Journal of Banking & Finance 36 (2012) 597–612

Contents lists available at SciVerse ScienceDirect

Journal of Banking & Finance

journal homepage: www.elsevier.com/locate/jbf

Order flow, bid–ask spread and trading density in foreign exchange markets

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ARTICLE INFO

Article history:
Received 12 January 2011
Accepted 5 September 2011
Available online 12 September 2011

JEL classification:
F31
G12

Keywords:
Bid–ask spread
Foreign exchange markets
Liquidity
Microstructure effects
Order flow
Trading density

ABSTRACT

This paper examines the implications of market microstructure for foreign exchange markets. We argue that the usual order flow model needs to be recast in broader terms to incorporate the transaction costs of liquidity and the limitation of price discovery through order flows that involve low trading density currencies. Using a daily data set, we find that order flows are inadequate when it comes to explaining the changes in the low trading density currencies. Alternatively, within the high trading density, both order flows and bid–ask spreads significantly affect the foreign exchange rate returns. Our findings suggest that the order flow model is better at incorporating these microstructure effects except for some currencies with a very high level of trading density.

1. Introduction

This paper examines the implications of market microstructure for foreign exchange markets. We argue that the usual order flow model needs to be recast in broader terms to incorporate the transaction costs of liquidity and the limitations of price discovery through order flows that involve low trading density currencies. Despite the notion of liquidity having previously been applied by a large number of authors to explain the behavior of asset prices, there is no consistent conclusion as to what drives the change in the asset price. Some authors suggest that information transmission is important to price discovery in the short run (Evans and Lyons, 2002, 2008). However, others attribute the change in the asset price to the liquidity (Roll, 1984; Glosten and Milgrom, 1985; Huang and Stoll, 1997; Chordia et al., 2008).[1]

On the one hand, empirical investigations of the order flow model question the ability of the information transmission to engage in foreign exchange (FX) rate discovery through excess buying (selling) pressure.[2] That is, when orders to purchase (sell) the base currency exceed orders to sell (purchase) it, the corresponding FX rate rises (falls).[3] Several studies support the view that the order flow is to a significant degree *successful* in explaining the change in the FX rate in the short term, and possibly even in the medium term.

On the other hand, liquidity refers to the matching of buyers and sellers. It is inter-temporal in nature and is not necessarily linked to price discovery. As a simple example of this distinction, suppose that all buyers of an asset arrive on Thursday and all sellers on Friday. In this case, no trade will take place on either Thursday or Friday in the absence of counterparty. To solve this problem, it is possible to introduce the liquidity supplier who will sell to the buyers on Thursday and buy from the sellers on Friday. To provide this liquidity, a spread emerges between the ask and bid prices to compensate the middleman.

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[1] Liquidity measures of trading activities such as the bid–ask spread, trading density and components of the transaction cost are highlighted in several studies related to trading sizes, high frequency trades, market quality and adverse selection.

[2] Order flow, a measure of net buying pressure, is defined as the difference between the amount of buyer-initiated trades and the amount of seller-initiated trades. In this study, the excess buying pressure denotes the amount traded at the "paid" (ask) price minus the amount traded at the "given" (bid) price.

[3] In this study, according to the definition of the term "quote" by Electronic Broking Services (EBS), a foreign exchange (FX) rate is quoted as the local currency (denominator) per unit of the base currency (numerator). In other words, it involves quoting in fixed units of base currency against variable amounts of the local currency. For example, in Canada, a quote for U.S. dollars would be US$1 = C$1.17 and would be expressed as USD/CAD = 1.17.

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doi:10.1016/j.jbankfin.2011.09.006

Recently, through the mediation process described in O'Hara (2003), a dispute between the two parties was settled. O'Hara (2003) clearly points out that these two concepts are related, but they are not the same for price discovery. Hence, when one wants to know what drives the change in the asset price, both information transmission and liquidity should be included as explanatory variables. As each function can influence asset prices, we first discuss how the order flow conveys the information to the FX rate markets, and then consider how liquidity enters into the determinant of FX rate.

Order flow is a major determinant of FX rates because it conveys the information through the excess buying (selling) pressure. Evans and Lyons (2002), for example, in their seminal paper report that a regression of daily exchange rate returns on daily order flow results in an *R*-square in excess of 60%. Following Evans and Lyons (2002, 2008) and Bacchetta and van Wincoop (2006) employ the macroeconomic information collection system to discuss how the indirect effect of the information transmission via the order flow affects the volatility of the FX rate.

However, any such issue is possibly misguided when the order flow *fails* to explain the low trading density currency due to the limitation of price discovery. The limitation of price discovery indicates that the price impact of the order flow should be positively correlated with the trade-size clustering. That is, the order flow of the *active* (high trading density) currency tends to be obviously larger than that of the *infrequently traded* (low trading density) currency. Evans (2011) points out that, without a great deal of trading activity, dealers will not immediately adjust their spot rate quotes via the order flow to accommodate the new information on fundamentals and the risk of providing liquidity to the market. As a result, the order flow is not suitable for investigating the behavior of FX rates when currency pairs trade with low liquidity.

The limitation of price discovery, as the measure of the market quality, is very important to the investigation of the order flow. In particular, some academic research articles argue that the explanatory power of the order flow should be positively associated with it. For example, Moulton (2005) and Gwilym and Meng (2010) highlight the relationship between the price impact of the order flow and trade-size clustering in order to explain the variations in the common liquidity measures of foreign exchange transactions. Their consistent conclusions show that the price impact of the order flow is greater when customers (traders) care more about trading precise quantities, while the number of trades and the total volumes are not significantly changed.

These challenges indicate that the order flow provides neither a model nor empirical estimates of the "liquidity based" and "clustering of transactions" price impact factor. Chan and Fong (2000) therefore assert that the volatility–volume relationship underlying stock returns could in principle be driven by either one or both components of the number of trades and the size of trades.[4] Moreover, Kaul and Sapp (2009) shed more light on the issue regarding the effect of the trading activity and dealer concentration on foreign exchange market quality. They clarify that the trading activity is an important determinant of market quality and dealer concentration.[5]

According to the above evidence, liquidity measures not only affect the volatility–volume relationship but also the information transmission ability of the order flow. We therefore suggest that the liquidity is another wedge of the microstructure that investors should look for in FX markets. Liquidity reflects the ability to buy or sell significant quantities of an asset both quickly and anonymously. To maintain liquidity, several exchange systems use liquidity suppliers, i.e., individuals who stand ready to sell or buy whenever the customer intends to buy or sell. As suppliers of liquidity, they have monopoly rights to buy at the lower *bid* price and sell at a higher *ask* price. This privilege is the primary source of compensation for offering liquidity, namely, the *bid–ask spread*.[6]

It is more important to notice that transaction data occurring in financial markets are often contaminated by market microstructure effects, such as bid–ask spreads, liquidity ratios, turnover, and asymmetric information. Market microstructure effects indicate that changes in transaction prices over very small time intervals are mainly composed of noise and carry little information about the underlying return volatility (Hasbrouck and Seppi, 2001; O'Hara, 2003). Amihud (2002) also point out that the bid–ask spread partly represents the *illiquidity premium* on the expected stock return due to the small trading size. With the same meaning, we expect that the liquidity suppliers should require more bid–ask spreads on low trading density currencies to compensate for their illiquid risks. According to these arguments, the presence of market microstructure effects is necessarily accounted for in the order flow model.

This study's first objective is to compute Stoll's realized bid–ask spread as the measure of the liquidity (Stoll, 1989). Such a spread is markedly different from the usual spread because it is easy to detect the pattern of price *reversal* and price *continuation* in a transaction. Alternatively, the usual spread is driven solely by the relative gap between the ask price and the bid price. We estimate the coefficients on the regression of the daily exchange rate return on the bid–ask spread, and order flow for each currency pair. We find that the order flow is a dominant explanatory variable for active currencies, while the bid–ask spread is a potential candidate in explaining the daily returns on infrequently traded currencies.

For the purpose of the comparison, our second objective is to provide a Generalized Method of Moments (GMMs) to understand the link between the order flow and the information dispersion, which is captured by the estimated coefficient on the variance of the order flow. Moreover, we also examine whether the variance in price changes can be attributable to the deviation in the bid–ask spread when trading density is at a high or low level.[7] We show that the contribution of information dispersion is an important determinant of the variance of exchange rate returns for active currencies. However, the empirical results for infrequently traded currencies yield the opposite conclusion because most of these currencies are insensitive to the clustering of transactions.

The remainder of this article is organized as follows. In Section 2, we introduce two common liquidity measures in economic and financial studies. In Section 3, we describe the data and the empirical procedures of the extended order flow model including the daily realized bid–ask spread. In Section 4, we present our results,

[4] For example, the order flow in large trade size categories affects the return more than in smaller size categories for NYSE stocks.

[5] According to Kaul and Sapp (2009), market quality is a key characteristic of financial markets because it summarizes the speed and accuracy with which information is impounded in prices.

[6] Several studies find that estimates of the liquidity effects are known to be sensitive to model specifications (Huang and Stoll, 1997; Chordia et al., 2008). For example, the relative spread (usual bid-ask spread) $s^{relative}_{i,t_n} = 2(p^{Ask}_{i,t_n} - p^{Bid}_{i,t_n})/(p^{Ask}_{i,t_n} + p^{Bid}_{i,t_n})$ characterizes the relative gap between bid and ask prices for the currency i at transaction n recorded in period t_n, and the larger the spread, the more illiquid the market. The Amihud (2002) statistic, $ILLIQ_{i,m} = (1/N_m)\sum_{d=1}^{N_m} |R_{i,d,m}|/V_{i,d,m}$, highlights the aggregated price impact measure based on daily returns and traded volumes, so that the larger this indicator, the lower the liquidity. $|R_{i,d,m}|$ is the absolute return and $V_{i,d,m}$ is the volume in dollars for day d in the month for the currency i. The Pastor–Stambaugh liquidity includes "non-traded" and "traded" liquidity factors, with the latter series being derived by dividing common stocks (in the CRSP monthly stocks file data) into 10 groups based on each stock's sensitivity to the "non-traded" liquidity innovation factor (as described in Pastor and Stambaugh, 2003).

[7] Several studies, especially for the covariance model of the bid-ask spread, have argued that liquidity costs can only have a second-order effect on the level of asset prices because the transactions costs are just too small relative to the equilibrium risk premium to matter (Roll, 1984; Glosten and Milgrom, 1985).