Learning about Distress
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Motivation & Aims

Model Summary

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Conclusion
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

- **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
Motivation & Aims

Paper’s aim

Theory

- Not always obvious when to default. If a firm is in distress, is it 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?
  - momentum
Corporate Finance Decisions and Asset Prices

- $\xi$, SDF process
- $X$, firm’s EBIT process
- $c$, coupon rate for perpetual debt
- levered equity value

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

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

$$\tau = \inf_{t>0} \{X_t \leq X_D\} \quad (2)$$
Model Summary

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

\[
\frac{d\xi_t}{\xi_{t-}} = -r_f(Z_{t-})dt + \left[\exp(\phi(Z_{t-}, Z_t)) - 1\right] dN^P_t(Z_{t-}, Z_t),
\]

where $dN^P_t(Z_{t-}, Z_t) = dN_t(Z_{t-}, Z_t) - \lambda(Z_{t-}, Z_t)dt$

=1, when, $Z_{t-} \neq Z_t$

- $G \rightarrow B$, $d\xi_t - E_t[\xi_t] > 0$, $\exp(\phi(G, B)) - 1 > 0$
- $B \rightarrow G$, $d\xi_t - E_t[\xi_t] < 0$, $\exp(\phi(B, G)) - 1 < 0$
- risk-neutral jump intensity, $\lambda^Q(Z_{t-}, Z_t) = \phi(Z_{t-}, Z_t)\lambda(Z_{t-}, Z_t)$
- $\lambda^Q(G, B) > \lambda(B, G)$
- $\lambda^Q(B, G) < \lambda(B, G)$
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, \(\pi_t\) – try and learn about type before entering a revealing state
- Equity value in opaque distressed states

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

- \(\tau^*\) chosen to maximize equity value, will be stopping time of form

\[
\tau^* = \inf_{t>0} \{\pi_t \leq \pi^R(Z)\}
\]

- Dependence of \(\tau^*\) 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 its equity value.
- Stock price is countercyclical when belief the underlying firm is bad is high.
- For low $\pi$, can get negative risk premium – distress puzzle.

Equity Risk Premia

![Equity Risk Premia Graph](image)

- $\pi$: Parameter
- $Z=B$: Line for $Z=\text{Bad}$
- $Z=G$: Line for $Z=\text{Good}$
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!
- 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

\[ X_1(z) \in \{X_1(db), X_1(dg)\} - 2 \text{ types} \]  
\[ X_2(z, w) \in \{X_2(db, l), X_2(db, m), X_2(dg, h)\} - 3 \text{ types} \]

- 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!