



NYU STERN SYSTEMIC RISK RANKING

NYU STERN SCHOOL OF BUSINESS

APRIL 2011

THE APPROACH

- We want to estimate for firm i , the expected capital requirements in a future crisis: (e.g. Stress Test)

$$E(\text{Capital Shortfall}_i | \text{Crisis})$$

- As we have little data on crises, it is necessary to carefully structure the problem.
- **Estimate** the expected equity losses for a firm from a modest decline in overall returns, MES
- **Extrapolate** this to a full financial crisis.
- **Calculate** capital shortages.

Equity Loss in Crisis

- To estimate the fall in equity value in a crisis, an adjustment is made to Dynamically-estimated MES (in market outcomes worse than 2% fall) using conditional normality and tail risk possibility
 - MES is adjusted to measure the expected fall in equity prices that would occur in six months if the market return is worse than a 40% decline.
 - Approximately this is 18 times daily MES. The factor 18 is constant across firms and reflects the crisis severity.
 - Crisis MES = 18 times MES
- This is the **extrapolation** step.

SRISK : CAPITAL SHORTFALL IN A CRISIS

- As equity values fall in a crisis, leverage increases until the firm is in distress.
- Nominal debt is taken from Bloomberg and changes little over time. It is from 10-K and 10-Q filings.
- Let $E = E_0 (1 - \text{Crisis MES})$
- $SRISK = \min(0, E - kA) = \min(0, (1-k)E - kD)$ where k is a prudential standard ratio of equity to assets such as 8%. E is equity, D is debt and A is asset value = $E + D$

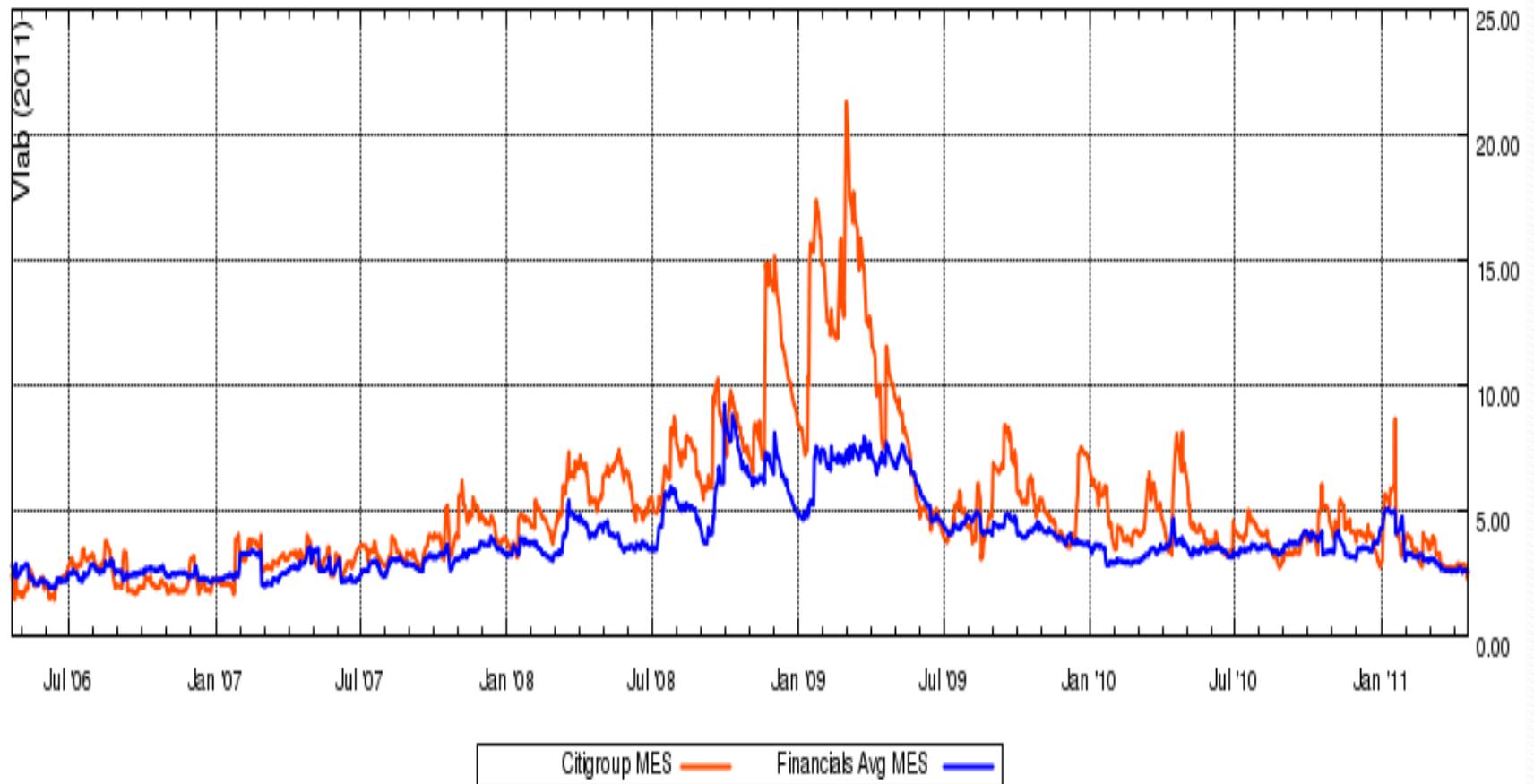
SRISK%

- When equity falls dramatically, CAPITAL SHORTFALL becomes positive and it is the contribution by each firm to aggregate SHORTFALL that is the Stern Systemic Risk measure.
- $SRISK\%_{i,t} = SRISK_{i,t} / (\text{Total } SRISK_t)$
- This is the **calculation** step.
- Alternately, we obtain a systemic capital requirement
- $E_0 \geq 8\% \text{ Assets} / (1 - 0.92 \text{ Crisis MES})$
- Equity should be high today to withstand a Crisis

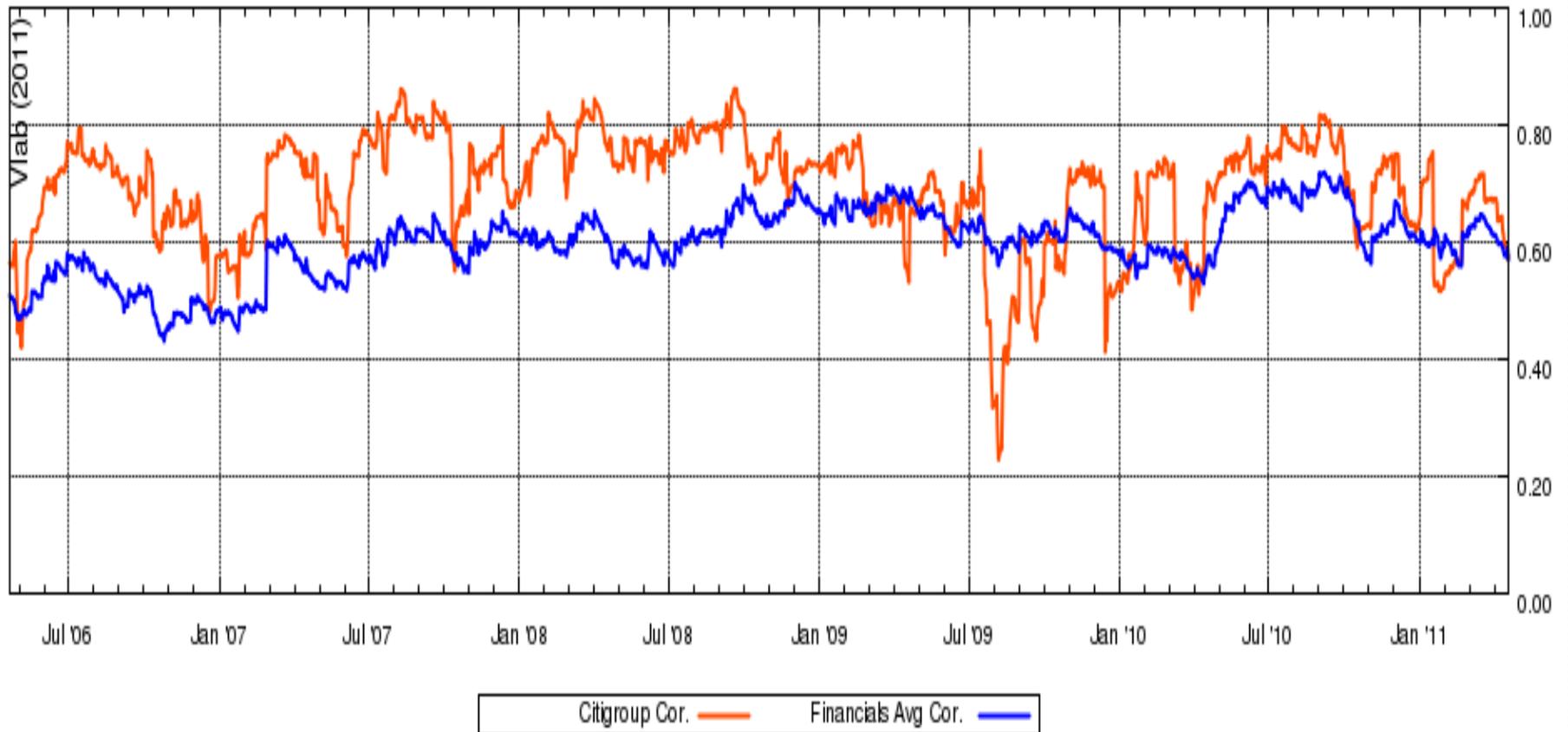
VLAB.STERN.NYU.EDU

- Daily updates of volatilities and correlations of hundreds of assets with a variety of methodologies
- Systemic Risk Measures with details on the components. These are updated weekly.
- How risky is the economy today?
- New measures of Long Term Risk called the LTR Forecasts to assess likelihood of crisis and LT-MES

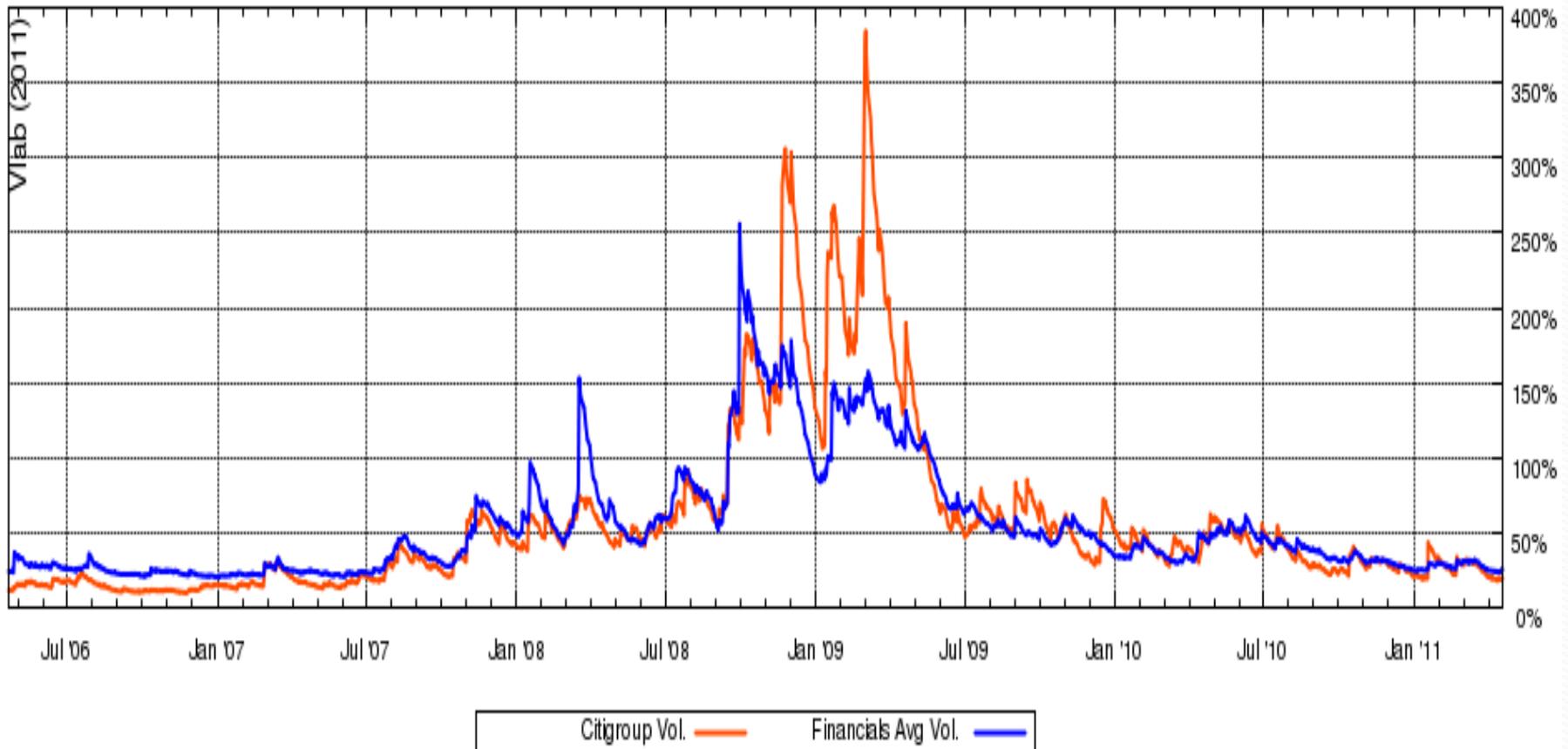
Citigroup MES



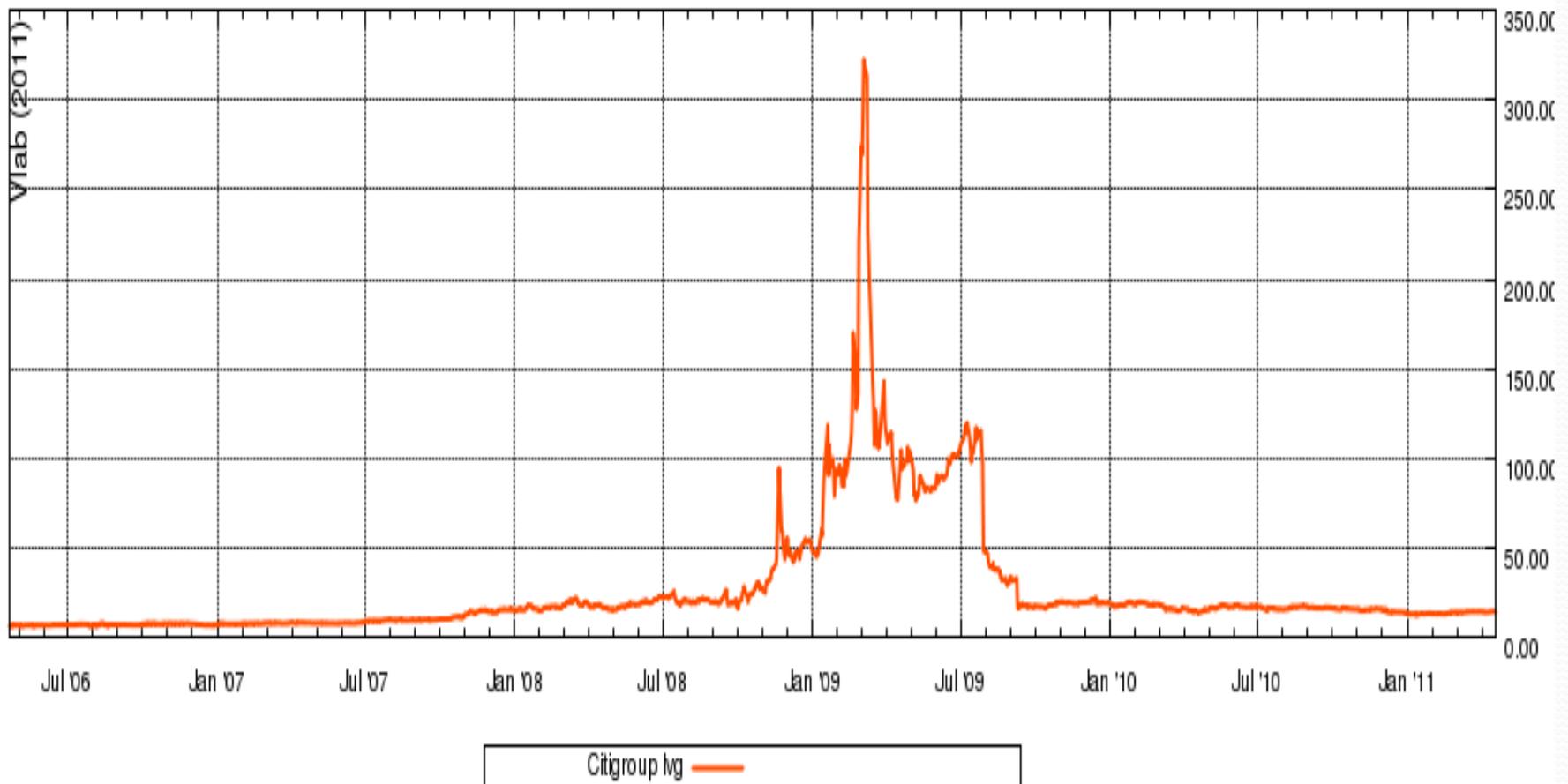
Citigroup Correlation



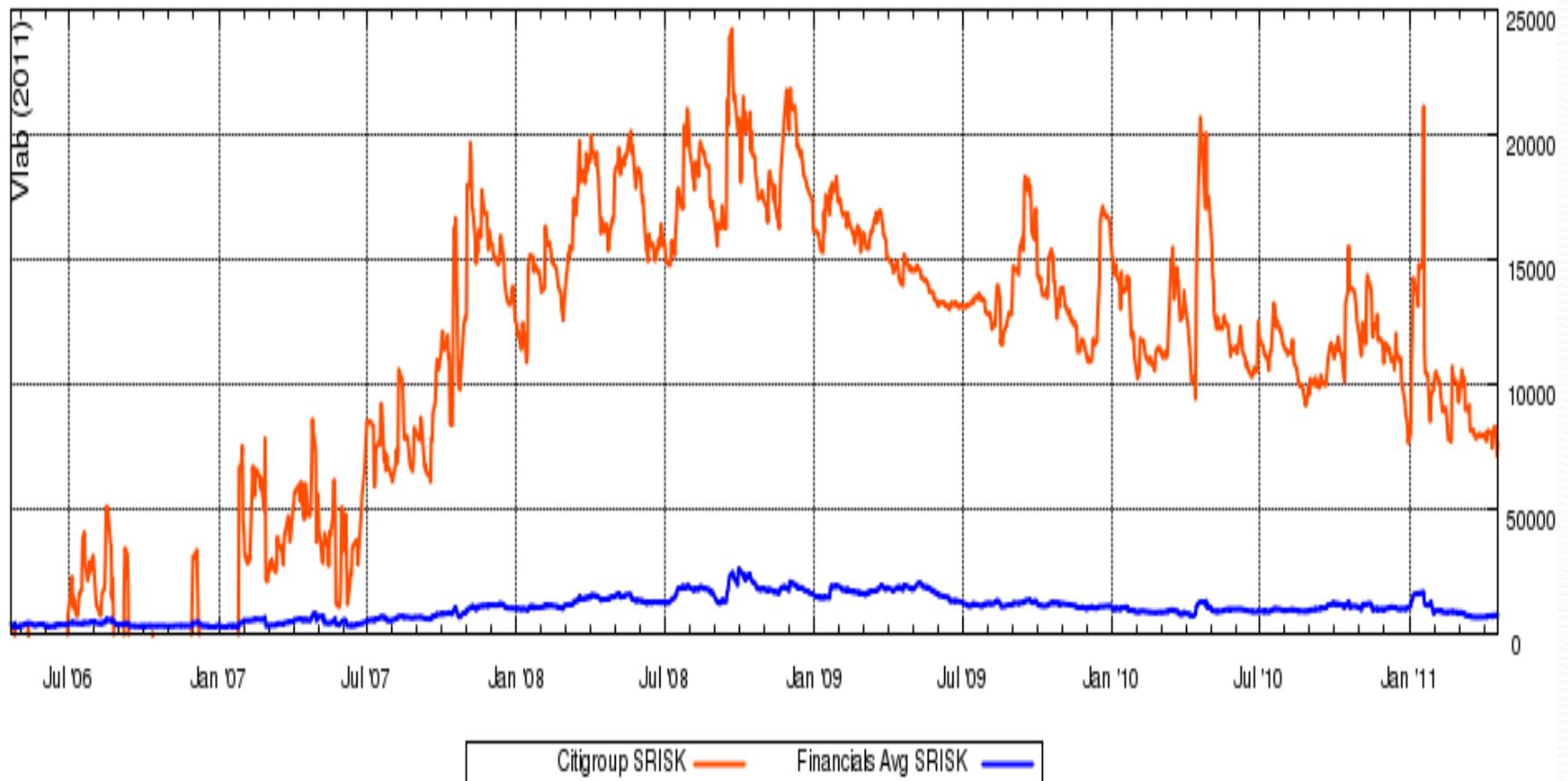
Citigroup Volatility



Citigroup Leverage



Citigroup SRISK



4/24/2011

| TOP 10 | SRISK% | MES | LVG |
|-------------------------------------|---------------|------------|------------|
| Bank Of America | 20.4 | 3.17 | 17.40 |
| JP Morgan Chase | 16.6 | 3.24 | 12.34 |
| Citigroup | 13.9 | 2.64 | 14.35 |
| Morgan Stanley | 8.2 | 3.59 | 19.14 |
| MetLife | 6.4 | 3.13 | 15.56 |
| Goldman Sachs | 5.7 | 3.12 | 10.69 |
| Prudential Financial | 5.2 | 3.30 | 17.90 |
| American International Group | 5.2 | 3.81 | 10.86 |
| Hartford Financial Services | 3.5 | 3.57 | 25.33 |
| SLM Corporation | 2.3 | 3.64 | 24.06 |

DETAILS

Systemic Risk Rankings for 2011-04-20 (MES is e equity loss for a 2% daily market decline)

| <u>Institution</u> | <u>SRISK%</u> | <u>RNK</u> | <u>SRISK (\$ m)</u> | <u>MES</u> | <u>Beta</u> | <u>Cor</u> | <u>Vol</u> | <u>Lvg</u> | <u>MV</u> |
|------------------------------------|---------------|------------|---------------------|------------|-------------|------------|------------|------------|-----------|
| <u>Bank Of America</u> | 20.7% | 1 | 122,668 | 3.57 | 1.19 | 0.55 | 27.4 | 17.46 | 124186.6 |
| <u>JP Morgan Chase</u> | 16.3% | 2 | 96,512 | 3.35 | 1.35 | 0.70 | 24.3 | 12.37 | 177505.2 |
| <u>Citigroup</u> | 12.9% | 3 | 76,697 | 2.59 | 0.91 | 0.58 | 19.8 | 14.33 | 133071.9 |
| <u>Morgan Stanley</u> | 7.8% | 4 | 46,069 | 3.56 | 1.36 | 0.70 | 24.4 | 19.44 | 40248.3 |
| <u>MetLife</u> | 5.9% | 5 | 35,043 | 3.01 | 1.16 | 0.63 | 23.0 | 15.74 | 46258.0 |
| <u>Wells Fargo</u> | 5.2% | 6 | 31,170 | 3.27 | 1.19 | 0.61 | 24.7 | 8.31 | 151878.7 |
| <u>Goldman Sachs</u> | 5.1% | 7 | 30,370 | 2.99 | 1.12 | 0.58 | 24.4 | 10.74 | 85493.1 |
| <u>Prudential Financial</u> | 4.9% | 8 | 29,048 | 3.21 | 1.43 | 0.72 | 25.0 | 18.12 | 29612.0 |
| <u>American Internation Group</u> | 4.8% | 9 | 28,707 | 3.80 | 1.07 | 0.46 | 29.4 | 10.80 | 58123.8 |
| <u>Hartford Financial Services</u> | 3.1% | 10 | 18,649 | 2.96 | 1.20 | 0.55 | 27.2 | 25.66 | 12087.9 |

SORT BY SIZE

Systemic Risk Rankings for 2011-04-20 (MES is equity loss for a 2% daily market decline)

| <u>Institution</u> | <u>SRISK %</u> | <u>RNK</u> | <u>SRISK (\$ m)</u> | <u>MES</u> | <u>Beta</u> | <u>Cor</u> | <u>Vol</u> | <u>Lvg</u> | <u>MV</u> |
|-------------------------------------|----------------|------------|---------------------|------------|-------------|------------|------------|------------|-----------|
| <u>Berkshire Hathaway Shares</u> | 0.0% | 77 | -91,699 | 2.31 | 0.80 | 0.69 | 14.5 | 2.04 | 201983.1 |
| <u>JP Morgan Chase</u> | 16.3% | 2 | 96,512 | 3.35 | 1.35 | 0.70 | 24.3 | 12.37 | 177505.2 |
| <u>Wells Fargo</u> | 5.2% | 6 | 31,170 | 3.27 | 1.19 | 0.61 | 24.7 | 8.31 | 151878.7 |
| <u>Citigroup</u> | 12.9% | 3 | 76,697 | 2.59 | 0.91 | 0.58 | 19.8 | 14.33 | 133071.9 |
| <u>Bank Of America</u> | 20.7% | 1 | 122,668 | 3.57 | 1.19 | 0.55 | 27.4 | 17.46 | 124186.6 |
| <u>Goldman Sachs</u> | 5.1% | 7 | 30,370 | 2.99 | 1.12 | 0.58 | 24.4 | 10.74 | 85493.1 |
| <u>American International Group</u> | 4.8% | 9 | 28,707 | 3.80 | 1.07 | 0.46 | 29.4 | 10.80 | 58123.8 |
| <u>American Express</u> | 0.0% | 75 | -20,075 | 2.32 | 0.96 | 0.68 | 17.7 | 3.25 | 56513.2 |
| <u>UnitedHealth Group</u> | 0.0% | 76 | -20,562 | 2.62 | 0.96 | 0.45 | 26.6 | 1.77 | 48385.1 |
| <u>US Bancorp</u> | 0.0% | 45 | -1,812 | 2.49 | 0.93 | 0.58 | 20.3 | 6.87 | 47741.1 |

SORT BY MES

Systemic Risk Rankings for 2011-04-20 (MES is equity loss for a 2% daily market decline)

| <u>Institution</u> | <u>SRISK %</u> | <u>RNK</u> | <u>SRISK (\$ m)</u> | <u>MES</u> | <u>Beta</u> | <u>Cor</u> | <u>Vol</u> | <u>Lvg</u> | <u>MV</u> |
|-------------------------------------|----------------|------------|---------------------|------------|-------------|------------|------------|------------|-----------|
| <u>MBIA</u> | 0.4% | 21 | 2,090 | 4.80 | 2.15 | 0.47 | 57.0 | 14.97 | 2107.4 |
| <u>Regions Financial</u> | 1.1% | 14 | 6,646 | 3.81 | 1.42 | 0.64 | 28.1 | 13.97 | 8879.7 |
| <u>American International Group</u> | 4.8% | 9 | 28,707 | 3.80 | 1.07 | 0.46 | 29.4 | 10.80 | 58123.8 |
| <u>T. Rowe Price</u> | 0.0% | 61 | -5,035 | 3.78 | 1.58 | 0.83 | 23.8 | 1.02 | 17189.4 |
| <u>Charles Schwab</u> | 0.0% | 34 | 198 | 3.75 | 1.67 | 0.70 | 30.2 | 4.85 | 22412.2 |
| <u>Janus Capital</u> | 0.0% | 36 | -592 | 3.74 | 1.71 | 0.68 | 31.6 | 1.62 | 2352.1 |
| <u>SLM Corporation</u> | 2.3% | 11 | 13,703 | 3.72 | 1.44 | 0.61 | 29.6 | 27.29 | 7619.1 |
| <u>Lincoln National</u> | 1.9% | 12 | 11,506 | 3.61 | 1.49 | 0.71 | 26.5 | 20.62 | 9224.5 |
| <u>Bank Of America</u> | 20.7% | 1 | 122,668 | 3.57 | 1.19 | 0.55 | 27.4 | 17.46 | 124186.6 |
| <u>Morgan Stanley</u> | 7.8% | 4 | 46,069 | 3.56 | 1.36 | 0.70 | 24.4 | 19.44 | 40248.3 |

SORT BY LEVERAGE

Systemic Risk Rankings for 2011-04-20 (MES is e equity loss for a 2% daily market decline)

| <u>Institution</u> | <u>SRISK%</u> | <u>RNK</u> | <u>SRISK (\$ m)</u> | <u>MES</u> | <u>Beta</u> | <u>Cor</u> | <u>Vol</u> | <u>Lvg</u> | <u>MV</u> |
|------------------------------------|---------------|------------|---------------------|------------|-------------|------------|------------|------------|-----------|
| <u>SLM Corporation</u> | 2.3% | 11 | 13,703 | 3.72 | 1.44 | 0.61 | 29.6 | 27.29 | 7619.1 |
| <u>Hartford Financial Services</u> | 3.1% | 10 | 18,649 | 2.96 | 1.20 | 0.55 | 27.2 | 25.66 | 12087.9 |
| <u>Lincoln National</u> | 1.9% | 12 | 11,506 | 3.61 | 1.49 | 0.71 | 26.5 | 20.62 | 9224.5 |
| <u>Morgan Stanley</u> | 7.8% | 4 | 46,069 | 3.56 | 1.36 | 0.70 | 24.4 | 19.44 | 40248.3 |
| <u>Prudential Financial</u> | 4.9% | 8 | 29,048 | 3.21 | 1.43 | 0.72 | 25.0 | 18.12 | 29612.0 |
| <u>Genworth Financial</u> | 1.0% | 15 | 5,712 | 3.43 | 1.33 | 0.56 | 29.3 | 17.50 | 5905.9 |
| <u>Bank Of America</u> | 20.7% | 1 | 122,668 | 3.57 | 1.19 | 0.55 | 27.4 | 17.46 | 124186.6 |
| <u>MetLife</u> | 5.9% | 5 | 35,043 | 3.01 | 1.16 | 0.63 | 23.0 | 15.74 | 46258.0 |
| <u>MBIA</u> | 0.4% | 21 | 2,090 | 4.80 | 2.15 | 0.47 | 57.0 | 14.97 | 2107.4 |
| <u>Synovus Financial</u> | 0.2% | 30 | 933 | 1.79 | 0.73 | 0.29 | 31.5 | 14.68 | 1978.9 |



WHAT IS NEW IN VLAB?

- The entire calculation and web display is now recursive so that the risk measures at any point in time use only information that was available at that time.
- We can look back at past rankings to see how well they worked.



Systemic Risk Rankings



“A Look Back”

2007 3-30

Systemic Risk Rankings for 2007-03-30 (MES is equity loss for a 2% daily market decline)

| Institution | SRISK % | RNK | SRISK (\$ m) | MES | Beta | Cor | Vol | Lvg | MV |
|---|---------|-----|--------------|------|------|------|------|-------|----------|
| Morgan Stanley | 16.5% | 1 | 78,503 | 4.62 | 1.71 | 0.77 | 33.1 | 14.65 | 83845.3 |
| Merrill Lynch | 12.4% | 2 | 58,876 | 4.19 | 1.45 | 0.73 | 29.4 | 14.02 | 72223.7 |
| Goldman Sachs | 10.0% | 3 | 47,777 | 4.16 | 1.63 | 0.84 | 28.8 | 10.33 | 92734.3 |
| Fannie Mae | 9.5% | 4 | 45,368 | 3.42 | 1.21 | 0.67 | 26.7 | 16.08 | 53218.4 |
| Freddie Mac | 8.3% | 5 | 39,315 | 2.04 | 0.79 | 0.59 | 20.1 | 20.76 | 39338.0 |
| Citigroup | 7.9% | 6 | 37,785 | 3.08 | 1.12 | 0.77 | 21.6 | 8.01 | 251694.5 |
| Lehman Brothers | 7.8% | 7 | 36,910 | 4.50 | 1.83 | 0.73 | 37.3 | 15.71 | 36863.0 |
| JP Morgan Chase | 5.9% | 8 | 28,211 | 3.02 | 1.24 | 0.78 | 23.7 | 8.35 | 168040.7 |
| Bear Stearns | 5.7% | 9 | 27,253 | 4.47 | 1.64 | 0.70 | 34.9 | 22.18 | 17997.9 |
| MetLife | 3.7% | 10 | 17,426 | 2.76 | 1.02 | 0.71 | 21.3 | 11.36 | 47531.1 |
| Hartford Financial Services | 2.1% | 11 | 9,932 | 2.66 | 0.97 | 0.73 | 19.6 | 11.05 | 30606.4 |
| Ameriprise Financial | 2.0% | 12 | 9,548 | 6.36 | 2.06 | 0.81 | 31.4 | 8.06 | 13668.2 |
| Prudential Financial | 1.6% | 13 | 7,463 | 1.71 | 0.74 | 0.63 | 17.3 | 11.17 | 42421.3 |
| Washington Mutual | 1.6% | 14 | 7,392 | 2.53 | 1.13 | 0.56 | 29.7 | 9.83 | 35899.2 |
| Countrywide Financial | 1.2% | 15 | 5,605 | 2.74 | 1.33 | 0.51 | 38.7 | 10.36 | 19841.4 |
| Lincoln National | 1.1% | 16 | 5,120 | 2.92 | 1.16 | 0.80 | 21.4 | 9.86 | 18764.9 |
| Bank Of America | 1.0% | 17 | 4,907 | 2.88 | 1.02 | 0.79 | 19.2 | 6.80 | 228177.5 |

DID THIS PREDICT WELL?

- EIGHT OUT OF TOP TEN FAILED OR NEARLY FAILED IN CRISIS
- Morgan Stanley, Merrill Lynch, Goldman Sachs, Fannie Mae, Freddie Mac, Citigroup, Lehman Bros, J.P. Morgan Chase, Bear Stearns, Met Life.
- Where are Bank of America and AIG?

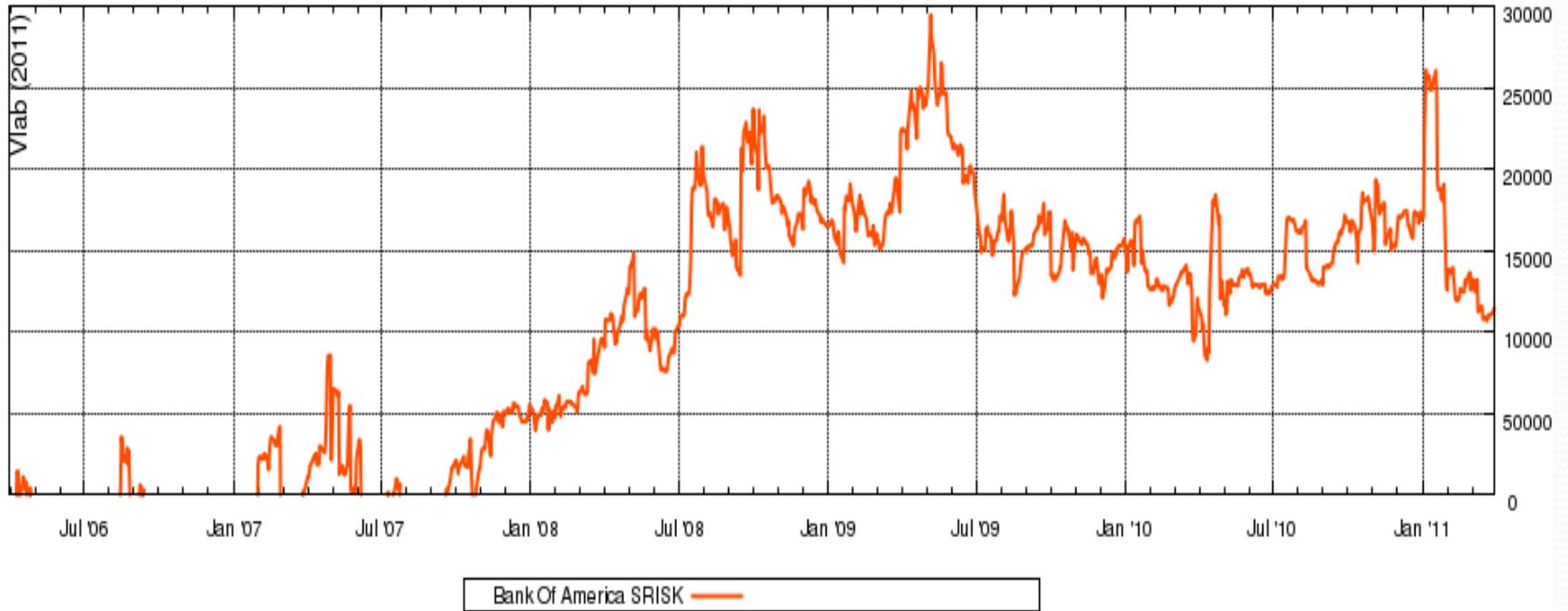


Systemic Risk Ranking Progressions

Bank of America

| Date | Rank | SRISK % | MES | LVG |
|-----------|------|---------|------|-------|
| 6/29/2007 | 87 | 0.0% | 2.07 | 7.30 |
| 1/30/2008 | 11 | 4.8% | 3.15 | 9.01 |
| 7/31/2008 | 1 | 11.9% | 8.78 | 11.61 |
| 6/30/2009 | 1 | 18.6% | 7.01 | 19.12 |
| 6/30/2010 | 1 | 17.1% | 3.73 | 15.78 |
| Current | 1 | 21.5% | 3.38 | 16.10 |

BAC Predicted Capital Shortfall





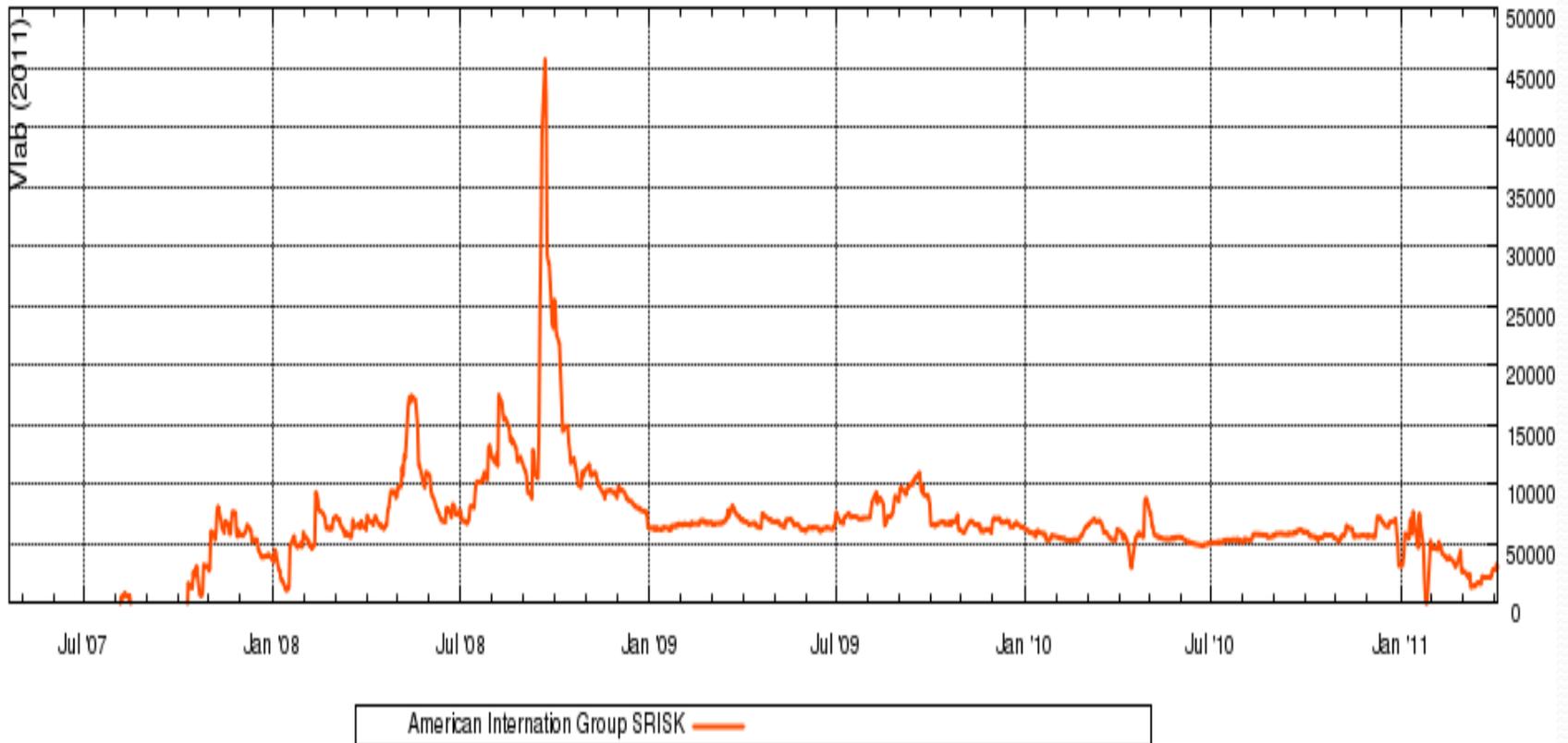
Systemic Risk Ranking Progressions

American International Group

| Date | Rank | SRISK % | MES | LVG |
|------------|------|---------|------|-------|
| 6/29/2007 | 91 | 0.0% | 1.99 | 5.89 |
| 10/31/2007 | 9 | 3.7% | 3.80 | 6.92 |
| 7/31/2008 | 4 | 7.3% | 9.58 | 14.85 |
| 6/30/2009 | 5 | 6.4% | 6.72 | 48.42 |
| 6/30/2010 | 4 | 6.9% | 3.37 | 32.03 |
| Current | 8 | 4.1% | 3.30 | 10.03 |



AIG Predicted Capital Shortfall



BEFORE BEAR STERNS

Systemic Risk Rankings for (MES is equity loss for a 2% daily market decline)

| Institution | SRISK % | RNK | SRISK (\$ m) | MES | Beta | Cor | Vol | Lvg | MV |
|--|---------|-----|--------------|------|------|------|------|-------|----------|
| Citigroup | 12.6% | 1 | 132,746 | 3.93 | 1.51 | 0.69 | 41.8 | 17.80 | 123441.8 |
| JP Morgan Chase | 7.8% | 2 | 81,776 | 4.08 | 1.64 | 0.70 | 44.8 | 11.51 | 136884.8 |
| Merrill Lynch | 7.5% | 3 | 78,614 | 5.50 | 2.08 | 0.72 | 54.9 | 21.52 | 48150.0 |
| Morgan Stanley | 7.2% | 4 | 75,642 | 4.39 | 1.61 | 0.72 | 42.6 | 23.73 | 46527.5 |
| American International Group | 6.3% | 5 | 66,263 | 5.09 | 1.81 | 0.58 | 59.3 | 8.97 | 118196.7 |
| Goldman Sachs | 6.0% | 6 | 62,977 | 3.28 | 1.38 | 0.61 | 43.0 | 16.29 | 74467.6 |
| Bank Of America | 5.9% | 7 | 62,295 | 3.39 | 1.31 | 0.71 | 35.3 | 9.89 | 176534.2 |
| Fannie Mae | 5.7% | 8 | 59,501 | 3.92 | 1.46 | 0.52 | 53.5 | 31.88 | 27049.6 |
| Lehman Brothers | 5.6% | 9 | 58,873 | 5.10 | 2.04 | 0.73 | 53.6 | 29.14 | 27054.7 |
| Freddie Mac | 5.5% | 10 | 57,920 | 4.26 | 1.60 | 0.47 | 65.5 | 48.18 | 16267.9 |
| Wachovia Bank | 4.7% | 11 | 49,299 | 4.87 | 1.86 | 0.72 | 49.1 | 12.58 | 60688.4 |
| Bear Stearns | 2.9% | 12 | 29,937 | 4.90 | 1.74 | 0.66 | 51.4 | 42.05 | 9430.7 |
| Prudential Financial | 2.7% | 13 | 27,873 | 3.86 | 1.49 | 0.63 | 46.9 | 15.21 | 32544.6 |
| MetLife | 2.5% | 14 | 25,854 | 3.23 | 1.24 | 0.68 | 34.7 | 13.64 | 41316.1 |
| Washington Mutual | 2.2% | 15 | 22,689 | 4.97 | 1.99 | 0.51 | 73.7 | 23.92 | 13061.8 |

BEFORE FREDDIE AND FANNIE, LEHMAN and A.I.G.

Systemic Risk Rankings for (MES is equity loss for a 2% daily market decline)

| Institution | SRISK% | RNK | SRISK (\$ m) | MES | Beta | Cor | Vol | Lvg | MV |
|--|--------|-----|--------------|-------|------|------|-------|--------|----------|
| Citigroup | 11.7% | 1 | 173,289 | 6.50 | 2.51 | 0.80 | 59.1 | 19.99 | 103408.0 |
| Bank Of America | 11.5% | 2 | 171,334 | 7.55 | 2.94 | 0.75 | 74.8 | 11.94 | 142001.9 |
| JP Morgan Chase | 9.8% | 3 | 145,537 | 6.20 | 2.48 | 0.75 | 62.7 | 13.42 | 132291.7 |
| American Internation Group | 8.2% | 4 | 121,658 | 10.24 | 3.72 | 0.70 | 99.9 | 17.62 | 57783.0 |
| Merrill Lynch | 6.7% | 5 | 100,114 | 9.12 | 3.46 | 0.78 | 84.0 | 22.45 | 43417.0 |
| Morgan Stanley | 5.4% | 6 | 79,906 | 5.58 | 2.10 | 0.75 | 52.9 | 23.01 | 45281.0 |
| Fannie Mae | 5.3% | 7 | 78,878 | 14.84 | 5.55 | 0.51 | 205.3 | 115.68 | 7363.9 |
| Freddie Mac | 4.9% | 8 | 72,801 | 12.85 | 5.00 | 0.43 | 220.4 | 297.76 | 2918.0 |
| Wachovia Bank | 4.9% | 9 | 72,553 | 7.99 | 3.09 | 0.66 | 88.3 | 22.40 | 34304.2 |
| Goldman Sachs | 4.4% | 10 | 65,839 | 4.11 | 1.70 | 0.76 | 42.7 | 15.73 | 70113.6 |
| Lehman Brothers | 4.2% | 11 | 61,849 | 12.47 | 5.07 | 0.74 | 129.9 | 55.88 | 11172.9 |
| Wells Fargo | 2.6% | 12 | 38,418 | 5.17 | 1.99 | 0.71 | 53.3 | 6.60 | 100162.3 |
| MetLife | 2.0% | 13 | 30,041 | 3.72 | 1.44 | 0.79 | 34.5 | 14.56 | 38470.0 |
| Prudential Financial | 1.7% | 14 | 25,515 | 3.50 | 1.35 | 0.72 | 36.0 | 15.39 | 31474.2 |
| Washington Mutual | 1.6% | 15 | 23,898 | 6.88 | 2.74 | 0.45 | 116.4 | 41.50 | 6906.7 |

DURING STRESS TEST

Systemic Risk Rankings for 2009-04-30 (MES is equity loss for a 2% daily market decline)

| <u>Institution</u> | <u>SRISK%</u> | <u>RNK</u> | <u>SRISK (\$ m)</u> | <u>MES</u> | <u>Beta</u> | <u>Cor</u> | <u>Vol</u> | <u>Lvg</u> | <u>MV</u> |
|---|---------------|------------|---------------------|------------|-------------|------------|------------|------------|-----------|
| Bank Of America | 17.3% | 1 | 244,409 | 13.78 | 4.58 | 0.77 | 174.2 | 37.43 | 57160.5 |
| JP Morgan Chase | 14.2% | 2 | 200,222 | 7.87 | 2.63 | 0.80 | 95.6 | 16.39 | 124004.1 |
| Wells Fargo | 11.3% | 3 | 159,404 | 10.17 | 3.40 | 0.75 | 131.4 | 14.82 | 85270.6 |
| Citigroup | 10.4% | 4 | 146,658 | 10.05 | 3.33 | 0.67 | 144.7 | 100.72 | 16814.0 |
| American Internation Group | 4.9% | 5 | 69,757 | 8.23 | 2.71 | 0.56 | 140.4 | 40.77 | 19248.5 |
| Goldman Sachs | 4.5% | 6 | 64,115 | 5.15 | 1.81 | 0.74 | 71.5 | 13.28 | 70070.7 |
| Morgan Stanley | 3.8% | 7 | 53,748 | 7.35 | 2.46 | 0.74 | 96.4 | 23.55 | 25583.2 |
| MetLife | 3.1% | 8 | 43,975 | 7.18 | 2.55 | 0.75 | 98.8 | 20.23 | 24337.9 |
| Prudential Financial | 3.0% | 9 | 42,322 | 10.09 | 3.30 | 0.76 | 129.9 | 34.81 | 12245.1 |
| US Bancorp | 2.9% | 10 | 41,061 | 9.75 | 3.23 | 0.76 | 123.8 | 8.37 | 31978.7 |
| Hartford Financial Services | 1.7% | 11 | 24,394 | 10.30 | 3.38 | 0.74 | 132.9 | 72.87 | 3732.7 |
| PNC Financial Services | 1.6% | 12 | 22,131 | 6.07 | 2.08 | 0.65 | 93.5 | 15.61 | 17639.2 |
| American Express | 1.6% | 13 | 21,968 | 8.33 | 2.81 | 0.81 | 101.4 | 4.58 | 29457.0 |
| State Street | 1.5% | 14 | 21,557 | 10.16 | 3.34 | 0.59 | 163.8 | 9.65 | 14825.3 |
| Capital One Financial | 1.4% | 15 | 20,433 | 13.26 | 4.48 | 0.70 | 186.6 | 23.92 | 6573.8 |
| BB&T Corporation | 1.3% | 16 | 17,872 | 9.11 | 2.98 | 0.79 | 109.2 | 10.74 | 13065.8 |
| Suntrust Banks | 1.3% | 17 | 17,752 | 11.60 | 3.92 | 0.75 | 151.2 | 31.57 | 5150.6 |
| Lincoln National | 1.1% | 18 | 15,519 | 12.92 | 4.19 | 0.67 | 182.2 | 53.16 | 2877.9 |
| SLM Corporation | 1.0% | 19 | 14,252 | 8.03 | 2.90 | 0.53 | 159.0 | 74.76 | 2258.5 |
| Bank Of New York Mellon | 1.0% | 20 | 13,797 | 5.51 | 1.84 | 0.69 | 78.3 | 6.96 | 29389.9 |

SCAP

| FIRM | SCAP | SCAP% |
|------------------------|------|----------|
| Bank of America | 33.9 | 45.44236 |
| Wells Fargo | 13.7 | 18.36461 |
| GMAC | 11.5 | 15.41555 |
| Citigroup | 5.5 | 7.372654 |
| Regions Financial | 2.5 | 3.351206 |
| SunTrust Banks | 2.2 | 2.949062 |
| Morgan Stanley | 1.8 | 2.412869 |
| KeyCorp | 1.8 | 2.412869 |
| Fifth Third Bancorp | 1.1 | 1.474531 |
| PNC Financial Services | 0.6 | 0.80429 |
| JP Morgan Chase | 0 | 0 |
| Goldman Sachs | 0 | 0 |
| US Bancorp | 0 | 0 |
| Capital One Financial | 0 | 0 |
| American Express | 0 | 0 |
| MetLife | 0 | 0 |
| BB&T Corporation | 0 | 0 |
| State Street | 0 | 0 |
| Bank of NY Mellon | 0 | 0 |

SRISK%

| FIRM | SRISK-BHC% |
|-------------------------|------------|
| Bank Of America | 21.77594 |
| JP Morgan Chase | 17.83904 |
| Wells Fargo | 14.20231 |
| Citigroup | 13.06669 |
| Goldman Sachs | 5.71241 |
| Morgan Stanley | 4.788748 |
| MetLife | 3.91801 |
| US Bancorp | 3.658383 |
| PNC Financial Services | 1.97179 |
| American Express | 1.957268 |
| State Street | 1.920649 |
| Capital One Financial | 1.820505 |
| BB&T Corporation | 1.592329 |
| Suntrust Banks | 1.581638 |
| Bank Of New York Mellon | 1.229262 |
| Regions Financial | 1.11406 |
| Fifth Third Bancorp | 0.939253 |
| Keycorp | 0.911722 |

HOW RISKY IS THE ECONOMY TODAY?

- The total capital shortfall expected if we have another crisis is a measure of the external cost of a crisis today.
- If firms reduce leverage, size, correlation or volatility, their shortfall will be reduced.
- What is total capital shortfall?

$$\text{Total Capital Shortfall} = \sum_{i=1}^N E(\text{Firm}_i \text{ Shortfall} | \text{Crisis})$$

SYSTEM CAPITAL SHORTFALL

