

Systemic Risk Measurement for Regulatory and Surveillance Purposes

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I. Systemic Risk

- What is systemic risk?
 - Widespread failure of financial institutions or freezing of capital markets that impair financial intermediation – payments system and lending to corporations/households.
- When does it emerge?
 - Financial sector has too little capital to cover its liabilities.
- In this crisis,
 - In early Fall of 08, the GSEs, Lehman, Merrill Lynch, Wamu, Wachovia, Citigroup, ... effectively failed. Markets were frozen or began to freeze.
 - Outcome of systemic risk in the Fall of '08 and Winter '09:
 - Stock Markets: US -42%, UK -46%, Europe -49%, Japan -35%, Latin America -50%
 - GDP: Advanced economies -3.2%, Global -0.8%
 - International Trade -12%

Systemic Risk vs Systematic Risk

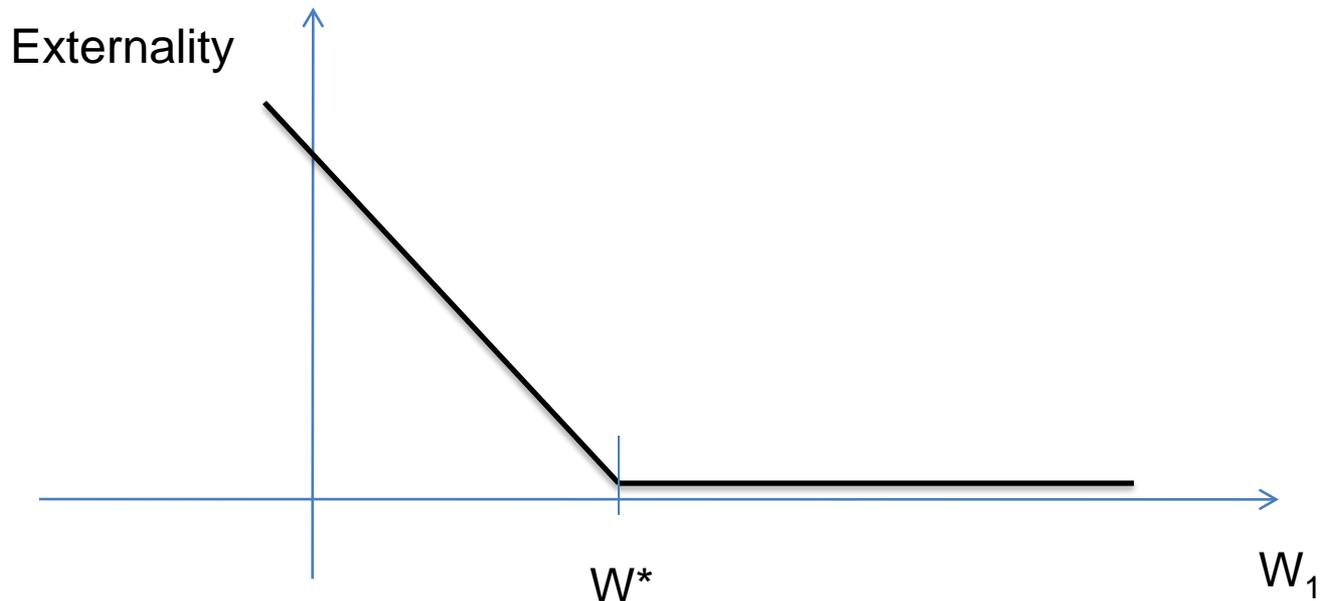
- What is systematic risk?
 - Exposure to aggregate risky factors of the economy
- Example 1:
 - Fidelity's Market Index Fund
 - Systematic risk but has no leverage and is not systemic (unless its liquidations may generate some fire-sale externalities)
 - Contrast with a bank that is 25:1 leveraged and invests all its funds in Fidelity's Market Index Fund
 - The bank is potentially systemic due to its high leverage
- Example 2:
 - NASDAQ crash was aggregate risk but did not result in undercapitalization of the financial sector
 - Effect on the real economy muted
 - Recession not Financial Crisis, Great Recession or Great Depression

2. Measures for systemic risk tax vs monitoring

- Identify (“monitor”) ex-ante firms posing greater systemic risk
- Make firms internalize (“tax”) external costs of systemic risk
- The two measures likely to be similar
 - Caveat: Tax may be based on objective criteria and measures;
Monitoring may focus on “model errors” in setting tax
 - Large banks and central counterparties deserve special scrutiny
- Research (w/ Pedersen, Philippon and Richardson)
 - “Measuring Systemic Risk”, working paper, NYU-Stern
 - “A Tax on Systemic Risk”, forthcoming, NBER proceedings on *Quantifying Systemic Risk*, Joe Haubrich and Andy Lo, eds. 2010)

3. Our model of systemic risk and regulation

- Let W_1 be aggregate net worth of financial system at time 1
- Systemic distress happens if W_1 falls below some cutoff W^*
- Imposes negative externality $e(W^*-W_1)$ on economy



Efficient regulation

- Tax each bank with two components
 - Could be a levy or capital requirement
- Default Expected Shortfall (DES):
 - ***The bank's expected losses upon default***
 - Analogous to the FDIC insurance premium. Justified by government guarantees on deposits.
- Systemic Expected Shortfall (SES):
 - ***The bank's expected losses in a crisis***
 - Expected contribution of bank to the aggregate shortfall of capital during a crisis. Justified by *e*.

Systemic Expected Shortfall

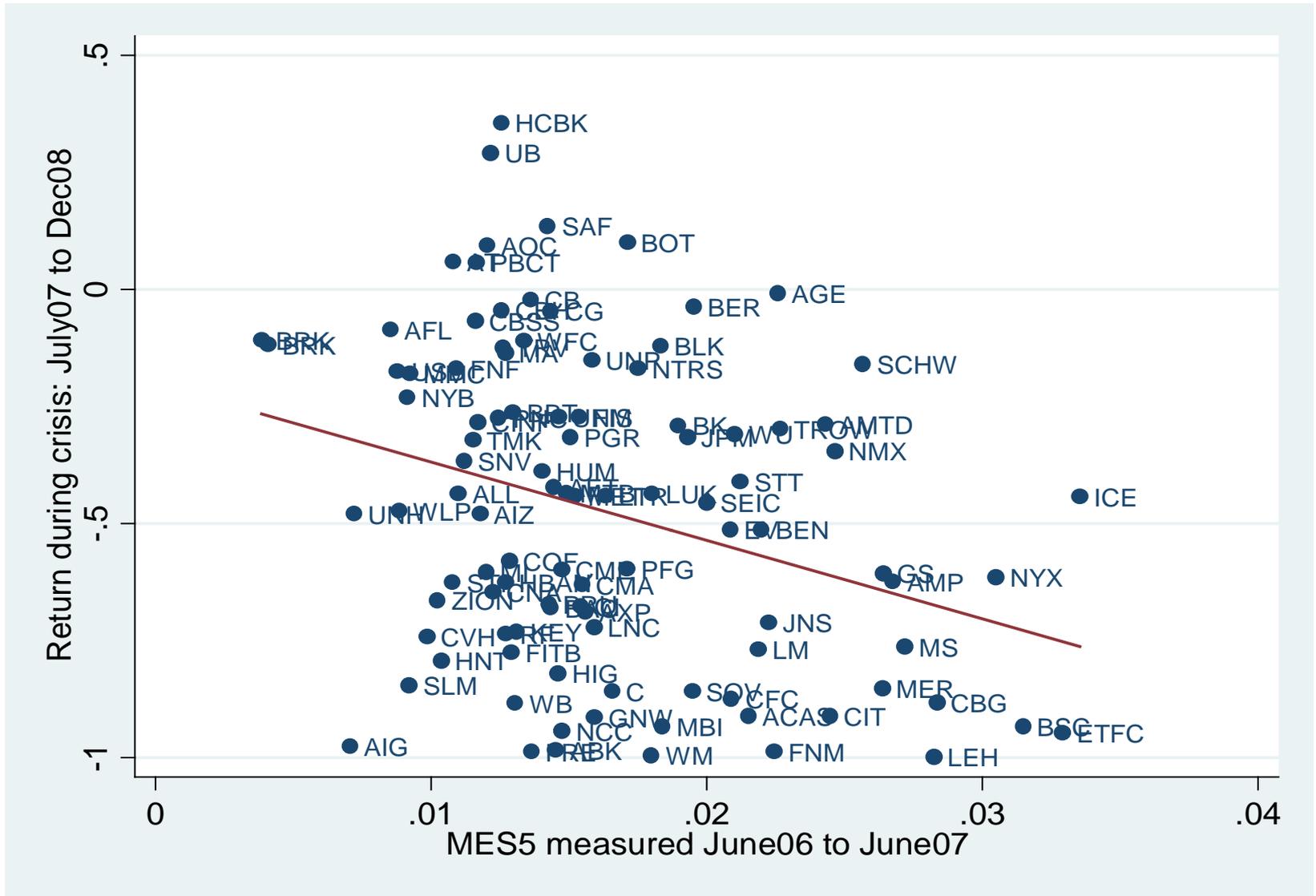
- A bank's SES is larger if
 - the externality is more severe (e),
 - systemic under-capitalization is more likely ($Pr[W_i < W^*]$)
 - the bank takes a larger exposure in correlated assets, that is, in assets that experiences losses when other banks are in trouble
 - the bank has more leverage to start with
- In our empirical work, we focus on the cross-sectional part of SES, taking as given the LEVEL of the SES (or the tax) in the economy (externality * likelihood of systemic crisis)

4. Three EMPIRICAL EXAMPLES of the CRISIS

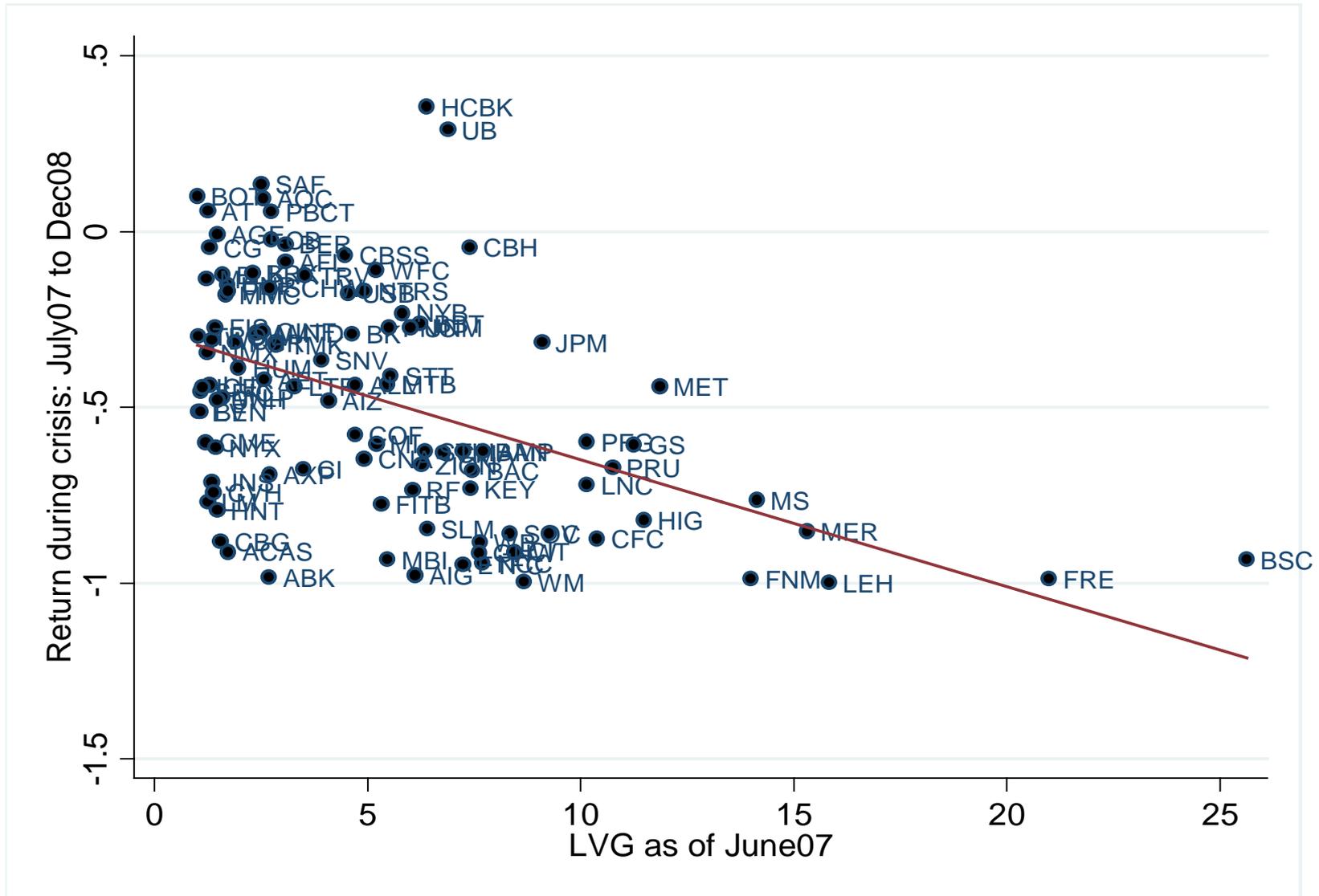
- We explain realized returns on equity/CDS during crisis using correlated asset exposure and leverage in pre-crisis period.
- Exercise uses “demo” crises and “pre-demo” measures
 - Unavoidable backward-looking bias but using market data helps
 - Brownlees and Engle (2010): Dynamic, forward-looking measure
 - <http://vlab.stern.nyu.edu/welcome/risk> - daily updated systemic risk rankings of US financial firms
- I. Equity market decline during July 2007 to Dec 2008
- II. CDS market widening during July 2007 to Dec 2008
- III. Stress tests of Spring 2009

Example #1

2007-08: Predictive power of MES (equity)

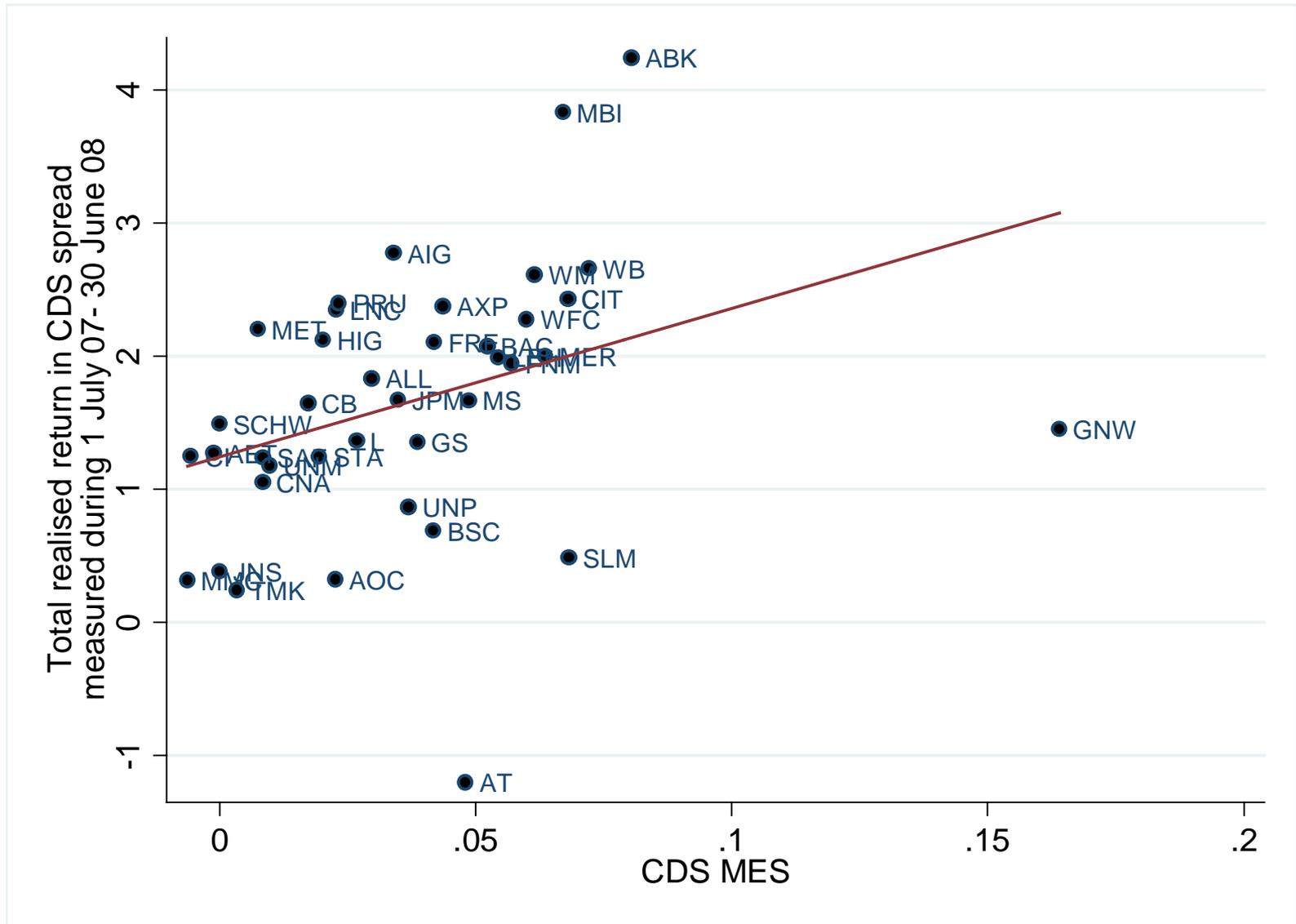


Example #1: 2007-08: Predictive power of LVG (quasi-assets by market equity)

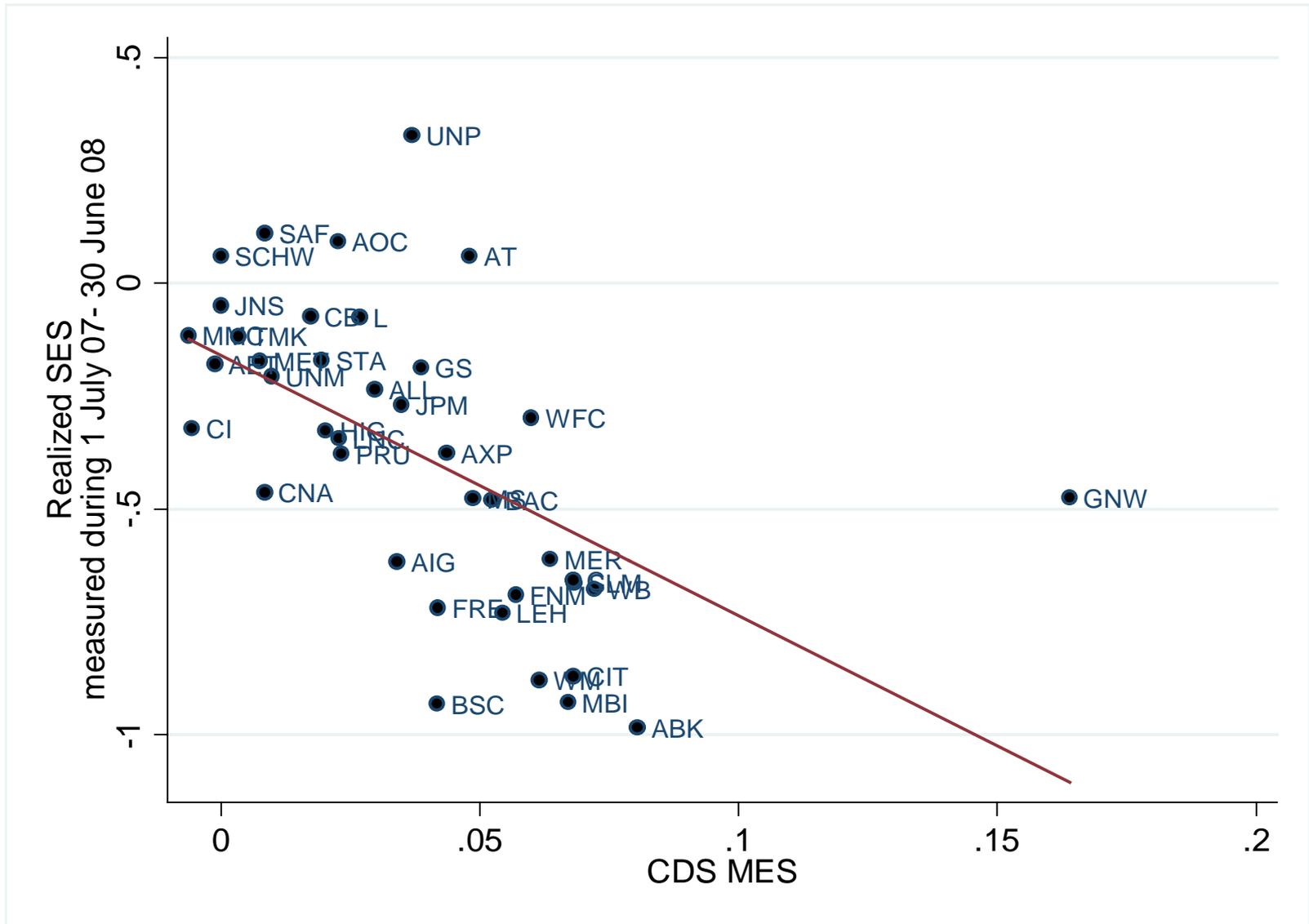


Example #2:

2007-08: Predictive power of MES (cds)



2007-08: Predictive power of MES (cds)



CDS MES rankings

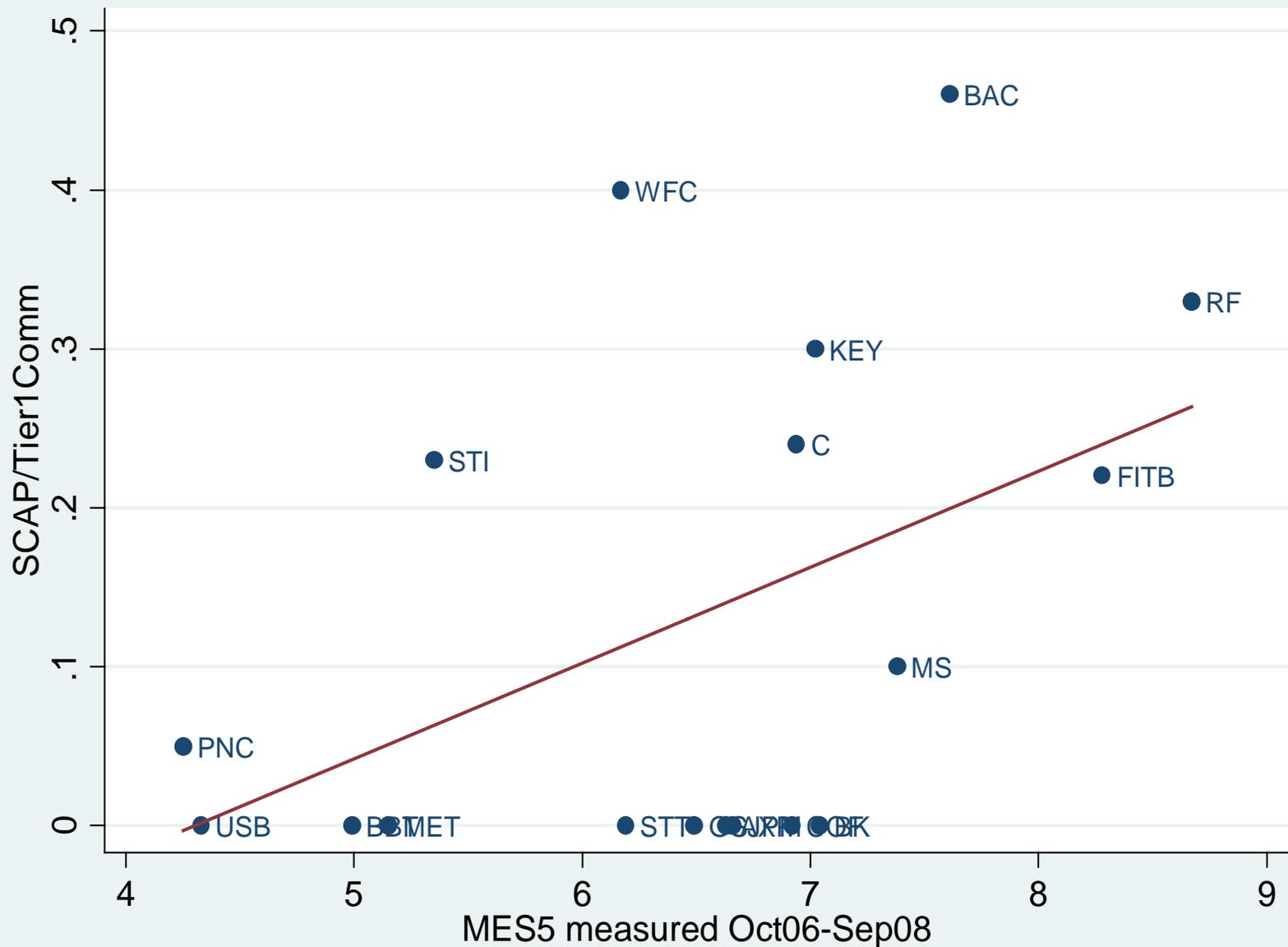
Name of company	Type of institution	CDS MES ranking	Realized CDS SES (July 07-June 08)	Realized CDS SES (July 07-Dec 08)	CDS MES
GENWORTH FINANCIAL INC	Insurance	1	145.38%	403.03%	16.40%
AMBAC FINANCIAL GROUP INC	Insurance	2	424.10%	389.12%	8.05%
WACHOVIA CORP 2ND NEW	Depository	3	266.11%	219.94%	7.21%
S L M CORP	Other	4	48.88%	113.08%	6.82%
CITIGROUP INC	Depository	5	243.16%	278.96%	6.80%
C I T GROUP INC NEW	Other	6	243.16%	278.96%	6.80%
M B I A INC	Insurance	7	383.11%	303.44%	6.71%
MERRILL LYNCH & CO INC	Broker-Dealer	8	200.27%	160.20%	6.37%
WASHINGTON MUTUAL INC	Depository	9	261.19%	436.42%	6.15%
WELLS FARGO & CO NEW	Depository	10	227.79%	233.43%	6.00%
FEDERAL NATIONAL MORTGAGE ASSN	Other	11	194.89%	78.69%	5.70%
LEHMAN BROTHERS HOLDINGS INC	Broker-Dealer	12	199.25%	282.25%	5.44%
BANK OF AMERICA CORP	Depository	13	207.86%	215.70%	5.23%
MORGAN STANLEY DEAN WITTER & CO	Broker-Dealer	14	166.88%	248.96%	4.86%
ALLTEL CORP	Other	15	-119.93%	-103.25%	4.80%
AMERICAN EXPRESS CO	Other	16	237.53%	293.40%	4.36%
FEDERAL HOME LOAN MORTGAGE CORP	Other	17	210.58%	94.57%	4.20%
BEAR STEARNS COMPANIES INC	Broker-Dealer	18	68.72%	84.96%	4.18%
GOLDMAN SACHS GROUP INC	Broker-Dealer	19	135.50%	213.68%	3.87%
UNION PACIFIC CORP	Other	20	86.69%	123.56%	3.69%
JPMORGAN CHASE & CO	Depository	21	166.95%	182.80%	3.49%
AMERICAN INTERNATIONAL GROUP INC	Insurance	22	277.42%	369.20%	3.40%

Example #3:

Stress test of Spring 2009: Summary results

Panel A							
Bank Name	SCAP	Tier1	Tier1Comm	SCAP/Tier1	SCAP/Tier1Comm	MES	LVG
REGIONS FINANCIAL CORP							
NEW	2.5	12.1	7.6	20.66%	32.89%	14.8	44.42
BANK OF AMERICA CORP	33.9	173.2	75	19.57%	45.50%	15.05	50.38
WELLS FARGO & CO NEW	13.7	86.4	34	15.86%	40.41%	10.57	20.58
KEYCORP NEW	1.8	11.6	6	15.52%	30.00%	15.44	24.36
SUNTRUST BANKS INC	2.2	17.6	9.4	12.50%	23.40%	12.91	39.85
FIFTH THIRD BANCORP	1.1	11.9	4.9	9.24%	22.45%	14.39	67.16
CITIGROUP INC	5.5	118.8	23	4.63%	24.02%	14.98	126.7
MORGAN STANLEY DEAN							
WITTER & CO	1.8	47.2	18	3.81%	10.11%	15.17	25.39
P N C FINANCIAL SERVICES							
GRP INC	0.6	24.1	12	2.49%	5.13%	10.55	21.58
AMERICAN EXPRESS CO	0	10.1	10	0.00%	0.00%	9.75	7.8
B B & T CORP	0	13.4	7.8	0.00%	0.00%	9.57	14.78
BANK NEW YORK INC	0	15.4	11	0.00%	0.00%	11.09	6.46
CAPITAL ONE FINANCIAL CORP	0	16.8	12	0.00%	0.00%	10.52	33.06
GOLDMAN SACHS GROUP INC	0	55.9	34	0.00%	0.00%	9.97	18.94
JPMORGAN CHASE & CO	0	136.2	87	0.00%	0.00%	10.45	20.43
METLIFE INC	0	30.1	28	0.00%	0.00%	10.28	26.14
STATE STREET CORP	0	14.1	11	0.00%	0.00%	14.79	10.79
U S BANCORP DEL	0	24.4	12	0.00%	0.00%	8.54	10.53

Stress tests: Predictive power of MES (equity)



Stress test: Predictive power of MES and LVG

Panel A: Dependent Variable is SCAP Shortfall/Tier1

April08-March09

	OLS			Probit		
	(I)	(II)	(III)	(IV)	(V)	(VI)
Intercept	-17.29 (-2.2)	3.14 (1.16)	-17.33 (-2.00)	-5.44 (-2.72)	-2.43 (-2.26)	-6.04 (-2.24)
MES	1.91 (3.00)		1.91 (2.46)	0.45 (2.72)		0.34 (1.65)
LVG		0.09 (1.35)	-0.001 (-0.01)		0.10 (2.16)	0.09 (1.61)
Adj. R²	32.03%	4.65%	27.5%	40.68%	45.09%	53.22%
No. Obs	18	18	18	18	18	18

Oct07-Sep08

OLS		
(VII)	(VIII)	(IX)
-13.46 (-1.50)	3.94 (1.12)	-14.19 (-1.50)
3 (2.19)		3.29 (2.04)
	0.15 (0.66)	-0.09 (-0.37)
18.27%	-3.46%	13.61%
18	18	18

5. Is systemic risk same as institution-specific risk?

- Yes
 - Leverage is clearly a first-order determinant of both
- No
 - Asset-side leads to different conclusions
 - A relatively risky asset may be mainly idiosyncratic and a relatively safe asset be entirely systemic!
 - Example 1: Basel capital weights assign 20% weight to AAA-rated MBS since mortgages have historically had lower expected losses than corporate loans
 - Problem: AAA-rated MBS risk is entirely cyclical; 20% risk weight means banks hold little capital against it; All banks prefer AAA-MBS...
 - Example 2: MBS repo is *almost* fail-safe, but fails in a systemic crisis
 - Problem: Banks and money-market funds do not hold capital against systemic liquidity risk of repos

6. What is missing data and information?

- Leverage data
 - Greater frequency disclosure of short-term CP, ABCP, repo, etc.
- Inter-connectedness (a transparency standard for derivatives based on “Regulating Wall Street”)
 - **Classification of exposures** into product types (such as single-name or index CDS, interest rate swaps, currency swaps, etc.), type of counterparty (bank, broker-dealer, corporation, monoline, etc.), maturity of contracts, and credit rating of counterparties.
 - **Size of exposures** should be reported as gross (maximum notional exposure), net (taking account of netting arrangements), uncollateralized net (recognizing collateral posted), in fair-value terms (to account for mark-to-market changes), by major currency categories.

Transparency standard (cont'd)

- Uncollateralized net exposures should be further modified and stated also as “**potential exposures**” based on stress tests that take account of replacement risk for the exposures assuming severe market conditions such as replacement time of two to four weeks.
- **Concentration reports** should provide the above information for the entity’s largest counterparty exposures (say, the largest five or ten) that account for a substantial proportion of the total exposure
- **Margin call report** that lists the additional collateral liabilities of the firm as total additional liability in case the firm was to experience one, two or more notch downgrades and largest such liabilities aggregated by different counterparties (say, five largest)

7. Risk-premia and policy-induced distortions?

- Persistent under-pricing or over-pricing of risk are related to leveraging and de-leveraging
- That is a part of the systemic risk, so do not ignore it
- Even well-intentioned policies change incentives, do consider
- Example: Announcing stress test results without prompt corrective action or re-capitalization plan can make incentives to gamble even stronger and contagion worse!

8. Likely behavioral response of regulated entities

- Arbitrage capital requirements if possible
 - Hence, risk measures and stress tests should be calibrated frequently
- But hopefully, also reduce leverage and correlated exposures
- Retained earnings, long-term pay better than capital “shocks”