Faculty of Social Sciences

Corporate Finance Theory

Lecture 5

The Leverage Ratchet Effect (2)
Admati et al. (2018)

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Intended outcomes for the day:

1. To analyze how shareholder incentives to reduce debt are affected by debt seniority.

2. To demonstrate how initial debt levels affect shareholder incentives to take on more debt in the future, and comment on the role of commitment.

3. To intuitively compare and contrast the ideas in Admati et al. (2018) to the Trade-off Theory of capital structure

Recap from Last Lecture

Theory to explain why shareholders may resist reducing debt, even if debt reduction is efficient (i.e. increases total firm value)

Conflict of interest between shareholders and debtholders

In the absence of taxes and default costs, buying back debt is a zero NPV transaction: debtholder gains = shareholder losses

Size of shareholder losses are increasing in tax level and decreasing in default costs

Losses are larger if debt trades at post-buyback prices; smaller if it is feasible for shareholders to negotiate with debtholders

Shareholder gain from buying back debt

Shareholder gain from reducing debt: $D \to D-d$.

$$G(D, D-d) \equiv V^E(D-d) - V^E(D) - q(D-d)d$$

price of debt

$$= \int_{D-d}^{D} (x - D)\mathrm{d}F(x)$$

"loss of default"

$$+ d \times (1 - F(D-d) - q(D-d))$$

"Reverse d1" option

$$+ \int_{D}^{\infty} t(x, D)\mathrm{d}F(x) - \int_{D-d}^{\infty} t(x, D-d)\mathrm{d}F(x).$$

"Tax effect"

All negative.

where

$$-d \times \underbrace{F(D-d)}_{\text{Probability of Default}} \times \underbrace{E\left[\frac{\tilde{x} - n(\tilde{x}, D-d)}{D-d} \middle| \tilde{x} < D-d\right]}_{\text{Expected Recovery Rate}} \leq 0. \quad (6)$$

Shareholder gain from buying back **junior** debt

Last lecture, we assumed that all debt was of equal seniority.

Now assume that an amount of debt **d** is junior to the remaining debt **D – d**.

That is, a junior debtholder can only be repaid if cash flows are high enough to first repay all senior debtholders in full. If cash flows are too low to repay all senior debtholders, then junior debtholders receive nothing.

Suppose shareholders are looking to buy back this junior debt **d**.

What is the shareholder gain from buying back this debt?

Shareholder gain from buying back **junior** debt

$$G(D, D-d) \equiv V^E(D-d) - V^E(D) - q(D-d)d$$

$$= \int_{D-d}^{D} (x - D)\mathrm{d}F(x)$$

$$+ d \times (1 - F(D-d) - q(D-d))$$

$$+ \int_{D}^{\infty} t(x, D)\mathrm{d}F(x) - \int_{D-d}^{\infty} t(x, D-d)\mathrm{d}F(x).$$

(1) < 0 (2) < 0 (3) < 0

price of debt

Compared to slide 4, which part of the above expression changes?

(1) -The first part ("loss of default option effect")?

(2) -The second part ("reverse dilution effect")?

(3) -The last part ("tax effect")?

Shareholder gain from buying back **junior** debt

Compared to slide 4, which part of the above expression changes:

A. The first part ("loss of default option effect")?
B. The second part ("reverse dilution effect")?
C. The last part ("tax effect")?

Something to consider: in last lecture, all of these parts were strictly negative. Is that still the case now?

Discuss with your neighbor. After 5 minutes, go to socrative.com, room 897458, and vote for what you think is the best answer

Shareholder gain from buying back **junior** debt

Buying back junior debt is cheaper.

This affects the size of the term "q", i.e. the price of debt, in the second expression from the earlier slide.

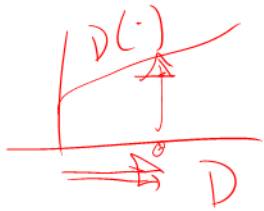
That is, the size of the reverse dilution effect.

Roughly, junior debt is cheaper to buy back. Making it less unattractive for shareholders to reduce debt.

You can see it mathematically in the expression for the "recovery rate" from slide 4, that affects the price of debt, q.

Leverage Ratchet Effect

D( ) is a function
Input: initial debt D
Output: D(D)



PROPOSITION 4 (Leverage Ratchet Effect): *Given total initial debt D, comprised of one or more classes, suppose that the firm has the opportunity to adjust its debt on a one-time basis. Then the following is true for the optimal choice* $D^*(D)$*:*

1) *If the firm has no initial debt, then the amount of debt* $D^*(0)$ *that maximizes the shareholders' gain also maximizes total firm value.*
2) *If the firm has outstanding debt* $D > 0$*, shareholders never gain by reducing leverage. Moreover, if* → equal seniority.
   - *the new debt is pari passu or senior to a claim with a positive expected recovery rate, or*
   - *the new debt is junior to existing claims but the marginal expected tax benefit is positive and the probability of default is continuous at D,*

then $D^*(D) > \max(D, D^*(0))$ *and it is always optimal for shareholders to increase leverage by issuing some amount of new debt, even if it reduces total firm value.*

Total firm value: $V^E + V^D$
: total expected cashflows to shareholders, creditors.

Leverage Ratchet Effect

Idea behind Proposition 4.

If initial debt is zero, then shareholders want to issue debt **D = D***, the exact amount that maximizes firm value

If initial debt is positive, then shareholders always benefit from issuing (a small amount of) additional debt.

Shareholders + new debtholders interests aligned

Shareholders + old debtholders: conflict of interest!

New debt -> high risk -> bankruptcy -> cost passed to old creditors

Leverage Ratchet Effect – zero initial debt

Assume zero initial debt. Shareholder gain from issuing debt D:

$$G(0, D) = V^E(D) - V^E(0) + Dq^J(0, D) = V^E(D) + V^D(D) - V^E(0). \quad \text{(A.4)}$$

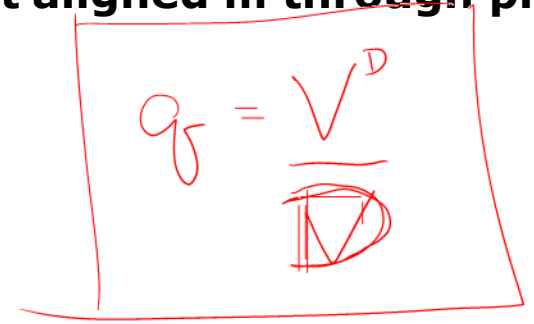
Gain to shareholders from increasing debt from 0 to D.

Amount raised: face value D, times price of debt, q.

The left-hand side is the shareholder gain. The right-hand side is the change in total firm value.

Thus, shareholders will choose to issue debt D that maximizes firm value.

Interest aligned … through price of debt!



Leverage Ratchet Effect – initial debt D > 0

Assume initial debt D. Shareholder gain from issuing junior debt D' - D:

$$G(D, D') = V^E(D') - V^E(D) + (D' - D)q^J(D, D')$$

Firm value:

$$V^E(D') - V^E(D) + (D' - D)q^J(D, D') + D[q(D, D') - q(D, D)]$$

Market value of the new, junior debt

Change in the market value of the previous, senior debt.

Extra term in change of firm value is the change in market value of the senior debt.

Interest not fully aligned through price of debt

Leverage Ratchet Effect - Commitment

If initial debt is zero, then shareholders want to issue debt **D = D***, the exact amount that maximizes firm value

If initial debt is positive, then shareholders always benefit from issuing (a small amount of) additional debt.

When issuing debt D*, with initial debt 0, shareholders would like to convince creditors that they will not take on even more debt in the future.

Commitment problem: once shareholders have borrowed D*, they have an incentive to borrow even more

Creditors should understand that further borrowing can reduce the market value of their claims. As a result, they are less willing to lend; pushes up the price of debt.

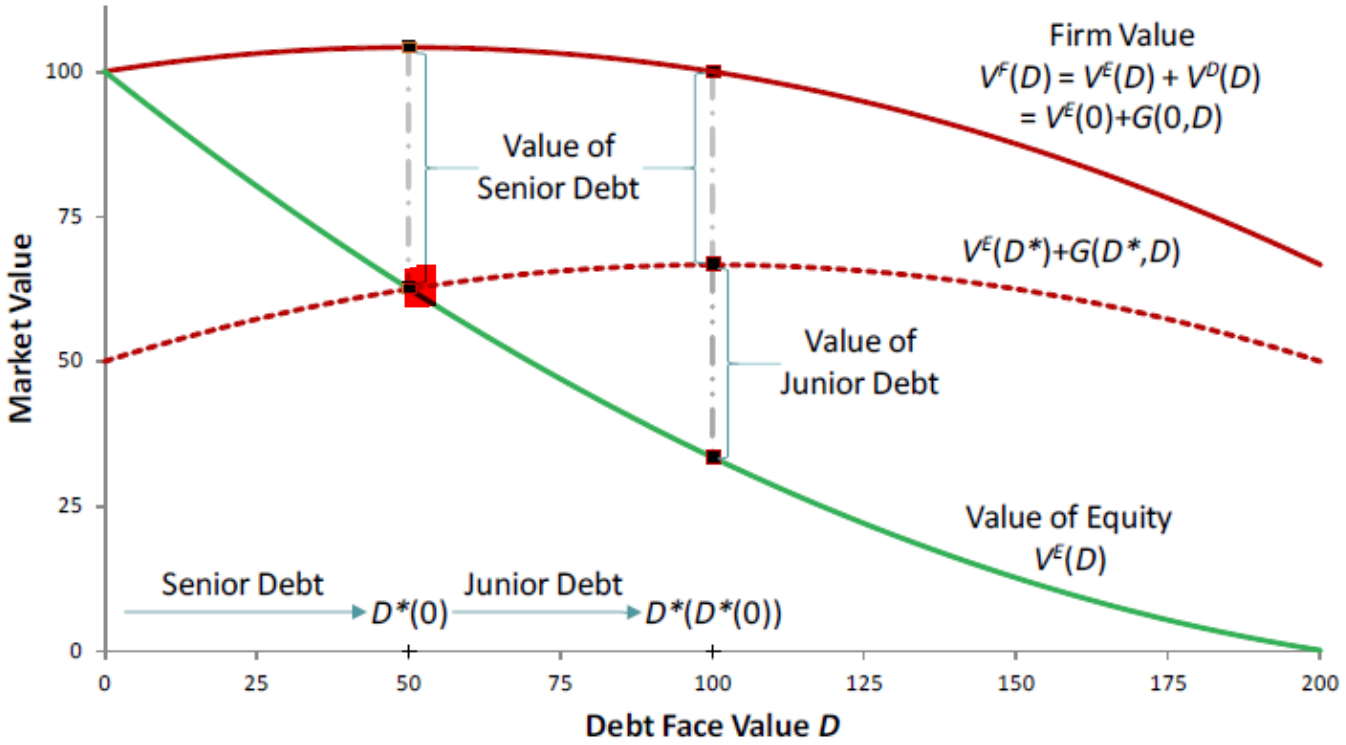


Figure 2: The Leverage Ratchet Effect

Starting with no debt, firm value is maximized with debt $D^*(0)$. But once this debt is in place, shareholders can gain from a new issue of junior debt. Though the new debt reduces firm value, it decreases the value of senior debt even more, leading to a gain for shareholders. At the margin, shareholders benefit from a higher interest tax shield, whereas default and agency costs are second order. (See Section 3.1 for the specific parameters used here.)

Leverage Ratchet Effect – Marginal increase in debt

To see this point, suppose that new debt is junior to all outstanding debt claims (and hence there is no direct dilution of existing creditors). Let $G(D, D')$ be the gain to shareholders when a firm with existing debt D increases its debt to $D' \geq D$ by issuing new junior debt with face value $D' - D$:

$$G(D, D') = V^E(D') - V^E(D) + (D' - D)q^J(D, D'), \tag{11}$$

where $q^J(D, D')$ is the price at which the new junior debt is sold. Consider the setting of (8) and let $X_{\theta,a}$ and K_a be random variables representing the total asset payoff and investment policy of the firm. Then we can write

$$V^E(D) = \max_{\theta,a} E[(X_{\theta,a} - t(X_{\theta,a}, D) - D)^+ - K_a].$$

indicator function.

tax

cost

Differentiate with respect to D

In the paper, they consider a bit more complicated model with choice variables theta and a. "Theta" relates to the project risk, and "a" relates to an investment policy. Basically, these are choices, from the shareholders, that can influence the probability of different cash flows, denoted by X_{theta,a}.

Leverage Ratchet Effect – Marginal increase in debt

where $q^J(D, D')$ is the price at which the new junior debt is sold. Consider the setting of (8) and let $X_{\theta,a}$ and K_a be random variables representing the total asset payoff and investment policy of the firm. Then we can write

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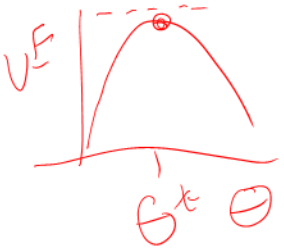

Take the total derivative with respect to D:

$$\frac{dV^E(D)}{dD} = \frac{\partial V^E(D)}{\partial D} + \frac{\partial V^E(D)}{\partial a}\frac{da}{dD} + \frac{\partial V^E(D)}{\partial \theta}\frac{d\theta}{dD}$$

$$= \frac{\partial V^E(D)}{\partial D}$$

which by the envelope theorem equals the partial derivative with respect to D

Leverage Ratchet Effect – Marginal increase in debt

Partial derivative with respect to D:

$$V^E(D) = \max_{\theta,a} E[(X_{\theta,a} - t(X_{\theta,a}, D) - D)^+ - K_a].$$

$$\frac{\partial}{\partial D} V^E(D) = -E[(1 + t_D(X_{\theta^*,a^*}, D))1_{X_{\theta^*,a^*} > D}]$$

$$\geq -q^J(D, D) - E[t_D(X_{\theta^*,a^*}, D)1_{X_{\theta^*,a^*} > D}] \qquad (12)$$

Recall: $$G(D, D') = V^E(D') - V^E(D) + (D' - D)q^J(D, D'), \qquad (11)$$

So the shareholder gain from marginally increasing debt above D satisfies:

$$G_2(D, D) \geq -E\left[t_D(X_{\theta,a}, D)\, 1_{X_{\theta,a} > D}\right] > 0.$$

Increase debt if it gives any tax advantage at all … regardless of its impact on default costs and firm value.

Some other elements of Admati et al. (2018)

Section II

-Agency costs associated with debt (e.g. asset substitution) make shareholders even less willing to buy back debt.

Section III

-Dynamic model, allows them to say more about debt dynamics.

-In equilibrium, shareholders may immeidately increase level to the highest stable level

-Reponse to shocks

Section IV

-Shareholders weakly prefer to reduce leverage via asset sales, rather than via issuing equity

Question: Leverage Ratchet Effect and Trade-off Theory

What is the main similarity between the ideas in Admati et al. and the Trade-off Theory of capital structure? What is the main difference?

Take 5 minutes to think about this.

Then go to socrative.com, room 897458, and write a short answer, in the following form: "Similarity: …., Difference: …",

Question: Leverage Ratchet Effect and Trade-off Theory

Similarity: both theories try to explain how much debt firms take on, optimal financing decisions. Also, both take into account, things like taxes, and default costs, that can affect this decision.

Difference: Trade-off Theory assumes that the chosen debt level is that which maximizes total firm value. Trade off between interest tax shield, and expected costs of financial distress.

Leverage ratchet effect focuses more on conflicts of interest, passing default costs on to say existing creditors. A theory that predicts debt level can be inefficiently high!

Intended outcomes for the day:

1. To analyze how shareholder incentives to reduce debt are affected by debt seniority. Shareholders are less averse to buying back junior debt, since this debt can be bought back more cheaply. Nonetheless, buying back junior debt still imposes a loss on shareholders.

2. To demonstrate how initial debt levels affect shareholder incentives to take on more debt in the future, and comment on the role of commitment. With zero initial debt, shareholders want to issue the amount of debt that maximizes firm value. But they will then want to issue even more debt in the future.

3. To intuitively compare and contrast the ideas in Admati et al. (2018) to the Trade-off Theory of capital structure. Taxes and costs of financial distress are important in both theories. Static theory focusing on efficient debt level vs. dynamic theory focusing on inefficient debt level.

For next time

Watch the short video posted in the module for Lecture 6.

Read Section 1 of Edmans and Mann (2019): ”Financing Through Asset Sales”, along with Section 2 up to and including the subsection 2.1. Focus on understanding the Balance Sheet Effect.

Look more quickly through the rest of Section 2, and Section 3, which will be more relevant for Lecture 7.

Prepare an answer to the question on slide 5 of the posted lecture slides: “Consider a firm of either high or low quality, in the framework of Edmans and Mann ….” and be ready to share in class.