

**Heterogeneous Beliefs in Finance:
Discussion of "Momentum as an Outcome of
Differences in Higher Order Beliefs" by
Banerjee, Kaniel and Kremer**

Stephen Morris
Economics Department and Bendheim Center for Finance
Princeton University
AFA Winter Meetings Chicago

January 2007

Three Kinds of Differences of Beliefs in Finance

1. Asymmetric Information
2. Heterogeneous Prior Beliefs
3. Behavioral Biases

History of Differences of Beliefs

1. Once we didn't know the difference, so we didn't differentiate the different kinds of heterogeneous prior beliefs (Miller 1977)

History of Differences of Beliefs in Finance

1. Once we didn't know the difference, so we didn't differentiate the different kinds of heterogeneous prior beliefs
2. Then we discovered asymmetric information, no trade theorems, efficient markets...
 - "Rational" differences in beliefs (asymmetric information) and "irrational" differences in beliefs (heterogeneous prior beliefs and behavioral biases)
 - "Heterogeneous Prior Beliefs" requires special pleading (Harrison and Kreps (1979), Harris and Raviv (1993), Morris (1994, 1995), Kandel and Pearson (1995))

-
3. Then we discovered market anomalies that were "irrational" (i.e., could not be explained by SYMMETRIC information models)
- Excess volatility, momentum
 - Rational models out, behavioral biases in

Operational Distinction Between Different Kinds of Differences of Beliefs

1. Model differences in beliefs as "Asymmetric Information" if I want to update my beliefs on learning your beliefs; model as "Heterogeneous Prior Beliefs" if I do not.
2. Behavioral biases describe systematic origins of heterogeneous - perhaps through psychological mechanism

What Pricing Anomalies can be explained by Asymmetric Information Alone?

We're not sure because....

- Most asymmetric information models make "simplifying", "tractability" assumptions that exclude the richness of higher order beliefs and restore a "universal martingale measure", e.g.
 1. Single most informed trader
 2. Existence of risk neutral trader
- Duffie and Kan (2002) *JMathEcon* show universal martingale measure does not exist in general

-
- Dynamic models with rich higher order beliefs (e.g., dynamic CARA normal) are hard to analyze
 - Singleton (1987), Grundy and McNichols (1989), Brown and Jennings (1989), He and Wang (1995)

Higher Order Beliefs in Asset Pricing

- Allen, Morris and Shin (2006) "Beauty Contests in Asset Markets"
 - Higher order belief characterization of equilibrium asset prices
 - Highlight why higher order beliefs do not collapse/become irrelevant/unnecessary due to backward induction/martingale arguments...
 - Inertia in higher forward average expectations
 - * asset pays θ at date T
 - * $E_{it}(\theta) = \alpha x_i + (1 - \alpha) y$
 - * $\overline{E}_t \overline{E}_{t+1} \dots \overline{E}_T(\theta) = \alpha^{T-t} \theta + (1 - \alpha^{T-t}) y$
 - * leads to momentum?

BKK: asymmetric information only

- "Price drift" $E(P_2|P_1)$ increasing in P_1
- Two reasons price drift does *not* arise in dynamic REE
 1. conditioning on price removes inertial effect
 2. mean reversion in "noise" term

BKK: heterogeneous prior beliefs only

- No price drift.
- Common knowledge differences beliefs act as shift in demand curve without implications for price changes

BKK: heterogeneous prior beliefs AND asymmetric information

- Price Drift!
- non-triviality of higher order beliefs / non-existence of universal martingale does lead to dynamic price behavior inconsistent with symmetric information (e.g., Brown-Jennings 1989 on technical analysis...), just not price drift
- an important finding: interaction between heterogeneous prior beliefs and asymmetric information seems key (c.f. Morris 1994)
 - in what sense are both necessary in general?

- for empirical relevance, would like to know
 - qualitative combination of heterogeneous prior beliefs and asymmetric information leading to price drift or mean reversion in general
 - ex ante judgement about when "heterogeneous prior beliefs" and "asymmetric information" are more important?