The role of private information in return volatility, bid–ask spreads and price levels in the foreign exchange market

Frank McGroarty [a,*], Owain ap Gwilym [b], Stephen Thomas [c]

[a] *School of Management, University of Southampton, Highfield, Southampton, Hampshire SO17 1BJ, UK*
[b] *School of Management & Business, University of Wales, Aberystwyth, Ceredigion SY23 3DD, UK*
[c] *Faculty of Finance, Cass Business School, 106 Bunhill Row, London EC1Y 8TZ, UK*

ARTICLE INFO

ABSTRACT

Trading volume and order flow have both been closely associated with informed trader activity in the market microstructure literature. Using theory that explains regular intraday patterns in trading data, we transform these two variables into proxies for private information and examine their relationships with bid–ask spreads and return volatility. We use a unique and unusually rich high-frequency intraday dataset from the world's largest financial market, namely, the electronic inter-dealer spot foreign exchange market. Our analysis takes account of institutional features peculiar to this order-driven market. Our empirical results strongly affirm our theoretical understanding of how these markets work. They also reveal how the structure of the inter-dealer spot FX market affects exchange rate volatility. Finally, we also explore how private information contributes to the evolution of prices.

1. Introduction

Private information is a common theme across various theories in the context of the widely documented patterns that exist in intraday trading data. These patterns emerge in volume, volatility and bid–ask spread data from a wide variety of financial markets. There is a distinct literature within market microstructure that aims to explain why these intraday patterns occur (see ap Gwilym and Sutcliffe, 1999). Our research uses that literature to explore how private information influences the formation of price changes and bid–ask spreads. We also introduce order flow as an additional variable for intraday pattern analysis.

* Corresponding author. Tel.: +44 23 8059 2540; fax: +44 23 8059 3844.
  E-mail address: F.J.McGroarty@soton.ac.uk (F. McGroarty).

Our data are sourced from the world's largest financial market, the inter-dealer spot foreign exchange market. This market is particularly important because, as McGroarty et al. (2006) explain, the inter-dealer market effectively sets the spot exchange rates for the entire FX market.[1] In spite of its size and importance, the spot FX market has been underrepresented in the literature on intraday empirical regularities, due to difficulties in obtaining data. Our analysis addresses this imbalance. Intraday trading data exhibit M- and U-shaped patterns, as markets go through the daily ritual of opening, trading normally and closing. Patterns in bid–ask spreads, trading volume and return volatility have been observed in all major financial markets. We believe that we are the first to reveal the intraday pattern for order flow, for any market.[2]

Evans and Lyons (2002) established a strong relationship between cumulative order flow and exchange rates. They define order flow as "the net of buyer-initiated and seller-initiated orders" and interpret it as "a measure of net buying pressure". They argue that order flow is driven by (private) information and they provide strong evidence that order flow is the proximate driver of price in the spot FX market. Specifically, they show that cumulative order flow is highly correlated with cumulative price change. From market microstructure theory, Easley and O'Hara (1992) suggest that another variable is closely linked to private information, namely, unanticipated deviations from normal intraday trading volume levels. We explore both ideas.

There is an abundance of theory which models bilateral relationships between the variables that we observe in intraday data, e.g. linking volatility and volume, or volume and bid–ask spreads. As ap Gwilym and Sutcliffe (1999) observe, the most common theme across these bilateral relationship models is private information. We use a correlation matrix to test multiple contemporaneous hypotheses, and to examine how the relationships under investigation changed following the introduction of the euro. We reveal the role of private information in explaining bid–ask spreads and in determining exchange rate volatility, whose determinants Flood and Rose (1995) tell us "are not macroeconomic". Finally, we explore how private information contributes to incremental returns which compound to determine the overall price level.

We take account of structures and practices in the inter-dealer spot FX market that are different from the assumed market structure underlying most of the existing market microstructure theory. The market we study is electronic, order-driven and conspicuously lacks market makers at its core. Rather, any eligible agent who wishes to trade in this market has two choices. He can submit a market order or a limit order. A market order executes immediately by selecting a trader on the other side of the market who has previously advertised on the system that he is willing to trade. A limit order is where a potential trader submits an advertisement that he is willing to trade. This limit order will sit alongside orders already in the system, awaiting execution. Limit orders can be either ask-side or bid-side. The same is true for market orders. There is no pressure on any market participant to submit two-way limit orders and no evidence that anyone routinely submits such orders.

The remainder of the paper is organized as follows. Section 2 reviews the empirical literature documenting patterns in intraday trading variables and explores the theory relating these data variables to each other in order to deduce a comprehensive set of mutually consistent bilateral hypothesized relationships. Section 3 describes the data and methodologies we use. Section 4 presents the empirical results. Section 5 concludes.

2. Literature review and hypotheses

The vast majority of studies which look at the intraday patterns of bid–ask spreads, trading volume and return volatility in financial markets find that they are U-shaped (see ap Gwilym and Sutcliffe, 1999 for a detailed survey). In some cases, the value at the open is larger than at the close, giving an L shape. Sometimes, the close is larger than the open, giving a J shape. In some instances, there is a spike

---

[1] All dealers in FX banks have EBS and Reuters 2000-2 terminals on their desks. These electronic inter-dealer markets are the most liquid and their prices are the most recent. Dealers reference these prices when giving quotes to customers.

[2] A working paper by Gencay et al. (2007) confirms our intraday order flow pattern for the EUR/USD exchange rate. Their 2003 and 2004 pattern closely resembles the pattern that we find for EUR/USD in 1998 and 1999 data.