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Information environment and investor behavior

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ABSTRACT

Market reactions to non-fundamental news (or no-news) reverse for extreme firm information environments. A one percentage increase in intangible returns for small firms (large firms) lead to a 2.33% decrease (0.70% increase) in monthly returns over the next 12 months. The results are robust to firm characteristics adjustments, alternative measures of firm information environment and private information, idiosyncratic risk, and microstructure effects. The results are consistent with the cross-sectional findings of confirmation bias, where investors show stronger bias when the information environment is rich. We derive a model with confirmation bias that further explains the cross-sectional momentum pattern for the majority of firms in the market.

1. Introduction

Market anomalies are generally stronger among firms with scarce information environments. Post-earnings-announcement drift, price reactions to firm cash-flow news, and various other behavioral biases have been documented to be stronger among firms with smaller market capitalization, less analyst coverage, higher information uncertainty, or slower information diffusion[2]. Consistent with this line of research, Hirshleifer (2001) states that "people are more prone to bias in valuing securities for which information is sparse." Typically, the existing literature focuses on market reactions to various explicit fundamental news and show stronger drifts in firm prices with scarce information environments (see, e.g., Vuolteenaho (2002)). This paper provides a complementary view: Returns driven by information that is not due to explicit fundamental news, which we refer to as "intangible returns", have opposite predictive power for future returns across firm information environments. Specifically, in the cross-section, firms with rich information show drift in intangible returns while those with scarce information show reversal. In other words, return predictability can be more than a one-sided monotonic function of information environment.

Examining market reactions to information, public or private, that necessitates private skills to decipher, can be fruitful in understanding various market anomalies. Chan et al. (1996) show that momentum is only partly driven by earnings surprises and may be attributed to information that is not immediately available. Daniel and Titman (2006) argue that the value effect is primarily driven by information orthogonal to accounting information. Chan (2003) shows that investors underreact to short-term explicit news and overreact to no news. More recently, Bali et al. (2014) argue that investors underreact to liquidity shocks, which compared to traditionally well-defined public information events, are indirect and illusive by nature[3]. Hirshleifer et al. (2013) argue that investors would "have greater difficulty processing information that is less tangible." In this paper, we use two empirical proxies for information that is not driven by explicit news: (1) the intangible return component from the return decomposition in Daniel and Titman (2006), and (2) return driven by no-news in Chan (2003). Daniel and Titman (2006) decompose returns into two components: the part that can be explained by a firm's fundamental performance as measured by growth in important accounting measures, and the part orthogonal to this performance. The information that drives

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[2] See, for example, Foster et al. (1984), Vuolteenaho (2002), Kumar (2009), Hong et al. (2000), and Zhang (2006).

[3] Related, Bali et al. (2011) show that extreme positive stock returns lead to low future returns in the cross-section.

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the former is labeled tangible information, and the latter intangible information. Daniel and Titman (2006, p.1631) argue that intangible returns are "ambiguous information about growth opportunities [that is] at least partially collected (or interpreted) privately by investors."[4] As an alternative measure, we use the no-news sample in Chan (2003); i.e., a small hand-collected random sample of firm returns not driven by explicit news headlines. We focus on the intangible return measure in most of our analyses as it covers a much larger cross-section and over a much longer time span.

In order to explore the effect of information environment on investors' decision making, we turn to one of the most robust findings in the behavioral finance literature: investors show overconfidence in decision making (see, e.g., Odean (1998), Barber and Odean (2001)). One feature of overconfidence is confirmation bias, where investors ignore information contradictory to their priors and distort subsequent prices in the direction of their priors. For example, Rabin and Schrag (1999) show that confirmation bias leads to overconfident beliefs. Importantly, social psychology studies suggest that the direction of confirmation bias is information-dependent. Specifically, Fischer et al. (2005), Jonas et al. (2001), Freedman (1965), and Sears (1965) find in experimental settings that once committed to a prior, people prefer supporting (opposing) information when subsequent information is abundant (scarce). Fischer et al. (2008) provide a theoretical framework for this empirical regularity, arguing that people use two different decision rules to assess new information against their priors: information direction and information quality. The intuition is that a decision maker in a scarce information environment will be more conscientious about appearing to be unbiased in her information search, and thus will have a relatively stronger preference for contradicting information. On the contrary, a decision maker in a rich information environment will be more concerned about information quality, leading to a preference for consistent information. In a finance setting, assuming limits to arbitrage and informed investors with confirmation bias set prices, investors will distort subsequent prices in the direction of their private priors when information is rich but in the opposite direction when information is scarce.

The Daniel et al. (1998) (hereafter, DHS) model with confirmation bias (or biased self-attribution in their words) is a convenient framework to explore the role of confirmation bias more formally. In Appendix A, we formally incorporate the cross-sectional dependency of confirmation bias on information environments in DHS. Intuitively, informed price-setting agents receive private signals about an asset in the first period and drive contemporaneous asset prices in the direction of their signals. In the second period, these investors receive noisy public signals that either confirm or contradict their priors. If the public signal is consistent (contradictory) in sign with their prior, an investor will become more (less) confident about their prior; i.e., her assessment of the signal variance will decrease (increase). Following the social psychology literature mentioned above, we assume that investors, in light of contradictory public signals, increase their variance assessment less (more) for assets with rich (scarce) information environment[5]. In other words, investors show stronger confirmation bias by ignoring contradictory signals for information-rich firms. Finally, investors receive an additional public signal in period 3 and in period 4 the asset value is revealed.

Empirically, we use a firm's market capitalization as a baseline measure for the richness of a firm's information environment. Consistent with our model, we find long-short portfolios formed by intangible returns or Chan's (2003) no-news sample show reversal (drift) for the smallest (largest) firms. Similarly, our baseline Fama-Macbeth regressions show that for firms around the 10% size percentile, a one percentage increase in intangible returns leads to −2.33% decrease in average monthly returns over the next 12 months. On the contrary, a one percentage increase in intangible returns for firms around the 90% size percentile on average leads to 0.70% increase in future monthly returns. We show that our finding is not driven by premiums related to firm characteristics such as book-to-market, size, and past returns. R&D spending that may drive future growth options and thus intangible returns also does not explain our findings. Similarly, Fama-French regressions show that long-short portfolios designed to capture this asymmetry yield monthly alphas of −0.71% and 0.60% for the smallest and largest quintile firms, respectively.

We perform a host of robustness tests for our baseline results. To highlight, first we show that, instead of intangible returns, the asymmetry in return predictability is similar if one uses the no-news sample in Chan (2003). Large (small) firms that did not have news headlines but yet have price movements tend to have price drift (reversal), consistent with our baseline results. Second, we follow Hong et al. (2000) and show that, *holding firm size constant*, the results are similar if we use analyst coverage to capture the richness of a firm's information environment. Third, we show that our results are not driven by microstructure effects as results are not affected by time lags, price filters, formal liquidity and idiosyncratic volatility controls.

The first prediction of our extended DHS model is that there should be asymmetric price reactions to intangible signals over the short to medium-term, which is thoroughly tested in this paper. We also test and find evidence consistent with a few other predictions. First, this model implies a positive relation between firm information environment and momentum in raw returns. Empirically, we show that, for the majority of stocks, there is indeed a positive relation between momentum in raw returns and firm size. We briefly discuss conditions under which this model can explain the full cross-sectional pattern of momentum. Second, we find that information-rich firms; i.e., firms with investors more prone to strong confirmation bias and thus prices are driven away further from fundamentals in date 2 in the model, show strong reversal in intangible returns over 12–36 months as prices revert back to fundamentals. Third, the model predicts that information-rich firms will have weaker price reactions to conclusive date 4 public signal such as earnings announcements, controlling for intangible returns. The intuition is that confirmation bias among information-rich firms distorts prices away from fundamentals and prices become fully rational when conclusive date 4 public signal is released.[6]

Research on confirmation bias has a long history in social psychology (see Frey (1986) for a review). While confirmation bias can be cast under the general framework of overconfidence, there has not been much direct modeling and empirical tests.[7] Pouget and Villeneuve (2008) derive a model in which confirmation bias among rational arbitrageurs leads to divergence of opinion in the market, leading to bubbles and crashes. Using data from the Iowa Political Stock Market, Forsythe et al. (1992) show that supporters of a presidential candidate are more likely to think that their candidate have won a debate. Confirmation bias is difficult to distinguish from other psychological biases because it shares similar empirical predictions with other biases. For instance, Barberis et al. (1998) assume investors suffer from conservatism, which can lead to similar

[4] Similarly, theoretical models in Kim and Verrecchia (1994, 1997) assume market participants possess differential information-processing abilities, in effect allowing for public signals to be interpreted privately.

[5] This is equivalent to assuming investor confidence increases more for information-rich firms given consistent public signals.

[6] We thank an anonymous referee for suggesting this test.

[7] See, for example, Hirshleifer (2001), Rabin and Schrag (1999), and Shefrin (2006).