Corporate Debt Standardization and The Rise of Electronic Bond Trading (in progress)

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Motivation

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- Electronic trading of corporate bonds has seen sustained growth over the past few years;
  - Promoted as a solution to deteriorating liquidity condition in secondary markets;
  - $\downarrow$ search costs, $\uparrow$ dealer competition, $\uparrow$ market transparency;
- Over a third of IG corporate bonds are now traded electronically;
- However, transactions are mostly restricted to smaller-sized trades ($<$ \$1 MIL)
  - Trade count $\sim$ 90% v.s. volume $\sim$ 20%.
- Moreover, only $\sim$ 11% of HY bonds traded electronically in 2019.

Motivation

- Obstacles to the adoption of electronic trading:
  1. Heterogeneous issuance (market fragmentation);
  2. Complexity of debt securities.
- In other asset classes: standardization facilitates pricing and helps concentrate liquidity in a few securities;
- But restrictions to the number and complexity of bonds may affect firms' ability to signal their credit quality;

Research question:

- Implications of debt standardization for the composition of debt and distribution of credit quality across competing secondary markets;

The Model in a Nutshell

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- Illiquid secondary bond markets + asymmetric information;
- Electronic (standardized debt only) v.s. OTC (less liquid);
- Equity investors exploit their private information about firms;
- Covenants arise endogenously $\Rightarrow$ signaling mechanism.

Informational v.s. Liquidity Costs

- Private information affects firms' funding costs $\Rightarrow$ Δ leverage;
- For high enough informational costs, safer firms may forego liquidity gains to signal their creditworthiness.

A 2-Period Model

The Economy

- The economy lasts for two periods: $t = 0, 1$;
- Risk-neutral investors: *bond investors* and *equity holders*;
- Firm types: *safe* (prob. μ_s) or *risky* (prob. $1 - \mu_s$).
  - After $t = 0$ but before period 1, risky firms experience an idiosyncratic, mean-reducing shock with probability q:

$$V_{1,s} = V_0 e^x, \quad V_{1,r} = \begin{cases} V_0 e^x, & \text{w/ prob } 1 - q \\ V_0 e^y, & \text{w/ prob } q \end{cases}$$

where

$$x \sim \mathcal{N}\left(r_f - \frac{1}{2}\sigma^2, \sigma\right), \quad y \sim \mathcal{N}\left(r_f - \frac{1}{2}\sigma^2 - s_f \cdot \sigma, \sigma\right), \quad s_f > 0$$

- Financed with a mix of debt and equity, issued at time 0;
- Debt: measure μ_b of coupon-less bonds with principal $P < V_0$;

Tax benefits v.s. bankruptcy costs

- tax shield: $\pi \mu_b P$
- risk of a costly bankruptcy: lost tax shields and fractional recovery value αV_1.

Bonds are traded in illiquid secondary markets: $r^b_{disc} > r_f$ ▷

- $\downarrow$ value of newly-issued bonds in primary markets;
- $\uparrow$ firms' funding costs.

Electronic Platforms (EP) v.s. Over-the-Counter (OTC) markets

- EPs are more liquid: $r^{b,EP}_{disc} < r^{b,OTC}_{disc}$
- But accept only covenant-free bonds.

A 2-Period Model

Payoffs, Prices & The Optimal Capital Structure

- Bankruptcy condition: $V_1 + \pi \mu_b P < \mu_b P$
- Debt: $D(\mu_b) = e^{-r^b_{disc}} E\left[\mu_b P + (\mu_b P - \alpha V_1)\, \mathbf{1}_{\{V_1 + \pi \mu_b P < \mu_b P\}}\right]$
- Equity: $E(\mu_b) = e^{-r_f} E\left[\max\{V_1 + \pi \mu_b P - \mu_b P, 0\}\right]$
- Expected Equity Return (ER):

$$E(\mu_b) - \underbrace{(V_0 - D(\mu_b))}_{\text{Cash Infusion}} = \overbrace{(E(\mu_b) + D(\mu_b))}^{\text{Firm Value}} - V_0$$

Optimal Capital Structure

μ_b that maximizes the total initial valuation of the firm.

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Assumption 1. [*Creditors' Information Set*]
Creditor's know the distribution of types and observe V, but not firms' exposure to the mean-reducing shock.

- Firms are ex-ante indistinguishable to debt holders;
- Misrepresentation raises the return to risky-type shareholders':

$$\frac{E_r\left(\mu^\star_{b,s}\right)}{V_0 - D_s\left(\mu^\star_{b,s}\right)} > \frac{E_r\left(\mu^\star_{b,r}\right)}{V_0 - D_r\left(\mu^\star_{b,r}\right)}$$

- But also $\uparrow$ safe firm's funding costs;

$$D^{POOL}\left(\mu_b\right) = \mu_s D_s\left(\mu_b\right) + \left(1 - \mu_s\right) D_r\left(\mu_b\right)$$

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Assumption 2. [*Creditor's Funding Condition*]
Creditors refuse funding if they can determine a firms' capital structure is not set optimally.

Consider first only covenant-free bonds:

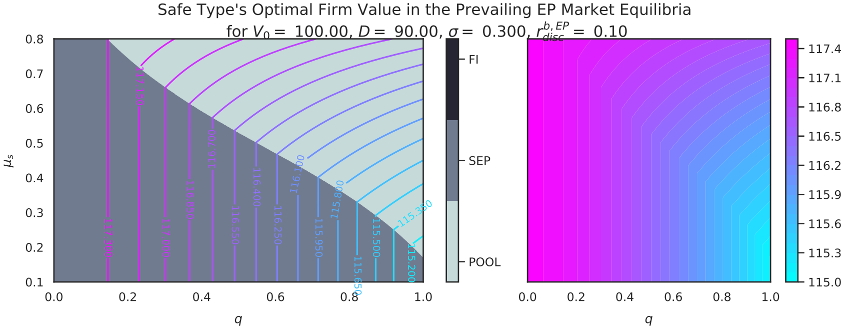
- Bonds are traded exclusively in the electronic market.
- Safe-type adjusts μ_b to minimize the informational cost in EP:

$$INFC \equiv FV_s^{FI,EP} - FV_s^{AI,EP}$$

where $FV_s^{AI,EP} \equiv \max\left\{FV_s^{POOL,EP}, FV_s^{SEP,EP}\right\}$

Electronic Market Equilibria

Safe Type's Firm Value



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Assumption 3. [*Debt Covenants*]
Firms can perfectly signal their type by issuing non-standardized debt with a debt protective covenant.

- Covenants arise endogenously as a means of mitigating informational costs;
- Liquidity Loss: trade restricted to the OTC market.

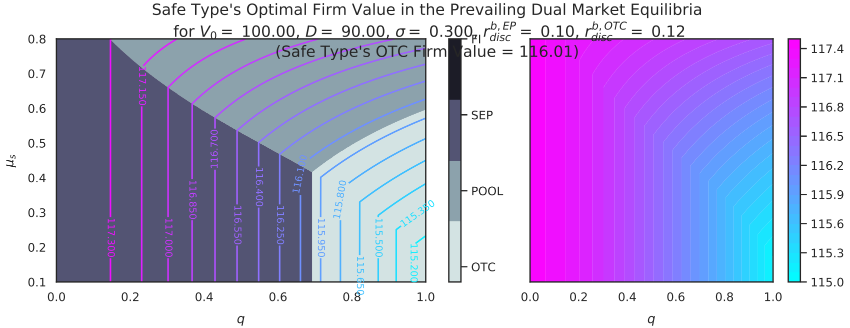
$$LQD \equiv FV_s^{FI,EP} - FV_s^{FI,OTC}$$

- Safe firms weight the informational costs in the exchange against the inter-market liquidity differential:

$$INFC \lesseqgtr LQD$$

Dual Market Equilibria

Safe Type's Firm Value



Conclusion

- Adoption of electronic trading in HY corporate bond markets limited by informational costs;

$$\Delta FV_s = \max\{LQD - INFC, 0\}$$

- Higher-rated firms' response:
  - $\downarrow$ leverage to reflect the higher funding costs in a pooling equilibrium; or
  - $\uparrow$ debt to discourage riskier firms' misrepresentation.
- In extremis $\Rightarrow$ forego the liquidity gains
  - higher-rated HY debt traded exclusively OTC.
- Implications for (i) debt composition, (ii) trade volume and (iii) revenue/profitability across secondary markets.

Bond Investor's Discount Rate

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- Creditors are subject to i.i.d. liquidity shocks before time 1;
- Shocks force portfolio liquidation at a fractional cost in secondary markets.

Equity Return and Misrepresentation

- Shareholders' investment: $W_0 < V_0$
- Measure of shareholders: $\nu(\mu_b)$

$$\nu(\mu_b) W_0 = \underbrace{V_0 - D(\mu_b)}_{\text{Book Value of Equity}}$$

- Individual shareholder's return:

$$\begin{aligned} \frac{E(\mu_b)}{\nu(\mu_b)} - W_0 &= \left(\frac{E(\mu_b)}{\nu(\mu_b) W_0} - 1\right) W_0 \\ &= \left(\frac{E(\mu_b)}{V_0 - D(\mu_b)} - 1\right) W_0 \\ &= (MBR(\mu_b) - 1) W_0 \end{aligned}$$

Equilibrium Algorithm

1. Start with Full Information equilibrium choices: $\left(\mu_{b,s}^{FI}, \mu_{b,r}^{FI}\right)$
2. Misrepresentation: $MBR_{j\to i}^{MP}\left(\mu_{b,i}^{FI}\right) > MBR_{j}^{FI}\left(\mu_{b,j}^{FI}\right)$?
3. Type-i's best response?

$$\mu_b^{POOL} = \underset{\mu_b\in(0,\overline{\mu}_b]}{\operatorname{argmax}} \left\{FV_i^{POOL}\left(\mu_b\right) = E_i^{FI}\left(\mu_b\right) + D^{POOL}\left(\mu_b\right)\right\}$$

$$\mu_{b,i}^{SEP} = \underset{\mu_b\in(0,\overline{\mu}_b]}{\operatorname{argmax}} \left\{FV_i^{FI}\left(\mu_b\right) : MBR_{j\to i}^{MP}\left(\mu_b\right) \leqslant MBR_j^{FI}\left(\mu_{b,j}^{FI}\right)\right\}$$

where $D^{POOL}\left(\mu_b\right) = \mu_s D_s^{FI}\left(\mu_b\right) + \left(1-\mu_s\right) D_r^{FI}\left(\mu_b\right)$

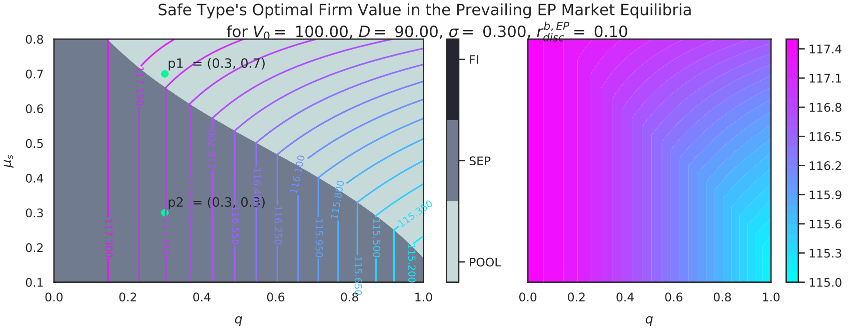
4. Equilibrium:

$$FV_i^{EP} = \max\left\{FV_i^{POOL}\left(\mu_b^{POOL}\right), FV_i^{SEP}\left(\mu_{b,i}^{SEP}\right)\right\}$$

for $\overline{\mu}_b = \frac{V_0}{e^{-r_{disc}^{b}}P}$.

Electronic Market Equilibria

Safe Type's Firm Value



Electronic Market Equilibria

Payoffs

μ_s			$q = 0.3$ FI	MP	POOL	SEP
0.7	s	FV	117.43	-	117.05	117.01
		MBR	1.71	-	1.65	1.56
	r	FV	112.26	113.44	113.04	112.26
		MBR	1.43	1.55	1.50	1.43
0.3	s	FV	117.43	-	116.61	117.01
		MBR	1.71	-	1.60	1.56
	r	FV	112.26	113.44	112.57	112.26
		MBR	1.43	1.55	1.45	1.43

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μ_s			FI	MP	POOL	SEP
			$q = 0.3$			
0.7	s	FV	117.43	-	117.05	117.01
		MBR	1.71	-	1.65	1.56
	r	FV	112.26	113.44	113.04	112.26
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		MBR	1.71	-	1.60	1.56
	r	FV	112.26	113.44	112.57	112.26
		MBR	1.43	1.55	1.45	1.43

Risky firms will attempt to copy safe firm's capital structure.

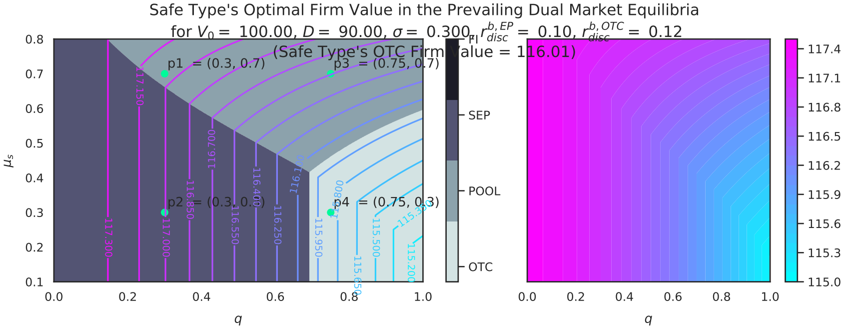
Electronic Market Equilibria

Pooling v.s. Separating Market Outcomes

			$q = 0.3$			
μ_s			FI	MP	POOL	SEP
0.7	s	FV	117.43	-	117.05	117.01
		MBR	1.71	-	1.65	1.56
	r	FV	112.26	113.44	113.04	112.26
		MBR	1.43	1.55	1.50	1.43
0.3	s	FV	117.43	-	116.61	117.01
		MBR	1.71	-	1.60	1.56
	r	FV	112.26	113.44	112.57	112.26
		MBR	1.43	1.55	1.45	1.43

Dual Market Equilibria

Safe Type's Firm Value



Dual Market Equilibria

EP v.s. OTC Payoffs

μ_s			$q = 0.75$				
			FI	MP	POOL	SEP	OTC
0.7	s	FV	117.43	-	116.56	115.85	116.01
		MBR	1.71	-	1.59	1.43	1.60
	r	FV	104.97	107.46	106.45	104.97	-
		MBR	1.15	1.30	1.23	1.15	-
0.3	s	FV	117.43	-	115.71	115.85	116.01
		MBR	1.71	-	1.49	1.43	1.60
	r	FV	104.97	107.46	105.49	104.97	-
		MBR	1.15	1.30	1.17	1.15	-

Dual Market Equilibria

Misrepresentation

			$q = 0.75$				
μ_s			FI	MP	POOL	SEP	OTC
0.7	s	FV	117.43	-	116.56	115.85	116.01
		MBR	1.71	-	1.59	1.43	1.60
	r	FV	104.97	107.46	106.45	104.97	-
		MBR	1.15	1.30	1.23	1.15	-
0.3	s	FV	117.43	-	115.71	115.85	116.01
		MBR	1.71	-	1.49	1.43	1.60
	r	FV	104.97	107.46	105.49	104.97	-
		MBR	1.15	1.30	1.17	1.15	-

Dual Market Equilibria

EP Pooling .v.s Separating v.s. OTC Payoffs

			$q = 0.75$				
μ_s			FI	MP	POOL	SEP	OTC
0.7	s	FV	117.43	-	116.56	115.85	116.01
		MBR	1.71	-	1.59	1.43	1.60
	r	FV	104.97	107.46	106.45	104.97	-
		MBR	1.15	1.30	1.23	1.15	-
0.3	s	FV	117.43	-	115.71	115.85	116.01
		MBR	1.71	-	1.49	1.43	1.60
	r	FV	104.97	107.46	105.49	104.97	-
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