Econ 234C – Corporate Finance

Lecture 11:

Capital Structure

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Homework 3

Testing a new capital structure theory – the "Depression Baby Theory of Capital Structure Decisions"

- How does a "Depression Baby" CEO's decision differ from the decision of Non-Depression Babies?
  - *Note:* Depression Babies are sometimes defined as people born in the 1930s'; sometimes as people who lived throug the 1930s' in their teenage years and early adulthood (e.g., born in the 1920s). You may want to try both definitions.
- In particular, are Depression Babies averse to accessing the market for external financing? Are they particularly averse to equity issues? Or to debt issues?
- How do you interpret the results? (Alternative explanations.)

- **Data**: Compustat and Execucomp (wrds.wharton.upenn.edu). You do not need SDC data.
  Software: STATA.

- **Programming**:
  - Retrieving the data.
  - Infiling the data into STATA.
  - Calculating debt/equity issues. (Go to recent capital structure literature when deciding about the correct data definitions, variable choices, etc.)
  - Regression (Go to recent capital structure literature and empirical regression specifications, controls etc. –> papers handed out last time.)

- **Purpose:**
  - Getting to know two important data sets for Empirical Corporate (even better).
  - Getting to know STATA (even better).
  - Promising research direction in capital structure: managerial fixed-effects.

Extra office hours on Research Proposals

Wed, 4/23 afternoon.

- OHs starting at 1pm.

- Sheet on my door: pick 20min slot between 1and 3pm; if filled up start adding after 3pm ...

1 Capital Structure – Theory

Modigliani-Miller Theorem

- Proposition (1958): Capital structure irrelevance.
  - Intuition: Value additivity. If operating cashflows are fixed, value of the pie unaffected by split-up of the pie.

- Practical message: "*If* there is an optimal capital structure, it should reflect taxes and/or specific market imperfections." [Myers 1993]

$$\Downarrow \quad \Downarrow$$
$$\text{leads} \qquad \text{to}$$
$$\Downarrow \quad \Downarrow$$

Trade-off Theory

Optimal capital structure trades off

- tax savings from debt financing (tax-deductibility of interest payments on debt) against

- costs of financial distress from debt financing
  (agency costs of issuing risky debt; deadweight costs of liquidation or re-organization; costs of debt overhang [Myers 1977]).

versus

Pecking-Order Theory

Firms prefer internal funds $\succ$ safe debt $\succ$ risky debt $\succ$ quasi-equity (e.g. convertibles) $\succ$ equity.

2 Capital Structure – Empirics

Empirical Tests

Traditional empirical approach: Analyze what type of financing is used to fill the "financing deficit."

- Financing deficit = asset growth *minus* liabilities growth minus growth in retained earnings.
- Financing deficit must be filled with (net) sales of new securities.
- Specification

$$\Delta D_{it} = \alpha + \beta DEF_{it} + \varepsilon_{it}$$

Prediction PO theory: $\beta \approx 1$.

Incorporate TO theory determinants of capital

$$\begin{aligned} \Delta D_{it} &= \alpha + \beta_{DEF} DEF_{it} + \beta_T \Delta T_{it} \\ &\quad + \beta_Q Q_{it} + \beta_{size} S_{it} + \beta_\Pi \Pi_{it} + \varepsilon_{it} \end{aligned}$$

with

$T =$ asset tangibility,

$Q =$ book-to-market

Size $=$ log sales (alt.: log assets)

$\Pi =$ profit

$\Longrightarrow$ DEF has little explanatory power.

1. Some stylized facts on financial policies

- *Low leverage puzzle*
  - Firms seem to use external debt financing too conservatively relative to what conventional trade-off models would predict
  - Too many firms have almost no debt financing
    - Also: Graham (JF 2000): finding on financial conservatism

Quasi-Market Leverage*

	1986–2003	1986	1990	1994	1998
Mean	29.26	34.45	28.40	26.00	29.65
Median	23.82	31.16	23.43	20.46	23.02
$< 1\%$	8.78	3.82	7.76	10.54	11.05
$< 5\%$	19.84	12.40	19.54	22.73	22.12
N	4206	3461	3965	5097	4282

*data: COMPUSTAT/CRSP merged file; Book Debt: D9+D34; Market Equity: D25*D199; conditions:no financials, book assets$>$ 10.

1.1 Stylized facts: Cont'd

- *International comparisons*
  - Similar results across both developed and developing countries
  - "Subtle" differences are still important to explain:
    - E.g.: size effect in Germany

Quasi-Market Leverage and Interest Coverage Ratio†

Developed Countries	Leverage	Coverage Ratio	Developing	Leverage	Coverage Ratio
USA	28/23	4.05	South Korea	64	–
Japan	29/17	4.66	India	35	–
Germany	23/15	6.81	Malaysia	20	–
France	41/28	4.35	Pakistan	19	–
Italy	46/36	3.24	Turkey	11	–
UK	19/11	6.44	Brazil	10	–
Canada	35/32	3.05	Mexico	14	–

†Source: Rajan and Zingales (JF 1995) for developed countries (period: 1991; data: Global Vantage; leverage: debt to capital (a/b: a: non-adjusted; b: adjusted); interest coverage ratio: EBITDA/Interest; medians reported), Booth, Aivazian, Demirguc-Kunt, and Maksimovic (JF 2001) for developing countries (period: 1985–1991; data: IFC; leverage: liability-based estimation; for Brazil and Mexico: book equity

1.2 Stylized facts: Cont'd

- *Persistence of leverage*
  - Leverage is heavily path-dependent and persistent
  - Explanations: Baker and Wurgler (JF 2002), Welch (JPE 2004), Strebulaev (2004)

Persistence of leverage[‡]

Panel B: $t/t+1$	1	2	3	4	5
1 lowest	72.80	12.45	3.12	1.03	0.37
2	16.18	70.58	18.37	3.95	1.18
3	1.98	21.62	53.10	19.53	3.63
4	0.54	2.83	22.38	55.41	18.81
5 highest	0.32	0.75	2.91	20.12	75.24
Panel A: $t/t+10$	1	2	3	4	5
1 lowest	44.92	19.82	11.24	6.55	4.96
2	33.74	33.13	23.14	12.98	9.48
3	11.46	25.21	28.34	20.42	14.46
4	6.30	14.08	23.17	31.02	25.31
5 highest	3.59	7.77	14.05	28.99	44.76

[‡]Source: My estimation; Data: COMPUSTAT/CRSP annual merged; period: 1950-2003; quantile 1: lowest leverage; rows: initial leverage; columns: leverage in 1/10 years

1.3 Stylized facts: Cont'd

- *Cross-sectional determinants of leverage*
  - Historically the most accepted empirical tool
  - Strebulaev (2004): critique

Cross-sectional determinants of leverage[§]

	Book Leverage	Q-Market Leverage
Constant	24.93	39.76
	(22.92)	(21.20)
Market-to-Book	-0.60	-6.33
	(-1.85)	(-14.47)
Tangibility	0.22	0.19
	(27.80)	(21.88)
Profitability	-0.58	-0.79
	(-12.94)	(-13.48)
Log Size	0.17	0.49
	(1.28)	(4.05)
$\bar{R}^2$	0.23	0.33
N	52/2244.44	52/2244.44

[§]Source: My estimation; Data: COMPUSTAT/CRSP annual merged; period: 1950-2003; no financials, assets(D6)>10; Method: Fama-McBeth (1973); no adjustment for t-stats

1.4 Stylized facts: Cont'd

- *What is tax advantage to debt*
  - In the absence of debt:

$$\pi_U = \delta(1-\tau)$$

  - In the presence of debt:

$$\pi_L = (\delta - c)(1-\tau) + c = \pi_U + c\tau$$

  - Definition of the marginal tax rate
- *How large is tax advantage?*

The aggregate tax benefits of debt¶

	1980	1984	1988	1992	1994
Gross Benefit	10.1	10.9	9.9	8.7	7.3
Net Benefit	2.6	4.3	4.8	4.6	3.5
Lost Gross Benefit	∼28	∼28	–	∼8	∼8
Lost Net Benefit	–	–	–	–	4.7
N	5335	5461	6115	6282	6849

¶% of firm value; data: from Graham (2000), COMPUSTAT and CRSP

1.5 Stylized facts: Cont'd

- *Debt policy factors: CFO's perspective*: (Graham and Harvey (JFE 2001))
  1. Financial flexibility (59%)
  2. Credit rating (57%)
  3. Earnings and cash flow volatility (48%)
  4. Insufficient internal funds (45%)
  5. Tax advantage (45%)

1.6 Stylized facts: Cont'd

- *Missing tables...*
  - Mean reversion
  - Frequency and types of (a) default; (b) financial distress
  - Private vs public debt usage
  - Sources of investment: internally generated cash, equity, debt
  - Complexity of debt structure: (a) distribution of instruments/trustees
  - Covenants used in debt contracts
  - Credit ratings
  - Response to business cycles

Capital Structure and Market Timing

A variant of Myers and Majluf (1984):

1. *Like* Myers-Majluf:
   - Managers have the incentive to try to time the market because they care more about existing shareholders.
   - Investors react to financing decisions, and this adverse selection dominates other considerations, so. . .
     . . . there is no optimal capital structure.

2. *Unlike* Myers-Majluf:
   - Managers think that they can successfully time the market, believing
     – Shares are occasionally under- or overvalued.
     – Investors underreact to new issues.

- **Implication**: Temporary fluctuations in market value have a lasting impact on capital structure outcomes
  - Managers respond to the (over-/under-)valuaion of their firm with security issuances.
  - Such market timing have a *persistent* effect.
- **Appeal** of market timing
  - Intuitive
  - Persistence not easy to explain with existing theory

Empirical Approach (Baker and Wurgler (2002): Market Timing and Capital Structure)

- Trace the evolution of capital structure as firms mature
  - Start from IPO date.
  - Trace the determinants of capital structure as firms mature.
- Capital structure; focus on leverage D_t/A_t
  - Compustat coverage from 1969 to 1998
- **Step 1**: analyze year-by-year capital structure and document the link between market value and financing decisions
- **Step 2**: analyze (persistent?) effect of market valuations on capital structure over time

- Capital structure changes:

$$\Delta \frac{D_t}{A_t} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right]$$

  - e_t = net equity issue
    = new issues minues repurchases
    = change in book equity – change in balance sheet retained earnings
    = 'active change in capital structure'
  - Newly retained earnings
    = 'passive change in capital structure'
  - Residual change in assets

$==>$ Break the equity-to-assets ratio into two main components: Net new equity issues and retained earnings

Step 1: Determinants of capital structure changes

- M/B (*market timing theory*)

- Other variables from Rajan and Zingales (determinants of capital structure in several countries):
  - Fixed assets intensity (defined as PPE/A - more collateral, more debt capacity under a *tradeoff theory* of capital structure)
  - Profitability (defined as EBITDA/A - more internal funds, less debt needed under a *pecking-order theory* – or, more free cash flow and so more debt required under a *tradeoff theory*)
  - Size (log sales – large firms may be more stable, less likely to enter financial distress, so more debt under a *tradeoff theory*)

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t.$$

Results (a and f not reported):

		M/B_{t-1}		PPE/A_{t-1} %		$EBITDA/A_{t-1}$ %		$\log(S)_{t-1}$		
Year	N	b	$t(b)$	c	$t(c)$	d	$t(d)$	e	$t(e)$	R^2
Panel A: Change in Book Leverage $(\Delta(D/A)_t)$ %										
IPO	2,281	−3.70	(−11.81)	0.04	(2.50)	−0.10	(−3.84)	3.83	(14.65)	0.45
IPO + 1	2,652	−1.21	(−5.65)	0.04	(3.78)	−0.16	(−6.33)	0.22	(1.24)	0.12
IPO + 3	2,412	−0.93	(−4.47)	0.03	(2.79)	−0.10	(−4.26)	0.69	(4.31)	0.08
IPO + 5	1,668	−0.03	(−0.10)	0.04	(3.89)	−0.11	(−3.22)	0.89	(5.09)	0.06
IPO + 10	715	−1.80	(−2.75)	0.04	(2.20)	−0.02	(−0.28)	0.12	(0.41)	0.09

Step 2: Persistence of M/B effect on capital structure

- Empirical approach: Summarize the historical path of valuations with a single statistic
- Main measure: weighted average market-to-book ratio
  - Definition weights = amount of external finance (debt plus equity) raised in each year from the IPO through t-1
  - Idea: Financing events represent a 'practical opportunity' to change capital structure
  - Note: restricted to non-negative external finance, i.e., negative values excluded from weighting scheme. (Eliminates the possibility of a negative overall weighted average and a negative denominator.)

$$\left(\frac{M}{B} \right)_{efwa,\,t-1} = \sum_{s=0}^{t-1} \frac{e_s + d_s}{\sum_{r=0}^{t-1} e_r + d_r} \cdot \left(\frac{M}{B} \right)_s$$

An example of the weighting scheme (sample firm):

Year	E/A_t	F/A_t	F_t	$\max(F_t,0)$	M/B_t	M/B_{efwa}
1986 (IPO)	0.77	0.29	19.41	19.41	4.35	4.35
1987	0.78	0.01	0.87	0.87	4.76	4.37
1988	0.77	0.03	3.37	3.37	4.65	4.41
1989	0.79	0.03	4.75	4.75	4.19	4.37
1990	0.80	0.03	6.74	6.74	4.00	4.30
1991	0.82	0.04	14.30	14.30	3.56	4.09
1992	0.72	-0.03	-8.43	0.00	1.96	4.09
1993	0.68	0.00	0.30	0.30	1.59	4.07
1994	0.68	0.03	10.07	10.07	1.86	3.70
1995	0.66	0.00	0.52	0.52	1.48	3.68
1996	0.61	0.11	36.05	36.05	2.54	3.25

Explanation:

- Firm went public in 1986. (Capital structure in next 2 columns.)
- Use dollar amounts of external finance (3rd column) to weight the past market-to-book, with the exception of negative values (truncate at 0).
- The fifth column shows the pattern of market-to-book, the last column shows the weighted average.

Cross-section regressions:

$$\left(\frac{D}{A}\right)_t = a + b\left(\frac{M}{B}\right)_{efwa} + c\left(\frac{M}{B}\right)_{t-1} + \mathbf{x}'_{t-1}\mathbf{k} + u_t$$

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{pre-IPO} = a + b\left(\frac{M}{B}\right)_{efwa} + c\left(\frac{M}{B}\right)_{t-1} + \mathbf{x}'_{t-1}\mathbf{k} + u_t$$

Controls x include

- Fixed assets intensity
- Profitability
- Firm size
- Also, FF (2000) controls

$$\left(\frac{D}{A}\right)_t = a + b\left(\frac{M}{B}\right)_{efwa,\,t-1} + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\,\log(S)_{t-1} + u_t.$$

		$M/B_{efwa,t-1}$		M/B_{t-1}		PPE/A_{t-1} %		$EBITDA/A_{t-1}$ %		$\log(S)_{t-1}$		
Year	N	b	$t(b)$	c	$t(c)$	d	$t(d)$	e	$t(e)$	f	$t(f)$	R^2
Panel A: Book Leverage %												
IPO + 1	2,652			−4.36	(−15.59)	0.13	(7.30)	−0.22	(−6.44)	5.00	(16.40)	0.25
IPO + 3	2,412	−4.93	(−8.40)	−0.86	(−1.50)	0.12	(6.63)	−0.31	(−7.41)	4.62	(15.53)	0.25
IPO + 5	1,668	−6.49	(−9.78)	0.05	(0.07)	0.12	(5.74)	−0.32	(−7.18)	4.30	(12.40)	0.26
IPO + 10	715	−10.81	(−10.59)	3.71	(3.23)	0.12	(3.65)	−0.38	(−5.01)	2.67	(4.82)	0.23
1980–1999 All firms	31,151	−7.21	(−21.20)	2.20	(3.38)	0.04	(3.62)	−0.48	(−7.20)	2.84	(21.79)	0.20
Panel B: Market Leverage %												
IPO + 1	2,694			−8.09	(−26.57)	0.14	(8.00)	−0.19	(−6.26)	2.91	(9.96)	0.36
IPO + 3	2,482	−6.05	(−10.03)	−5.84	(−9.53)	0.12	(6.53)	−0.32	(−9.17)	3.31	(10.43)	0.40
IPO + 5	1,731	−7.41	(−9.55)	−5.30	(−6.14)	0.12	(4.99)	−0.36	(−7.09)	2.43	(6.25)	0.37
IPO + 10	738	−10.77	(−9.38)	−3.29	(−3.19)	0.11	(3.22)	−0.53	(−5.92)	1.23	(2.06)	0.37
1980–1999 All firms	32,209	−7.35	(−20.52)	−5.53	(−14.45)	0.06	(3.65)	−0.61	(−7.54)	1.63	(15.06)	0.35

- **Economic and statistical significance** of efwa-M/B effect
  - Since the standard deviation of the weighted average is typically about 1, you can interpret these coefficients as 1 STD effects on capital structure.
  - In other words, a one standard deviation in the weighted average, holding everything else constant, changes capital structure by about 10 percent for firms 10 years out.
  - Including the weighted average doubles the R-squared from 10 to 20 percent.
- **Conclusion**:
  - Firms issue equity when their market value is relatively high.
  - They do not rebalance subsequently.
- Put differently, temporary fluctuations in market value have a lasting impact on capital structure.

Possible Explanations

1. Trade-off theories
   - Taxes, costs of financial distress, and agency lead to an optimal leverage ratio
   - Market-to-book could be connected to
     - Costly financial distress
     - Debt overhang
     - Agency
     - Perhaps tax benefits

     $\Longrightarrow$ Ancillary prediction: Temporary fluctuations in market-to-book (or anything else) should have a temporary impact.
     $\Longrightarrow$ Refuted.

2. Pecking order

   - Adverse selection dominates other considerations, leading to a pecking order
   - High market-to-book means investment opportunities exceed internally generated funds and debt capacity.

     $\Longrightarrow$ Ancillary prediction: Temporary increases in market-to-book should lead to lower cash balances or higher future investment.
     $\Longrightarrow$ Ancillary finding: Increases in M/B have a permanent *negative* impact on cash balances and no lasting impact on investment.
     $\Longrightarrow$ Refuted.

3. Market timing

   - Managers *believe* they can time the market.

Flipside of Market Timing:

Biased managers face rational investors

$\Longrightarrow$ Remember I/CF discussion: reluctance to issue equity if perceived to be undervalued in the market.

Readings for next week:

* Loughran, Tim and Jay Ritter (1995), "The New Issues Puzzle," Journal of Finance 50, pp.23-51.

Fama, Eugene and Kenneth French (2005), "Financing Decisions: Who Issues Stock?" Journal of Financial Economics 76: 549-582.

Asquith, Paul and David Mullins (1986), "Equity Issues and Offering Dilution," Journal of Financial Economics 15, pp. 61-89.

* Jay Ritter (1991), "The long-run performance of initial public offerings," Journal of Finance 42, pp.365-394.