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Trading volume and exchange rate volatility: Evidence for the sequential arrival of information hypothesis

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ABSTRACT

The relationship between trading volume and volatility in foreign exchange markets continues to be of much interest, especially given the higher than expected volatility of returns. Allowing for nonlinearities, this paper tests competing hypotheses on the possible relationship between volatility and trading volume using data for three major currency futures contracts denominated in US dollars, namely the British pound, the Canadian dollar and the Japanese yen. We find that trading volumes and return volatility are negatively correlated, implying a lack of support for the mixture of distributions hypothesis (MDH). Using linear and nonlinear Granger causality tests, we document significant lead–lag relations between trading volumes and return volatility consistent with the sequential arrival of information (SAI) hypothesis. These findings are robust and not sample-dependent or due to heterogeneity of beliefs as proxied by open interest. Furthermore, our results are insensitive to the modeling approach used to recover volatility measures. Overall, our findings support the contention that short- to medium-term currency relationships may be dominated by trading dynamics and not by fundamentals.

1. Introduction

There is much continuing interest in the relationship between exchange rate volatility and trading volume in the floating rate regime under which most major currencies have traded since at least the early to mid-1970s. Under the previous regime of fixed exchange rates, periodic movements in exchange rates were expected to be primarily determined by fundamentals such as changes in interest rate differentials, relative money supplies, real incomes and the balance of payments accounts. However, none of these models explain the increased unpredictability and volatility that has been a characteristic of the floating exchange rate regime (see, e.g., Rogoff, 1996). The failure of these models driven by fundamentals to explain the behavior of exchange rates over the floating exchange rate regime has led to the development of alternative models (see, e.g., Dornbusch, 1976; Frankel, 1993; Baldwin and Lyons, 1989).[1]

Although these alternative models have had some success in explaining the predictability of foreign exchange rates, other aspects of the performance of these models remain unsatisfactory. For example, although theoretically it has been suggested that exchange rates are not ex-ante predictable, these models have not been able to explain a significant portion even of the ex-post variability of exchange rate movements (Diebold and Nason, 1990). Different explanations, including model mis-specification and the inability to properly model expectations, have been offered for the failure of these structural models. Indeed, Frankel and Rose (1994) state quite succinctly that: "The case for macroeconomic determinants of exchange rates is in a sorry state... (the) results indicate that no model based on such standard fundamentals like money supplies, real income, interest rates, inflation rates and current account balance will ever succeed in explaining or predicting a high percentage of the variation in the exchange rate, at least at short – or – medium-term frequencies." This suggests that other approaches and explanations must be found if both theorists and empiricists are to be successful in modeling foreign exchange rate changes. One promising area of research has been microstructure models (Lyons, 2001), and among the variables introduced to better explain exchange rate dynamics is trading volume.

In addition, a persistent puzzle in currency markets is the higher than expected volatility of returns. Allowing for nonlinearities, this paper tests competing hypotheses on the possible relationships between trading volume and expected volatilities in the foreign exchange markets. Using data for three major currency futures contracts denominated in US dollars, namely the British

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[1] Dornbusch (1976) pioneered the development of over shooting models. Frankel (1993) developed models based on the concept of the impact of news, while Baldwin and Lyons (1989) introduced hysteresis.

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pound, the Canadian dollar and the Japanese yen, this paper investigates which of the two major hypotheses, the sequential arrival of information (SAI) or the mixture of distributions hypothesis (MDH), better describes the volume–volatility relationship in currency futures.[2]

Investigation of the relationship between trading volume and currency futures return volatility is important on several reasons. First, the analysis in this paper presents stylized facts about the intertemporal relationship between return volatility and volume in the foreign exchange market. By establishing empirical regularities, we hope to provide theorists and empiricists with additional insights, which may be helpful in modeling the role that volume plays in the foreign exchange market. Second, our findings may also have important policy and trading implications. For example, finding a significant *linear* and *nonlinear* causal relationship between price volatility and trading volume may be of interest to market regulators as they decide on the effectiveness or the appropriateness of market restrictions such as daily price movement limits and position limits. However, the appropriateness of such regulation may hinge on the cause of price volatility. Greater regulatory restrictions may be warranted if increased price fluctuations are caused by increased trading volume. On the other hand, further regulation may be detrimental to the price responsiveness in futures markets if increased price volatility and trading volume are attributed to liquid and efficient markets. Also, increased volume in futures markets may lead to increased variability in both the spot and futures markets, thus possibly providing regulators with a tool to detect market manipulations and empiricists and policy-makers with an additional metric to evaluate the success or lack thereof of central bank intervention.

The empirical findings of this study also have practical implications for traders and other futures markets participants. For example, successful hedging and speculative activities in futures markets depend crucially on the ability to forecast futures price movements. The finding of strong linear and nonlinear causal relationships between currency futures price volatility and trading volume reported in this study implies that knowledge of current trading volume improves the ability to forecast futures prices. This improvement of short-term price predictability should lead to the construction of more accurate hedge ratios and improvements in investment strategies.

The use of futures prices to investigate the relationship between trading volume and volatility in foreign exchange markets is chosen for several reasons. First, futures contracts are traded on organized exchanges, which provide transaction prices important for assessing asset-pricing models. Another advantage of being traded on organized exchanges is that futures contracts provide a more reliable and accessible measure of volume. In contrast, volume data from the spot and forward markets are generated by inter-bank markets and may therefore be incomplete and unreliable. Additionally, although foreign currency futures markets only account for a relatively small proportion of the volume of foreign exchange trading, futures prices are intimately related to the inter-bank spot and forward prices by arbitrage and futures trading volumes reflect volume in the larger inter-bank market. Finally, currency futures markets provide an important source of information, namely, open interest. This variable is important since it has recently been used in several studies, (see, e.g., Bessembinder et al., 1996) as a proxy for dispersion of beliefs, hypothesized to be an important determinant of volume. This variable is not available in the other foreign exchange markets.

This paper documents important new results for the foreign currency futures markets. Our findings are not supportive of the mixture of distribution hypothesis since we find a significant but *negative* contemporaneous correlation between daily trading volumes and return volatility for the three currency futures contracts we examine. In contrast, using linear and nonlinear Granger causality tests, we find significant lead–lag relations between trading volumes and return volatility consistent with the sequential information arrival hypothesis. We establish the robustness of our empirical findings by showing that they are not due to the heterogeneity of beliefs as proxied by open interest and by showing that they are not sample-dependent. These results support the contention that short- to medium-term currency market relationships may be dominated by market microstructure and related trading dynamics and not by fundamentals.

The rest of the paper is structured as follows. Section 2 offers possible explanations for both linear and nonlinear causal relations between trading volume and price changes. Section 3 discusses the data and methodology used in this paper. Section 4 presents and discusses the empirical results. Section 5 ascertains the robustness of our empirical results while Section 6 concludes the paper.

2. Volume–return relationships in currency markets

There is voluminous literature on the higher than expected volatility of returns in currency markets. It remains a puzzle as there is no clear explanation of the reasons for these anomalous empirical results. However, the current literature in this area may be considered to be deficient in at least two areas, consideration of nonlinearities in relationships and evaluation of the role of trading dynamics as represented by, for example, trading volume.

2.1. Trading volume and return volatility in currency markets

Although the relation between trading volume and volatility has been extensively investigated in equity markets (see, e.g., Andersen, 1996; Bollerslev and Jubinski, 1999; Liesenfeld, 2001; Fleming et al., 2006; Fleming and Kirby, 2011) currency markets have received comparatively only scant attention. This paucity is especially surprising given the importance and size of the foreign exchange market. In recent years, however, a number of papers have begun addressing the volume–volatility link in foreign exchange markets.[3]

For example, Evans and Lyons (2007) and Lyons (2001) provide very interesting interpretations and motivations for the explanatory power of trading volume.[4] Using tick-by-tick data on the

[2] A number of explanations for a causal relation between asset prices and trading volume have been presented in the literature. One explanation, due to Copeland (1976) and later extended by Jennings et al. (1981) and Smirlock and Starks (1988), relies on the concept of sequential arrival of information (SAI). In these models, new information is disseminated to investors one at a time such that a sequence of transitional equilibriums are achieved prior to the final equilibrium. A second explanation that is due to Clark (1973), Epps and Epps (1976), Tauchen and Pitts (1983), Harris (1987) and more recently modified by Andersen (1996), is the mixture of distributions hypothesis (MDH) where the relationship between asset prices and trading volume arises because of a joint dependence on a common latent variable. Clark does not model a causal relationship per se, but argues that events happen at a random rate over time, with trading volume acting as a proxy for the arrival of this information. Thus, there is a contemporaneous relationship between trading volume and prices. In contrast, Epps and Epps utilizing the mixture of distributions hypothesis contend that price changes are mixtures of distributions with volume being the mixing variable. The implication of either MDH approach is that there is causation from volume to changes in asset prices.

[3] There has also been a burgeoning literature that focuses on the relation between trading volume in derivative markets and returns and volatility for the corresponding spot markets (see, e.g., Chang et al., 2009, 2010).

[4] The three types of information to which exchange rates react are information about payoffs for holding currency, information about discount rate for currency inventories, and information about the discount rate for portfolio balance adjustments. The first two are important in the short term and the third is important in the longer run.