

Testing Macroprudential Stress Tests: The Risk of Regulatory Risk Weights

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Why do we need macroprudential stress tests? (1/2)

Crises occur when

- Common asset shock (Shleifer and Vishny (1992))
- Short-term debt rollover problems (Diamond and Dybvig (1983))

Why don't we obtain privately efficient outcomes?

- Externalities (Acharya, Pedersen, Philippon and Richardson (2010))
- Debt-overhang problem (Jensen and Meckling (1976), Myers (1977)): undercapitalized banks do not raise capital on their own

Macroprudential stress tests can help address this market failure:

- Bring capitalization of the financial sector in line with market perceptions of risk
- Restore financial sector's access to short-term funding

Why do we need macroprudential stress tests? (2/2)

Regulators assess capital requirements in “normal” times by

- attaching risk weights to different asset classes
- requiring a fraction of risk-weighted assets be funded with equity

Regulatory risk weights are, however, currently static in nature

Risks of asset classes change over time, especially in “stress” times

- changing the ability to fund assets with leverage in private markets

Stress tests could potentially help in dealing with this “risk that risks will change” (Engle (2009))

Recent Concerns on Macro Stress Tests

Macroprudential stress tests: part of the macroprudential toolkit (Greenlaw et al. (2012))

Concerns on macro stress tests:

- Stress tests remain microprudential (Greenlaw et al. (2012))
- Basel risk regulation (capital ratios)
 - Capital ratios are not a binding constraint (Hanson et al. (2011))
 - Regulatory risk weights are inconsistent (Basel Committee on Banking Supervision (2013); Haldane (2011, 2012))

An alternative to stress tests: Vlab

We provide a test of regulatory macro stress tests by comparing their outcomes to those from a simple methodology (Vlab) that relies on publicly available market data.

The Volatility Laboratory (Vlab): vlab.stern.nyu.edu/welcome/risk/ 

SRISK: the capital a firm would need to raise in the event of a crisis (Acharya et al. (2010, 2012); Brownlees and Engle (2011))

$$\begin{aligned} SRISK_{it} &= E_t[k(Debt_{it+h} + MV_{it+h}) - MV_{it+h} | R_{mt+h} \leq -40\%] \\ &= kDebt_{it} - (1 - k)(1 - LRMES_{it}) * MV_{it} \end{aligned}$$

where MV_{it} is the market value of equity of the bank, $LRMES_{it}$ is its long-run marginal expected shortfall, and k is the prudential capital ratio.

The Risk of Regulatory Risk Weights

Static regulatory risk weights are flawed

- Actual and stressed regulatory risk weights have no link with the realized risk of banks during a crisis
- Regulatory risk weights are informative only when we control for other more important risk factors (leverage ratio, market risk)
- Provide perverse incentives to build exposures to low-risk weight asset categories (see Acharya and Steffen (2013) for empirical evidence).

Outline

- 1 Macro stress tests sample
- 2 Testing the efficacy of regulatory risk weights
- 3 Testing stressed losses
- 4 Testing stressed capital shortfalls

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US and EU-wide macro stress tests

In the US: the Board of Governors of the Federal Reserve

- Supervisory Capital Assessment Programme (SCAP) 2009
- Comprehensive Capital Analysis and Review (CCAR) 2011 - 2012 - 2013

EU-wide stress tests:

- Committee of European Banking Supervisors (CEBS) 2009 - 2010
- European Banking Authority (EBA, ex-CEBS) 2011
- EBA Capital Exercise 2011 (not a stress test)

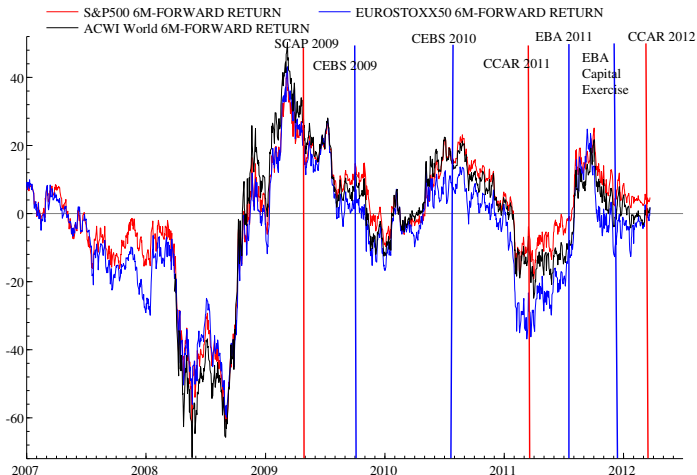
Stress tests with bank-level disclosure

	Disclosure	Institutions	Tier 1 Capital	Scenario horizon
SCAP 2009	May 2009	19 US BHCs	837 \$ bn	2009 - 2010
CCAR 2012	March 2012	19 US BHCs	907 \$ bn	Q4 2011 - Q4 2013
CCAR 2013	March 2013	18 US BHCs		Q4 2012 - Q4 2014
CEBS 2010	July 2010	91 banks, 65% of EU-27 assets	1162 € bn	2010 - 2011
EBA 2011	July 2011	90 banks, 65% of EU-27 assets	1218 € bn	2011 - 2012
EBA Capital Exercise	Dec 2011	65 banks, excl. Greek banks	1190 € bn	no scenario

The context of stress tests disclosure

2 stress tests are followed by an economic recession: CCAR 2011 (US) and EBA 2011 (EU). Only EBA 2011 discloses bank-level output of the stress test.

6-month realized return after disclosure of EBA 2011: S&P500 -4.89%;
EUROSTOXX50 -20.67%; ACWI World -13.47%



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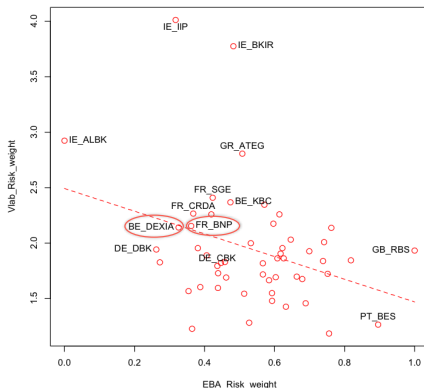
Regulatory risk weight vs. market risk weight (EBA 2011)

Stressed regulatory risk weight = RWA_S / TA_S

Vlab RWA: $SRISK \leq 0 \Leftrightarrow MV \geq \frac{k}{1-(1-k)LRMES} TA$ (Acharya, Engle and Richardson (2012))

Vlab risk weight = $(1 - (1 - k)LRMES)^{-1}$ (rank correlation: -0.238)

Dexia and BNP: below 25% quantile of RWA_S / TA_S , above the 75% quantile of Vlab risk weight distribution



Forecasting risk: realized volatility regression (EBA 2011)

	1	2	3	4	5	6
Constant	4.39** (0.27)	-0.12 (1.82)	6.34** (0.83)	5.34** (0.88)	1.70 (1.89)	0.12 (1.90)
Book-to-market	0.03** (0.001)	0.03** (0.001)	0.03** (0.002)	0.03** (0.002)	0.03** (0.002)	0.04** (0.004)
Vlab risk weight		2.50* (0.96)			2.62** (0.79)	2.99** (0.78)
EBA T1 LVGR, scenario end			-39.99* (16.82)		-41.39* (19.02)	-62.44* (26.39)
EBA risk weight, scenario end				-1.75 (1.52)		3.56 (2.08)
F-test	11.48**	10.2**	11.88**	6.43**	12.72**	11.25**
Adj. R ² (%)	16.78	26.14	29.50	17.28	40.34	44.10

* Significant parameters at 5%; ** at 1%. Standard errors in parentheses. Sample size: 53

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Stress tests vs. Vlab losses

- Vlab MV loss = $LRMES * MV$
- Stress test “Loss” is the projected loss over the stress scenario horizon
- Stress test “Net Loss” = $\max(0, \text{Projected Loss} - \text{Projected Revenue})$

		Stress tests estimates		Vlab estimates
US	Sample	Loss	Net loss	MV loss
SCAP 2009	18 US BHCs	590 \$ bn	229 \$ bn	438 \$ bn
CCAR 2012	18 US BHCs	529 \$ bn	226 \$ bn	447 \$ bn
CCAR 2013	17 US BHCs	457 \$ bn	197 \$ bn	525 \$ bn
EU	Sample	Loss	Net loss	MV loss
CEBS 2010	50 EU banks	425 € bn	39 € bn	399 € bn
EBA 2011	53 EU banks	381 € bn	70 € bn	402 € bn

Stress tests vs. Vlab losses: rank correlations

- Vlab MV loss = $LRMES * MV$
- Stress test “Total Loss” is the projected loss over the stress scenario horizon
- Stress test “Total Net Loss” = *Projected Loss – Projected Revenue*
- Loan losses and trading losses are the most important sources of losses (85% in the CCAR 2012)

Panel A: Rank correlations with Vlab MV loss

Stress tests losses	SCAP 2009	CCAR 2012	CCAR 2013	CEBS 2010	EBA 2011
Loan losses	0.580*	0.555*	0.662**	0.837**	0.751**
Trading losses	0.477*	0.660**	0.589*	0.731**	0.694**
Total Loss	0.682**	0.851**	0.842**	0.830**	0.760**
Total Net Loss	0.280	0.604**	0.507*	-0.296*	-0.476**

* Significant parameter at 5%; ** at 1%.

Forecasting losses during the European sovereign debt crisis (EBA 2011)

$$\text{Realized loss}_{i,t,W} = -MV_{it} * \sum_{t+1}^{t+1+W} \ln(p_{it}/p_{it-1})$$

where $t = 06/30/2011$ and $W = 130$ (six months).

Panel A: Performance in predicting the 6-month realized EUR loss

		Rank correlations			RMSE of losses
Estimated losses		Large	Small	All	All
Vlab	MV loss	0.293 (0.289)	0.610 (0.000)	0.832 (0.000)	5086
EBA	Total Loss	0.557 (0.000)	0.527 (0.000)	0.803 (0.000)	4945
EBA	Total Net Loss	0.329 (0.232)	-0.100 (0.549)	-0.272 (0.048)	11202

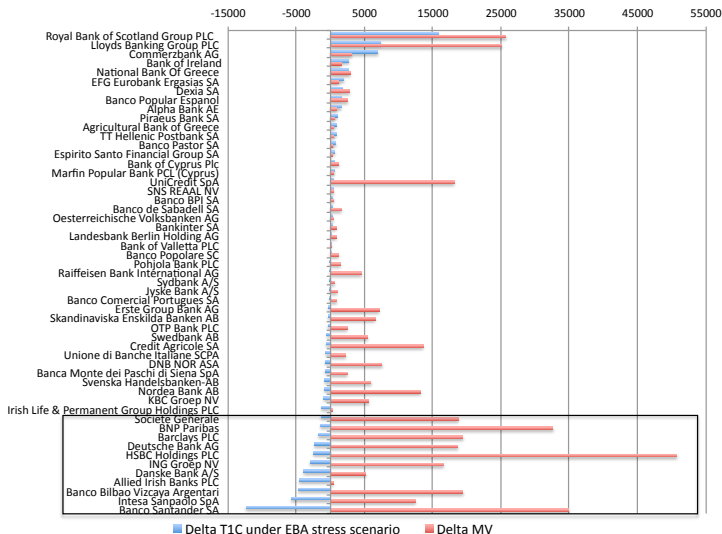
Forecasting returns during the European sovereign debt crisis (EBA 2011)

Panel B: Performance in predicting the 6-month realized returns					
		Rank correlations			RMSE of returns
Estimated losses		Large	Small	All	All
Vlab	LRMES	0.350 (0.201)	0.314 (0.055)	0.299 (0.029)	0.553
EBA	T1C return	0.546 (0.035)	0.339 (0.038)	0.354 (0.009)	0.767

P-values in parentheses. EBA T1C return: change in T1C (%) from the EBA stress scenario

EBA capital increase under stress (EBA 2011)

The projected profits under the EBA stress scenario lead to increasing Tier 1 capital levels for many SRISK top banks



Stress tests assumptions on revenues (EBA vs. CCAR)

Some banks are making profits during the EBA stress scenario

- EBA stress scenario is a deviation of the baseline scenario
- The net interest income is increasing for some banks due to higher interest rates
- Directional market risk stress test: “depending upon the size and direction of their exposures, banks may make gains on certain portfolios”

Different assumptions on the projected PPNR (Pre-Provision Net Revenue) in the CCAR

- low net interest income due to low interest rate, flat yield curve environment
- low non-interest income due to falling asset prices and sharply contracting economic activity
- higher operational losses included in the PPNR

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Stress tests capital shortfalls vs. SRISK

$$Vlab\ SRISK = kDebt - (1 - k)(1 - LRMES) * MV$$

$$\text{Stress test disclosed capital shortfall} = \max(0, [k' * RWA_S - Capital_S])$$

		Stress tests estimates		Vlab estimates
US	Sample	Threshold k'	Shortfall	SRISK ($k=8\%$)
SCAP 2009	18 US BHCs	4% T1CR	63.1 \$ bn (9)	674 \$ bn (18)
EU	Sample	Shortfall	Shortfall	SRISK ($k=5.5\%$)
CEBS 2010	50 EU banks	6% T1R	0.2 EUR bn (1)	796 EUR bn (48)
EBA 2011	53 EU banks	5% T1CR	1.2 EUR bn (4)	886 EUR bn (51)
EBA Capital Exercise	44 EU banks	9% T1CR	72 EUR bn (22)	1059 EUR bn (42)

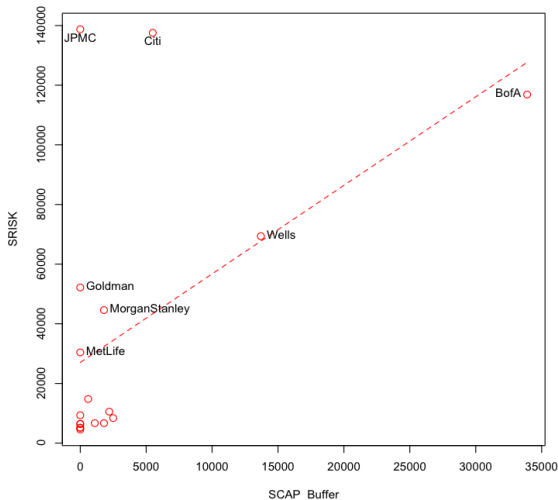
In parentheses: number of banks with capital shortfall > 0 under stress. T1R = Tier 1 Capital ratio, T1CR = Tier 1 Common Capital ratio (US), Core Tier 1 Capital ratio (EU).

SCAP capital buffer vs. SRISK (SCAP 2009)

$$\text{Vlab } SRISK = kDebt - (1 - k)(1 - LRMES) * MV$$

$$\text{SCAP capital buffer} = \max(0, [k' * RWA_S - Capital_S])$$

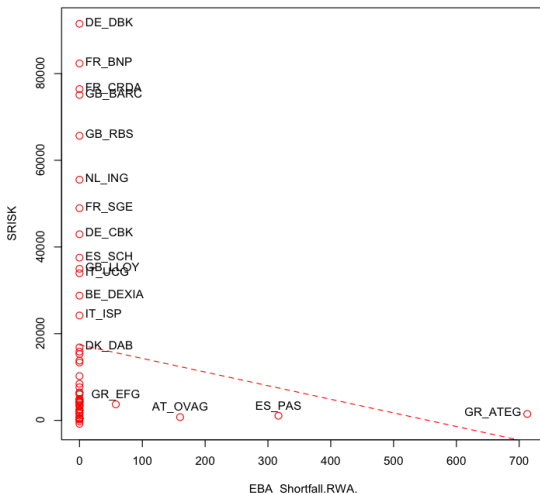
($k=0.08$, $k'=0.04$, rank correlation: 0.507)



EBA capital shortfall vs. SRISK (EBA 2011)

$$V_{lab} SRISK = kDebt - (1 - k)(1 - LRMES) * MV$$

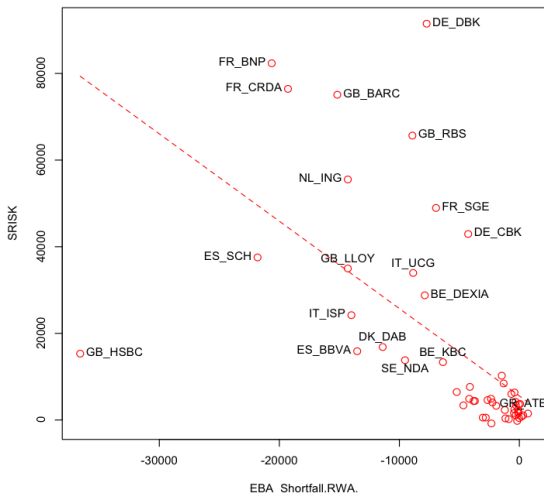
EBA disclosed capital shortfall = $\max(0, [k' * RWA_S - Capital_S])$
($k=0.055$, $k'=0.05$, rank correlation: -0.273)



EBA capital excess vs. SRISK (EBA 2011)

$$V_{lab} SRISK = kDebt - (1 - k)(1 - LRMES) * MV$$

EBA 'absolute' capital shortfall (RWA) = $k' * RWA_S - Capital_S$
($k=0.055$, $k'=0.05$, rank correlation: -0.790)



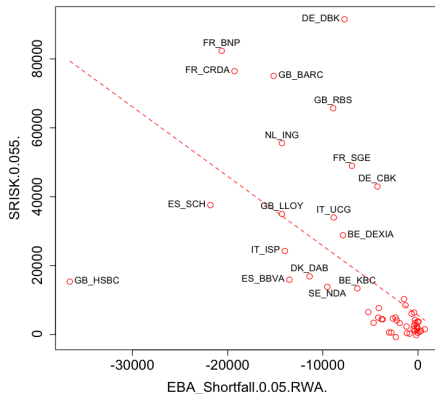
Risk-based capital vs. leverage-based capital shortfall (EBA 2011)

Risk-based shortfall

$$k' * RWA_S - Capital_S$$

(correlation with SRISK: -0.790)

Total shortfall (53 banks): 1.2 EUR bn

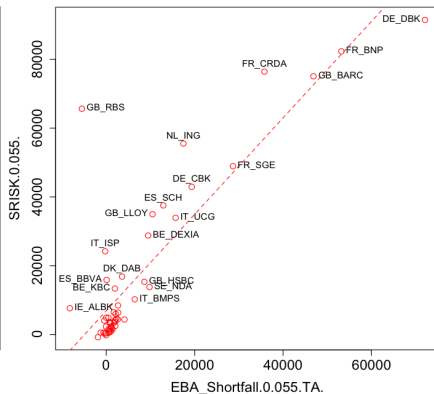


Leverage-based shortfall

$$k * TA_S - Capital_S$$

(correlation with SRISK: 0.679)

Total shortfall: 390 EUR bn



Conclusion

- Vlab and stress tests *projected losses* are well correlated & both predict well the actual realized losses during the European sovereign debt crisis.
- The *required capitalization* in stress tests is found to be inadequate ex post (especially in Europe), compared to SRISK.
- This discrepancy arises due to the reliance on *regulatory risk weights*.

Static regulatory risk weights are flawed and provide perverse incentives to build exposures to low-risk weight asset categories (Acharya and Steffen (2013)).

Recommendations:

- complement the assessment of banks and system risks with market measures of risk
- use multiple ratios in bank capital requirements to reduce regulatory arbitrage (e.g. T1CR *and* T1 LVGR)