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Jumps in equilibrium prices and asymmetric news in foreign exchange markets

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ABSTRACT

In this paper we examine the intraday effects of surprises from scheduled macroeconomic announcements and unscheduled event news on six major exchange rate excess returns (jumps) using a Tobit model with conditionally heteroskedastic errors that we extend so as to account for asymmetries. Besides this novel model, our approach embodies several important features: we perform Lee and Mykland's (2012) non-parametric test procedure to filter out microstructure noise from observed exchange rates and extract jumps as the significant "equilibrium" returns; various categories of information news from different geographical regions are exploited; the hypothesis of a leverage effect on foreign exchange jumps due to asymmetric volatility shocks is examined. We found that the most influential scheduled macroeconomic news are globally related to the US job markets, output growth indicators and public debt, whereas significant event news include announcements of bank failures and government rescue plans. Surprises impact Forex jumps for about one third as a result of rather pessimistic forecasts due to the crisis period analyzed. For most of the currencies the hypothesis that negative volatility shocks have a greater impact on volatility than positive shocks of the same magnitude is validated, reflecting markets' concern about the costs implied by central bank's stabilization policies. Our findings provide evidence that the major foreign exchange markets are not efficient.

1. Introduction

Understanding asset price volatility is a crucial goal for traders and portfolio managers involved in asset pricing, portfolio allocation and hedging strategies against portfolio risk. While standard volatility models such as GARCH or stochastic volatility models have been successful to fit the dynamic features of financial return series up to daily frequencies, they have proven inadequate at higher frequencies because of their inconsistency to represent the market microstructure patterns emerging at the intraday level. With the availability of tick-by-tick data, a wide strand of the literature on volatility modeling has pointed at the role of intraday periodic patterns and of macroeconomic news releases in explaining large changes in financial prices. Intraday volatility results from any regular intraday patterns such as openings and closings of financial markets (Andersen and Bollerslev, 1997; Erdemlioglu et al., 2012). As for macroeconomic news effects, Andersen et al. (2003, 2007), Laakkonen (2007), Balduzzi et al. (2001), Evans and Lyons (2005) among others, have shown that surprises on major expected macroeconomic announcements, defined as the discrepancies between analysts' forecasts and ex-post releases of scheduled announcements, appear to be a key factor of price dynamics in financial markets and can generate abnormally large changes in price returns, also called 'jumps'.

The question is to identify which large changes in a price process can be qualified as jumps. Barndorff-Nielsen and Shephard (2004) proposed an asymptotic non-parametric test where they developed a jump robust measure of the daily integrated variance called realized bipower variation. The test statistic is then computed as the relative difference between the realized variance, which is a sum of squared intraday residuals, and the bipower variation. Other authors have emphasized the usefulness of the bipower and multipower variations for detecting jumps (Bollerslev et al., 2009; Huang and Tauchen, 2005). Jiang and Oomen (2008) exploited sample moments of third and higher order returns to identify periods that contain jumps and suggested a test procedure based on the hedging error of a swap variance replication strategy. They showed by simulations that their test is more powerful than the bipower variation test. Lee and Mykland (2008) proposed a non-parametric test using the standardized intraday returns where the robust instantaneous volatility is calculated as the average of realized bipower variation over an appropriately chosen window size. Using Monte Carlo simulations, they have shown that their test outperforms those of Barndorff-Nielsen and Shephard (2004) and Jiang and Oomen (2008) in terms of size and power (see also Fan and Fan, 2011). Boudt et al. (2011) and Lahaye et al. (2011) have improved this test by introducing market intraweek seasonality in the instantaneous price volatility.

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However, all these studies, notwithstanding their importance, have a major drawback: they extract jumps from observed prices without taking into account the presence of market microstructure noise generated by the trading process.[2] Yet, microstructure noise, equal to the difference between observed prices and non-observable efficient prices, can seriously contaminate observed financial prices due to market frictions at the high frequency level. Moreover, large noise may even lead tests to fail to accurately identify the true jumps (Fan and Fan, 2011). Lee and Mykland (2008) showed that their jump test has good power at the 15-min frequency, and that above this frequency a large number of detected jumps are spurious because of the presence of microstructure noise in price data. A number of studies have sought to examine volatility by controlling for noise; see, inter alia, Ait-Sahalia et al. (2012), Bandi and Russell (2006), Hansen and Lunde (2006) and Andersen et al. (2011). These contributions generally assume that the non-observable frictionless efficient price follows a diffusion process and aim at extracting jumps from large changes in this process. Bandi and Russell (2006, 2008) have addressed this issue by showing that optimally-sampled frequency data provide consistent estimates of the variances of the noise and of efficient price process. Other authors have focused on the pre-averaging technique, which consists in averaging observed prices over non-overlapping blocks with an appropriate size to asymptotically remove noise from observed price data (Podolskij and Vetter, 2009; Ait-Sahalia et al., 2012; Lee and Mykland, 2012). Once efficient prices are extracted as a result of the pre-averaging method, nonparametric test procedures are proposed to identify jumps in these frictionless prices.

The connection between foreign exchange jumps – extracted from jump tests – and the scheduled macroeconomic news has been examined extensively in recent decades. Barndorff-Nielsen and Shephard (2006) applied their bipower variation procedure to estimate jumps on USD/DEM and USD/JPY exchange rates data by relating the jump days to those of macroeconomic announcements. Using their intraweek seasonality-augmented non-parametric test, Lahaye et al. (2011) detected the presence of jumps in a variety of financial asset prices (exchange rates, equities and bonds) and, using a Tobit-GARCH model, showed that US macro announcements significantly contribute to explaining jumps and cojumps in financial returns. With regard to foreign exchange rates, Lahaye et al. (2011) identify the non-farm-payroll, federal funds target releases, GDP, consumer confidence and trade balance shocks as being the most influential macroeconomic news. Implementing Andersen et al.'s (2010) jump detection technique, Chatrath et al. (2014) extract jumps and cojumps in four major currencies against the Dollar and report the major role of US news announcements in currency jumps. In short, most papers concerned with the question of the impact of announcement releases on returns report that macroeconomic news exert a significant influence on exchange rate jumps and thereby play a role in the volatility of the Forex market. However, these studies suffer from a substantial limitation with regard to our preceding discussion: in most cases, they identify jumps in observed currency prices and thus ignore the presence of microstructure noise or they do account for it but they set the noise-removing sampling frequency arbitrarily (Lahaye et al., 2011). It follows that extracted jumps may not be equilibrium price jumps or the noise correction may not be complete.

Our paper distinguishes from previous studies primarily on this specific issue. We use the recent non-parametric jump detection test proposed by Lee and Mykland (2012), which allows for asymptotically removing microstructural noise from observed prices by a re-sampling procedure at an appropriate frequency. Our choice is motivated by the fact that (i) the nonparametric approach is robust to model specification as well as to non-stationarity of price processes, which is a crucial feature of financial variables; (ii) it allows for the presence of general dependent noise processes, which is an advantage over alternative jump tests; and (iii) the method is easy to implement. Our approach is innovating in that, to our knowledge, no previous empirical study using high frequency data has ever employed such methods to accurately eliminate noise and detect jumps from efficient prices in order to conduct a news analysis.

Secondly, while literature generally consider surprises on macroeconomic news only, we consider two categories of news interacting with jumps: scheduled macroeconomic announcements and historical event news. Scheduled macroeconomic announcements and their survey forecasts are published by Bloomberg at specific dates of each month. They convey information from various sectors of the economy: output, consumption, employment, housing, inflation, monetary policy, foreign trade. This category of information is accounted for in the form of market surprises, a surprise being defined as the standardized spread between the released value of the announcement and the value of its median survey forecast (Balduzzi et al., 2001). Following Lahaye et al. (2011), we distinguish positive and negative surprises. According to the nature of the announcement, we translate these signed surprises into optimistic and pessimistic expectations in order to examine their potential asymmetric effects on volatility. Historical event news consist in one-time and mostly unexpected shocks extracted from Reuters' and Bloomberg's real time financial news database Factiva. They are unexpected in the sense that, contrary to scheduled macro announcements, they are not regularly monitored and forecasted by financial experts. This category of unexpected one-time news is generally omitted in previous studies where new information takes essentially the form of surprises on scheduled macroeconomic announcements. An exception is, however, Dominguez and Panthaki (2006) who introduce a category of non-fundamental unexpected news that they classify as news related to foreign exchange markets, private sector and politics. By exploiting both surprises on scheduled macro announcements and unexpected event news, we aim at better understanding price changes in foreign exchange markets and contributing to solve the so-called 'news puzzle' (Evans and Lyons, 2008), according to which news effects only account for a small proportion of total exchange rate variation.

Thirdly, our scheduled macroeconomic news are not restricted to the US economy, as it is the case in the majority of previous papers (see, however, Chatrath et al., 2014). Rather, in order to account for the international propagations of national announcement releases, we also consider scheduled macroeconomic news from China, Japan, UK and Eurozone.[3]

Fourthly, a major innovation of our model is to allow for asymmetric volatility shocks, a main feature of financial markets. Following Lahaye et al. (2011), we represent the relation between jumps and news using a Tobit-GARCH class of models (Calzolari and Fiorentini, 1998) that we expand so as to capture potential asymmetry in the GARCH effects. A Tobit model is particularly appropriate for describing financial jump variables whose values are given by abnormal returns or zero otherwise, taking thus the form of censored data. The GARCH specification for the errors is motivated by the fact that since Mandelbrot (1963), financial returns are known to exhibit volatility clustering patterns at daily or higher frequencies. However, financial asset prices are also characterized by the empirically observed fact that negative shocks have a stronger impact on volatility than positive shocks (this is the so-called leverage effect when stock market is considered). In order to account for this asymmetry in the variance, we go further than the previous studies and expand the GARCH process with the more general GJR-GARCH model introduced by Glosten et al. (1993) (this model can be qualified as general since for a zero value of the leverage coefficient – e.g., no asymmetry – it reduces to a standard GARCH). We thus derive the appropriate likelihood and estimate our exchange rate jump model using a Tobit-GJR-GARCH framework

[2] Microstructural noise represent frictions that can distort trading activity such as transaction costs, liquidity shortages, information asymmetry, bid-ask bounces or errors in the measurement of the observed price.

[3] See Appendix 1 for more details.