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Intra-day seasonality in foreign exchange market transactions

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ABSTRACT

This paper examines the intra-day seasonality of transacted limit and market orders in the DEM/USD foreign exchange market. Empirical analysis of completed transactions data based on the Dealing 2000-2 electronic inter-dealer broking system indicates significant evidence of intra-day seasonality in returns and return volatilities under usual market conditions. Moreover, analysis of realised tail outcomes supports seasonality for extraordinary market conditions across the trading day.

1. Introduction

In recent times much has been made of the trading revolution in currency markets brought about through the screen-based electronic trading and broking systems that have come to dominate foreign exchange trading activities. The importance of these systems is illustrated by the fact that, according to the Bank for International Settlements (BIS) survey on foreign exchange, electronic trading makes up 48% of activity in the largest market, the UK (Williams, 2005).

This study examines the intra-day seasonalities of returns and volatilities in FX transactions. More specifically, it examines the intra-day return and volatility seasonalities for both limit and market orders involving the DEM/USD exchange rate from the D2000-2 electronic FX broking system. The analysis is based on actual transaction data rather than the more common (but less reliable) use of indicative quotes in which there is no firm commitment to transact on the stated terms. The dataset also represents the transaction outcomes of a multiple-dealer market. Limit orders represent an order to buy or sell at some prespecified price, whereas market orders are orders for immediate execution at whatever price can be obtained.[1]

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[1] A reviewer has quite rightly pointed out that the D2000-2 is a pure limit order system where market orders get matched against the best outstanding limit orders. However we have the transaction data that identifies the execution of both limit and market orders and the associated price and quantities of the trade. Our presented results for each order type support each other in identifying seasonality for ordinary and extraordinary market conditions. Moreover, previous studies have presented separate results by order type in analysing liquidity of the D2000-2 system (e.g. see Lo & Sapp, 2008).

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Previous microstructure studies have demonstrated the importance of order type return and volatility characteristics. For example, Hasbrouck and Saar (2004) find evidence of a market order certainty effect where increased limit order volatility is associated with a reduction in the proportion of limit orders in incoming order flow.[2] Relatedly, Harris and Hasbrouck (1996) compare the execution performance of market and limit order and show that limit order trading strategies generally perform best across various spreads, order sizes and position (buy or sell). However, neither study examined the role of intra-day seasonality of limit and market order realisations.[3]

There is also reason to believe that traders will alter their trading strategies and associated order mechanisms during periods of extreme market movements (Goldstein & Kavajecz, 2004). We therefore believe that it is also important to distinguish between normal and extraordinary market conditions (Longin, 2000). To do so, we also examine the intra-day seasonality of the tail behaviour of market and limit orders to both determine if seasonalities and trading patterns differ between normal and extreme market conditions.[4]

We model the tail behaviour using Extreme Value Theory (EVT). Many previous studies have documented the presence of heavy tails for the distribution of exchange rate price changes over different frequencies (e.g. Dacorogna, Gencay, Muller, Pictet, & Olsen, 2001). Recently, in comparing limit order versus market order realised returns, Cotter and Dowd (2007) find fat-tails are associated with limit and market order transactions and that on average the extreme returns of limit orders are found to have fatter tails than market orders. However, they do not examine whether there is any seasonality in these findings across the trading day.

The rest of the paper proceeds as follows. Section 2 outlines the foreign exchange market and limit and market order features of the D2000-2 dataset on which the study is based. Section 3 presents EVT and explains its properties and the measurement techniques used to examine market and limit order tail behaviour in the market considered. Section 4 presents the empirical findings. Some conclusions are given in section 5.

2. Data considerations

2.1. Foreign exchange market

The foreign exchange market is a highly decentralized market. Market participants seldom physically meet, but rather operate in separate offices of the major commercial banks. Trading typically takes place using telephone and electronic means. There is no central regulator governing these trading relationships, although private regulation exists to ensure a code of conduct in market transactions. Traditionally, individual dealers had only to disclose information to the trade's counterparty and no mechanism existed to observe other market activity. However, with the introduction of electronic broker dealer trades, foreign exchange traders have access to information on other traders' activity and can now assess ongoing market conditions in real-time.

The spot foreign exchange market is the largest spot asset market in the world and the most actively traded exchange rate over the period of this study—October 6, 1997 through October 11, 1997—was the DEM/USD exchange rate. To give an illustration, the average daily volume for all currency trading was US$568 billion, an amount which dwarves the average US$75 billion traded daily in the New York Stock Exchange, and transactions involving the DEM/USD exchange rate accounted for 20% of total trading (BIS, 2004).

2.2. D2000-2 data set

The limit and market order foreign exchange data employed in this study are from the D2000-2 electronic FX inter-dealer broking system run by Reuters that provides a unified source on transactions of foreign exchange (for previous studies that have used the system see Danielsson & Payne, 2002; Payne, 2003; Carlson & Lo, 2006; and Lo & Sapp, 2008). This unique brokerage system is one of two main electronic brokers in this market, the other operated by the EBS partnership. Unlike other systems which deal only with single dealers, D2000-2 allows for an examination of the activities of multiple traders (see, e.g., Evans & Lyons (2002)) and provides greater coverage of inter-dealer trading over using single-dealer data (Payne, 2003). As the system covers multiple trader activities, it provides for a comprehensive description of market order information, and is the only source of complete information on the orderbook (Lo & Sapp, 2008). Furthermore, because it refers to actual transaction data, use of the D2000-2 data set overcomes problems associated with the use of indicative quotes which can be unreliable because they do not refer to binding trade commitments.[5] Thus we can determine the true risk and return characteristics of foreign exchange trading.

Foreign exchange trading can be distinguished under three headings: customer dealer trades, direct inter-dealer trades and brokered dealer trades. Of these the majority of foreign exchange trading are inter-dealer based and were traditionally completed

[2] The market order certainty effect implies that risk-averse traders place a premium on a definite outcome. Moreover, higher volatility increases the dispersion of wealth outcomes for a limit order strategy thereby making market orders more attractive.

[3] Two other related papers are: Brockman and Chung (2008), which examines the commonality in intra-day liquidity of an order-driven market (the Stock Exchange of Hong Kong), and suggests that order-driven and quote-driven markets behave differently under conditions of market stress; and Maniar, Bhatt and Maniyar (2009), which looks at expiration-day effects on the intra-day dynamics of futures and options markets.

[4] We note here that seasonality of extreme realisations has recently been examined for the less commonly used stop-loss and take-profit orders (Osler & Savaser, 2007), and their findings suggest that seasonality in the kurtosis in the distribution of orders drive the seasonality of extreme returns.

[5] Further shortcomings in applying these indicative quotes in microstructure studies include the lack of traded volume information and the absence of details on the timescale of quotes (Danielsson & Payne, 2002).