

Applied Corporate Finance

Capital Structure and Convertible Bonds

Rui Silva



• Corporate Capital Structure: Some Stylized Facts

• Theories of Capital Structure – Traditional and Modern

• Convertible Bonds



Capital Structure: Some Stylized Facts



Leverage Ratios Around the World: 1990-2005





- There is significant variation in average leverage ratios across countries.
- What might explain these differences?
 - Legal origin (Common Law vs. Civil Law)
 - Relative size of the banking sector
 - Tax system (treatment of dividends)
 - Bankruptcy code
 - Power of labour unions
 - Degree of economic development
 - Government debt guarantees



Stylized Fact #2

Internally generated funds are the primary source of financing, followed by debt.





• 9 factors are consistently correlated with cross-sectional differences in leverage:

Factor	Relationship
Industry Median Leverage	+
Fixed Assets	+
Firm Size	+
Time since IPO	+
Expected Inflation	+
Market-to-Book	-
Profits	-
NOLCs	-
Dividend Payer	-



- Corporate leverage is mean-reverting at the firm level.
 - Empirical studies estimate target adjustment rates at 8-10% per year.
 - Firms often have a target leverage ratio, or target credit rating.



- Approximately 70% of firms in a given year issue some amount of equity
 - This is much more than would be expected if firms strictly followed the pecking order.
- After an IPO, equity issues are more important for small firms than for large firms.
 - Large firms tend to issue equity less frequently, but on a larger scale.



Composition of Debt:

Rated US Firms

	Share of Total Capital (Debt Type)/(D+E)	Share of Total Debt (Debt Type)/D
Total Debt	0.502	1.000
Bonds	0.192	0.382
Bank Loans	0.132	0.263
Convertible Bonds	0.055	0.110
Program Debt	0.044	0.088
Private Placements	0.033	0.066
Mortgage Debt & Equipment Notes	0.021	0.042
Other	0.024	0.048

- Program Debt: Commercial paper, MTNs, shelf-registered debt.
- Other: Capitalized leases, unclassified debt.

Stylized Fact #6 (2)

Composition of Debt For Rated Firms 1996-2006



BUSINESS & ECONOMICS



Theories of Capital Structure



• Static Model Predicts:

 $V^{L} = V^{U} + PV$ (Interest Tax Shield) – PV(Financial Distress Costs)

- An increase in non-debt tax shields reduces optimal leverage
- Increase in the tax on interest income decreases debt
- Increase in personal tax on equity increases leverage



Static Trade-off Theory (2)





Costs of Financial Distress

- Direct Costs:
 - Legal fees, accounting experts, consultants, investment banks, etc...
 - Enron: \$30 million per month on legal fees total cost exceeded
 \$750 million.
 - Estimates suggest direct costs of bankruptcy average about 3 to
 4% of the pre-bankruptcy market value of total assets.
- Indirect Costs:
 - Loss of suppliers, loss of employees, loss of receivables, fire sales of assets, delayed liquidation, etc...
 - Andrade and Kaplan (1998) estimated that the potential loss of value due to financial distress is between 10% and 20% of firm value.



 $V^{L} = V^{U} + PV$ (Interest Tax Shield) -PV(Financial Distress Costs) +PV(Agency Benefits) -PV(Agency Costs)

- Agency Costs of Debt:
 - Risk-Shifting (asset substitution)
 - Underinvestment (debt overhang)
 - Risk Avoidance
- Agency Benefits of Debt:
 - Managerial perquisites
 - Overinvestment
 - Empire Building







- 1. Firms prefer internal to external finance.
 - Note: Dividends are "sticky," so dividend cuts are not made to finance capital expenditure.
- 2. If external finance is required, firms will issue the safest
 - (i.e., lowest information sensitivity) security first
 - debt before equity.
 - firms issue equity as a last resort.
 - Why is equity the most "informationally sensitive"?
- 3. If internally generated funds exceed capital investment, the firms retire securities by working up the pecking order
- 4. The firm's debt ratio therefore reflects its cumulative requirement for external financing.



Debt Conservatism Puzzles

- Low-Leverage Puzzle:
 - Graham (2000) finds that firms are under-levered with respect to their marginal tax rates.
 - Estimates that firms could add an average of 7.3% to firm value by increasing leverage to the optimal level.
- Zero-Leverage Puzzle:
 - Approximately 10% of firms have no (or even negative) leverage.
 - 23% of firms have leverage ratios less than 0.05.
 - This is not just a small firm phenomenon. Why?



- Explicitly incorporate the roles of the following into a firm's current debt policy:
 - Time
 - Expectations
 - adjustment costs
- There are various costs associated with external finance (transaction costs, information costs, agency costs, etc...).
- Today's financing choices reflect next period's expected financing margin.
 - Firm's are dynamic, and so optimal capital structures are set to maximize the value of the firm over time.



Dynamic Models and Debt Conservatism

- In dynamic models, the firm must come to the capital markets for financing from time to time.
- The cost of external finance varies over time according to macroeconomic conditions and the firm's financial strength.
 - E.g., Julio, Kim, and Weisbach (2008): Firms with higher probability of default (high leverage, low rating) are rationed out of debt markets during market downturns.
- Firms that have a large proportion of value coming from growth options will choose financial structures that avoid the risk of losing access to external finance.
- The benefit from maintaining access to finance will, in some cases, out-weight the tax benefits of debt for growth firms even if they are profitable
 - → firms will appear under-levered relative to a static trade-off model.



- 1. Irrational Managers
 - Overconfidence/Overoptimistic:
 - Overconfident managers will have otherwise higher leverage ratios as they over-estimate cash flows and underestimate volatility.
 - Overweighting Personal Experience:
 - Graham and Narasimhan (2004) find that firms with managers who lived through the great depression have significantly lower leverage ratios.
- 2. Irrational Investors
 - Rational managers take advantage of the mis-pricing of equity and issue when the stock price irrationally high.
 - Explains: price run-up, negative price reaction, long-run underperformance of SEOs
 - Implies that a firm's observed capital structure is the cumulative effect of attempts to time the market.



Convertible Bonds



- Convertible bonds give bondholders the option to convert the bonds into shares, at a pre-specified schedule and price.
- Conceptually, convertible bonds are somewhere in between straight bonds and equity in the capital structure.
- They are equivalent to the following package:
 - A straight bond
 - A warrant
 - the exercise price is linked to the value of the straight bond.
 - The warrant is the option to convert into equity.
- This is the most common option in bond contracts.



- Remark 1: Optionality
 - The owner of a convertible owns a bond and a call option on the firm's stock.
- Remark 2: Value is Bounded Below
 - Since the bond is convertible at the option of the holder, its value can never fall below the greater of the straight debt and the conversion value.
- Remark 3: The Full Value
 - At maturity the convertible bondholder can choose to receive the principal repayment on the bond or convert to common stock.
 - The value of the convertible bond is therefore the higher of its bond value and its conversion value.

Convertible Payoff = Max {Conversion Value, Straight Bond Value}



Convertible Bonds (3)



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Source: UBI



Why Do Firms Issue Convertible Bonds?



- What managers say in survey...
- 68% said they issued convertible because they expected their stock price to rise and this makes it possible to sell equity at a higher price.
- 27% say convertible debt is 'cheaper' than regular debt because the coupon rate is lower.

Do these explanations make sense? They are misleading. Why?



- A convertible is like a package of a straight bond and an option. The difference between the market value of the convertible and the straight bond is the price investors place on the call option.
 - The convertible is "cheap" only if this price overvalues the option.
- A convertible bond gives you the right to buy stock by giving up a bond.
 - Bondholders may decide to do this, but perhaps they may not.
 - Issuing convertibles may amount to a deferred stock issue.
 - If firm *needs* equity capital, a convertible issue is an unreliable way of getting it.



1) Asymmetric Information

• Suppose managers are better informed than the market about a firm's prospects.

	Managers Know		Market Believes	
	Boom	Bust	Boom	Bust
Firm Cash Flow	95	40	100	35

- Assume that the probabilities for the boom and bust are 0.4 and 0.6 respectively. The firm wants to raise £50 million.
- Let's divide the analysis using first straight debt and then a convertible.



- Face Value: F solves 0.40*F + 0.60*35 = 50 → F = 72.5
- **Note:** Market participants set the price, so their beliefs count!
- The management thinks that the face value should be:

 $0.40*F + 0.60*40 = 50 \rightarrow F = 65$

• What value will management place on the bond?

0.40*72.5+0.60*40=£53

• The firm has to over-pay by £3.00 million due to the market's incorrect beliefs. How does a convertible help solve this problem? Lets see...



- Suppose they issue bonds with a face value of £50 and the option to convert to *n* shares. Let's say that there are 100 shares outstanding already.
- **Question:** What value of *n* will allow them to raise £50?
- Conversion option is irrelevant in the bust.
- Conversion option in the boom is worth: $0.40*(n/(n+100))*\pm 100$
- Therefore, to raise £50, the firm must set *n* according to:

 $0.40^{*}(n/(n+100))^{*}100 + 0.60^{*}35 = 50 \rightarrow n = 263$



• The bondholders will convert if:

 $2.63/(1+2.63)*V_{firm} > \pm 50$ $V_{firm} > 68.96$

• How does the management value this bond?

 $V = 0.40*[2.63/(1+2.63)]*95 + 0.60*40 = \pm 51.55$

- So this beats the straight bond since the firm has to over-pay by \$1.55 million only due to the market's incorrect beliefs.
- **Question:** What would happen if the management were more optimistic than the market?



2) Asset Substitution

- A reason to issue convertibles is to prevent risk-shifting problems.
- Convertible financing, as opposed to debt financing, reduces the incentive for equity holders to choose risky, negative NPV projects.

Lets study an example:

- Consider a firm with \$25 in cash and existing assets paying \$20 in all states at date 1.
- Assume:
 - Risk-free rate=0.
 - Discount rate = 0.



- Assume firm can take either:
 - A Safe Project: Investment at date 0 = \$25, payoff = \$30 in all states.
 - A Risky Project: Investment at date 0 = \$25, payoff = \$50 in boom, nothing in the bust at date 1.
- The probabilities for Boom and Bust are 0.4 and 0.6 respectively.
- **Question:** Which project will managers take if they are managing shareholder's equity and the firm is all equity financed?



• The payoffs are given by:

	Boom	Bust	Value of Equity
Cash to equity	20130	20130	
under safe project	20+30	20+30	50=0.4 50+0.0 50
Cash to equity	20150	2010	40-0 4*70+0 6*20
under risky project	20+30	20+0	40=0.4 70+0.0 20

- The manager of all equity financed firm would choose the safe project. The safe project is positive NPV while the risky project is a negative NPV project.
- **Question:** Which project will the firm take if it has \$40 of debt to be paid next year at t = 1?



Asset Substitution (cont.)

• For the levered firm the payoffs are given by:

	Boom	Bust	Value of Equity
Cash to equity	20120.40	20+30-40	10 = 0.4*10+0.6*10
under safe project	20+30-40		
Cash to equity	20150.40	0	12 = 0.4*30+0.6*0
under risky project	20+30-40		

- Managers will select the risky project if acting in the interest of equity holders.
 - Taking it allows the equity holders to transfer value from the debt holders.
 - D(Under Safe) = 40 > D(Under Risky) = 28
 - E(Under Safe) = 10 < E(Under Risky) = 12</p>
 - V(Under Safe) = 50 >V(Under Risky) = 40
- The difference of 10 is exactly the gap between the two projects, but risky projects takes 12 from debt holders!



Asset Substitution (cont.)

- Suppose instead that the firm issues convertible debt with a promised payment of \$20.
- The convertible debt holders have the option of converting their debt into 60% of the value of the firm. They will convert when the value of the firm is greater than \$33.33.

	Boom	Bust	Value of Equity
Cash to equity	0.4(20+20)	0.4(20+20)	
under safe project	0.4(20+30)	0.4(20+30)	$20 = 0.4 \ 20 \pm 0.0 \ 20$
Cash to equity	0.4(20+50)	0	11.2 = 0.4*28 + 0.6*0
under risky project	0.4(20+50)		

- Managers will select the safe project if acting in the interests of the equity holders.
 - The reason is that now they have to share the upside.
 - Gambling is less attractive.



How Much is The Convertible Worth?

• The payoff to debt holders is given by:

	Boom	Bust	Value of Convert
Cash to bond	0 6(20 + 20)	0 6(20 + 20)	20 - 0 4*20+0 6*20
under safe project	0.0(20+30)	0.0(20+30)	$30 = 0.4 \ 30 \pm 0.0 \ 30$
Cash to bond		20	
under risky project	0.0(20+50)	20	$20.0 = 0.4 42 \pm 0.0 20$

- The value of the convertible debt is \$30 and the value of the equity is \$20 under the safe project compared to \$28.8 and \$11.2 under the risky project respectively.
- **Bottom Line:** Both equity holders and debt holders do better in this case, hence **security design creates value.**



Summary (1) : Convertible Bonds

- Convertibles can serve as an intermediate signal between debt and equity.
 - this makes sense since convertibles have intermediary riskiness, implying:
 - that their adverse selection properties (lemons problem properties) fall between those of debt and equity;
 - the insurance against bankruptcy offered by convertibles fall between those of debt and equity.
- Convertible Bonds can mitigate the agency problems of debt:
 - The option to convert is one of the covenants that shareholders willingly introduce to deal with the agency problems.



Summary (2): Capital Structure

- The goal of capital structure is to choose the financing mix that maximizes the value of the firm.
- Finance can add/subtract value in places where the Modigliani-Miller assumptions fail. For example,
 - Tax shield benefits
 - Costs of financial distress
 - Agency problems
 - Mitigate FCF problem?
 - Cause debt overhang problems?
 - Asymmetric information
 - Signalling through financial structure, security choice.
 - Information sensitivity of different claims affects offering prices.