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Competition, premature trading and excess volatility ☆

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ABSTRACT

A substantial body of research suggests that it is difficult to account for all of the volatility of asset prices in terms of news. This paper attempts to explain the excess volatility puzzle as a consequence of competitive interaction between market participants in the presence of noisy information. We develop a model of competitive interaction between market participants in response to unverified information. Our model shows that in the presence of competitive pressures, market participants find it optimal to act prematurely on unverified information. This premature reaction leads to lower total profits and excess market volatility in equilibrium. Our model also shows that the spike in volatility at the closing time of the market can be modelled as a direct consequence of premature trading.

1. Introduction

One of the enduring puzzles in the finance literature is excess volatility. Shiller (1981) shows that equity markets are more volatile than what the fundamentals, i.e. changes in the level of dividends and interest rates, suggest. Although Kleidon (1986) casts some doubt on Shiller's findings, there exists accumulating evidence that not all asset price movements reflect changes in fundamental values. LeRoy and Porter (1981), Mankiw et al. (1985), West (1988), and Ebrahim and Mathur (2001) amongst several others have all documented a significant amount of volatility that cannot be explained by changes in fundamentals. After an extensive survey, Gilles and LeRoy (1991) conclude *"this finding of excess volatility is robust and is difficult to explain within the representative consumer, frictionless market model"*.

In this paper, we explain the excess volatility puzzle as a consequence of competitive interaction between market participants. We assume that the initial information received by market participants is very noisy, often taking the form of a rumour or speculation. This could be attributed to information uncertainty à *la* Zhang (2006) and Epstein and Schneider (2008).

Ideally, market participants should wait to verify this information before trading on it. However, we show that in the presence of competitive pressures, market participants, fearful of losing out on the trading opportunity, find it optimal to act prematurely on unverified information. This result stems from the fact that each market participant is afraid that if he does not act quickly enough, he will miss out on the trading opportunity. We show that this premature reaction leads to excess market volatility and lower expected profits in equilibrium.

Furthermore, high frequency data has shown systematic patterns in the dynamics of intraday volatility. In particular, there is strong evidence suggesting that market volatility spikes as the market closing time approaches. We show that this spike in volatility at the closing time of the market can be modelled as a direct outcome of premature trading. Intuitively, as the market closing time draws near, market participants tend to overreact further in fear of not being able to use the information at hand. We assume that if they wait until the next trading day, the information is revealed to the market and ceases to be a profitable trading

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opportunity. Thus as the market nears its closing time, the time left to execute a profitable trade decreases. As a result, market participants tend to trade even more on unverified and unreliable initial information, resulting in the spike in market volatility during the end of the trading day.

We model the competitive interaction between market participants in a three-period rational expectations equilibrium (REE) model, where informed traders trade against a price setting competitive market maker, in the presence of a noise trader. Informed traders initially receive a noisy signal which they can verify over time. This evolving nature of information plays a key role in our setting. Informed traders can either trade early on an unverified, noisy signal or they can choose to wait and trade on verified information.

The informed traders' payoff from either action is contingent on the actions of other informed traders. The uncertainty surrounding the actions of other traders leads to coordination failure and lower profits in equilibrium. The intuition behind the coordination failure in our model is similar to the one employed in Abreu and Brunnermeier (2003). While in Abreu and Brunnermeier (2003), the uncertainty surrounding the action of informed traders (rational arbitragers in their setting) results in the persistence of asset price bubbles, in our model it leads to premature trading and excess volatility.

The rest of the paper is organised as follows. Section 2 places our paper in the existing academic literature. In Section 3, we describe the basic setup of our model in which informed traders receive homogeneous signals. We then solve for the symmetric equilibrium and optimal strategy of the informed traders in the case of one, two and N informed traders respectively. Section 4 outlines the implication of our results for total expected profits of the informed traders and market volatility. We also look at the impact of market closing in this section. In Section 5, we drop the assumption of homogeneous signals and assume that informed traders receive independent signals. This allows us to study the interplay between premature trading and information aggregation and its implications on our results. Section 6 concludes. All proofs of propositions are relegated to Appendix A.

2. Literature review

Our paper is related to the extensive market microstructure literature on price formation in the presence of asymmetric information. Asymmetric information is generally modelled in the form of informed traders – agents with private information unavailable to the wider market. These informed traders are distinct from insiders, usually defined as corporate officers with fiduciary obligations to the shareholders. Informed traders trade against the price setting competitive market maker, in the presence of liquidity-motivated noise traders. The market maker makes losses on the trades with the informed traders, but recoups these loses on trades with the noise traders, making zero profit on average.

Our modelling strategy is similar to the one employed in the seminal Kyle (1985) paper. In the static version of the Kyle (1985) model, the market maker sets the price after observing the aggregate order flow – a batch clearing model. The market maker sets the price equal to his best estimate, given his belief about the insiders' trading strategy. Kyle (1985) derives a perfect Bayesian Nash equilibrium strategy where the informed trader's profit is increasing in his informational advantage and market depth. Kyle (1985) also extends this static model to a dynamic setting focussing on the profit maximising temporal decision of the informed trader. In the dynamic version of the model, if the insider takes a larger position on the early periods, his early profits increase but this comes at a cost of revealing his private information to the market. As a result, the prices in the later trading rounds worsen. The optimal strategy for the informed trader is to exploit the informational advantage over time by hiding his private information behind the noise traders.

Holden and Subrahmanyam (1992) generalise Kyle's model to incorporate competition amongst informed traders. They show that such competition results in high trading volumes and rapid revelation of private information, which is compatible with strong-form market efficiency. They argue, in the same spirit as Spiegel and Subrahmanyam (1992) that insider trading may not be a concern in the presence of competition amongst agents, and that price variance decreases in the number of informed traders. However, they do not allow for informational gains from waiting and the strategic decision between trading early and late. In our model, informed traders face the trade-off between trading early on unverified information and trading late on accurate information, which suggests that enhanced competition may lead to greater volatility in the price. In this regard, our paper complements Holden and Subrahmanyam (1992).

Our paper contributes to the growing strand of recent literature which studies the effect of unverified initial information or ambiguous interpretations of incoming information on asset returns and volatility. For example, Barron and Karpoff (2004) find that trading volume reactions to public announcements are most sensitive to announcement precision among low-transaction cost securities and in low-cost trading regimes. More recently, Chen and Zhao (2012) investigate the effects of informed trading and information uncertainty in determining price momentum. Lu et al. (2010) examine the effects of information uncertainty and information asymmetry on corporate bond yield spreads.

Our paper contributes to the literature which explains the spike in volatility at the closing time of the market. Research based on high frequency data suggests that returns volatility varies systemically over the trading day, with Wood et al. (1985) and Harris (1986) documenting the existence of a distinct 'U-shaped' pattern in return volatility over the trading day. A number of papers including these document spikes in market volatility as the market closing time approaches. See McInish and Wood (1990), Foster and Viswanathan (1990), and Niemeyer and Sandas (1994).

A number of studies have sought to rationalise this 'U-shaped' pattern in intraday volatility by strategic interaction of asymmetrically informed agents – Admati and Pfleiderer (1988), Foster and Viswanathan (1990), Brock and Kleidon (1992), and Slezak (1994). In particular, Admati and Pfleiderer (1988) develop a model of strategic play by informed and uninformed traders and allow for the uninformed traders to have discretion as to which time period they would trade in. They show that this can result in concentrated bouts of trading, similar to the spike in volatility at the start and close of trading. While this finding is consistent with our model, Admati and Pfleiderer (1988) approach excess volatility from concentrated-trading stemming from the strategic behaviour of noise traders while we focus on the behaviour of informed traders who strategically decide whether to trade early on unverified information or wait and verify the accuracy of the information.

3. Baseline model: Homogeneous signals

We consider a three period model, $t = 0, 1, 2$, with three types of agents – informed traders, a noise trader and a market maker. There is a risky asset that can be traded at $t = 0$ and $t = 1$ via a competitive market maker. The asset pays a liquidating dividend V at $t = 2$, where

$$V = \begin{cases} H & \text{with probability} \quad \frac{1}{2} \\ L & \text{with probability} \quad \frac{1}{2}. \end{cases}$$

The explicit time-line of our model is as follows.