Discussion of "Time Inconsistency and Financial Covenants" by Haotian Xiang

Nicolas Crouzet[1]

[1]Kellogg School of Management, Northwestern University

Overview

- Long-term debt is a key source of external funds for firms
  - 64% of flow of new debt in 2018
- Borrowing long-term comes with commitment problems
  - cannot commit not to issue more debt in the future
    - De Marzo and He (2017), Coase (1972)
  - depresses debt and equity values ex-ante
- This paper says covenants can help address this problem
  - market value of equity/book value of debt
  - accelerate debt at par
  - theoretical analysis + quantitative evaluation

1. The simple model

Final period, legacy debt

$$J^*(b_l) = \max_b \quad q(b)(b - b_l) + \int_{z \geq z_d} \Big\{(1-\tau)z - (1+(1-\tau)c)b\Big\} dF(z)$$

$$\text{s.t.} \qquad q(b) = (1+c)\,(1 - F(z_d))$$

$$z_d = \frac{1+(1-\tau)c}{1-\tau} b$$

the firm only borrows to maximize the value of the tax shield

b_l is legacy debt

$b - b_l$ is new issued debt

both trade at price $q(b)$

Final period, legacy debt

$$\underbrace{\tau c(1 - F(z_d))}_{\text{tax shield}} = \underbrace{(b - b_l)\left(-\frac{\partial q}{\partial b}(b)\right)}_{\text{infra-marginal price effect}}$$

Equityholders only care about the revaluation **new** debt $(b - b_l)$

Two-period model: no commitment

$$\mathcal{I}_\lambda^{(NC)} = \max_b \quad q_\lambda(b)b + \int_{z \geq z_d} \left\{(1-\tau)z - (\lambda + (1-\tau)c)b + J^*\Big((1-\lambda)b\Big)\right\} dF(z)$$

$$\text{s.t.} \quad q_\lambda(b) = (1 - F(z_d))\left\{\lambda + c + (1-\lambda)q^*\Big((1-\lambda)b\Big)\right\}$$

$$z_d = \frac{\lambda + (1-\tau)c}{1-\tau} b - \frac{1}{1-\tau} J^*\Big((1-\lambda)b\Big)$$

Assumptions:

- fraction λ matures today, $1-\lambda$ tomorrow
- equityholders may fund the firm between periods at unit cost

In second (last) period, same FOC as the one-period firm with legacy debt

Two-period model: commitment

$$\mathcal{I}_{\lambda}^{(C)} = \max \quad q_1 b_1 + \int_{z_1 \geq z_{d,1}} \Big\{(1-\tau)z_1 - (\lambda + (1-\tau)c)b_1 + J(z_1)\Big\} dF(z_1)$$

$$\text{s.t.} \quad [\lambda_1] \quad q_1 \leq \int_{z_1 \geq z_{d,1}} \{\lambda + c + (1-\lambda) q_2(z_1)\} \, dF(z_1)$$

$$[\lambda_2(z_1)] \quad q_2(z_1) \leq \{1 - F(z_{d,2}(z_1))\} \, (1+c)$$

and

$$J(z_1) = q_2(z_1)(b_2(z_1) - (1-\lambda) b_1) + \int_{z_2 \geq z_{d,2}(z_1)} \Big\{(1-\tau)z_2 - (1 + (1-\tau)c) b_2(z_1)\Big\} dF(z_2)$$

Maximize over $q_1, b_1, \{q_2(z_1), b_2(z_1)\}$

$z_{d,1}$ and $z_{d,2}(z_1)$ are defined as before (cannot commit not to default)

Debt choice with commitment

$$\underbrace{\tau c(1 - F(z_{d,2}))}_{\text{tax shield}} = \underbrace{(1 + c)f(z_{d,2})\frac{\partial z_{d,2}}{\partial b_2} b_2}_{= -\frac{\partial q_2}{\partial b_2}}$$

Equityholders with commitment care about the revaluation of **total** debt b_2

Unlike the case without commitment

The choice of debt is independent of b_1 and z_1:

$$z_{d,2}(z_1) = z_{d,2}, \;\; b_2(z_1) = b_2$$

The effects of lacking commitment

Assume:

$$1 - F(z) = \exp\left(-\frac{z}{\mu}\right)$$

Then:

$$b_2^C = \frac{(1-\tau)}{1+(1-\tau)c}\frac{\tau c}{1+c}\mu$$

$$b_2^{NC}(b_1) = \frac{(1-\tau)}{1+(1-\tau)c}\frac{\tau c}{1+c}\mu + b_1 \quad \left(> \max(b_2^C, b_1)\right)$$

$$q_2^C = (1+c)\exp\left(-\frac{\tau c}{1+c}\right)$$

$$q_2^{NC}(b_1) = (1+c)\exp\left(-\frac{\tau c}{1+c}\right)\exp\left(-\frac{1+(1-\tau)c}{1-\tau}\frac{b_1}{\mu}\right)$$

What do covenants do?

- Trigger: $(1-\tau)z_1 - (\lambda + (1-\tau)c)b_1 + J\Big((1-\lambda)b_1\Big) \leq \kappa b_1$

- Between periods 1 and 2

- Equityholders must pay αb_1 to debtholders, with net effect:

$$\underbrace{(\Delta q)}_{>0}(b_2 - b_1) + \underbrace{(\tilde{q} - 1)}_{\gtrless 0}\alpha b_1$$

- Two possibilities
    1. $\tilde{q} > 1$: positive transfer to equityholders (debt relief)
    2. $\tilde{q} \ll 1$: negative transfer to equityholders (debt punishment)

- Debt relief can dominate and exacerbate the commitment problem ex-ante

Comment 1: debt maturity

The problem with commitment has a closed-form solution:

$$\mathcal{I}_{\lambda}^{(C)} = \overbrace{\left\{ \frac{1}{2} + \frac{1}{2} \frac{1 + c + (1-\lambda)(q_2^{(C)} - 1)}{1 + (1-\tau)c + (1-\lambda)(q_2^{(C)} - 1)} \frac{q_2^C}{1 + (1-\tau)c} \right\}}^{\text{leverage}} \times \underbrace{2(1-\tau)\mu}_{\text{fundamental}}$$

This is increasing in λ so long as $q_2^{(C)} > 1$ — which holds in this model

In other words, in this model, **short-term debt is always better than long-term debt with commitment**

Comment 1: debt maturity

- Why? Cash flows from rolling over debt

$$q_2^{(C)}\lambda b - \lambda b = (q_2^{(C)} - 1)\lambda b$$

- So why not borrow short-term, instead of covenants?

  Aguiar, Amador, Hopenhayn and Werning (2016)

  or, with covenants: always accelerate?

- To be fair, this depends on $q_2^{(C)} - 1 > 0$ (no discounting)

  narrow in on cases where the short-term debt equilibrium is **worse** than the commitment equilibrium with long-term debt?

Comment 2: which covenants?

- The model assumes
  - a specific trigger (threshold for market/book)
  - a specific form of restructuring (acceleration of principal at par)
- Ideally, pay existing bondholders the difference between
  - the bond price if there had been no issuance
  - the bond price after new issuance
- Not observable, and hard to compute. But are there other, better rules?
  - feasible rules, i.e. depend only on, say, EBITDA, b_l and $q_-(b_l)$
  - bond price falls below a certain threshold?
  - Hatchondo, Martinez, and Sosa-Padilla (2015)

2. The complicated model

Comments on the complicated model

- It's complicated

    risk-shifting

    capital adjustment costs

    dilution and restructuring costs

    persistent shocks

    ...

- Complicated is good, but it's hard to think through all the mechanisms

    plus, they interact with each other independently of committment

    isolate the effects of some important ones — restructuring costs?

- Missing: what if equity issuance is not frictionless?

3. The quantitative implications

Comments on quantitative implications

- Covenant violation frequency is targeted to be 0.015 per quarter

  that number seems low

    Chava and Roberts (2009, table 3): 15% of obs. are in violation

    but maybe I'm confused — violations in the model don't persist

    almost all violations in the model lead to restructurings

  implications of violations for other covenant-relevant ratios?

    debt/EBITDA, net worth, interest coverage

- Restructuring costs f are important to the welfare implications

  they are calibrated to 0.25% of book assets

    is this small/large? evidence?

  without f, covenants are welfare-decreasing ex-ante

    why? (doesn't seem to be the case in the simple model)

    how is this consistent with the hump-shape in κ?

4. Conclusion

Conclusion

- This is a very ambitious paper and I really enjoyed reading it

- It's challenging, so help the reader more

  sharper theoretical results (two-period?)

  streamline and clarify discussion of the quantitative implications