

Capital Shortfalls of European Banks following the 2018 Stress Test

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Abstract

The European Banking Authority (EBA) disclosed the effect of hypothetical losses in a stress scenario on bank capital ratios on November 2, 2018. We assess the capital adequacy of the participating banks based on these disclosures and using an alternative supervisory approach (the methodology used by U.S. supervisors in the Comprehensive Capital Analysis and Review (CCAR)) and a market-based approach to define capital shortfalls. The CCAR approach ranks banks according to their capital shortfalls similarly as the market-based approach. The two capital shortfall measures are negatively correlated with the regulatory risk measures (the “risk weights”) used in the stress test to assess the riskiness of bank assets and therefore, their capitalization needs. Differences in the magnitude of capital shortfalls between market-based and CCAR approaches are however substantial, and can be attributed to (i) different prudential thresholds applied to capital ratios, (ii) different loss projections under the stress scenario, and (iii) the difference between market and book values of bank equity.

Motivation

The European Banking Authority (EBA) conducted another round of stress test in 2018 including a set of 48 large European banks covering about 70% of bank assets in the European Union.³ Similar to earlier stress tests, the EBA applied an adverse (i.e. stress) scenario and calculated the effect on the bank balance sheet, profits and losses, and eventually on bank capital. It did, however, not specify a benchmark capital ratio and threshold relative to which a bank can either pass or fail the stress test.

In this note, we use an alternative supervisory approach to calculate bank capital shortfalls based on the scenarios and losses disclosed by the EBA. More precisely, we use the four target capital ratios and respective prudential thresholds used in the U.S. stress tests. As in Pierret and Steffen (2018), we use a second methodology and calculate capital shortfalls for banks using market data as an objective benchmark, compare them to the supervisory stress test results, and explain the differences and what they mean for the supervisory process.

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³ The EBA 2018 stress test and the methodology are described in EBA (2018).

Stress Test Sample

The EBA has published a list of 48 European banks that were part of the 2018 stress test and comprise about 70% of the banking sector assets in the EU. 32 of these banks are publicly listed. Balance sheet information and market data collected to produce this report are as of December 2017, comparable to the information used in the 2018 EBA stress test.

Comprehensive Capital Analysis and Review (CCAR 2018) methodology

The assessment of bank resilience to the stress scenario in the CCAR is based on four different capital ratios and thresholds in the adverse scenario in each of the years of the scenario (2018, 2019 and 2020).⁴ In our analyses, we use the transitional numbers reported by the EBA unless otherwise stated. We detail below the four ratios and corresponding thresholds used to derive CCAR capital shortfalls of banks in the EBA stress test:

- 1. Common Equity Tier 1 Capital ratio:** This first method uses a Common Equity Tier 1 Capital ratio (**CET 1**) and a 4.5% threshold as benchmark to calculate shortfalls. The ratio is defined as common equity tier 1 capital over risk-weighted assets. The (equally weighted) average CET 1 ratio in our sample as reported based on 31 December 2017 numbers is 16.38% (Appendix I).
- 2. Tier 1 Capital ratio:** The second capital ratio is the Tier 1 Capital ratio (**Tier 1**) and a benchmark capital ratio of 6%. Tier 1 capital ratio is defined as Tier 1 capital over risk-weighted assets. The (equally weighted) average Tier 1 ratio in our sample as reported based on 31 December 2017 numbers is 17.77% (Appendix I).
- 3. Total Capital ratio:** The third capital ratio is the Total Capital ratio (**Total Capital**) and a benchmark of 8%. This ratio is defined as total capital over risk-weighted assets. The (equally weighted) average Total Capital ratio in our sample as reported based on 31 December 2017 numbers is 20.7% (Appendix I).
- 4. Tier 1 Leverage ratio:** The fourth capital ratio is the Tier 1 Leverage ratio (**Leverage**) and a benchmark of 4%. This ratio is defined as tier 1 capital over total leverage ratio exposure. The (equally weighted) average Tier 1 Leverage ratio in our sample as reported based on 31 December 2017 numbers is 5.88% (Appendix I).
 - a.** The banks with the lowest actual Tier 1 Leverage ratios as of 31 December 2017 are Nord LB (3.4%), N.V. Bank Nederlandse Gemeenten (3.5%), and ABN Amro Group N.V. (4.03%).

For each of these four capital ratios, we take the maximum capital shortfall over the three years (2018-2020) and derive the final capital shortfall measure taking the maximum of these shortfalls.

⁴ In addition, U.S. banks using their advanced approaches to derive regulatory risk weights in the 2018 CCAR were subject to a 3% supplementary leverage ratio requirement (not considered in our derivations of CCAR capital shortfalls).

Capital Shortfall in a Systemic Crisis (SRISK)

We assume a systemic financial crisis with a global stock market decline of 40% over six months. SRISK is our measure for a bank's capital shortfall in this scenario, assuming a 5.5% prudential threshold to the capital ratio with losses estimated using the VLAB methodology to estimate the downside risk of bank stock returns.⁵ 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-wide 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. SRISK reported in our analysis is based on bank data as of December 2017, to make SRISK and the capital shortfalls based on EBA stress test data comparable.

Main Results using the EBA 2018 projected losses in the adverse scenario

1. Based on CCAR rules (based on 4 ratios including a 4% minimum Tier 1 leverage ratio requirement over the stress scenario) the total capital shortfall of all 48 banks in the stress test is **€56 billion** based on transitional numbers, and €80 billion based on fully loaded accounting (Table 1).
 - a. The €80 billion capital shortfall can be compared to the €123 billion capital shortfall obtained two years ago in Acharya et al. (2016) for European banks participating in the 2016 EBA stress test using the same methodology (using fully loaded accounting). Therefore, the capital shortfall of banks representing 70% of EU banks' assets has decreased by €43 billion over the last two years.
 - b. The EBA reported that 25 banks had to include capital distribution restrictions in their capital plan assumptions under the adverse scenario (MDA restriction), as their projected CET1 ratios under the adverse scenario hit the trigger of the combined buffer requirements (on top of Pillar I and II requirements). Based on transitional accounting, we find that **19 banks have CCAR capital shortfalls**, 14 of which had to include distribution restrictions in their capital plans in the EBA stress test.
 - c. CCAR capital shortfalls of all banks are derived using a 4% Tier 1 Leverage ratio requirement, which appears to be the most stringent requirement among all CCAR capital ratio requirements for European banks. In addition, there are no shortfalls under (i) the CET 1 capital ratio, (ii) the Tier 1 Capital ratio or (iii) the Total Capital ratio, using the CCAR requirements described above.
 - d. The bank with the largest capital shortfall of €16.9 billion is Deutsche Bank, followed by Société Générale (€7.7 billion), and Barclays (€6.9 billion, Figure 1 and Table 1).

⁵ The data are provided by New York University's VLAB (<http://vlab.stern.nyu.edu/welcome/risk/>).

- e. Capital shortfalls of the 32 publicly listed banks in the stress test using the CCAR 2016 methodology are €40 billion or 71% of the total capital shortfalls of all banks (Panel A of Table 2).
- f. If, instead of a 4% Tier 1 leverage ratio requirement, we apply a 3% requirement (as recommended under Basel III), the capital shortfall of European banks becomes €5.6 billion.
 - i. We find four banks that do not comply with this recommendation: Deutsche Bank (€2.9 billion shortfall), Norddeutsche LB (€2 billion), Bayerische LB (€0.5 billion), and N.V. Bank Nederlandse Gemeenten (€0.16 billion).

2. Comparing capital shortfalls under SRISK and CCAR 2018

- a. The total capital shortfall of the 32 **publicly listed banks** in the stress test using the CCAR 2018 methodology is **€40 billion**, and **€505 billion** using the SRISK methodology (Panel A of Table 2).
- b. The difference between the capital shortfalls using SRISK versus CCAR 2018 is €465 billion, and is particularly large for BNP Paribas (€68 billion), Crédit Agricole (€60 billion), and Deutsche Bank (€48 billion) as shown in Panel A of Table 2.
- c. CCAR 2018 capital shortfalls are particularly large among German banks (€17 billion), French banks (€11 billion) and UK banks (€8.6 billion). Overall, the five countries that account for more than 90% of the CCAR capital shortfall are France, United Kingdom, Germany, Spain and Italy (Panel B of Table 2).
- d. Capital shortfalls under SRISK and CCAR 2018 are positively correlated; the rank correlation is 0.27 (Table 3). We illustrate the correlation between SRISK and CCAR 2018, for positive capital shortfalls, in Figure 2.
- e. Both capital shortfalls (SRISK and CCAR) are negatively correlated to regulatory risk measures in the adverse scenario (EBA risk weights). The EBA risk weight is the ratio of total risk exposure amount to total leverage ratio exposure, taking the maximum of this ratio over the three years of the adverse scenario. The correlation of SRISK with the EBA risk weight is -0.29, and the correlation of the CCAR capital shortfalls with the EBA risk weight is -0.40 (Table 3). Therefore banks with the lowest estimated regulatory risk weights in the adverse scenario are the banks with the largest estimated capital shortfalls under both methodologies.

Understanding the differences between shortfalls under SRISK and CCAR 2018

The difference between the capital shortfalls based on SRISK and CCAR 2018 is €465 billion and is reported in Panel B of Table 2 on a country level. The five countries that account for €413 billion of that amount are France, United Kingdom, Germany, Spain and Italy. In this section, we describe the main drivers of this shortfall difference.

Our decomposition of the difference between SRISK and CCAR 2018 capital shortfalls includes four categories:⁶

- 1. Threshold:** SRISK and CCAR 2018 use different prudential thresholds to capital ratios (i.e., thresholds under which the bank is considered undercapitalized) to derive the capital shortfalls. The CCAR capital shortfall is based on a 4% prudential capital ratio, while SRISK considers a 5.5% prudential capital ratio.
- 2. Assets:** in SRISK and CCAR 2018 methodologies, we use different measures of the banks' assets. While in SRISK, we use the quasi-market assets (market value of equity plus book value of debt); in the CCAR capital shortfalls we use the total leverage ratio exposure of the bank (defined under Basel III, and including off-balance sheet items).
- 3. Market-to-book:** banks differ substantially in their market-to-book ratios at the start of the stress test, which will eventually affect how much additional capital they need to raise under SRISK methodology.
- 4. Stress:** SRISK and CCAR 2018 differ both in the severity of their stress scenarios as well as how losses in these scenarios affect bank capital.
- 5. Balance Sheet:** another reason why SRISK and the CCAR capital shortfalls are different comes from the static balance sheet assumption (constant total leverage ratio exposure) in the EBA stress test. In the SRISK methodology, the quasi-market assets are assumed to decline by the market capitalization loss under the stress scenario.

Our results about the main drivers of the capital shortfall difference are summarized below:

- 1.** The difference in capital shortfalls using SRISK and CCAR methodologies is driven by a more severe prudential threshold to capital ratios (explaining 57% of the difference), and larger stressed capital losses in SRISK (37%, Table 4).
- 2.** We find large differences between countries on the relative importance of market-to-book and stress components
 - a.** The market-to-book ratio contributes to 44%, 38%, and 27% of the capital shortfall difference in Italy, Germany, and France respectively, reflecting the

⁶ All categories affecting the difference between the two capital shortfalls, and the methodology to derive the contribution of these categories are described in Appendix III in this report.

under the CCAR approach. The key difference between the Tier 1 Leverage ratio and the CET 1 capital ratio typically watched by European regulators is the denominator, which is based on total (book value) leverage ratio exposure in the Tier 1 Leverage ratio and risk-weighted assets in the CET 1 capital ratio. We do not find capital shortfalls based on the CET1 ratio CCAR requirement (corresponding to the Pillar I requirement). While 25 banks hit the trigger of the combined buffer requirements with their CET1 ratio under the adverse scenario, 14 of these banks have capital shortfalls based on the 4% Tier 1 leverage ratio requirement under the same scenario. Supervisors should consider these differences in shortfalls and adopt a robust ("belt and suspenders") approach that takes the greater of the two shortfalls (based on Tier 1 leverage ratio or CET1 ratio) to assess bank capital adequacy.

Focusing on the 32 publicly listed banks participating in the 2018 EBA stress test, the CCAR 2018 capital shortfall is €40 billion. For this set of banks, we estimate a second measure of capital shortfalls based on a market capital requirement in a systemic crisis (SRISK). The capital shortfall estimate SRISK amounts to €505 billion. The rank correlation of banks with capital shortfalls based on SRISK and CCAR 2018 is 0.27. Both capital shortfalls are negatively correlated with regulatory measures of risk in the adverse scenario. This highlights the dissonance between the market's assessment of banks' capital adequacy and typical regulatory approaches based on risk-weighted assets while results based on unweighted book value of assets are congruent.

While the ordering of banks with capital shortfalls is similar between the CCAR approach and the market-based approach, there are substantial differences in the absolute capital shortfalls particularly for banks in large countries such as France, United Kingdom, Germany, Spain and Italy. These differences can be attributed to three factors in particular: (i) a higher prudential threshold to the capital ratio applied in SRISK (explaining 57% of the difference), (ii) larger stressed losses in SRISK (37%), and (iii) low market-to-book ratios in some countries (explaining 44%, 38% and 27% of the difference in Italy, Germany and France, respectively).

References

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Figure 1

Capital Shortfalls of European Banks using the CCAR 2018 Methodology

This figure shows the ranking of banks with the highest capital shortfall in the EBA 2018 stress test using the losses in the adverse scenario of the EBA stress test and the CCAR 2018 methodology (using CCAR prudential capital ratios). Capital shortfalls are reported in million euros and banks are shown if the capital shortfall is at least one billion euros.

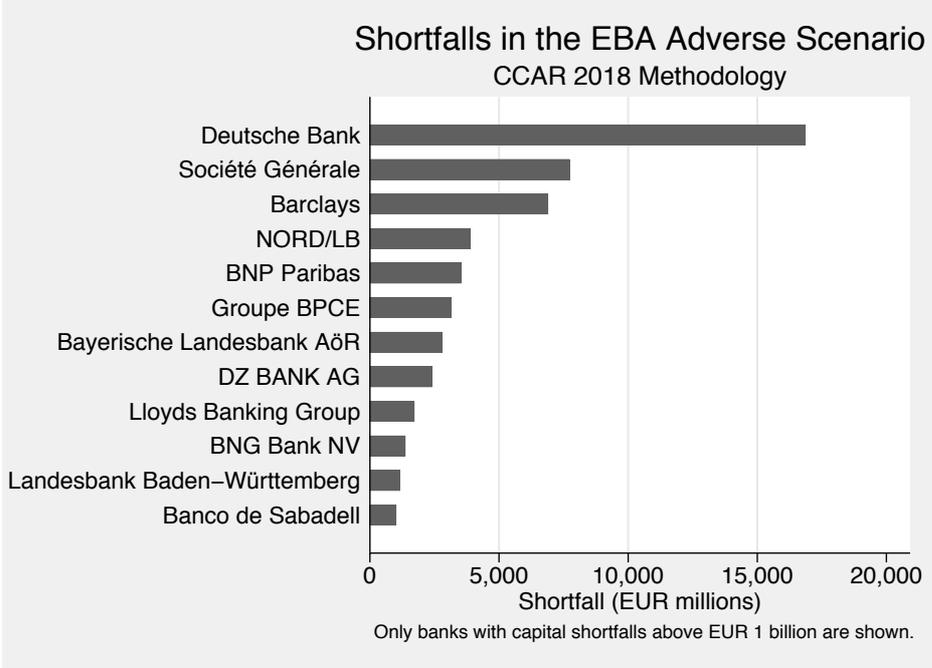


Figure 2
Capital Shortfalls SRISK vs. CCAR

This figure shows the correlation between capital shortfalls using SRISK and CCAR prudential capital ratios. Capital shortfalls are in million euros. SRISK is measured as of 29 Dec 2017.

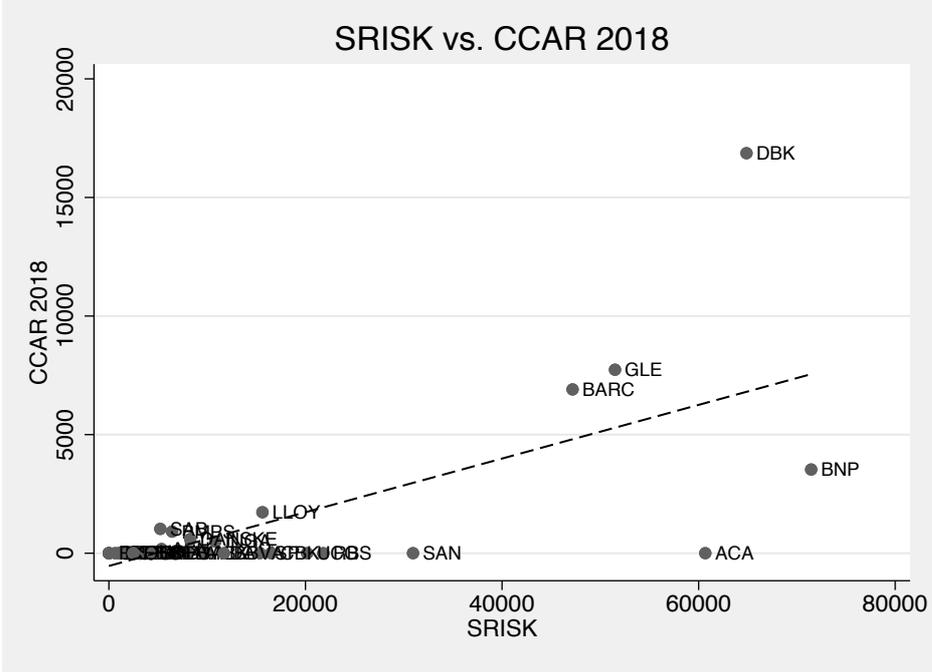


Figure 3

Understanding Capital Shortfall Differences: Market-to-book Ratios

This figure shows the correlation between the difference between SRISK and CCAR capital shortfalls and banks' market-to-book ratio. Capital shortfalls are scaled by the market value of banks' equity. Market values and market-to-book ratios are as of 31 Dec 2017.

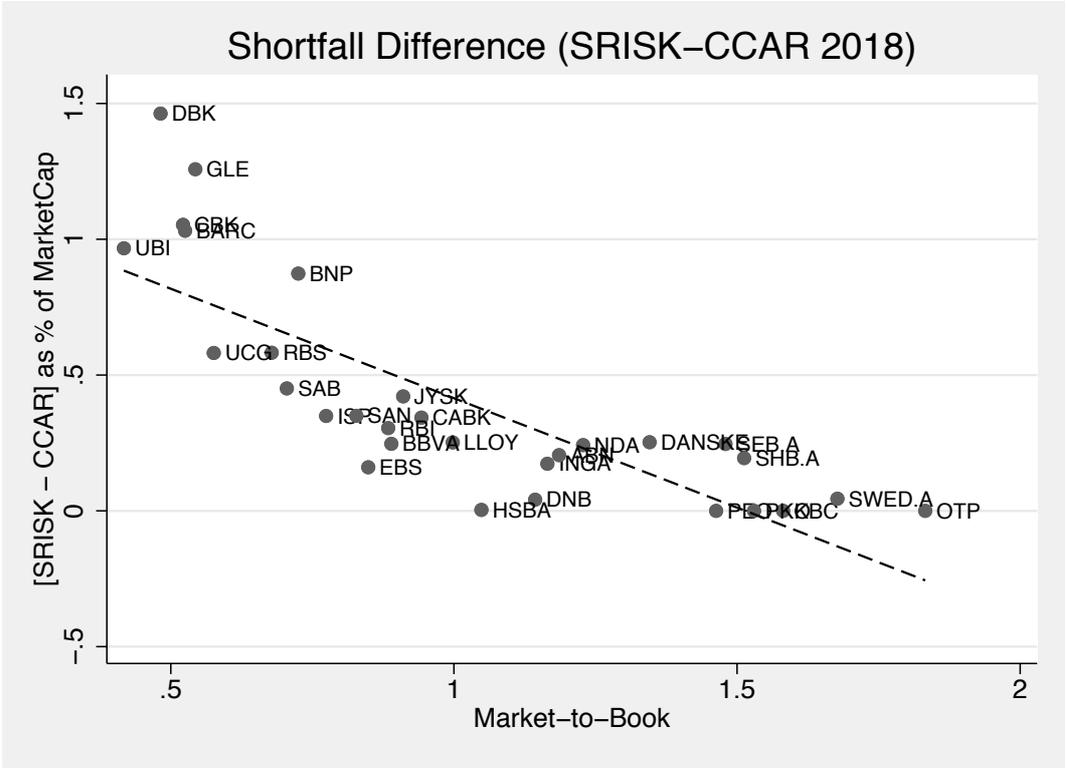


Table 1. Capital Shortfalls under CCAR 2018 and Distribution Restrictions in the Adverse Scenario

This table reports capital shortfalls of 48 European banks that participated in the 2018 EBA stress test. Shortfalls are calculated under the CCAR 2018 methodology (4% Tier 1 leverage ratio requirement). MDA restriction indicates whether a bank included distribution restrictions for MDA (Maximum Distributable Amount) adjustments in the results reported for the adverse scenario. Shortfalls are reported in million euros.

Bank	CCAR 2018 (transitional)	CCAR 2018 (fully loaded)	MDA restriction
Deutsche Bank AG	16,865	19,336	Yes
Société Générale S.A.	7,735	8,291	Yes
Barclays Plc	6,904	14,232	Yes
Norddeutsche Landesbank - Girozentrale -	3,892	3,980	Yes
BNP Paribas	3,529	3,547	Yes
Groupe BPCE	3,161	3,389	Yes
Bayerische Landesbank	2,804	2,831	
DZ BANK AG Deutsche Zentral-Genossenschaftsbank	2,407	2,899	Yes
Lloyds Banking Group Plc	1,727	7,676	Yes
N.V. Bank Nederlandse Gemeenten	1,379	1,381	
Landesbank Baden-Württemberg	1,175	1,641	Yes
Banco de Sabadell S.A.	1,024	1,672	Yes
Banco BPM S.p.A.	909	2,236	Yes
Landesbank Hessen-Thüringen Girozentrale AdöR	679	889	Yes
La Banque Postale	671	680	Yes
Danske Bank	593	1,552	
ING Groep N.V.	495	2,976	Yes
ABN AMRO Group N.V.	176	180	
Unione di Banche Italiane Società Per Azioni	43	593	
Commerzbank AG	-	75	Yes
Jyske Bank	-	-	
Nykredit Realkredit	-	-	
Belfius Banque SA	-	-	
CaixaBank, S.A.	-	-	Yes
Erste Group Bank AG	-	-	Yes
Bank of Ireland Group plc	-	-	
Svenska Handelsbanken - group	-	-	
Raiffeisen Bank International AG	-	-	Yes
OTP Bank Nyrt.	-	-	
Bank Polska Kasa Opieki SA	-	-	
Skandinaviska Enskilda Banken - group	-	-	
Swedbank - group	-	-	
OP Financial Group	-	-	
Powszechna Kasa Oszczednosci Bank Polski SA	-	-	
KBC Group NV	-	-	
Allied Irish Banks Group plc	-	-	
UniCredit S.p.A.	-	-	Yes
Nordea Bank - group	-	-	Yes
Coöperatieve Rabobank U.A.	-	-	Yes
Groupe Crédit Agricole	-	-	
DNB Bank Group	-	-	
The Royal Bank of Scotland Group Plc	-	-	Yes
Banco Santander S.A.	-	-	Yes
Intesa Sanpaolo S.p.A.	-	-	
Group Crédit Mutuel	-	-	
NRW.BANK	-	-	
Banco Bilbao Vizcaya Argentaria S.A.	-	-	Yes
Total shortfall (€ million)	56,169	80,056	

Table 2
SRISK and CCAR 2018

This table reports capital shortfalls of all 32 publicly listed banks that participated in the EBA 2018 stress test comparing CCAR to SRISK. Shortfalls are sorted by SRISK and reported in million euros. SRISK is derived using bank data as of 29 December 2017.

Panel A. Capital shortfalls (Bank level)

Bank	Country	CCAR 2018	SRISK	SRISK - CCAR 2018
BNP Paribas	FR	3,529	71,451	67,922
Deutsche Bank AG	DE	16,865	64,875	48,010
Groupe Cr�dit Agricole	FR	-	60,676	60,676
Soci�t� G�n�rale S.A.	FR	7,735	51,494	43,759
Barclays Plc	GB	6,904	47,172	40,268
Banco Santander S.A.	ES	-	30,940	30,940
The Royal Bank of Scotland Group Plc	GB	-	21,816	21,816
UniCredit S.p.A.	IT	-	20,163	20,163
Commerzbank AG	DE	-	16,498	16,498
Lloyds Banking Group Plc	GB	1,727	15,627	13,900
Intesa Sanpaolo S.p.A.	IT	-	15,350	15,350
Banco Bilbao Vizcaya Argentaria S.A.	ES	-	11,710	11,710
ING Groep N.V.	NL	495	10,822	10,327
Nordea Bank - group	SE	-	9,903	9,903
Danske Bank	DK	593	8,279	7,686
CaixaBank SA	ES	-	7,981	7,981
Banco BPM S.p.A.	IT	-	6,428	5,519
ABN AMRO Group N.V.	NL	909	5,361	5,185
Skandinaviska Enskilda Banken - group	SE	176	5,237	5,237
Banco de Sabadell S.A.	ES	-	5,227	4,203
Svenska Handelsbanken - group	SE	1,024	4,232	4,232
Unione di Banche Italiane Societ� Per Azioni	IT	-	4,078	4,034
Raiffeisen Bank International AG	AT	43	3,027	3,027
Erste Group Bank AG	AT	-	2,493	2,493
Jyske Bank	DK	-	1,783	1,783
DNB Bank Group	NO	-	1,039	1,039
Swedbank - group	SE	-	1,015	1,015
HSBC Holdings Plc	GB	-	627	627
Bank Polska Kasa Opieki SA	PL	-	-	-
KBC Group NV	BE	-	-	-
OTP Bank Nyrt.	HU	-	-	-
Powszechna Kasa Oszczednosci Bank Polski SA	PL	-	-	-
Total shortfall (� million)		40,001	505,302	465,301

Panel B. Capital shortfalls (Country level)

Country	CCAR 2018	SRISK	SRISK - CCAR 2018
France	11,264	183,621	172,357
United Kingdom	8,631	85,242	76,610
Germany	16,865	81,373	64,508
Spain	1,024	55,858	54,834
Italy	952	46,019	45,067
Netherlands	671	16,184	15,513
Denmark	-	10,483	10,483
Sweden	593	10,061	9,468
Finland	-	9,903	9,903
Austria	-	5,520	5,520
Belgium	-	1,039	1,039
Hungary	-	-	-
Ireland	-	-	-
Norway	-	-	-
Poland	-	-	-
Total shortfall (� million)	40,001	505,302	465,301

Table 3**Understanding Capital Shortfall Difference between SRISK and CCAR 2018**

This table shows rank correlations of (a) SRISK with the CCAR 2018 capital shortfall and EBA risk weights, (b) losses under the SRISK methodology (Vlab loss) with the cumulative 3-year loss under the EBA scenario (3-yr EBA loss), minus net interest income, trading loss, and impairments; and of (c) the difference between shortfalls SRISK and CCAR 2018 with the difference in losses under the SRISK methodology (Vlab loss) and the 3-year cumulative loss under the EBA scenario (scaled with market capitalization or using absolute amounts). EBA risk weights is the ratio of the total risk exposure amount to total leverage ratio exposure (maximum ratio over the three years of the adverse scenario).

Rank correlation with SRISK		Rank correlation with CCAR 2018	
CCAR 2018	EBA Risk weights	EBA Risk weights	
0.273	-0.290	-0.396	
Rank correlation with Vlab loss		Rank correlation with SRISK-CCAR 2018	
3-yr EBA loss		Vlab loss - 3yr EBA Loss	MTB
0.326		0.451	-0.596
-Net interest income	Trading loss	Rank correlation with (SRISK-CCAR 2018)/MarketCap	
-0.900	-0.171	LRMES - (3yr EBA Loss/Tier1)	MTB
		0.868	-0.138
			-0.858

Table 4**Decomposing the difference between SRISK and CCAR 2018**

This table shows the difference between capital shortfalls based on SRISK and CCAR 2018 on a country level decomposed into five categories (see Appendix III): (i) different thresholds to capital ratios applied to derive the capital shortfall (Threshold), (ii) the measure of assets (Assets), (iii) market-to-book ratio (MTB), (iv) the severity of the stress scenario and how it affects the numerator of the capital ratio (Stress), and (v) the balance sheet evolution assumption (Balance Sheet). Shortfalls based on SRISK or CCAR 2018 are in million euros.

Country	Threshold	Assets	MTB	Stress	Balance Sheet
France	41%	12%	27%	21%	-2%
Germany	44%	5%	38%	16%	-2%
Italy	45%	-7%	44%	21%	-3%
Spain	57%	-4%	-7%	60%	-6%
United Kingdom	99%	5%	-62%	67%	-9%
Total	57%	2%	8%	37%	-4%

Appendix I

Capital Ratios as of 31 December 2017 (as reported)

This table reports capital ratios of 48 European banks that participated in the 2018 EBA stress test as reported on 31 December 2017.

Bank	Country	Capital ratios (Actual, as of 31 Dec 2017)			
		CET 1	Tier 1	Total Capital	Leverage
Erste Group Bank AG	AT	13.37%	13.97%	18.46%	6.55%
Raiffeisen Bank International AG	AT	12.89%	13.68%	17.93%	6.12%
KBC Group NV	BE	16.46%	18.00%	20.36%	6.08%
Belfius Banque SA	BE	16.08%	16.08%	18.63%	5.59%
Deutsche Bank AG	DE	14.80%	16.79%	18.65%	4.13%
Commerzbank AG	DE	14.94%	15.16%	18.32%	5.51%
DZ BANK AG Deutsche Zentral-Genossenschaftsbank	DE	13.81%	15.17%	17.21%	4.61%
Landesbank Baden-Württemberg	DE	15.79%	16.90%	22.28%	4.96%
Bayerische Landesbank	DE	15.32%	15.32%	17.54%	4.04%
Landesbank Hessen-Thüringen Girozentrale AdöR	DE	15.40%	16.42%	21.77%	4.88%
Norddeutsche Landesbank - Girozentrale -	DE	12.40%	13.31%	18.06%	3.41%
NRW.BANK	DE	41.74%	41.74%	45.34%	11.41%
Danske Bank	DK	17.62%	20.06%	22.61%	4.41%
Nykredit Realkredit	DK	20.69%	21.79%	25.31%	4.80%
Jyske Bank	DK	16.35%	18.04%	19.84%	5.42%
Banco Santander S.A.	ES	12.26%	12.77%	14.99%	5.28%
Banco Bilbao Vizcaya Argentaria S.A.	ES	11.67%	12.95%	15.37%	6.62%
CaixaBank	ES	12.73%	12.81%	16.15%	5.54%
Banco de Sabadell S.A.	ES	13.44%	14.34%	16.07%	4.97%
OP Financial Group	FI	20.10%	20.26%	22.54%	7.85%
BNP Paribas	FR	11.77%	13.05%	14.63%	4.68%
Groupe Cr�dit Agricole	FR	14.84%	16.16%	18.63%	5.62%
Groupe BPCE	FR	15.28%	15.40%	19.17%	5.05%
Soci�t� G�n�rale S.A.	FR	11.57%	14.01%	17.16%	4.30%
Group Cr�dit Mutuel	FR	17.44%	17.90%	21.06%	6.58%
La Banque Postale	FR	13.07%	14.29%	18.19%	4.53%
HSBC Holdings Plc	GB	14.50%	17.35%	20.96%	5.91%
Barclays Plc	GB	13.28%	17.22%	21.46%	4.79%
Lloyds Banking Group Plc	GB	14.06%	17.22%	21.17%	5.12%
The Royal Bank of Scotland Group Plc	GB	15.91%	19.69%	23.86%	5.82%
OTP Bank Nyrt.	HU	15.21%	15.21%	17.15%	9.27%
Allied Irish Banks Group plc	IE	20.81%	21.32%	22.56%	11.94%
Bank of Ireland Group plc	IE	15.82%	16.94%	20.18%	7.03%
UniCredit S.p.A.	IT	13.73%	15.36%	18.10%	5.73%
Intesa Sanpaolo S.p.A.	IT	13.27%	15.15%	17.91%	6.42%
Banco BPM S.p.A.	IT	12.36%	12.66%	15.21%	5.59%
Unione di Banche Italiane Societ� Per Azioni	IT	11.56%	11.56%	14.13%	5.85%
ING Groep N.V.	NL	14.71%	16.24%	18.53%	4.65%
Co�peratieve Rabobank U.A.	NL	15.77%	18.76%	26.19%	6.03%
ABN AMRO Group N.V.	NL	17.70%	18.48%	21.29%	4.03%
N.V. Bank Nederlandse Gemeenten	NL	30.35%	36.65%	36.65%	3.49%
DNB Bank Group	NO	16.21%	17.74%	20.62%	6.90%
Powszechna Kasa Oszczednosci Bank Polski SA	PL	16.50%	16.50%	17.37%	10.54%
Bank Polska Kasa Opieki SA	PL	16.41%	16.41%	17.45%	9.79%
Nordea Bank - group	SE	19.49%	22.27%	25.24%	5.20%
Skandinaviska Enskilda Banken - group	SE	19.35%	21.63%	24.21%	5.24%
Svenska Handelsbanken - group	SE	22.73%	25.04%	28.31%	4.57%
Swedbank - group	SE	24.61%	27.32%	30.67%	5.25%
Average (unweighted)		16.38%	17.77%	20.74%	5.88%

Appendix II

Capital Ratios in the Adverse Scenario (31 Dec 2020)

This table reports capital ratios of 48 European banks that participated in the 2018 EBA stress test. We report stressed capital ratios in the adverse scenario on 31 December 2020 (transitional).

Bank	Country	Capital ratios (Adverse Scenario, 31 Dec 2020)			
		CET 1	Tier 1	Total Capital	Leverage
Erste Group Bank AG	AT	8.56%	9.42%	13.71%	4.67%
Raiffeisen Bank International AG	AT	9.73%	10.55%	13.29%	5.18%
KBC Group NV	BE	13.60%	14.95%	17.14%	5.75%
Belfius Banque SA	BE	13.21%	13.21%	15.63%	4.82%
Deutsche Bank AG	DE	8.14%	9.97%	11.96%	2.79%
Commerzbank AG	DE	9.93%	10.17%	13.54%	4.07%
DZ BANK AG Deutsche Zentral-Genossenschaftsbank	DE	8.97%	9.75%	12.04%	3.44%
Landesbank Baden-Württemberg	DE	10.69%	11.27%	17.47%	3.54%
Bayerische Landesbank	DE	9.44%	9.48%	11.98%	2.80%
Landesbank Hessen-Thüringen Girozentrale AdöR	DE	9.96%	10.32%	14.74%	3.60%
Norddeutsche Landesbank - Girozentrale -	DE	7.07%	7.37%	11.88%	1.88%
NRW.BANK	DE	33.96%	33.96%	37.05%	11.06%
Danske Bank	DK	12.77%	14.83%	16.79%	3.90%
Nykredit Realkredit	DK	15.63%	16.53%	19.44%	4.45%
Jyske Bank	DK	11.69%	13.02%	14.71%	4.42%
Banco Santander S.A.	ES	9.72%	11.12%	12.64%	4.78%
Banco Bilbao Vizcaya Argentaria S.A.	ES	9.25%	10.82%	13.07%	6.06%
CaixaBank	ES	9.11%	9.73%	11.84%	4.52%
Banco de Sabadell S.A.	ES	8.40%	9.84%	11.52%	3.54%
OP Financial Group	FI	15.28%	15.34%	15.88%	6.35%
BNP Paribas	FR	8.64%	9.90%	11.36%	3.80%
Groupe Cr�dit Agricole	FR	10.21%	11.38%	13.76%	4.42%
Groupe BPCE	FR	10.69%	10.74%	13.70%	3.73%
Soci�t� G�n�rale S.A.	FR	7.61%	9.84%	12.58%	3.33%
Group Cr�dit Mutuel	FR	13.26%	13.45%	16.42%	5.45%
La Banque Postale	FR	8.22%	9.19%	11.97%	3.67%
HSBC Holdings Plc	GB	9.42%	11.34%	13.87%	4.69%
Barclays Plc	GB	7.28%	10.03%	12.90%	3.46%
Lloyds Banking Group Plc	GB	8.55%	10.53%	14.06%	3.78%
The Royal Bank of Scotland Group Plc	GB	9.93%	12.92%	16.22%	4.83%
OTP Bank Nyrt.	HU	13.03%	13.03%	14.81%	8.64%
Allied Irish Banks Group plc	IE	14.81%	15.32%	16.14%	9.06%
Bank of Ireland Group plc	IE	11.15%	12.56%	15.63%	5.57%
UniCredit S.p.A.	IT	9.34%	10.59%	13.19%	4.52%
Intesa Sanpaolo S.p.A.	IT	10.40%	12.07%	14.81%	5.35%
Banco BPM S.p.A.	IT	8.47%	8.59%	9.66%	3.48%
Unione di Banche Italiane Societ� Per Azioni	IT	8.32%	8.32%	11.10%	3.97%
ING Groep N.V.	NL	10.70%	11.95%	14.82%	4.02%
Co�peratieve Rabobank U.A.	NL	11.44%	13.39%	19.87%	4.97%
ABN AMRO Group N.V.	NL	14.85%	15.85%	19.44%	4.03%
N.V. Bank Nederlandse Gemeenten	NL	22.33%	27.88%	27.88%	3.02%
DNB Bank Group	NO	15.03%	16.48%	19.21%	6.77%
Powszechna Kasa Oszczednosci Bank Polski SA	PL	15.93%	15.93%	16.80%	10.21%
Bank Polska Kasa Opieki SA	PL	15.47%	15.47%	16.52%	9.16%
Nordea Bank - group	SE	16.68%	18.50%	20.87%	5.23%
Skandinaviska Enskilda Banken - group	SE	16.47%	18.43%	20.77%	5.18%
Svenska Handelsbanken - group	SE	19.53%	21.41%	24.06%	4.81%
Swedbank - group	SE	21.98%	24.30%	27.23%	5.45%
Average (unweighted)		12.18%	13.35%	15.96%	4.92%

Appendix III

Decomposition of SRISK and CCAR 2018 – Methodology

We can decompose the difference between SRISK and CCAR capital shortfalls into five categories:

- a. **Threshold:** different prudential thresholds to capital ratios are applied to derive the capital shortfalls. The CCAR capital shortfall is based on a 4% prudential threshold, while SRISK considers a 5.5% prudential threshold.
- b. **Measure of assets:** the denominators in the capital ratios used to derive capital shortfalls are different. The denominator of Tier 1 leverage ratio is the Tier 1 leverage ratio exposure (including off-balance sheet items), while SRISK uses the quasi-market assets (book value of liabilities plus market value of equity). More specifically, it reflects differences in the amount of assets financed by the bank liabilities.
- c. **Market-to-book:** the valuation of equity and the measure of capital are different in the two approaches. CCAR uses Tier 1 capital, while SRISK uses the market valuation of equity. Market-to-book is measured in this case by the ratio of market capitalization to Tier 1 capital.
- d. **Stress:** the severity of the stress scenario and how it affects the numerator of the capital ratio. Differences in “stress” can be assessed by comparing the percentage change in Tier 1 capital over the stress scenario with the percentage change in market capitalization in Vlab stress scenario (LRMES).
- e. **Balance sheet assumption:** different assumptions concerning the evolution of the size of the balance sheet over the stress scenario. The EBA stress test results (and the CCAR capital shortfall) are based on a static balance sheet assumption. The Tier 1 leverage ratio exposure amount stays constant over the EBA stress scenario, while the quasi-market assets in SRISK will be reduced by the market cap loss in Vlab stress scenario.

The quantitative decomposition of the difference between SRISK and CCAR in Table 4 is based on the capital shortfall definitions

$$\begin{aligned} SRISK &= k\{D + E(1 - LRMES)\} - E(1 - LRMES) \\ &= kD - (1 - k)E(1 - LRMES), \end{aligned}$$

$$CCAR = j(D^* + E^*) - E^*(1 - LRMES^*),$$

where E is the market value of equity (as of 2017), D is quasi-market assets minus E (as of 2017), E^* is Tier 1 capital before the stress scenario (as of 2017), D^* is the leverage ratio exposure minus E^* (as of 2017), $LRMES^*$ is the change in Tier 1 capital in the stress scenario, and $k=5.5\%$ (SRISK prudential threshold), $j=4\%$ (CCAR prudential threshold).

It is possible to decompose SRISK – CCAR in its different components according to

$$\begin{aligned}
 SRISK - CCAR &= kD - (1 - k)E(1 - LRMES) - j(D^* - E^*) + E^*(1 - LRMES^*) \\
 &= (k - j)(D + E) && \text{(Prudential threshold)} \\
 &\quad + j(D - D^*) && \text{(Measure of assets)} \\
 &\quad + (1 - LRMES^* - j)(E^* - E) && \text{(Market-to-book)} \\
 &\quad + E(LRMES - LRMES^*) && \text{(Stress)} \\
 &\quad - k E LRMES && \text{(Balance sheet assumption)}
 \end{aligned}$$