

# Intraday exchange rate volatility: ARCH, news and seasonality effects

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## Abstract

This paper examines how the calendar seasonality in terms of intraday New Taiwan dollar/U.S. dollar (NTD/USD) exchange rate volatility is impacted by public news arrivals and the unexpected volume shocks. Incorporating counts of Taiwan and the U.S news releases, unexpected volume of trading, and explicit time-of-day seasonality into the framework of GARCH model, we find that the pronounced periodicity of intraday volatility can be partly captured by the augmented model, whereas the spikes of volatility at the market closing and at the opening of the afternoon trading session are not successfully explained by time-of-day factors, public news, unexpected volume of trading, and lagged squared return innovations. © 2006 Board of Trustees of the University of Illinois. All rights reserved.

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## 1. Introduction

The market volatility is related to information releases (Ross, 1989). The use of high-frequency intraday data allows us to examine the link between the variation of intraday volatility and information arrivals during a day. However, to interpret the impact of intraday information arrivals on the volatility, we have to adjust for intraday volatility seasonality to avoid compounded results.

The seasonality of volatility has been found in intradaily and intraweekly returns in the foreign exchange (FX) markets, stock markets, and other exchange traded instruments. A typically U-

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shaped pattern is often observed in intraday volatility,<sup>1</sup> even a doubly U-shaped pattern is found in exchanges where the daily trading schemes are interrupted by a lunch break (e.g., Andersen, Bollerslev, and Cai, 2000; Gau, 2005; Gau & Hua, 2004; Ito & Lin, 1992; Tang & Lui, 2002).

The substantial periodic clustering variation in intraday returns is often explained by the arrival of information. Mitchell and Mulherin (1994) apply daily counts of news reported by Dow Jones on the Broadtape to investigate the link between news arrivals and stock prices. Their results indicate a significant relation between information arrivals and trading volumes, but only a weak link between news counts and stock returns. Berry and Howe (1994) employ the numbers of news headlines crossing the Reuters news screen as the proxy of information arrivals and find a positive relation between news arrivals and trading volume but an insignificant relation with stock return volatility. Moreover, they find that public information arrives seasonally, and it exhibits a distinctively inverted U-shaped pattern across trading days. Low and Muthuswamy (1996), Melvin and Yin (2000), and Chang and Taylor (2003) use the numbers of news reported in Reuters News pages as the information proxy and discuss the link between public information arrivals and exchange rate volatility.

As argued in Andersen and Bollerslev (1998), Ederington and Lee (2001) also point out the inappropriate use of the traditional ARCH-GARCH (i.e., Autoregressive Conditional Heteroskedastic and Generalized Autoregressive Conditional Heteroskedastic; see Bollerslev, 1986; Engle, 1982) models for estimating the intraday periodicity and persistence in the volatility of high-frequency returns. Ederington and Lee (2001) observe that the typically U-shaped pattern of intraday volatility completely disappears after controlling for effects of scheduled macroeconomic announcements. By contrast, Andersen and Bollerslev (1998) and Han, Kling, and Sell (1999) find that public news arrivals cannot explain the intraday periodicity fully, implying that there are some other important factors that affect the periodicity of intraday volatility.

On the other hand, the dealers' liquidity demand and private information could influence the exchange rate volatility as well. As discussed in Flood (1994) and Lyons (1995, 1996, 2001), the hot-potato hypothesis or inventory-control hypothesis implies that dealers in the FX market tend to pass undesired positions along to another, thus giving rise to temporary misallocations of currency inventories. Moreover, as argued in Lyons (2001), order flow is an ideal variable to measure dealers' belief or uncommon-knowledge information. However, due to the unavailability of inventory and order flow data for the New Taiwan dollar/U.S. dollar (NTD/USD) exchange rate, we utilize the unexpected volume of trading as a proxy variable that corresponds to the combined effects of inventory adjustments and uncommon-knowledge information. As new information flows into the market, the expected volume changes in response to common-knowledge information and the unexpected volume reflects the disagreement or uncommon-knowledge information among dealers. If the dealers adjust trading volumes just for inventory control, the trading volume will change even when no new information flows into the FX market and the expected volume remains unchanged. The discrepancy between the actual volume and expected volume of trading therefore can work as a proxy variable for the combined effects of inventory control and private information.

However, to handle the intraday seasonality in high-frequency return volatility, some researchers deseasonalize or filter out the seasonality in the data before analyzing the time-varying and persistent intraday volatility. This two-stage approach is taken by, for example, Andersen and

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<sup>1</sup> For example, Baillie and Bollerslev (1991), Harvey and Huang (1991), Dacorogna, Muller, Nagler, Olsen, and Pictet (1993), Cornett, Schwarz, and Szakmary (1995), Bollerslev and Ghysels (1996), and Andersen and Bollerslev (1998).

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