



Private information and its origins in an electronic foreign exchange market



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ABSTRACT

We study the risk of informed trading in an electronic foreign exchange market and test whether informed trading is driven by marketwide private information. Our framework is based on a structural microstructure trade model that measures the market makers' beliefs directly. Evidence of high concentration of informed trades is found to be inversely related to the overall 24-hour trading activity, i.e., early morning and late afternoon GMT rounds of trading involve the highest risk of informed trading. We structurally identify that the trades due to region-specific private information are dominant and explain between 5 and 25% of the variation in currency returns. In contrast, marketwide private information explains only about 1–5% of the variation in returns.

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1. Introduction

Structural macroeconomic spot exchange rate models ignore the role of asymmetric information in exchange rate determination. These models assume that markets are efficient in the sense that information is widely available to all market participants and that all relevant and ascertainable information is already reflected in exchange rates. In other words, from this point of view, exchange rates are not informed by microstructure variables. Even if price effects from currency order flows arise, they are quickly incorporated through the error term of an exchange rate equation. Furthermore, as currency valuation depends primarily on macroeconomic information, the absence of firm-specific information implies a reduced potential for market maker losses to better informed traders (Bessembinder, 1994). In this context, the existence of private information in the foreign

exchange (FX) market implies traders privately informed about macroeconomic fundamentals.³ However, the large volatility of currency returns can not be understood by the slow-moving macroeconomic variables.

In an alternative view, private information in the FX market can originate from proprietary trading models and non-common knowledge private news sources such as direct interdealer transactions and customer orders (Evans, 2002). For example, Lyons (2001) notes that currency orders from firms engaged in international trade convey private signals about the shift in demand for foreign currency because the orders are observed in advance of trade statistics. Foreign exchange orders by central banks placed with FX dealers represent another example of price-relevant private information that can be exploited by the dealers (Peiers, 1997). Recently, Albuquerque et al. (2008) demonstrate that the private information relevant for exchange rates could be

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³ It is worth noting that such issues do not arise with equities. In the equities case, in addition to public information, some traders may have information about firm characteristics (such as future asset prices) that other traders do not have (Glosten and Milgrom, 1985). In line with this notion, theoretical market microstructure models have extensively utilized a setting that involves a risk-neutral competitive market maker who faces two types of traders: informed and uninformed (noise) traders. Some notable research contributions include Easley et al. (1996a, 1997a,b, 2008). They showed that both informed and uninformed traders are highly persistent in equity markets.

contained in the equity market order flows, thus, reflecting information such as that on future mergers and acquisitions or cash flows of firms.

The heterogeneity of expectations in the FX market may also be understood as differences in valuation: some traders may place a higher value on a particular currency than others. These differences may originate in taxes, liquidity shocks or behavioral considerations (e.g., overconfidence) (Daniel et al., 1998). For example, Handa et al. (2003) show that the spread widens as valuation differences increase. Further, time-of-day variations in liquidity could also give rise to time-of-day variations in price impact. Particularly, as financial centers around the world open and close, there are changes in the depth of the market that might naturally change the price's sensitivity to order flow. Finally, as outlined in Evans and Lyons (2002), order flow drives exchange rates because it represents an uninformative portfolio shift that requires a risk premia change in order to clear the market. These portfolio shifts, however, could embody regional information content about such shifts, which is generally in line with the premise of the current paper.

This paper addresses a number of important issues and contributes to the study of private information effects in FX markets. First, using a structural model, we estimate parameters that reflect market maker's beliefs about the arrival of informed traders to the market and the risk of informed trading. We establish the exact timing of arrival of informed traders in FX markets. Moreover, by investigating intraday fluctuations in the probability of informed trading and arrival rates of the traders, we uncover the origins of private information in an electronic spot FX market. Specifically, we adapt the model from Albuquerque et al. (2008) to identify the role of marketwide private information in price discovery. In addition, we estimate the impact of *region-specific private information*⁴ on currency returns. In general, our approach can help validate and complement the recent market microstructure literature on the existence of private information in FX markets.⁵

This strand of research was pioneered by Lyons (1995) and Yao (1998), and extended by Payne (2003) who revealed substantial informed trading effects in an electronic FX market. More recently, Evans and Lyons (2007) show that the private information content in transaction activity (such as customer order flow) can predict exchange rates as well as macroeconomic fundamentals. Marsh and O'Rourke (2005) conclude that order flows of leveraged and unleveraged financial institutions contain price-relevant information. Similarly, Osler and Vandroych (2009) show that the trades by leveraged investors are consistently informative. Further, Bjonnes et al. (2008) document information asymmetries based on the interdealer transactions at a large Scandinavian bank. A theoretical model involving asymmetric information in FX markets is provided in Vitale (2007). The model demonstrates how informed traders influence exchange rates by inventory management as well as through their private information. Finally, in a related recent contribution, Gençay et al. (2011) search for a more direct evidence of informed trading using a small retail FX trading platform. They find that both the estimates of the trade model parameters and model-free analysis of the data suggest a time-varying, strategic pattern of arrival of informed traders. Although their data set is exceptionally rich and allows for tracking of individual currency orders, in contrast to the current paper, they do not explore the potential commonality of private information across exchange rates.

The paper's first contribution is the study of the relation between the time of day and the risk of informed trading in an electronic FX market. We utilize high-frequency FX data from Electronic Broking Services

(EBS) that cover one year (2005) of trading in the global interdealer spot market for the EUR/USD, USD/JPY and USD/CHF exchange rates. To control for high-frequency noise effects and no-trade periods, we aggregate to 10-minute data. This enables us to structurally investigate intraday (geographical) patterns in the arrival of informed and uninformed traders as well as the intraday patterns in the probability of informed trading (PIN).⁶ Consistent with the findings for equity markets (Goldstein et al., 2006), we show that the time of day is an important determinant of the risk of informed trading in the FX market. We also find that the PIN is inversely related to the trading activity, measured by the number of buy and sell orders. Furthermore, we reveal that for all exchange rates the highest PIN values correspond to late GMT afternoon North American and early GMT Asian trading. Therefore, it appears that North American and Asian traders are better informed than traders in other geographic regions. Our findings extend and complement the contributions by Dufour and Engle (2000), Payne (2003) and Menkhoff and Schmeling (2010). The latter two papers suggest that price impacts of unexpected trades are highest in non-peak trading periods, when the order book is relatively thin. It is also worthwhile to note that we document relatively high average PIN levels (≈ 0.2) that are comparable to those in equity markets. This is a novel and surprising evidence for a market that is considered to be largely driven by public information, and to have no or limited private information.

Next, to uncover the origins of informed trading, as in Albuquerque et al. (2008), we differentiate between marketwide private information that affects all geographic regions of the FX market and region-specific private information. Using the assumption that marketwide private information generates trading simultaneously in several currencies, we test whether such information drives currency returns. Our findings suggest that marketwide private information plays a minor role in price discovery as it is able to explain only between 1 and 5% of the variation in high-frequency currency returns. In line with the observed intraday patterns in the PIN, the origins of the potentially informed trading activities lie in region-specific private information. Our measure of region-specific private information is derived from the parameter estimates for each exchange rate and it explains roughly 5–25% of the variation in currency returns. This paper is the first to provide a structural evidence for the geographic origins of private information in FX markets. Other studies either investigate the informativeness of orders by different end-users or utilize non-structural models (Bjonnes et al., 2008; Osler and Vandroych, 2009; Schulmeister, 2006).

The remainder of the paper is organized as follows. In Section 2, we derive a high-frequency version of the theoretical model by Easley et al. (1996b). Section 3 describes the EBS data and presents the estimates of the model. Section 4 extends the model in the spirit of Albuquerque et al. (2008) to uncover the origins of private information in the FX market. Section 5 concludes the paper.

2. Independent arrival model

The model consists of informed and uninformed traders and a risk-neutral competitive market maker.⁷ The traded asset is a foreign currency for the domestic currency. The trades and the governing price process are generated from the quotes of the market maker over a trading day of 24 h (or 144 ten-minute intervals). Within any trading interval, the time is continuous, and the market maker is expected to buy and sell currencies at his posted bid and ask prices.

⁴ The region-specific private information is comprised of "local knowledge" that traders from other geographic regions may have difficulties obtaining. Although there has not been any formal evidence for the existence of such information, these effects may, for instance, arise from the leakage of information from central bank officials that have been reported in Japan (*The Wall Street Journal* 12, March, 1998). Temporary informational advantage by local banks can also be achieved via aggregation of information extracted from currency orders of large regional corporations (Covrig and Melvin, 2002).

⁵ For an excellent review of FX market microstructure literature see Osler (2009).

⁶ As in Dacorogna et al. (2001) and, recently, Kaul and Sapp (2009) we use the following geographic regions to cover the 24-hour trading day: 00:00–08:00 GMT (Asia), 08:00–12:00 GMT (Europe only), 12:00–16:00 GMT (both Europe and North America), 16:00–20:00 GMT (North America only), and 20:00–00:00 GMT (post-North America).

⁷ In this section, our framework follows Easley et al. (1996b).

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