



# Intraday seasonality in activities of the foreign exchange markets: Evidence from the electronic broking system

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This paper examines intraday patterns of the exchange rate behavior, using the “firm” bid–ask quotes and transactions of USD-JPY and Euro-USD recorded in the electronic broking system of the spot foreign exchange markets. The U-shape of intraday activities (deals and price changes) is confirmed for Tokyo and London participants, but not for New York participants. Activities do not increase toward the end of business hours in the New York market, even on Fridays (ahead of weekend hours of non-trading). Return volatility is found to have intraday patterns similar to those of activities, and volatility and the bid–ask spread is negatively correlated. A negative correlation is observed between the number of deals and the width of bid–ask spread during business hours. It is also found that the concentration of transaction during overlapping business hours between Tokyo and London markets (London and New York markets) may arise from heterogeneous expectations among participants from different regions. *J. Japanese Int. Economies* **20** (4) (2006) 637–664. Faculty of Economics, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-0033 Japan; Faculty of Economics, Toyo University, 5-28-20 Hakusan, Bunkyo-ku, Tokyo, 112-8606 Japan.

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## 1. Introduction

The foreign exchange market remains sleepless. Someone is trading somewhere all the time—24 hours a day, (almost) 7 days a week. Analyzing the behavior of the exchange rate has become a popular sport of international finance researchers, while global financial institutions are investing millions of dollars to build a real-time computer trading scheme. High-frequency, reliable data are the key in finding robust results for researchers or profitable schemes for businesses.

The objective of this paper is to analyze intraday patterns, or seasonality, of market activities—frequency of quote revisions, transaction volumes, volatility, and bid–ask spread—of the dollar/yen and the euro/dollar spot exchange rates using a newly available data of the electronic broking system for the spot foreign exchanges.<sup>1</sup> The intraday seasonality is in itself interesting but it serves as a basis for further theoretical and empirical analysis.<sup>2</sup> Some of our findings will be confirmation of what has been established in the literature with less reliable data, and some results, concerning behavior of the bid–ask spread, are new.

The overwhelming majority of the spot foreign exchanges are now transacted through the global electronic broking systems—the EBS and Reuters D3000. The data, provided by the EBS, consist of global electronic broking bid–ask quotes, lowest given and highest paid transaction prices, and transaction volumes for three years starting January 01, 1999 at the frequency of every one minute.<sup>3</sup> The EBS data set has advantage over the frequently-used, indicative quotes of a foreign exchange market tick-by-tick data set, such as FXFX of Reuters, in at least two important aspects. First, the quotes in the EBS data set are “firm,” in that banks that post quotes are committed to trade at those quoted prices, when they are “hit.”<sup>4</sup> In contrast, the indicative quotes of FXFX screen are those input by dealers for information only, without any commitment for trade. Indicative quotes are much less reliable than firm quotes in capturing the whole picture of market reality. Second, transactions data available in the EBS data set is simply not available in the FXFX screen. Although exact trading volumes are not disclosed, transactions counts (counts of seconds that had at least one transaction) and trade volume shares (a daily percentage share of trading volumes in one minute) are available in the EBS data set.

The contribution of this paper to the literature is three-fold. First, the paper presents a careful description of intraday seasonality (quote revisions, trading volumes, volatility, and bid–ask spread), taking into account time zone and daylight saving time of major markets, and national holidays. Over different GMT hours, quote revision frequency, trading volume, and return volatility are found to move together whereas the spread moves the opposite way, most of the time. Second, the U-shaped pattern of quote revision frequency and trading volume shares is found for both Tokyo and London participants, but no daily U-shaped patterns for New York participants. Effects of overlapping hours on price changes and transaction volumes seem to be large. Third, with regard to the intraday patterns of the bid–ask spread, the following tendencies were estab-

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<sup>1</sup> The EBS notations define the base currency as the first currency in the name of the currency pair. Note that trading in EBS is done in millions of the base currency.

<sup>2</sup> In an earlier paper of ours, Ito and Hashimoto (2004), we have analyzed intraday patterns without data set of trade volume shares, which will be described later. This paper is a much expanded version of our earlier paper with an additional data set. Although most of the contents are absorbed in this paper, this is practically new paper. The earlier paper will remain unpublished.

<sup>3</sup> The data set was provided for fee by the EBS Co., for the use at the University of Tokyo, Graduate School of Economics. The authors are grateful to EBS for such an arrangement.

<sup>4</sup> See Goodhart and O'Hara (1997, p. 78) for general discussions on the difference between the indicative and firm quotes.

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