Discussion of
- Leverage-induced Fire Sales & Crashes
- Leverage Network & Market Contagion

by
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MFM Conference 2018

New York, Jan 25th, 2018
2 papers with different focus

- **Amplification**
  - Fire-sales, Liquidity Spirals
    - Losses amplify

- **Contagion/spillovers**

Brunnermeier & Pedersen (2009)
2 papers with different focus

- **Amplification**  
  Fire-sales, Liquidity Spirals  
  • Losses amplify

- **Contagion/spillovers**  
  • Losses spill to other asset  
  - 2 asset case

Brunnermeier & Pedersen (2009)
NYSE Margin Debt ... in the US

NYSE Margin Debt and the S&P 500
Real Values (Adjusted to Present-Day Dollars)

Margin Debt in China

Figure 1. This figure shows the Shanghai Stock Exchange (SSE) Composite Index (the red line), as well as the aggregate brokerage-financed margin debt (blue bars, in billions), at the end of each day for the period October 2014 to August 2015.
Absorbers vs. amplifier

<table>
<thead>
<tr>
<th>Direct</th>
<th>Indirect</th>
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<tbody>
<tr>
<td>Contractual links</td>
<td>“Virtual links”</td>
</tr>
<tr>
<td>Loss through bankruptcy/default</td>
<td>Share similar exposure with other levered players</td>
</tr>
<tr>
<td>Position data</td>
<td>Response indicator</td>
</tr>
<tr>
<td></td>
<td>- expectations/constraints</td>
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- Shock absorber
- Shock amplifier
Liquidity mismatch – not maturity mismatch

- Technological Illiquidity
  - Irreversibility

- Market Illiquidity
  - Price Impact

- Fund Illiquidity
  - Maturity
  - Haircut/margin sensitivity

See Brunnermeier, Gorton & Krishnamurthy (2012)
Data

- Chinese margin account data
  - 180k brokerage-financed/150k shadow-financed accounts
  - Cover 5% of the margin system
  - Observe asset portfolio, debt at daily-account level

- Time frame: May – July 2015

- Stock market index:
Figure 2. This figure shows the average leverage ratio of brokerage-financed margin accounts (red line) and that of shadow-financed margin account at the end of each day for the period May to July 2015.
Contrasting papers: Deleveraging

- Spiral Paper
  - Avoid leverage constraint

- Contagion Paper
  - Aim at leverage target
Contrasting papers: Deleveraging

- **Spiral Paper**
  - Avoid leverage constraint

- **Contagion Paper**
  - Aim at leverage target

\[ P_{j,t} = \frac{\text{Lev}_{j,t-1}}{\text{Lev}_{j,t-1}} \] (at 8:00 a.m.)

- Regress net sell stock \( i \), account \( j \)
- \( \delta_{i,j,t} \propto P_{j,t} \)
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- **Contagion Paper**
  - Aim at leverage target

  - Contagion depends on
    - Deviation from target leverage
    - Portfolio weight of stock \( i \) in account \( j \)

  \[ \delta_{i,j,t} \propto w_{i,j} \Delta \text{Lev}_{j,t} \]

  \[ \propto -w_{i,j} \text{Lev}_{j,t-1} R_{j,t-1} \]

  \[ \propto -w_{i,j} \text{Lev}_{j,t-1} R_{i2,j,t-1} \]
Contrasting papers: Asset Pricing

- Measure of Sell Pressure on returns across horizons

- Spiral paper
  \[ \text{Pressure}_{i,j,t} = \#_{i,j,t} \cdot 1_{P_{j,t} > 0.6} \]

- Contagion paper
  \[ \text{Pressure}_{i,j,t} = \sum_{i_2 \neq i} w_{i,j} \text{Lev}_{j,t-1} R_{i_2,j,t-1} \]

- Linear!

- Stock-level: \( \text{Pressure}_{i,t} = \sum_{j} \text{Pressure}_{i,j,t} \)
- Regress stock returns across horizons
  \[ R_{i,t} \rightarrow t+h \propto \text{Pressure}_{i,t} \]
Reversal Speed

- Spiral paper
  - Reversal after 30 days

- Contagion paper
  - Reversal after 5 days

- Is contagion less important quantitatively?
Pricking Bubble vs. temp. illiquidity

- Finding:
  - Deleveraging “depresses” price temporarily but returns after 30 days (spiral paper) / 5 days (contagion paper)
  - Suggests temporary liquidity problem
- ... pure cross-sectional results (CAR)
Pricking Bubble vs. temp. illiquidity

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- Did it prick a bubble?

- Did it speed up bursting of the bubble (too much)?
  - Long run (real) impact of fast deleveraging?
  - Deleveraging contributes to slowdown of long run growth?
Disposition effect vs. Deleveraging

- **Dispositional Effect absorber**
  - Buy tomorrow after today’s loss
  - Potentially Strong for Chinese Market

- **Deleveraging (Contagion) amplifier**
  - Sell tomorrow after today’s loss

<table>
<thead>
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<th>Panel B: Interacting Portfolio Returns with Leverage Ratio</th>
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<td>Brokerage-Financed Margin Accounts</td>
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- The account with average leverage seems to have net buy order?
- Dispositional Effect as shock absorber?
- Is aggregate impact large?
Nonlinearity

- Linear regression
  - Nice result on nonlinearity of proximity to constraint
  - \( \delta_{i,j,t} = \sum_k \lambda_k I_{k,t-1}^j + \mu_{i,t} + \alpha_j + \text{error} \)

- Why not apply the same idea for asset return test?
  - Current test: \( R_{i,t\to t+h} \) linear in \( \text{Pressure}_{i,t} / \text{Network Cent}_{i,t} \)
  - Could test nonlinearity of measures.
Quantile/CoVaR Regressions

- “Tail-dependency”
- Quantile-regress
- \( F_R^{-1}(q|\text{pressure}_{i,t}) = \alpha_q + \beta_q \text{Pressure}_{i,t} \)

- If pressure of other stocks is high, then return on stock low (controlling for its own pressure)
Quantile Regressions: A Refresher

- **OLS Regression:** min sum of squared residuals
  \[ \beta^{OLS} = \arg\min_{\alpha, \beta} \sum (y_i - \alpha - \beta x_i)^2 \]

  - Predicted value \( E[y|x] = \alpha + \beta x \)

- **Quantile Regression:** min weighted absolute values
  \[ \beta^q = \arg\min_{\alpha, \beta} \sum_i q |y_i - \alpha - \beta x_i| \quad \text{if } (y_i - \alpha - \beta x_i) \geq 0 \]
  \[ \sum_i (1-q)|y_i - \alpha - \beta x_i| \quad \text{if } (y_i - \alpha - \beta x_i) < 0 \]

  - Predicted value \( \text{VaR}_q|x = F^{-1}_y(q|x) = \alpha_q + \beta_q x \)
q-Sensitivities

CS/Tremont Hedge Fund Index

- Fixed Income Arbitrage
- 50%-Sensitivity
- 5%-Sensitivity
- 1%-Sensitivity
Loss vs. Margin Spiral

- Loss spiral

- Margin spiral  (Repo Run as a special case)
  - Only to the extent that “announcement” of shadow bank margin regulation tightened expected future margins (precautionary)
More on margin spiral

- US CDS Market
  Capponi, Cheng, Giglio and Hanyes (2017) explores margin spiral.
  - Margins are more conservatively set than what VaR implies

- US Futures Market
Controversy: Pro-/Countercyclical Leverage

- Procyclical vs. countercyclical leverage

![Graphs showing the relationship between total asset growth and leverage growth for primary dealers and banks.](Fig. 3. Total assets and leverage of commercial banks. Fig. 4. Total assets and leverage of security brokers and dealers.)

Source: Adrian and Shin (2010)
Timing of amplification/contagion

- Reverse causality challenge
  - Price decline ⇒ Leverage rise ⇒ fire-sale ⇒ ...
  - simultaneous vs. lagged

- In theory simultaneous
  - Simultaneous equation problem
  - Same-day contagion should be stronger than lagged-contagion

- Challenge: identification of shock
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<td>(1)</td>
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<tr>
<td></td>
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<tr>
<td>Account Return (t-2)</td>
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* Significant at the 1% level
### Standard Errors

- **Why is controlling for leverage so important to get tight standard errors?**

#### Panel B: Interacting Portfolio Returns with Leverage Ratio

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Brunnermeier
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*R^2 similar, but now all significant.
Endogenous Network

- Policy recommendation:
  save stocks in center of contagion network

- ... but network is endogenous?
  - What determines contagion network?
  - Would policy endogenously change network? Lucas critique
  - Map into a structural model
Conclusion

- First-rate papers
- Great dataset
- Convincing evidence for theory
  - Liquidity spirals
  - Contagion in multiple assets case
- Shock amplifiers vs. absorbers
  - Response indicator: Liquidity mismatch
- Loss spiral (readjust leverage) & margin spiral (lower leverage)
- Is it a temporary depressed liquidity (40/5 days) or bursting a bubble (faster)?
- Tail-dependency - Quantile regressions à la CoVaR
- Nice if link investor characteristics to margin account