Discussion:
Bank Risk Dynamics and Distance to Default

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Main Idea: Bank Assets

Figure 1: Payoffs at maturity in the simplified model with perfectly correlated borrower defaults.

Figure 2: Bank asset value at bank debt maturity as a function of aggregate borrower asset value. Simulated bank asset values shown as dots. Dashed line shows the kinked payoff that would result with perfectly correlated borrower asset values and without staggering of loan maturities.
Discussion: Two Main Points

1. Are banks different because of their assets or their liabilities?

2. How does banks’ change in $\sigma_A$ from Oct 07 to Oct 08 compare to that of non-financial firms?

   - All firms’ DI (and DD) deteriorate together, and to a similar extent.
   - Most of the decline is due to an increase in (idiosyncratic) volatility.
   - For banks, the change in leverage contributes relatively more.
What, if anything, is special about banks?

- Different assets?
  - All firms likely face decreasing returns to scale or scope.
    
    Implies firm value concave in underlying asset value.
  - How much of bank asset value comes from existing loans?
    
    Banking is a (pro) cyclical business.
  - Missing: Bank assets may have much lower value in second best use.
    
    Important connection to liability side.

- Different liabilities?
  - Deposits and other short term debt finance.
  - Tiny equity cushions. \( \frac{V_A - V_B}{V_A} \) small.
  - Subject to runs.

- \( \exists \) Important interaction b/t asset value, fragile capital structure.
Bank Assets: Betas are Procyclical

Table 1: An EW index of the 50 top financial firms are constructed. Monthly observations from July 1926–March 2015 are split into quintiles according to the return on the CRSP VW index by year. The CAPM beta for the financial index overall, for the 20% best years, and for the 20% worst years are shown below. CRSP VW returns are from Ken French’s website.

<table>
<thead>
<tr>
<th></th>
<th>Overall index</th>
<th>Bottom quintile years</th>
<th>Top quintile years</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPM β</td>
<td>0.926***</td>
<td>0.808***</td>
<td>0.992***</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.033)</td>
<td>(0.060)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.004***</td>
<td>−0.002</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Observations</td>
<td>1,065</td>
<td>268</td>
<td>177</td>
</tr>
<tr>
<td>R²</td>
<td>0.753</td>
<td>0.687</td>
<td>0.608</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.752</td>
<td>0.685</td>
<td>0.606</td>
</tr>
<tr>
<td>Residual Std. Error</td>
<td>0.029 (df = 1063)</td>
<td>0.025 (df = 266)</td>
<td>0.041 (df = 175)</td>
</tr>
<tr>
<td>F Statistic</td>
<td>3,234.856*** (df = 1; 1063)</td>
<td>582.909*** (df = 1; 266)</td>
<td>271.370*** (df = 1; 175)</td>
</tr>
</tbody>
</table>

Note: *p<0.1; **p<0.05; ***p<0.01
Bank Assets: What’s Missing in Model

Banks scale loan portfolio up and down with aggregate state.
Bank Assets: What’s Missing in Model

Bank assets more varied. BofA Book Assets 06/30/2010
### Bank Liabilities

<table>
<thead>
<tr>
<th>Good State</th>
<th>Bad State</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td><strong>Liabilities</strong></td>
</tr>
<tr>
<td>Cash</td>
<td>STD</td>
</tr>
<tr>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Loans</td>
<td>Equity</td>
</tr>
<tr>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

#### Crisis State

<table>
<thead>
<tr>
<th><strong>Assets</strong></th>
<th><strong>Liabilities</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>STD</td>
</tr>
<tr>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>Loans</td>
<td>Equity</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

**Crisis State with Partial Run**

<table>
<thead>
<tr>
<th><strong>Assets</strong></th>
<th><strong>Liabilities</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>STD</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Loans</td>
<td>Equity</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

Note: Must reconcile with lower correlation with market in bad times.
Bank Assets = A(L)
Discussion: Two Main Points

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2. How does banks’ change in $\sigma_A$ from Oct 07 to Oct 08 compare to that of non-financial firms?

- All firms’ DI (and DD) deteriorate together, and to a similar extent.
- Most of the decline is due to an increase in (idiosyncratic) volatility.
- For banks, the change in leverage contributes relatively more.
\[ \text{DI} = \frac{V_A - V_B}{V_A} \frac{1}{\sigma_A} \approx \frac{1}{\sigma_E} \]

%. change in asset value which renders firm insolvent, measured in units of \( \sigma_A \).
I.e. How many \( \sigma_A \)'s is a firm's equity cushion?

Use the structural measure to decompose changes in financial soundness into \( \Delta \text{ lvg} \) and \( \Delta \text{ vol} \). How does 07/08 change in \( \sigma_A \) for banks and non-banks compare?
\[ \frac{1}{\sigma_E} \approx \frac{V_A - V_B}{V_A} \frac{1}{\sigma_A} = \text{DI} \]

Are Banks Different?

Figure 22: A comparison of the log median measured DI for the largest 50 financial and non-financial firms in terms of market capitalization, 1962-2012. The horizontal lines indicate the position of our benchmark cutoffs (DI=1,2,3,4) on the log scale.
\[
\frac{1}{\sigma_E} \approx \frac{V_A - V_B}{V_A} \frac{1}{\sigma_A} = \text{DI}
\]

**Figure S8:** The median of log DI for those firms with no long term debt (in blue) and those firms long term debt (in red), 1972-2012.

**Punch line:** Banks, non-financials, tech firms experience similar DI declines. Larger for firms with more debt. But, is it \( \Delta \) lvg or \( \Delta \) vol?
$\Delta_{07-08} \ln(DI) = \Delta_{07-08} \ln\left(\frac{V_A - V_B}{V_A}\right) + \Delta_{07-08} \ln\left(\frac{1}{\sigma_A}\right)$
\[ \Delta_{07-08} \ln(DI) = \Delta_{07-08} \ln\left( \frac{V_A - V_B}{V_A} \right) + \Delta_{07-08} \ln\left( \frac{1}{\sigma_A} \right) \]
\[ \Delta_{07-08} \ln(DI) = \Delta_{07-08} \ln\left(\frac{V_A-V_B}{V_A}\right) + \Delta_{07-08} \ln\left(\frac{1}{\sigma_A}\right) \]

Smallest equity cushion is portfolio 1 (banks)
Largest equity cushion is portfolio 5 (tech)
Decomposition Take Aways

• Overall, $\Delta \frac{1}{\sigma_A}$ More Important  
  More blue then red on previous slides!

• There does appear to be systematic variation in the relative contribution of $\Delta$ lvg vs. $\Delta$ vol.  
  Firms with more leverage (and banks) attribute more of their decline to equity cushions shrinking with falling asset values.
Bond spreads, CDS spreads, DI and DD similar

Not a problem with structural models, bond spreads look the same. The crisis appears to be a surprise increase in idiosyncratic volatility.
\[ \frac{1}{\sigma_E} \approx \frac{V_A - V_B}{V_A} \frac{1}{\sigma_A} = \text{DI} \]

- **Median DI Total Volatility**
- **Median DI Idiosyncratic Volatility**
Does not mean banks don’t matter

Need to understand large variation in quantity of idiosyncratic risk that drives variation in firms’ financial soundness.
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- For banks, the change in leverage contributes relatively more.
- Note: Fragility affects both first and second moments.
Takeaway from Paper

- Extremely worthwhile to put a model on the table.
- Log normality is clearly a simplifying assumption.
- Useful to rigorously explore the implications of alternative assumptions with micro foundations.