Capital Shortfalls of European Banks since the Start of the Banking Union

Viral V. Acharya (NYU, NBER and CEPR)[1]
Diane Pierret (University of Lausanne)[2]
Sascha Steffen (University of Mannheim and ZEW)[3]

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Abstract

Since the start of the Banking Union in November 2014, European banks lost nearly half their market capitalization. Important risks in bank balance sheets are still unaccounted for requiring an even larger recapitalization compared to the capital shortfall estimates of November 2014. The market's assessment of banks' risky assets is still decoupled from their book valuation and associated Basel risk-weights, causing a divergence between market and regulatory assessments of bank capital. Not only Italian but also German and French banks show large capital shortfalls, some of which may require public backstops if losses are not to be passed onto non-subordinated debtholders of banks.

Motivation

The outcome of the referendum in the United Kingdom (U.K.) to leave the European Union had not been anticipated by the market and caused a massive stock price decline in global capital markets. While non-financial stocks quickly recovered from their initial losses, the market value of European banks dropped by 19% (and by 28% for largest Italian banks) during the first week after the referendum. Moreover, since the start of the Banking Union in November 2014, the Euro Stoxx Banks index declined by 44 percent as Figure 1 shows. This has once more raised the issue of adequate capitalization of the European financial sector.

Acharya and Steffen (2014a) documented a capital shortfall of European banks that were part of the comprehensive assessment in October 2014 up to €450 billion for 39 public banks participating in the stress test. Surprisingly, the official assessment revealed a shortfall of €24 billion for all 130 banks (including private banks) participating in the stress test.

We assess that important risks in bank balance sheets have not been accounted for even today. Banks did not raise sufficient capital following the stress test of 2014. Large amounts of non-performing loans (particularly in the case of Italian banks) and too little capital have contributed to increasing financial instability in some European countries since the start of the Banking Union.

[1] C.V. Starr Professor of Economics, Department of Finance, New York University, Stern School of Business, 44 West 4th St., New York, NY 10012, email: vacharya@stern.nyu.edu, phone: +1 (212) 998 - 0354 fax: +1(212) 995 - 4256. Acharya is also a Research Affiliate of the CEPR and a Research Associate in Corporate Finance at the NBER.
[2] Assistant Professor of Finance, University of Lausanne, HEC, Extranef building, 1015 Lausanne, email: diane.pierret@unil.ch, phone: +41 21 692 6128.
[3] Professor of Finance, University of Mannheim, and Center for European Economic Research, L7 1, 68161 Mannheim, email: steffen@zew.de, phone: +49(621) 181-1235 fax: +49(621) 181-1410.

On July 29, 2016, the European Banking Authority (EBA) is going to release the results of the 2016 stress tests. In this paper, we use our own tests and investigate the extent of lack of capital in the banking sector as of June 2016 (about 20 months after the start of the Banking Union) and whether possible shortfalls are so large that they may have to be dealt with public backstops.

Stress Test Sample

The EBA has published a list of 53 European banks that will be part of the 2016 stress test that comprise about 70% of the banking sector in each country.[4] 34 of these banks are publicly listed. Balance sheet information and market data are collected from SNL Financial. We use market data as of 30 June 2016 as well as 3 November 2014 (before the start of the Banking Union) for comparison. Book data is the most recent available data.

Table 1 shows that the banks in our sample represent €27 trillion in total assets. Table 1 also provides an overview of all banks at the country level, showing mean regulatory capital ratios and bank characteristics. There is substantial cross-sectional heterogeneity in terms of Basel risk-weighted assets (RWA) among European banks, ranging from 19.3% of total assets (Sweden) to more than 69% (Poland). While Deutsche Bank AG (one of the largest bank in the stress test) reports a RWA/Asset ratio of 24%, several large publicly listed banks have RWA/Asset ratios below 20%, namely Credit Agricole, Handelsbanken and Swedbank (Table 2 and Appendix I).

Book Capital Ratios

The four book capital ratios we employ are: (1) Core Tier 1 ratio (C Tier 1), which is core Tier 1 capital divided by risk weighted assets (RWA); (2) book equity divided by total assets (Equity/Assets); (3) tangible equity/tangible assets, which is book equity less intangible assets divided by total assets less intangibles assets; and (4) the International Financial Reporting Standards (IFRS) Tier 1 leverage ratio (IFRS Tier 1 LVG), which is Tier 1 capital divided by tangible assets minus derivative liabilities.[5] The average C Tier 1 ratio is 13.3% and the average book Equity/Assets ratio is 5.8%.

Market Capital Ratios

We use market equity to total assets (Market Equity/Assets) as market capital ratio. The total market capitalization of the 34 publicly listed banks is €693 billion, the average Market Equity / Assets ratio is 4.4%. The banks with the lowest market capital ratios are located in Germany (1.1%) and in Italy (2.9%). On a bank level basis, Banca Monte dei Paschi has the lowest Market Equity/Assets ratio (0.57%) followed by Deutsche Bank (1.02%) and Commerzbank (1.39%).

[4] A list of these banks is provided in Appendix I. DZ Bank and National Bank of Greece are not tested and we do not have financial data for Confédération Nationale du Crédit Mutuel.

[5] This ratio accounts for the fact that IFRS (in contrast to the generally accepted accounting principles or GAAP in the U.S.) does not allow netting of derivative securities. This measure of assets is thus most comparable to U.S. financial institutions.

Further, the average market-to-book ratio (ratio of Market Equity to Book Equity) of 0.70 suggests that the market is heavily discounting banks' assets portfolios (Table 3), at least in part due to the relatively high risk of some of the "riskless" assets relative to the markdowns taken by banks on these assets against their book equity values. Notably, German banks have the lowest market-to-book ratios (0.25), followed by Italian (0.41) and French banks (0.42). The banks with the lowest market-to-book ratios are Banca Monte dei Paschi (0.10), UBI Banca (0.14) and Banco Popular Espanol (0.25).

Stressed Capital Shortfall Measures

To account for potential losses in future stress scenarios, we employ four stressed capital shortfall measures. The first two measures raise the level of capital requirements, while the remaining two measures (also) account for losses:

1. **Book Capital Shortfall**: Using book values of equity and assets, the less stringent benchmark is a leverage ratio (book equity/assets) of 4% and the more stringent benchmark is a 7% leverage ratio. Haldane (2012) reports that a 4% capital ratio (7% for the largest financial institutions) would have been necessary to guard against bank failure during the recent financial crisis.

2. **Market Capital Shortfall**: Similarly, using the market value of equity and assets, the less stringent benchmark is a leverage ratio (market equity/assets) of 4% and the more stringent benchmark is a 7% leverage ratio.

3. **SRISK or Capital Shortfall in a Systemic Crisis**: We assume a systemic financial crisis with a global stock market decline of 40%. *SRISK* is our measure for a bank's capital shortfall in this scenario, assuming a 5.5% prudential capital ratio with losses estimated using the VLAB methodology to estimate the downside risk of bank stock returns.[6] While this scenario and the resulting *SRISK* measure uses market data and market equity (instead of book equity) in determining leverage, the approach is conceptually similar to that of the EU stress tests, which is to estimate losses in a stress scenario and determine the capital shortfall between a prudential capital requirement and the remaining equity after losses.

Market Risk Weights

By adjusting the market capitalization of a bank by its expected six-month return in a crisis, the capital shortfall measure *SRISK* implicitly incorporates a measure of asset risk of the bank. The banks with the most negative expected six-month return in a crisis are considered to have the riskiest assets. This way, we can back out an implied risk-weight from *SRISK* that is calculated in a top-down manner at the level of the entire bank rather than bottom-up (i.e.,

[6] This capital shortfall measure has been implemented based on Acharya at al. (2012) and Brownlees and Engle (2016) and. The data are provided by New York University's VLAB (http://vlab.stern.nyu.edu/welcome/risk/). The theoretical motivation for the measure can be found in Acharya et al. (2010). SRISK has been documented to be a comprehensive measure that includes losses due to both a bank's investments in assets and its exposure to fragile liabilities, which in the current European context relate, respectively, to holdings of peripheral sovereign bonds and (short-term) funding risk such as U.S. money market fund withdrawals and other wholesale investors.

asset by asset) as in the Basel risk weights.[7] This market risk weight can be compared with the average regulatory risk weight of a bank estimated from the Basel methodology.

Main Results on Stressed Capital Shortfall Estimates as of 30 June 2016

1. The book capital shortfall estimates indicate a capital shortfall for all 50 banks of between €7 billion and €33 billion (4% benchmark capital ratio) or between €388 billion and €521 billion (7% capital ratio, Table 3).

2. The market capital shortfall estimates indicate a capital shortfall of €259 billion (4% benchmark capital ratio) or €833 billion (7% capital ratio) for the 34 publicly listed banks (Table 4).

3. Estimates of *SRISK* or the capital shortfall in a systemic financial crisis (40% market decline over a six-month period) is €882 billion (Table 5).

4. Cross-country variation in our capital shortfall estimates indicate that:
    a. French banks lead almost each book and market capital shortfall measure, both in absolute euro amounts and relative to its GDP. The capital shortfall ranges from €2 billion (using the equity/asset ratio and a 4% threshold) to €189 billion (using the tangible equity/tangible asset ratio and a 7% threshold) (Table 3). The *SRISK* stress scenario suggests a shortfall of €248 billion, which corresponds to almost 12% of the country's GDP (Table 5).
    b. The banks with the largest *SRISK* next to France are from the U.K., Spain and Germany. While German banks benefit from a stronger domestic economy with a higher GDP and capacity for public backstops, shortfalls relative to the GDP of these countries is large corresponding to almost 11% in Spain and 7% in the U.K. (Table 5).
    c. Italian banks have capital shortfalls of €97 billion, which correspond to about 6% of Italy's GDP.

5. Comparing capital shortfalls in June 2016 to November 2014 shows that:
    a. The banks in our stress test lost on average one third of their market value since the start of the Banking Union ranging from an increase in market of 55% (Hungary) to a loss of 69% (Ireland). The banks with the largest declines in market capitalization are from Germany, Italy and Spain (Table 6).
    b. *SRISK*, on average, increased by 35% from €655 billion to €882 billion. Spanish banks' capital shortfall increased by 110% (from €55 billion to €117 billion). The other banks with the largest percentage increase in *SRISK* are from Ireland, the U.K. and Sweden. Italian banks' shortfall increased by 29% during this period. The capital shortfall of German banks increased by about 8% (Table 6).
    c. Capital shortfall and market-to-book ratios from November 2014 predict capital shortfalls as of June 2016. Banks in countries with very low market-to-book ratios or high capital shortfalls as of November 2014 have large capital

[7] The methodology is described in Acharya et al., 2014.

shortfalls today (Figure 3). The rank correlation between *SRISK* in June 2016 and the market-to-book ratio in November 2014 is -0.79 at the country level.

d. Similarly, banks that had a lower market capitalization relative to their book equity in 2014 than other banks still have low market-to-book ratios today (Figure 4). The rank correlation between both market-to-book ratios is 0.74 at the country level.

6. The capital shortfalls are large as a multiple of the banks' market value of equity. The average shortfall corresponds to 1.1 times the current market capitalization of our sample banks. The market value of equity reflects the maximum amount of capital a bank can raise today in private markets based on the current capital structure and valuation of the firm. If we add subordinated debt as the next group of creditors that is going to be bailed-in, the shortfalls require about 67% of this "bail-in-able" capital.

a. Banks in Germany, France and Italy lead the group of banks with the largest capital shortfall estimates, with shortfalls as a multiple of the banks' market value of equity up to 4.7 (Germany).

b. Even after including subordinated debt in a possible bail-in, banks in Germany, France and Italy still show shortfalls as a multiple of market equity and subordinated debt of above 1, implying that public backstops may have to be involved to achieve desired capital adequacy (unless losses are passed onto non-subordinated debt holders).

Comparing market risk weights and regulatory risk weights

In Figure 5, we compare the implied market risk weight from *SRISK* with the most recent Basel risk weights of public banks participating in the 2016 EBA stress test.

1. Countries that are considered to have the safest banking sectors according to Basel risk weights (e.g., Belgium, France, Germany) are considered to be the riskiest according to market risk weights (Panel A of Figure 5). The rank correlation between these two risk measures is negative (-0.166) at the bank level, and highlights important differences between the two risk measures.[8]

2. The correlation between Basel risk weights projected under the EBA stress scenario (to be released) and market implied risk weights is expected to be negative too, consistent with previous stress tests (Panel B of Figure 5).

Implications

1. As portfolio (micro-level) data of banks' individual exposures is not publicly available, our estimates of capital shortfalls employ publicly available book capital and market data and are motivated by empirical evidence and theory. We believe this

[8] For example, Basel risk weights are still static in nature, while market data reflect the views of market participants on banks' future performance. In addition, Basel risk weights are subject to discretion by banks (using their own models to derive risk weights), and central banks (setting risk weight "floors" to some asset categories).

approach provides useful estimates of the current capitalization of the European banking system as well as a useful benchmark for the upcoming 2016 stress test exercise of the EBA.

2. Our results suggest that the European banking sector requires a comprehensive recapitalization across almost all countries including not only peripheral countries such as Italy and Spain but also large core-European banks in Germany and France, in particular.

3. Our results also suggest that capital shortfalls that were revealed in the comprehensive assessment (the "Asset Quality Review" or "AQR") in October 2014 (before the start of the Banking Union) have not been dealt with. Those banks that had large shortfalls in 2014 also have large capital shortfalls today.

4. Acharya and Steffen (2014b) showed that official capital shortfalls in the AQR were negatively correlated with shortfalls based on market capital ratios and, more generally, with those capital ratios that do not rely on regulatory risk weights. Similarly, our analysis also highlights the discrepancy between capital adequacy assessments of banks based on book versus market values.

5. The average ratio of market capitalization to book capitalization of 0.7 reflects that market participants are heavily discounting bank asset values. This ratio was above one in November 2014 and highlights the increasing concerns of market participants on bank asset quality compared to the valuation of bank assets in their balance sheets. Market participants will therefore expect banks to be undercapitalized more rapidly in the stress scenario than what will be reflected in the EBA stress test results.

6. Our results suggest that with common equity issuance (e.g., through deep-discount rights issues) and haircuts on subordinated creditors (e.g., through bail-ins), it should be possible to deal with many banks' capital needs. Some will, however, require public backstops, especially if bail-ins are difficult to implement without imposing losses on bondholders, who may themselves be other banks and systemically important financial institutions (and in the case of Italy, retail investors). The banking sectors in Germany, France, and Italy seem likely to require public backstops. These backstops can be provided by national governments or other European institutions such as the European Stability Mechanism.

7. The 2016 stress test corrects for some of the past critiques. One main area of improvement is the disclosure of several measures to assess the conditions of the bank in the stress scenario. The 2016 EBA stress test will disclose for the first time a Tier 1 leverage ratio (ratio of Tier 1 capital to total assets) in addition to three other capital ratios based on risk-weighted assets. In our opinion, the disclosure of a Tier 1 leverage ratio is an important step forward that will limit the reliance of stress test results on regulatory risk weights. As in the United States, a 4% Tier 1 leverage restriction should be considered as part of the capital shortfall calculation in the stress test.

References

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5. Brownlees, C., and R. Engle (2016). SRISK: A Conditional Capital Shortfall Measure of Systemic Risk, *Review of Financial Studies*, forthcoming.

Figure 1. Euro Stoxx Banks

This figure shows the evolution of the Euro Stoxx Banks index (based on 30 largest banks in the EU) from 3 November 2014 until 30 June 2016.

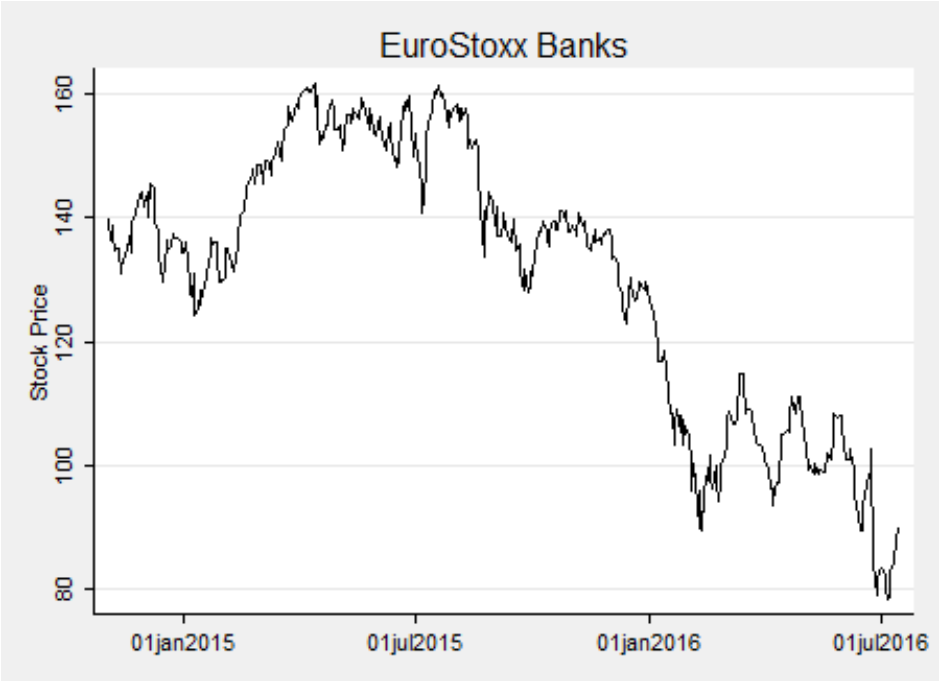


Figure 2. Capital Shortfall in a Systemic Crisis: 2014 versus 2016

This figure shows the evolution of the estimated capital shortfall measure *SRISK* by country between November 2014 and June 2016. *SRISK* represents the expected capital shortfall of a bank in the scenario where the market index drops by 40% over six months. *SRISK* by country is summed over all public banks participating in the 2016 EBA stress test in each country.

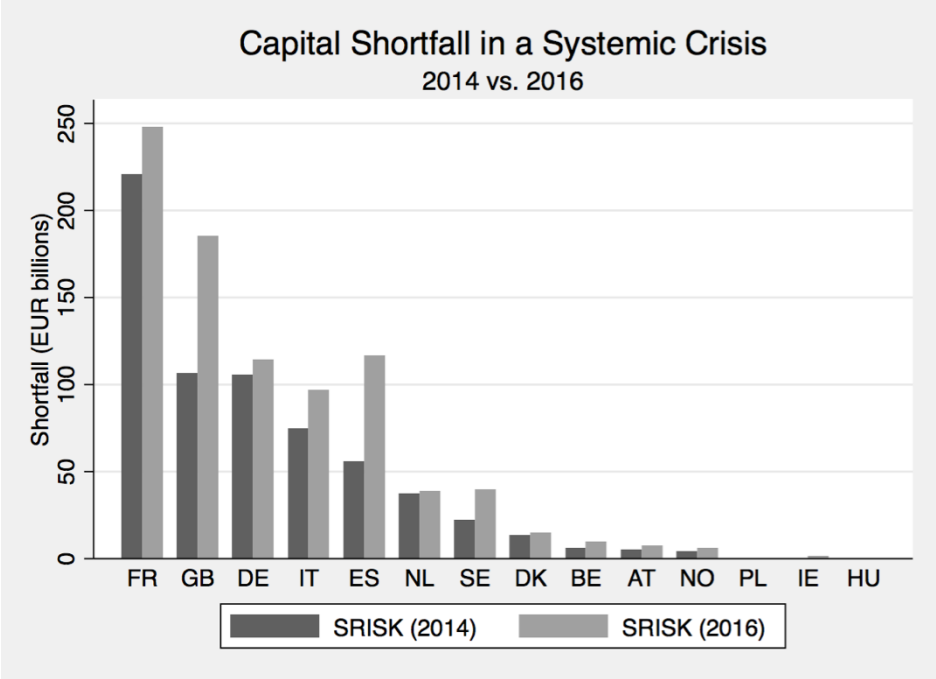
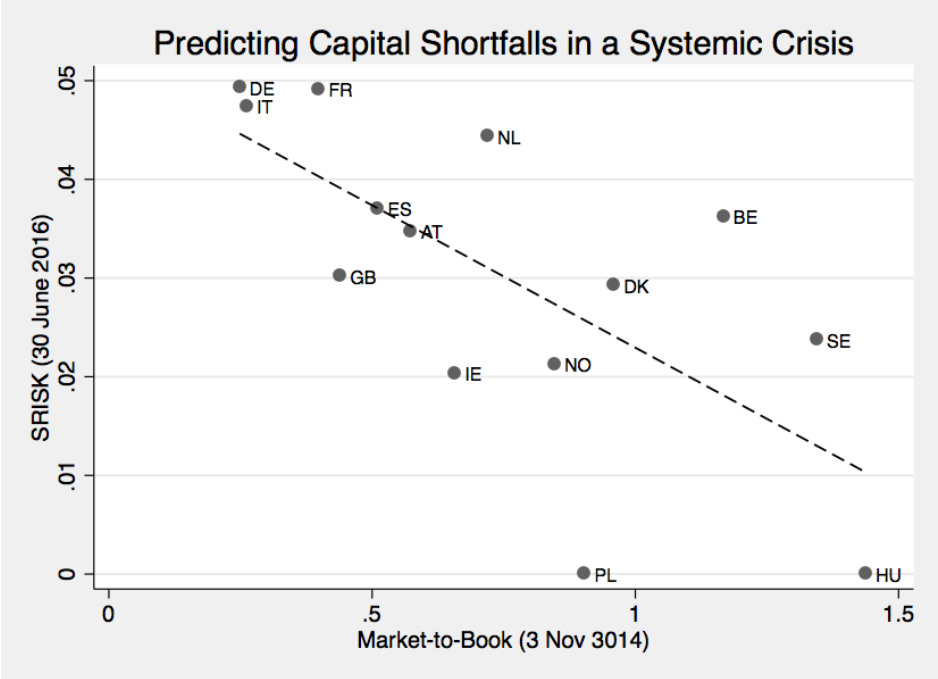


Figure 3. Predicting Capital Shortfalls in a Systemic Crisis
This figure shows the correlation between *SRISK* in June 2016 and bank characteristics measured in November 2014. Panel A: correlation between the ratio of country total *SRISK* to country total banks assets in June 2016 and the average market-to-book ratio of banks of the country in November 2014. Panel B: correlation between the ratio of country total *SRISK* to country total banks assets in June 2016 and the same ratio measured in November 2014.



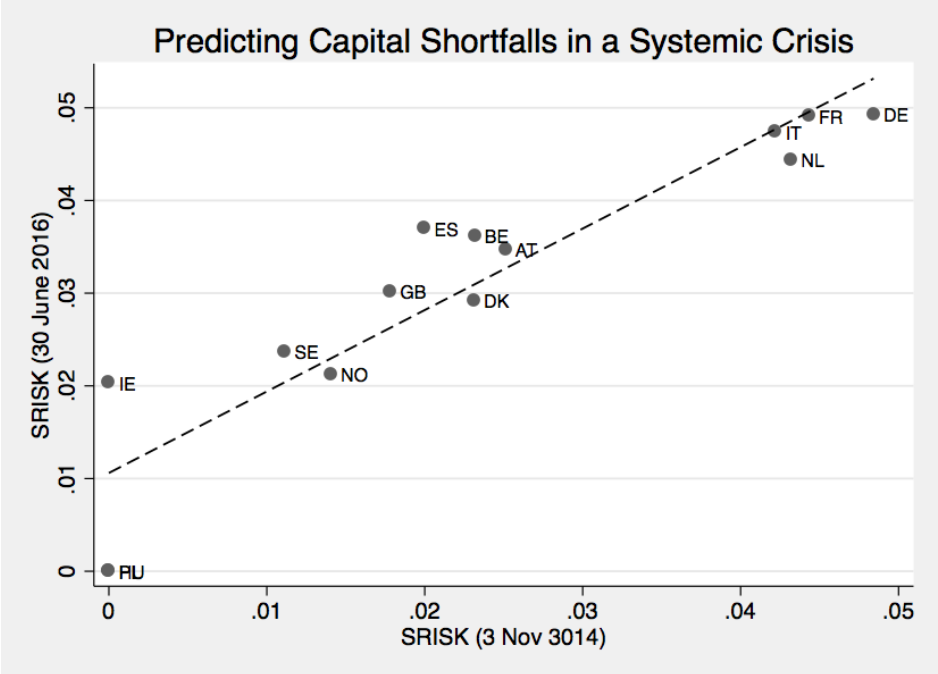


Figure 4. Predicting Market-to-Book Ratios

This figure shows the correlation between the average market-to-book ratio of banks located in a country in June 2016 and the same ratio measured in November 2014.

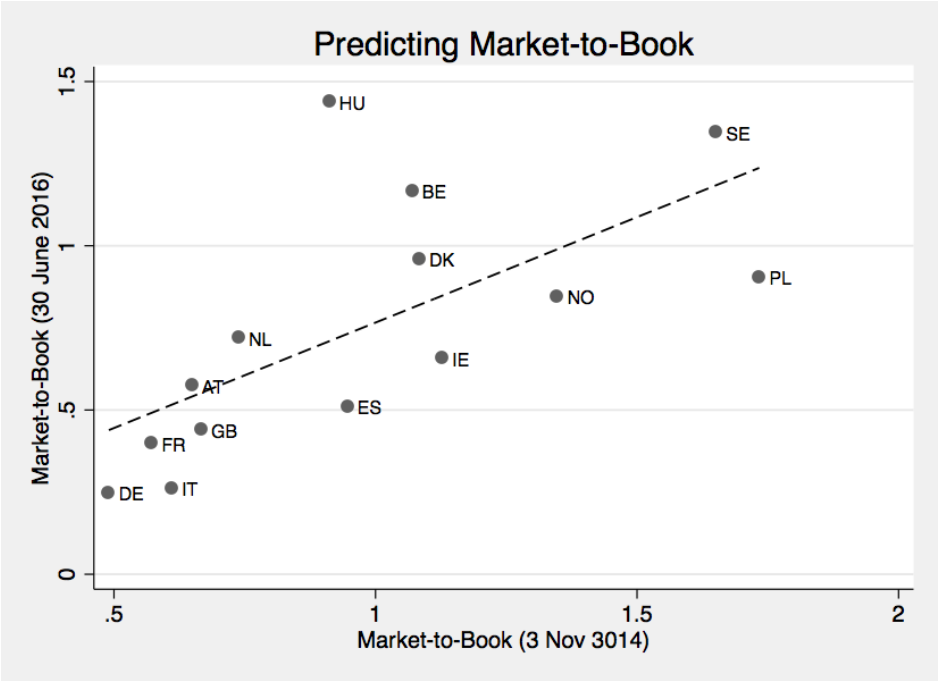
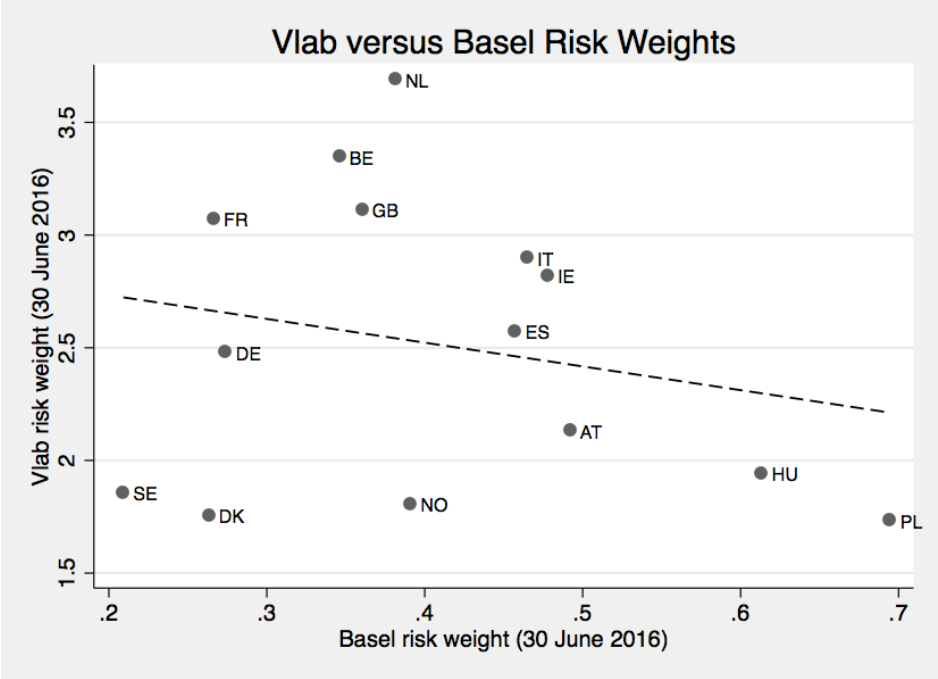


Figure 5. Vlab risk weights versus regulatory risk weights

This figure shows the correlation between the market risk weight implied by the *SRISK* capital shortfall measure (Vlab risk weight) and the regulatory risk weight (ratio of RWA/Assets). Panel A: correlation between the average June 2016 Vlab risk weight by country and the average regulatory risk weight as of December 2015 (Basel risk weight). Panel B: correlation between the average June 2016 Vlab risk weight by country and the average regulatory risk weight projected in the stress scenario of the 2014 EBA stress test (EBA risk weight).

Panel A. Market risk weights versus Basel risk weights



Panel B. Market risk weights versus EBA stressed risk weights

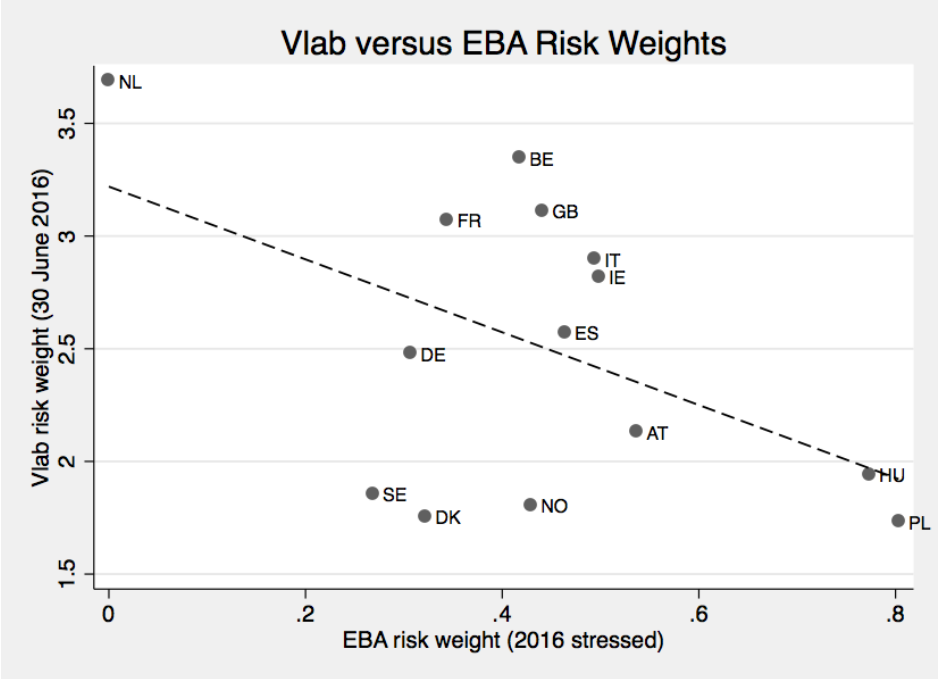


Table 1
Descriptive Statistics: Book Capitalization

This table reports descriptive statistics of the banks participating in the EU-wide stress test conducted by the European Banking Authority (EBA) in 2016 (data are available for 50 out of the 51 banks included in the 2016 EBA stress test). Panel A: descriptive statistics by country as of December 2015. Panel B: Average capital ratios as of November 2014. C Tier 1 is the Core Tier 1 ratio and is the ratio of Core Tier 1 Capital divided by Risk-Weighted Assets (RWA). Equity/Assets is book equity over total assets. IFRS Tier 1 LVG is C Tier 1 Capital divided by total assets minus intangible assets minus derivative liabilities. Tangible Equity/Tangible Assets is defined as book equity minus intangible assets divided by total assets minus intangible assets. RWA/Assets is RWA divided by total assets. Net Impaired Loans/C Tier 1 Capital is the amount of impaired loans net of reserves over Common Tier 1 Capital. Assets are total assets and measured in million euros. Banks are the number of banks per country participating in the EBA stress test and for which data are available.

Panel A. Book measures of capital

Country	Number of banks	C Tier 1	IFRS Tier1 LVG	Equity/ Assets	Tan. equity/ Tan. assets	RWA/Assets	Net Impaired Loans / C Tier 1 Capital	Assets
Austria	2	11.5%	6.0%	7.1%	6.5%	50.1%	28.9%	344,795
Belgium	2	15.1%	5.2%	5.6%	5.3%	31.0%	34.4%	438,513
Denmark	3	16.3%	4.4%	4.7%	4.6%	24.9%	19.4%	717,806
Finland	1	19.5%	7.1%	7.6%	6.5%	34.3%	1.4%	124,296
France	5	11.6%	3.7%	4.6%	4.1%	26.6%	24.2%	6,480,940
Germany	9	14.0%	5.3%	5.1%	4.7%	29.9%	10.5%	3,481,186
Hungary	1	13.2%	8.4%	11.5%	10.2%	62.4%	32.8%	34,132
Ireland	2	14.4%	7.2%	9.1%	8.8%	47.8%	65.2%	234,082
Italy	5	11.6%	5.4%	6.6%	5.8%	42.6%	57.2%	2,004,914
Netherlands	4	16.1%	4.7%	5.4%	5.2%	31.3%	26.0%	2,045,712
Norway	1	17.0%	6.5%	7.4%	7.1%	35.7%	7.4%	280,108
Poland	1	14.1%	10.0%	11.6%	10.5%	69.3%	20.0%	63,004
Spain	6	12.3%	6.1%	7.3%	5.7%	45.4%	32.7%	2,977,022
Sweden	4	19.5%	4.1%	4.5%	4.1%	19.3%	8.7%	1,536,929
United Kingdom	4	12.4%	5.4%	6.5%	6.0%	33.9%	13.8%	6,007,405
	50	13.3%	5.0%	5.8%	5.2%	32.7%	22.9%	26,770,845

Panel B. Comparison November 2014 to June 2016

Capital Measures	Obs	2014	2016
Tangible equity/Tangible assets	15	4.9%	5.2%
IFRS Tier1 LVG	15	4.8%	5.0%
C Tier 1	15	12.6%	13.3%
Equity/Assets	15	5.6%	5.8%
RWA/Assets	15	33.7%	32.7%
Net Impaired Loans / C Tier 1 Capital	15	26.4%	22.9%

Table 2
Descriptive Statistics: Market Capitalization

This table reports descriptive statistics of market-based measures of capitalization on a country level. Panel A: descriptive statistics by country as of June 30, 2016. Panel B: Average capital ratios as of November 3, 2014. LRMES is the expected six-month return of a bank in the scenario where the MSCI World Index drops by 40% over six months. Std. Dev. is the annualized standard deviation of the bank equity return. Beta is the beta of the bank with respect to the MSCI World Index. Correlation is the correlation of the bank stock return with respect to the MSCI World Index return. Market-to-Book is market value over book value of equity. Market Equity/Assets is a market leverage ratio defined as market equity divided by asset minus book equity plus market equity. Assets are total assets measured in million euros. Market Cap is the market value of equity measured in million euros. Number of banks is the number of public banks participating in the EBA stress test in each country.

Panel A. Market measures of capital

Country	LRMES	Std. Dev.	Beta	Correlation	Market-to-Book	Market Equity / Assets	Assets	MarketCap	Number of banks
Austria	0.56	3.9%	1.61	0.60	0.57	4.3%	206,369	8,735	1
Belgium	0.74	8.4%	2.65	0.69	1.17	6.8%	261,551	18,374	1
Denmark	0.46	2.4%	1.19	0.57	1.07	4.9%	529,863	26,438	2
France	0.71	8.1%	2.49	0.73	0.42	2.0%	5,065,221	93,631	3
Germany	0.63	4.7%	1.94	0.76	0.25	1.1%	2,276,393	24,309	2
Hungary	0.51	2.3%	1.41	0.78	1.44	15.4%	34,132	5,636	1
Ireland	0.48	8.1%	1.48	0.33	1.07	11.6%	234,082	20,933	2
Italy	0.78	15.6%	3.07	0.70	0.41	2.9%	2,004,914	44,309	5
Netherlands	0.77	7.9%	2.89	0.79	0.72	4.1%	868,897	35,611	1
Norway	0.47	2.5%	1.25	0.49	0.85	6.1%	280,108	17,418	1
Poland	0.45	2.0%	1.16	0.54	0.90	10.4%	63,004	6,616	1
Spain	0.63	11.3%	2.02	0.67	0.53	3.9%	2,977,022	112,842	6
Sweden	0.49	3.7%	1.31	0.48	1.32	5.9%	1,536,929	89,065	4
United Kingdom	0.57	8.2%	1.84	0.63	0.61	4.3%	6,007,405	189,055	4
	0.61	**7.9%**	**1.98**	**0.63**	**0.70**	**4.4%**	**22,345,892**	**692,972**	**34**

Panel B. Comparison November 2014 to June 2016

Capital Measures	Obs	2014	2016
Market-to-Book	14	1.03	0.7
Market Equity / Assets	14	7.1%	4.4%

Table 3
Book Capital Shortfall

This table reports the banks' capital shortfall derived from different capital requirement rules based on several measures of book capitalization. We assume a prudential capital ratio for all book leverage measures of 4% as well as 7%. C Tier 1 is the Core Tier 1 ratio defined as Core Tier 1 Capital over Risk-Weighted Assets (RWA). Equity/Assets is book equity divided by total assets. Tangible Equity/Tangible Assets is book equity minus intangible assets divided by total assets minus intangible assets. IFRS Tier 1 LVG is Tier 1 Capital divided by total assets minus intangible assets minus derivative liabilities. Assets are total assets measured in million euros. Shortfalls are reported in million euros and are summed over all banks in each country.

		Shortfall Assuming 4% threshold			Shortfall Assuming 7% threshold		
Country	**Assets**	**Equity/Assets**	**Tan. equity/ Tan. assets**	**IFRS Tier1 LVG**	**Equity/Assets**	**Tan. equity/ Tan. assets**	**IFRS Tier1 LVG**
Austria	344,795	-	-	-	394	1,622	3,293
Belgium	438,513	-	-	-	6,301	7,372	7,320
Denmark	717,806	-	-	-	16,431	17,290	17,119
Finland	124,296	-	-	-	-	631	-
France	6,480,940	2,064	17,027	26,391	152,800	189,155	185,742
Germany	3,481,186	3,077	12,587	-	81,932	95,318	53,944
Hungary	34,132	-	-	-	-	-	-
Ireland	234,082	-	-	-	54	543	1,788
Italy	2,004,914	-	-	-	11,407	24,343	29,301
Netherlands	2,045,712	2,254	2,256	1,780	33,078	36,134	43,101
Norway	280,108	-	-	-	-	-	1,296
Poland	63,004	-	-	-	-	-	-
Spain	2,977,022	-	-	-	3,246	37,632	24,545
Sweden	1,536,929	-	1,061	925	37,876	44,293	41,180
United Kingdom	6,007,405	-	-	3,218	44,589	66,779	76,003
	26,770,845	**7,394**	**32,931**	**32,314**	**388,109**	**521,111**	**484,631**

Table 4
Book Capital vs. Market Capital Based Measures

This table reports the banks' capital shortfall derived from different capital requirement rules based on measures of book and market capitalization for the 34 publicly listed banks participating in the 2016 EBA stress test. Equity / Assets is book equity over total assets. Market Equity / Assets is a market leverage ratio and defined as market equity over asset minus book equity + market equity. The less stringent benchmark is a leverage ratio of 4% and the more stringent benchmark is a leverage ratio of 7%. For comparison, we report the shortfall using the unstressed capital ratios (Equity/Assets and Market Equity/Assets) of 3%. Shortfalls are reported in million euros and are summed over all banks in each country.

	Stressed Book Capital Ratios			**Stressed Market Capital Ratios**		
Country	**Equity/Assets**	**Equity/Assets**	**Equity/Assets**	**Market Equity / Assets**	**Market Equity / Assets**	**Market Equity / Assets**
	3%	**4%**	**7%**	**3%**	**4%**	**7%**
Austria	0	0	0	0	0	5,650
Belgium	0	0	2,574	0	0	648
Denmark	0	0	12,153	0	0	11,378
France	0	2,064	128,363	58,248	108,900	260,856
Germany	0	3,077	62,561	43,767	66,530	134,822
Hungary	0	0	0	0	0	0
Ireland	0	0	54	0	0	2,901
Italy	0	0	11,407	21,382	35,276	95,423
Netherlands	0	0	11,343	0	0	25,527
Norway	0	0	0	0	0	2,409
Poland	0	0	0	0	0	0
Spain	0	0	3,246	0	8,475	94,428
Sweden	0	0	37,876	0	0	23,818
United Kingdom	0	0	44,589	18,700	34,456	187,091
	0	**5,141**	**314,166**	**142,097**	**253,637**	**844,951**

Table 5
SRISK or Capital Shortfall in a Systemic Crisis

This table reports the banks' capital shortfall derived from different capital requirement rules based on the market capitalization of banks in the scenario where the market index drops by 40% over six months. Sample: 34 publicly listed banks participating in the 2016 EBA stress test. Market Cap is the total market capitalization as of 30 June 2016 in million euros. Market Equity / Total Assets is market capitalization over total assets. *LRMES* is the expected six-month return of a bank in the scenario where the MSCI World Index drops by 40% over six months. *LRMES**Market Equity is the absolute market value loss in a systemic financial crisis in million euros. *SRISK* is the expected shortfall of a bank in a systemic crisis over a six-month period considering both *LRMES* and market leverage. By default, *SRISK* is calculated assuming a 5.5% prudential capital ratio (which is the measure available on the NYU Stern Vlab website). *SRISK* 3%, 4%, 7% are capital shortfall estimates in a systemic crisis under different prudential capital ratio assumptions. Panel A reports the absolute shortfalls in million euros for each country sorted by the largest absolute *SRISK* (5.5%) value (in bold). Panel B reports the shortfalls scaled by each country's GDP and sorted by the highest relative *SRISK*.

Panel A. Absolute SRISK (in million euros)

Country	MarketCap	Market Equity / Assets	LRMES	LRMES * Market Equity	SRISK	SRISK 3%	SRISK 4%	SRISK 7%
					Prudential Capital Ratio			
					5.50%	3%	4%	7%
France	93,631	2.0%	71.5%	66,939	247,951	123,113	173,048	322,854
United Kingdom	189,055	4.3%	57.1%	107,991	185,347	64,251	112,690	258,005
Spain	112,842	3.9%	63.2%	71,321	116,626	44,741	73,495	159,757
Germany	24,309	1.1%	62.8%	15,273	114,467	58,330	80,785	148,150
Italy	44,309	2.9%	78.1%	34,608	96,657	48,312	67,650	125,663
Sweden	89,065	5.9%	48.8%	43,488	39,767	5,186	16,491	63,043
Netherlands	35,611	4.1%	77.1%	27,470	38,564	17,334	25,826	51,302
Denmark	26,438	4.9%	45.5%	12,039	14,896	1,580	6,906	22,885
Belgium	18,374	6.8%	74.2%	13,635	9,477	3,015	5,600	13,355
Austria	8,735	4.3%	56.2%	4,907	7,173	2,173	4,173	10,174
Norway	17,418	6.1%	47.2%	8,222	5,955	0	1,823	10,087
Ireland	20,933	11.6%	48.0%	10,045	5,330	2,317	3,522	7,137
Hungary	5,636	15.4%	51.3%	2,894	0	0	0	0
Poland	6,616	10.4%	44.8%	2,962	0	0	0	600
	692,972	**4.4%**	**60.9%**	**421,793**	**882,210**	**370,353**	**572,010**	**1,193,010**

Panel B. Relative SRISK (Scaled by GDP)

Country	MarketCap	Market Equity / Assets	LRMES	LRMES * Market Equity	SRISK	SRISK 3%	SRISK 4%	SRISK 7%
					Prudential Capital Ratio			
					5.5%	3%	4%	7%
France	93,631	2.0%	71.5%	3.1%	11.4%	5.7%	7.9%	14.8%
Spain	112,842	3.9%	63.2%	6.6%	10.8%	4.1%	6.8%	14.8%
Sweden	89,065	5.9%	48.8%	9.8%	9.0%	1.2%	3.7%	14.2%
United Kingdom	189,055	4.3%	57.1%	4.2%	7.2%	2.5%	4.4%	10.1%
Italy	44,309	2.9%	78.1%	2.1%	5.9%	3.0%	4.1%	7.7%
Netherlands	35,611	4.1%	77.1%	4.1%	5.7%	2.6%	3.8%	7.6%
Denmark	26,438	4.9%	45.5%	4.5%	5.6%	0.6%	2.6%	8.6%
Germany	24,309	1.1%	62.8%	0.5%	3.8%	1.9%	2.7%	4.9%
Ireland	20,933	11.6%	48.0%	4.7%	2.5%	1.1%	1.6%	3.3%
Belgium	18,374	6.8%	74.2%	3.3%	2.3%	0.7%	1.4%	3.3%
Austria	8,735	4.3%	56.2%	1.5%	2.1%	0.6%	1.2%	3.0%
Norway	17,418	6.1%	47.2%	2.4%	1.7%	0.0%	0.5%	2.9%
Hungary	5,636	15.4%	51.3%	2.7%	0.0%	0.0%	0.0%	0.0%
Poland	6,616	10.4%	44.8%	0.7%	0.0%	0.0%	0.0%	0.1%
	692,972	**4.4%**	**60.9%**	**4.8%**	**7.6%**	**2.7%**	**4.6%**	**10.7%**

Table 6
Capital shortfalls comparison: November 2014 versus June 2016

This table reports the evolution of the market capitalization and the capital shortfall measure *SRISK* from November 2014 until June 2016. Market Cap is the total market capitalization of banks by country in million euros. *SRISK* is the total expected capital shortfall of banks located in the country in the scenario where the market index drops by 40% over six months. Change is the percentage change between November 2014 and June 2016 measures.

	MarketCap			SRISK		
Country	**2014**	**2016**	**Change**	**2014**	**2016**	**Change**
France	122,489	93,631	-23.6%	220,554	247,951	12.4%
United Kingdom	278,434	189,055	-32.1%	106,565	185,347	73.9%
Germany	48,076	24,309	-49.4%	105,573	114,467	8.4%
Italy	83,600	44,309	-47.0%	74,796	96,657	29.2%
Spain	193,564	112,842	-41.7%	55,541	116,626	110.0%
Netherlands	43,879	35,611	-18.8%	37,537	38,564	2.7%
Sweden	110,056	89,065	-19.1%	23,227	39,767	71.2%
Denmark	26,031	26,438	1.6%	13,157	14,896	13.2%
Belgium	17,684	18,374	3.9%	6,060	9,477	56.4%
Austria	8,730	8,735	0.1%	5,182	7,173	38.4%
Norway	23,619	17,418	-26.3%	3,939	5,955	51.2%
Ireland	68,448	20,933	-69.4%	2,818	5,330	89.2%
Hungary	3,641	5,636	54.8%	0	0	0.0%
Poland	11,140	6,616	-40.6%	0	0	0.0%
	1,039,391	**692,972**	**-33.3%**	**654,948**	**882,210**	**34.7%**

Table 7
Capital shortfalls and "Bail-Ins"

This table reports the banks' capital shortfall in a systemic crisis (*SRISK*) relative to market equity and market equity plus subordinated debt. *SRISK* is the expected capital shortfall in the scenario where the market index drops by 40% over six months and assuming a prudential capital ratio of 5.5%.

Country	SRISK/Market Equity	SRISK/(Market Equity+Sub Debt)
Germany	470.9%	249.6%
France	264.8%	162.1%
Italy	218.1%	100.7%
Netherlands	108.3%	73.3%
Spain	103.4%	74.1%
United Kingdom	98.0%	59.2%
Austria	82.1%	47.1%
Denmark	56.3%	47.1%
Belgium	51.6%	42.9%
Sweden	44.7%	36.1%
Norway	34.2%	28.9%
Ireland	25.5%	18.1%
Hungary	0.0%	0.0%
Poland	0.0%	0.0%
	111.3%	67.1%

Appendix I

This table is a list of all banks participating in the 2016 stress tests and for which data are available from SNL Financial as of Q1 2016.

Bank	Country	Ticker	Total Assets (€ mn)	CET 1 (%)	Equity/Assets (%)	RWA/Assets (%)
Erste Group Bank	Austria	EBS	199,743	12.35	7.41	49.21
Raiffeisen Zentralbank	Austria		138,426	10.58	6.72	52.11
KBC Group	Belgium	KBC	252,356	15.16	6.27	34.61
Belfius Banque	Belgium		176,962	15.90	4.89	26.57
Danske Bank	Denmark	DANSKE	441,188	16.12	4.88	25.32
Nykredit Realkredit	Denmark		185,403	19.45	4.73	22.49
Jyske Bank	Denmark	JYSK	72,806	16.06	5.53	32.56
OP Financial Group	Finland		125,145	19.55	7.45	33.42
BNP Paribas	France	BNP	1,994,193	11.05	5.02	31.57
Crédit Agricole SA	France	ACA	1,529,294	10.79	3.89	19.98
Société Générale	France	GLE	1,334,391	11.42	4.70	26.73
Groupe BPCE	France		1,166,535	13.02	5.59	33.55
La Banque Postale	France		218,708	13.20	4.18	24.79
Deutsche Bank	Germany	DBK	1,629,130	13.19	4.15	24.39
Commerzbank	Germany	CBK	532,641	13.77	5.71	37.22
DZ Bank AG	Germany		408,341	13.85	4.83	23.96
Landesbank Baden-Württemberg	Germany		234,015	16.36	5.83	31.82
Bayerische Landesbank	Germany		215,711	15.14	5.13	32.27
NORD/LB	Germany		180,998	13.07	4.70	35.18
Landesbank Hessen-Thüringen	Germany		172,256	13.79	4.46	31.85
NRW.BANK	Germany		141,175	42.58	13.27	30.58
Volkswagen Financial Svcs AG	Germany		121,251	11.97	12.22	89.35
DekaBank Deutsche Girozentrale	Germany		107,981	13.51	4.56	28.88
National Bank of Greece	Greece	ETE	111,232	14.52	8.83	55.56
OTP Bank	Hungary	OTP	33,916	13.28	11.51	61.35
Governor and Co. of the bank	Ireland	BKIR	130,960	13.30	6.96	40.70
Allied Irish Banks	Ireland	AIB	103,122	15.86	11.78	56.78
UniCredit	Italy	UCG	860,433	10.59	6.22	45.40
Intesa Sanpaolo	Italy	ISP	676,496	12.98	7.18	42.03
Banca Monte dei Paschi	Italy	BMPS	169,012	12.01	5.69	41.91
Banco Popolare	Italy	BP	120,510	13.15	7.09	37.13
UBI Banca	Italy	UBI	117,201	12.08	8.97	52.34
ING Groep	Netherlands	INGA	841,769	12.94	5.76	38.15
Rabobank	Netherlands		670,373	13.49	6.16	31.79
ABN AMRO Group	Netherlands		390,317	15.53	4.51	27.67
Nederlandse Waterschapsbank	Netherlands		91,314	65.07	1.53	2.19
DNB ASA	Norway	DNB	270,076	16.03	7.33	39.12
PKO Bank Polski	Poland	PKO	62,265	13.27	11.34	69.48
Banco Santander	Spain	SAN	1,340,262	12.55	7.37	43.70
BBVA	Spain	BBVA	750,078	12.10	7.39	53.50
CaixaBank	Spain	CABK	344,255	12.90	7.32	41.63
Banco de Sabadell	Spain	SAB	208,628	11.50	6.12	42.55
Bankia SA	Spain	BKIA	206,970	13.89	6.13	39.28
Banco Popular Español	Spain	POP	158,650	13.11	7.89	47.96
Nordea Bank	Sweden	NDA	646,868	16.45	4.80	22.15
Handelsbanken	Sweden	SHB.A	275,323	21.25	5.09	18.76
Skandinaviska Enskilda Banken	Sweden	SEB.A	272,466	18.84	5.72	22.87
Swedbank	Sweden	SWED.A	234,575	24.14	5.74	18.11
HSBC Holdings	UK	HSBA	2,218,570	11.86	8.20	45.77
Barclays	UK	BARC	1,519,816	11.37	5.88	32.00
Royal Bank of Scotland Group	UK	RBS	1,106,479	15.51	6.64	29.76
Lloyds Banking Group	UK	LLOY	1,094,647	12.81	5.82	27.62

Appendix II

This table is a list of all publicly listed banks participating in the 2016 stress tests and for which data are available from SNL Financial as of 30 June 2016.

Bank	Country	Ticker	Market Cap (€ mn)	Market Equity / Total Assets (%)	MTB	SRISK
Erste Group Bank	Austria	EBS	8,735	4.81	0.57	7,173
KBC Group	Belgium	KBC	18,374	7.18	1.17	9,477
Danske Bank	Denmark	DANSKE	23,207	5.04	1.11	12,580
Jyske Bank	Denmark	JYSK	3,231	4.45	0.81	2,316
BNP Paribas	France	BNP	49,581	2.51	0.48	101,683
Société Générale	France	GLE	22,798	1.77	0.36	68,369
Crédit Agricole SA	France	ACA	21,252	1.40	0.35	77,900
Deutsche Bank	Germany	DBK	17,010	1.02	0.26	88,985
Commerzbank	Germany	CBK	7,298	1.39	0.24	25,482
OTP Bank	Hungary	OTP	5,636	16.57	1.44	0
Allied Irish Banks	Ireland	AIB	14,942	16.85	1.23	0
Governor and Co. of the bank	Ireland	BKIR	5,991	4.70	0.66	5,330
Intesa Sanpaolo	Italy	ISP	27,010	4.62	0.54	31,940
UniCredit	Italy	UCG	12,178	1.51	0.23	45,177
UBI Banca	Italy	UBI	2,232	2.15	0.21	4,924
Banco Popolare	Italy	BP	1,776	1.61	0.22	5,943
Banca Monte dei Paschi	Italy	BMPS	1,113	0.57	0.11	8,672
ING Groep	Netherlands	INGA	35,611	4.36	0.72	38,564
DNB ASA	Norway	DNB	17,418	5.83	0.85	5,955
PKO Bank Polski	Poland	PKO	6,616	10.68	0.90	0
Banco Santander	Spain	SAN	49,527	4.15	0.50	55,400
BBVA	Spain	BBVA	32,837	4.66	0.60	28,462
CaixaBank	Spain	CABK	11,633	3.38	0.47	13,055
Bankia SA	Spain	BKIA	7,445	3.75	0.59	7,122
Banco de Sabadell	Spain	SAB	6,567	3.37	0.51	6,976
Banco Popular Español	Spain	POP	4,834	3.21	0.39	5,611
Nordea Bank	Sweden	NDA	30,525	4.59	1.05	21,472
Handelsbanken	Sweden	SWED.A	21,144	7.83	1.55	4,040
Swedbank	Sweden	SHB.A	20,568	6.89	1.55	6,208
Skandinaviska Enskilda Banken	Sweden	SEB.A	16,829	5.77	1.23	8,047
HSBC Holdings	United Kingdom	HSBA	111,144	5.01	0.63	60,043
Lloyds Banking Group	United Kingdom	LLOY	46,458	4.60	0.75	43,807
Barclays	United Kingdom	BARC	28,221	1.92	0.33	79,182
Royal Bank of Scotland Group	United Kingdom	RBS	3,231	2.32	0.05	2,316