Finding Comfort in Stress Tests

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Stress Testing and Macroprudential Regulation:
A Trans-Atlantic Assessment
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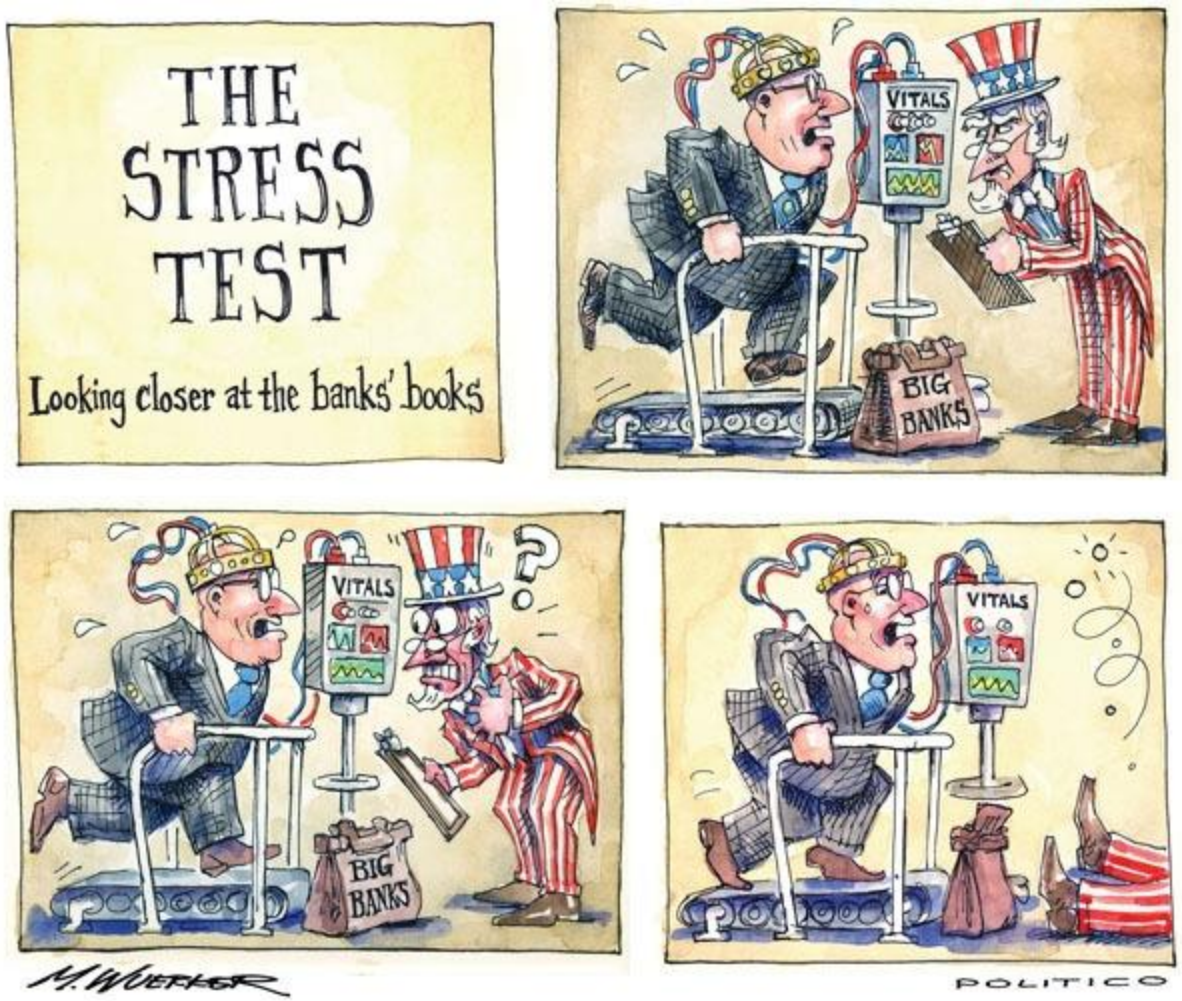


Motivation

- Stress tests are here to stay, so how can we make them better?
  - Scenario design
    - Relevance, granularity, coherence, alignment with internal models
  - Technical improvements
    - Joint modeling, feedback mechanisms, networks
  - Communication
    - Disclosure, credibility, learning, effect on incentives

Roadmap

- Brief history and literature
- Research questions and approach
- Findings
- Interpretation and further work

Stress testing in the United States

- Ad hoc usage before the crisis
- Current framework has beginnings in 2009
  - SCAP 2009
  - CCAR 2011
  - CCAR 2012
  - CCAR & DFAST 2013
  - CCAR & DFAST 2014
  - CCAR & DFAST 2015
- For better or worse, stress tests are now part of the regular supervisory toolkit, with work in progress to expand beyond banks

Growing number of studies

- Many focus on price impact, with a few exceptions
  - SCAP 2009: Peristian & Savino (JMCB 2014)
  - EBA 2011: Petrella & Resti (JBF 2013)
  - CCAR 2012 vs. EBA 2011: Woo et al. (FMII 2014)
  - SCAP 2009 vs. EBA 2010: Greenlaw et al. (2011)
  - EBA 2010 & 2011: Ellahie (2012)
  - EU and US ST 2009–13: Candelon & Sy (2015)
  - US ST 2009–14: Glasserman & Tangirala (2015), Flannery, Hirtle, & Kovner (2015)
- A few papers on what to expect theoretically
  - Goldstein & Sapra (2012), Goldstein & Leitner (2013)

This paper

- Ours is a story of information and disclosure
  - Building on market microstructure and accounting literature
- Why relevant?
  - Public disclosure of information
  - Model convergence
  - Informativeness of market prices
  - Accounting gimmicks and distortion of activities

What to look at?

- Not all banks get the same results:
  - Unrealistic to think that cumulative abnormal returns (CAR) are in the same direction, so negatives likely offsetting positives in the standard event study set-up
- In addition to CAR, study a range of indicators:
  - Absolute value of CAR (|CAR|)
  - Abnormal trading activity (CAV)
  - Bid-ask and CDS spreads
  - Implied and realized volatility and jump component

Whom to look at?

- Not all banks are the same:
  - Opacity and quality of disclosure affect market's demand for and production of information
- Dig deeper:
  - Cross-sectional analysis to understand the characteristics of the banks for which more information appears to be produced by public disclosure

Price reaction

- Revelation about tail event
  - Announcement reveals what the supervisor cares about but not obvious if there is new information content specific to a bank (unless combined with private information)
  - Disclosure should have an impact to the extent that it differs from expectations and it is deemed to be credible
- Direction matters, as well as magnitude

Information asymmetry

- Anticipation of news affect incentives to acquire and trade on private information, increasing asymmetry
- Release of news may decrease asymmetry if there is info content and/or commitment for disclosure

Information uncertainty

- Pending disclosure may increase uncertainty as distribution of cash flows are reassessed
- When information is released, uncertainty may go down—unless there is doubt about usefulness or accuracy of new information

Testable hypotheses

- Announcement
  - Price reaction and trading
  - Bid-ask spread ↑
  - Implied volatility ↑
  - CDS spread (1y/5y) ↑
- Release of results
  - Price reaction and trading
  - Bid-ask spread ↓
  - Implied volatility ↓
  - CDS spread (1y/5y) ↓

Data

- Daily and intraday frequency
- U.S. bank holding companies, both tested and untested, 100 largest by assets as of 2014Q4
- CRSP & Datastream & TAQ: equity prices, bid-ask spreads
- Bloomberg: bond bid-ask spreads
- Datastream: implied volatility, CDS spreads
- SNL: key balance sheet and income statement variables

Methodology

- Standard event study setup separately for tested and untested
- Diff-in-diff where treatment is the event

$$Y_{it}=\alpha+\beta_1*Event_t+\beta_2*Test_i+\beta_3*Event_t*Test_i+\gamma X_{it}+\varepsilon_{it}$$

- Seven-day event window
- Concern: Treatment is not random
  - Solution: Propensity matching
- Focus on β_3

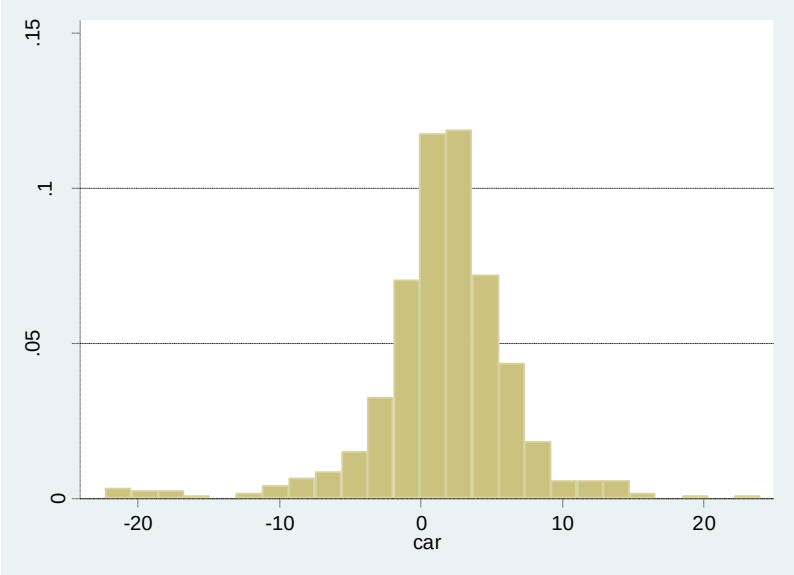
Technical issues

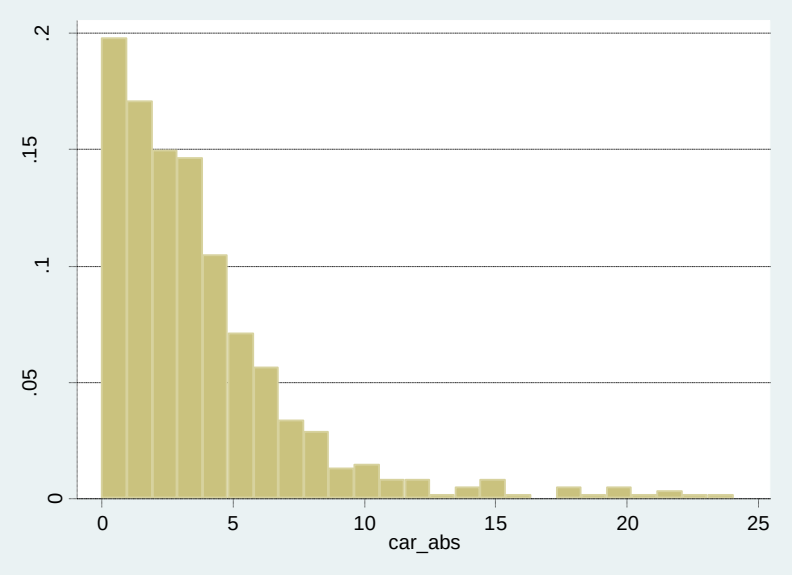
- Daily volatility and jump component
  - Bipower variation (Barndorff-Nielsen & Shephard, 2004)
- Significance tests and CAR vs. |CAR|
  - Skewness bias in the distribution of absolute value
  - More generally, the portion of positive versus negative returns may make a difference for the power of the significance test used and a parametric test will not do the job right in this case
- Dealing with CCAR 2011
  - There was no bank-specific release but some banks voluntarily announced that they passed

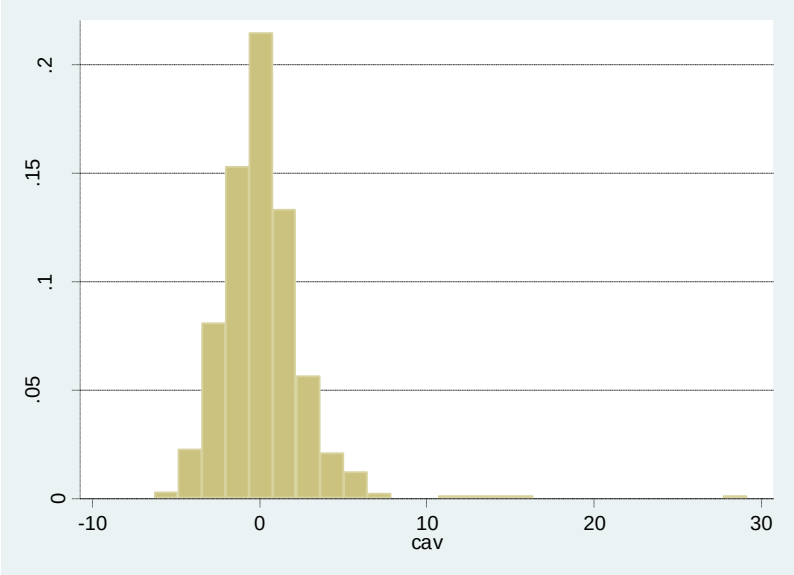
Dates

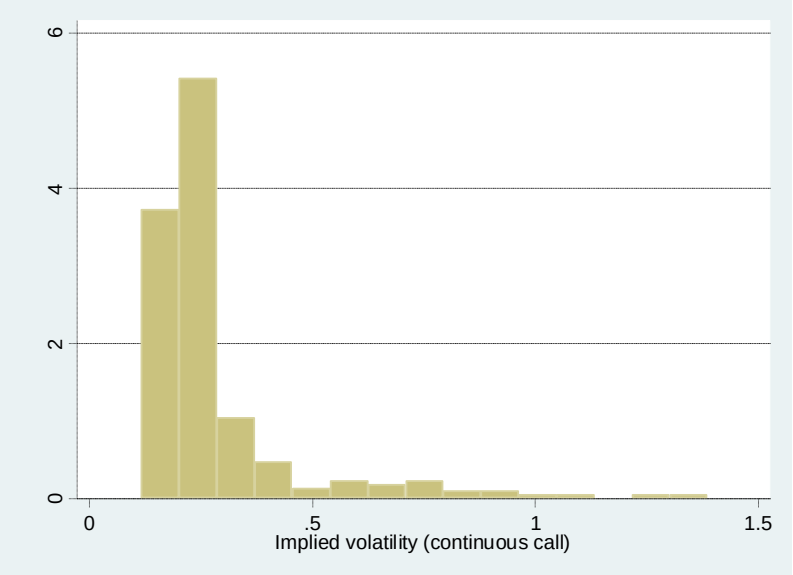
Event	Announcement	Results release	Failures
SCAP 2009	Feb 10, 2009	May 7, 2009	10 banks
CCAR 2011	Nov 17, 2010	Mar 18, 2011 (11am)	Unknown
CCAR 2012	Nov 22, 2011	Mar 13, 2012	4 banks
DFAST 2013	Nov 15, 2012	Mar 7, 2013	1 bank
CCAR 2013	Nov 9, 2012	Mar 14, 2013	2 banks (+2)
DFAST 2014	Nov 1, 2013	Mar 20, 2014	1 bank
CCAR 2014	Nov 1, 2013	Mar 26, 2014	5 banks
DFAST 2015	Oct 23, 2004	Mar 5, 2015	All pass
CCAR 2015	Oct 23, 2004	Mar 11, 2015	2 banks (+1)

Distribution of CAR, |CAR|, CAV, IVol









CAR around announcement

	Tested	≠0?	Untested	≠0?	Diff. ≠0?
SCAP 2009	3.73	No	0.53	No	No
CCAR 2011	-4.35	Yes	-1.36	Yes	Yes
CCAR 2012	-0.49	No	-0.15	No	No
DFAST 2013	-0.23	No	-0.98	Yes	No
CCAR 2013	-1.32	Yes	-1.11	Yes	No
DFAST – CCAR 2014	-0.40	No	0.89	Yes	No
DFAST – CCAR 2015	1.34	Yes	1.95	Yes	No
All events	-0.14	No	-0.08	No	No

|CAR| around announcement

	Tested	Untested	Diff. significant?
SCAP 2009	8.94	3.66	Yes
CCAR 2011	4.77	2.08	Yes
CCAR 2012	1.93	2.30	No
DFAST 2013	1.50	2.68	Yes
CCAR 2013	1.80	1.98	No
DFAST – CCAR 2014	2.40	2.15	No
DFAST – CCAR 2015	2.53	2.97	No
All events	3.30	2.55	Yes

CAV around announcement

	Tested	≠0?	Untested	≠0?	Diff. ≠0?
SCAP 2009	3.59	Yes	1.07	Yes	Yes
CCAR 2011	0.14	No	-1.37	Yes	Yes
CCAR 2012	-0.78	Yes	-1.39	Yes	Yes
DFAST 2013	0.11	No	0.65	Yes	No
CCAR 2013	-0.26	No	-0.11	No	No
DFAST – CCAR 2014	-0.09	No	0.10	No	No
DFAST – CCAR 2015	3.05	No	1.74	Yes	No
All events	0.89	Yes	0.07	No	Yes

Other indicators (announcement)

	Spread (equity)	Spread (bond)	IVol	RVol	CDS
SCAP 2009	0.03	…	-0.06**	-0.86	-0.001
CCAR 2011	0.06	0.02	0.03	1.27**	-0.01
CCAR 2012	-0.08	…	0.01	-2.08***	…
DFAST 2013	0.43	…	0.02	0.25**	-0.02
CCAR 2013	1.44	-0.08	-0.001	0.22*	-0.01
DFAST – CCAR 2014	-0.14	…	0.02	-0.19*	…
DFAST – CCAR 2015	0.21	0.03	-0.04	-0.14	…
All events	0.31	-0.02	-0.002	3.31***	-0.15***

CAR around results release

	Tested	≠0?	Untested	≠0?	Diff. ≠0?
SCAP 2009	-1.44	No	-2.32	No	No
CCAR 2011	-0.89	No	0.36	No	Yes
CCAR 2012	4.35	Yes	4.92	Yes	No
DFAST 2013	1.38	No	1.42	Yes	No
CCAR 2013	-0.13	No	1.07	Yes	Yes
DFAST 2014	2.35	Yes	1.45	Yes	Yes
CCAR 2014	-0.46	No	0.49	No	Yes
DFAST 2015	4.84	Yes	4.02	Yes	Yes
CCAR 2015	2.72	Yes	2.19	Yes	Yes
All events	1.55	Yes	1.50	Yes	No

|CAR| around results release

	Tested	Untested	Diff. significant?
SCAP 2009	11.79	6.77	Yes
CCAR 2011	2.14	2.04	No
CCAR 2012	4.46	5.02	No
DFAST 2013	2.49	2.25	No
CCAR 2013	1.91	2.14	No
DFAST 2014	2.97	1.92	Yes
CCAR 2014	1.59	2.12	Yes
DFAST 2015	4.84	4.18	No
CCAR 2015	2.72	2.44	No
All events	3.75	3.24	Yes

CAV around results release

	Tested	≠0?	Untested	≠0?	Diff. ≠0?
SCAP 2009	1.38	Yes	0.54	No	Yes
CCAR 2011	0.61	No	0.22	No	No
CCAR 2012	1.46	Yes	0.65	Yes	Yes
DFAST 2013	-0.19	No	-0.16	No	No
CCAR 2013	-0.32	No	0.02	No	No
DFAST 2014	0.58	No	0.55	Yes	No
CCAR 2014	0.02	No	-0.03	No	No
DFAST 2015	-0.25	No	-0.77	Yes	No
CCAR 2015	0.14	No	-0.34	No	No
All events	0.34	Yes	0.08	No	Yes

Other indicators (results release)

	Spread (equity)	Spread (bond)	IVol	RVol	CDS
SCAP 2009	0.46	0.04	-0.02	6.77*	-0.002
CCAR 2011	-0.42	-0.14*	-0.03*	0.67	…
CCAR 2012	0.08	-0.16	-0.03	0.48**	-0.004
DFAST 2013	-1.24*	0.06	-0.02	0.06	0.02*
CCAR 2013	-0.42	…	0.02	0.03	0.02***
DFAST 2014	-0.01	-0.08	0.01	…	…
CCAR 2014	-0.22	…	0.03*	…	0.03*
DFAST 2015	-0.85	-0.04	-0.01	…	0.02*
CCAR 2015	-0.54*	-0.10	-0.001	…	0.002
All events	-0.37*	-0.04	-0.01	3.53***	0.04***

Information in failure

	CAR	|CAR|	CAV
Passed	1.85	3.26	0.19
Failed	-0.51	7.11	1.41
Difference	2.36	-3.85	-1.22
Pr(dif≠0)	0.35	0.06	0.02

Bank characteristics: Announcement

	|CAR|	|CAR|	Spread	Spread	Spread	IVol	IVol
Tested	5.36*	0.82	-0.33	-0.64*	0.73	-0.07**	-0.03**
Tier1	-0.001		-0.07**			-0.01***	
Tier1*tested	-0.37*		0.05			0.01***	
Leverage				-7.47**			
Leverage*tested				7.97**			
Opacity					-0.09***		
Opacity*tested					-0.03		
Audit		1.18*					0.03**
Audit*tested		0.72					0.01

Bank characteristics: Results release

	|CAR|	|CAR|	CAV	CAV	Spread
Tested	1.83**	-0.45	1.68***	-0.82	-1.80**
Risk					-0.02**
Risk*tested					0.02**
Opacity	-0.01		0.02		
Opacity*tested	-0.17**		-0.16***		
Audit		1.40*		0.01	
Audit*tested		1.52		0.91*	

Summary of first set of findings

- There is information content in stress tests, not only for the tested but also the untested
  - CAR mixed (as expected) and not significantly different for tested and untested
  - |CAR| larger for stress-tested banks compared to untested
    - Difference most striking in SCAP 2009
  - CAV also higher for tested banks
    - Again difference most striking in SCAP 2009
  - Market has something to learn from failures
  - Spreads decrease after results release
    - CDS results against expected but small sample size

Summary of second set of findings

- Reaction varies by bank characteristics (but not easy to pin down significant, robust relationships)
  - Leveraged banks have larger price response but smaller drop in information asymmetry and uncertainty
  - More opaque banks have larger drop in information asymmetry when announcement comes but price and volume response is smaller for more opaque tested banks when results are released
  - Identity of the auditor seems to matter
- Differential effect for tested banks relative to untested is somewhat muted
  - Supporting the idea that information is useful for both tested and untested banks

Interpretation

- There is information in stress tests, especially when overall distress levels are heightened
- But no indication that market learned to perfectly anticipate the results
  - True that there is less action, on average, in the later tests for tested banks
    - Possible explanations: learning by doing and supervisory incentives "not to surprise"
  - Yet, untested banks still see significant action
- There is information for untested likely due to:
  - Scenarios (e.g., what is in the supervisor's mind?)
  - Systemic risk spillover

Work in progress

- Pre-stress test characteristics
  - Quality of disclosure and information
  - Portfolio details
  - Reputation and corporate governance
- Post-stress test behavior
  - Accounting
  - Risk taking and risk sharing
  - Organizational decisions
- Completion of 2015 results and robustness checks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