Asset Pricing with Disagreement

Andrea Buraschi

2014 Fall Inquire Conference

A History of Asset Pricing

- **One tree, one agent**: [Lucas (1978)]:
- **One tree, two agents**: [Detemple and Murthy (1994)]

  Agents have different expectations on the state space, $E^i(X_t)$. Thus they can disagree. Agents have $U(c_t) = \log(c_t)$. Equilibrium interest rates is a wealth-weighted average of optimist and pessimist.

- **One tree, two agents**: [Buraschi and Jiltsov (2006), Dumas et.al.(2009)]

  Agents are Non-myopic and learn about the (unobservable) growth rate of the economy using signals. Disagreement is the rational outcome of agents with different priors. The SDF is directly affected by disagreement η_t (not just the weighted average belief as in DM(1994)):

  $$M(t) = U'(C_t) \times H(\eta_t)$$

  Disagreement: (a) increases the risk premium, (b) generates an option smile, and (d) source of joint behavior of option prices and open interest.

A History of Asset Pricing

- **Two (N) trees, one agent**: [Cochrane, Longstaff, and Santa-Clara (2008), Martin (2013)]

  $U(C)$ with $C = c_1 + c_2$. The two goods are perfectly substitutable (relative price is $p = 1$). Because good markets have to clear, i.e. $C = c_1 + c_2$, shocks to one tree immediately propagate (correlation is hard-wired in preferences).

- **Two trees, two agents**: [Buraschi, Trojani, and Vedolin (2013)]

  The objective is to link disagreement, correlation and correlation risk premia. This is motivated by the large difference between volatility risk premium on index options and single name options.

- **Network, one agents**: [Acemoglu et. al (2011), Buraschi, Porchia and Tebaldi (2014)]
- **Network, N agents**: [Any volunteer?]

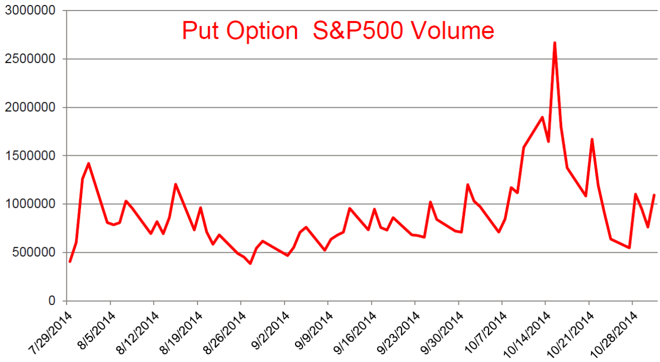
Returns and Volumes

- One of the most embarassing limitation of many representative agent models is that trading volume is indeterminate. For instance, in Black and Scholes (1973), options prices are determined in a model in which options are redundant and should not exist in the first place.

- In conventional rational asset-pricing models with common priors (Grossman and Stiglitz, 1980; Kyle, 1985) volume is due to unanticipated portfolio rebalancing needs. Far too small to account for the tens of trillions of dollars.

- H. Hong and J. Stein (2007), "*Disagreement models have a number of attractive features. In our view, the most compelling is that they allow us to speak directly to the joint behavior of stock prices and trading volume.*"

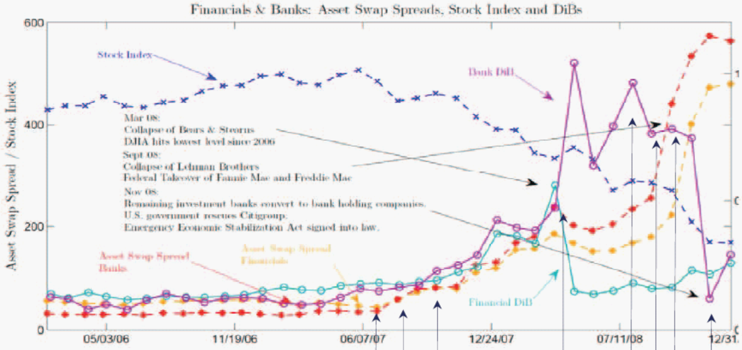
Put Option Volumes in 2014



Two Key Questions

- First, what are the underlying mechanisms, either at the level of market structure or individual cognition, that give rise to disagreement among traders and hence to trading volume?
- Second, how do these mechanisms simultaneously affect asset prices? Why do they not simply lead to trades that cancel each other out in terms of price effects, as implicitly assumed by the traditional model?

The Crisis and Disagreement on Earnings



Jul 07: Bear Stearns unwinds two hedge funds . Ben Bernanke warns that U.S. sub-primecrisis could cost up to $100bn

9 Aug 07: BNP Paribas tells it cannot value (and take money out of) two of its structured product funds. ECB pumps 95bn euro into banking sector

17 Aug 07: Fed cuts rate and warns credit crunch could be a risk to economic growth.

13 Sep 07: Northern Rock asks emergency financial support from the BoE. A day later depositors withdraw £1bn: biggest run on a British bank for more than a century

Mar 08: Collapse of Bears& Sterns. DJIA hits lowest level since 2006

11 July 08: IndyMac fails (second largest financial bankruptcy in US history). Fannie Mae and Freddie Mac share prices drop 50%.

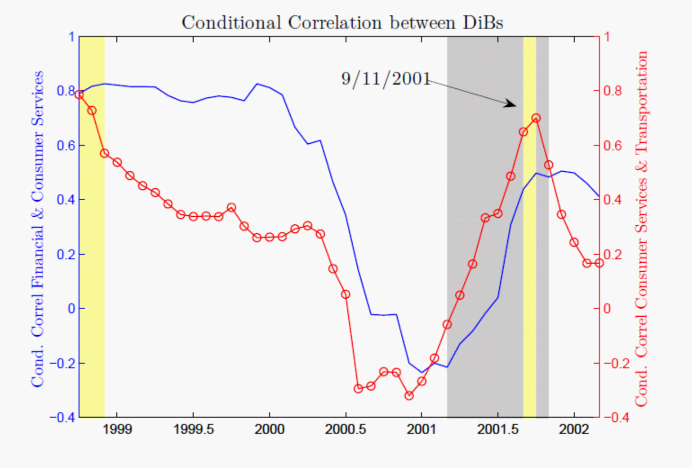
14 Jul 08: Emergency intervention to help Fannie Mae and Freddie Mac.

7 Sep 08: Federal takeover of the GSEs.

15 Sep 08: Lehman Brothers files for Chaper 11.

16 Sep 08: Rescue of AIG.

Systematic Factors in Disagreement: An Example



Disagreement Mechanisms

1. Limited Attention.[Hirshleifer and Teoh (2003), Peng and Xiong (2006)] Cognitively-overloaded investors pay attention to only a subset of publicly available information. When trading with others, they do not adjust for the fact that they are basing their valuations on only a subset of the relevant information.
    - Other Implication. Firm specific news will have less effect if investors with limited attention are distracted by large macro shock.
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3. Heterogeneous Models.[Harris and Raviv (1993), Kandel and Pearson (1995)] Agents will disagree if they use different models to interpret the same signals. If they agree to disagree, this induce may trade.

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    - Agent A expected no increase in earnings and thinks shock is permanent. He adjust PV of expected future earnings by $+10\%$.
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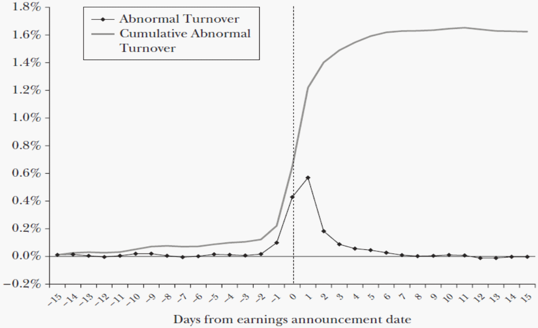
Trading Volume at Earning Announcements

- In a standard rational expectation model, public signal should induce agents to agree more, not less, and trade should be immediate.
- During earning announcements, trade and disagreement stay elevated for 1 week after the announcement.

Abnormal Turnover Around Earnings Announcements, 1986–2005



Source: The underlying data is from the Center for Research in Security Prices (CRSP) database. Earnings announcement dates are taken from Compustat.
Notes: Analysis is based on the universe of the 1,000 largest stocks on CRSP in each quarter from 1986Q1 to 2005Q4. Abnormal daily turnover for any given stock is actual daily turnover in the stock minus average turnover in the stock for the 250 days preceding the event window (days −266 to −16 relative to the earnings announcement date). Cumulative abnormal turnover is then the cumulative sum of abnormal daily turnover over the event window.

4. Gradual Information Flow.

   - *Information percolation*. Information flows in such a way that the specialists get certain pieces of news before the generalists; this leads to trading volume around the news-release events, and also to an apparent gradual response of prices to the substance of the news itself (Menzly and Ozbas (2006), Cohen and Frazzini (2006)).

Disagreement and Asset Prices

- People may disagree and trade; however, this does not have necessarily to impact asset prices if these shocks were to compensate each other.

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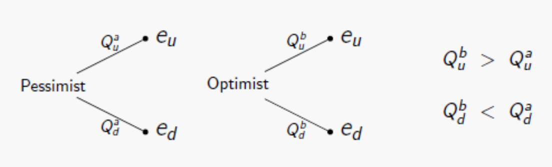
Disagreeement and Equilibrium

- Agents with subjective probability measures dQ_t^a and dQ_t^b:



- Disagreement is summarized by a Radon-Nykodym derivative process $\eta = \frac{dQ^b}{dQ^b}$.The key property is that:

1. With short selling constraints, an increase in the number of news "stories" about a company has a systematic tendency to increase prices (Miller's Hypothesis; Harrison and Kreps (1978), and Sheinkman and Xiong (2003)).
2. When no short-selling constraints, disagreement plays a rather different role as both agents affect asset prices. Indeed, ex-ante marginal utilities must equate:
$$E^a(U_a'|\mathcal{F}_t) = E^b(U_b'|\mathcal{F}_t)$$
Risk sharing: optimist trade insurance with pessimists against bad states. Difference in beliefs becomes a *source of risk*.

Disagreement and Frictions

- With short-selling constraints: Dynamic models can induce price to go above the current valuation of the optimist (as in Miller (1977)): Resale option that arises in the dynamic setting. Optimists may be willing to pay a price that exceeds his own current valuation of the stock, on the premise that he will be able to resell it to somebody else next period (Harrison and Kreps (1978), Scheinkman and Xiong (2003)).
  - **Time series** [Baker and Stein (2004)]: Negative relationship between turnover and subsequent year's return on the aggregate market (1933–1999), even controlling for P/D ratio: $+1\sigma$ in detrended turnover leads to a -10% next year's expected returns.
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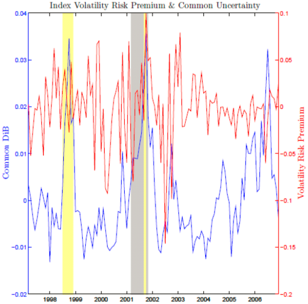
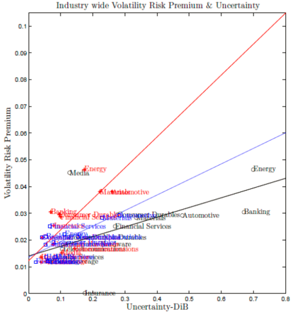
  - **Case Study** [Lamont and Thaler's (2003), 3COM] Palm's trading volume many times larger than 3COM.

No Frictions and Disagreement

- Without short-selling constraints: (a) Many markets most certainly are not affected by short sellling constraints ("Treasury bond market", "Markets with Options"); (b) What about link with "systematic" Disagreement?

Resilient across periods





- ☐ 1996-2000: $\hat{\beta} = 5.36$, t-stat $= 7.12$, $R^2 = 0.43$.
- ☐ 2001-2004: $\hat{\beta} = 4.37$, t-stat $= 9.29$, $R^2 = 0.53$.
- ☐ 2005-2008: $\hat{\beta} = 10.85$, t-stat $= 6.29$, $R^2 = 0.37$.

P. Whelan's Contribution

- Whelan (2014) shows: (i) we need to "get real" to explain dynamics of *nominal* Treasury bonds and model the real SDF; (ii) study the implications of disagreement on the persistence of shocks on the shape of the term structure; (iii) first paper to solve for general risk aversion case. He shows three effects:
  1. Disagreement affect interest rates. When agents are non-myopic ($\gamma \neq 1$), yields are linear-quadratic in current disagreement level.
  2. Past disagreement affects past speculative trade and current realized relative wealth. The lower γ, the larger this effect.
  3. Even if current disagreement is zero, future disagreement is a source of risk to be hedged.

P. Collin-Dufresne

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- Two important differences with respect to Buraschi and Jiltsov (2006) and Dumas et.al. (2009):
  1. OLG structure allows for asymptotic disagreement;
  2. Epstein-Zin preferences. When a Bayesian agent updates her beliefs about the mean growth rate, this update is permanent and therefore affects the subjective consumption distribution for all future dates. Thus, even a small update in beliefs can have a large impact on the continuation utility. Effectively, parameter/model learning generates *subjective* long-run consumption risks.

The Literature

	$\mathcal{M}_t = u'(C_t)\mathcal{H}(\eta)_t$	r_t
Myopic Models ($\gamma = 1$)		
Detemple and Murthy (1994)	$\mathcal{M}_t^*(1+\zeta\eta_t)$	$(X^a/X)\mu_d^a + (X^a/X)\mu_d^b - \sigma_d^2$
Xiong and Yan (2010)	as above	$\pi_t + \delta + \mu_d - \sigma_d^2$
Risk-sharing Models ($\gamma > 1$)		
Buraschi and Jiltsov (2006)	$\mathcal{M}_t^* \left(1+\zeta\eta_t^{1/\gamma}\right)^{\gamma}$	$\underbrace{[\delta + \gamma\hat{\mu}_d - \frac{1}{2}\gamma(\gamma-1)\sigma_d^2]}_{r^*(\eta_t)} + \frac{1}{2}\frac{\gamma-1}{\gamma}\omega_a\omega_b\psi_{g,t}^2$
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Ehling, Gallmeyer, Heyerdahl-Larsen, Illeditsch (2012)	$\mathcal{M}_t^* B \left(1+\zeta\eta_t^{1/\gamma}\right)^{\gamma} V(h_t)$	$r^*(\eta_t) + v(\bar{h} - h_t) + \frac{1}{2}(1 - \frac{1}{\gamma})f(t)(1-f(t))\psi_{\pi,t}^2$
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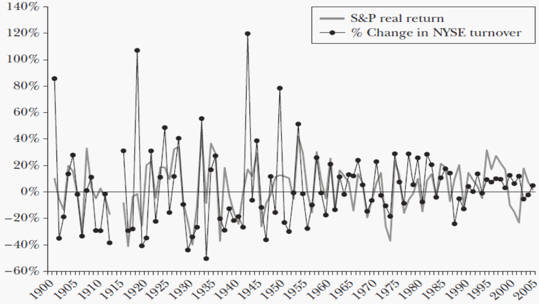
Disagreement and Frictions

- For equities, in the early part of the sample, there seems to be a positive relation.

Market-Wide Stock Returns and Changes in Turnover, 1901–2005



Sources: Data on the real (inflation-adjusted) level of the S&P index are from Robert Shiller's web-page, ⟨http://www.econ.yale.edu/~shiller⟩. Data on NYSE turnover are from the NYSE Fact Book, available at ⟨http://www.nyse.com⟩.
Notes: The figure plots year-to-year percentage changes in the S&P index and year-to-year percentage changes in turnover. We omit the years 1914 and 1915 from the plot since the NYSE was closed for much of the latter half of 1914 due to the outbreak of World War I. The correlation between the two series shown in the plot is 0.49.

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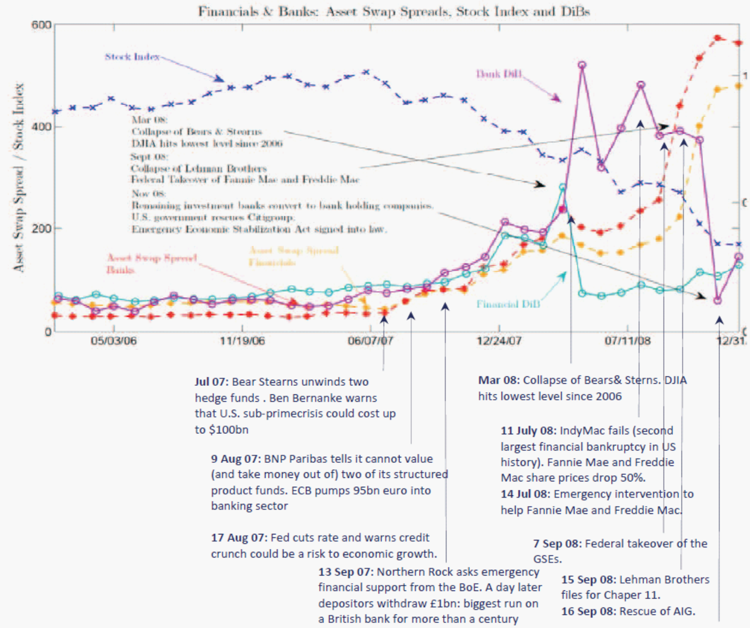

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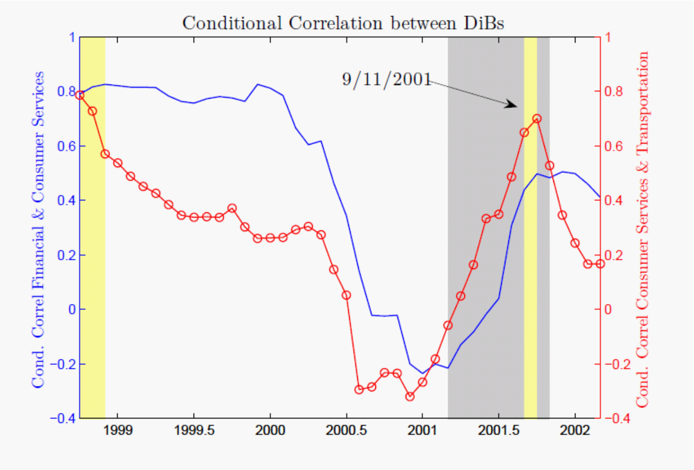

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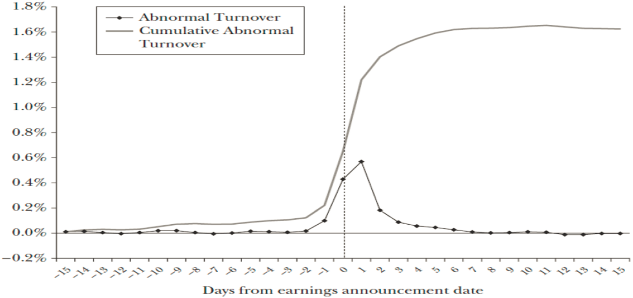

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   - *Overconfidence*. Gradual information flow by itself can be entirely consistent with a rational model with costs of information acquisition. To get interesting price and volume effects, unlike in a classical rational-expectations setting, generalists somewhat unaware of their informational disadvantage and stick to their priors and do not fully use prices to update: "Overconfidence" (Menzly and Ozbas (2006), Cohen and Frazzini (2006))

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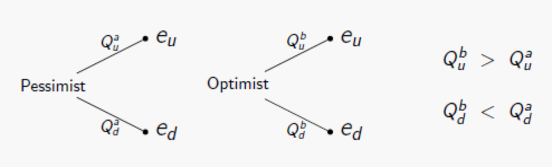

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- Without short-selling constraints: Notice that all the previous articles assume presence of short-selling constraints: (a) Many markets most certainly are not affected by short sellling constraints ("Treasury bond market"); (b) there is a strong systematic component in disagreement, occurring especially during periods of high uncertainty.
- Whelan (2014) shows: (i) we need to "get real" to explain dynamics of *nominal* Treasury bonds and model the real SDF; (ii) study the implications of disagreement on the persistence of shocks on the shape of the term structure; (iii) first paper to solve for general risk aversion case. He shows three effects:
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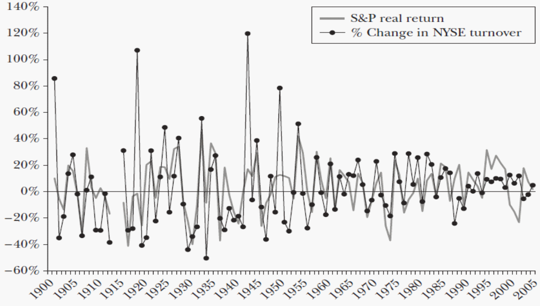
Hong, Sraer, Yu (2013)	$\mathcal{M}_t^* \rightarrow \mathit{Optimist}$	$r^*(\eta_t) \rightarrow \mathit{Optimist}$

Disagreement and Frictions

- For equities, in the early part of the sample, there seems to be a positive relation.

Market-Wide Stock Returns and Changes in Turnover, 1901–2005



Sources: Data on the real (inflation-adjusted) level of the S&P index are from Robert Shiller's web-page, ⟨http://www.econ.yale.edu/~shiller⟩. Data on NYSE turnover are from the NYSE Fact Book, available at ⟨http://www.nyse.com⟩.

Notes: The figure plots year-to-year percentage changes in the S&P index and year-to-year percentage changes in turnover. We omit the years 1914 and 1915 from the plot since the NYSE was closed for much of the latter half of 1914 due to the outbreak of World War I. The correlation between the two series shown in the plot is 0.49.