

The Hazards of Debt: Rollover Freezes, Incentives, and Bailouts

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How should debt be structured?

Liquidity and crisis literature:

- ▶ Role of risk created by liability-side of balance sheet: “rollover risk”
- ▶ Freezes in short-term debt markets led to failures on Wall St.
- ▶ Emphasizes conflict of interest between debtors as source of inefficiency (He & Xiong 2010, Brunnermeier & Oehmke 2010)

Corporate finance literature:

- ▶ Short-term debt disciplines moral hazard: lowers asset-side risk by preventing inefficient “risk-shifting”
- ▶ Mitigates conflict of interest between debt and equity
- ▶ Calomiris & Kahn 1991, Leland 1998, Diamond & Rajan 2000

Trade-off between rollover risk and disciplining incentives from short-term debt has not been fully reconciled

Our Paper: Question & Results

What is tradeoff between risk-shifting incentives and rollover risk implied by maturity structure?

- 1.) Debt maturity structure: Debt can be too short-term, even with incentive provision
- 2.) Optimal to allow some forms of risk-shifting: Risk-shifting can be efficient because it relieves the incentive to run
 - ▶ Non-maturing debtholders similar to equity & may like volatility
- 3.) Bailouts: Limited bailouts can improve the terms of incentives-rollover risk tradeoff even weighing taxpayer losses
 - ▶ Primary benefit is indirect via establishing creditor confidence and avoiding runs, not actually saving firms ex post

Static Intuition

Imagine a firm where an equity-holding manager has potential to switch between risky strategies (high volatility, low-mean) and safe (low volatility, high-mean) strategies

- ▶ Wedge between debt and equity: when asset fundamentals drop, he will have an incentive to “risk-shift” to the “bad” strategy
- ▶ Static intuition: short-term debt can preserve incentives through the threat of a run (Calomiris and Kahn, 1991; Diamond and Rajan, 2000)

Dynamic Intuition

But suppose debt does not come due together.

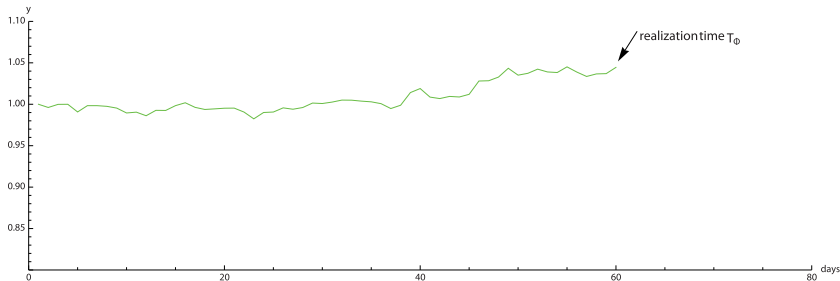
- ▶ Wedge between today's maturing creditors and tomorrow's maturing creditors + conflict of interest with equity

Today's maturing creditors may be stuck with bankruptcy costs if future creditors walk away \Rightarrow walk away now

- ▶ Optimal maturity maximizes value subject to trade-off between maturity debt, non-maturing debt, equity
- ▶ Risk-shifting may actually *increase* value by alleviating the wedge between types of creditors: creditors may want volatility

Bailouts may alleviate this three-way trade-off as well even with moral hazard costs

Model: Asset-Side Risk



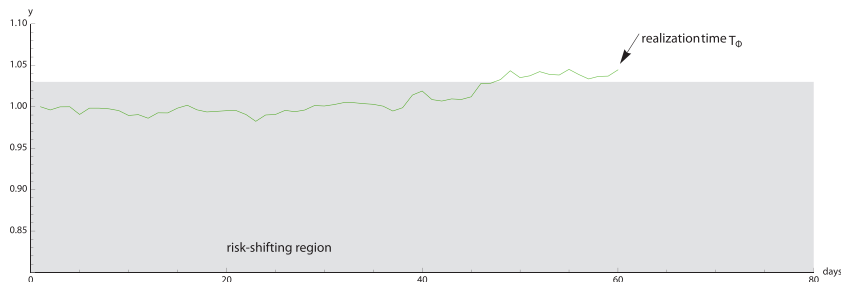
1. ASSET-SIDE RISK

Firm is a leveraged institution invested in a long-term strategy generates a random final payoff y at exponential time

$$\frac{dy}{y} = \mu_i dt + \sigma_i dZ, \quad y_0 = 1$$

Continuous cash flows r routed to debt with face value 1

Model: Asset-Side Risk



Risk-neutral manager holds the equity $E(y)$ of the firm, cares about final payoff y

Every instant, chooses strategy A (high drift/low vol) **or** B (low drift/high vol)

$\mu_A > \mu_B, \sigma_A < \sigma_B \Rightarrow$ B '**risk-shifting**' (inferior technology)

Model: Liability-Side Risk

2. LIABILITY-SIDE RISK (He, Xiong 2010)

Debt $D(y)$ of face value 1 gets paid asset cash-flow r

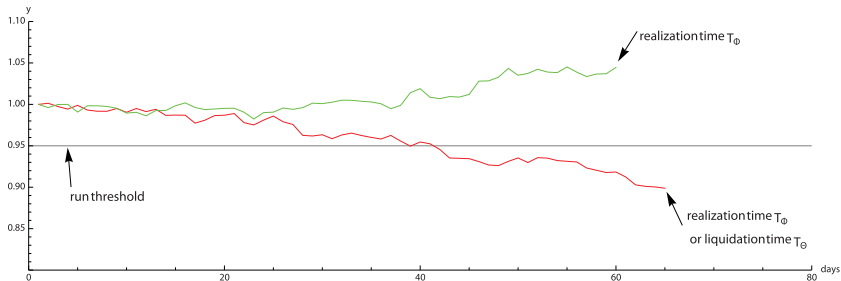
Dispersed debt with staggered maturity, fraction δ due each instant (avg. maturity $1/\delta$)

Maturing creditors have choice to roll over or get paid face value

Probabilistic liquidation during freeze with intensity $\theta\delta dt$ (θ = strength of credit lines, endogenized later)

Distressed liquidation at firesale discount $1 - \alpha$ if firm fails

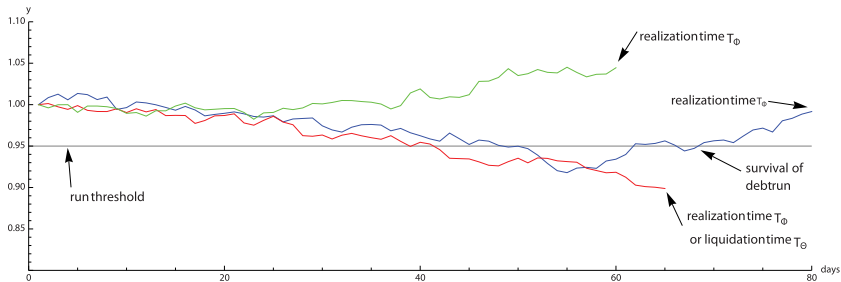
Model: Liability-Side Risk



Continuous flow of debtors who may not roll over debt below a symmetric equilibrium cutoff point y^* .

Firm is kept alive by either credit lines (or government funding) during a freeze, but this may dry up, which results in fire-sale liquidation...

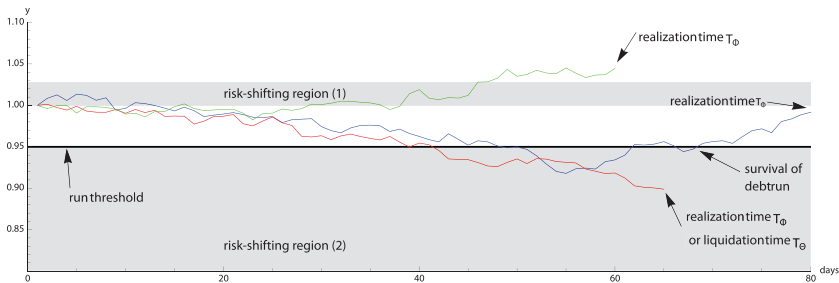
Model: Liability-Side Risk



...or the firm may survive the rollover freeze. Outside of a rollover freeze, only possible outcome is realization of terminal payoff y .

Full Equilibrium

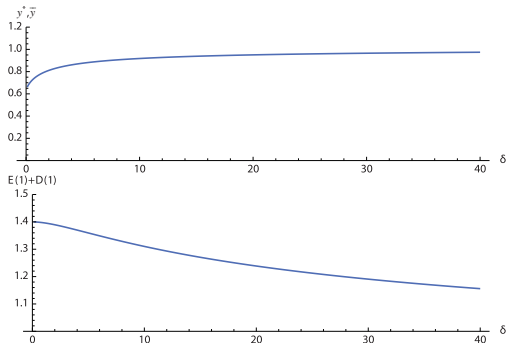
Equilibrium where debtors choose a rollover cutoff y^* and managers choose a risk shifting region $\bar{\mathcal{R}}$.



Look for symmetric Markov equilibrium $(y^*, \bar{\mathcal{R}})$: with $\bar{\mathcal{R}} = (0, \bar{y}_1) \cup (\bar{y}_2, \bar{y}_3)$.

Partial equilibrium: Runs

He, Xiong 2010: shorter maturities \Rightarrow stronger run incentives



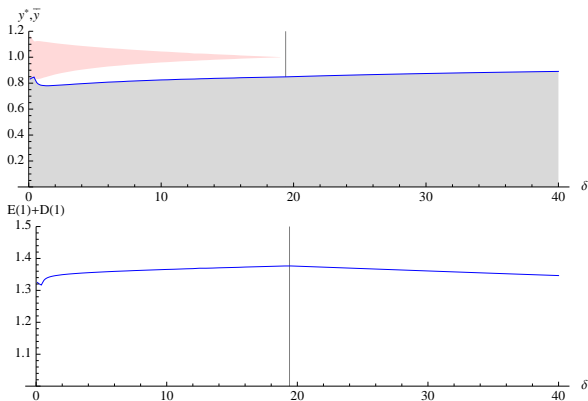
Current maturing creditor who rolls over is exposed to possible distressed liquidation by future maturing creditors \Rightarrow incentive to run today

- ▶ Higher liquidation intensity during run, less option value of fundamental recovering

Full equilibrium: Runs & Risk-Shifting

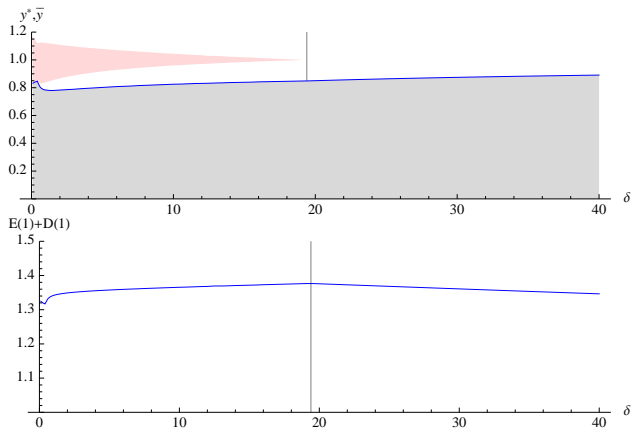
Debt runs **discipline** manager

- ▶ Lowers incentives to risk-shift on (y^*, ∞) : risk-shifting increases chance of ending up in run ('punishment') region
- ▶ Risk-shifting dominant on $(0, y^*)$: volatility dominant for equity when run ensues



Optimal Maturity

Result 1: Optimal maturity is short enough to just eliminate preemptive risk-shifting, but not any shorter



But should we write covenants to get rid of risk-shifting altogether?

Value Effects of Risk-Shifting

Pre-emptive risk-shifting

Risk-shifting *before run* is inefficient transfer from debt to equity

“Good” risk-shifting

Risk-shifting *during run* increases firm value because of option value

- ▶ Higher volatility shifts prob mass above run threshold
- ▶ Feeds back to alleviate ex ante incentive to run
- ▶ Non-maturing debt can be more like equity during a run (maturing debt gains seniority)
- ▶ *Value increase is a transfer of value away from liquidation cost towards D & E*

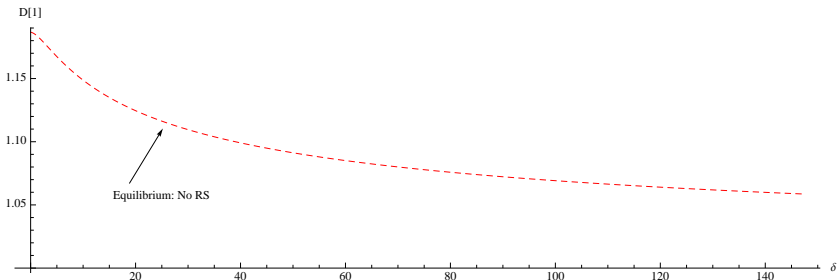
Result 2: Suboptimal to eliminate risk-shifting capabilities of manager

- ▶ “Desperate times may call for desperate measures”

Good Risk-Shifting

Consider risk-shifting only available during run (i.e. we are excluding bad risk-shifting)

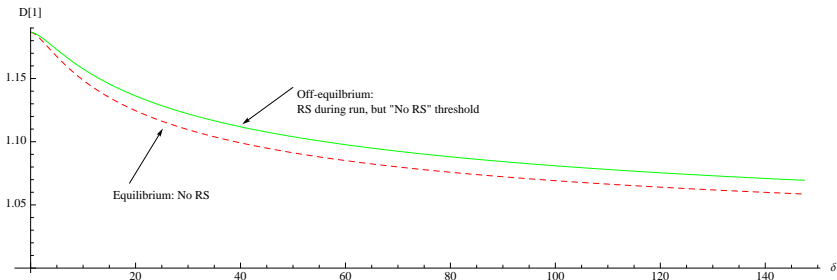
1. No-risk shifting gives run-threshold y_{NoRS}^*
2. Partial equ effect: Allow risk-shifting during run. Fix symmetric strategy at y_{NoRS}^* . Then convex value function for non-maturing debtholders implies debt value increases
3. General equ effect: Higher debt values means y_{NoRS}^* not optimal anymore. As everyone's 3run threshold shifts down, debt becomes more valuable



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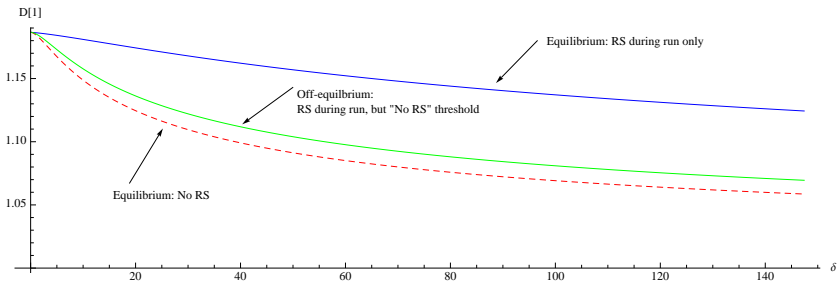
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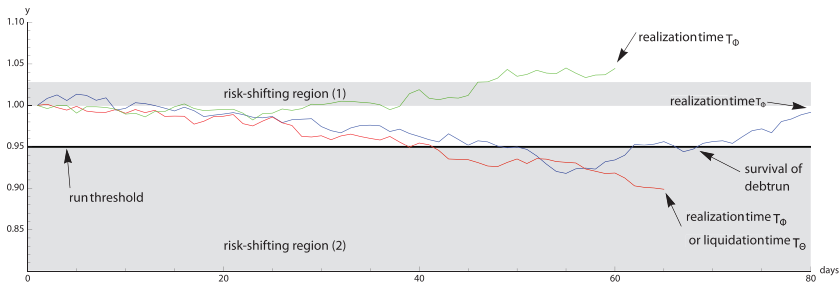


Emergency Financing, Bailouts

Suppose government subsidizes maturing creditors just enough to roll over (“market-based intervention” or “bailout”). Can this increase value?

- ▶ Include losses to the taxpayer, future moral hazard costs:

$$F = E + D - G$$



Emergency financing until a “random time”, intensity θ (committed to ex ante).

Emergency Financing, Bailouts

Optimal Bailout policy weighs three effects

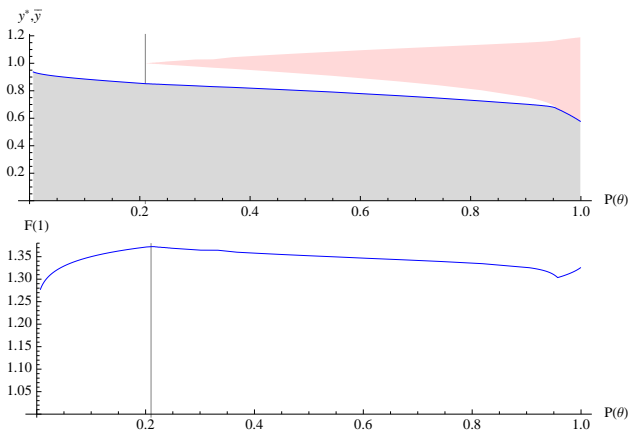
1. **Incentive effects** - increases bad asset holdings (bad), increases chance of ending up in a run (even worse)
2. **“Avoid fire-sale” effect** - save the firm, avoid distressed liquidation (good but small)
3. **Equilibrium effect on creditor confidence** - prevent runs by alleviating incentives to run (good, large)

Gov't losses and total system losses higher for “too-low” bailouts even though risk-shifting is minimal

⇒ Creditor confidence effect can dominate.

Emergency Financing, Bailouts

Result 3: Optimal bailout is an interior solution; limited bailouts can improve creditor confidence



Conclusion

Dynamic intuition that emphasizes simultaneous trade-off among creditors + debt vs. equity

1) Short-term debt is a costly but effective disciplining instrument

2) Allowing some risk-shifting is actually efficient because dynamic debtholders similar to equity when locked-in

3) Limited probabilistic/randomized bailouts can be optimal even in presence of incentive effects

- ▶ But may be difficult to implement due to political economy constraints