Learning about Distress by Christian Opp

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Motivation

Position in the literature

- Corporate Financial Decisions & Asset Prices
  - Decisions made by managers and shareholders depend on asset prices
  - Decisions made by managers and shareholders affect asset prices
  - Unified framework for corporate finance and asset pricing
  - Bhamra, Kuehn, Strebulaev (2010a, 2010b), Chen (2010) – embed structural models of credit risk [Leland (1998)] inside asset pricing model with exogenous SDF
- This paper
  - Embed structural model of credit risk [Leland (1998)] inside asset pricing model with exogenous SDF
  - Firm type is not known, but will be revealed – how does this impact the decision to default and hence asset prices?
  - David (2008) – does not have optimal default

Paper's aim

- Theory
  - Not always obvious when to default. If a firm is in distress, is it is a bad firm with cashflows that could deteriorate or a good firm experiencing temporary difficulties?
  - Good firm – inject equity and avoid liquidation
  - Bad firm – liquidate
  - Not sure – beliefs matter for liquidation decision
- Empirical
  - Do corporate finance implications of difficulty in distinguishing between good and bad firms help us understand asset pricing data better?
    - distress puzzle – Fama and French (1992) suggest size and value premiums result from distress risk. Dichev (1998), Griffin and Lemmon (2002), Campbell, Hilscher and Sziglayi (2008) find financially distressed firm have lower returns
    - momentum

Corporate Finance Decisions and Asset Prices

- ξ, SDF process
- X, firm's EBIT process
- c, coupon rate for perpetual debt
- levered equity value

$$V_t = E_t \int_t^{\tau} \frac{\xi_u}{\xi_t}(X_u - c)du \tag{1}$$

- shareholders choose τ to maximize shareholder value
- Feedback between optimal default decision & asset prices
- Not fully captured in simple cases (log-normal SDF and X)

$$\tau = \inf_{t>0}\{X_t \leq X_D\} \tag{2}$$

SDF

- Aggregate state $Z \in \{B, G\}$, 2-state Markov chain, intensity $\lambda(Z_{t-}, Z_t)$

$$\frac{d\xi_t}{\xi_{t-}} = -r_f(Z_{t-})dt + \underbrace{[\exp(\phi(Z_{t-}, Z_t)) - 1]}_{\text{risk prices}} dN_t^P(Z_{t-}, Z_t), \tag{3}$$

where $dN_t^P(Z_{t-}, Z_t) = \underbrace{dN_t(Z_{t-}, Z_t)}_{=1, \text{when}, Z_{t-} \neq Z_t} - \lambda(Z_{t-}, Z_t)dt$

- $G \to B$, $d\xi_t - E_{t-}[d\xi_t] > 0$, $\exp(\phi(G, B)) - 1 > 0$
- $B \to G$, $d\xi_t - E_{t-}[d\xi_t] < 0$, $\exp(\phi(B, G)) - 1 < 0$
- risk-neutral jump intensity, $\lambda^{\mathbb{Q}}(Z_{t-}, Z_t) = \phi(Z_{t-}, Z_t)\lambda(Z_{t-}, Z_t)$
- $\lambda^{\mathbb{Q}}(G, B) > \lambda(B, G)$
- $\lambda^{\mathbb{Q}}(B, G) < \lambda(B, G)$

Individual Firm

- firm type is z, $z \in \{db, dg\}$, **unobservable**
- initially earnings is $X_d < c$.
- at some random time, type is revealed – for bad firm, X jumps down to $X(db)$, for good firm jumps up to $X(dg)$
- Exogenous earnings process, $X \in \{X(db), X(dg)\}$ always positive
- Exogenous fixed coupon, c
- Residual dividend, $X(z) - c$
- Equity price

$$V(Z_t, z_t) = \int_t^\tau \frac{\xi(Z_u)}{\xi(Z_t)}(X(z_u) - c)du. \quad (4)$$

- Optimal default rule will depend on belief about type and aggregate state
- Also, waiting may lead to revelation of type, so speed of learning about type matters.

Optimal default rule

- Initial solvent states $(Z, z) \in \Omega_s$. Not in distress.
- **Opaque distressed states** $(Z, z) \in \Omega_d$. In distress, but firm type unknown
- Revealing states $(Z, z) \in \Omega_b$, true firm state is *db* can be deduced.
- Revealing states $(Z, z) \in \Omega_g$, true firm state is *dg* can be deduced.
- In **opaque distressed states**, agents need to choose when to default – form beliefs about the earnings state through Bayesian updating.
- Posterior probability firm is in good state, π_t – try and learn about type before entering a revealing state
- Equity value in opaque distressed states

$$V(\pi_t, Z_t) = \int_t^{\tau^*} \frac{\xi(Z_u)}{\xi(Z_t)}(X(z_u) - c)du \tag{5}$$

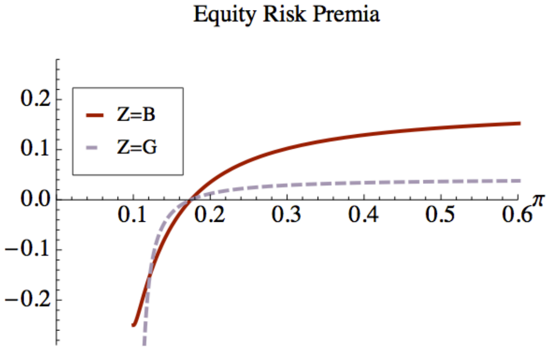
  - τ^* chosen to maximize equity value, will be stopping time of form

$$\tau^* = \inf_{t>0}\{\pi_t \leq \pi^R(Z)\} \tag{6}$$

  - Dependence of τ^* on aggregate state generates risk premia

Learning and Risk Premia

- When belief that a firm is bad is high, an improvement in aggregate conditions strengthens negative signals about the firm being bad – reducing it's equity value.
- Stock price is countercyclical when belief the underlying firm is bad is high
- For low π, can get negative risk premium – distress puzzle.



Nice modelling assumptions

- Continuous time with discrete states: get a system of first order ode's
  - You might be able to solve in closed-form – literature on Stefan problem and obstacle problems
- No growth in earnings – leverage does not vanish – no need for dynamic capital structure
- Exogenous coupon

The learning framework

- Explain this better in the paper. Make it clear firms have a fixed type, which is initially unknown.
- Don't talk about firm-specific states. Just talk about firm type.

The main result?

Paper links results on belief dynamics and risk premia to:

- Momentum
- Distress puzzle
- Business cycles and default
- Active investment and returns

Focus!

Relationship to Distress Puzzle

- How are the model's implications different from other ways of understanding the distress puzzle [Bhamra & Shin (2015), real options and economic distress]
- Look at CAPM alpha's in a simulation – will they be negative enough for distressed firms?
- Model's simplicity starts to become a problem for empirical work – in the long-run firm type is revealed, there is no growth in cashflows

What happens when you have 2 or more firms I

Why? Odd to think about cross-sectional asset pricing anomalies without a cross-section of firms.

- Aggregate shocks affect prices of all firms
- Could types and learning be linked across firms? What does the increase in belief that VW is bad tell us about BMW?
- The intuition in this paper tells us that learning speed matters. Having a cross-section can impact learning speed. What we learn from the cross-section is important for default decisions and hence asset prices. Can you explore the implications?

What happens when you have 2 or more firms II

- Toy Model

$$X_1(z) \in \{X_1(db), X_1(dg)\} - 2 \text{ types} \tag{7}$$
$$X_2(z,w) \in \{X_2(db,l), X_2(db,m), X_2(dg,h)\} - 3 \text{ types} \tag{8}$$
$$\tag{9}$$

  - Initially observe $X_{1,d}$ and $X_{2,d}$
  - At some random time, observe $X_1(z)$ and $X_2(z,w)$ – revelation
  - Before revelation, belief about firm 2's type depends on beliefs about firm 1's type

Concluding Remarks

- Interesting model
- Likes: simplicity of assumptions, getting risk premia with no systematic risk in cashflows (say more about this)
- More clarity about learning set-up
- Decide which way to go:
  - Stop
  - Extend to cross-section where firms are interconnected. Start with 2 firms, which are interconnected.
  - Could go after quite a few empirical anomalies with a slightly more complex model – if you go this way, focus on one anomaly!