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Portfolio reallocation and exchange rate dynamics

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ABSTRACT

This paper explains exchange rate dynamics by linking financial customers' foreign exchange order flow with their dynamic portfolio reallocation. For any currency pair in a particular period, one currency has higher assets return than the other and can be considered the high-return-currency (HRC). Financial institutions attempt to hold more HRC assets when they become more risk-loving or the relative return of the assets is expected to increase. Such a portfolio reallocation generates buy order toward the HRC and the currency appreciates. As the HRC changes over time, the direction that the relative return and risk appetite affect the exchange rate varies in different regimes.

1. Introduction

Explaining exchange rate dynamics has been the biggest challenge in international finance since the collapse of the Bretton Woods system. The early efforts started with macro-based models that tried to connect exchange rate dynamics with fundamental variables such as money supplies, aggregate outputs, and interest rates. However, as argued by Meese and Rogoff (1983), these macro-based models cannot even outperform a random walk and their explanatory power is minimal at best.

In response to these failures, a number of scholars have attempted to ground macro models in more solid microfoundations. Major advances along these lines include the dynamic general equilibrium model of Obstfeld and Rogoff (1995), the productivity differentials model of DeGregorio and Wolf (1994), and the behavioral equilibrium exchange rate model of Clark and MacDonald (1999). While a large number of studies have subsequently claimed to find success with various fundamentals-based models, the success has not proven to be robust. This pessimistic conclusion is shared by several comprehensive surveys including Lane (2001), Sarno and Taylor (2002), and Cheung et al. (2005).

The most recent attempts to improve the macro-based models emphasize expected fundamentals. Engel and West (2005) treat the exchange rate as an asset price and argue that the exchange rate should be the net present value of expected future fundamentals. Engel et al. (2007) further show that including expected fundamentals improves the performance of macro-based models. However, this improvement is only limited to certain currencies and long horizons (16-quarter and longer); unsatisfactory performance at short horizons continues to haunt macro models.[1] One explanation for these disappointing results is that the relationship between the exchange rate and macro fundamentals is nonlinear and highly unstable.[2] Current models that try to capture the nonlinearity, Bacchetta and Wincoop (2009) for instance, mainly rely on econometric techniques and do not provide explicit economic rationales for the structural change.

Given the poor performance of the macro models, a new line of research developed in the mid-1990s that focused on the behavior of price-setting economic agents in foreign exchange markets – the FX dealers. The initial results of FX market microstructure research seemed stunning: Evans and Lyons (2002) show that order flow[3] can explain 40–60% of daily exchange rate fluctuations. Despite its unprecedented explanatory power, these findings were initially

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[1] where the "short horizons" correspond to any time horizon between a day and perhaps a year or two, depending on context.
[2] See survey Cheung and Chinn (2001) and econometric evidence Rossi (2005) and Sarno and Valente (2009).
[3] In market microstructure literature, order flow is usually measured as aggregate buy orders minus aggregate sell orders.

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criticized because they left unanswered the question of what drives order flow. Although reduced-form examinations such as Evans and Lyons (2007, 2008) show that order flow contains fundamental information, transition mechanism seems lacking in these studies.[4]

FX orders are submitted by market participants. Intuitively, explaining the trading behavior of these participants would be a straightforward and reasonable approach to explain exchange rate dynamics. Evans and Lyons (2005) made the initial effort in this direction through the use of consumption-based utility functions which might have difficulty in describing the behavior of highly leveraged financial institutions. Models in Carlson et al. (2008) as well as Dunne et al. (2010) better accommodate market reality, but they seem hard to be tested directly due to the difficulty of measuring certain explanatory variables.[5] Moreover, these models say little about the regime-switches that apparently exist in exchange rate dynamics.

Motivated by the financial crisis in 2008, researchers have examined more specific features of market participants: Brunnermeier et al. (2008) and Gagnon and Chaboud (2007) find that a popular FX arbitrage strategy – the carry trade – may play an important role in exchange rate determination, while Adrian et al. (2009) find a connection between exchange rates and risk appetite, arguing that high leverage is followed by appreciation of the USD. Supporting evidence presented by these studies, however, is either limited to certain currencies and periods, or obtained through panel data regression, which could hide inconsistencies across currencies and periods.[6]

In the big picture, pure econometric models can capture exchange rate dynamics to some extent but lack economic intuition, macro-based models are intuitive but lack adequate micro foundation and decent explanatory power at short horizons, and microstructure models have a solid microfoundation and high explanatory power but need to better explain the origin of order flow. With the exception of order flow models, existing work has yet to produce models that are sufficiently statistically satisfactory to be considered reliable and robust. One model may do well for one exchange rate in one era, but not for another currency or another era. Although the order flow models seem to be robust across time and currencies, it is vital that we develop a better understanding of what drives order flow.

To better explain the exchange rate dynamics, this paper starts with several stylized facts about the FX market: the exchange rate is quoted by dealers based on the order flow they receive (Evans and Lyons, 2002); the order flow is dominated by inter-dealer and financial customer order flow (New York Federal Reserve Bank, 2009); and inter-dealer order flow is proportional to the non-public customer order flow (Evans and Lyons, 2002). Hence, exchange rate dynamics are mainly driven by the FX transactions initiated by financial customers, which has been empirically confirmed by Menkhoff et al. (2012). Consequently, a core question this paper tries to answer is what drives the financial customers to buy or sell in the FX market?.

Financial customers are profit-seeking and attempt to maximize the return of their portfolios, which usually contain domestic and foreign assets. As market conditions change, portfolio reallocation between domestic and foreign assets produces FX order flows. Due to the differences in monetary policies and economic growth potential between the two countries, for each currency pair in a particular period, one currency has a higher expected return in bonds or stocks than the other and can be called the high-return-currency (HRC). When the relative return of HRC assets is expected to increase (decrease), financial customers attempt to hold more HRC assets, which generates positive (negative) order flow for the HRC, and the HRC appreciates (depreciates). Meanwhile, holding HRC assets is risky due to exchange rate risk and the higher volatility associated with HRC assets. As expected market risk increases, financial customers would hold fewer HRC assets, causing the HRC to depreciate. Holding relative return and market risk constant, when financial firms have higher (lower) risk appetite, they hold more (less) HRC assets and that currency appreciates (depreciates).

We test these theoretical implications with ample data and find country-specific and period-specific supportive evidence for all major currencies throughout the sample period. At the 1-month horizon, our model can explain on average 27% of the British Pound dynamics,[7] 24% of the Canadian Dollar, 24% of the Deutsche Mark, 13% of the Euro and 14% of the Japanese Yen. To our knowledge, these are the best results obtained at monthly horizon by a structural model without using order flow. The model also outperforms a random walk in the out-of-sample test.

Our paper follows the FX market microstructure literature in the sense that we model how market participants' behavior affects exchange rate dynamics.[8] But instead of considering order flow as an exogenous variable, we tie FX order flow to the endogenous portfolio flows which emerge under optimal dynamic portfolio allocation processes. Exchange rate dynamics are thus based *directly* on financial market structure as opposed to traditional macroeconomic variables.[9] Furthermore, the way that financial variables drive the exchange rate varies in different regimes that constantly switch, and such a switch can be caused explicitly by the change of HRC status, the business cycle, or the dominance of conflicting assets reallocation. Our paper is not the first to explain exchange rate dynamics through market participants trading behavior, but it is the first among similar models to explicitly incorporate regime-switching and provide country-specific and period-specific supporting evidence from explicit *ex ante* tests.

The regime-switching mechanism proposed by our paper provides an economic rationale for nonlinearity in exchange rate models. We would emphasize that this mechanism is intuitive and explicit, which can improve the performance of pure econometric regime-switch models. This feature can also reconcile several puzzling results found in related research.[10] The carry trade (bond market reallocation in our model) only can explain variability in certain currencies in certain periods because stock reallocation dominates in other cases. High leverage is not always followed by appreciation of the USD because what fund managers have to dump when leverage unwinds are the assets of the HRC, which can be the USD as well.

This research also has important implications for the macro exchange rate literature. Our model suggests that fundamentals must influence the exchange rate through the financial markets, which provides a microfoundation for expectation-based macro models. Meanwhile, financial variables that drive exchange rate dynamics are certainly related to fundamentals, but not in a one-to-one mechanical relationship. Information heterogeneity, human psychology, irrational behavior and institutional arrangements can all cause a disconnect between fundamentals and financial

[4] These studies do not show how market participants incorporate the fundamental information into their trading behavior, which essentially determines the order flow.

[5] The explanatory variables "expected future spot rate" and "belief change" proposed in Carlson et al. (2008) and Dunne et al. (2010) respectively are difficult to measure, and these models were consequently unable to be tested directly.

[6] Details are presented in Section 4.

[7] All versus the US dollar. The percentage number is the average of the adjusted R-squared of all periods we tested.

[8] The direct connection between order flow and exchange rate dynamics, which our model is built on, bypasses market clearing conditions, which makes our model a flow, rather than stock, equilibrium model.

[9] We are not saying that the exchange rate is unrelated to macro fundamentals. Rather, we want to emphasize that the fundamentals must affect the exchange rate through market participants trading behavior in the FX market.

[10] See Section 4 for more details.