Investor sentiment and price discovery: Evidence from the pricing dynamics between the futures and spot markets

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A B S T R A C T
This study examines the role of investor sentiment in the pricing dynamics between the spot and futures markets. The empirical evidence suggests that investor sentiment has a positive impact on price volatility and the bid–ask spread on both the spot and futures markets, which induces higher arbitrage risk and trading costs during high sentiment periods. Consequently, during high sentiment periods, informed traders become less willing to leverage their information advantages on the futures market, which diminishes the futures markets’ leading informational role and contributions to price discovery. Our findings provide support for the theory of limits to arbitrage.

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1. Introduction

This paper investigates the relation between investor sentiment and the price discovery process between the spot and futures markets. Extensive literature finds that futures prices lead spot prices and contribute more to the price discovery process (Chan, 1992; Frino et al., 2000). However, far less clear is how this leading role of futures markets in price discovery will be affected as trading risks and/or costs fluctuate over time. This paper aims to fill this gap in the literature by characterizing the relation between investor sentiment, trading risks and costs, and the price discovery process, and we propose that investor sentiment can significantly affect cross-market pricing dynamics.

When homogeneous or closely linked securities trade in multiple markets, price discovery tends to occur first in the market where informed traders can utilize their information with the highest net profit. The literature shows that the futures market, compared to the spot market, offers higher leverages, lower trading costs, and fewer short-sale restrictions (Black, 1975; Kawaller et al., 1987; Stoll and Whaley, 1990; Back, 1993; Mayhew et al., 1995; Fleming et al., 1996; Käppi, 1997; Easley et al., 1998). Accordingly, informed traders prefer the futures market, and the futures market reacts to new information faster than the spot market does. Several studies find that futures returns significantly lead spot index returns in the price discovery process (Finnerty and Park, 1987; Ng, 1987; Kawaller et al., 1987; Harris, 1989; Stoll and Whaley, 1990; Chan, 1992).

On the other hand, the literature shows that investor sentiment affects investors’ trading behavior (Tetlock, 2007; Kurov, 2008; Garcia, 2013) and has a significant impact on stock returns and price volatility (Lee et al., 2002; Brown and Cliff, 2005; Baker and Wurgler, 2006; Schmeling, 2009; Kurov, 2010; Berger and Turtle, 2011; Baker et al., 2012; Garcia, 2013; Yu and Yuan (2011) and Stambaugh et al. (2012) suggest that high investor sentiment at-
tracts more noise traders into the market, which increases noise trader risk and undermines market efficiency (Barberis et al., 1998; Brown, 1999; Karlsson et al., 2009; Yuan, 2015).

Noise trader risk, driven by high investor sentiment, plays an important role in determining the participation of informed traders. Specifically, the theory of limits to arbitrage predicts that informed traders are less willing to utilize their information when noise trader risk is high (Shleifer and Vishny, 1997). De Long et al. (1990) show that the unpredictability of noise traders’ future beliefs creates a risk in asset prices that deters rational arbitrageurs from taking aggressive positions against them. Similarly, Barberis et al. (1998) argue that informed traders who bet against mispricing run the risk that investor sentiment will become more extreme and that prices will move even further away from fundamental values. Thus, noise trader risk can be a source of limits to arbitrage, preventing informed traders from utilizing their information.

Given that high investor sentiment increases noise trading and noise trader risk, which are positively related to trading risks and costs, we posit that informed traders become less willing to leverage their information on the futures market during high sentiment periods. This phenomenon, in turn, diminishes the futures market’s leading informational role (in the short run) and contribution to price discovery (in the long run) during high sentiment periods.

We begin our empirical analyses by validating investor sentiment as a positive shock to both trading risks and costs. First, we use price volatility as a proxy for trading risks (Brown, 1999; Lee et al., 2002; Yuan, 2015). Jones and Seguin (1997) find that because noise trades are not based on information about underlying values, these trades can move prices away from their intrinsic value, thus increasing price volatility.

Next, we use bid–ask spread as a proxy for trading costs. The literature suggests three major determinants of bid–ask spreads: order processing costs, adverse selection costs, and inventory risk costs. The relation between investor sentiment and the bid–ask spread is somewhat complicated and ambiguous because investor sentiment can affect the bid–ask spread through two possible channels. On one hand, increased noise trading driven by high investor sentiment lowers adverse selection costs, which, in turn, decreases the bid–ask spread (Glosten and Milgrom, 1985; Lee et al., 1993; Greene and Smart, 1999; Baker and Stein, 2004; Liu, 2015). The literature suggests that when liquidity providers encounter a pool of noise traders during high sentiment periods, they decrease the bid–ask spread, resulting a negative impact of investor sentiment on the bid–ask spread.

On the other hand, investor sentiment can positively impact the bid–ask spread due to the positive relation between price volatility and the inventory risk component. Stoll (1978) proposes that inventory costs comprise the price risk and opportunity costs of holding securities. Both theoretical and empirical studies suggest a positive relation between price volatility and the bid–ask spread (Amihud and Mendelson, 1987; Roll, 1984; French and Roll, 1986; Glosten, 1987). Moreover, Cohen et al. (1986) review previous empirical studies and find, in general, a positive relation between transaction price volatility and bid–ask spreads due to the relative importance of order processing costs and the inventory risk component. Given that investor sentiment positively affects price volatility and the positive relation between price volatility and the inventory risk component, we expect a positive impact of investor sentiment on the bid–ask spread.

Intuitively, the net effect of investor sentiment on the bid–ask spread is an empirical issue: The relation between investor sentiment and the bid–ask spread is negative (positive) if the adverse selection (inventory risk) effect dominates the inventory risk (adverse selection) effect. However, Glosten and Milgrom (1985) show that the adverse selection effect exists only when liquidity providers in the market can identify potential noise traders. Whereas prior studies find that, in some specific information events, liquidity providers can easily identify shifts in trader components and adjust the bid–ask spread accordingly, Greene and Smart (1999) suggest that large shifts in noise and informed trading are difficult to identify. Given that our empirical examination does not focus on any specific information event and that investor sentiment is unobservable, we expect the inventory risk effect to dominate the adverse selection effect, resulting in a positive relation between investor sentiment and the bid–ask spread.

To examine the impact of investor sentiment on the pricing dynamics between the spot and futures markets, we use Standard & Poor’s Depositary Receipts (S&P 500 ETFs), the Nasdaq 100 Index Tracking Stocks (Nasdaq 100 ETFs), and the unit investment trust of the Dow Jones Industrial Average (DJIA ETFs) along with their corresponding futures contracts. Our analysis leads to several findings. First, investor sentiment has a positive impact on both price volatility and the bid–ask spread. The minute-by-minute realized volatility of exchange-traded funds (ETFs) and futures contracts is significantly positively related to investor sentiment. This finding is consistent with prior research showing that sentiment-driven investors trade more actively during high sentiment periods and thereby increase noise in the market (Jones and Seguin, 1997; Barberis et al., 1998; Brown, 1999; Karlsson et al., 2009; Yuan, 2015). Moreover, the bid–ask spreads of ETFs and futures contracts are, in general, significantly positively related to investor sentiment, implying that the inventory risk effect dominates the adverse selection effect and that trading costs increase during high sentiment periods.

Second, in the short run, the leading informational role of futures is significantly weaker when investor sentiment is high, consistent with the argument that informed investors tend to trade less aggressively on the futures markets when trading risks and costs increase. This effect is not only statistically significant but also economically significant. In one of our empirical tests for the lead–lag relation between the DJIA ETFs and futures, the coefficient on the first lagged futures return drops by 23%, with the ETFs returns as the dependent variable, when the sentiment index is higher than the 75th percentile in our sample period.

Third, in the long run, futures market information shares are negatively related to investor sentiment. This finding suggests that investor sentiment not only has temporal effects on the lead–lag relation but also affects the price discovery process between the two markets in the long-run equilibrium. Prior literature shows that futures prices contribute more to price discovery in equilibrium than spot prices do, suggesting that futures prices are more informative (Chan, 1992; Frino et al., 2000). Our evidence, however, shows that futures prices become relatively less informative when investor sentiment is high, which is in line with De Long et al. (1990), Chan (1992), Fleming et al. (1996), and Barberis et al. (1998), who argue that informed traders tend to be less willing to utilize their information when noise trader risk is high.

Our results are robust when we use alternative sentiment index. Overall, the findings are in line with the theory of limits to arbitrage. While Kyle’s (1985) standard model suggests that a higher level of noise trading may allow informed traders to extract more value from their information, our empirical evidence shows that informed traders are less willing to utilize their information on the futures market during high sentiment periods due to increased trading risk and costs. Consequently, during high sentiment periods, the leading informational role of the futures market is diminished, and the futures market contributes relatively less to the

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1 Huang and Stoll (1997) empirically estimate the relative importance of these three components: adverse selection component (9.59%), order processing component (61.76%) and inventory risk component (28.65%).
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