November 2013

WORKING PAPER SERIES

2013-FIN-03

Foreign exchange customers and dealers: Who's driving whom?

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Abstract

This paper tests the theoretical assumption of the foreign exchange market microstructure that dealers and non-dealer customers interact over discrete trading rounds. An exhaustive frequency-domain analysis reveals that the interaction is limited and mainly due to the instability of financial markets. The principal finding is that the trading activity of dealers is able to predict the customer order flow at low frequencies with wavelengths longer than roughly a week. In all, the evidence shows that non-financial customers are not as passive as some other research has suggested.

Keywords: Foreign Exchange Market; Market Microstructure; Order Flow; Frequency-domain; Causality

JEL classification: F31; G15; C58.

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1. Introduction

The portfolio shifts model by Evans and Lyons (2002) describes intraday trading in the foreign exchange (FX) market. It assumes that FX dealers and non-dealer customers interact and affect exchange rate formation over three rounds of trading. In the final round, the dealers set prices to encourage the public to trade and absorb dealers' inventory imbalances, whereas the dealers end the day with no net position. Hence, this setting views non-dealer customers as relatively passive market participants whose activity is consistent with liquidity provision. Similar arguments and empirical findings are documented in Bjønnes *et al.* (2005), Gradojevic and Neely (2008) and Gereben *et al.* (2006). Sager and Taylor (2006) refer to *passive customers* as those who are pulled into the market by favourable price movements where they exercise an "option to trade" once the price crosses their "strike price".

In contrast to this view, Breedon and Vitale (2004), Della Corte *et al.* (2011) and D'Souza (2008) suggest that customers may in fact be more active, informed and present a source of information relevant for FX rate determination. Such *active customers* push prices by their buying or selling activity. In other words, they correspond to non-dealer market participants who trade in the first round of the portfolio shifts model. For example, Della Corte *et al.* (2011) devise a multi-currency trading strategy based on non-financial and financial order flows and demonstrate its superiority over the carry trade strategy. Also, D'Souza (2008) shows that dealers in FX markets provide intraday and overnight liquidity, while the activity of non-financial customers is more complex and somewhat interlinked with trading positions taken by other FX market participants. The relevance and informativeness of non-financial customer order flow is confirmed in a recent paper by Marsh and Miao (2012). Their results are consistent with the premise that corporate order flows contain dispersed information about fundamentals.

The goal of this paper is to determine whether non-financial customers act as passive market participants relative to FX dealers in the Canada/U.S. dollar market. More specifically, this work tests the robustness of the causal relationship between order flows generated by dealers and non-financial customers in both the time and frequency domains. As the bulk of the FX market microstructure literature concentrates on the order flow-price relationship, this analysis is unique in its focus and importance for the field. The data set spans 15 years of daily order flows for eight biggest currency dealers in Canada. This offers an unprecedented

insight into the role of FX dealers and their potential impact on non-financial customers under various market conditions.

The findings first reveal the absolute absence of causality from customer order flow to interdealer trading, which implies that commercial customers are not push customers. Second, the causality from interbank trading to the customer-dealer order flow is non-existent in relatively stable markets and can only be observed over the 1998-2001 period. More specifically, the causality is present at weekly and longer horizons, but not in the very short run. This indicates that commercial customers are passive, long-run liquidity providers in times of market distress. A possible interpretation for this may be that during such periods FX dealers are better-informed and more knowledgeable in predicting long-run exchange rate movements than commercial customers. In this context, due to an increased uncertainty (and behavioral factors) commercial customers become reluctant to trade at longer horizons. This situation is consistent with an economic structure in which financial order flows are better informed and drive the exchange rate while commercial order flows respond to lower prices and provide liquidity (Gradojevic and Neely, 2008).

In Sections 2 and 3, the data and the methodology are briefly outlined. Section 4 discusses the findings and the final section concludes the paper with some suggestions for future research.

2. Data description

The data are recorded at a daily frequency and represent currency order flows (spot transactions in millions of Canadian dollars) for eight major Canadian commercial banks. The source of data is the Bank of Canada's FX volume report. This report is coordinated by the Bank of Canada and organized through the Canadian Foreign Exchange Committee (CFEC). From the Triennial Central Bank Survey (conducted by the Bank for International Settlements) perspective, the CFEC order flows represent approximately 40-60% of all Canada/U.S. dollar transactions. The time period is between January 2, 1990 and December 30, 2004, which is a total of 3715 observations.[1]

The interest is in order flows with the following two types of counterparties:

[1]The Bank of Canada's FX volume report was cancelled in 2005.

Variable	Mean	Median	Std. Dev.	Min	Max	Skewness	Kurtosis
IB	18.80	17.90	178.20	-1691.1	1610.9	-0.10	15.01
CC	-48.84	-37.80	257.70	-1727	6880	5.09	146.39

Table 1: Summary statistics.

- Commercial client transactions (CC) include all transactions with resident and non-resident non-financial customers.
- Canadian-domiciled interbank transactions (IB) include transactions with domestic offices of Canadian chartered banks and the Bank of Canada.

The CC transactions are motivated by trades in real goods and services, while the IB transactions are motivated by the inventory risk and/or by the informational content of orders the dealers receive. Using the definition from Evans and Lyons (2002), order flows are measured as the difference between the number of currency purchases (buyer-initiated trades) and sales (seller-initiated trades). Table 1 displays the summary statistics for the CC and IB order flows. Several important differences between the two order flow types can be observed. First, on average, the IB order flow is positive, while the CC order flow is negative. This means that the dealers were on average the sellers of Canadian dollars (buyers of U.S. dollars), while commercial customers were the buyers of Canadian dollars (sellers of U.S. dollars). In addition, there exist more variation, skewness and kurtosis in the transactions of commercial customers. Hence, the trading of commercial customers exhibits more excessive fluctuations and deviations from normality when compared to the trading of dealers.

3. Methodology

The test for causality in the frequency domain by Breitung and Candelon (2006) originates from Geweke (1982) and Hosoya (1991). Let $z_t = [x_t, y_t]'$ be a two-dimensional time series vector with $t = 1, \ldots, T$. It is assumed that z_t has a finite-order VAR representation

$$\Theta(L) z_t = \epsilon_t, \tag{1}$$

where $\Theta(L) = I - \Theta_1 L - \ldots - \Theta_p L^p$ is a 2×2 lag polynomial with $L^k z_t = z_{t-k}$. It is assumed that the vector ϵ_t is white noise with $E(\epsilon_t) = 0$ and $E(\epsilon_t \epsilon_t') = \Sigma$, where Σ is a positive definite matrix.

To test the hypothesis that y does not cause x at frequency ω the following null hypothesis is used:

$$M_{y \to x}(\omega) = 0 \tag{2}$$

Denoting the determinant of $\Theta(L)$ by $|\Theta(L)|$, the null hypothesis can also be expressed as

$$|\Theta_{12}(e^{-i\omega})| = \left| \sum_{k=1}^{p} \theta_{12,k} \cos(k\omega) - \sum_{k=1}^{p} \theta_{12,k} \sin(k\omega) i \right| = 0, \tag{3}$$

where $\theta_{12,k}$ is the (1,2)-element of Θ_k. Thus, a necessary and sufficient set of conditions for $|\Theta_{12}(e^{-i\omega})| = 0$ is

$$\sum_{k=1}^{p} \theta_{12,k} \cos(k\omega) = 0, \tag{4}$$

$$\sum_{k=1}^{p} \theta_{12,k} \sin(k\omega) = 0. \tag{5}$$

The notation can be simplified by letting $\alpha_j = \theta_{11,j}$ and $\beta_j = \theta_{12,j}$. Then, the VAR equation for x_t can be written as

$$x_t = \alpha_1 x_{t-1} + \ldots + \alpha_p x_{t-p} + \beta_1 y_{t-1} + \ldots + \beta_p y_{t-p} + \epsilon_{1t}. \tag{6}$$

The hypothesis $M_{y \to x}(\omega) = 0$ is equivalent to the linear restriction

$$H_0 : R(\omega)\beta = 0, \tag{7}$$

where $\beta = [\beta_1, \ldots, \beta_p]'$ and

$$R(\omega) = \begin{bmatrix} \cos(\omega) & \cos(2\omega) & \dots & \cos(p\omega) \\ \sin(\omega) & \sin(2\omega) & \dots & \sin(p\omega) \end{bmatrix}.$$

The ordinary F statistic for (7) is approximately distributed as $F(2, T-2p)$ for $\omega \in (0, \pi)$. As in Breitung and Candelon (2006), to assess the statistical significance of the causal relationship between exchange rate returns and order flows, the causality measure for $\omega \in (0, \pi)$ is compared to the 5% critical value of a χ^2-distribution with 2 degrees of freedom (5.99).[2]

4. Results

This section reports the results of causality tests in the frequency domain for the bivariate system that contains CC and IB transactions. Both Dickey-Fuller and Phillips-Perron tests reject the null hypothesis of a unit root in both time series at the 1% significance level (p-value=0.000). According to the AIC, LR and the final prediction error criteria, a VAR(4) model was selected for the system.[3]

As in Breitung and Candelon (2006), to assess the statistical significance of the causal relationship between exchange rate returns and order flows, the causality measure for the frequency ω is compared to the 5% critical value of a χ^2-distribution with 2 degrees of freedom (5.99).

Figure 1 presents the causality measure between non-financial and interbank order flows for all frequencies ($\omega \in (0, \pi)$) along with the 5% critical value that is represented with a horizontal dashed line. The top panel indicates that the null hypothesis of no causality is rejected when $\omega < 0.80$ which corresponds to frequencies with a wavelength of roughly more than eight days ($T = 2\pi/\omega$=7.85 days). This shows that non-financial order flow is sensitive to interbank order flow, but its sensitivity depends on the horizon length.

The bottom panel of Figure 1 does not reveal any evidence that the trading of commercial

[2]Breitung and Candelon (2006) study the local power of the test when the frequency being tested converges to the true frequency and show that the Wald statistic is asymptotically distributed as noncentral χ^2.

[3]The Schwarz's BIC and the Hannan and Quinn information criterion found a VAR(2) model as the most appropriate, but in order to stay on the conservative side, a VAR(4) was used as the final choice. A VAR(2) model provides similar results (available upon request), but the causal relationship between commercial customers and dealers is more pronounced.

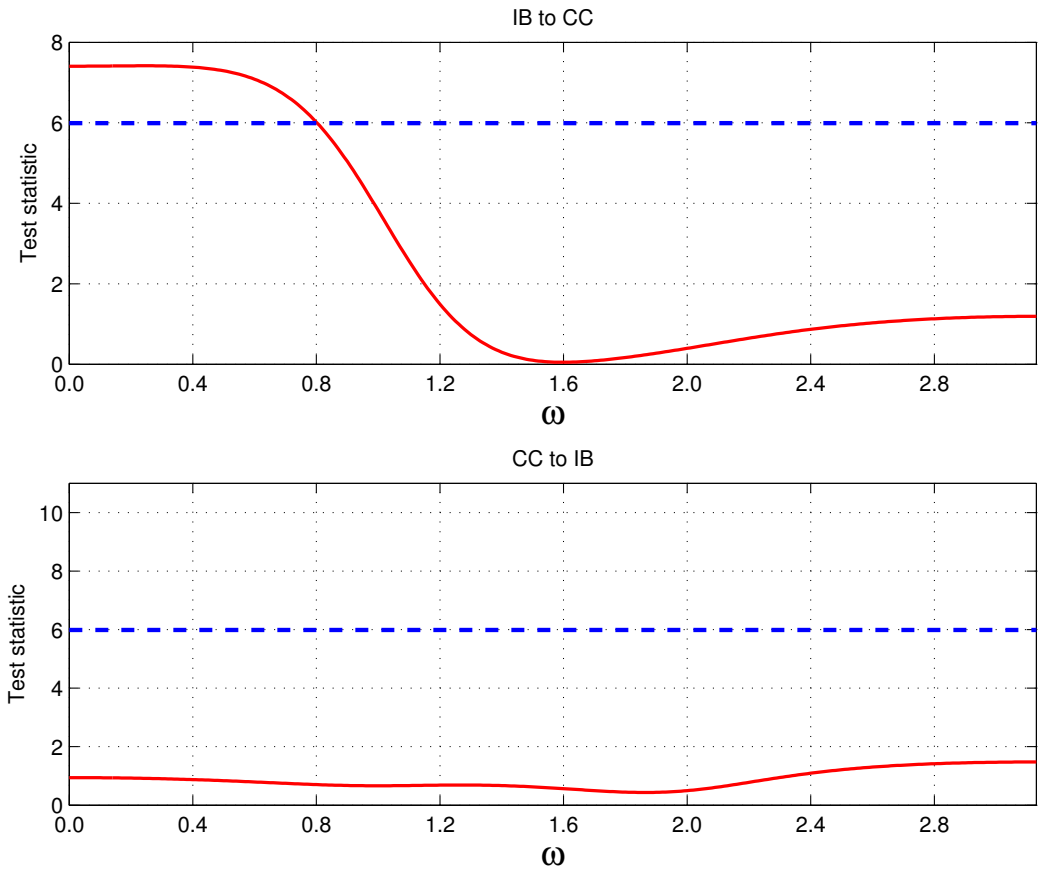

Figure 1: Top panel: Causality tests (IB order flow to CC order flow). Bottom panel: Causality tests (CC order flow to IB order flow). The values of the χ^2 test statistic are given by a solid line. The 5% critical value (5.99) that is given by a horizontal dashed line. The null hypotheses are 1) that interbank order flow does not cause CC order flow at frequency ω (top) and 2) that commercial customers order flow does not cause IB order flow at frequency ω (bottom).

customers impacts the interbank trading. As the test statistic is consistently below the critical value across the spectrum of frequencies, the findings emphasize the passive role of non-financial customers at longer horizons (but not at very short horizons).

A sub-period analysis, however, sheds a new light on the results. The data is divided into three subsets according to Gradojevic and Neely (2008) as follows: 1990-1997 (1989

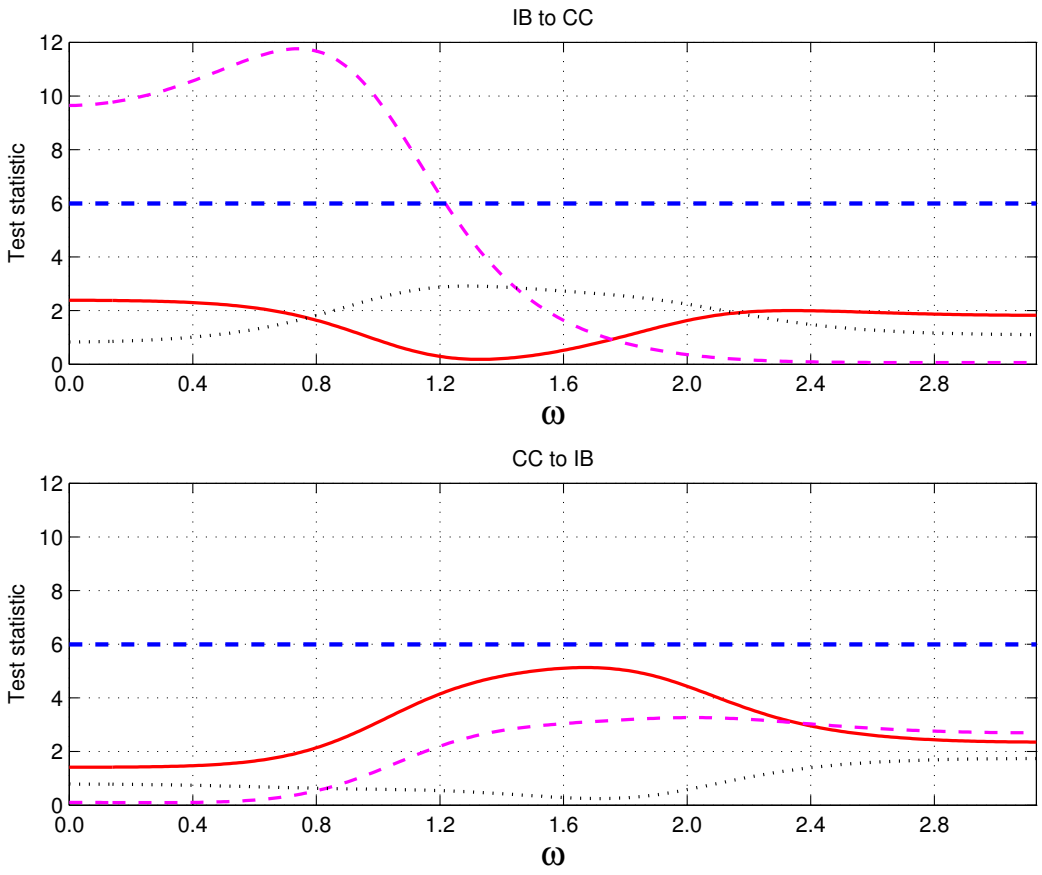

Figure 2: Top panel: Causality tests (IB order flow to CC order flow). Bottom panel: Causality tests (CC order flow to IB order flow). The values of the χ^2 test statistic are given by a solid line. The 5% critical value (5.99) that is given by a horizontal dashed line. The null hypotheses are 1) that interbank order flow does not cause CC order flow at frequency ω (top) and 2) that commercial customers order flow does not cause IB order flow at frequency ω (bottom). The time periods (market regimes) are represented by the following line types: solid (1990-1997), dashed (1998-2001) and dotted (2002-2004).

observations), 1998-2001 (988 observations), and 2002-2004 (738 observations).[4] The top panel of Figure 2 plots the test statistic for the null hypothesis that interbank order flow does not cause CC order flow at frequency ω for each of the three sub-periods. An interesting

[4]They utilized the test for the constancy of the log-likelihood on the same data set and found structural instability in 1998 and 2001.

finding is that the null hypothesis in not rejected in 1990-1997 (solid line) and 2002-2004 (dotted line). Thus, the evidence of passive, liquidity-provision role by the commercial customers is found only in the 1998-2001 period, when $\omega < 1.2$ (i.e., at weekly and lower frequencies). As seen before, the bottom panel of Figure 2 confirms that there exists no causality from the CC to the FD order flow, regardless of the frequency and the sub-period under consideration.

Overall, it can be concluded that commercial customers resort to passive behavior only in the times of financial distress. The excessive fluctuations in financial markets commenced in 1998 and were caused mainly by the economic crisis in emerging markets in Asia, Russian default, and the collapse of Long-Term Capital Management. Additional instability over the 1998-2001 period was caused by the "dot-com bubble" and the events of September 11th, 2001. The most likely explanation for such trading activity is that due to their uncertainty aversion and lack of information about future market prospects in the times of crises, commercial customers become more dependent on the activity of FX dealers who are presumably better informed than non-financial market participants.

5. Conclusions

Excessive price movements in FX markets impose major risks for currency-dealing banks and other financial institutions. This study shows that, due to information asymmetries, price risks for other non-financial market participants at the retail level such as commercial customers can be even more pronounced. The results for the the Canada/U.S. dollar market show that commercial customers behaved like passive, long-run liquidity providers over the 1998-2001 period, while under normal market conditions, their trading activity can not be predicted by the interbank order flow. Furthermore, the trading of non-financial customers appears to have no effect on the interbank level and this conclusion is robust to the choice of frequency and time period.

The frequency-domain analysis presented in this paper complements the FX market microstructure literature and it should be perceived as an empirical extension of the portfolio shifts model. However, in order to truly validate the portfolio shifts model, one must utilize intraday data for dealer-dealer and customer-dealer transactions. Understanding the distinction between active (push) and passive (pull) customers with respect to their time-of-day

activity and trading horizon represents an important future research direction.

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