Ranking Systemically Important Institutions

Preliminary - comments are most welcome

Mardi DUNGEY†* Matteo LUCIANI‡* David VEREDAS‡

† Centre for Financial Analysis and Policy – University of Cambridge – UK
   * University of Tasmania – Australia
‡ Université libre de Bruxelles – ECARES – Belgium
   * F.R.S.-FNRS – Belgium

Latsis Symposium 2012 – ETH Zurich, Switzerland
September 13, 2012
What we do:

What we produce:

Is it useful because
What we do:
We rank firms according to their systemic importance

What we produce:

Is it useful because
What we do:
We rank firms according to their systemic importance

What we produce:
a ranking

Is it useful because
What we do:
We rank firms according to their systemic importance

What we produce:
a ranking
a general index of systemic risk

Is it useful because
What we do:
We rank firms according to their systemic importance

What we produce:
a ranking
a general index of systemic risk

Is it useful because
they can be used to monitor the state of the economy
Outline

1. Systemic risk: a definition
2. Ranking systemically important institutions
3. The great financial crisis – and beyond
4. Conclusion
Systemic risk: a definition

Jean-Claude Trichet
Clare Distinguished Lecture in Economics and Public Policy
Clare College, University of Cambridge, 10 December 2009
Jean-Claude Trichet
Clare Distinguished Lecture in Economics and Public Policy
Clare College, University of Cambridge, 10 December 2009

Threat that developments in the financial system can cause a seizing–up or breakdown of this system and trigger massive damages to the real economy.
Outline

1. Systemic risk: a definition
   - Four fundamental points
   - Other sources of systemic risk

2. Ranking systemically important institutions

3. The great financial crisis – and beyond
   - Systemic risk indexes
   - The SIFI Ranking

4. Conclusion
Point 1: A system of risks

We understand systemic risk as a problem of measuring the relations between risks, i.e., measuring how risks among firms are connected.

Before the crisis: build-up of system-wide risks (instead of risk sharing). CDS and other derivatives did not diversify risk, rather increased the magnitude of the network of risks in the financial system.

We therefore use risks measures within a network context as our data set. More precisely, we denote by $x_{it}$ the risk for asset $i$ at time $t$. 
Point 1: A system of risks

- We understand systemic risk as a problem of measuring the relations between risks

  i.e. measuring how risks among firms are connected
Point 1: A system of risks

- We understand systemic risk as a problem of measuring the relations between risks
  i.e. measuring how risks among firms are connected

- Why risks instead of price or returns?
Point 1: A system of risks

- We understand systemic risk as a problem of measuring the relations between risks
  
i.e. measuring how risks among firms are connected

- Why risks instead of price or returns?
  
  - Before the crisis: build-up of system-wide risks (instead of risk sharing)
Point 1: A system of risks

- We understand systemic risk as a problem of measuring the relations between risks
  i.e. measuring how risks among firms are connected

- Why risks instead of price or returns?
  - Before the crisis: build–up of system–wide risks (instead of risk sharing)
  - CDS and other derivatives did not diversify risk,
Point 1: A system of risks

- We understand systemic risk as a problem of measuring the relations between risks
  - i.e. measuring how risks among firms are connected

- Why risks instead of price or returns?
  - Before the crisis: build-up of system-wide risks (instead of risk sharing)
  - CDS and other derivatives did not diversify risk, rather increased the magnitude of the network of risks in the financial system.
Point 1: A system of risks

- We understand systemic risk as a problem of measuring the relations between risks
  i.e. measuring how risks among firms are connected

- Why risks instead of price or returns?
  - Before the crisis: build–up of system–wide risks (instead of risk sharing)
  - CDS and other derivatives did not diversify risk, rather increased the magnitude of the network of risks in the financial system.

- We therefore use risks measures within a network context as our data set

- More precisely, we denote by $x_{it}$ the risk for asset $i$ at time $t$. 
Point 2: Shocks instead of the level of risk

A threat is an expression of intention to inflict damage. The damage may or may not happen. A threat therefore has an unexpected –or shock– sense. A shock needs to happen so the systemic crisis is triggered. The object of interest, therefore, are the relations between shocks in risks rather than between risks. This admits the following representation:

\[ x_{it} = C_i(L_{vt}) \]
Point 2: Shocks instead of the level of risk

*Threat:* an expression of intention to inflict damage.
Point 2: Shocks instead of the level of risk

*Threat:* an expression of intention to inflict damage.

- The damage may or may not happen.
- A threat has therefore an unexpected –or shock– sense.
- A shock needs to happen so the systemic crisis is triggered.
Point 2: Shocks instead of the level of risk

**Threat:** an expression of intention to inflict damage.

- The damage may or may not happen.
- A threat has therefore an unexpected –or shock– sense.
- A shock needs to happen so the systemic crisis is triggered

- The object of interest therefore are the relations between shocks in risks rather than between risks
- $x_{it}$ admits the following representation: $x_{it} = C_i(L)v_{it}$. 

Point 3: The financial sector and the real economy

The financial system and the real economy are not independent networks. A shock in one sector may trigger a crisis in the other. The object of interest therefore are the relations between shocks in risks in both the financial sector and the real economy. A network where the transmission channels between all firms are given by the conditional correlations $\rho_{ijt} = \text{Corr}(x_{it}, x_{jt}|I_{t-1}) = \text{Corr}(v_{it}, v_{jt}|I_{t-1})$. 

M. Luciani (ULB – ECARES)
Point 3: The financial sector and the real economy

- The financial system and the real economy are not independent networks
  - Lend
  - Insure
- A shock in one sector may trigger a crisis in the other
**Point 3: The financial sector and the real economy**

- The financial system and the real economy are not independent networks
  - Lend
  - Insure
- A shock in one sector may trigger a crisis in the other
- The object of interest therefore are the relations between shocks in risks in both the financial sector and the real economy
- A network where the transmission channels between all firms are given by the conditional correlations
  \[ \rho_{ijt} = Corr(x_{it}, x_{jt} | \mathcal{I}_{t-1}) = Corr(v_{it}, v_{jt} | \mathcal{I}_{t-1}). \]
Point 3: The financial sector and the real economy

- 1/5/2006
- 1/11/2007
- 12/9/2008
- 30/12/2011
Point 4: Common and idiosyncratic shocks

There are three particularly important ways in which financial events are transmitted so widely that the fallout reaches systemic dimensions (Bandt and Hartman, 2000, Bandt, Hartman and Peydro, 2009):

- **Contagion**: A shock that leads to the failure of one can lead to failures of other, even when the latter has not invested in the same risks and are not subject to the same original shock as the former.

- **Correlations between idiosyncratic shocks**: Wide spread financial imbalances that can build up over time and then unwind abruptly.

- **Common shock**: Negative aggregate shocks can affect intermediaries and markets simultaneously.

Common and idiosyncratic shocks are all contained in **\( v \)**.
Point 4: Common and idiosyncratic shocks

There are three particularly important ways in which financial events are transmitted so widely that the fallout reaches systemic dimensions (Bandt and Hartman, 2000, Bandt, Hartman and Peydro, 2009):
Point 4: Common and idiosyncratic shocks

There are three particularly important ways in which financial events are transmitted so widely that the fallout reaches systemic dimensions (Bandt and Hartman, 2000, Bandt, Hartman and Peydro, 2009):

- **Contagion**: A shock that leads to the failure of one can lead to failures of other, even when the latter has not invested in the same risks and are not subject to the same original shock as the former.
Point 4: Common and idiosyncratic shocks

There are three particularly important ways in which financial events are transmitted so widely that the fallout reaches systemic dimensions (Bandt and Hartman, 2000, Bandt, Hartman and Peydro, 2009):

- **Contagion**: A shock that leads to the failure of one can lead to failures of other, even when the latter has not invested in the same risks and are not subject to the same original shock as the former.

- **Wide spread financial imbalances** that can build up over time and then unwind abruptly
Point 4: Common and idiosyncratic shocks

There are three particularly important ways in which financial events are transmitted so widely that the fallout reaches systemic dimensions (Bandt and Hartman, 2000, Bandt, Hartman and Peydro, 2009):

- **Contagion**: A shock that leads to the failure of one can lead to failures of other, even when the latter has not invested in the same risks and are not subject to the same original shock as the former.

- **Wide spread financial imbalances** that can build up over time and then unwind abruptly

- **Negative aggregate shocks** can affect intermediaries and markets simultaneously
Point 4: Common and idiosyncratic shocks

There are three particularly important ways in which financial events are transmitted so widely that the fallout reaches systemic dimensions (Bandt and Hartman, 2000, Bandt, Hartman and Peydro, 2009):

- **Contagion**: A shock that leads to the failure of one can lead to failures of other, even when the latter has not invested in the same risks and are not subject to the same original shock as the former.

- **Correlations between idiosyncratic shocks**

- **Wide spread financial imbalances** that can build up over time and then unwind abruptly

- **Negative aggregate shocks** can affect intermediaries and markets simultaneously

Common shock
Point 4: Common and idiosyncratic shocks

There are three particularly important ways in which financial events are transmitted so widely that the fallout reaches systemic dimensions (Bandt and Hartman, 2000, Bandt, Hartman and Peydro, 2009):

- **Contagion**: A shock that leads to the failure of one can lead to failures of other, even when the latter has not invested in the same risks and are not subject to the same original shock as the former.

  Correlations between idiosyncratic shocks

- **Wide spread financial imbalances** that can build up over time and then unwind abruptly

  Common shock

- **Negative aggregate shocks** can affect intermediaries and markets simultaneously

  Common shock

**Common and Idiosyncratic shocks are all contained in** $v_{it}$
Outline

1. Systemic risk: a definition
   - Four fundamental points
   - Other sources of systemic risk

2. Ranking systemically important institutions

3. The great financial crisis – and beyond
   - Systemic risk indexes
   - The SIFI Ranking

4. Conclusion
Firm characteristics

- Firm characteristics are known to play an important role in ranking systemically important institutions and in computing the systemic risk contributions.
  - A large, leveraged and illiquid firm should be ranked high.
Firm characteristics

- Firm characteristics are known to play an important role in ranking systemically important institutions and in computing the systemic risk contributions.
  - A large, leveraged and illiquid firm should be ranked high.
- Following Brownlees (2011), the firm characteristics we use are
  - **Size** Market value of equity: $size_{kt}$
  - **Leverage** Debt to finance the firm: $lvg_{kt}$
  - **Liquidity** Assets that can be quickly transformed in cash: $liq_{kt}$
Outline

1. Systemic risk: a definition
2. Ranking systemically important institutions
3. The great financial crisis – and beyond
4. Conclusion
A company is systemically important if it has many and/or strong transmission channels, and if it is connected with systemically important firms.
Ranking systemically important institutions

Ranking a network

- A company is systemically important if it has many and/or strong transmission channels, and if it is connected with systemically important firms.

- Let $S_{kt}$ be the systemic risk importance of the company that ranks in the $k$–th position at time $t$.

- $S_{kt}$ depends on all the other importances weighted by the number and strength of the transmission channels:

$$S_{kt} = \sum_j S_{jt} c_{kjt},$$

where $c_{kjt}$ is the transmission weight: $c_{kjt} = \frac{\rho_{kjt}}{\sum_j \rho_{kjt}}$. 

M. Luciani (ULB – ECARES)
Firm characteristics

- Let $\mathbf{fc}_{kt} = (\text{size}_{kt}, \text{lvg}_{kt}, \text{liq}_{kt}^{-1})$ be the vector of characteristics for firm $k$, and let $\omega$ be a vector of weights.
- Each company gains an amount of importance as a function of $\mathbf{fc}_{kt}$

$$S_{kt} = \sum_{j \in S_{kt}} S_{jt} c_{kj} + \omega' \mathbf{fc}_{kt}$$

- We introduce a scaling $\alpha < 1$ that governs the balance between the network and the firm characteristic contributions:

$$S_t = \alpha C_t \cdot S_t + \omega' \mathbf{fc}_t$$
Hence the vector of systemic risk importances at time $t$ is

$$S_t = (I - \alpha C_t)^{-1} \omega f c_t$$
Hence the vector of systemic risk importances at time $t$ is

$$S_t = (I - \alpha C_t)^{-1} \omega' f c_t$$

- Enhancement of Google’s PageRank
Hence the vector of systemic risk importances at time $t$ is

$$S_t = (I - \alpha C_t)^{-1} \omega' f c_t$$

Enhancement of Google’s PageRank

$$SIFIRank_t = \text{rank}(S_t^{Fin})$$
Hence the vector of systemic risk importances at time $t$ is

$$S_t = (I - \alpha C_t)^{-1} \omega' fc_t$$

Enhancement of Google’s PageRank

$$\text{SIFIRank}_t = \text{rank}(S_t^{Fin})$$

This is a neat and readily interpretable expression.
The general index of systemic importance
The general index of systemic importance

\[ S_{kt} = \sum_j S_{jt} c_{kjt}, \]
The general index of systemic importance

\[ S_{kt} = \sum_j S_{jt} c_{kjt}, \]

\[ S_t = C_t \cdot S_t \]
The general index of systemic importance

\[ S_{kt} = \sum_{j} S_{jt} c_{kj t}, \]

\[ S_t = C_t \cdot S_t \]

- \( S_t \) is the eigenvector associated with the largest eigenvalue of \( C_t \)
The general index of systemic importance

\[ S_{kt} = \sum_j S_{jt} c_{kj} t, \]

\[ S_t = C_t \cdot S_t \]

- \( S_t \) is the eigenvector associated with the largest eigenvalue of \( C_t \)

\[ GS_t = \frac{1}{N^{Fin}} \sum_{k=1}^{N^{Fin}} \frac{S^{Fin}_{kt}}{\max_{t' \leq t} (GS_{t'})} \]
The general index of systemic importance

\[ S_{kt} = \sum_j S_{jt} c_{ktj}, \]

\[ S_t = C_t \cdot S_t \]

- \( S_t \) is the eigenvector associated with the largest eigenvalue of \( C_t \)

\[ GS_t = \frac{1}{N^{Fin}} \sum_{k=1}^{N^{Fin}} \frac{S_{Fin}^{kt}}{\max_{t' \leq t} (GS_{t'})} \]

- \( GS_t \), is based on the fact that as the strength of the transmission channels increases, the network becomes denser.
The general index of systemic importance

\[ S_{kt} = \sum_j S_{jt} c_{kjt}, \]

\[ S_t = C_t \cdot S_t \]

- \( S_t \) is the eigenvector associated with the largest eigenvalue of \( C_t \)

\[ GS_t = \frac{1}{N^{Fin}} \sum_{k=1}^{N^{Fin}} \frac{S_{k't'}}{\max_{t' \leq t}(GS_{t'})} \]

- \( GS_t \), is based on the fact that as the strength of the transmission channels increases, the network becomes denser.

NB: Recall that one of the features of the building-up of the financial crisis was the increase in system-wide risks.
Outline

1. Systemic risk: a definition
2. Ranking systemically important institutions
3. The great financial crisis – and beyond
4. Conclusion
Data

- Panel of log realized volatility measures from January 2, 2003 to December 30, 2011.
- 500 stocks that appeared in the S&P500 at some time in the sample period (2262 trading days).
- Rolling window exercise with size 400 observations (1.5 years)
- 1863 estimations
- Network contribution: $\alpha = 0.66$
- Firm characteristics weights:
  - Size: $\omega_1 = 0.4$
  - Leverage: $\omega_2 = 0.4$
  - Illiquidity: $\omega_3 = 0.2$
Outline

1. Systemic risk: a definition
   - Four fundamental points
   - Other sources of systemic risk

2. Ranking systemically important institutions

3. The great financial crisis – and beyond
   - Systemic risk indexes
   - The SIFI Ranking

4. Conclusion
$G_{t}$ Index - Financial sector
The great financial crisis – and beyond

Systemic risk indexes

$G_{S_t}$ Index - Financial subsectors

Ranking systemic institutions

Latsis Symposium 2012
Outline

1. Systemic risk: a definition
   - Four fundamental points
   - Other sources of systemic risk

2. Ranking systemically important institutions

3. The great financial crisis – and beyond
   - Systemic risk indexes
   - The SIFI Ranking

4. Conclusion
The great financial crisis – and beyond

The SIFI Ranking

*SIFI*Rank*$_t$*

![Graph of American International Group Inc](image1)

![Graph of Bank of America Corporation](image2)

![Graph of The Bank of New York Mellon Corporation](image3)

![Graph of Lehman Brothers](image4)
# Systemically Important Institutions

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_1$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$S_2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Systemically Important Institutions

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amex</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>BofA</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>BB&amp;T</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bank of N. Y.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Citigroup</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Capital One</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Goldman Sachs</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>JPMorgan</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>KeyCorp</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Loews</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lehman Bros.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MetLife</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Morgan Stanley</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>M&amp;T Bank</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Northern Trust</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Principal</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Progressive Corp</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Prudential</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Synovus</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>SunTrust Banks</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>T Rowe Price</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Unum</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>US Bancorp</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wells Fargo</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Outline

1. Systemic risk: a definition
2. Ranking systemically important institutions
3. The great financial crisis – and beyond
4. Conclusion
Conclusion

Based on Trichet’s definition of systemic risk, we propose a simple methodology for ranking systemically important institutions.

We view firm’s risks as a network with vertices equal to the volatility shocks and edges their correlations.

We use dynamic centrality measures to score the firms in terms of risk connectedness and firm characteristics.

An application to all firms in S&P500 during 2006-2009 reveals that

- The highest global level of systemic risk was Sept. 15 2008
- The connections between the real economy and the financial sector are fundamental
- Insurance sector is becoming increasingly systemic