Quiet Bubbles

H. Hong D. Sraer

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Motivation: Loud versus Quiet Bubbles

- Classic speculative episodes associates high prices, high price volatility and high turnover (Hong and Stein '07).
  - Internet stocks during 1996-2000: (1) price volatility excess of 100% and (2) more than 20% of stock market turnover.
  - Over-trading as investors buy in anticipation of capital gains.
- Credit bubble in AAA/AA tranches of subprime mortgage CDOs important in financial crisis (Coval et al. 09).

Motivation: Loud versus Quiet Bubbles

- However, this credit bubble seems quiet: high price but low price volatility and low turnover.

1. ABX prices of CDO tranches, especially AA and AAA, not volatile until beginning of crisis.
2. Little turnover of these securities. (anecdotal evidence)
3. CDS prices for insurance against default of finance companies extremely cheap and not volatile.

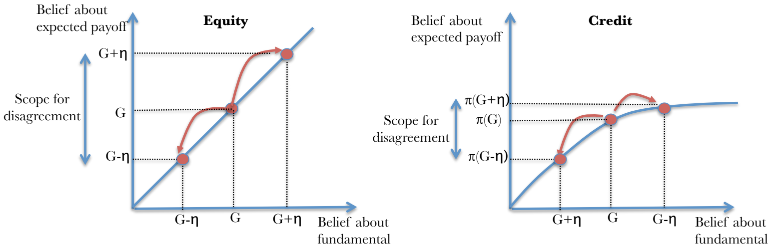
Our Paper

- Role of payoff concavity in a model of speculative bubbles (Scheinkman-Xiong '03, Harrison-Kreps '79)
  - What are the trading patterns associated with a credit bubble?

Main intuition:

- Pure resale option framework: investors buy an asset anticipating tomorrow's (1) disagreement and (2) binding short-sales constraints.
- With concave payoff, less scope for disagreement $\Rightarrow$ lower resale option.
- lower resale option $\Rightarrow$ lower turnover, volatility.

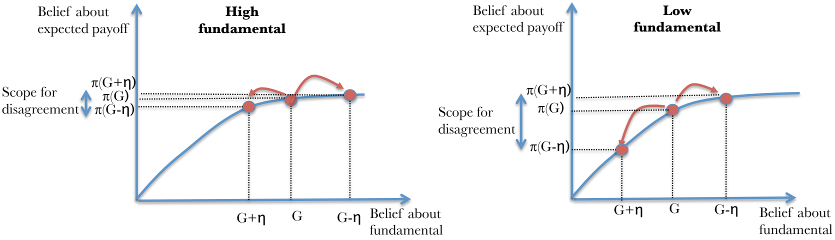
Concave payoffs reduce the scope for disagreement.



Main Results

1. Credit bubble has smaller resale option than equity bubble.
   $\Rightarrow$ debt less disagreement sensitive than equity.
2. Deterioration in fundamental leads to (1) larger bubble (2) more volume (3) more volatility.
   - Contrasts with models of adverse selection (Dang et al '10).

Deterioration in fundamentals ⇒ louder and larger bubbles



Main results (continued)

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   - Contrasts with models of adverse selection (Dang et al '10).
3. Large credit mispricing requires either:
   - more leverage (magnify disagreement)
   - more average investor optimism.
4. Optimist bias makes credit (not equity) mispricing quiet.
   - A rise in optimism (sentiment) makes credit bubbles (not equity ones) larger and quieter.

Sketch of the model: risky asset

- Three dates $t = 0, 1, 2$. Risk neutral agents. No discounting.
- Supply Q of risky credit w/ face value of D and date-2 payoff:

$$m_2 = \min\left(D, \tilde{G}_2\right) \quad \text{where} \quad \tilde{G}_2 = G + \epsilon_2, \quad \text{and} \quad \epsilon_2 \sim \Phi(.).$$

- Expected payoff with unbiased belief:

$$\pi(G) = E[m_2|v] = \int_{-\infty}^{D-G} (G + \epsilon_2)\phi(\epsilon_2)d\epsilon_2 + D\left(1 - \Phi\left(D - G\right)\right).$$

- Works more generally with any concave payoff function $\pi()$.

Sketch of the model: agents beliefs

- Two groups of agents (A and B) w/ homogenous priors about fundamental.

$$\tilde{V}_2 = G + b + \epsilon_2, \quad \text{where } b \text{ is aggregate bias}$$

- At t=1, agents beliefs about fundamental becomes:

$$\begin{cases} G + b + \eta^A + \epsilon_2 & \text{for group A agents} \\ G + b + \eta^B + \epsilon_2 & \text{for group B agents} \end{cases}$$

- Where η^A and η^B are i.i.d. with normal C.D.F. $\Phi()$.

Leverage and trading costs

- Reduced form view of leverage: cost of borrowing.
  - Agents endowed with 0 liquid wealth but large illiquid wealth W (pledgeable at date 2).
  - Access to an imperfectly competitive credit market: banks charge > 0 interest rates for risk-free loans.
- Quadratic trading costs to have finite positions:

$$c(\Delta n_t) = \frac{(n_t - n_{t-1})^2}{2\gamma},$$

- Trading costs allow equilibrium to exist – results similar in CARA/Gaussian framework.

Moments

Construct a dynamic equilibrium and analyze following moments:

1. Ex ante mispricing: P_0 relative to no short-sales constraint / no aggregate bias (b=0) prices.
2. Price volatility between 0 and 1:

$$\sigma_P = \int_{\eta^A,\eta^B} \left(P_1(\eta^A,\eta^B) - m\right)^2 d\Phi(\eta^A) d\Phi(\eta^B)$$

   $m = \int_{\eta^A,\eta^B} P_1(\eta^A,\eta^B) d\Phi(\eta^A) d\Phi(\eta^B)$ is average date-1 price.

3. Share turnover between 0 and 1:

$$\mathbb{T} = \int_{\eta^A,\eta^B} \mathcal{T}(\eta^A,\eta^B) d\Phi(\eta^A) d\Phi(\eta^B)$$

   with $\mathcal{T}(\eta^A,\eta^B) = \left| n_1^A(\eta^A,\eta^B) - n_0^A(\eta^A,\eta^B) \right|$

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Date-1 equilibrium

1. Both groups are long (low leverage/high supply/small shocks):

$$\left|\pi(\eta^A) - \pi(\eta^B)\right| < \frac{2Q}{\mu\gamma}$$

$$\Rightarrow P_1 = \mu\frac{\pi(\eta^A) + \pi(\eta^B)}{2} \text{ and } \mathcal{T} = \frac{\mu\gamma}{2}\left|\pi(\eta^A) - \pi(\eta^B)\right|$$

2. Group i sidelined (high leverage/low supply/large relative shock):

$$\pi(\eta^i) - \pi(\eta^j) \geq \frac{2Q}{\mu\gamma}$$

$$\Rightarrow P_1 = \mu\pi(\eta^i) - \frac{Q}{\gamma} \text{ and } \mathcal{T} = Q$$

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Date-0 equilibrium

- Agents select date-0 holdings anticipating date-1 equilibrium.
- Market clearing condition $(n_0^A + n_0^B = 2Q)$ gives P_0.
- Symmetric equilibrium: $n_0^A = n_0^B = Q$.

$$P_0 = \int_{-\infty}^{\infty} \left[\underbrace{\left(\mu\pi(y) - \frac{2Q}{\gamma} \right) \Phi\left(\underline{x}(y)\right)}_{\text{short-sales constraint}} + \underbrace{\int_{\underline{x}(y)}^{\infty} \mu\pi(x) d\Phi(x)}_{\text{no short-sales}} \right] d\Phi(y) - \underbrace{\frac{Q}{\gamma}}_{\text{supply}}$$

Equilibrium moments: bubble

- Bubble can be decomposed in two terms:

$$\text{bubble} = \underbrace{\int_{-\infty}^{\infty} \left(\int_{-\infty}^{\underline{x}(y)} \left(\mu\pi(y) - \mu\pi(x) - \frac{2Q}{\gamma} \right) d\Phi(x) \right) d\Phi(y)}_{\text{resale option}} + \underbrace{\hat{P}_0 - \bar{P}_0}_{\text{optimism}}$$

- $\bar{P}_0$ is the price when $b = 0$ and no short-sales constraint
- $\hat{P}_0$ is the no-short-sales constraint price with aggregate bias b.

Equilibrium moments: turnover

- Expected turnover:

$$\mathbb{T} = \int_{-\infty}^{\infty} \left(\underbrace{Q(\Phi(\underline{x}(y)) + (1 - \Phi(\bar{x}(y)))}_{\text{A,B short-sale constrained}} + \underbrace{\int_{\underline{x}(y)}^{\bar{x}(y)} \mu\gamma \frac{|\pi(y) - \pi(x)|}{2} d\Phi(x)}_{\text{no short-sale constraint}} \right) d\Phi(y)$$

- Mechanic link between turnover and mispricing:
  - Turnover maximized when short-sales constraints are binding.
  - Resale option maximized when short-sales constraints are binding.

Comparative statics: credit riskiness

Proposition 1: An increase in D leads to larger mispricing, larger turnover and larger volatility.

- Intuition: as D increases, credit becomes more disagreemeent sensitive.

  $\Rightarrow$ Larger resale option

  $\Rightarrow$ Larger mispricing

  $\Rightarrow$ Larger turnover, volatility.
- Thus, credit bubbles are quiet – and small.
- In the pure resale option framework, noise and prices goes hand in hand.

Comparative statics: optimism

Proposition 2: An increase in b leads to larger mispricing, **lower** turnover and **lower** volatility.

- Intuition: as b increases, credit becomes safer in the agents' eyes.
  $\Rightarrow$ credit becomes less disagreemeent sensitive.
  $\Rightarrow$ lower resale option
  $\Rightarrow$ lower turnover, volatility.
- Lower resale option, but larger bubble from optimism.
- When optimisim rises, credit bubbles quieter **and** larger.
- Optimism decouple turnover/volatility and price.
- Important: b leaves unchanged an equity bubble.

Comparative statics: fundamental

Proposition 3: An decrease in G leads to larger mispricing, higher turnover and higher volatility.

- Intuition: as G decreases, credit becomes riskier and thus more disagreemeent sensitive.
  $\Rightarrow$ higher resale option $\Rightarrow$ larger bubble (but lower price)
  $\Rightarrow$ higher turnover, volatility.
- Thus, deterioration in fundamentals leads to more trading, more volatility, larger bubbles.
- Opposite to models of adverse selection that predict trading freeze and low prices.
- Can explain rise in ABX vol in the months preceding the crisis.

Extension: Interim Payoff and Dispersed Priors

- Agents have heterogenous priors: $G + b + \sigma$ for group A, $G + b - \sigma$ for group B
- Agents receive interim payoff $\pi(G + \epsilon_1)$. (Interest payments)
- This $t = 1$ cash-flow occurs before belief shock.
- Two rationales for holding credit: (1) short term payments and (2) speculation on capital gains.
- Another mechanism that decouples pricing and volatility/turnover:

Proposition 5: if leverage is cheap, $\nearrow$ in σ makes bubble "quieter" and larger.

“Miller” quietness – Intuition

- $\nearrow$ in σ increases group A date-0 holdings (interest payments) up to the point where they hold all the supply (provided leverage is cheap enough).
- $\nearrow$ in σ makes it more likely that short-sales constraints bind at date 1 and group A agents want to hold on to their shares.
- Thus as σ increases, turnover becomes lower.
- Yet, large date-0 bubble because of (1) mispricing of interest payments (Miller) and (2) binding date 1 short-sales constraints.

Implications

- Dispersion can lead to concentration of positions and quiet bubbles.
    - Anecdotal evidence on AIG-FP as being key to rise of subprime mortgage CDO market.
- Implication for security design: trade-off between adverse selection and exposure to disagreement.
- Credit bubbles are potentially harder to detect. Associated with lower volatility and turnover – quiet bubbles.

Conclusion

- Our model offers a new take on the crisis:
  - Simple extension of speculative bubbles to the assets that were at the heart of the crisis.
  - Unified theory relating credit bubbles to Internet bubbles
- Part of a broader agenda that explores cross-sectional asset pricing implications of exposure to disagreement.