The Technical Default Spread

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Motivation and Research Questions

- Traditional macro-finance treats lenders as passive bystanders

Fig. 1 Traditional view of control rights (source: Nini et al (2012))
Motivation and Research Questions

- In practice, lenders write loan covenants to ensure loan repayment
  - Covenants are a *pervasive* tool to discipline borrowers
    - Virtually all private credit agreements contain at least one covenant (Roberts and Sufi (2009))
  - Breaching a covenant known as *technical default*, results in transfer of control rights

Fig. 2 Technical default and lender control
Motivation and Research Questions

- Some examples of creditor control rights after covenant violation
  - Stronger voice in corporate decisions
    - Resolution plan (Roberts and Sufi (2009), Lou and Otto (2018))
    - Mandatory consultant call-in
  - Projects actually taken over by lenders
    - Known as “step-in rights” in project finance (Madykov (2015), Rossi (2018))

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  - In the time series?
  - In the cross-section?
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• Presents a dynamic GE model of corporate investment with endogenous loan covenants
  ○ Builds on Bernanke, Gertler, and Gilchrist (1999)
  ○ Technical default assigns investment control rights to lenders (Chava and Roberts (2008), Nini et al. (2009))

• Studies effects of technical default on investment, risk taking, and cost of equity

• Shows that payoffs of lenders/entrepreneurs lead to
  ○ Different investment choices
    - Concave payoffs induce lender to choose risk-less investments
    - Convex payoffs and loan contract induce entrepreneur to choose risky investments
  ○ Different exposure to aggregate shock
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- Uses Murfin (2012) loan covenant strictness as a measure of distance to technical default
  - Probability that firm will breach a covenant next quarter

- Shows that high-strictness firms
  - Have more conservative investment policies
  - Earn lower future returns
  - E.g., portfolio of firms in top strictness quintile earns average 4% lower annual returns than portfolio of firms in bottom quintile
  - Results extremely robust, not related to distress anomaly
  - Results also confirmed in RDD framework

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Model
Bernanke, Gertler, and Gilchrist (BGG) Model Overview

Diagram:

- **Household**
  - **Entrepreneurs**
    - Wealth $N$
  - **Workers**

- **Firm**
  - $QK$
  - $B$

- **Bank**
  - Equity
  - Deposit
  - Loans

- **Idiosyncratic shock**
  - $K \rightarrow \exp(\omega)K$
Two Major Departures from BGG

1. Firm can invest \((1 - \theta)\) fraction of assets in risk-free bank deposit

2. Technical default based on signal of \(\omega\)
Entrepreneur in Control

- Investment policy $\theta$ decided by entrepreneur (as in BGG)
What Happens in Technical Default?

- Investment policy $\theta$ decided by lender
Optimal Investment Choice: Overview

• Lender in control choose $\theta = 0$
  ○ Wants to preserve concave payoff

• Entrepreneur in control choose $\theta = 1$
  ○ If $\omega$ is low, entrepreneur better off giving up control
    - Lender would make the same investment choice as she would, but charge lower loan payment

$\Rightarrow$ Entrepreneur optimally gives up control rights in exchange for lower loan rate
  - As in Demiroglu and James (2010)
Firms: Production Technology and Labor Choice

- At time $t$, firm $i$ uses capital $K_{it}$ and labor $L_{it}$ to produce output $Y_{it}$ according to

$$Y_{i,t} = \bar{Z}_t \left(\exp(\omega_{i,t}) K_{i,t}\right)^{\alpha} \left(L_{i,t}\right)^{1-\alpha},$$

with $\alpha \in (0, 1)$ and $\bar{Z}_t$ an aggregate productivity shock.

- Capital is traded on competitive markets at price $Q_t$, depreciates at rate $\delta \in (0, 1)$.

- The return on capital from $t$ to $t+1$ is

$$R^K_{t+1} = \frac{1}{Q_t} \left[MPK_{t+1} + (1 - \delta) Q_{t+1}\right]. \quad (1)$$

  - $MPK_{t+1} K_{t+1}$ is the firm’s dividend at $t + 1$.
  - $(1 - \delta) Q_{t+1} K_{t+1}$ is the value of the firm’s undepreciated capital at $t + 1$. 

Entrepreneurs: Idiosyncratic Productivity, Signal Structure

- Each entrepreneur $i$ receives idiosyncratic productivity shock $\omega_i$
  - Turns one unit of productive capital into $\exp(\omega_i)$ productive units
  - Similar to Bernanke et al. (1999)

- Idiosyncratic shock between time $t - 1$ and $t$ is sum of two shocks
  \[ \omega_{it} = \omega_{i0}^{0} + \omega_{i1}^{1}, \]
  - $\omega_{i0}^{0}, \omega_{i1}^{1}$ are normally-distributed iid shocks

- Assumption: $\omega_{i0}^{0}$ and $\omega_{i1}^{1}$ are realized at different stages
  - $\omega_{i0}^{0}$ is realized in the middle of $t - 1$, before investment decision
    - We think of it as a signal on the entrepreneur’s risky cash flows at $t$
  - $\omega_{i1}^{1}$ is realized at the end of $t - 1$, after investment decision
Timeline

• Each period $t$ is divided into three sub-periods

• Stage 1:
  ◦ Entrepreneurs with wealth $N_{it}$ meet with lenders, sign loan contract
  ◦ Contract features endogenous covenant threshold $\bar{\omega}_{it+1}$

• Stage 2:
  ◦ Idiosyncratic signal $\omega^0_{it+1}$ is realized
  ◦ Control rights allocation, investment $\theta_{it+1}$ based on $\omega^0_{it+1}$ and $\bar{\omega}^0_{it+1}$

• Stage 3:
  ◦ Idiosyncratic shock $\omega^1_{it+1}$ and aggregate shock $Z_{it+1}$ are realized
  ◦ Entrepreneurs default if, for given $\theta_{it+1}$, $\omega^0_{it+1}$,

\[
\left[ \theta_{it+1} \exp \left( \omega^0_{it+1} + \omega^1_{it+1} \right) R^K_{it+1} + (1 - \theta_{it+1}) R^D_{it+1} \right] A_{it} < R^K_{it+1} B_{it}
\]

  ◦ Lenders recover fraction $1 - \zeta$ of firm’s assets
Timeline

- Each period $t$ is divided into three sub-periods

- Stage 1:
  - Entrepreneurs with wealth $N_{it}$ meet with lenders, sign loan contract
    - Contract features endogenous covenant threshold $\bar{\omega}_{it+1}^0$

- Stage 2:
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    \[
    \left[ \theta_{it+1} \exp \left( \omega_{it+1}^0 + \omega_{it+1}^1 \right) R_{it+1}^K + (1 - \theta_{it+1}) R_{it+1}^D \right] A_{it} < R_{it+1}^B B_{it}
    \]
  - Lenders recover fraction $1 - \zeta$ of firm's assets
Timeline

• Each period $t$ is divided into three sub-periods
  
  • Stage 1:
    - Entrepreneurs with wealth $N_{it}$ meet with lenders, sign loan contract
      - Contract features endogenous covenant threshold $\tilde{\omega}_{it+1}$
  
  • Stage 2:
    - Idiosyncratic signal $\omega_{it+1}^{0}$ is realized
    - Control rights allocation, investment $\theta_{it+1}$ based on $\omega_{it+1}^{0}$ and $\tilde{\omega}_{it+1}^{0}$
  
  • Stage 3:
    - Idiosyncratic shock $\omega_{it+1}^{1}$ and aggregate shock $Z_{t+1}$ are realized
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      \[
      \left[ \theta_{it+1} \exp \left( \omega_{it+1}^{0} + \omega_{it+1}^{1} \right) R_{t+1}^{K} + (1 - \theta_{it+1}) R_{t+1}^{D} \right] A_{it} < R_{it+1}^{B} B_{it}
      \]
      - Lenders recover fraction $1 - \zeta$ of firm’s assets
Financial Contract Problem

- Ex ante, the endogenous loan terms maximize entrepreneurs’ ex-ante value given lender break-even

\[
\left( B_{it}, R^{B}_{it+1}, \hat{\omega}_{it+1}^0 \right)^* = \arg \max_{(B_{it}, R^{B}_{it+1}, \hat{\omega}_{it+1}^0)} V_{it}
\]

subject to

\[
W_{it} = R^{B}_{it+1} B_{it}
\]

where

\[
V_{it} = \int_{-\infty}^{\hat{\omega}_{i,t+1}} V^L_{it} dF \left( \omega_{i,t+1}^0 \right) + \int_{\hat{\omega}_{i,t+1}}^{\infty} V^E_{it} dF \left( \omega_{i,t+1}^0 \right),
\]

\[
W_{it} = \int_{-\infty}^{\hat{\omega}_{i,t+1}} W^L_{it} dF \left( \omega_{i,t+1}^0 \right) + \int_{\hat{\omega}_{i,t+1}}^{\infty} W^E_{it} dF \left( \omega_{i,t+1}^0 \right).
\]

- \( V^L_{it} \) is value of entrepreneur when lender in control
- \( V^E_{it} \) is value of entrepreneur when herself in control
Results: Expected Returns

- Two sets of results simplify model computation
  - Optimal contract features same terms across all entrepreneurs
    - Allows us to achieve aggregation
  - Optimal investment choice implies $\theta^E = 1$ and $\theta^L = 0$

- Relationship between expected return and covenant strictness:

\[
R_{i,t+1} = \begin{cases} 
R^D_{i,t+1} & \text{if } \omega^0_{i,t+1} < \bar{\omega}^0_{i,t+1}, \\
\exp(\omega^0_{i,t+1}) R^K_{i,t+1} (1 + H_t) - R^B_{i,t+1} H_t & \text{if } \omega^0_{i,t+1} \geq \bar{\omega}^0_{i,t+1} \text{ and } \omega^1_{i,t+1} \geq \hat{\omega}^1_{i,t+1}, \\
0 & \text{otherwise},
\end{cases}
\]

where $H$ is leverage ratio $B/N$

- When signal is low, lender is in control, choose risk-less asset
  - Expected return on equity is low
- When signal is high, entrepreneur in control choose risky asset
  - Expected return on equity is high
Empirical Analysis
Data

• LPC Dealscan: Terms (including covenants) for syndicated and bilateral private loans
  ○ More than 75% of value of commercial loans in the US (Bradley and Roberts (2015))
  ○ Data sourced from SEC filings, private contracts

• Compustat/CRSP: Quarterly financial data, returns

• Greg Nini: Covenant violation data
  ○ Sourced from firm SEC filings

• Sample frequency and period: Quarterly, 1996q1-2016q4
## Investment Conservatism for Strictness-Sorted Portfolios

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>High</th>
<th>High-4</th>
<th>High-Low</th>
<th>4-Low</th>
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</thead>
<tbody>
<tr>
<td>Δ CAPX/Asset</td>
<td>-0.08*</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.11*</td>
<td>-0.08*</td>
<td>-0.03</td>
<td>0.04*</td>
</tr>
<tr>
<td>t-stat.</td>
<td>-1.78</td>
<td>-1.10</td>
<td>-1.00</td>
<td>-0.77</td>
<td>-1.80</td>
<td>-1.94</td>
<td>-0.66</td>
<td>1.66</td>
</tr>
<tr>
<td>Δ ACQU/Asset</td>
<td>-0.18***</td>
<td>-0.10</td>
<td>-0.19***</td>
<td>-0.09</td>
<td>-0.34***</td>
<td>-0.25**</td>
<td>-0.17</td>
<td>0.08</td>
</tr>
<tr>
<td>t-stat.</td>
<td>-2.99</td>
<td>-1.09</td>
<td>-2.96</td>
<td>-1.12</td>
<td>-3.15</td>
<td>-2.36</td>
<td>-1.58</td>
<td>0.97</td>
</tr>
</tbody>
</table>

- We sort firms into five portfolios based on their strictness
  - Constructed following Murfin (2012)
  - Portfolios are rebalanced quarterly

- Firms in high-strictness portfolio feature conservative investment
  - Both relative to low-strictness and to 4th portfolio
  - Investment conservatism measured with CAPEX and acquisition expenditure growth (Nini et al. (2012))
  - Consistent with recent empirical evidence (Chava and Roberts (2008), Nini et al. (2009, 2012), Falato and Liang (2016), Ersahin et al. (2017))
### Excess Returns for Strictness-Sorted Portfolios

<table>
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<tr>
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<th>4-Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess Return (pp)</td>
<td>6.76*</td>
<td>8.40**</td>
<td>6.90*</td>
<td>10.36**</td>
<td>2.64</td>
<td>-7.72**</td>
<td>-4.12</td>
<td>3.60*</td>
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<tr>
<td>t-stat.</td>
<td>1.90</td>
<td>2.27</td>
<td>1.83</td>
<td>2.59</td>
<td>0.49</td>
<td>-2.32</td>
<td>-1.52</td>
<td>1.88</td>
</tr>
<tr>
<td>$\alpha_{FF}$</td>
<td>-2.76*</td>
<td>-2.03</td>
<td>-3.06</td>
<td>-0.79</td>
<td>-6.56***</td>
<td>-5.77*</td>
<td>-3.80</td>
<td>1.97</td>
</tr>
<tr>
<td>t-stat.</td>
<td>-1.84</td>
<td>-1.12</td>
<td>-1.45</td>
<td>-0.42</td>
<td>-2.68</td>
<td>-1.97</td>
<td>-1.64</td>
<td>1.19</td>
</tr>
<tr>
<td>$\beta_{MKT}$</td>
<td>1.06***</td>
<td>1.03***</td>
<td>1.08***</td>
<td>1.09***</td>
<td>1.18***</td>
<td>0.10</td>
<td>0.12*</td>
<td>0.02</td>
</tr>
<tr>
<td>t-stat.</td>
<td>30.64</td>
<td>27.18</td>
<td>29.53</td>
<td>21.09</td>
<td>24.88</td>
<td>1.58</td>
<td>1.88</td>
<td>0.56</td>
</tr>
<tr>
<td>$\beta_{SMB}$</td>
<td>0.09</td>
<td>0.24***</td>
<td>0.19***</td>
<td>0.30***</td>
<td>0.37***</td>
<td>0.07</td>
<td>0.28***</td>
<td>0.21***</td>
</tr>
<tr>
<td>t-stat.</td>
<td>1.70</td>
<td>3.55</td>
<td>2.75</td>
<td>4.31</td>
<td>6.37</td>
<td>0.85</td>
<td>3.09</td>
<td>3.53</td>
</tr>
<tr>
<td>$\beta_{HML}$</td>
<td>0.05</td>
<td>0.02</td>
<td>0.12*</td>
<td>0.17</td>
<td>0.21**</td>
<td>0.04</td>
<td>0.17**</td>
<td>0.13</td>
</tr>
<tr>
<td>t-stat.</td>
<td>0.58</td>
<td>0.18</td>
<td>1.69</td>
<td>1.31</td>
<td>2.18</td>
<td>0.37</td>
<td>2.03</td>
<td>1.41</td>
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<tr>
<td>$\beta_{RMW}$</td>
<td>0.29***</td>
<td>0.45***</td>
<td>0.32***</td>
<td>0.39***</td>
<td>-0.09</td>
<td>-0.48***</td>
<td>-0.37***</td>
<td>0.10</td>
</tr>
<tr>
<td>t-stat.</td>
<td>4.86</td>
<td>4.65</td>
<td>4.42</td>
<td>4.74</td>
<td>-0.68</td>
<td>-3.82</td>
<td>-2.75</td>
<td>1.38</td>
</tr>
<tr>
<td>$\beta_{CMA}$</td>
<td>0.06</td>
<td>0.13</td>
<td>-0.02</td>
<td>0.13</td>
<td>-0.25</td>
<td>-0.37***</td>
<td>-0.30*</td>
<td>0.07</td>
</tr>
<tr>
<td>t-stat.</td>
<td>0.80</td>
<td>1.28</td>
<td>-0.17</td>
<td>1.23</td>
<td>-1.57</td>
<td>-2.64</td>
<td>-1.87</td>
<td>0.76</td>
</tr>
</tbody>
</table>

- Firms in high-strictness portfolio earn lower expected returns
  - Similar pattern observed for investment conservatism
- Pattern arises from exposure to investment and profitability factors (Fama and French (2015), Hou et al. (2015))
  - Findings provide supportive evidence for mechanism
Robustness and Additional Tests

- Strictness strongly predicts future covenant violation

- Strictness-return relationship strong and robust to
  - Fama-MacBeth cross-sectional regression specifications
  - Pooled OLS regression specifications
  - Alternative specifications for strictness measure

- RDD tests show that covenant violation is associated with reduction in future excess returns

- Results are not driven by financially-distressed firms
  - E.g., stronger results for low-failure-probability firms
  - Suggests our mechanism arises from different economic forces than distress anomaly (e.g., Garlappi and Yan (2011))
Current Work

- Quantitative analysis of the model
  - Aggregate implications:
    - Covenants alter impulse response functions of aggregate variables relative to Bernanke et al. (1999)
    - Time-varying strictness is an important state variable in the economy
  - Cross-sectional implications:
    - Firms close to technical default have less exposures to aggregate shocks, thus lower expected return
Conclusions

• We build dynamic model of firm borrowing with endogenous loan covenants and transfer of control rights
  ○ Investment control rights transferred to lenders when covenants are breached

• We provide evidence for mechanism in the data
  ○ Firms closer to technical default
    - Exhibit more conservative investment
    - Have 4% lower expected returns
Appendix
## Strictness: Measure Validation

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Quarter Lag Strictness</td>
<td>0.109***</td>
<td>0.065***</td>
<td>0.058***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Firm FE</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year-Quarter FE</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.069</td>
<td>0.249</td>
<td>0.257</td>
</tr>
<tr>
<td>Observations</td>
<td>72,781</td>
<td>72,639</td>
<td>72,639</td>
</tr>
</tbody>
</table>

- Strictness is positively correlated with future covenant violations
## Fama-MacBeth

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<th>(3)</th>
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</tr>
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<tbody>
<tr>
<td><strong>Dependent Variable: Monthly Excess Returns</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Strictness</strong></td>
<td>-0.357***</td>
<td>-0.327***</td>
<td>-0.364***</td>
<td>-0.330***</td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>-0.088*</td>
<td>-0.100**</td>
<td>-0.066</td>
<td>-0.079*</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.05)</td>
<td>(0.05)</td>
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</tr>
<tr>
<td><strong>Log B/M</strong></td>
<td>0.141</td>
<td>0.136</td>
<td>0.081</td>
<td>0.075</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.11)</td>
</tr>
<tr>
<td><strong>Reversal</strong></td>
<td>-0.016**</td>
<td>-0.016**</td>
<td>-0.016**</td>
<td>-0.017**</td>
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<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
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<tr>
<td><strong>Book Leverage</strong></td>
<td>-0.112</td>
<td>-0.081</td>
<td>-0.415</td>
<td>-0.407</td>
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<tr>
<td></td>
<td>(0.48)</td>
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<tr>
<td><strong>ROA</strong></td>
<td>5.082</td>
<td>3.217</td>
<td>5.139</td>
<td>3.376</td>
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<td>(3.87)</td>
<td>(3.53)</td>
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<td>(3.42)</td>
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<tr>
<td><strong>Pr(Failure)</strong></td>
<td>-80.929**</td>
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<td>-91.997***</td>
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<tr>
<td></td>
<td>(31.79)</td>
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<tr>
<td><strong>EDF</strong></td>
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<td>0.192</td>
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<td>2.272</td>
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<tr>
<td><strong>R-Squared</strong></td>
<td>0.041</td>
<td>0.047</td>
<td>0.049</td>
<td>0.054</td>
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<tr>
<td><strong>Observations</strong></td>
<td>219,331</td>
<td>218,952</td>
<td>214,750</td>
<td>214,699</td>
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## Fama-MacBeth with Portfolio Dummies

<table>
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<tbody>
<tr>
<td>Str. Portfolio 2</td>
<td>0.013</td>
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<td>(0.09)</td>
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<tr>
<td>Str. Portfolio 3</td>
<td>-0.026</td>
<td>-0.034</td>
<td>0.002</td>
<td>-0.008</td>
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<td>(0.09)</td>
<td>(0.08)</td>
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<tr>
<td>Str. Portfolio 4</td>
<td>-0.162</td>
<td>-0.169</td>
<td>-0.147</td>
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<td>(0.11)</td>
<td>(0.10)</td>
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<tr>
<td>High Str. Portfolio</td>
<td>-0.310**</td>
<td>-0.296**</td>
<td>-0.317**</td>
<td>-0.298**</td>
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<tr>
<td>Pr(Failure)</td>
<td>-84.430***</td>
<td>-94.865***</td>
<td>-94.865***</td>
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<tr>
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<td>(32.18)</td>
<td>(28.83)</td>
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<td>EDF</td>
<td>0.119</td>
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<td>2.216</td>
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<td>(2.52)</td>
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<td>(2.42)</td>
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<tr>
<td>Other Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.044</td>
<td>0.050</td>
<td>0.052</td>
<td>0.057</td>
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<td>219,247</td>
<td>218,872</td>
<td>214,669</td>
<td>214,619</td>
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- Dummies for firms belonging to strictness portfolios
## Pooled OLS

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<tbody>
<tr>
<td><strong>Strictness</strong></td>
<td>-0.440*** (0.16)</td>
<td>-0.445*** (0.17)</td>
<td>-0.482*** (0.17)</td>
<td>-0.480*** (0.17)</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>-0.119** (0.06)</td>
<td>-0.111* (0.06)</td>
<td>-0.091 (0.06)</td>
<td>-0.088 (0.06)</td>
</tr>
<tr>
<td><strong>Log B/M</strong></td>
<td>0.159 (0.13)</td>
<td>0.149 (0.13)</td>
<td>0.071 (0.13)</td>
<td>0.078 (0.13)</td>
</tr>
<tr>
<td><strong>Reversal</strong></td>
<td>-0.032** (0.01)</td>
<td>-0.032** (0.01)</td>
<td>-0.033** (0.02)</td>
<td>-0.033** (0.02)</td>
</tr>
<tr>
<td><strong>Book Leverage</strong></td>
<td>-0.116 (0.51)</td>
<td>-0.176 (0.51)</td>
<td>-0.505 (0.55)</td>
<td>-0.478 (0.55)</td>
</tr>
<tr>
<td><strong>ROA</strong></td>
<td>-1.235 (6.11)</td>
<td>-0.789 (5.50)</td>
<td>-0.500 (6.16)</td>
<td>0.071 (5.73)</td>
</tr>
<tr>
<td><strong>Pr(Failure)</strong></td>
<td>3.513 (2.77)</td>
<td>2.600 (2.95)</td>
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<tr>
<td><strong>EDF</strong></td>
<td>2.226* (1.16)</td>
<td>1.959 (1.23)</td>
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<tr>
<td><strong>R-Squared</strong></td>
<td>0.151</td>
<td>0.151</td>
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<td>219,331</td>
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## RDD Tests

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<tr>
<td>Violation</td>
<td>-0.443***</td>
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<td>(0.11)</td>
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<tr>
<td>Distance</td>
<td>0.134***</td>
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<tr>
<td></td>
<td>(0.03)</td>
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<tr>
<td>Violation × Distance</td>
<td>-0.224***</td>
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<tr>
<td></td>
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<tr>
<td>Size</td>
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<td>(0.02)</td>
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<tr>
<td>Log B/M</td>
<td>0.068</td>
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<td>(0.05)</td>
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<tr>
<td>Book Leverage</td>
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<td>ROA</td>
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<td>(1.60)</td>
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<td>High Order Polynomials</td>
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<td>Year-Quarter FE</td>
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<td>R-Squared</td>
<td>0.214</td>
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<td>Observations</td>
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</table>
## Distressed Firms

<table>
<thead>
<tr>
<th></th>
<th>EDF $\leq$ 90th Percentile</th>
<th>Pr(Failure) $\leq$ 90th Percentile</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
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<tr>
<td>Str. Portfolio 2</td>
<td>-0.005</td>
<td>0.011</td>
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<td>(0.08)</td>
<td>(0.08)</td>
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<tr>
<td>Str. Portfolio 3</td>
<td>-0.097</td>
<td>-0.072</td>
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<td>(0.08)</td>
<td>(0.08)</td>
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<tr>
<td>Str. Portfolio 4</td>
<td>-0.203**</td>
<td>-0.171*</td>
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<tr>
<td></td>
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<td>(0.10)</td>
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<tr>
<td>High Str. Portfolio</td>
<td>-0.328**</td>
<td>-0.308**</td>
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<td>(0.14)</td>
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<tr>
<td>Distress Controls</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>Other Controls</td>
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<td>Yes</td>
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<tr>
<td>R-Squared</td>
<td>0.044</td>
<td>0.052</td>
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<tr>
<td>Observations</td>
<td>193,327</td>
<td>193,281</td>
</tr>
</tbody>
</table>

- Expected Default Frequency (EDF) from Bharath and Shumway (2008)
- Failure Probability from Campbell et al. (2008)