

# Chapter 30

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## THE MICROSTRUCTURE/ MICRO-FINANCE APPROACH TO EXCHANGE RATES

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### Abstract

*The vast empirical failure of standard macro exchange rate determination models in explaining exchange rate movements motivates the development of microstructure approach to exchange rates in the 1990s. The microstructure approach of incorporating “order flow” in empirical models has gained considerable popularity in recent years, since its superior performance to macro exchange rate models in explaining exchange rate behavior. It is shown that order flow can explain about 60 percent of exchange rate movements versus 10 percent at most in standard exchange rate empirical models. As the microstructure approach to exchange rates is an active ongoing research area, this chapter briefly discusses key concepts that constitute the approach.*

**Keywords:** microstructure approach; order flow; exchange rates; macroexchange rate models; heterogeneous information; private information; asset market approach; goods market approach; currency; divergent mappings; transaction

### 30.1. Definition

The microstructure approach to exchange rates is considered to be a fairly new but active research area. This line of research emerged in the early

1990s mostly due to the vast empirical failure of standard macro exchange rate determination models. In more recent years (the late 1990s), there was considerably a large amount of published work regarding the microstructure approach to exchange rates, suggesting order flow is evident to be the missing piece in explaining exchange rate behavior. The following definition of the microstructure approach to exchange rates comes directly from its pioneer, Richard Lyons (See Lyons, 2001).

The microstructure approach is a new approach to exchange rates whose foundations lie in microeconomics (drawing particularly from microstructure finance). The focus of the approach is dispersed information and how information of this type is aggregated in the marketplace. By dispersed information, we mean dispersed bits of information about changing variables like money demands, risk preferences, and future inflation. Dispersed information also includes information about the actions of others (e.g. about different trading responses to commonly observed data). The fact that the private sector might be solving a problem of dispersed information is not considered in traditional macro models. Rather, macro models assume that information about variables like money demands, risk preferences, and inflation is either symmetric economy-wide, or in

some models, asymmetrically assigned to a single player – the central bank. In reality, there are many types of dispersed information that exchange rates need to impound. Understanding the nature of this information problem and how it is solved is the essence of this micro-based research agenda.

### 30.2. Empirical Failure of Traditional Approaches To Exchange Rates

The literature has documented extensively the little ability traditional/standard exchange rate determination models have to explain exchange rate behavior. Meese and Rogoff (1983) show that a random walk model outperforms the standard international-finance models in forecasting exchange rates. In that respect, Meese (1990) writes that “. . . the proportion of (monthly or quarterly) exchange rate changes that current models can explain is essentially zero. . . This result is quite surprising, since exchange rate changes would be entirely unpredictable only in very special cases of the theoretical models discussed.” More recently, a survey paper by Frankel and Rose (1995) also notes that “To repeat a central fact of life, there is remarkably little evidence that macroeconomic variables have consistent strong effects on floating exchange rate, except during extraordinary circumstances such as hyperinflations.”

Two most frequently discussed standard exchange rate determination approaches are (1) goods market approach and (2) asset market approach. The goods market approach suggests that exchange rates move to reflect necessary changes in excess demand/supply of foreign currency resulting from international trades. A domestic economy necessarily demands for more foreign currencies when its citizens consume more imported goods. The general prediction of goods market approach is that an increase in domestic trade deficit must lead to the depreciation of domestic currency against foreign currency. However, existing studies find no empirical evidence to

support any specific relation between current account imbalance and exchange rate movements.

In open economies, domestic citizens can purchase not only foreign goods but also foreign financial assets. The asset market approach suggests that demand for foreign currency increases when domestic citizens increase their possessions on foreign assets, and this in turn would cause domestic currency to depreciate against foreign currency. Different from the goods market approach, the asset market approach also concerns the market efficiency issue. Specifically, the theoretical models on asset market approach determine equilibrium exchange rate at the level that no public information can lead to excess returns.

In general, the empirical model specification for asset market approach is as follows (Lyons, 2001):

$$\Delta E_t = f_1(i, m, z) + \varepsilon_{1t}, \quad (30.1)$$

where  $\Delta E_t$  is changes in nominal exchange rate (usually monthly or weekly data is used), the function  $f_1(i, m, z)$  includes the current and past values of domestic and foreign interest rates ( $i$ ), money supply ( $m$ ), and all other macro variables ( $z$ ). Similar to the low predictability of goods market approach, the majority of asset market empirical studies report that macro variables in Equation (30.1) explain 10 percent only, at most, of exchange rate movements. Further details on the empirical failure of various standard exchange rate determination models are well documented by Taylor (1995).

The disappointing results from the existing exchange rate models motivated researchers to look for sources responsible for the empirical failure. They attribute the general empirical failure to the unrealistic assumptions shared among standard exchange rate determination models. In detail, these models assume that every market participant learns new information at the same time when macroeconomic information/news is made public. Further, all market participants are assumed to have the ability to impound macro information into prices to the same level. However, both assumptions can easily be argued. In reality, not only

market participants' information set is heterogeneous, but also their mapping ability from available information to price is impossible to be the same. The heterogeneity in information set is evident from the fact that foreign exchange traders, working for different banks, each have their own customers to deal with. Transactions with different customers offer each trader "private" information that he may not intend to share with others. In addition, it is understandable that different people tend to interpret the market impact of new information on exchange rate differently, regardless whether the information is made available to all of them at the same time. This idea of divergent mappings from information to prices is discussed by Isard (1995, pp. 182–183) who states that "economist's very limited information about the relationship between equilibrium exchange rates and macroeconomic fundamentals, . . . it is hardly conceivable that rational market participants with complete information about macroeconomic fundamentals could use that information to form precise expectations about the future market-clearing level of exchange rates."

### 30.3. Why Microstructure Approach?

The unrealistic assumptions in standard exchange rate models mentioned above have been relaxed in the literature that aims to explain why the financial market crashed. It is important to note that despite events such as stock market crash and currency crisis appear to be macro issues, they can be largely explained by microstructure approach that considers the existence of heterogeneous information among market participants (see Grossman, 1988; Romer, 1993; Carrera, 1999). For the same token, Lyons argues that adopting microstructure approach to investigate the trading process of exchange rates may help our understanding on when and how exchange rates move. Lyons (2001, p. 4) notes that the microstructure approach is an approach that relaxes three of the assets approach's most uncomfortable assumptions. First, on the aspect of information, microstructure

models recognize that some information relevant to exchange rates is not publicly available. Second, on the aspect of players, microstructure models recognize that market participants differ in ways that affect prices. Last, on the institutional aspect, microstructure models recognize that trading mechanism differs in ways that affect prices.

### 30.4. The Information Role of Order Flow

The central variable that takes the fundamental role in microstructure approach, but has never been presented in any of previous exchange rate models, is order flow. Order flow is cumulative flow of signed transaction volume. A simple example on how order flow is counted for individual transaction can be helpful. Suppose that a dealer decides to sell 5 units of U.S. dollars via a market order (one unit usually represents a transaction worth \$ million), then order flow is counted as  $-5$ . The negative sign is assigned for this \$ million transaction because it is a seller-initiated order. Each transaction is signed positively or negatively depending on whether the initiator of the transaction is buying or selling. Over time, order flow gives us a relative number of buyer-initiated versus seller-initiated orders in a market. Thus, order flow provides information to dealers about the relative demand for currencies at any time in the market. Since market participant must make buy-or-sell decisions according to available information (including their private information), it is presumed that order flow is at certain level driven by market fundamentals.

Order flow plays a fundamental role in exchange rate movements because it has the function to transmit information that is not known by everyone in the market. In fact, this concept of order flow transmitting information is intuitively appealing. As an example to describe the intuition, consider two traders (referred to dealer A and dealer B) in the foreign exchange market, and each of them trades for a particular bank. Each bank of course has its own customers from whom it buys and sells foreign exchange. When

dealer A trades with his own customers, he obtains private information, such as the customers' view of the current market (price), and which, is not known to dealer B. However, when dealer A puts orders in the inter-dealer market in an attempt to balance out positions with outside customers (for inventory concern), dealer A's private information is learned by dealer B. An alternative example is related to the idea of divergent mappings from (public) information to prices. Suppose dealer A hears a macro announcement at the same time as dealer B. Although they do not know how each other would interpret the announcement's effect on prices, they can learn this information by watching how each other trades.

A related question that is frequently asked is "does order flow really contain (market) information?" The answer is positive. The direct evidences come from dealers themselves. In surveys conducted by Cheung and Wong (2000), about 50 percent of dealers who responded to the survey claim that they believe banks with larger customer base have information advantage. This is because they get to trade with more customers, and more transactions ensure more private information, which leads to better speculative opportunities. Further evidence is from empirical analysis, which examine whether order flows have a permanent effect on prices. The rationale behind this empirical analysis is if order flow does not contain any information about market fundamentals, it can only have transitory effect on prices. French and Roll (1986) have used this methodology to identify the information arrival. Using vector autoregression models, Evans (2001) and Payne (1999) found that order flow innovation has long-run effect on prices. This result provides evidence that order flow does contain information related to market fundamentals.

The general empirical model specification for microstructure approach to exchange rates can be written as follows (Lyons, 2001):

$$\Delta E_t = f_2(X, I, Z) + \varepsilon_{2t}, \quad (30.2)$$

where  $\Delta E_t$  is changes in nominal exchange rate between two transactions, function  $f_2(X, I, Z)$  includes the order flow ( $X$ ), dealers' inventory ( $I$ ), and all other micro variables ( $Z$ ). The microstructure models predict that an upward move in price is associated with a situation in which buyer-initiated trades exceed seller-initiated trades. In other words, to support microstructure approach to exchange rate, there needs to be a positive relation between order flows and prices. Lyons (2001) and Evans and Lyons (2002) have shown the considerably strong positive impact of order flow on exchange rates. More precisely, they have shown that order flow can explain about 60 percent (versus 10 percent at most in standard exchange rate empirical models expressed in Equation (30.1) ) of exchange rate movement.

### 30.5. Conclusion

The high explanatory power of order flow for exchange rate movements is exciting news for researchers in the area. So far, all empirical evidences have suggested order flow is indeed the important missing piece in exchange rate determination. Lyons (2001) thus claims that order flows help solve three exchange rate puzzles: (1) the determination puzzle, (2) the excess volatility puzzle, and (3) the forward-bias puzzle. Yet, there is not much agreement toward this claim (see Dominguez, 2003). Clearly, more research needs to be done before these puzzles may be solved.

### REFERENCES

- Carrera, J.M. (1999). "Speculative attacks to currency target zones: a market microstructure approach." *Journal of Empirical Finance*, 6: 555–582.
- Cheung, Y.W. and Wong, C.Y.P. (2000). "A survey market practitioners' view on exchange rate dynamics." *Journal of International Economics*, 51: 401–423.
- Dominguez, K.M.E. (2003). "Book Review: Richard K. Lyons, The microstructure approach to exchange rates, 2001, MIT Press" *Journal of International Economics*, 61: 467–471.

- Evans, M. (2001). "FX trading and exchange rate dynamics." Working Paper No. 8116, National Bureau of Economic Research.
- Evans, M. and Lyons, R.K. (2002). "Order flow and exchange rate dynamics." *Journal of Political Economy*, 110: 170–180.
- Frankel, J. and Rose, A. (1995). "Empirical research on nominal exchange rates," in *Handbook of International Economics*. Amsterdam, New York and Oxford: Elsevier, North-Holland, p. 3, 1689–1729.
- French, K.R. and Roll, R. (1986). "Stock return variances: the arrival of information and the reaction of traders." *Journal of Financial Economics*, 17: 5–26.
- Grossman, S.J. (1988). "An analysis of the implications for stock and futures price volatility of program trading and dynamic hedging strategies." *Journal of Business*, 61: 275–298.
- Isard, P. (1995). "Exchange Rate Economics." Cambridge: Cambridge University Press.
- Lyons, R.K. (2001). "The Microstructure Approach to Exchange Rates." Cambridge: MIT Press.
- Meese, R. (1990). "Currency Fluctuations in the Post-Bretton Woods Era." *The Journal of Economic Perspectives*, 4(1): 117–134.
- Meese, R. and Rogoff, K. (1983). "Empirical exchange rate models of the seventies." *Journal of International Economics*, 14: 3–24.
- Payne, R. (1999). "Informed trade in spot foreign exchange markets: an empirical investigation." Typescript, London School of Economics.
- Romer, D. (1993). "Rational asset-price movements without news." *American Economic Review*, 83: 1112–1130.
- Taylor, M.P. (1995). "The economics of exchange rates." *Journal of Economic Literature*, 83: 13–47.