ECONOMIC POLICY FORUM
EXPLAINING AND FORECASTING EXCHANGE RATES WITH ORDER FLOWS

COMMENTS

on Richard K. Lyons's "Explaining and Forecasting Exchange Rates with Order Flows"

by **Paul Fisher & Robert Hillman**[1]

Richard K. Lyons has pioneered the academic study of flow analysis in the foreign exchange market. Lyons' approach is to study the microeconomics of how information about the macroeconomy gets processed by the 'market' and thus reflected in prices. The two key elements of the approach are to consider that not all information is public and widely known, rather to begin with it is 'dispersed' across market participants and it has to be impounded into the price via trading; and that market participants are different in their individual preferences (Lyons uses the term 'risk fundamentals'). Lyons' paper investigates two main issues. First, that order flow – a statistic that records the cumulated net balance of buy or sell orders – might help predict exchange rate movements; and second, that order flow might help predict future macroeconomic variables.

Our perspective is that of a central bank, so we start by considering why central banks are interested in exchange rates, before considering how order flow might be useful. The fundamental motivation for a central bank's interest in exchange rates is because the exchange rate impacts on the macroeconomy, and hence on monetary policy decisions. The UK's Monetary Policy Committee has an inflation target, and its primary policy instrument is the repo rate, with which it hopes to influence other short-term interest rates in the economy, and via the transmission mechanism, future inflation. It is worth noting however, that econometric estimates of the impact of the exchange rate on both prices and quantities are often smaller and slower than theory might predict. And distinguishing between an effect that is small and/or slow is, in experience, hard. Neither theory nor empirics suggest a constant correlation between the exchange rate and inflation or real activity. In particular, the effect of changes in the exchange rate crucially depend on the source of the original shock – there are for example different implications of a real versus a nominal shock, or a domestic versus a foreign shock. This fundamental observation that the source of the shock matters, heavily influences our perspective on the flow analysis literature.

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As a central bank we are also interested in any financial stability or market efficiency issues that might be associated with the foreign exchange market, but in this talk our comments will be primarily concerned with how order flow might help us in our monetary policy making.

From our location in London, the Bank of England is at the centre of the world's foreign exchange market. We have an active dealing room where we make prices for other central and commercial banks outside London; transact on behalf of UK government departments; and of course most importantly manage the UK's foreign exchange reserves, consisting of some $40bn in assets and around $25bn of liabilities. We also manage the foreign exchange elements of the Bank of England balance sheet.

One of our key aims is to generate intelligence about financial markets for policy purposes. We believe that to do this effectively it is necessary to be present in the market - and our dealers actively take risk, trading in a range of major currencies. As part of our market analysis we already monitor investment bank flow analysis – which we note has become an increasingly competitive arena in the last couple of years – as well as the more traditional capital flow data. In our dealing room we have collected data on (interbank) order flow that has since been made available to external researchers.

Lyons' description of how order flow affects the exchange rate seems a sensible description of the process of exchange rate determination. It is clear that exchange rates (like any asset price) can change – at least temporarily – as the balance of orders becomes skewed. Some refer derisorily to this *description* of the process as there being 'more buyers than sellers'. Exchange rates can also change in response to events with little directional order flow, for example when news hits the market. But it is well established that only occasionally are macroeconomic data surprises market-moving events, and seldom in the ex-ante predicted direction. However, although the 'reaction to news' literature thus far could be seen as limited (and this is one reason why flow analysis has received attention) it does encourage us to compare predictions and outcomes. And this is one way of getting closer to uncovering the underlying sources of exchange rate movements – if only at the very least it tells us more about our models and assumptions than about the real world, it is a step in the right direction. Our reading of the extant order flow literature is that it has assembled a set of interesting empirical observations, but that the emphasis so far has been on ex-post rationalization rather than on testing market-microstructure hypotheses. We also recognise that the literature is potentially in its infancy, and that as more data sets become available, and the theory gets developed, the literature will naturally become more balanced.

Turning to some of Lyons' specific claims: we agree that interbank flows help 'explain' concurrent one-day returns. This seems consistent with the 'more buyers than sellers' description of price movements. Our own internal work at the BoE supports this result, although we are slightly sceptical about the robustness of the degree of explanatory power (70-80% as suggested by Lyons) claimed in the paper. In internal work at the BoE, and in a

recent paper by Daniellson, Payne and Luo, the R^2s for comparable regressions (both using a longer sample of data than Lyons), are somewhat lower[2]. Also consistent with Lyons, our internal analysis supports the idea that interbank flow has no forecasting power for future exchange rate movements.

The paper also studies end-user flows. The data was collected within Citibank between 1993 and 2000 and measures the order flow from different types of clients. Lyons has two main findings. First, that end-user flow has both forecasting power for future returns, as well as contemporaneous explanatory power. And second, that segregating the end-user flow into type of user can increase both the explanatory and forecasting power. We agree with the usefulness of having an appreciation of what type of player is predominant in the market at certain times. In our monitoring of the market it is clear to us that different segments often trade at different times, and in different ways. A typical example might be a period in which flow (buy orders say) is generated by hedge-fund players, which may encourage trend-follo-wing (often model-based) traders into the market. Next, flow might be seen to be domina-ted by real-money players, who may reinforce or end the move. The Bank's active presence in the market helps us detect these shifts in the apparent dominance of types of participants over time, and we use this information in a qualitative way in our provision of market intelli-gence. For example, it is useful to be able to tell the MPC that a particularly sharp move-ment in sterling on a certain day was more likely due to a large UK corporate readjusting its hedge in a relatively illiquid market, than as reflecting a permanent 'market' reassessment of expectations about future real activity.

Our experience in using flow information in a mainly qualitative way suggests that quantita-tive analysis (particularly econometric analysis) is likely to be difficult. A first observation is that the relative importance of different types of player changes over time. Sometimes spe-culative traders might be considered to reinforce a trend, so their 'flow' might be followed by a series of positive returns. At other times speculators might be considered to arrest or terminate a trend, so their flow might be followed by flat or negative returns. If this descrip-tion is realistic, it seems unlikely that there are stable statistical relationships between any particular segment's flow and future returns, over a set horizon.

A second observation based on our experience, is that because at any *point in time* a buyer must be matched by a seller, it is likely that over any period of time one market segment's flow is roughly balanced by another market segment's flow. For example, speculators may be 'net buyers' and corporates 'net sellers'. This suggests the possibility for econometric pro-blems. At best one could expect collinearity, which might be detectable and dealt with

2. For example in Danielsson, J., Payne, R., and Luo, J., 'Exchange rate determination and inter-market order flow effects' mimeo, London School of Economics, R^2s for cable and euro/sterling are less than 10%. Including other cross rate flows (particularly euro/dollar) does increase the explanatory power, but we suspect 70-80% is at the upper end of what might be discovered with longer data sets.

appropriately; but if the former description of time-varying shifts in the importance of diffe-rent market segments is correct, the problems may be harder to detect and deal with.

Given these observations, we have some reservations about accepting Lyons' regression results at face value. In TABLE 1 for example, which breaks down end-user flow into eight components, there are several coefficients of opposite sign but nearly equal size. This may be a symptom of econometric misspecification. A similar picture is given is TABLE 3, which reports the results of regressing end-user flows on future returns. In both cases, although there is apparent statistical significance, as recognised by Lyons the coefficients are not straightforward to interpret. Lyons also discusses how different segments might be seen to be more important at different horizons than at others. This seems more plausible to us and also motivates – as Lyons suggests – work on the relationship between more traditional flow data (capital flow and balance-of-payments data) and order flow. This seems a worthwhile area of future research.

Lyons' most novel claim is that exchange rates and order flow can forecast future realised macroeconomic data. That changes in exchange rates might help predict future macroeco-nomic variables does not seem implausible. The basic idea is that as a forward looking variable, the exchange rate should reflect expectations about future macroeconomic out-turns, and so changes in the exchange rate will reflect changes in expectations. And to the extent to which expectations are accurate and/or influence the economy, forecasts might be improved by conditioning on changes in the exchange rate. If order flow reflects the process by which 'dispersed bits of information' gets incorporated into prices, then just as changes in exchange rates should reflect changes in expectations (and possibly improve forecasts), so might order flow.

Lyons finds (the data sample covers 1993 to 2000) that changes in the euro/dollar exchange rate are statistically significant in forecasting future US output growth and inflation. And he also finds that euro/dollar end-user flows improve forecasts of US money growth, output growth, and German inflation. In fact, flows appear to contain more information than the exchange rate itself. However, as with the flows and returns analysis, we have some similar reservations about accepting these results at face value quite yet. It seems unlikely that movements in the exchange rate, and by implication flows associated with movements in the exchange rate, should have a stable predictable link with future macroeconomic variables. There should be serious endogeneity issues at play, not least due to the role of monetary policy. In these circumstances, the ability of an OLS regression to investigate these hypo-theses seems limited.

It is also possible, perhaps even to be expected, that in any particular sample one or more measures of end-user flow might be statistically related to future macroeconomic variables. But it is not clear what if anything we should read into this. By splitting end-user flows into many segments (often offsetting each other as described earlier) it is likely that one or more will trend in the same direction as stationary, yet often persistent macroeconomic variables.

With short samples as well, one would have to take extremely seriously the possibility of detecting spurious relationships.

Overall, we find Lyons' present paper, and more generally the literature on flow analysis, interesting and thought provoking. The macroeconomic forecasting results discussed above are positively intriguing. But we remain unconvinced that the results reported so far improve our understanding of exchange rates – at least from a monetary policy making perspective. We certainly encourage further theoretical work on the links between market-microstructure and flow data analysis, in particular the generation of testable hypotheses where possible. The paucity of data, although improving, has no doubt been one constraint on the literature thus far. As central bankers we watch this space for future developments.

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