Rational Inattention and Price Underreaction

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Outline

1. High-Level Overview

2. This Paper’s Results
Background

Well-known back and forth in the literature:

1. Excess volatility is pervasive, especially at very high & very low frequencies [Shiller (1981); LeRoy & Porter (1981); De Bondt & Thaler (1985); Lehmann (1990); lots of stuff over intervening 20 years...; Augenblick & Lazarus (2018); Giglio & Kelly (2018)]
   - Campbell (2017): Equity volatility is one of three “fundamental challenges for consumption-based asset pricing models”

2. At the same time, momentum is pervasive as well!
   - Especially in the medium term and in response to firm-specific announcements

How/why??

- Point 1 interpreted as indicative of widespread overreaction
- Point 2: widespread underreaction
- Can these be reconciled?
Reconciling Over- and Underreaction

Some (excellent) work has been done writing down models to reconcile the two sets of results:

- Overreaction coupled with some form of (mental or physical) adjustment friction generates both predictions [e.g., Barberis, Greenwood, Shleifer, Jin (2018)]
- Will talk about other possibilities in a bit

For this paper, though, I want to focus on a higher-level question: Over- or underreaction *relative to what benchmark*?

- That is, what does it mean to over- vs. underreact?
- And when can we call such behavior “rational”?

This paper will have a good answer to the second question, but want to push as well on the first.
What is Over- vs. Underreaction?

▶ Imagine a “biased Bayesian” updating beliefs about the likelihood of some underlying state \( \theta \) given signals \( s^t \equiv (s_0, s_1, \ldots, s_t) \) [Augenblick & Rabin (2018)]:

\[
\pi(\theta|s^t) = \frac{\mathbb{P}(s_t|\theta, s^{t-1})^\alpha \pi(\theta|s^{t-1})^\beta}{\sum_{\theta' \in \Theta} \mathbb{P}(s_t|\theta', s^{t-1})^\alpha \pi(\theta'|s^{t-1})^\beta'}
\]

▶ \( \alpha > 1 \): Overreaction to new signal relative to “correct” weight of \( \alpha = 1 \)

▶ \( 0 \leq \beta < 1 \): Underattentiveness (underreaction?) to prior (“base-rate neglect”)

▶ Note that both produce excess volatility of beliefs; both feature overreaction to new information relative to prior information

▶ But are they the same phenomenon? No:
  ▶ \( \alpha > 1 \): on avg., agent has beliefs that are too certain (too close to 0 or 1)
  ▶ \( \beta < 1 \): agent’s not certain enough [Benjamin, Bodoh-Creed, Rabin (2017)]

▶ What about \( \alpha < 1 \) and \( \beta \ll 1 \)?
  ▶ Underreaction to new signals, but excess belief volatility

▶ Starts to seem tough to disentangle over- vs. underreaction just from prices...
  ▶ ...but risk-neutral beliefs are useful
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This Paper’s Framework

Clever set of tests:

▶ Two-way sort of corporate bonds by “payoff relevance” of (i) interest-rate risk, (ii) credit risk

▶ Payoff relevance of risk $j$: Variance of fundamental-value shocks attributable to risk $j$

▶ Concretely: Value $= \sum_j f_j$, with $\{f_j\}$ uncorrelated mean-zero factors $\implies$ Payoff relevance of factor $f_j$ is $\sigma_j$

▶ See how long it takes each set of bonds to incorporate all new info from interest-rate shocks and credit-risk shocks

▶ In particular, what fraction of 8-week bond returns are realized within 1 week in response to change in interest rates vs. change in credit risk?

▶ Findings:

(a) Higher payoff relevance for a given risk $\implies$ quicker price reaction to that risk

(b) Higher payoff relevance for a given risk $\implies$ slower price reaction to other risk (though evidence is mixed on this one)
Interpretation: Over- vs. Underreaction

\[
\text{BondRet}_{i,t} = \alpha_i + \sum_{l=0}^{7} \beta_{l}^{\text{stock}} \text{StockRet}_{i,t-l} + \sum_{l=0}^{7} \beta_{l}^{\text{Tsy}} \text{TsyRet}_{i,t-l} + \epsilon_{i,t} \tag{1}
\]

\[
\text{PayoffRelevance}_{i}^{\text{stock}} = \text{explained sum of squares from (1)}
\]

\[
\text{Underreaction}_{i}^{\text{stock}} = 1 - \frac{\hat{\beta}_{0}^{\text{stock}}}{\sum_{l=0}^{7} \hat{\beta}_{l}^{\text{stock}}} \tag{2}
\]

- Stock underreaction is lower for bond portfolios with greater payoff relevance from stocks (proxy for higher credit risk); corollary holds for interest-rate risk

- Let’s return to the overview: What are we ruling in vs. out?
  - Finding: Bond prices react too little relative to predicted eventual reaction in response to stock-return innovations
  - But what if stock returns are also positively autocorrelated at this horizon?
Interpretation: Over- vs. Underreaction

- Finding: Bond prices react too little relative to predicted eventual reaction in response to stock-return innovations.

- But what if stock returns are also positively autocorrelated at this horizon?
  - P. 10: “In using these returns as shock proxies, I am relying on Treasuries and stock returns being faster to reflect interest-rate and firm-level fundamental movements... investors in [the] stock market should pay much more attention to firm-specific fundamental information because, being lower in the capital structure, stocks are more sensitive to firm fundamentals than corporate bonds.”

- Not sure this always follows. Consider Merton model: risky debt is risk-free bond minus put on firms’ assets with strike equal to face value of debt; stock is call on assets with same strike.

- Put-call parity tells us that put and call with same strike have exact same price response to change in asset vol. \[\implies\] stocks and debt have exact same sensitivity to this change in default risk.

- Also know from lots of other literature [Hou & Moskowitz (2005); Asness, Moskowitz, Pedersen (2013); Bittlingmayer & Moser (2014)] that stocks exhibit momentum at medium horizon.
Interpretation: Over- vs. Underreaction

- Finding: Bond prices react too little *relative to predicted eventual reaction in response to stock-return innovations*

- But what if stock returns are also positively autocorrelated at this horizon?
  - Takeaway: Bond market may be reacting “correctly” *relative to contemporaneous stock-market reaction* if stocks also take time to fully incorporate info
  - Do results survive controlling for lagged bond-market returns?
  - Either way, still finding momentum; issue is just how to interpret it

- More on over- vs. underreaction: What if investors are underreacting to market-wide info, but *over*reacting to private info (relative to Bayesians)?  
  [Daniel, Hirshleifer, Subrahmanyam (1998); Gennaioli, Ma, Shleifer (2018)]

- Seems consistent with longer-term excess volatility, which Giglio & Kelly (2018) find direct evidence for in corporate CDS markets

- And the fact that there are such high Sharpe ratios for momentum strategy, *but* that transactions costs are large enough to render these small from a trading perspective, would seem to indicate this is a market where private info is important
Interpretation: Rational Inattention

- While I’m a bit skeptical of “underreaction” framing, the rational inattention framing seems interesting and robust.

- My quibbles over the past few slides are about how to interpret momentum, but *not* how to interpret relatively less momentum in response to more-relevant shocks.

- Seems to me to be a nice, fairly clean test of the fact that attention allocation makes sense directionally within this market (which is dominated by institutional investors).

  - But one note: inattention that’s rational doesn’t preclude overattention that’s irrational.

  - ...especially since (I think) evidence is at least consistent with overattentiveness to private info, as on last slide.
Final Notes

What we learn from this exercise:

1. Underreaction in bonds *relative to predicted eventual reaction* in response to stock-return (and interest-rate) innovations

2. This response “makes sense,” in that investors do underreact less when innovations are more payoff-relevant

Jury still out on overreaction vs. underreaction more generally, and lots of conceptual issues to sort through

To disentangle a bit better between different explanations, would love to know about behavior of risk-neutral beliefs (e.g., from options on corporate CDS)

Neat paper overall