The Technical Default Spread

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Motivation and Research Questions

- Traditional macro-finance treats lenders as passive bystanders
  - Examples: Bernanke and Gertler (1989), Kiyotaki and Moore (1997)

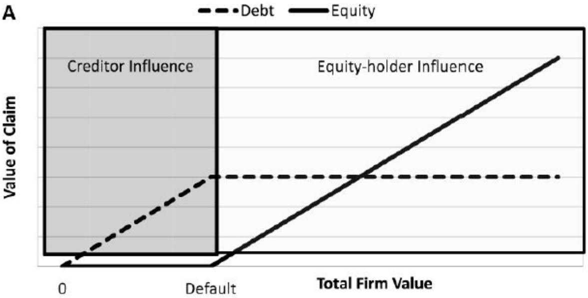

Fig.1 Traditional view of control rights (source: Nini et al (2012))

Motivation and Research Questions

- In practice, lenders write loan covenants to ensure loan repayment
  - Covenants are a *pervasive* tool to discipline borrowers
    - Virtually all private credit agreements contain at least one covenant (Roberts and Sufi (2009))
  - Breaching a covenant known as *technical default*, results in transfer of control rights

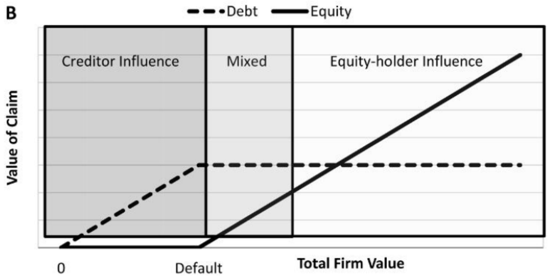

Fig.2 Technical default and lender control

Motivation and Research Questions

- Some examples of creditor control rights after covenant violation
  - Stronger voice in corporate decisions
    - Resolution plan (Roberts and Sufi (2009), Lou and Otto (2018))
    - Mandatory consultant call-in
  - Projects actually taken over by lenders
    - Known as "step-in rights" in project finance (Madykov (2015), Rossi (2018))

⇒ What is the quantitative impact of covenants on corporate investment, risk taking, and cost of capital?

- In the time series?
- In the cross-section?

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- Presents a dynamic GE model of corporate investment with endogenous loan covenants
  - Builds on Bernanke, Gertler, and Gilchrist (1999)
  - Technical default assigns investment control rights to lenders (Chava and Roberts (2008), Nini et al. (2009))
- Studies effects of technical default on investment, risk taking, and cost of equity
- Shows that payoffs of lenders/entrepreneurs lead to
  - Different investment choices
    - Concave payoffs induce lender to choose risk-less investments
    - Convex payoffs and loan contract induce entrepreneur to choose risky investments
  - Different exposure to aggregate shock
    - Firm has *less* exposure to aggregate shock, earns *lower* expected returns in technical default

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This Paper: Empirics

- Uses Murfin (2012) loan covenant strictness as a measure of distance to technical default
    - Probability that firm will breach a covenant next quarter
- Shows that high-strictness firms
    - Have more conservative investment policies
    - Earn lower future returns
        - E.g., portfolio of firms in top strictness quintile earns average *4% lower* annual returns than portfolio of firms in bottom quintile
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        - Results also confirmed in RDD framework
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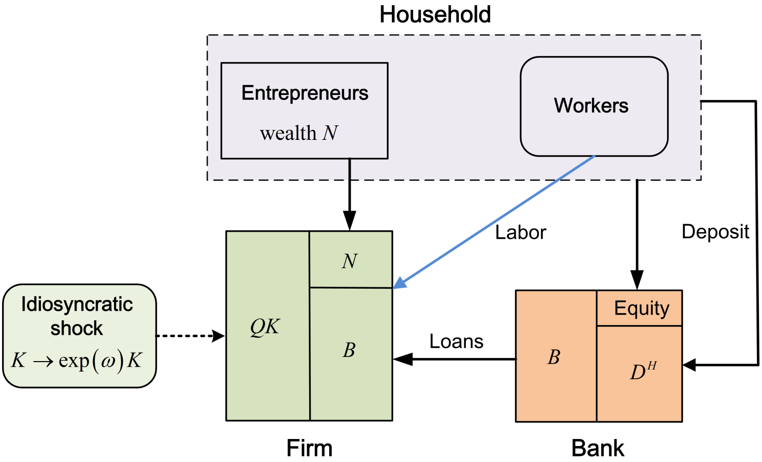
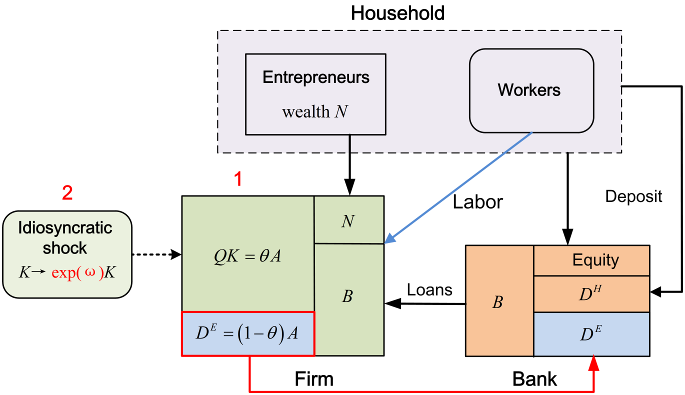
Model

Bernanke, Gertler, and Gilchrist (BGG) Model Overview



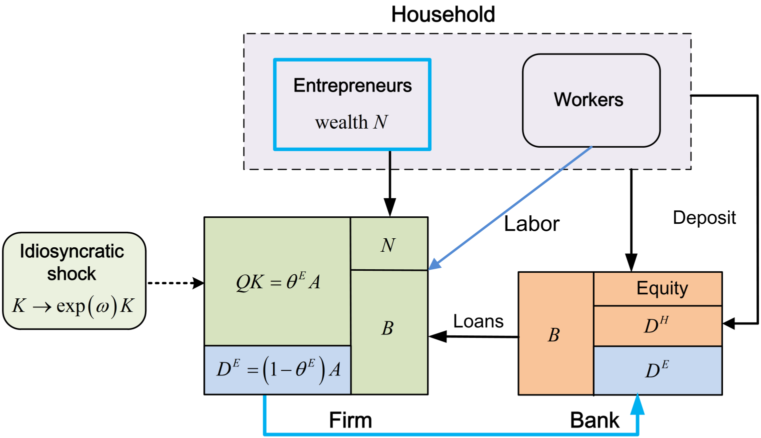
Two Major Departures from BGG

1. Firm can invest $(1-\theta)$ fraction of assets in risk-free bank deposit
2. Technical default based on signal of ω



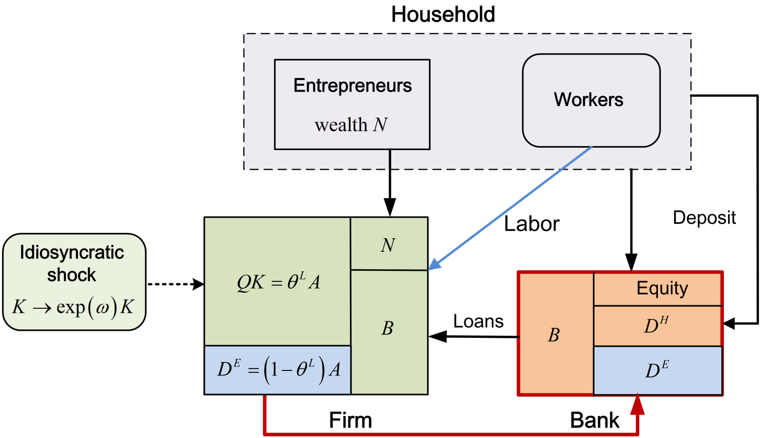
Entrepreneur in Control

- Investment policy θ decided by entrepreneur (as in BGG)



What Happens in Technical Default?

- Investment policy θ decided by lender



Optimal Investment Choice: Overview

- Lender in control choose $\theta = 0$
  - Wants to preserve concave payoff
- Entrepreneur in control choose $\theta = 1$
  - If ω is low, entrepreneur better off giving up control
    - Lender would make the same investment choice as she would, but charge lower loan payment

$\Rightarrow$ Entrepreneur optimally gives up control rights in exchange for lower loan rate

- As in Demiroglu and James (2010)

Firms: Production Technology and Labor Choice

- At time t, firm i uses capital K_{it} and labor L_{it} to produce output Y_{it} according to

$$Y_{i,t} \quad = \quad \bar{Z}_t \left(\exp\left(\omega_{i,t}\right) K_{i,t}\right)^{\alpha} \left(L_{i,t}\right)^{1-\alpha},$$

with $\alpha \in (0,1)$ and $\bar{Z}_t$ an aggregate productivity shock

- Capital is traded on competitive markets at price Q_t, depreciates at rate $\delta \in (0,1)$

- The return on capital from t to $t+1$ is

$$R^K_{t+1} \quad = \quad \frac{1}{Q_t}\left[MPK_{t+1} + (1-\delta)\, Q_{t+1}\right], \tag{1}$$

  - $MPK_{t+1}K_{t+1}$ is the firm's dividend at $t+1$
  - $(1-\delta)\, Q_{t+1}K_{t+1}$ is the value of the firm's undepreciated capital at $t+1$

Entrepreneurs: Idiosyncratic Productivity, Signal Structure

- Each entrepreneur i receives idiosyncratic productivity shock ω_i
    - Turns one unit of productive capital into $\exp(\omega_i)$ productive units
    - Similar to Bernanke et al. (1999)
- Idiosyncratic shock between time $t-1$ and t is sum of two shocks

$$\omega_{it} = \omega_{it}^0 + \omega_{it}^1,$$

    - $\omega_{it}^0, \omega_{it}^1$ are normally-distributed *iid* shocks
- Assumption: ω_{it}^0 and ω_{it}^1 are realized at different stages
    - ω_{it}^0 is realized in the middle of $t-1$, before investment decision
        - We think of it as a *signal* on the entrepreneur's risky cash flows at t
    - ω_{it}^1 is realized at the end of $t-1$, after investment decision

Timeline

- Each period t is divided into three sub-periods
- Stage 1:
  - Entrepreneurs with wealth N_{it} meet with lenders, sign loan contract
    - Contract features endogenous covenant threshold $\bar{\omega}^0_{it+1}$
- Stage 2:
  - Idiosyncratic signal ω^0_{it+1} is realized
  - Control rights allocation, investment θ_{it+1} based on ω^0_{it+1} and $\bar{\omega}^0_{it+1}$
- Stage 3:
  - Idiosyncratic shock ω^1_{t+1} and aggregate shock Z_{t+1} are realized
  - Entrepreneurs default if, for given θ_{it+1}, ω^0_{it+1},

$$\left[\theta_{it+1}\exp\left(\omega^0_{it+1}+\omega^1_{it+1}\right)R^K_{t+1}+\left(1-\theta_{it+1}\right)R^D\right]A_{it} < R^B_{it+1}B_{it}$$

    - Lenders recover fraction $1-\zeta$ of firm's assets

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Financial Contract Problem

- Ex ante, the endogenous loan terms maximize entrepreneurs' ex-ante value given lender break-even

$$\left(B_{it}, R^B_{it+1}, \bar{\omega}^0_{it+1}\right)^* = \arg \max_{\left(B_{it}, R^B_{it+1}, \bar{\omega}^0_{it+1}\right)} V_{it}$$

subject to

$$W_{it} = R^B_{it+1} B_{it}$$

where

$$V_{it} = \int_{-\infty}^{\bar{\omega}^0_{i,t+1}} V^L_{it} dF\left(\omega^0_{i,t+1}\right) + \int_{\bar{\omega}^0_{i,t+1}}^{\infty} V^E_{it} dF\left(\omega^0_{i,t+1}\right), \quad (2)$$

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- V^L_{it} is value of entrepreneur when lender in control
- V^E_{it} is value of entrepreneur when herself in control

Results: Expected Returns

- Two sets of results simplify model computation
  - Optimal contract features same terms across all entrepreneurs
    - Allows us to achieve aggregation
  - Optimal investment choice implies $\theta^E = 1$ and $\theta^L = 0$
- Relationship between expected return and covenant strictness:

$$R_{i,t+1} = \begin{cases} R^D_{t+1} & \text{if } \omega^0_{i,t+1} < \bar{\omega}^0_{i,t+1}, \\ \exp\left(\omega_{i,t+1}\right) R^K_{t+1}\left(1 + H_t\right) - R^B_{t+1} H_t & \text{if } \omega^0_{i,t+1} \geq \bar{\omega}^0_{i,t+1} \text{ and } \omega^1_{i,t+1} \geq \hat{\omega}^1_{i,t+1}, \\ 0 & \text{otherwise,} \end{cases}$$

where H is leverage ratio B/N

- When signal is low, lender is in control, choose risk-less asset
  - Expected return on equity is low
- When signal is high, entrepreneur in control choose risky asset
  - Expected return on equity is high

Empirical Analysis

Data

- LPC Dealscan: Terms (including covenants) for syndicated and bilateral private loans
  - More than 75% of value of commercial loans in the US (Bradley and Roberts (2015))
  - Data sourced from SEC filings, private contracts
- Compustat/CRSP: Quarterly financial data, returns
- Greg Nini: Covenant violation data
  - Sourced from firm SEC filings
- Sample frequency and period: Quarterly, 1996q1-2016q4

Investment Conservatism for Strictness-Sorted Portfolios

	Low	2	3	4	High	High-4	High-Low	4-Low
Δ CAPX/Asset	-0.08*	-0.03	-0.03	-0.03	-0.11*	-0.08*	-0.03	0.04*
t-stat.	-1.78	-1.10	-1.00	-0.77	-1.80	-1.94	-0.66	1.66
Δ ACQU/Asset	-0.18***	-0.10	-0.19***	-0.09	-0.34***	-0.25**	-0.17	0.08
t-stat.	-2.99	-1.09	-2.96	-1.12	-3.15	-2.36	-1.58	0.97

- We sort firms into five portfolios based on their strictness
  - Constructed following Murfin (2012)
  - Portfolios are rebalanced quarterly
- Firms in high-strictness portfolio feature conservative investment
  - Both relative to low-strictness and to 4th portfolio
  - Investment conservatism measured with CAPEX and acquisition expenditure growth (Nini et al. (2012))
  - Consistent with recent empirical evidence (Chava and Roberts (2008), Nini et al. (2009, 2012), Falato and Liang (2016), Ersahin et al. (2017))

Excess Returns for Strictness-Sorted Portfolios

	Low	2	3	4	High	High-4	High-Low	4-Low
Excess Return (pp)	6.76*	8.40**	6.90*	10.36**	2.64	-7.72**	-4.12	3.60*
t-stat.	1.90	2.27	1.83	2.59	0.49	-2.32	-1.52	1.88
α^{FF5}	-2.76*	-2.03	-3.06	-0.79	-6.56***	-5.77*	-3.80	1.97
t-stat.	-1.84	-1.12	-1.45	-0.42	-2.68	-1.97	-1.64	1.19
β^{MKT}	1.06***	1.03***	1.08***	1.09***	1.18***	0.10	0.12*	0.02
t-stat.	30.64	27.18	29.53	21.09	24.88	1.58	1.88	0.56
β^{SMB}	0.09	0.24***	0.19***	0.30***	0.37***	0.07	0.28***	0.21***
t-stat.	1.70	3.55	2.75	4.31	6.37	0.85	3.09	3.53
β^{HML}	0.05	0.02	0.12*	0.17	0.21**	0.04	0.17**	0.13
t-stat.	0.58	0.18	1.69	1.31	2.18	0.37	2.03	1.41
β^{RMW}	0.29***	0.45***	0.32***	0.39***	-0.09	-0.48***	-0.37***	0.10
t-stat.	4.86	4.65	4.42	4.74	-0.68	-3.82	-2.75	1.38
β^{CMA}	0.06	0.13	-0.02	0.13	-0.25	-0.37***	-0.30*	0.07
t-stat.	0.80	1.28	-0.17	1.23	-1.57	-2.64	-1.87	0.76

- Firms in high-strictness portfolio earn *lower* expected returns
  - Similar pattern observed for investment conservatism
- Pattern arises from exposure to investment and profitability factors (Fama and French (2015), Hou et al. (2015))
  - Findings provide supportive evidence for mechanism

Robustness and Additional Tests

- Strictness strongly predicts future covenant violation Validation
- Strictness-return relationship strong and robust to
  - Fama-MacBeth cross-sectional regression specifications Fama-MacBeth
  - Pooled OLS regression specifications Pooled OLS
  - Alternative specifications for strictness measure
- RDD tests show that covenant violation is associated with reduction in future excess returns RDD
- Results are *not* driven by financially-distressed firms
  - E.g., stronger results for low-failure-probability firms Distress
  - Suggests our mechanism arises from different economic forces than distress anomaly (e.g., Garlappi and Yan (2011))

Current Work

- Quantitative analysis of the model
  - Aggregate implications:
    - Covenants alter impulse response functions of aggregate variables relative to Bernanke et al. (1999)
    - Time-varying strictness is an important state variable in the economy
  - Cross-sectional implications:
    - Firms close to technical default have less exposures to aggregate shocks, thus *lower* expected return

Conclusions

- We build dynamic model of firm borrowing with endogenous loan covenants and transfer of control rights
  - Investment control rights transferred to lenders when covenants are breached
- We provide evidence for mechanism in the data
  - Firms closer to technical default
    - Exhibit more conservative investment
    - Have 4% lower expected returns

Appendix

Strictness: Measure Validation

	Dependent Variable: Covenant Violation		
	(1)	(2)	(3)
One-Quarter Lag Strictness	0.109***	0.065***	0.058***
	(0.00)	(0.01)	(0.01)
Firm FE	No	Yes	Yes
Year-Quarter FE	No	No	Yes
R-Squared	0.069	0.249	0.257
Observations	72,781	72,639	72,639

- Strictness is positively correlated with future covenant violations

Back

Fama-MacBeth

	Dependent Variable: Monthly Excess Returns			
	(1)	(2)	(3)	(4)
Strictness	-0.357***	-0.327***	-0.364***	-0.330***
	(0.12)	(0.12)	(0.12)	(0.12)
Size	-0.088*	-0.100**	-0.066	-0.079*
	(0.05)	(0.05)	(0.05)	(0.05)
Log B/M	0.141	0.136	0.081	0.075
	(0.13)	(0.12)	(0.12)	(0.11)
Reversal	-0.016**	-0.016**	-0.016**	-0.017**
	(0.01)	(0.01)	(0.01)	(0.01)
Book Leverage	-0.112	-0.081	-0.415	-0.407
	(0.48)	(0.47)	(0.46)	(0.46)
ROA	5.082	3.217	5.139	3.376
	(3.87)	(3.53)	(3.65)	(3.42)
Pr(Failure)		-80.929**		-91.997***
		(31.79)		(28.05)
EDF			0.192	2.272
			(2.48)	(2.41)
R-Squared	0.041	0.047	0.049	0.054
Observations	219,331	218,952	214,750	214,699

Fama-MacBeth with Portfolio Dummies

	Dependent Variable: Monthly Excess Returns			
	(1)	(2)	(3)	(4)
Str. Portfolio 2	0.013	0.011	0.038	0.027
	(0.09)	(0.09)	(0.08)	(0.08)
Str. Portfolio 3	-0.026	-0.034	0.002	-0.008
	(0.10)	(0.09)	(0.08)	(0.08)
Str. Portfolio 4	-0.162	-0.169	-0.147	-0.147
	(0.11)	(0.11)	(0.11)	(0.10)
High Str. Portfolio	-0.310**	-0.296**	-0.317**	-0.298**
	(0.12)	(0.12)	(0.13)	(0.13)
Pr(Failure)		-84.430***		-94.865***
		(32.18)		(28.83)
EDF			0.119	2.216
			(2.52)	(2.42)
Other Controls	Yes	Yes	Yes	Yes
R-Squared	0.044	0.050	0.052	0.057
Observations	219,247	218,872	214,669	214,619

- Dummies for firms belonging to strictness portfolios

Back

Pooled OLS

	Dependent Variable: Monthly Excess Returns			
	(1)	(2)	(3)	(4)
Strictness	-0.440***	-0.445***	-0.482***	-0.480***
	(0.16)	(0.17)	(0.17)	(0.17)
Size	-0.119**	-0.111*	-0.091	-0.088
	(0.06)	(0.06)	(0.06)	(0.06)
Log B/M	0.159	0.149	0.071	0.078
	(0.13)	(0.13)	(0.13)	(0.13)
Reversal	-0.032**	-0.032**	-0.033**	-0.033**
	(0.01)	(0.01)	(0.02)	(0.02)
Book Leverage	-0.116	-0.176	-0.505	-0.478
	(0.51)	(0.51)	(0.55)	(0.55)
ROA	-1.235	-0.789	-0.500	0.071
	(6.11)	(5.50)	(6.16)	(5.73)
Pr(Failure)		3.513		2.600
		(2.77)		(2.95)
EDF			2.226*	1.959
			(1.16)	(1.23)
R-Squared	0.151	0.151	0.151	0.151
Observations	219,331	218,952	214,750	214,699

Back

RDD Tests

	Dependent Variable: Excess Returns		
	(1)	(2)	(3)
Violation	-0.443***	-0.309***	-0.272*
	(0.11)	(0.11)	(0.15)
Distance	0.134***	0.109***	-0.017
	(0.03)	(0.03)	(0.07)
Violation $\times$ Distance	-0.224***	-0.180***	0.083
	(0.04)	(0.04)	(0.13)
Size		-0.021	-0.024
		(0.02)	(0.02)
Log B/M		0.068	0.076
		(0.05)	(0.05)
Book Leverage		-0.475**	-0.309
		(0.21)	(0.23)
ROA		4.407***	3.981**
		(1.60)	(1.62)
High Order Polynomials	No	No	Yes
Year-Quarter FE	Yes	Yes	Yes
R-Squared	0.214	0.220	0.220
Observations	67,591	64,451	64,451

Back

Distressed Firms

	EDF $\leq$ 90th Percentile		Pr(Failure) $\leq$ 90th Percentile	
	(1)	(2)	(3)	(4)
Str. Portfolio 2	-0.005	0.011	0.022	0.031
	(0.08)	(0.08)	(0.08)	(0.08)
Str. Portfolio 3	-0.097	-0.072	-0.096	-0.085
	(0.08)	(0.08)	(0.08)	(0.08)
Str. Portfolio 4	-0.203**	-0.171*	-0.156*	-0.139
	(0.10)	(0.10)	(0.09)	(0.09)
High Str. Portfolio	-0.328**	-0.308**	-0.347***	-0.324**
	(0.14)	(0.14)	(0.13)	(0.14)
Distress Controls	No	Yes	No	Yes
Other Controls	Yes	Yes	Yes	Yes
R-Squared	0.044	0.052	0.041	0.051
Observations	193,327	193,281	197,033	193,338

- Expected Default Frequency (EDF) from Bharath and Shumway (2008)
- Failure Probability from Campbell et al. (2008)

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