The Debt-Equity Choice

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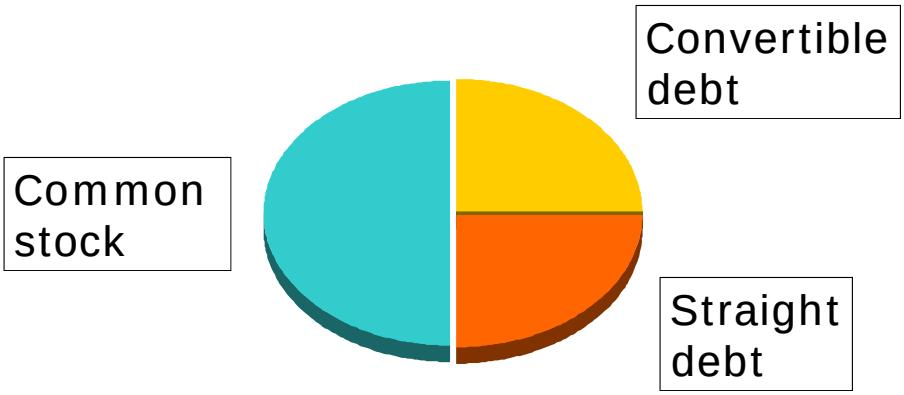
2010

Capital structure Choice



Agenda

- Miller (1977): Debt and taxes
- Tradeoff vs. pecking order
- CFO Survey

Notation

Two firms, U and L:

- Same stream of operating income.
- Differ only in capital structure.
- Value of unlevered firm: $V_U = E_U$
- Value of levered firm: $V_L = E_L + D_L$

Sufficient conditions for $V_L=V_U$

- Rational and frictionless markets, and
- no information asymmetries, and
- no taxes, and
- no agency costs, and
- no capital rationing

Proof by simple arbitrage: Buying/selling securities always a zero NPV project

Is $V_L=V_U$ in practice?

- Hard to test directly: Need to compare firms that differ only in their capital structures
  - The firms must have identical asset structures
- Look instead on the validity of the sufficient conditions (prior slide)
- Most would agree debt policy matters for V
- The more difficult question is WHY?

Effect of Corporate Taxes (only)

- Annual cash flow to levered firm
  - = Cash flow to unlevered firm
  - + Interest tax shield

$CF_L = CF_U + \tau I$

$PV(CF_L) = PV(CF_U) + \tau PV(I)$

$V_L = V_U + \tau PV(I)$

- If the firm's debt is perpetual:

$PV(I) = I/r_D = D_L$

$\rightarrow \quad V_L = V_U + \tau D_L$

Recap: With corporate tax $V_L = V_U + \tau_C D$

- $WACC = (D/V)(1-\tau_C)r_D + (E/V)r_E$
- Firms should be 100% debt financed!
  - assuming no cost of debt
- What about personal tax on interest income?
- Two-stage tax analysis

Effects of Personal Taxation

- The personal tax structure is typically biased in favor of equity (dividend and capital gains) over debt (interest) income
- To induce debt to be held by investors, debt must now pay a tax-induced interest rate premium
- If the debt coupon equals the market interest rate, the premium is in the form of an initial debt issue discount
- The discount determines whether there is a net tax advantage to debt financing

Miller's (1977) Equilibrium

- Assumes:
  - (1) all firms face the same effective marginal corporate tax rate τ
  - (3) there are no bankruptcy costs
- Firms issue debt until the market price of debt is such that the debt tax premium equals the marginal corporate tax advantage of debt
- At this point, the net tax advantage of debt to the corporation is zero

Two-stage tax analysis

- Investors value corporate securities based on the risk-adjusted return after all taxes have been paid, corporate and individual
  - Thus, firms maximize value by looking to minimize the total tax burden, not just the corporate tax bill
- Suppose interest (debt) income is taxed at the personal level but equity (dividends and capital gains) income is not
  - Now, debt financing has a tax advantage at the corporate level, but a tax disadvantage at the personal level, relative to equity

Illustration with two tax rates

	Equity	Debt
Taxable income to firm	1	1
Corporate tax	τ_C	0
Income to security holder	1- τ_C	1
Personal tax (no dividend tax)	0	τ_D
Income after all taxes	1- τ_C	1- τ_D

Two-stage tax example

- To maximize value, finance using the instrument yielding the largest return after <u>all</u> taxes have been paid
- Thus, prefer debt financing if

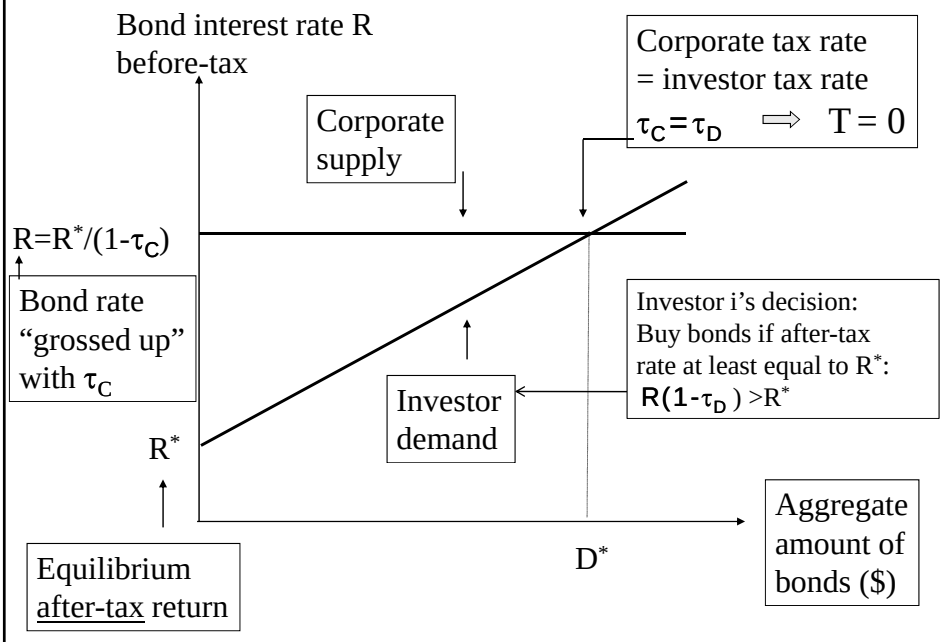
$$(1-\tau_D)>(1-\tau_C)$$

or if

$$T\equiv 1-(1-\tau_C)/(1-\tau_D)> 0$$

so,

$$V_L = V_U + T*D$$



Miller's Bond Market Equilibrium

- Investor demand:
  - If $R<R^*$: Zero demand
  - If $R=R^*$: Demand from tax-exempt investors only
  - If $R>R^*$: Individual I demands bonds if $R(1-{}_i\tau_D)>R^*$
- Corporate bond supply:
  - Indifference between debt and equity when $R=R^*(1-\tau)$ (perfectly elastic supply)
- Equilibrium: (1) Marginal investor indifferent between holding debt or equity. (2) Personal tax advantage of equity exactly offset by corporate tax advantage of debt

Illustration with three tax rates

	Equity	Debt
Taxable income:	\$1	\$1
Corporate tax:	τ	0
Income after corp. tax:	$1-\tau$	1
Personal tax:	$\tau_E(1-\tau)$	τ_D
Income after all tax:	$(1-\tau)(1-\tau_E)$	$1-\tau_D$

- Let ΔV = change in firm value from issuing more equity (ΔE) and debt (ΔD)

$$\Delta V = \Delta D(1- \tau_D) + \Delta E(1- \tau)(1- \tau_E) = 0$$

- Since we are considering replacing one dollar equity by one dollar debt:

  $\Delta E = -\Delta D$
- Thus, replace until

  $(1- \tau_D) = (1- \tau)(1- \tau_E)$

$\rightarrow$ prefer debt financing if

$(1-\tau_D) > (1-\tau)(1-\tau_E)$

or, equivalently, if

$$T_d \equiv 1 - \frac{(1-\tau)(1-\tau_E)}{(1-\tau_D)} > 0$$

- Again, T_d is the net corporate tax-benefit from a dollar debt financing. Thus,

$$V_L = V_U + T_d D$$

- Special cases:

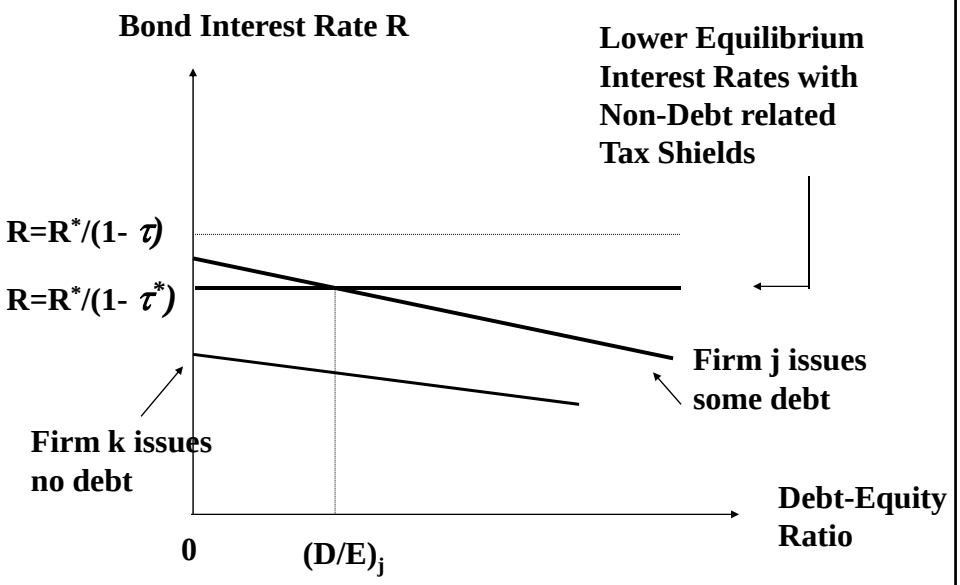
If $\tau = \tau_D = \tau_E = 0$, then $V_U = V_L$

If $\tau = \tau_D$ and $\tau_E = 0$, then $V_U = V_L$.

- In sum, what matters is not tax rates per se, but the relative magnitude of the tax rates at the corporate and personal level (so that $T_d > 0$)

Miller and Non-Debt Tax Shields

- Above, each firm issues debt until the net tax advantage is driven to zero
- With non-debt tax shields (e.g., depreciation allowance), the firm can have more tax shield than it can use
- This reduces the effective tax shield on interest expense (at least in present value terms), increasing the cost of debt capital
- The cost increases because the firm must pay the debt tax premium set by the market, without realizing the corporate tax benefit



Miller (1977) and bankruptcy costs

- Miller (1977) assumes zero bankruptcy costs
- Let E(BC) = increase in expected bankruptcy costs from adding one more dollar of debt
- Firms issue debt until $E(T_d) = E(BC)$
- Rule: issue debt until the expected tax advantage is reduced to the level of expected bankruptcy costs

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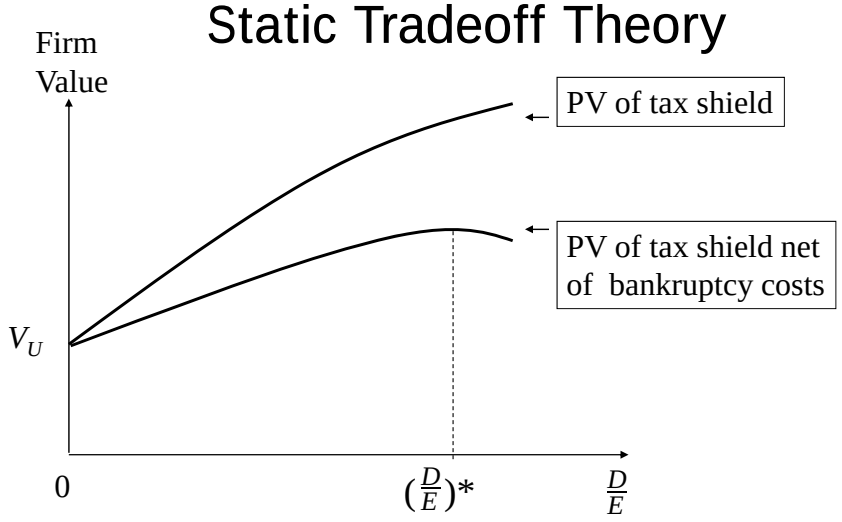
- CFO Survey

The Balancing Act (Tradeoff Theory)

- $E(T_d)$ and E(BC) differ across firms
- As a firm raises its debt level, both the probability of having excess tax shields and the probability of bankruptcy increase
- As a result, the expected incremental tax benefit of debt falls with leverage while the expected incremental costs of leverage rise
- This leaves each firm with a unique optimum debt level

Static Tradeoff Theory



Balancing of tax shields and bankruptcy costs.

Predictions of Tradeoff Theory

- Firms with higher non-debt tax shields relative to earnings (EBIT), and higher expected bankruptcy costs, will tend to have lower leverage ratios
- Firms with higher volatility of earnings have lower leverage
- The expected marginal net corporate tax benefit is always lower than the corporate tax rate, and decreasing in leverage

Debt Tax Shield Estimation

- Want to estimate $T_d \equiv 1-(1-\tau)(1-\tau_E)/(1-\tau_D)$

1. Marginal personal tax rate on debt (τ_D):

- Let r_{MZ} denote the yield on a 1-year AAA municipal zero discount bond (muni), and r the yield on a 1-year T-bill
- For the marginal investor, it must be that

$$r(1-\tau_D) = r_{MZ} \text{ or } \tau_D = 1-r_{MZ}/r$$

2. Marginal personal tax rate on equity (τ_E)

- τ_E can be approximated by adjusting the personal tax rate on debt income τ_D by the expected fraction α of a stock's expected return that that is due to taxable dividends, i.e.,

$$\tau_E = \alpha\tau_D$$

3. The probability p_d of realizing T_d

- Can be estimated using scenarios for EBIT, and determine which scenarios have EBIT> All Firm Tax Shields. Then sum the probabilities of such scenarios to get p_d

- The total expected net tax advantage of debt, given that we can fully use the debt tax shield, is now given by

$$T_d \, p_d \, \Delta D$$

4. Expected net tax cost of debt when we cannot use the debt tax shield

- When the firm no longer saves on taxes as another dollar debt is added, the term $1-\tau$ is eliminated from the expression for T_d

  [recall: $T_d \equiv 1-(1-\tau)(1-\tau_E)/(1-\tau_D)$]
- Denote this adjusted value $T_{da} < 0$

- θ= proportion of the new debt that gives rise to an excess tax shield
- p_d = probability that the firm is in full tax position (and deducts interest expense)
- p_{da} = probability that the firm has excess tax shields (firm pays no taxes)
- $T_{da}p_{da}\theta \, \Delta D$ = expected net tax cost
- Redefine: $p_{da}^* \equiv \theta p_{da}$

  $p_d^* \equiv p_d + (1-\theta p_{da})$
- This redefinition let the probabilities p^* reflect the *partial* use of debt tax shields

5. The total tax valuation effect of changing the firm's debt level

$$\Delta V = T_d\, p_d^*\, \Delta D + T_{da} p_{da}^*\, \Delta D$$

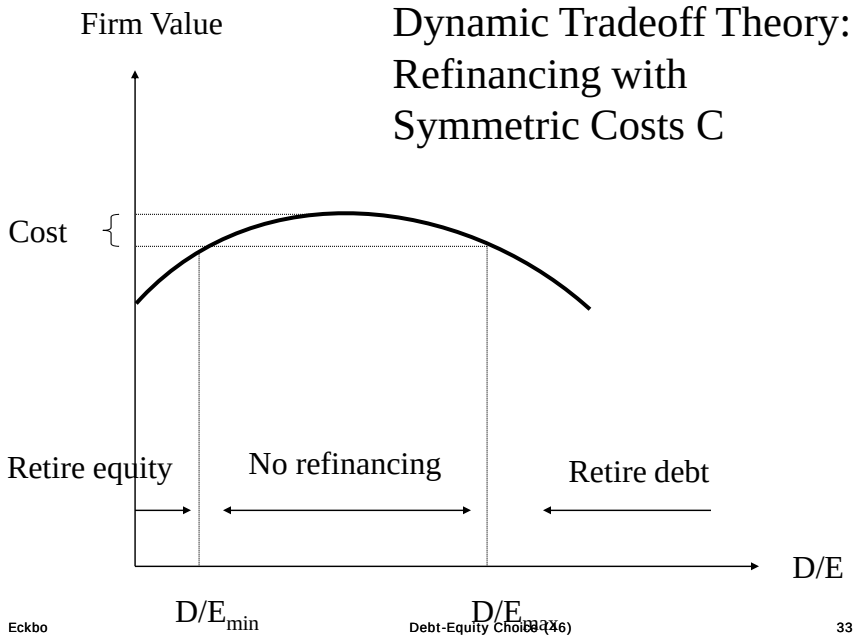
- Note: We have so far ignored the possibility of bankruptcy. If the probability of bankruptcy is estimated to be p_{bc}, then it follows that

$$p_{da}^* + p_d^* + p_{bc} = 1$$

  Default reduces, but does not necessarily eliminate, the debt tax shield
- The literature estimates the corporate tax advantage to be less than 10%

- When estimating the firm's tax shield it should also be kept in mind that the firm can adjust its tax shield position over time
- A sale-leaseback shifts the depreciation and tax credits on the leased asset to an outside lessor
- Vice versa, establishing a leasing subsidiary that loans funds to outside purchasers of assets transfers the leased asset's depreciation and tax credits into the firm (the lessee)

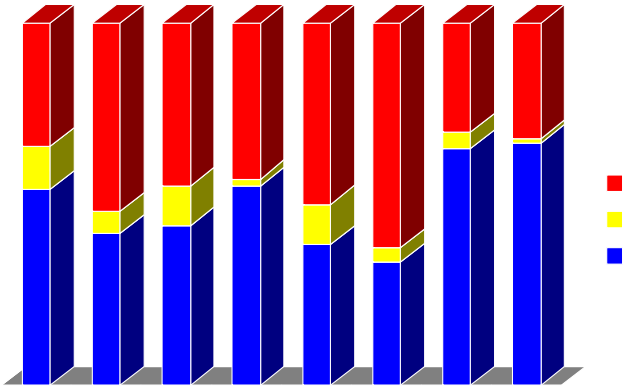
Dynamic Tradeoff Theory: Refinancing with Symmetric Costs C



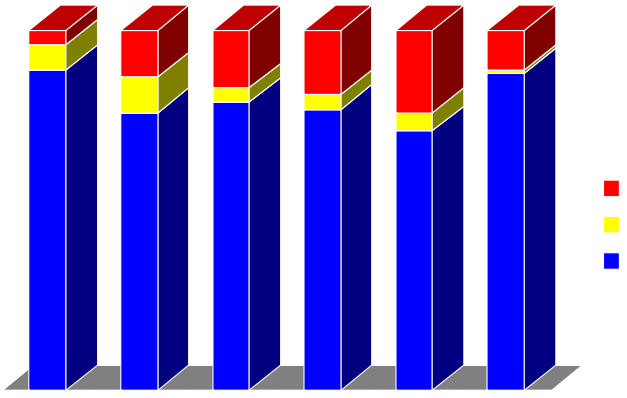
The "pecking order"

- The order in which firms typically elect to finance investments
  - 65%+ through retained earnings
  - Next, straight debt issue
  - Next, convertible debt issue
  - Next, preferred share issue
  - Finally, common stock issue

Total Financing Sources 1970-1995: Retention dominates



US Corporate Security Offerings for Cash 1940-1990: Bonds dominate



Debt and the Financing Deficit

$$DEF_t \equiv DIV_t + I_t + \Delta W - C_t \equiv \Delta D_t + \Delta E_t$$

$$\Delta D_t = a + bDEF_t + e_t$$

- Shyam-Sunder and Myers (1999)
- Frank and Goyal (2005)

A Debt Puzzle

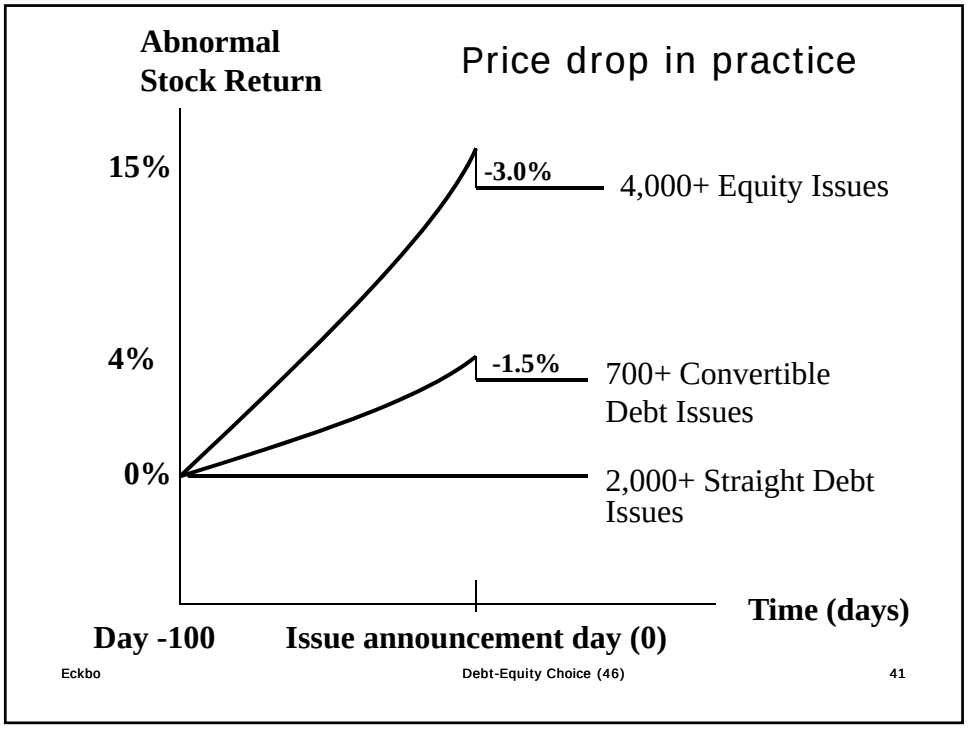
- Highly profitable firms (with a stable dividend policy) tend to have lower long-term leverage ratios
- Why?
  - They forego tax benefits
  - They seemingly maintain unused debt capacity
- Are firms underleveraged?

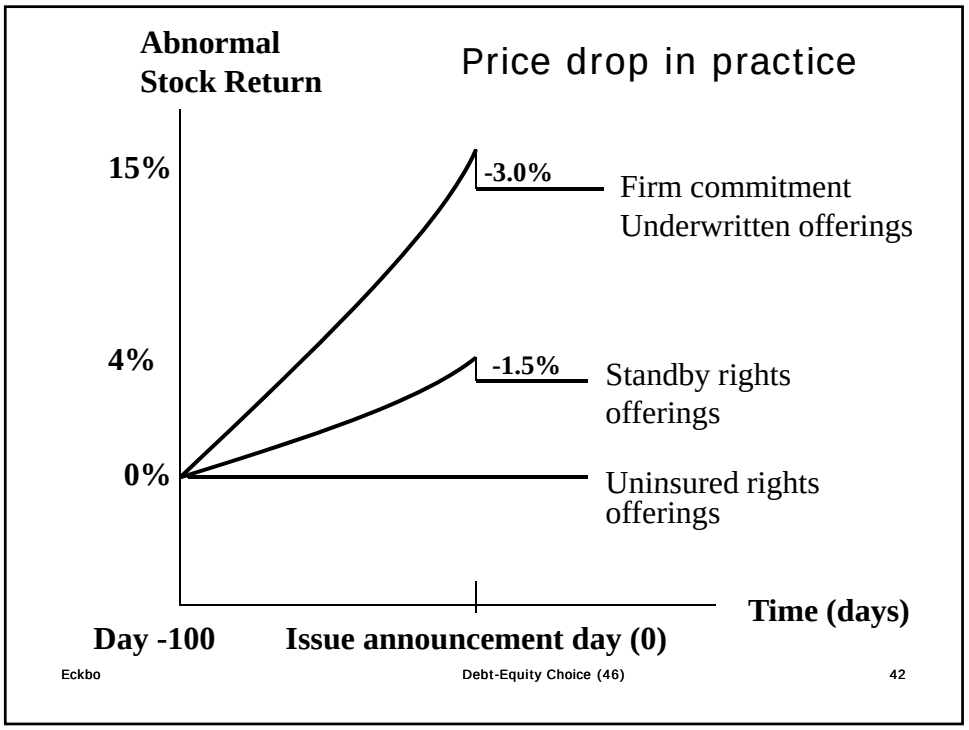
Possible resolution of puzzle

- Firms prefer internal (equity) financing to external equity
- If a profitable company needs cash for future investments, it builds financial slack (cash or short-term debt)
- If a profitable company does not expect to need capital, it uses the profits to pay down long-term debt
- Both actions reduces long-term leverage ratios

Tradeoff or pecking order?

- Tradeoff theory cannot explain the debt paradox
  - More profitable firms should have higher target debt ratios
- Tradeoff theory cannot explain market reaction to debt issues
  - It's non-positive


Abnormal
Stock Return
Price drop in practice
15%
4%
0%
-3.0%
4,000+ Equity Issues
-1.5%
700+ Convertible
Debt Issues
2,000+ Straight Debt
Issues
Time (days)
Day -100
Issue announcement day (0)
Eckbo
Debt-Equity Choice (46)
41


Abnormal
Stock Return
Price drop in practice
15%
4%
0%
-3.0%
Firm commitment
Underwritten offerings
-1.5%
Standby rights
offerings
Uninsured rights
offerings
Time (days)
Day -100
Issue announcement day (0)
Eckbo
Debt-Equity Choice (46)
42

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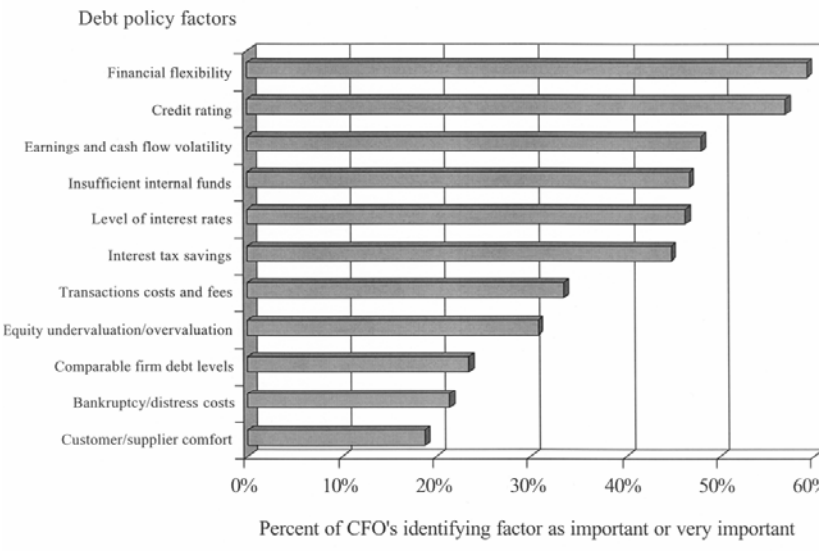
The Debt-Equity Choice in Practice



Market-leverage vs. book-leverage

- Market-leverage: Total debt/Market assets
  - Market assets = Market equity + book debt
  - "Forward looking" leverage ratio
- Book-leverage: Total debt/Book assets
  - Book assets = Book equity + book debt
  - "Backwards looking" leverage ratio

Reliable market-leverage factors

- Industry: Firms that compete in industries in which the median firm has high leverage tend to have high leverage
- Growth: Firms that have a high M/B tend to have low levels of leverage
- Asset tangibility: Firms that have more tangible assets tend to have more leverage
- Profits: Firms that have more profits tend to have less leverage
- Firm size: Larges firms (book assets) tend to have high leverage
- Dividends: Dividend-payers have less leverage than non-payers