.40%, the coefficient of MES is 0.34 (p – value = 0.001).



Figure 5: Public interventions

The fitted SES of each country as of June 2007 is plotted against the public interventions during the 2008 and 2009 period. SES (Fitted) is the best fit of realized bank stock returns as explained by MES and LVG during the July 2007 to December 2008 period (equation (1)) aggregated at the country level. Public interventions (% GDP) is the sum of all direct bank support within each country as percentage of the country’s GDP. The following support schemes are considered: Support schemes can be classified as (1) debt guarantees, (2) recapitalizations, (3) liquidity support and (4) support for bad assets. The R^2 of the regression of Public interventions (% GDP) on SES (Fitted) is 19.14%. The coefficient of SES (Fitted) is -201.93 (p-value = 0.05).

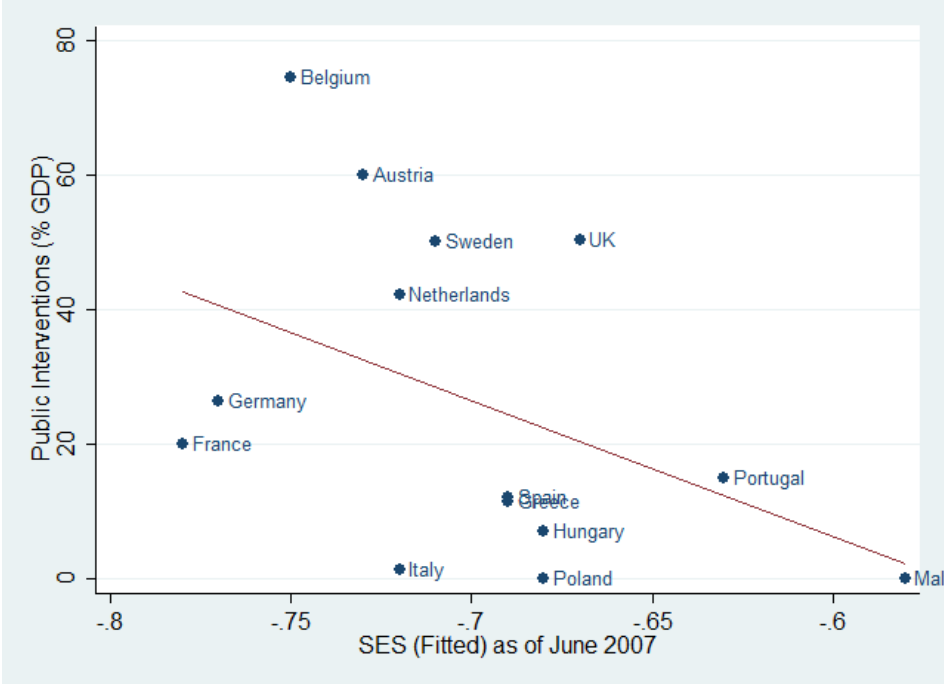


Figure 6: Total return versus GIPSI exposure

Exposure to GIPSI sovereign debt (GIPSI/MV) of an individual bank is plotted against the realized return over the October 2010 to September 2011 period. GIPSI/MV is measured as the Euro amount of exposure to GIPSI countries over market value of equity. GIPSI exposure is based on December 2010 data. The R^2 of the regression on realized stock returns on GIPSI/MV is 54.17%, the coefficient of GIPSI/MV is -0.088 (p-value < 0.001).

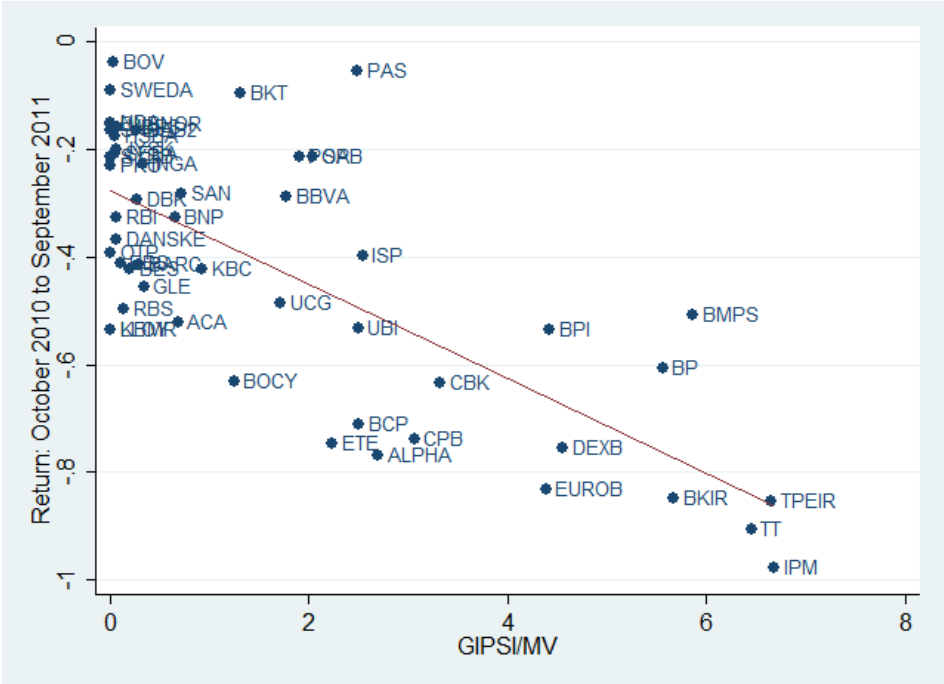


Figure 7: Fitted SES and GIPSI exposure

Exposure to GIPSI sovereign debt (GIPSI/MV) of an individual bank is plotted against SES (Fitted) as of September 2010. SES (Fitted) is the best fit of realized stock returns as explained by MES and LVG using this fit:

$$\text{SES (Fitted)} = -0.71 - 6.86 * \text{MES} - 0.001 * \text{LVG} + 0.05 * \text{Log Assets}$$

MES is measured over the October 2009 to September 2010 period. LVG and Log Assets are as per September 2010. GIPSI/MV is measured as the Euro amount of exposure to GIPSI countries over market value of equity. GIPSI exposure is based on December 2010 data. The R² of the regression on realized stock returns on GIPSI/MV is 29.69%, the coefficient of GIPSI/MV is -0.028 (p-value = 0.002).

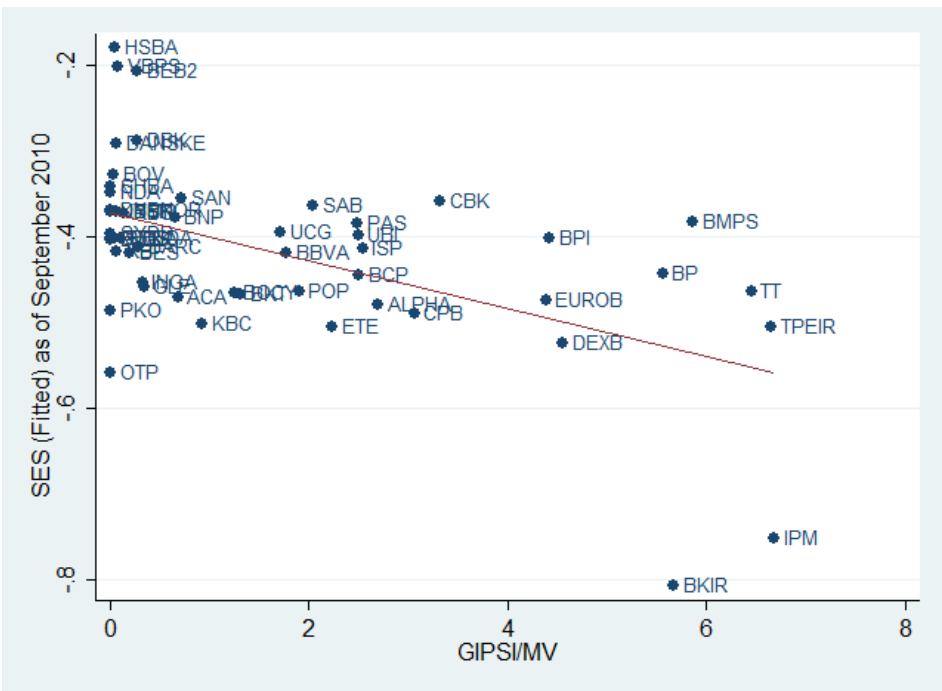


Table 1: Descriptive Statistics

This table contains the overall descriptive statistics and sample correlation matrices. Realized SES is the stock return during the July 2007 and December 2008 period. ES is the expected shortfall of an individual stock at the fifth percentile. MES is the marginal expected shortfall of a stock given that the market return is below its fifth percentile. Vol is the annualized daily individual stock return volatility. Beta is constructed regressing the bank's stock return on that of the market. LVG is a leverage ratio measured as quasi-market value of assets divided by market value of equity, where quasi-market value of assets is book value of assets minus book value of equity + market value of equity. Log-Assets is the natural logarithm of total book assets. ME(blns) is the market value of equity. The MSCI Europe is used as market portfolio for calculating MES. ES, MES, Vol and Beta are measured for each individual bank's stock using the June 2006 to June 2007 period. LVG, Log-Assets and ME(blns) are end of June 2007. All variables are defined in Appendix 4.

	Realized SES	ES	MES	Vol	Beta	LVG	Log-Assets	ME(blns)
Average	-71.46%	3.07%	1.47%	22.66%	0.90	14.44	11.93	24.91
Median	-73.54%	2.97%	1.49%	21.69%	0.94	11.46	12.04	12.42
Std. Dev.	14.90%	1.11%	0.52%	6.63%	0.37	8.99	1.56	29.09
Min.	-40.12%	1.31%	-0.04%	12.77%	-0.08	2.97	7.69	0.03
Max.	-98.87%	10.05%	2.62%	55.91%	1.82	40.47	14.50	154.78

Sample Correlation

	Realized SES	ES	MES	Vol	Beta	LVG	Log-Assets	ME(blns)
Realized SES	1							
ES	-0.21	1						
MES	-0.38	0.31	1					
Vol	-0.18	0.94	0.25	1				
Beta	-0.28	0.16	0.76	0.12	1			
LVG	-0.29	0.34	0.26	0.25	0.24	1		
Log-Assets	-0.09	-0.22	0.31	-0.25	0.35	0.54	1	
ME(blns)	0.09	-0.27	0.10	-0.31	0.27	0.16	0.76	1

Table 2a: Systemic risk of European banks and stock returns during the financial crisis

This table reports results from an OLS regression. Dependent variable is the banks' realized return during the July 2007 to December 2008 period (Realized SES). ES is the expected short fall, Vol the annualized daily volatility, and MES is the marginal expected shortfall using the MSCI Europe as market portfolio. ES, Vol and MES are measured between June 2006 and June 2007. Beta measures the correlation between the bank's stock price return and the MSCI Europe between June 2006 and June 2007. LVG is the bank's (quasi-) market leverage ratio (LVG), which is its (quasi-) market value of assets divided by market value of equity. Log Assets is the natural logarithm of the banks' total assets. Broker Dealer is an indicator variable equal to 1 if the bank belongs to the group of broker dealer banks are shown in Appendix 1. T-statistics are in parentheses. . ***, **, * denote significance levels at the 1, 5 and 10 percent level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ES	-2.84*									
	(-1.69)									
Vol		-0.40							0.12	
		(-1.41)							(.37)	
MES			-11.01***				-9.45***	-9.50***	-10.89***	-10.41***
			(-3.23)				(-2.72)	(-2.19)	(-2.31)	(-2.94)
Beta				-0.12**						
				(-2.36)						
LVG					-0.005**		-0.003*	-0.004**	-0.005**	-0.005**
					(-2.39)		(-1.71)	(-2.07)	(-2.06)	(-2.15)
Log Assets						-0.01			0.02	0.02
						(-.68)			(1.3)	(1.31)
Broker Dealer								0.07		
								(1.27)		
Constant	-0.64***	-0.63***	-0.59***	-0.62***	-0.65***	-0.62***	-0.53***	-0.52***	-0.75***	-0.73***
	(-11.46)	(-9.26)	(-11.57)	(-13.08)	(-18.7)	(-4.21)	(-10.8)	(-10.68)	(-3.75)	(-4.99)
Adj. R2	2.85%	1.57%	13.22%	6.85%	7.06%	-0.90%	15.88%	16.86%	15.65%	16.89%
No. Obs.	63	63	63	63	63	63	63	63	63	63

Tabelle 2b: Systemic risk of European banks and Country Effects

This table reports results from an OLS regression. Dependent variable is the banks' realized return during the July 2007 to December 2008 period (Realized SES). MES is the marginal expected shortfall using the MSCI Europe as market portfolio and is measured between June 2006 and June 2007. LVG is the bank's (quasi-) market leverage ratio (LVG), which is its (quasi-) market value of assets divided by market value of equity. Log Assets is the natural logarithm of the banks' total assets. Broker Dealer is an indicator variable equal to 1 if the bank belongs to the group of broker dealer banks as shown in Appendix 1. Country indicates that country fixed effects are included which are omitted for brevity. T-statistics are in parentheses. . ***,**,* denote significance levels at the 1, 5 and 10 percent level, respectively.

	(1)	(2)	(3)
MES	-7.97**	-8.35**	-8.70***
	(-2.24)	(-2.43)	(-2.55)
LVG	-0.005*	-0.005**	-0.03**
	(-1.79)	(-2.02)	(-2.2)
Log Assets			0.04**
			(2.25)
Broker Dealer		0.12**	
		(2.06)	
Country	Yes	Yes	Yes
Constant	-0.59***	-0.58***	-1.00***
	(-5.57)	(-5.67)	(-4.79)
Adj. R2	37.74%	42.20%	43.23%
No. Obs.	59	59	59

Table 3: Systemic Risk Ranking as of June 2007

This table contains the list of European banks listed in descending order according to their fitted realized return during the crisis (SES (Fitted)). Country is where the bank is headquartered, MES the marginal expected shortfall at the 5 percent level, LVG the (market-) leverage ratio and Log-Assets the natural logarithm of the bank's asset size.

SES (Fitted) is constructed based on the following regression (model (10) from Table 2a):

$$\text{SES (Fitted)} = -0.73 - 10.41 * \text{MES} - 0.005 * \text{LVG} + 0.02 * \text{Log Assets}$$

Ranking	Bank	SES	ES	MES	Vol	Beta	LVG	Log-Assets	SES (Fitted)
1	Banca Italease SpA	-85.98%	10.01%	2.30%	55.91%	1.50	40.47	10.18	-95.94%
2	Deutsche Bank AG	-73.77%	2.69%	1.81%	18.48%	1.22	39.91	14.48	-83.08%
3	Natixis	-89.42%	3.39%	1.73%	24.58%	1.10	36.83	13.20	-82.96%
4	Commerzbank AG	-80.76%	3.78%	2.10%	25.51%	1.19	27.83	13.37	-82.09%
5	Hypo Real Estate Holding	-93.74%	3.13%	1.82%	23.52%	1.01	27.32	12.04	-81.27%
6	IKB Deutsche Industriebank	-96.07%	3.38%	1.79%	24.01%	1.21	22.31	10.88	-80.52%
7	Raiffeisen Bank International	-83.43%	4.50%	2.62%	33.17%	1.82	4.61	11.05	-80.16%
8	DnB NOR Bank ASA	-71.16%	4.10%	2.27%	29.44%	0.45	14.80	12.13	-79.61%
9	Bank of Ireland	-94.48%	2.94%	1.91%	20.32%	1.00	22.24	12.21	-79.38%
10	Credit Agricole SA	-70.88%	3.06%	1.83%	22.05%	1.38	30.53	14.15	-79.24%
11	Swedbank AB	-85.16%	3.79%	2.07%	25.47%	0.74	14.97	12.03	-77.81%
12	Irish Life and Permanent	-91.52%	3.25%	1.69%	23.71%	0.98	16.15	11.27	-75.82%
13	Allied Irish Banks	-91.48%	3.17%	2.10%	22.67%	1.35	10.41	12.09	-75.75%
14	Dexia SA	-86.03%	2.51%	1.79%	19.02%	1.13	20.72	13.27	-75.53%
15	Bankinter	-52.20%	2.76%	1.79%	19.86%	1.22	11.04	10.74	-75.18%
16	BNP Paribas	-65.37%	2.66%	1.87%	20.41%	1.41	21.97	14.32	-75.18%
17	SEB AG	-76.95%	4.29%	1.21%	30.41%	0.61	29.20	12.41	-75.17%
18	Credit Suisse	-63.92%	2.53%	1.85%	19.41%	1.26	20.35	13.91	-74.88%
19	KBC Group SA	-78.36%	2.94%	2.07%	20.46%	1.22	10.45	12.75	-74.33%
20	HBOS PLC	-94.86%	3.48%	2.03%	24.02%	0.94	13.53	13.47	-74.16%
...									

Table 4: Total shortfall risk as per June 2007

This table reports the required capital amount which banks have to raise in order to cover an expected shortfall as predicted by the fitted SES and to maintain a specific leverage ratio (MV / TA) benchmark. Adj. MV is the bank's MV as of June 30th, 2007 less than the expected shortfall during the crisis. The table shows the 10 largest banks as of June 30th, 2007 sorted by asset size.

Banks	Ticker	Adj. MV	Benchmark MV / TA Ratios				
			4%	6%	8%	10%	12%
UBS AG	UBSN	23,120	55,812	95,278	134,744	174,210	213,676
Deutsche Bank AG	DBK	8,266	69,262	108,026	146,789	185,553	224,317
BNP Paribas	BNP	19,014	47,530	80,802	114,074	147,346	180,618
HSBC Holdings Plc	HSBA	66,420	0	23,724	53,772	83,821	113,869
Credit Agricole SA	ACA	9,451	46,223	74,060	101,897	129,734	157,571
Barclays Bank Plc	BARC	19,514	33,268	59,659	86,050	112,442	138,833
ING Groep NV	INGA	19,599	33,178	59,567	85,956	112,344	138,733
Royal Bank of Scotland Group PLC	RBS	31,255	14,829	37,871	60,912	83,954	106,996
Societe Generale	GLE	13,700	32,383	55,425	78,467	101,509	124,551
Credit Suisse Group AG	CSGN	13,799	31,185	53,677	76,170	98,662	121,154
...							
		470,381	576,781	1,068,501	1,575,992	2,084,941	2,593,929

Table 5: Ranking countries based on their SIFI's as of June 2007

This table shows the ranking of each country based on the systemic risk of their respective banks. SES (Fitted), MES and LVG are averages across all banks within each country. TA, BV and MV are summed over all banks.

Ranking	Country	SES (Fitted)	MES (JUNE'07)	LVG (JUNE'07)	TA (JUNE'07)	BV (JUNE'07)	MV (JUNE'07)	Predicted Shortfall	Shortfall Contribution
1	UK	-0.67	0.014	12.38	5,307,020	229,999	442,613	-294,693	25.9%
2	France	-0.78	0.018	27.78	4,718,579	157,380	189,071	-147,123	12.9%
3	Spain	-0.69	0.014	9.26	1,695,759	93,018	185,056	-128,062	11.3%
4	Italy	-0.72	0.015	15.59	1,925,499	131,297	146,816	-106,085	9.3%
5	Switzerland	-0.73	0.016	22.71	3,072,844	81,050	135,064	-98,616	8.7%
6	Germany	-0.77	0.015	26.87	3,129,395	69,180	96,804	-74,407	6.5%
7	Netherlands	-0.72	0.017	19.13	1,319,432	40,491	70,538	-50,939	4.5%
8	Belgium	-0.75	0.019	15.59	921,518	37,078	62,805	-47,057	4.1%
9	Sweden	-0.71	0.013	19.54	1,006,689	37,772	56,315	-40,070	3.5%
10	Ireland	-0.76	0.019	14.52	552,197	27,330	42,648	-32,381	2.8%
11	Greece	-0.69	0.014	7.28	267,754	19,542	44,128	-30,573	2.7%
12	Austria	-0.73	0.019	8.24	259,997	16,362	33,093	-24,241	2.1%
13	Denmark	-0.72	0.014	12.91	452,149	15,249	24,263	-17,395	1.5%
14	Norway	-0.80	0.02	14.80	184,668	8,666	12,751	-10,151	0.9%
15	Cyprus	-0.66	0.011	4.86	52,957	5,235	13,287	-8,734	0.8%
16	Hungary	-0.68	0.012	3.75	30,728	3,274	12,581	-8,596	0.8%
17	Portugal	-0.63	0.01	6.98	85,672	5,238	13,445	-8,485	0.7%
18	Poland	-0.68	0.01	2.97	26,295	2,622	12,018	-8,184	0.7%
19	Malta	-0.58	0.00	7.45	5,687	401	820	-476	0.0%

Table 6a: Comparing risk rankings

This table shows the ranking of SIFI's in Europe as of May 5th, 2009 (US stress tests), July 23rd, 2010 (Europe stress test) and July 12th, 2011 (Europe stress test). Only the Top 10 systemic banks are shown. The rankings are based on the best fit of realized returns as explained by MES and LVG shown in equation (1).

Ranking as of May 5th, 2009			Ranking as of July 23rd, 2010			Ranking as of July 12th, 2011		
Ranking	Bank	MES	Ranking	Bank	MES	Ranking	Bank	MES
1	Commerzbank AG	8.07%	1	Allied Irish Banks	7.73%	1	Irish Life and Permanent	-0.49%
2	Bank of Ireland	7.92%	2	Irish Life and Permanent	4.49%	2	Dexia SA	2.81%
3	Allied Irish Banks	6.94%	3	Dexia SA	4.58%	3	EFG Eurobank Ergasias SA	2.08%
4	ING Groep NV	11.98%	4	Credit Agricole SA	5.27%	4	Credit Agricole SA	3.17%
5	Barclays Bank Plc	9.59%	5	Bank of Ireland	6.17%	5	Piraeus Bank SA	2.41%
6	Natixis	7.54%	6	Commerzbank AG	2.56%	6	Bank of Ireland	3.17%
7	Royal Bank of Scotland Group PLC	8.76%	7	ING Groep NV	5.49%	7	Societe Generale	3.01%
8	KBC Group SA	9.88%	8	Natixis	4.96%	8	Alpha Bank AE	1.65%
9	Swedbank AB	8.86%	9	Societe Generale	5.33%	9	Natixis	2.92%
10	Deutsche Bank AG	8.63%	10	KBC Group SA	5.34%	10	Commerzbank AG	2.54%

Table 6b: Comparing risk rankings (cont'd)

This table shows the most recent ranking (September 30th, 2011) ranking financial institutions based on the fitted SES for the Top 20 systemic banks in Europe. The last 5 columns report the input parameter MES, MV, TA, BV and LVG for each bank as of June 30, 2007.

Ranking	Bank	MES (30SEPT'11)	MV (30SEPT'11)	TA (30JUNE'11)	BV (30JUNE'11)	LVG (30SEPT'11)	MES (30JUNE'07)	MV (30JUNE'07)	TA (30JUNE'07)	BV (30JUNE'07)	LVG (30JUNE'07)
1	Dexia SA	5.87%	2,820	517,747	6,945	182.12	1.79%	28,328	577,349	16,774	20.72
2	Credit Agricole SA	6.57%	13,064	1,593,815	44,383	119.60	1.83%	45,531	1,391,850	39,086	30.53
3	Societe Generale	8.59%	15,522	1,158,008	41,358	72.94	1.69%	52,430	1,152,090	28,712	21.79
4	EFG Eurobank Ergasias SA	4.05%	514	81,921	4,466	151.62	0.76%	10,827	61,320	3,798	6.30
5	ING Groep NV	6.78%	20,180	1,240,731	43,288	60.34	1.68%	70,538	1,319,432	38,166	19.13
6	Commerzbank AG	6.10%	9,690	683,681	22,915	69.19	2.10%	23,152	1,099,550	15,962	27.83
7	Barclays Bank Plc	6.07%	22,891	1,653,100	57,106	70.72	3.31%	67,586	1,319,560	31,094	20.04
8	Alpha Bank AE	4.71%	711	63,444	5,260	82.88	1.49%	8,607	52,211	3,801	6.62
9	Piraeus Bank SA	3.65%	537	57,069	3,170	101.30	1.20%	3,549	37,276	1,672	10.97
10	Deutsche Bank AG	5.40%	24,344	1,849,695	50,055	74.93	1.81%	48,859	1,938,190	36,287	39.91
11	TT Hellenic Postbank S.A.	4.85%	219	15,609	743	68.87	1.37%	1,954	12,487	816	6.97
12	Natixis	5.68%	7,342	452,820	16,789	60.39	1.73%	14,508	538,516	17,996	36.83
13	BNP Paribas	5.65%	36,293	1,926,079	68,090	52.19	1.87%	76,602	1,663,600	45,754	21.97
14	Agricultural Bank of Greece	4.35%	456	28,918	728	62.77	1.64%	3,388	22,127	1,376	7.11
15	UniCredit SpA	5.23%	15,502	918,772	64,726	56.09	1.68%	61,872	868,687	39,748	14.33
16	Royal Bank of Scotland Group	5.51%	30,126	1,601,100	82,764	51.40	1.22%	88,808	1,152,093	61,592	13.38
17	KBC Group SA	5.15%	6,264	312,899	11,499	49.12	2.07%	34,477	344,169	17,201	10.45
18	Intesa Sanpaolo SpA	5.91%	19,354	644,673	58,935	31.26	1.23%	38,144	603,105	52,806	15.40
19	Swedbank AB	5.87%	9,695	191,613	10,458	19.69	2.07%	11,472	167,197	6,692	14.97
20	Lloyds Banking Group	5.18%	27,912	1,084,000	49,728	38.05	0.94%	47,635	402,266	16,861	9.16
...			696,273	25,970,253	1,175,068	47.49		1,499,114	24,296,496	867,218	13.82

Table 7: Equity and rights issues of European banks

This table shows equity and rights issues of European banks over the July 2007 to September 2011 period. Panel A of Table 7 reports the number of offerings as well as amount of capital raised of the top 10 banks sorted by the amount of capital raised. Panel B of Table 7 shows the amount 22 banks raised during 2008, separated into the pre Lehman (January – September 15th) and post-Lehman (September 16th – December) period.

Panel A: Equity and rights issues of European banks 2007 – 2011 (Top 10)

Bank	Ticker	Number offerings	Total Capital Raised
Royal Bank of Scotland Group	RBS	3	40,294
Lloyds Banking Group	LLOY	4	26,103
UBS AG	UBSN	4	15,996
HSBC Holdings Plc	HSBA	2	14,329
Barclays Plc	BARC	5	13,079
Deutsche Bank AG	DBK	2	12,384
Commerzbank AG	CBK	4	11,348
Societe Generale	GLE	2	10,383
Standard Chartered	STAN	4	7,540
ING Groep NV	INGA	1	7,498
...			
	Total	122	243,387

Panel B: Equity and rights issues in 2008

Bank	Ticker	Pre-Lehman	Post-Lehman	Total Capital Raised
Royal Bank of Scotland Group	RBS	15,279	19,088	34,367
UBS AG	UBSN	9,863		9,863
Banco Santander S.A.	SAN		7,195	7,195
Lloyds Banking Group	LLOY		6,696	6,696
Credit Agricole	ACA	5,889		5,889
Barclays Plc	BARC	4,987	888	5,875
Societe Generale	GLE	5,541		5,541
Banca Monte Dei Paschi	BMPS	4,231		4,231
Natixis	KN	3,698		3,698
UniCredit S.p.A.	UCG		2,994	2,994
Deutsche Bank AG	DBK		2,200	2,200
Standard Chartered	STAN		2,111	2,111
Credit Suisse Group	CSGN		2,081	2,081
Banco Comercial Portugues, S.A.	BCP	1,300		1,300
Swedbank AB (publ)	SWEDA		1,241	1,241
Banca Italease SpA	BIL		1,199	1,199
Commerzbank AG	CBK	1,112		1,112
Banco BPI, SA	BPI	350		350
Espirito Santo Financial Group	BES		200	200
IKB Deutsche Industriebank AG	IKB	149		149
Nova Kreditna Banka Maribor D.D.	KBMR		111	111
Unione Di Banche Italiane ScPA	UBI	87		87
	Total	52,486	46,004	98,490

Table 8: Impairments

This table shows the 10 banks with the highest impairment charges on Greek debt assuming a 60% haircut. Total Sovereign Shortfall takes into account that all GISPI sovereign exposure is written down to market value assuming the following haircuts: Greek (60%), Ireland (47%), Portugal (45%), Italy and Spain (25%).

Bank	Ticker	Greece	Total Sovereign Shortfall
National Bank of Greece SA	ETE	8,330	8,330
EFG Eurobank Ergasias SA	EUROB	6,401	6,401
Alpha Bank AE	ALPHA	4,503	4,506
Piraeus Bank SA	TPEIR	4,200	4,200
Dexia SA	DEXB	2,497	7,280
BNP Paribas SA	BNP	2,452	3,272
Marfin Popular Bank Public Company Limited	CPB	2,027	2,045
Commerzbank AG	CBK	1,775	5,080
Bank of Cyprus Public Company Limited	BOCY	1,427	1,585
Société Générale SA	GLE	1,220	2,376
...			
Total			166,826

Table 9: Capital shortfall

This table reports the capital shortfall for the 10 largest banks sorted by asset size as of September 2011. Benchmark leverage ratios are based on book values (BV Leverage Ratio) as well as market values (MV Leverage Ratio) and are calculated as capital over total assets.

Bank	Ticker	BV Leverage Ratio (Shortfall)					MV Leverage Ratio (Shortfall)				
		3%	4%	5%	6%	7%	3%	4%	5%	6%	7%
BNP Paribas	BNP	0	11,691	30,952	50,213	69,473	27,208	46,469	65,730	84,991	104,252
HSBC Holdings Plc	HSBA	0	0	0	1,620	20,166	0	0	0	9,382	27,928
Deutsche Bank AG	DBK	5,393	23,890	42,387	60,884	79,380	33,954	52,451	70,948	89,445	107,942
Barclays Plc	BARC	0	11,340	27,871	44,402	60,933	29,186	45,717	62,248	78,779	95,310
Royal Bank of Scotland Group	RBS	0	0	0	13,847	29,858	19,182	35,193	51,204	67,215	83,226
Credit Agricole	ACA	6,334	22,272	38,210	54,148	70,086	36,761	52,699	68,637	84,575	100,514
ING Bank NV	INGA	0	8,171	20,578	32,986	45,393	19,929	32,336	44,744	57,151	69,558
Banco Santander S.A.	SAN	0	0	0	11,287	23,606	0	947	13,266	25,585	37,905
Societe Generale	GLE	0	6,944	18,524	30,104	41,684	21,822	33,402	44,983	56,563	68,143
Lloyds Banking Group	LLOY	0	0	4,498	15,338	26,178	5,584	16,424	27,264	38,104	48,944
...											
		40,568	135,334	278,202	462,450	681,288	263,475	442,861	644,625	865,028	1,094,600

Appendix 1: List of banks and input parameters as of June 2007

* denotes broker-dealer banks

Broker-Dealer Banks	Ticker	TA (JUNE'07)	BV (JUNE'07)	MV (JUNE'07)	LVG (JUNE'07)	BV/TA	MV/TA
UBS AG*	UBSN	1,973,300	30,992	80,125	25.07	1.57%	4.06%
Deutsche Bank AG*	DBK	1,938,190	36,287	48,859	39.91	1.87%	2.52%
BNP Paribas*	BNP	1,663,600	45,754	76,602	21.97	2.75%	4.60%
HSBC Holdings Plc*	HSBA	1,502,410	88,477	154,776	10.12	5.89%	10.30%
Credit Agricole SA	ACA	1,391,850	39,086	45,531	30.53	2.81%	3.27%
Barclays Bank Plc*	BARC	1,319,560	31,094	67,586	20.04	2.36%	5.12%
ING Groep NV	INGA	1,319,432	38,166	70,538	19.13	2.89%	5.35%
Royal Bank of Scotland Group PLC	RBS	1,152,093	61,592	88,808	13.38	5.35%	7.71%
Societe Generale*	GLE	1,152,090	28,712	52,430	21.79	2.49%	4.55%
Credit Suisse Group AG*	CSGN	1,124,610	26,512	54,939	20.35	2.36%	4.89%
Commerzbank AG*	CBK	1,099,550	15,962	23,152	27.83	1.45%	2.11%
Banco Santander SA	SAN	883,036	46,505	79,829	11.46	5.27%	9.04%
UniCredit SpA	UCG	868,687	39,748	61,872	14.33	4.58%	7.12%
HBOS PLC	HBOS	711,000	30,028	54,758	13.53	4.22%	7.70%
Intesa Sanpaolo SpA	ISP	603,105	52,806	38,144	15.4	8.76%	6.32%
Dexia SA	DEXB	577,349	16,774	28,328	20.72	2.91%	4.91%
Natixis	KN	538,516	17,996	14,508	36.83	3.34%	2.69%
Banco Bilbao Vizcaya Argentaria SA	BBVA	466,443	22,908	62,108	8.13	4.91%	13.32%
Danske Bank A/S	DANSKE	411,826	13,089	19,218	21.75	3.18%	4.67%
Lloyds Banking Group	LLOY	402,266	16,861	47,635	9.16	4.19%	11.84%
Nordea Bank AB	NDA	375,003	15,472	23,904	16.04	4.13%	6.37%
KBC Group SA	KBC	344,169	17,201	34,477	10.45	5.00%	10.02%
Skandinaviska Enskilda Banken AB	SEBA	244,680	7,593	8,397	29.2	3.10%	3.43%
Svenska Handelsbanken AB	SHBA	219,809	7,154	12,542	17.94	3.25%	5.71%
Standard Chartered	STAN	219,696	14,053	29,049	8.06	6.40%	13.22%
Bank of Ireland	BKIR	199,921	7,189	9,074	22.24	3.60%	4.54%
Erste Group Bank AG	EBS	197,353	8,483	17,109	11.87	4.30%	8.67%
Deutsche Postbank	DPB	189,814	5,118	10,411	18.6	2.70%	5.48%
DnB NOR Bank ASA	DNBNOR	184,668	8,141	12,751	14.8	4.41%	6.90%
Allied Irish Banks	ALBK	177,216	9,386	17,697	10.41	5.30%	9.99%
Banca Monte dei Paschi di Siena SpA	BMPS	171,147	7,794	12,289	14.29	4.55%	7.18%
Hypo Real Estate Holding	HRX	168,641	3,113	6,290	27.32	1.85%	3.73%
Swedbank AB	SWEDA	167,197	6,692	11,472	14.97	4.00%	6.86%
Landesbank Berlin	BEB2	141,397	2,654	5,708	25.24	1.88%	4.04%
Unione die Banche Italiane	UBI	123,615	11,272	12,046	10.25	9.12%	9.74%
Banco Popular Espanol	POP	97,987	5,899	15,044	7.1	6.02%	15.35%
Anglo Irish Bank Corp Ltd	ANGL	96,652	4,052	10,878	9.26	4.19%	11.25%
Banco Comercial Portugues SA	BCP	85,672	3,995	13,445	6.98	4.66%	15.69%
National Bank of Greece SA	ETE	82,332	7,439	15,803	5.73	9.04%	19.19%
Irish Life and Permanent	IPM	78,408	2,477	5,000	16.15	3.16%	6.38%
Banco Popolare SC	BP	74,706	10,472	8,010	9.74	14.02%	10.72%
Banco de Sabadell SA	SAB	74,597	4,549	9,976	8.02	6.10%	13.37%
Banco Espirito Santo SA	ESF	64,397	893	5,160	12.49	1.39%	8.01%
Raiffeisen Bank International AG	RBI	62,644	4,310	15,984	4.61	6.88%	25.52%
EFG Eurobank Ergasias SA	EUROB	61,320	3,798	10,827	6.3	6.19%	17.66%
Mediobanca SpA	MB	57,840	7,783	13,808	4.62	13.46%	23.87%
IKB Deutsche Industriebank AG	IKB	53,178	2,356	2,385	22.31	4.43%	4.48%
Alpha Bank AE	ALPHA	52,211	3,801	8,607	6.62	7.28%	16.48%
Bankinter	BKT	46,306	1,731	4,438	11.04	3.74%	9.58%
Banco BPI SA	BPI	38,880	1,731	4,725	8.8	4.45%	12.15%
Piraeus Bank SA	TPEIR	37,276	1,672	3,549	10.97	4.48%	9.52%
OTP Bank Nyrt	OTP	28,542	3,396	11,964	3.12	11.90%	41.92%
Bank of Cyprus co Ltd	BOCY	28,427	1,770	5,229	6.09	6.23%	18.40%
Banca Italease SpA	BIL	26,399	891	646	40.47	3.38%	2.45%
PKO Bank Polski SA	PKO	26,295	2,756	12,018	2.97	10.48%	45.70%
Marfin Popular Bank Public Co Ltd	CPB	24,530	3,323	8,058	3.62	13.54%	32.85%
Banco Pastor	PAS	24,113	1,386	3,776	7	5.75%	15.66%
Jyske Bank	JYSK	24,081	1,353	2,760	9.24	5.62%	11.46%
Agricultural Bank of Greece	ATE	22,127	1,376	3,388	7.11	6.22%	15.31%
Sydbank	SYDB	16,241	828	2,285	7.74	5.10%	14.07%
TT Hellenic Postbank S.A.	TT	12,487	816	1,954	6.97	6.53%	15.65%
Bank of Valletta	BOV	5,687	400	820	7.45	7.04%	14.41%
FHB Mortgage Bank PLC	FHB	2,186	116	616	4.37	5.29%	28.19%

Appendix 2: Capital Shortfall as of June 2007

Banks	SES (Fitted)	Benchmark MV / TA Ratios					
		Adj. MV	4%	6%	8%	10%	12%
UBS AG*	-71%	23,120	55,812	95,278	134,744	174,210	213,676
Deutsche Bank AG*	-83%	8,266	69,262	108,026	146,789	185,553	224,317
BNP Paribas*	-75%	19,014	47,530	80,802	114,074	147,346	180,618
HSBC Holdings Plc*	-57%	66,420	0	23,724	53,772	83,821	113,869
Credit Agricole SA	-79%	9,451	46,223	74,060	101,897	129,734	157,571
Barclays Bank Plc*	-71%	19,514	33,268	59,659	86,050	112,442	138,833
ING Groep NV	-72%	19,599	33,178	59,567	85,956	112,344	138,733
Royal Bank of Scotland Group PLC	-65%	31,255	14,829	37,871	60,912	83,954	106,996
Societe Generale*	-74%	13,700	32,383	55,425	78,467	101,509	124,551
Credit Suisse Group AG*	-75%	13,799	31,185	53,677	76,170	98,662	121,154
Commerzbank AG*	-82%	4,147	39,835	61,826	83,817	105,808	127,799
Banco Santander SA	-71%	23,218	12,104	29,765	47,425	65,086	82,747
UniCredit SpA	-71%	18,223	16,524	33,898	51,272	68,645	86,019
HBOS PLC	-74%	14,148	14,292	28,512	42,732	56,952	71,172
Intesa Sanpaolo SpA	-67%	12,597	11,528	23,590	35,652	47,714	59,776
Dexia SA	-76%	6,933	16,161	27,708	39,255	50,802	62,349
Natixis	-83%	2,472	19,069	29,839	40,610	51,380	62,150
Banco Bilbao Vizcaya Argentaria SA	-74%	16,429	2,229	11,558	20,887	30,216	39,544
Danske Bank A/S	-74%	5,089	11,384	19,621	27,857	36,094	44,331
Lloyds Banking Group	-62%	18,280	0	5,856	13,901	21,947	29,992
Nordea Bank AB	-66%	8,174	6,826	14,326	21,826	29,326	36,826
KBC Group SA	-74%	8,852	4,915	11,798	18,682	25,565	32,448
Skandinaviska Enskilda Banken AB	-75%	2,085	7,702	12,596	17,489	22,383	27,276
Svenska Handelsbanken AB	-66%	4,285	4,507	8,903	13,299	17,696	22,092
Standard Chartered	-71%	8,519	269	4,663	9,057	13,451	17,845
Bank of Ireland	-79%	1,871	6,126	10,124	14,123	18,121	22,120
Erste Group Bank AG	-66%	5,759	2,135	6,082	10,029	13,977	17,924
Deutsche Postbank	-71%	2,986	4,606	8,402	12,199	15,995	19,791
DnB NOR Bank ASA	-80%	2,600	4,787	8,480	12,173	15,867	19,560
Allied Irish Banks	-76%	4,292	2,797	6,341	9,886	13,430	16,974
Banca Monte dei Paschi di Siena SpA	-71%	3,558	3,288	6,711	10,134	13,557	16,980
Hypo Real Estate Holding	-81%	1,178	5,568	8,941	12,313	15,686	19,059
Swedbank AB	-78%	2,546	4,142	7,486	10,830	14,174	17,518
Landesbank Berlin	-63%	2,117	3,539	6,367	9,195	12,023	14,850
Unione die Banche Italiane	-66%	4,086	859	3,331	5,804	8,276	10,748
Banco Popular Espanol	-66%	5,147	0	732	2,692	4,651	6,611
Anglo Irish Bank Corp Ltd	-73%	2,963	903	2,836	4,769	6,702	8,635
Banco Comercial Portugues SA	-63%	4,959	0	181	1,894	3,608	5,321
National Bank of Greece SA	-71%	4,646	0	294	1,941	3,587	5,234
Irish Life and Permanent	-76%	1,209	1,927	3,495	5,064	6,632	8,200
Banco Popolare SC	-67%	2,609	380	1,874	3,368	4,862	6,356
Banco de Sabadell SA	-69%	3,114	0	1,362	2,854	4,346	5,838
Banco Espirito Santo SA	-63%	1,891	685	1,973	3,261	4,549	5,837
Raiffeisen Bank International AG	-80%	3,171	0	587	1,840	3,093	4,346
EFG Eurobank Ergasias SA	-62%	4,151	0	0	755	1,981	3,208
Mediobanca SpA	-68%	4,450	0	0	177	1,334	2,491
IKB Deutsche Industriebank AG	-81%	465	1,663	2,726	3,790	4,853	5,917
Alpha Bank AE	-70%	2,602	0	530	1,574	2,619	3,663
Bankinter	-75%	1,101	751	1,677	2,603	3,529	4,455
Banco BPI SA	-63%	1,737	0	596	1,373	2,151	2,928
Piraeus Bank SA	-69%	1,084	407	1,153	1,898	2,644	3,389
OTP Bank Nyrt	-71%	3,428	0	0	0	0	0
Bank of Cyprus co Ltd	-70%	1,559	0	146	715	1,284	1,852
Banca Italease SpA	-96%	26	1,030	1,558	2,086	2,614	3,142
PKO Bank Polski SA	-68%	3,834	0	0	0	0	0
Marfin Popular Bank Public Co Ltd	-61%	3,120	0	0	0	0	0
Banco Pastor	-73%	1,027	0	420	902	1,385	1,867
Jyske Bank	-71%	789	174	656	1,137	1,619	2,101
Agricultural Bank of Greece	-73%	914	0	413	856	1,298	1,741
Sydbank	-70%	682	0	292	617	942	1,267
TT Hellenic Postbank S.A.	-71%	563	0	186	436	686	936
Bank of Valletta	-58%	343	0	0	112	225	339
FHB Mortgage Bank PLC	-65%	214	0	0	0	5	49
Total		470,381	576,781	1,068,501	1,575,992	2,084,941	2,593,929