Reorganization or Exit: Bankruptcy Choice and Firm Dynamics

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1The views expressed here do not necessarily reflect those of the FRB Philadelphia or The Federal Reserve System.
Questions

- How does bankruptcy law affect the financial decisions of corporations and firm dynamics?

- What are the positive and normative consequences of an American Bankruptcy Institute proposal (similar to Aghion, Hart, Moore (1992), hereafter AHM) which amounts to a “fresh start” for bankrupt firms?
**Current Bankruptcy Options**

- Liquidation (Chapter 7)
  - The proceeds of liquidating the corporation’s assets \( k \) with fire-sale price \( s_7 \) are used to repay debt \( b \) after which the firm exits.
  - Limited liability for corporate shareholders
    \[
    \max\{s_7 k - b - c_7, 0\}
    \]
    where \( s_7 < 1 \) is firesale value and \( c_7 \) are bankruptcy costs.
- Reorganization (Chapter 11)
  - Bankruptcy law determines the negotiation rules over the fraction \( \phi \) of debt that is repaid and cash flow to shareholders
  - After paying \( c_{11} \) bankruptcy costs, the reorganized corporation retains its assets and continues to operate.
WHAT WE DO

1. Document capital structure facts for non-bankrupt vs Ch. 7 vs. Ch. 11 firms from Compustat.

2. Extend structural corporate finance models to include bankruptcy selection and endogenous entry/exit in a GE framework.

3. After estimating the parameters of the model to match item 1 facts, conduct policy counterfactual to assess variant of current American Bankruptcy Institute reform proposal (similar to AHM (1992))
   - “fresh start” for bankrupt firms: after declaring bankruptcy, debt is canceled and creditors receive the rights to an all-equity firm.
   - The “debt overhang” problem is reduced considerably under the AHM proposal since the creditor chooses to liquidate the firm only when the NPV of a firm with no debt is negative.
   - Does this move the economy closer to a financially frictionless “efficient” economy?
PREVIEW OF RESULTS

- Counterfactual yields sizable drop in borrowing costs leading to increased investment, a shift in the size distribution of firms, higher measured aggregate productivity and lower $Var(mpk)$.

- Welfare gains from higher consumption and output (closing the gap with the efficient case)
PREVIEW OF RESULTS

▶ Counterfactual yields sizable drop in borrowing costs leading to increased investment, a shift in the size distribution of firms, higher measured aggregate productivity and lower \( \text{Var}(mpk) \).

▶ Welfare gains from higher consumption and output (closing the gap with the efficient case)

INTUITION

▶ After the reform, absolute priority is enforced (lenders get full payment unless equity is wiped out)

▶ Reduction in debt overhang problem and dead-weight losses associated with inefficient liquidation (most bankruptcies result in reorganization)
Some Previous Literature

- Cooley and Quadrini (2001, AER), Hennessy and Whited (2007, JF) assume positive cash flows so Ch. 11 is a dominant strategy and there is no exit via Ch. 7. Further, creditor take-it-or-leave-it bargaining in renegotiation. More general bargaining problem in Eraslan (2008, IER).

- Gomes (2001, AER) allows negative cash flows (due to fixed costs) so has endogenous exit via Ch. 7 but no Ch. 11 in an industry equilibrium. Khan, et. al. (2014) also consider a version of Ch. 7 in GE with aggregate shocks.

- Broadie, et. al. (2007, JF) study Ch. 7 vs. Ch. 11 decision problem but with exogenous cash flows and initial bond finance of fixed investment.
COMPSTAT DATA

- Annual observations from 1980-2014.
- Medians (means) are time series averages of the cross-sectional median (mean) obtained for every year in our sample.
- Consistent with definitions in Duffie, et. al.:
  - Ch. 7 is value for final observation of a firm that exits via DLRSN code 03 (Liquidation) (nobs=315).
  - Ch. 11 is value for initial period observation of a DLRSN code 02 (Bankruptcy) (nobs=1,319).
- Non-bankrupt identifies annual observations (nobs=173,617) of firms that are not in the state of bankruptcy (i.e. firms which never declare bankruptcy as well as observations of firms before they declare bankruptcy excluding the above).
- To be consistent with the way that the U.S. Census constructs exit statistics, a deleted firm is counted as a firm that exits if its deletion code is not 01 (e.g. M&A), 02 (Ch.11), 04 (Reverse A), 07&10 (other), 09 (private).
### Compustat Data Facts 1980-2014

<table>
<thead>
<tr>
<th>Moment</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Frequency of Exit (%)</td>
<td>1.10</td>
</tr>
<tr>
<td>Fraction of Exit by Ch 7 (%)</td>
<td>19.83</td>
</tr>
<tr>
<td>Frequency of (all) Bankruptcy (%)</td>
<td>0.96</td>
</tr>
<tr>
<td>Fraction of Chapter 11 Bankruptcy (%)</td>
<td>79.15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Non-Bankrupt</th>
<th>Chapter 11</th>
<th>Chapter 7</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital (millions 1983$)</td>
<td>917.05</td>
<td>33.21</td>
<td>405.71*,***</td>
<td>108.47</td>
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<tr>
<td>Cash (millions 1983$)</td>
<td>119.18</td>
<td>9.06</td>
<td>65.86*,***</td>
<td>10.90</td>
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<tr>
<td>Assets (millions 1983$)</td>
<td>1036.22</td>
<td>53.26</td>
<td>471.69*</td>
<td>123.56</td>
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<tr>
<td>Op. Income (EBITDA) / Assets (%)</td>
<td>11.13</td>
<td>15.89</td>
<td>-12.67*,***</td>
<td>-2.05</td>
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<tr>
<td>Net Debt / Assets (%)</td>
<td>26.08</td>
<td>15.79</td>
<td>58.05*,***</td>
<td>36.50</td>
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<tr>
<td>Total Debt / Assets (%)</td>
<td>57.38</td>
<td>35.47</td>
<td>79.51*,***</td>
<td>53.87</td>
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<tr>
<td>Frac. Firms with Negative Net Debt (%)</td>
<td>26.26</td>
<td>-</td>
<td>17.49*</td>
<td>-</td>
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<tr>
<td>Secured Debt / Total Debt (%)</td>
<td>43.78</td>
<td>40.65</td>
<td>50.26*</td>
<td>49.66</td>
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<td>Interest Coverage (EBITDA/Interest)</td>
<td>13.88</td>
<td>4.78</td>
<td>-1.76*</td>
<td>-0.20</td>
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<tr>
<td>Equity Issuance / Assets (%)</td>
<td>8.10</td>
<td>0.09</td>
<td>4.82*</td>
<td>0.00</td>
</tr>
<tr>
<td>Fraction Firms Issuing Equity (%)</td>
<td>27.62</td>
<td>-</td>
<td>35.22*</td>
<td>-</td>
</tr>
<tr>
<td>Net Investment / Assets (%)</td>
<td>1.43</td>
<td>0.62</td>
<td>-4.37*,***</td>
<td>-4.73</td>
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<tr>
<td>Dividend / Assets (%)</td>
<td>5.92</td>
<td>3.12</td>
<td>3.34*,***</td>
<td>1.32</td>
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<td>Z-score</td>
<td>3.77</td>
<td>3.21</td>
<td>-0.93*,***</td>
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<td>DD Prob. of Default (%)</td>
<td>2.20</td>
<td>0.00</td>
<td>3.27*,***</td>
<td>0.72</td>
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</table>

**Note:** *p < 0.10, **p < 0.05, ***p < 0.01
Summary Data Facts

- Exit rates (fraction of deletions classified as exit to all firms in a given year) are small (1.10%).

- 20% of exits are by Chapter 7 liquidation.

- Fraction of all firms declaring bankruptcy is 0.96%.

- 79% of bankruptcies are by Chapter 11 (similar to BWZ who have data on recovery rates).
  - Note: Statistics on all business filings from the U.S. Courts suggests a lower fraction of Ch. 11, roughly 25% in 2013.

- Creditors in Chapter 11 recover considerably more than creditors in Chapter 7.
On average, Nonbankrupt firms:

- Are bigger than Ch 11 which are bigger than Ch 7.
- Are profitable while bankrupt firms are not.
- Have lower leverage than bankrupt firms.
- Have lower interest expenses relative to their cash flow.
- Have higher equity issuance.
- Have positive net investment as opposed to negative net investment for bankrupt firms.
- Have higher dividend payouts than bankrupt firms.
- In terms of statistical significance, there are many instances where there are differences between Chapter 11 versus Chapter 7 (despite small sample size).
Environment Basics

- General equilibrium model with a representative household but a distribution of heterogeneous firms with idiosyncratic productivity shocks and fixed operating costs.

- Firms finance investment with internal funds, debt or costly equity.

- Firms can choose Ch.7 liquidation and exit or Ch. 11 renegotiation of debt burden via Nash Bargaining.

- Competitive lenders price debt taking into account bankruptcy choices.

- Entry and exit generates an endogenous firm size distribution.
Environment - Technology

- Competitive firms produce a homogeneous good that can be consumed by households or can be used as capital.
- Firms have access to a decreasing returns to scale production technology

\[ y_{jt} = z_{jt} \left( k_{jt}^{\alpha} n_{jt}^{1-\alpha} \right)^{\nu}, \quad \alpha \in (0, 1), \nu \in (0, 1) \] (1)

where

- \( z_{jt} \) is an idiosyncratic productivity shock, i.i.d. across firms, drawn from Markov process \( G(z_{jt+1}|z_{jt}) \),
- \( n_{jt} \) is labor input,
- and \( k_{jt} \) is capital input.

- There is a fixed cost of production \( c_f \), measured in units of output.
- Firms own their capital and choose investment

\[ i_{jt}^g = k_{jt+1} - (1 - \delta) k_{jt} \] with quadratic adjustment costs.
Environment - Financing and Entry

- Inputs can be financed by:
  
  1. One period non-contingent debt $b_{jt+1}$ at discounted price $q_{jt}$ which can depend on firm characteristics,

  2. Current cash flow and savings,

  3. External equity at cost $\lambda(e_{jt})$ depending on equity amount $e_{jt}$ raised.

- Firms can enter by paying a fixed cost $\kappa$ (financed via an equity injection) after which they draw an initial level of productivity $z_{j0}$ from the stationary distribution $\overline{G}(z)$ derived from $G(z_{jt+1}|z_{jt})$. 
Environment - Cash Flow

- Firm $j$’s operating income (EBITDA) is given by

$$\pi_{jt} = y_{jt} - w_t n_{jt} - c_f$$

where $w_t$ is the competitively determined real wage.

- Taxable income is

$$\Upsilon_{jt} = \pi_{jt} - \delta k_{jt} - \left(\frac{1}{q_{jt}} - 1\right) \frac{b_{jt+1}}{(1+r)}$$

- Corporate taxes are

$$T_{jt}^c = 1_{\{\Upsilon_{jt} \geq 0\}} \tau_c \cdot \Upsilon_{jt}$$

where $1_{\{\cdot\}}$ is an indicator function (note tax benefits of debt).
Environment - Firm Objective

- Firm $j$ maximizes the expected discounted value of dividends

$$E_0 \sum_{t=0}^{\infty} (1 + r)^{-t} d_{jt}$$  \hspace{1cm} (4)$$

- The after-tax net cash flow to equity holders is given by

$$d_{jt} = \begin{cases} 
(1 - \tau_d)e_{jt} & \text{if } e_{jt} \geq 0 \\
 e_{jt} - \lambda(e_{jt}) & \text{if } e_{jt} < 0 
\end{cases}$$  \hspace{1cm} (5)$$

where

$$e_{jt} = \pi_{jt} - T_{jt}^c - i_{jt} - b_{jt} + q_{jt}b_{jt+1} - \Psi(k_{jt+1}, k_{jt}).$$  \hspace{1cm} (6)$$
ENVIRONMENT - BANKRUPTCY

- Firms have 2 possible default options:

  1. **Chapter 7 liquidation**: Firm $j$ liquidates its assets at firesale discount $s_7 < 1$ which it uses to pay debts subject to limited liability:

     - Firm incurs a bankruptcy cost $c_7(z_{jt})$ and exits.
     - Shareholders obtain (pre-tax): $\max\{s_7k_{jt} - b_{jt} - c_7(z_{jt}), 0\}$.
     - Lenders obtain: $\min\{b_{jt}, \max\{s_7k_{jt} - c_7(z_{jt}), 0\}\}$.

  2. **Chapter 11 reorganization**: Firm $j$ and lender renegotiate the defaulted debt:

     - Nash bargain over the repayment fraction $\phi_{jt}$ (firm weight $\theta(z_{jt})$),
     - Firm pays bankruptcy cost $c_{11}(z_{jt})$,
     - debt reduced to $\phi_{jt}b_{jt}$ (where $\phi_{jt} \in [0, 1]$),
     - net payouts to shareholders restricted to be non-positive, faces equity finance cost $\lambda_{11}(e_{jt})$, and external debt finance cost $\lambda_{b11} \leq 1$
     - continues operating (i.e. does not exit).

- A firm can choose to exit (without default) at any point in time (selling price of capital $s_x$).
**Environment - Households**

- HHs choose a stream of consumption $C_t$, shares $\{S_{jt+1}\}_j$ of incumbent and entrant firms, and risk free bonds $B_{t+1}$ to maximize the expected present discounted value of utility given by

$$
\max E_0 \left[ \sum_{t=0}^{\infty} \beta^t U(C_t) \right] \tag{7}
$$

subject to

$$
C_t + \int p_{jt} S_{jt+1} dj + q_t^B B_{t+1} = (1 - \tau_i) w_t 
+ \int (p_{jt} + d_{jt}) S_{jt} dj + B_t + T_t^h
$$

where $p_{jt}$ is the after dividend stock price of firm $j$, $q_t^B$ is the after-tax price of the risk free bond, and $T_t^h$ are lump sum taxes/transfers for households.
Timing

1. Productivity $z_{jt}$ is realized.

2. Bankruptcy decision for incumbent firms.
   - If the firm chooses to repay debt (to avoid bankruptcy costs), it chooses whether or not to exit.
   - If the firm chooses to default, it chooses whether to exit by Ch. 7 (incurring $c_7(z)$ and $s_7$) or not by Ch. 11 (incurring $c_{11}(z)$, $\lambda_{11}$, and $\theta(z)$).

3. Potential entrants decide whether to start a firm or not.

4. Households choose shares and bonds, which given earnings and taxes determines their consumption.
Upon reorganization, the value of defaulted debt is reduced to a fraction $\varphi$ of the unpaid debt $b$.

The value of an agreement of size $\varphi$ to the firm is

$$V^R(z, k, b; \varphi) = \max_{n, b', k', d \leq 0} \left\{ d + (1 + r)^{-1} E_{z'|z}[V(k', b', z')] \right\}$$

subject to

$$e = \pi - T^c(k, z, k', b') - 1_{i_g \geq 0} i^g - 1_{i_g < 0} s_{11} i^g - \Psi(k', k) - \varphi b + q(k', b', z) \lambda_{11} b' - c_{11}(z)$$

$$d = e - \lambda_{11}(e)$$
Reorganization: Nash Bargaining Solution

The recovery rate is the solution to the following Nash Bargaining problem:

\[
\phi(z, k, b) \equiv \arg \max_{\varphi \in [0,1]} [W^R(z, k, b; \varphi)]^{\theta(z)} [W^L(z, k, b; \varphi)]^{1-\theta(z)}
\]

s.t.

\[
W^R(z, k, b; \varphi) \geq 0, \quad W^L(z, k, b; \varphi) \geq 0.
\]

where

- The surplus for the firm reflects a threat point of Ch.7 given by
  \[
  W^R(z, k, b; \varphi) = V^R(z, k, b; \varphi) - (1 - \tau_d) \max\{s_7k - b - c_7(z), 0\}.
  \]

- The surplus for the lender is given by
  \[
  W^L(z, k, b; \varphi) = \varphi b - \min\{b, \max\{s_7k - c_7(z), 0\}\}.
  \]
Lenders’ Profits

\[ \Omega(b', k', z) = -q(b', k', z)b' + q^B[1 - \Lambda(b', k', z)]b' \]
\[ + q^B \sum_{z' \in D_7(k', b')} \min \{ b', \max \{ s_7k' - c_7(z'), 0 \} \} G(z'|z) \]
\[ + q^B \sum_{z' \in D_{11}(k', b')} \phi(k', b', z')b' G(z'|z). \]

where the expected default probability is given by:

\[ \Lambda(b', k', z) = \sum_{z' \in \{ D_7(k', b') \} \cup \{ z' \in D_{11}(k', b') \}} G(z'|z), \]

with default intervals:

\[ D_7(k, b) = \{ z \in Z : \Delta_7(z, k, b) = 1 \}, \]
\[ D_{11}(k, b) = \{ z \in Z : \Delta_{11}(z, k, b) = 1 \}. \]
**Definition of Steady State Equilibrium**

\[ \{V^*, w^*, r^*, q^{B*}, q^*, \phi^*, p^*, D^*_7, D^*_11, \Lambda^*, \Gamma^*, M^*, C^*, B'^*, S'^*, T^* \} \]

such that:

1. Given \( w, r, q, \phi \), firm’s optimize yielding \( V^* \).
2. Given \( V, w, r, q \), the recovery rate \( \phi^*(k, b, z) \) solves the bargaining problem.
3. The prob. of default \( \Lambda^* \) is consistent with firm decision rules.
4. Loan prices \( q^* \) are such that lenders expect to earn zero profits.
5. Entry condition \( V^*_E \leq 0 \) is satisfied with \( = \) when \( M > 0 \).
6. \( \Gamma^*(z, k, b) \) and \( M^* \) is a fixed pt. of the LOM of firm distribution.
7. Given \( (w, q^{B}, p) \) and taxes/transfers \( T^h \), households optimize.
8. Goods, Labor, Bond and Stock markets clear at \( w^*, q^{B*}, p^* \).
Model Parameters

Our model has 24 parameters, 12 of which we estimate within the model.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount Rate</td>
<td>(\tilde{r}^B)</td>
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<tr>
<td>Corporate Tax Rate</td>
<td>(\tau_c)</td>
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<tr>
<td>Dividend Tax Rate</td>
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<tr>
<td>Income Tax Rate</td>
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<td>Depreciation Rate</td>
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<tr>
<td>Capital Share</td>
<td>(\alpha)</td>
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<tr>
<td>Return to Scale</td>
<td>(\nu)</td>
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<tr>
<td>Autocorr. (z)</td>
<td>(\rho_z)</td>
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<td>Std. Dev. Shock</td>
<td>(\sigma_\epsilon)</td>
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<tr>
<td>Price (k) Liq.</td>
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<td>Price (k) Reorg.</td>
<td>(s_{11})</td>
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<td>Fixed Cost Prod.</td>
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<td>Chapter 7 Cost</td>
<td>(c_{0,7})</td>
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<tr>
<td>Chapter 7 Cost</td>
<td>(c_{1,7})</td>
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<tr>
<td>Chapter 11 Cost</td>
<td>(c_{0,11})</td>
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<td>Chapter 11 Cost</td>
<td>(c_{1,11})</td>
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<td>Firm’s Barg. Power</td>
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<td>Firm’s Barg. Power</td>
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<td>E.I. Cost</td>
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<td>E.I. Cost Ch. 11</td>
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<tr>
<td>Entry Cost</td>
<td>(\kappa)</td>
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\[
\log(z') = \rho \log(z) + \epsilon, \quad \epsilon \sim N(0, \sigma_\epsilon)
\]

\[
\lambda(e) = \lambda_1 e
\]

\[
c_i(z) = \max\{0, c_i^0 + c_i^1 (\max\{0, z - \mu_z\} - \max\{0, \mu_z - z\})^2\} \quad i \in \{7, 11\}
\]
# Baseline Moments

<table>
<thead>
<tr>
<th>Moment</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit Rate</td>
<td>1.10</td>
<td>1.12</td>
</tr>
<tr>
<td>Frequency of All Bankruptcy</td>
<td>0.96</td>
<td>1.47</td>
</tr>
<tr>
<td>Fraction of Bankruptcy Ch 11 - Reorganization</td>
<td>79.15</td>
<td>72.15</td>
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<tr>
<td>Recovery Rate by Liquidation</td>
<td>5.80</td>
<td>5.29</td>
</tr>
<tr>
<td>Recovery Rate Ch 11 - Reorganization</td>
<td>49.09</td>
<td>58.77</td>
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<tr>
<td>Med. Equity Issuance Non-Bankrupt</td>
<td>0.06</td>
<td>0.09</td>
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<tr>
<td>Med. Equity Issuance Ch 11 - Reorganization</td>
<td>0.01</td>
<td>0.08</td>
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<tr>
<td>Debt to Assets Non-Bankrupt</td>
<td>28.31</td>
<td>24.13</td>
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<tr>
<td>Debt to Assets Ch 11 - Reorganization</td>
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<td>Net Investment/Assets Non-Bankrupt</td>
<td>1.16</td>
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<td>Net Investment/Assets Ch 11 - Reorganization</td>
<td>-2.94</td>
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<td>Expenses over Assets Ch 7</td>
<td>8.10</td>
<td>6.59</td>
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<tr>
<td>Expenses over Assets Ch 11 - Reorganization</td>
<td>16.90</td>
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<tr>
<td>Std. Dev Recovery Rate Ch 11 - Reorganization</td>
<td>32.40</td>
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<td>Fraction of Exit by Liquidation</td>
<td>19.83</td>
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<tr>
<td>Frac. Firms Issuing Equity Non-Bankrupt</td>
<td>22.04</td>
<td>36.39</td>
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<tr>
<td>Frac. Firms Issuing Equity Ch 11 - Reorganization</td>
<td>13.14</td>
<td>5.94</td>
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<tr>
<td>Dividend to Asset Non-Bankrupt</td>
<td>3.49</td>
<td>2.93</td>
</tr>
<tr>
<td>Spread All firms</td>
<td>1.30</td>
<td>1.30</td>
</tr>
</tbody>
</table>
High prod. firms do not exit nor liquidate.

Low prod. firms both exit and liquidate.
Debt Price Schedules

- Low prod. firms, since more likely to liquidate, face lower prices (higher interest rates), than high prod. firms.
DISTRIBUTION OF FIRMS (CONDITIONAL ON $z$)

- Low prod. firms are amassed on lower capital and debt levels than high prod. firms.
Bankruptcy, Prices, & Firm Size Distn.

Decision rules in the first figure induce price menus in the second but choices ultimately depend upon the firm’s individual state \((z, k, b)\) in the distribution \(\Gamma(z, k, b)\).

- **Low prod. firms are:**
  - More likely to choose Ch. 7 in first figure where the recovery rates are lowest.
  - Thus, they face the highest interest rates in the second figure.
  - Facing high interest rates, they borrow and invest less, leading them to amass on the lower end of the cum. distn. for capital and net debt in the third figure.

- **High prod. firms are:**
  - Least likely to choose bankruptcy in the first figure.
  - Thus, they face the lowest interest rates in the second figure.
  - Hence they borrow and invest more leading them to amass on the upper end of the cum. distn for capital and net debt in the third figure.
**Distribution of Capital: Model vs Data**

- Model does not capture completely dispersion of (normalized) capital observed in the data
Distribution of Debt/Assets: Model vs Data

- Avg and Std Dev (cond on size) in the model are in line with data

Reorganization or Exit: Bankruptcy Choice and Firm Dynamics
Dean Corbae and Pablo D'Erasmo
Model generates inv. inaction due to financial frictions (<data>
Reorganization Event Analysis

Reorganization or Exit: Bankruptcy Choice and Firm Dynamics
Dean Corbae and Pablo D'Erasmo
LIQUIDATION EVENT ANALYSIS

Panel (i): Debt/Assets Model
avg model

Panel (ii): Debt/Assets Data
avg data

Panel (iii): Int. Rate Model

Panel (iv): Int. Rate Data

Panel (v): Sales/Assets Model

Panel (vi): Sales/Assets Data

Panel (vii): Net Inv./Assets Model

Panel (viii): Net Inv./Assets Data

Motivation Data Environment Equilibrium Parameterization Positive Results Normative Results Conclusion

Reorganization or Exit: Bankruptcy Choice and Firm Dynamics
Dean Corbae and Pablo D’Erasmo
Policy Counterfactual: AHM Proposal


- Western bankruptcy procedures “are thought either to cause the liquidation of healthy firms (as in Chapter 7 of the U.S. Bankruptcy Code) or to be inefficient and biased toward reorganization under incumbent management (as in Chapter 11 in the United States).”
**Policy Counterfactual: AHM - cont.**

AHM proposed the following bankruptcy reform:

- When a firm goes bankrupt, all of the firm’s existing debts are canceled.

- Rights to the equity in this new firm are allocated among the former debt holders.

- The new shareholders –that is, the former debt holders– decide whether to continue or liquidate the firm.

- After these steps the firm exits from bankruptcy (given a “fresh start”).

Their policy is similar to a recent proposal by the American Bankruptcy Institute.
Policy Counterfactual: AHM - cont.

Differences from current bankruptcy law:

- **AHM Reorganization.**
  - Unlike Chapter 11, there is no bargaining over recovery rates.
  - Capital structure and production input decisions are made at the AHM Reorganization state $b = 0$ thus avoiding the partial debt overhang friction associated with Chapter 11.

- **AHM Liquidation.**
  - As opposed to Chapter 7 liquidation, the debt overhang problem is reduced considerably in AHM liquidation since the creditor chooses to liquidate the firm only when the net present value of a firm with no debt is negative.
COUNTERFACTUAL: EFFICIENCY

Efficient (financially frictionless) economy:

- The corporate tax shield $\tau_c$ is set to zero and equity issuance costs $\lambda$ are zero.
- Firms cannot go bankrupt but can choose to exit at zero cost.
- Since there are no financial frictions the liability side of the balance sheet of the firm is irrelevant (i.e., Modigliani-Miller applies).
- This is effectively a general equilibrium version of Hopenhayn’s (1992) model with capital.
IMPLEMENTING AHM

- No changes to no default and exit value functions.

- Now reorganization value function becomes:

\[ V_{AHM}(z, k, b) = \max \{ 0, (1 - \tau_d)(W_{AHM}(z, k, 0) - b) \} , \quad (12) \]

where \( W_{AHM}(z, k, 0) \) is the value of the “new” firm given by

\[ W_{AHM}(z, k, 0) = \max \{ W(z, k, 0) - c_{AHM}(z), \max\{0, s_{AHM} k - c_{AHM}(z)\} \} \quad (13) \]

and

\[ W(z, k, 0) = \max_{n \geq 0, k' \geq 0, b', d \leq 0} \left\{ d + (1 + r)^{-1} E_{z'}|z[V(z', k', b')] \right\} \quad (14) \]

s.t.

\[ e = \pi - T^c(k, z, k', b') - i^g + q(k', b', z)b' - \Psi(k', k), \]

\[ d = e - \lambda(e). \]
Ceteris paribus, new recovery procedure reduces the need for the firm to hold as much capital (collateral) against loans and puts downward pressure on interest rate menu.
AHM Reform: Main Findings

▶ Ceteris paribus, new recovery procedure reduces the need for the firm to hold as much capital (collateral) against loans and puts downward pressure on interest rate menu.

▶ Nonbankrupt and bankrupt firms increase borrowing (to assets) considerably.

Table Moments  Dist. Debt/Assets
AHM Reform: Main Findings

- Ceteris paribus, new recovery procedure reduces the need for the firm to hold as much capital (collateral) against loans and puts downward pressure on interest rate menu.

- Nonbankrupt and bankrupt firms increase borrowing (to assets) considerably.

- This increased demand for debt increases equilibrium real interest rates (GE effect) for some nonbankrupt firms but average is still lower than prior than reform.
AHM Reform: Main Findings (cont.)

- Net investment to assets increases 41% on average for non-bankrupt firms.
AHM Reform: Main Findings (cont.)

- Net investment to assets increases 41% on average for non-bankrupt firms.

- There is a considerable reduction of the bankruptcy rate (-60%) and a jump in the fraction of bankruptcy via reorganization (via the new policy) while leaving the exit rate almost unaffected (+1%).
AHM Reform: Main Findings (cont.)

- Net investment to assets increases 41% on average for non-bankrupt firms.
- There is a considerable reduction of the bankruptcy rate (-60%) and a jump in the fraction of bankruptcy via reorganization (via the new policy) while leaving the exit rate almost unaffected (+1%).
- The change in the composition of bankruptcies contrasts with an experiment where lenders get all bargaining power. In this case, most firms self select into liquidation as opposed to entering into reorganization (reform).
AHM Reform: Main Findings - Aggregates/Welfare

▶ Aggregate consumption rises 0.87%.
AHM Reform: Main Findings - Aggregates/Welfare

- Aggregate consumption rises 0.87%.
- Measured aggregate total factor productivity (TFP) rises by 0.46%.
AHM Reform: Main Findings - Aggregates/Welfare

- Aggregate consumption rises 0.87%.
- Measured aggregate total factor productivity (TFP) rises by 0.46%.
- The variance of marginal product of capital ($\text{Var}(mpk)$) declines in both the reform and the efficient case (a sign of a better allocation of resources) by 1.65%.
CONCLUDING REMARKS

- We build a general equilibrium model of firm dynamics with both Ch 7 and Ch 11 bankruptcy choices.

- We find that if reforms proposed by legal and economic scholars are followed, there can be significant changes in borrowing costs, capital structure and investment decisions, as well as the cross-sectional distribution of firms.

- The GE consequences of such reforms can actually lead to a rise in consumer welfare, measured TFP, and efficiency.
Reorganization or Exit: Bankruptcy Choice and Firm Dynamics

Dean Corbae and Pablo D'Erasmo
**Data Facts: Dist. Debt / Assets & EBITDA / Assets**

![Graph of Distribution Debt / Assets](image1)

![Graph of Distribution EBITDA / Assets](image2)
Data Facts: Dist. Net Inv / Assets & z-scores

Distribution Net Inv / Assets

Distribution z-scores
For each variable of interest $x_t$, we run the following regressions:

$$x_{it} = a_0 + a_1 d_{it}^{ch11} + a_2 d_{it}^{ch7} + b_t + u_{it}$$  \hspace{1cm} (15)$$

where $d_{it}^{ch11} = 1$ if the firm/year observation corresponds to the start of a Chapter 11 bankruptcy; $d_{it}^{ch7} = 1$ if the firm/year observation corresponds to a Chapter 7 bankruptcy; and $b_t$ corresponds to a full set of year fixed effects.

- A significant coefficient $a_1$ reflects that average $x_t$ is significantly different for firms in Chapter 11 bankruptcy than that of Non-bankrupt firms.

- Similarly, a significant coefficient $a_2$ reflects that average $x_t$ is significantly different for firms in Chapter 7 bankruptcy than that of Non-bankrupt firms.

- To test whether $a_1$ is significantly different than $a_2$ we perform an F-test.
# Model Definitions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book Value Assets</td>
<td>$k + I_{{b&lt;0}}(-b)$</td>
</tr>
<tr>
<td>Capital</td>
<td>$k$</td>
</tr>
<tr>
<td>Net Debt</td>
<td>$b$</td>
</tr>
<tr>
<td>Total Debt</td>
<td>$I_{{b\geq0}}b$</td>
</tr>
<tr>
<td>Operating Income</td>
<td>$\pi = zk^{\alpha}n^{1-\alpha} - wn - cf$</td>
</tr>
<tr>
<td>Taxable Income</td>
<td>$\pi - \delta k - \left(\frac{1}{q} - 1\right) \frac{b'}{(1+r)}$</td>
</tr>
<tr>
<td>Cash Flow</td>
<td>$\pi - \left(\frac{1}{q} - 1\right) b' - T$</td>
</tr>
<tr>
<td>Equity Issuance</td>
<td>$I_{{e&lt;0}}e$</td>
</tr>
<tr>
<td>Dividends</td>
<td>$I_{{d\geq0}}(1 - \tau^d)d$</td>
</tr>
<tr>
<td>Gross Investment</td>
<td>$i^g = k' - (1 - \delta)k$</td>
</tr>
<tr>
<td>Net Investment</td>
<td>$i^n = i^g - \delta k$</td>
</tr>
<tr>
<td>Secured Debt</td>
<td>$I_{{b\geq0}} \min{sk, b}$</td>
</tr>
<tr>
<td>Unsecured Debt</td>
<td>$I_{{b\geq0}} \max{0, b - sk}$</td>
</tr>
<tr>
<td>Market Value Assets</td>
<td>$V(k, b, z) + qb'$</td>
</tr>
</tbody>
</table>
Computational Algorithm

1. Guess initial wage rate $w^0$, price schedule $q^0(k', b', z)$, recovery rate schedule $\phi^0(k', b', z)$.

2. Solve the Firm Problem.

3. Obtain Recovery Schedule $\phi^1(k', b', z)$.

4. Obtain Bond Price Schedule $q^1(k', b', z)$.

5. If $||\phi^1(\cdot) - \phi^0(\cdot)|| < \epsilon_\phi$ and $||q^1(\cdot) - q^0(\cdot)|| < \epsilon_q$, continue to the next step. If not, update the price and recovery schedule and return to point 2.

6. Evaluate the free entry condition $V^E$ at $w^0$. If it holds with equality, continue. If it does not, update $w^0$ and return to point 2.

7. Clear the Labor Mkt: Set $M = 1$ and compute the stationary distribution associated with this mass of entrants. Denote this distribution $\hat{\Gamma}(k, b, z; M = 1)$. Given homogeneity, set $M^0$ to

$$M^0 = \frac{1}{\int n(z, k, b) d\hat{\Gamma}(z, k, b; M = 1)}$$
**Goods Market Clearing**

\[
C = Y - CF - I - \Lambda + X - BC - E
\]

where aggregate output is

\[
Y = \int_{K \times B} \sum_z (1 - x(k, b, z))z(k^\alpha n^{1-\alpha})^\nu \Gamma(dk, db, z),
\]

aggregate operating costs are

\[
CF = \int_{K \times B} \sum_z (1 - x(k, b, z))c_f \Gamma(dk, db, z),
\]

aggregate investment plus adjustment costs are

\[
I = \int_{K \times B} \sum_z (1 - x(k, b, z)) [k' - (1 - \delta)k + \Psi(k', k)] \Gamma(dk, db, z),
\]

aggregate equity issuance costs are

\[
\Lambda = \int_{K \times B} \sum_z (1 - x(k, b, z))1_{\{e(k,b,z) < 0\}} (1_{\{\zeta = 0\}} \lambda(e) + 1_{\{\zeta = 11\}} \lambda_{11}(e)) \Gamma(dk, db, z).
\]
where final distributions from exiting firms are

\[ X = \int_{K \times B} \sum_z x(k, b, z) \left\{ 1_{\{\zeta=0\}}(k - b) + 1_{\{\zeta=7\}} \max\{sk - b - c_7, 0\} \right\} \Gamma(dk, db, z), \]

aggregate bankruptcy costs are

\[ BC = \int_{K \times B} \sum_z \left\{ (1 - x(k, b, z)) 1_{\{\zeta=11\}} c_{11} + x(k, b, z) 1_{\{\zeta=7\}} \max\{c_7, sk\} \right\} \Gamma(dk, db, z), \]

and entrants’ investment and costs are

\[ E = M \left\{ k^e + \kappa + \lambda(-k^e + q(k^e, b^e)b^e - \kappa) \right\}. \]
Labor, Bond, and Stock Market Clearing

\[
1 = \int_{K,B} \sum_Z (1 - x(z, k, b)) \sum_{J=0,1} \left[ \mathbf{1}_{\{\Delta(k, b, z) = J\}} h_J^n(z, k, b) \right] \Gamma(dk, db, z)
\]

\[
B' = \int_{K,B} \sum_Z (1 - x(z, k, b)) \sum_{J=0,1} \left[ \mathbf{1}_{\{\Delta(k, b, z) = J\}} h_J^b(z, k, b) \right] \Gamma(dk, db, z)
\]

\[
1 = S'^n
\]
Taxes

Total Household Taxes are

\[ T^h = T^d + T^B + T^7 + T^i \]

\[ + \int_{K \times B} \sum_z (1 - x(k, b, z)) T^c(k, z) \Gamma(dk, db, z) + T^L \]

Dividend taxes \( T^d \) are

\[ T^d = \tau_d \int_{K \times B} \sum_z (1 - x(k, b, z)) 1\{e(k, b, z) \geq 0\} e(k, b, z) \Gamma(dk, db, z), \]

Taxes on interest earnings \( T^B \) are

\[ T^B = \tau_i \tilde{q}^B \left( \frac{1}{\tilde{q}^B} - 1 \right) B', \]

Taxes to cover bankruptcy cost of liquidated firms \( T^7 \) are

\[ T^7 = \int_{K \times B} \sum_z x(k, b, z) 1\{\zeta = 7\} \max\{c_7, sk\} \Gamma(dk, db, z), \]
Taxes (cont.)

Income taxes on the final distribution by exiting firms $T^i$ are

$$T^i = \tau^i \int_{K \times B} \sum_z x(k, b, z) \left\{ 1_{\{\zeta=0\}} (k - b) + 1_{\{\zeta=7\}} \max\{sk - b - c_7, 0\} \right\} \Gamma(dk, db, z),$$

Taxes to cover ex-post losses associated with bankruptcy $T^L$ are

$$T^L = q^B \int_{K \times B} \sum_z \left\{ -\Lambda(z, k, b) b \right\} + \min \left\{ b, \max\{sk - c_7, 0\} \right\} + \phi(z, k, b) b \right\} \Gamma(dk, db, z).$$
AHM Reform: Price Schedules

Panel (i): Benchmark Price Function $q(k', b', z_M)$

Panel (ii): Counterfactual Price Function $q_c(k', b', z_M)$
AHM Reform: Laffer Curve

(i): Debt Laffer Curve $q(k_i', b', z_M)b'$

(ii): Debt Laffer Curve $q(k_M', b', z_M)b'$

(iii): Debt Laffer Curve $q(k_H', b', z_M)b'$
# AHM Bankruptcy Reform: Main Findings

<table>
<thead>
<tr>
<th>Moments (%)</th>
<th>Bench. Model</th>
<th>Decomposition</th>
<th>Bankruptcy Reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit Rate</td>
<td>1.12</td>
<td>1.18</td>
<td>1.14</td>
</tr>
<tr>
<td>Frequency of all Bankruptcy</td>
<td>1.47</td>
<td>0.46</td>
<td>0.58</td>
</tr>
<tr>
<td>Frac of bankruptcy Reorg.</td>
<td>72.15</td>
<td>0.00001</td>
<td>99.99</td>
</tr>
<tr>
<td>Recovery rate by Liq.</td>
<td>5.29</td>
<td>5.33</td>
<td>28.15</td>
</tr>
<tr>
<td>Recovery rate Reorg.</td>
<td>58.77</td>
<td>76.88</td>
<td>86.55</td>
</tr>
<tr>
<td>Debt/Assets Non-bankrupt</td>
<td>24.13</td>
<td>29.19</td>
<td>38.83</td>
</tr>
<tr>
<td>Debt/Assets Reorg.</td>
<td>43.07</td>
<td>60.92</td>
<td>91.42</td>
</tr>
<tr>
<td>Net Inv/Assets Non-Bankrupt</td>
<td>0.81</td>
<td>0.50</td>
<td>1.16</td>
</tr>
<tr>
<td>Net Inv/Assets Reorg.</td>
<td>-3.00</td>
<td>-48.03</td>
<td>-26.98</td>
</tr>
<tr>
<td>Fraction of exit by Liquidation</td>
<td>36.33</td>
<td>38.55</td>
<td>0.00</td>
</tr>
<tr>
<td>Dividend to Asset Non-Bankrupt</td>
<td>2.93</td>
<td>3.15</td>
<td>2.97</td>
</tr>
<tr>
<td>Dividend to Asset Reorg.</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Spread all firms</td>
<td>1.30</td>
<td>0.24</td>
<td>0.07</td>
</tr>
<tr>
<td>Avg Size ($k$) / Prod. $z$ Non-Bankrupt</td>
<td>0.636 / 1.012</td>
<td>0.650 / 1.018</td>
<td>0.634 / 1.022</td>
</tr>
<tr>
<td>Avg Size ($k$) / Prod. $z$ Ch 11 - Reorg.</td>
<td>1.789 / 1.538</td>
<td>2.304 / 0.532</td>
<td>0.433 / 0.621</td>
</tr>
<tr>
<td>Avg Size ($k$) / Prod. $z$ Ch 7 - Liq.</td>
<td>0.010 / 0.672</td>
<td>0.010 / 0.671</td>
<td>0.010 / 0.589</td>
</tr>
<tr>
<td>Avg Size ($k$) / Debt $b$ Entrant</td>
<td>0.625 / 0.425</td>
<td>0.737 / 0.546</td>
<td>0.685 / 0.619</td>
</tr>
</tbody>
</table>
AHM Reform: Distribution Debt/Assets

Reorganization or Exit: Bankruptcy Choice and Firm Dynamics

Dean Corbae and Pablo D'Erasmo
AHM Reform: Distribution of Investment Rates

Return

Reorganization or Exit: Bankruptcy Choice and Firm Dynamics

Dean Corbae and Pablo D’Erasmo
# AHM Reform: Welfare and Aggregates

<table>
<thead>
<tr>
<th></th>
<th>Bench.</th>
<th>Δ % from Baseline</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model</td>
<td>Reform</td>
<td>Efficient</td>
<td>Economy</td>
</tr>
<tr>
<td>Aggregate Consumption $C$</td>
<td>1.126</td>
<td>0.87</td>
<td>1.90</td>
<td></td>
</tr>
<tr>
<td>Aggregate Output $Y$</td>
<td>1.755</td>
<td>0.05</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>Fixed Cost $CF$</td>
<td>0.202</td>
<td>1.43</td>
<td>17.73</td>
<td></td>
</tr>
<tr>
<td>Investment $I$</td>
<td>0.363</td>
<td>-0.64</td>
<td>12.70</td>
<td></td>
</tr>
<tr>
<td>Adjustment Costs $\Psi$</td>
<td>0.025</td>
<td>-5.90</td>
<td>-8.43</td>
<td></td>
</tr>
<tr>
<td>Equity Issuance $\Lambda$</td>
<td>0.003</td>
<td>-90.71</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Bankruptcy Costs $BC^c$</td>
<td>0.006</td>
<td>-99.82</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Bankruptcy Costs $BC^s$</td>
<td>0.000</td>
<td>-100.00</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Exit Value $X$</td>
<td>0.005</td>
<td>69.13</td>
<td>109.32</td>
<td></td>
</tr>
<tr>
<td>Entry Costs $E$</td>
<td>0.035</td>
<td>11.19</td>
<td>2.32</td>
<td></td>
</tr>
<tr>
<td>Equilibrium wage</td>
<td>1.000</td>
<td>0.05</td>
<td>4.97</td>
<td></td>
</tr>
<tr>
<td>Capital to output ratio $K/Y$</td>
<td>1.461</td>
<td>-1.26</td>
<td>4.84</td>
<td></td>
</tr>
<tr>
<td>Measured TFP ($= Y/K^{1/3}$)</td>
<td>1.282</td>
<td>0.46</td>
<td>1.69</td>
<td></td>
</tr>
<tr>
<td>Avg. Productivity $\bar{z}$</td>
<td>1.017</td>
<td>0.21</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>Avg. (output weighted) Prod. $\hat{z}$</td>
<td>1.246</td>
<td>0.01</td>
<td>-0.19</td>
<td></td>
</tr>
<tr>
<td>$Cov(z,\omega)$</td>
<td>0.229</td>
<td>-0.89</td>
<td>-2.00</td>
<td></td>
</tr>
<tr>
<td>Mass Entrants</td>
<td>0.044</td>
<td>3.34</td>
<td>19.13</td>
<td></td>
</tr>
<tr>
<td>Total Mass Firms</td>
<td>3.990</td>
<td>1.46</td>
<td>17.75</td>
<td></td>
</tr>
<tr>
<td>Capital $K$</td>
<td>2.564</td>
<td>-1.21</td>
<td>10.09</td>
<td></td>
</tr>
<tr>
<td>$Var(mpK)$</td>
<td>0.300</td>
<td>-1.67</td>
<td>1.65</td>
<td></td>
</tr>
</tbody>
</table>

Note: $z$ is average firm productivity, $\hat{z}$ is the (output weighted) average firm level productivity and $\omega$ is the output share of each firm.
HOUSEHOLD PROBLEM

- The HHs f.o.c in a steady state implies

\[ q_t^B = \beta \]  
\[ p_{jt} = \beta E_t [p_{jt+1} + d_{jt+1}] \]  

- To characterize stock prices, consider an incumbent firm and let

\[ p(z, k, b) = V(z, k, b) - d(z, k, b) \text{ and } (1 + r)^{-1} = \beta. \]

- Then it is straightforward to show that (18) is equivalent to (??) or

\[ p(z, k, b) = \beta E_{z' | z} [p(z', k', b') + d(z', k', b')] \]
\[ \iff \quad V(z, k, b) - d(z, k, b) = (1 + r)^{-1} E_{z' | z} [V(z', k', b')] \]
Cross-Sectional Distribution of Firms

The law of motion for the cross-sectional distribution of firms is given by:

\[
\Gamma'(K, B, Z; M, w) = \\
\int K \sum_{B} \left\{ \int K \sum_{B} \left(1 - x(z, k, b) \right) \left[ 1\{\Delta(k, b, z) = 0\} 1\{k' = h_0^k(z, k, b), b' = h_0^b(z, k, b)\} \\
+ 1\{\Delta(k, b, z) = 1\} 1\{k' = h_1^k(z, k, b), b' = h_1^b(z, k, b)\} \right] G(z'|z) \Gamma(\text{dk}', \text{db}', \text{z}') \right\} \text{dk}' \text{db}' \\
+ M \sum_{Z} 1\{k_E', b_E'\} \overline{G}(z)
\]

where \(M\) denotes the mass of new entrants.
# Other Moments

<table>
<thead>
<tr>
<th>Non-Targeted Moments (%)</th>
<th>Data (%)</th>
<th>Model (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraction of Exit by Liquidation</td>
<td>19.83</td>
<td>36.33</td>
</tr>
<tr>
<td>Frac. Firms Issuing Equity Non-Bankrupt</td>
<td>22.04</td>
<td>36.39</td>
</tr>
<tr>
<td>Frac. Firms Issuing Equity Ch 11 - Reorganization</td>
<td>13.14</td>
<td>5.94</td>
</tr>
<tr>
<td>Dividend to Asset Non-Bankrupt</td>
<td>3.49</td>
<td>2.93</td>
</tr>
<tr>
<td>Net Debt / Assets Non-Bankrupt</td>
<td>9.11</td>
<td>16.91</td>
</tr>
<tr>
<td>Net Debt / Assets Ch 11 - Reorganization</td>
<td>29.61</td>
<td>43.07</td>
</tr>
<tr>
<td>Spread All firms</td>
<td>1.30</td>
<td>1.30</td>
</tr>
<tr>
<td>Spread Non-Bankrupt</td>
<td>n.a.</td>
<td>1.11</td>
</tr>
<tr>
<td>Spread Reorganization</td>
<td>n.a.</td>
<td>18.40</td>
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</table>
Some Corporate Bankruptcy Facts

BWZ (2006, JF) sample of 300 bankrupt public and private firms in AZ and NY from 1995-2001:

- Fraction of Ch 11 bankrupts in all bankruptcies is 80%. Note: Statistics on all business filings from the U.S. Courts suggests a lower fraction of Ch. 11, roughly 25% in 2013.

- Ch. 11 are larger (assets) and have lower debt-to-asset ratios.

- Creditors in Chapter 11 reorganizations recover considerably more than creditors in Chapter 7 liquidations

<table>
<thead>
<tr>
<th></th>
<th>Chapter 7</th>
<th>Chapter 11</th>
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<tr>
<td>Mean</td>
<td>27.4</td>
<td>69.4</td>
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<tr>
<td>Median</td>
<td>5.8</td>
<td>79.2</td>
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<tr>
<td>= 0%</td>
<td>43</td>
<td>0</td>
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</tbody>
</table>

Table: BWZ (2006) Recovery Rates (% of initial claim)