# Discussion of: *Ambiguity Shifts and the 2007-08 Financial Crisis* by Nina Boyarchenko

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# Paper's Objective

Construct a model that explains:

1. "Credit Spread Puzzle": the spread between the yields on corporate bonds and treasuries are high relative to the historically observed default and recovery rates
   - Huang and Huang (2003)
   - Driessen (2005)
2. Sharp rise in CDS spreads during the 2007-08 financial crisis
   - especially for financial firms, which this paper focuses on

# Approach: the Model of Risky Debt

- Black and Cox (1976) model of risky debt and equity as claims on cash flows from firm assets
  - cash flow is a constant fraction of fundamental asset value
  - firm assets are a composition of a common (systematic) and a firm-specific component
  - each component follows a finite-state markov chain
- Debt is a consol bond with face value $D$ that pays coupon $C$
  - default occurs mechanically when the markov chain enters the lowest-value state for the firm
  - recovery value (X) equals the discounted present value of future cash flows from assets
- Investors have incomplete accounting information as in Duffie and Lando (2001)
  - creates uncertainty about the state
  - credit spreads can be high even at short maturities
- Credit Default Swap (CDS) pays $(D - X)$ upon default
  - CDS spread set to have same present value as expected CDS payout

# Preferences and Pricing

- Risk neutral but *ambiguity averse* representative investor prices debt and equity
- He has a reference model of the fundamental states and their transition probability matrix
- Filters for the current state using the reference model and the set of noisy signals of firms' asset values
- Wants robustness to uncertainty about the current state ($\theta_s^{-1}$)
  - A potentially different level of robustness to uncertainty about the state transition probabilities ($\theta_d^{-1}$)

# Mechanism

- Robustness can be obtained by making decisions under probabilities that overweight
  - being in low-value states
  - transitioning to low-value states
- Resulting prices reflect a higher likelihood of default and wider CDS spread than the reference model
  - also decreases price of equity
- Crisis shocks increase posterior state uncertainty
  - increases statistical ‘distance’ between worst-case and reference models (more ambiguity)
  - CDS spreads widen

# Implementation

1. Solve for investor's value function and robust (pricing) probabilities
   - approximation for value function and equity price
2. Estimate reference model states + transitions probabilities (on pre-crisis data)
   - book equity for fundamental asset value
   - house-price index for common component
   - *long-term* debt for face value of debt
   - coupon set so debt is "optimal" (?)
3. Robustness parameters ($\theta_d^{-1}$ and $\theta_s^{-1}$) estimated to fit CDS spreads across maturities, firms, and time

- What identifies $\theta_s$ versus $\theta_d$?
  - Term structure of CDS spreads?
- How is desire for robustness disciplined?
  - reports relative entropy of worst-case model, but this is not directly interpretable
  - can use detection-error probability to assess plausibility of worst-case model

# Credit Spread Puzzle: Alternative Approaches

- Power utility
  - doesn't work under the reference model (see Appendix)
  - spreads are too low in pre-crisis period
- Habits-based model (Chen, Collin-Dufresne, Goldstein (2009))
  - default likelihood high, recovery value low when risk-aversion is high
- Long-run risks-based model (Bhamra, Kuehn, Strebulaev (2010), Chen (2010))
  - default in low growth, high volatility states
  - low recovery rate
  - high marginal utility

# Crisis CDS Spread Widening: Alternative Approaches

- LRR or Habits Models: what do these imply?
- Disaster risk model: investors price a low probability of "meltdown", an extreme drop in output
- Asymmetric Information + Adverse Selection: Investors don't know condition of banks' balance sheets (how much toxic assets they hold or how toxic these assets really are)
  - uncertainty over quality has common component across banks (undiversifiable)
  - banks have incentive to conceal (avoid funding freeze, bank runs) and cannot credibly convey their quality
  - investors price in the adverse selection possibility

  → CDS spreads are wide relative to reported fundamentals

# Adverse Selection vs. Ambiguity

Adverse selection is distinct form ambiguity aversion though they can sound similar

- ambiguity: the true state and dynamics are not known
- adverse selection: investors don't know, banks do, but they cannot credibly reveal their information

However, the two forces are *not* mutually exclusive:

- ambiguity: no good information on how 'toxic' are toxic assets? What is the impact of falling real-estate prices on defaults? on economic growth?
- This ambiguity can exacerbate the adverse selection concern
- adverse selection: how much of such toxic assets do banks hold?

# Bank CDS spreads, Financial Crisis, and Welfare

- Bank credit risk leads to high CDS spreads, tighter bank funding constraints (a banking crisis)
- interbank lending dries up and there is increased risk of bank runs
- lack of bank lending hurts output ('bank lending channel')

$\Rightarrow$ Alleviating any CDS-increasing frictions is an important target for policy

# Policy Implications

Adverse Selection: Reduce information asymmetry

- Credible third party investigation of bank holdings
  - Federal Reserve and other bank regulators?
  - Is there a mechanism for good banks to voluntarily signal their quality?

Ambiguity: Not obvious if there are any policy implications

- Nature won't show us its "books"
- Can reduce some uncertainty by gathering public information and expertise
  - e.g, early crisis investors lacked knowledge/understanding of pre-crisis lending standards, shadow-banking system, government oversight (or lack thereof) and powers

**Question**: Is this mainly an issue of *private information* or *uncertainty*?

# Policy Implications: *Bank Stress Tests*

- In sovereign-debt crisis context: March 2010 and June 2011
- A response to fears of insufficient bank capital and large risky sovereign bond holdings
  1. Reported bank holdings of each country's bonds
  2. Estimated loss in equity capital under "worst-case scenarios"
- 2010 stress test followed by temporary relief of bank credit risk, 2011 test had little impact (issues with credibility and rigor)

**Question:** Do stress tests have value because they

1. reveal private bank balance sheet information?
2. reduce ambiguity by quantifying the worst-case scenario?
   - do regulators have any comparative advantage in figuring this out?
3. Or none of the above. Maybe investors interpreted passing the test as a committment to bailout in the future?

# Conclusion

- Interesting paper
- Policy implications are not immediately clear
- Can be difficult to distinguish ambiguity aversion from asymmetric information + adverse selection
- Both can be present and reinforce each other
- Thanks for the invitation to discuss!