Comments on “Leverage over the Life Cycle and Implications for Firm Growth and Shock Responsiveness”
by Dinlersoz, Kalemlı-Ozcan, Hyatt and Pencıakova

Nicolas Crouzet
Kellogg School of Management, Northwestern University

NBER Capital Markets
July 2018
THE CAPITAL STRUCTURE OF PRIVATE US FIRMS

- Private firms make up a large share of aggregate economic activity
An estimate of non-listed firms' share of activity using Compustat data, the fixed asset tables, & KLEMS
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  Not much representative data!


This paper: explore the ORBIS database
US, 2005-2012, approximately 150,000 unique private firms

Crucial: ORBIS suffers from severe selection issues
Much larger (525 employees vs. 20 in the LBD) and older (21 years old vs. 11 in the LBD)

Main contribution of the paper: merge ORBIS with the Census data on age and size (LBD) in order to “re-weight” the ORBIS sample
No small task — analogous to creating a new Compustat-SSEL bridge
The capital structure of private US firms

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Private firms make up a large share of aggregate economic activity. Yet we know relatively little about their capital structure because there is not much representative data. Asker, Farre-Mensa and Ljunqvist (2015) used Sageworks and Crouzet and Mehrotra (2018) used Quarterly Financial Report. This paper explores the ORBIS database of US private firms from 2005-2012, approximately 150,000 unique firms. However, ORBIS suffers from severe selection issues, with much larger companies (525 employees vs. 20 in the LBD) and older (21 years old vs. 11 in the LBD) than the average firm. The main contribution of the paper is to merge ORBIS with the Census data on age and size (LBD) in order to "re-weight" the ORBIS sample.
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AGE DISTRIBUTION IN UNWEIGHTED VS. WEIGHTED SAMPLES

Notes:
This figure compares the fraction of sample firm-level employment accounted for by each age group. Each bar represents a different sample. The first bar represents all private, non-financial employer businesses in the LBD. The second bar represents the weighted LOCUS sample of private firms, where the weights are derived from estimating equations (3) through (5). The third bar represents the unweighted LOCUS sample of private firms, where each firm gets equal weight.
### Cross-sectional regressions:

<table>
<thead>
<tr>
<th></th>
<th>Private firms</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Overall leverage</td>
<td>−</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Short-term leverage</td>
<td>−</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>−</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Size</td>
<td>+</td>
<td>+</td>
<td>○</td>
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</table>

### Time-series regressions:

<table>
<thead>
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Financial Debt/Total Assets (quadratic in age)

Notes:
Use unbalanced samples of private and publicly-listed firms separately between the years 2005 and 2012.
The dependent variable is financial debt/total assets (FD/TA). Each line shows the conditional relationship between firm age and leverage, where we allow for some flexibility by introducing a quadratic term for age (AGE). The figures condition on log(EMP) to measure firm size; COLLAT to measure tangible fixed assets over total assets; PROFIT to measure net income over total assets; and PROD to measure log labor productivity; and a full set of 3-digit industry-year fixed effects. All observations are weighted to adjust for selection into the LOCUS sample.
The leverage/age relationship

Figure 9: Quadratic Relationship between FD/TA and Age

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Figure 10: Quadratic Relationship between STL/TA and Age

Notes:
Use unbalanced samples of private and publicly-listed firms separately between the years 2005 and 2012.

The dependent variable is short-term loans/total assets (STL/TA\(_{it}\)). Each line shows the conditional relationship between firm age and leverage, where we allow for some flexibility by introducing a quadratic term for age (AGE\(_{it}\)). The figures condition on log(EMP\(_{it}\)) to measure firm size; COLLAT\(_{it}\) to measure tangible fixed assets over total assets; PROFIT\(_{it}\) to measure net income over total assets; and PROD\(_{it}\) to measure log labor productivity; and a full set of 3-digit industry-year fixed effects. All observations are weighted to adjust for selection into the LOCUS sample.
What do we learn?

- Models with two ingredients:
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Cooley and Quadrini (2001), Hennessy and Whited (2005, 2007), and a lot of others

“Generic” predictions, so long as productivity is stationary:
- Leverage declines with age, particularly quickly among young/small firms
- More ambiguous predictions about size
  Conditional on age, often increasing in size, as firms with better investment opportunities borrow more
  But this can depend on how the borrowing constraint is formulated
- Age predictions seem fine for private firms, but not for public firms ...
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The leverage/age relationship among listed firms

Dependent variable: gross leverage $\frac{dlc+dltt}{at}$

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<thead>
<tr>
<th></th>
<th>(1)</th>
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<tbody>
<tr>
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<td>.0010***</td>
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<tr>
<td></td>
<td>(.0002)</td>
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<td>obs.</td>
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<td>16,557</td>
<td>16,557</td>
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<tr>
<td>industry × year F.E</td>
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<td>yes</td>
<td>yes</td>
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Heteroskedasticity-robust s.e. in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- (1): years since first appearance in CRSP (IPO date)
- (2): years since founding, from Jay Ritter’s website
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## The Leverage/Age Relationship Among Listed Firms

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Leverage/age dynamics depend on time to IPO?
SECTORAL DIFFERENCES IN THE LEVERAGE/AGE RELATIONSHIP AMONG LISTED FIRMS

Gross overall leverage

age

0 3 6 9 12 15 18 21 24 27 30 33 36

All sectors (with 95% c.i.)
Wholesale and retail
High-tech
Manufacturing
Which financial constraints?

- All firms may not face constraints of the form $b_{i,t} \leq \theta k_{i,t}$
Which financial constraints?

- All firms may not face constraints of the form $b_{i,t} \leq \theta k_{i,t}$
  - i.e. **asset-based** borrowing may not be prevalent among all firms

- The prevalence of earnings- vs. asset-based lending may be very different between private and listed firms
- Is it possible to explore how important asset-based lending is among private firms?
- Difficulty: no information on covenants for private firms, except perhaps a few in CapitalIQ?
  - Sensitivity of debt issuance to earnings ratios?
  - Sensitivity of debt issuance to property values?
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The Prevalence of Cash-flow Based Lending Among Listed Firms

Figure 1: Prevalence of Cash Flow-Based Lending and EBCs: Large Public Firms

This figure shows the prevalence of cash flow-based lending and EBCs among large US public non-financial firms. In Panel A, we sum up firm-level estimates of asset-based and cash flow-based lending across all large firms (assets above Compustat median), and plot the share of each type among total debt of these firms in each year. Large public firms account for more than 95% of debt, sales, investment, and employment among all public firms. The solid line with diamond represents the share of cash flow-based lending; the dashed line with circle represents the share of asset-based lending. In Panel B, we merge covenant data from DealScan and FISD with Compustat, and plot the fraction of large firms with earnings-based covenants each year.

Panel A. Share of Cash Flow-Based Lending in Total Debt Outstanding

Panel B. Fraction of Firms with Earnings-Based Covenants

Table 1: Composition of Corporate Borrowing

This table summarizes the composition of corporate debt. Panel A shows aggregate estimates by debt type. Panel B shows median share by firm group (among public non-financial firms). Procedures for aggregate estimates and firm-level analyses are explained in detail in Appendix B.

Panel A. Aggregate Corporate Debt Share by Type:

<table>
<thead>
<tr>
<th>Category</th>
<th>Debt Type</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset-based lending</td>
<td>Mortgage</td>
<td>6.5%</td>
</tr>
<tr>
<td>Asset-based loans</td>
<td>13.5%</td>
<td></td>
</tr>
<tr>
<td>Cash flow-based lending</td>
<td>Corporate bond</td>
<td>48.0%</td>
</tr>
<tr>
<td>Cash flow-based loans</td>
<td>32.0%</td>
<td></td>
</tr>
</tbody>
</table>

Panel B. Firm-Level Median Share by Group (Public Firms)

<table>
<thead>
<tr>
<th></th>
<th>Large Firms</th>
<th>Rated Firms</th>
<th>Small Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset-based lending</td>
<td>12.4%</td>
<td>8.0%</td>
<td>61.0%</td>
</tr>
<tr>
<td>Cash flow-based lending</td>
<td>83.0%</td>
<td>89.0%</td>
<td>7.2%</td>
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From Lian and Ma (2018)
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- The prevalence of earnings- vs. asset-based lending may be very different between private and listed firms

- Is it possible to explore how important asset-based lending is among private firms?
  - Difficulty: no information on covenants for private firms, except perhaps a few in CapitalIQ?
Which financial constraints?

- All firms may not face constraints of the form \( b_{i,t} \leq \theta k_{i,t} \)
  - i.e. **asset-based** borrowing may not be prevalent among all firms

- Among public firms, borrowing is frequently restricted by earnings-based covenants, rather than the value of existing assets
  - Chava and Roberts (2008), Roberts and Sufi (2009), Nini, Smith and Sufi (2012), Lian and Ma (2018)
  - Constraints look like:
    \[
    b_{i,t} \leq \psi \pi_{i,t} \quad \text{or} \quad r_{i,t}b_{i,t} \leq \phi \pi_{i,t}
    \]

- The prevalence of earnings- vs. asset-based lending may be very different between private and listed firms

- Is it possible to explore how important asset-based lending is among private firms?
  - Difficulty: no information on covenants for private firms, except perhaps a few in CapitalIQ?
  - Sensitivity of debt issuance to earnings ratios?
This page discusses financial constraints faced by firms. It highlights that not all firms may face constraints of the form $b_{i,t} \leq \theta k_{i,t}$, indicating that asset-based borrowing may not be prevalent among all firms.

Among public firms, borrowing is frequently restricted by earnings-based covenants, rather than the value of existing assets. This is evidenced by studies such as Chava and Roberts (2008), Roberts and Sufi (2009), Nini, Smith, and Sufi (2012), and Lian and Ma (2018). The constraints look like:

$$b_{i,t} \leq \psi \pi_{i,t} \quad \text{or} \quad r_{i,t} b_{i,t} \leq \phi \pi_{i,t}$$

The prevalence of earnings- vs. asset-based lending may be very different between private and listed firms. The page asks if it is possible to explore how important asset-based lending is among private firms, noting the difficulty in obtaining information on covenants for private firms, except perhaps a few in CapitalIQ. It also inquires about the sensitivity of debt issuance to earnings ratios and property values.
CONCLUSION

- Three (plus one) suggested additions:
  1. "IPO" vs. "founding" differences in age effects
  2. Heterogeneity across broad industries in the private firm sample
  3. Does it look like lending to private firms might be more asset-based?
  4. Report results with and without re-weighting; more on selection into ORBIS

- Excited to learn more from this data!