It's Not Only U.S. News that Matters: International Macroeconomic Announcements and Exchange Rates

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ABSTRACT

This paper analyzes the empirical relationship between international macroeconomic surprises and exchange rates. Analyzing more than 50 key announcements from the U.S., Germany, the Euro-area, Japan, the U.K., and Canada over the period 1996 – 2009, a one-standard-deviation announcement surprise moves exchange rates by more than 25 basis points. Although the focus of prior literature is almost exclusively on U.S. announcements, non-U.S. news is shown to be equally important. Better-than-expected macroeconomic conditions unambiguously lead to an appreciation of the exchange rate, while the response to news about consumer and producer prices and the central bank target rate is less strong. For U.S. announcements, bad news has a greater impact than good news and large surprises have a disproportionately greater impact than small surprises.

Keywords: Exchange rates; macroeconomic announcements; survey data; international financial markets

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1. Introduction

Many papers analyze the impact of macroeconomic data releases on asset prices in general and on exchange rates in particular. Traditionally, researchers try to link exchange rate fluctuations to monthly or quarterly fundamentals. Starting with the classic work of Meese and Rogoff (1983), the results from this line of research are weak. Disappointed with an apparent disconnect, recent studies turn to data at a daily or even higher frequency. The focus of this literature, however, is almost exclusively on U.S. (and sometimes German) news. The potential influence of foreign news is largely ignored, probably because of the unavailability of data for other countries. This, however, implicitly assumes that only U.S. news is important for exchange rates, orthogonal to the insights from fundamental models of exchange rate determination. Engel and Frankel (1984) are among the first to link macroeconomic surprises to exchange rates. They show that greater-than-expected money supply announcements lead to increases in real interest rates and an appreciation of the U.S. dollar. Subsequent work has expanded the number of announcements, but still centers around U.S. news announcements.[1] Four exceptions are Ito and Roley (1987), Clarida and Waldman (2008), Cai, Joo and Zhang (2009), and Rime, Sarno and Sojli (2009), but the focus of these studies is different from this paper. Ito and Roley (1987) use time-series methods and final revised data instead of survey data and initial unrevised data to measure U.S. and Japanese announcement surprises. Clarida and Waldman (2008) analyze only international inflation surprises over the period 2001 – 2005, while Rime, Sarno and Sojli (2009) study the interaction between order flow and macroeconomic variables during a rather short sample period of a year. Cai, Joo and Zhang (2009) examine nine emerging markets using high-frequency data.

This paper provides a detailed empirical characterization of the impact of international macroeconomic news announcements on exchange rates. The impact of more than 50 international macroeconomic key announcements is studied over a daily sample period of 14 year. Data is collected for the U.S., Germany, the Euro-area, the U.K., Japan, and Canada and includes announcements on prices (consumer and producer), international balances (current account and trade balance), real activity (GDP and retail sales), employment (changes in employment and the unemployment rate), monetary policy (the central bank target rate), and surveys (of consumers and purchasing managers). Incorporating both U.S. and non-U.S. macroeconomic announcements makes it possible to explicitly contrast domestic and foreign sources of news for the first time in the empirical exchange rate literature.

[1] The literature is flooded with examples. Andersen, Bollerslev, Diebold and Vega (2003) investigate the influence of U.S. and German news on the U.S. dollar / euro – Deutsche Mark (USD/EUR-DEM) exchange rate, U.S. dollar / British pound (USD/GBP), U.S. dollar / Japanese yen (USD/JPY), and U.S. dollar / Swiss franc (USD/CHF). Faust, Rogers, Wang and Wright (2005) consider the response of USD/DEM and USD/GBP to U.S. announcements. Hardouvelis (1988) considers the effects of U.S. news on USD/DEM, USD/JPY, USD/CHF, USD/GBP, USD/CAD and two non-German European exchange rate pairs (French franc and Italian lira). Ederington and Lee (1993 and 1995) focus on U.S. news and the response of Deutsche Mark futures.

The design of the empirical analysis consists of four parts. First, the approach of ´benchmark studies´ in this area is followed by analyzing the impact of individual announcements in a univariate regression setting for announcement days.[2] Since the sample period is relatively long, stability of the response coefficients might be an issue. The second approach therefore expands previous literature by testing for unknown breakpoints using the framework of Andrews (1993) and, when found, re-estimating the models with the Kalman filter to allow for time-variation in the response coefficients. Third, multi-factor models are estimated which include all announcements from two countries for all days in the sample (i.e. not only announcement days). An automated model selection algorithm is used to search for optimal empirical exchange rate models. Fourth and finally, all macroeconomic announcements from a country are pooled into a single variable to estimate aggregated-news regressions. With these pooled-news variables, the differential impact of good and bad news and large and small surprises on exchange rates is analyzed.

The results are as follows. The release of U.S. and non-U.S. macroeconomic news leads to a significant response in the foreign exchange market and both are of equal importance. Although the previously published dominance of U.S. news for USD/EUR-DEM is confirmed in this paper, the results also show that this pair is an exception. For USD/JPY and USD-GBP, U.S. and non-U.S. is equally important, while Canadian news announcements are more important for USD/CAD. A one-standard-deviation surprise in the most important announcements leads to a change of more than 25 basis points (bp.) in an exchange rate on announcement days. The results are strong in the light of the conclusion of Almeida, Goodhart and Payne (1998) that the impact of news on DEM/USD evaporates during the two hours following the announcement. The magnitude of the response coefficients is also economically meaningful, given that daily exchange rate volatility is between 50 and 70 bp. during the sample period. The U.S. nonfarm payrolls announcement, dubbed 'the king of announcements', is the most market moving release across a broad range of international macroeconomic indicators. A positive one-standard-deviation surprise in the U.S. nonfarm payrolls moves exchange rates by as much as 28 bp. The estimated impact is high compared to the findings of Andersen, Bollerslev, Diebold and Vega (2003) who find a 16 bp. move during the first five minutes after a one-standard-deviation announcement shock in nonfarm payrolls.

Given the relatively long sample period, parameter instability is an issue for some of the announcements. However, when time-varying response coefficient models are estimated using the Kalman filter, general conclusions are not affected. If anything, the impact of the most important

[2] E.g. Ito and Roley (1987), Hardouvelis (1988), Ederington and Lee (1993, 1995), Almeida, Goodhart and Payne (1998), Andersen, Bollerslev, Diebold and Vega (2003), and Ehrmann and Fratzscher (2005).

announcements has increased over time. Neither changing the time of the day at which exchange rates are sampled nor including non-German European indicators changes any of the conclusions.

The results from multi-factor models with all announcements from two countries are in line with those from the univariate announcement-day analyses. The conclusion of previous research that U.S. news dominates non-U.S. news therefore seems premature and strictly confined to EUR/USD. The equal importance of U.S. and non-U.S. news is confirmed when I select optimal models for exchange rate determination with an automated general-to-specific search algorithm. The search routine eliminates statistically-insignificant announcements while using a battery of diagnostic tests to check the validity of each elimination round. Optimal models always contain both U.S. and non-U.S. announcement surprises.

Finally, pooling all macroeconomic announcements from a country into a single variable significantly enhances estimation efficiency, and the aggregate news indicators are significant for every country and every exchange rate pair. Again, Germany is the exception. The aggregated-news regressions strengthen the conclusions that macroeconomic announcements are important in explaining exchange rate movements and that non-U.S. news is of equal importance, except for USD/EUR. Andersen, Bollerslev, Diebold and Vega (2003) and Ehrmann and Fratzscher (2005) document sign (the differential impact of good and bad news) and size effects (the differential impact of large and small surprises) for EUR/USD. I extend these results to an international context and, in contrast to previous literature, test for statistical significance of these effects. I find that exchange rates are in general more responsive to the announcement of bad news and larger surprises emanating from the U.S. These effects are both statistically significant and economically meaningful.

The rest of this paper is organized as follows. Section 2 describes the exchange rates, announcements and expectations data. Section 3 outlines the econometric methodology and Section 4 discusses the estimation results in detail. Section 5 analyzes the effect of aggregate indicators of news for each country, where all news items are pooled into a single announcement variable. This section also investigates the role of asymmetries in the reaction of exchange rates to news by studying sign and size effects. Section 6 concludes. The Appendix describes the general-to-specific model selection algorithm in more detail.

2. Data

2.1 International exchange rate data

Spot exchange rates are collected for USD/EUR-DEM, USD/JPY, USD/GBP and USD/CAD for all trading days during the period January 1, 1996 to December 31, 2009. Related studies document a strong reaction of exchange rates to U.S. news announcements using high-frequency data, but the

impact of news has been shown to diminish quickly after the announcement is made. Almeida, Goodhart and Payne (1998), for example, show that the impact of macroeconomic announcements on exchange rates is only significant until approximately two hours after the release. This points at the reversal of the initial announcement effect, rather than a continuation. The daily frequency used in this paper is thus likely to bias the results downward. Nevertheless, the empirical evidence reported in Sections 4 and 5 is rather strong. Although announcement effects can be measured more precisely using intraday data, daily data is less susceptible to high-frequency noise such as the bid-ask bounce, staleness, price discreteness, and the clustering of quotes.

Exchange rates are measured as foreign currency per U.S. dollar. An increase in the exchange rate thus signals an appreciation of the U.S. dollar and a depreciation of the foreign currency. The foreign exchange market trades around the clock. Following Ehrmann and Fratzscher (2005), I collect prices at 5pm Eastern Standard Time (EST), or New York time, which guarantees that the macroeconomic announcements from the U.S., Germany, Japan, the U.K., and Canada all affect the exchange rates on the same day. The time at which exchange rates are sampled, however, is inconsequential for the results, as Section 4.6 shows. Table 1 shows the summary statistics for changes in log exchange rates.

[Insert Table 1 about here]

Table 1 shows that the U.S. dollar on average depreciated versus the other currencies during the sample period. The standard deviation as well as the differences between minimum and maximum show that USD/JPY is the most volatile and USD/CAD the least volatile pair in the data set. For the yen, 1998 is a remarkable year with interventions by the Bank of Japan, the U.S. Treasury, and the Federal Reserve and a dramatic appreciation from more than 150 to almost 110 yen per U.S. dollar. The low average daily return of USD/EUR-DEM is the result of steady dollar appreciation during the first half and steady dollar depreciation during the second half of the sample. Table 1 furthermore shows that the returns of all exchange rate pairs are non-normal and that there is small, albeit significant, first order serial autocorrelation in USD/EUR-DEM, USD/GBP and USD/CAD log changes.

2.2 International macroeconomic announcement data

Survey expectations and first-issued announcement data is collected from Bloomberg. The combination of survey data and first-issued announcements circumvents well-documented problems with ex-post revisions in macroeconomic data and time-series models to extract expectations. The data

set contains key announcements from the United States, Germany, Japan, the United Kingdom, and Canada.[3]

Previous studies that examine the impact of macroeconomic announcements on exchange rates often use expectations data from Money Markets Services International (MMS), see Hardouvelis (1988), Almeida, Goodhart and Payne (1998), Andersen, Bollerslev, Diebold and Vega (2003), Ehrmann and Fratzscher (2005), and Faust, Rogers, Wang and Wright (2005). MMS, however, only provides survey outcomes for the U.S. and Germany, whereas the added-value of this paper is the analysis of international news announcements. In addition, MMS stopped with the survey in 2002 and it is not clear whether its successor, Action Economics, employs the same methodology (see Brenner, Pasquariello and Subrahmanyam, 2009). This makes Bloomberg a natural choice for a consistent source of global macroeconomic expectations over a long sample period.

The Bloomberg survey is conducted by e-mail and usually starts 7 to 10 days before the release of a macroeconomic statistic. As forecasters submit their predictions, the forecast, the name of the forecaster and the company of the forecaster are visible to all users of the system. This transparent procedure is likely to enforce reputational discipline on survey participants. The survey remains open until 3 days before the release. The short window during which forecasters can submit their forecasts limits the influence that new information might have that is not reflected in the survey. The time between the start and the end of the survey also seems short enough for the survey not to reflect outdated information. The calendar with global economic releases in Bloomberg contains a chronological overview of all upcoming releases with the date and time of the release along with the survey median and prior value of the variable. If a macroeconomic figure is released, the announced value is highlighted in the screen in real-time. If relevant, revisions of prior releases are also given. The single screen with survey consensus and actual release makes it possible for market participants to immediately form an opinion on the surprise element of an announcement and use this in dynamic trading strategies.

The theoretical exchange rate literature distinguishes various categories of fundamentals that affect exchange rates. Announcement data is collected in the categories: prices (consumer and producer), international balances (current account and trade balance), real activity (GDP and retail sales), employment (change in employment and the unemployment rate), monetary policy (the central bank

[3] Germany is generally considered to be the benchmark country in Europe (see Andersen, Bollerslev, Diebold and Vega, 2003; and Ehrmann and Fratzscher, 2005) and German announcements are more timely than announcements for the Euro-area. Nevertheless, Section 4.6.3 studies the impact of non-German European announcements as a robustness check.

target rate) and surveys (of consumers and purchasing managers).[4] Taken together, these variables are likely to cover the most important macroeconomic variables. The survey median, the number of participants in the survey, the day of the announcement and the initial unrevised actual announcement are collected. Series with less than 25 observations are omitted. For the remaining series, all "non-available" entries are checked and observations that are available from either the economic calendar screen or the indicator schedule in Bloomberg are hand-collected. When the frequency in the screen differs from the downloaded data, data at the highest-possible frequency is hand-collected.

Data on the target rate of the central banks deserve special attention. The target rate only moves in discrete steps of 25 or 50 basis points, if it moves at all. The mean of the survey is therefore more informative than the median (see also Ehrmann and Fratzscher, 2005). For Japan, the main operating target was the outstanding balance of current accounts at the Bank of Japan between March 19, 2001 and March 9, 2006. This results in a very short history for the target rate, which is not enough to draw reliable inferences and the Japanese target rate is therefore dropped.

Following the approach of Balduzzi, Elton and Green (2001), the standardized announcement surprise for each variable i in country n on announcement day τ ($S^n_{i,\tau}$) is defined as:

$$S^n_{i,\tau} = \frac{A^n_{i,\tau} - E^n_{i,\tau}}{\hat{\sigma}_{n,i}},$$

where $A^n_{i,\tau}$ is the announced value of indicator i in country n on announcement day τ, where $n = \{US, GE, JP, UK, CA\}$. $E^n_{i,\tau}$ is the Bloomberg survey median for indicator i in country n to be announced on day τ, and $\hat{\sigma}_{n,i}$ is the sample standard deviation of $A^n_{i,\tau} - E^n_{i,\tau}$. Dividing by the sample standard deviation of announcement surprises makes the surprises comparable, as the original series have different units of measurement. This transformation, however, is otherwise innocuous, as it does not affect levels of significance or the fit of the regressions in the remainder of this paper.

Table 2 provides details on the dates of the first and the last observation, the number of observations and the number of forecasters for each indicator.

[Insert Table 2 about here]

[4] Following the convention in the literature, month-over-month variables are taken (see Almeida, Goodhart and Payne, 1998 and Ehrmann and Fratzscher, 2005). For Japan, CPI and retail trade are only available as year-over-year figures.

The number of observations varies between 40 for some of the quarterly announcements to almost 160 for the monthly series. The coverage in terms of the number of forecasters is higher for U.S. variables, where the median number of forecasters over time exceeds 65 for the most important variables. For other countries, the number of contributing forecasters is around 20 to 30.

In unreported analyses, the Bloomberg survey data is subjected to several quality tests. These show that the international expectations data from Bloomberg always contains significant information about the actual announcements. Furthermore, the regression-based framework of Mincer and Zarnowitz (1969) for unbiasedness shows that the results are comparable to previously reported tests for MMS data. Finally, if information about upcoming releases is leaked prior to the announcement in some countries, forecasts may be less accurate. There are, however, no obvious differences in the accuracy of Bloomberg survey expectations across countries. In addition, tests are run to check whether variables with a higher number of contributing participants in the survey are more accurate. The mean absolute standardized announcement surprises for each variable in each country are regressed on a constant and the median number of contributing forecasters over time (the last column of Table 2). The association is negative (i.e. more contributing forecasters reduce the prediction error), but not significant. This makes it statistically unlikely that variation in the response coefficients across variables and countries is driven by differences in the number of survey participants. The full results from these analyses are available upon request.

3. Methodology

3.1 Univariate analysis: announcement days

This section first follows the set-up of prior 'benchmark studies' in this area before allowing for time variation in the response coefficients and selecting optimal models with an automated search algorithm:

$$\Delta(\ln e_\tau) = \alpha_i^n + \beta_i^n S_{i,\tau}^n + \varepsilon_\tau, \qquad (1)$$

where $\Delta(\ln e_\tau)$ is the change in the log exchange rate on announcement day τ multiplied by 100, $S_{i,\tau}^n$ is the standardized macroeconomic surprise of variable i in country n on announcement day τ as described in Section 2.2 and ε_τ is the error term. Since the exchange rate is measured as foreign currency per U.S. dollar, a positive coefficient corresponds to dollar appreciation and foreign currency depreciation.

3.2 Time-varying announcement response model

Given the relatively long sample period, parameter instability is a potential concern in equation (1). The sample period is characterized by recessions in several countries, the 1998-swing in USD/JPY as described before, the introduction of the euro, the terrorist attacks of September 2001, and the credit crisis. It may therefore not be reasonable to assume that the exchange rate response to news is time-invariant. Recent empirical evidence indeed suggests that response coefficients may depend on news content, the business cycle, or a combination of both (see for example Andersen, Bollerslev, Diebold and Vega, 2003; and Ehrmann and Fratzscher, 2005). Moreover, Andersen, Bollerslev, Diebold and Vega (2003) explicitly suggest the issue of parameter stability as a direction for future research.

To test for unknown structural breaks in the response coefficient, the *SupF*-test developed by Andrews (1993) is employed. The test works as follows. Let the sample run from $t = 1$ to $t = T$. At each point in time between dates $t = m$ and $t = n$, a Chow (1960) breakpoint test is employed to test the null of no structural change in the response coefficient. The *SupF*-test is the maximum of the individual Chow F-tests: $SupF = \max_{m \le i \le n}\left(ChowF\left(t = i\right)\right)$ for which Hansen (1997) develops approximate asymptotic p-values. Since the test statistic becomes degenerate towards the beginning and the end of the sample, the first and last 15% of the sample are excluded as Andrews (1993) suggests.[5]

For some of the announcements, the breakpoint test rejects the null hypothesis of parameter stability. This calls for a framework that accommodates time-variation in the announcement effects. Since many of the events during the sample came abruptly, rolling-window regressions are ill-suited since these assume that parameters are fixed within the window. Furthermore, the initial observations are lost to arrive at the first estimate. For these reasons the Kalman filter is used and the benchmark specification in equation (1) is modified to allow for time-variation in the response coefficients (leaving subscripts *i* and *n* out):

$$\Delta\left(\ln e_\tau\right) = \alpha_\tau + \beta_\tau S_\tau + \varepsilon_\tau \qquad \varepsilon_\tau \sim NID\left(0, \sigma_\varepsilon^2\right) \tag{2}$$

$$\alpha_{\tau+1} = \alpha_\tau \tag{3}$$

$$\beta_{\tau+1} = \beta_\tau + \eta_{\tau+1}, \qquad \eta_\tau \sim NID\left(0, \sigma_\eta^2\right) \tag{4}$$

[5] As a robustness check, Andrews' (1993) *AveF* and *ExpF* statistics are also used, which are the average and an exponential transformation of the individual Chow F-statistics, respectively: $AveF = \frac{1}{n-m+1}\sum_{t=m}^{n} ChowF\left(t = i\right)$ and $ExpF = \ln\left(\frac{1}{n-m+1}\sum_{t=m}^{n}\exp\left(\frac{1}{2}ChowF\left(t = i\right)\right)\right)$. Since the conclusions are very similar, only the results for the *SupF* test are reported in the remainder.

The hyper parameters σ_ε^2 and σ_η^2 of the model are estimated by maximum likelihood. To calculate the Kalman recursions for the parameters, information from the full sample is used (i.e. the Kalman smoother).[6] The model in equations (2) – (4) is known as the random walk model (see Harvey, 1993). The system is in state space form, where equation (2) is the measurement equation and equations (3) and (4) are the transition equations. Note that since the error in the transition equation for the constant is zero, the constant is time-invariant in this model.

3.3 Multi-factor analysis: all days in the sample

In addition to the univariate analysis on announcement days, multi-factor models with all announcements from the U.S. and country n for all days in the sample (i.e., both announcement and non-announcement days) are estimated:

$$\Delta\left(\ln e_t^{USD,n}\right) = \alpha + \sum_{k=1}^{K} \gamma_k \Delta\left(\ln e_{t-k}^{USD,n}\right) + \sum_{d=1}^{4} \delta_d Dum_{d,t} + \sum_{i=1}^{11} \beta_i^{US} S_{i,t}^{US} + \sum_{j=1}^{J} \beta_j^{n} S_{j,t}^{n} + \varepsilon_t, \qquad (5)$$

where $\Delta\left(\ln e_t^{USD,n}\right)$ is the change in the log exchange rate of foreign currency $n = \{EUR, JPY, GBP, CAD\}$ per USD on day t multiplied by 100, and $Dum_{d,t}$ are dummy variables for the days of the week (Monday through Thursday) to differentiate between the impact of announcements and their regular scheduling. For example, a Friday dummy would separate the impact of U.S. nonfarm payrolls announcements from a potential Friday-effect, since the nonfarm payrolls number is usually released on Friday. $S_{i,t}^{US}$ is U.S. standardized macroeconomic surprise i on day t, $S_{j,t}^{n}$ is standardized macroeconomic surprise j in country n on day t and ε_t is the error term. The specification in equation (5) is the general unrestricted model (GUM), since it includes all variables from both countries. Note that subscript t is used for calendar days and subscript τ in equations (1) and (2) for announcement days. The general unrestricted model is estimated with OLS, but using the weighted-least squares approach used in Andersen, Bollerslev, Diebold and Vega (2003) and Ehrmann and Fratzscher (2005) instead does not affect the results materially. These results are therefore not reported.

The ultimate question that equation (5) tries to answer is which international announcements significantly affect exchange rates. Although the general unrestricted model is likely to capture the basic dynamics of the data, the dimensions can potentially be reduced by eliminating statistically insignificant variables. To avoid ad-hoc modeling choices, an automated general-to-specific model

[6] The Kalman smoother parameters are estimated with SsfPack 3.30 in Ox 5.00, see Koopman, Shephard and Doornik (1999).

selection algorithm is employed. The specification in this paper builds on the work of Hoover and Perez (1999, 2004) and Krolzig and Hendry (2001). The procedure does not only select the relevant macroeconomic announcements, but also the lags of the dependent variable and the day-of-the-week dummies. In each round, statistically insignificant variables are removed from the model while a battery of diagnostic checks is run to assure that the model remains well-specified. The Appendix describes the algorithm in more detail.

Although the selection procedure is relatively objective, transparent and structured, a potential criticism is that it is prone to data mining. Hoover and Perez (1999, 2004) and Krolzig and Hendry (2001) conduct Monte Carlo experiments to study the properties of the automated general-to-specific approach. They show that the procedure is very accurate in recovering the true data-generating process. Furthermore, empirical size and power are close to what would be expected if the true data generating process was known (Krolzig and Hendry, 2001). Overall, these studies favor the general-to-specific approach over alternative model selection procedures. The approach therefore seems useful in the present context of optimal model selection for exchange rates. This is confirmed in the empirical section, since the conclusions based on the final multi-factor models reinforce the results from both the univariate analyses for announcement days and the multi-factor general unrestricted model estimates with all days and all announcements.

4. The impact of macroeconomic fundamentals on exchange rates

Before discussing the results of each currency pair, this section first provides a general overview of the importance of international macroeconomic announcements and the relative importance of U.S. and non-U.S. news.

The four general unrestricted models for USD/EUR, USD/JPY, USD/GBP, and USD/CAD are estimated using equation (5) and the absolute response coefficients from these morels are ranked. The models contain all days in the sample. Figure 1 graphically displays the 15 international macroeconomic announcements with the highest absolute impact on exchange rates.

[Insert Figure 1 about here]

Figure 1 shows that a one-standard-deviation announcement surprise in the most important international macroeconomic announcements moves exchange rates between 13 and 27 bp. This is substantial compared to the daily volatility in spot exchange rates of 50 to 70 bp. per day. Eleven of the 15 most important international announcements originate from the United States. Among these U.S. indicators, nonfarm payrolls and Fed target rate announcements are the most important indicators. Together, these announcements enter the top-15 five times: the Fed target rate twice and the

U.S. nonfarm payrolls three times. The U.S. nonfarm payrolls release is the only variable that is significant for all currency pairs in either the announcement-day or the all-day regression. Almeida, Goodhart and Payne (1998) and Andersen, Bollerslev, Diebold and Vega (2003) show the importance of the nonfarm payrolls release for USD/EUR-DEM.

Most of the U.S. announcements are from the USD/EUR model (nonfarm payrolls, GDP, Fed funds target rate, ISM manufacturing, and the unemployment rate). Other important indicators are Canadian retail sales announcements, Canadian net change in employment, Bank of Canada rate announcements, and U.K. Bank of England target rate announcements. There are no Japanese or German announcements among the most influential macroeconomic releases. This does, however, not necessarily mean that announcements from these countries are on average unimportant and it is interesting to consider the average impact of all announcements from a country. Figure 2 graphically summarizes the impact of all surprises per country by averaging the absolute coefficients of the general unrestricted model. In formula form, Figure 2 shows $\frac{1}{11}\sum_{i=1}^{11}\left|\beta_i^{US}\right|$ and $\frac{1}{J}\sum_{j=1}^{J}\left|\beta_j^{n}\right|$ from equation (5) for each country n. This provides insight into how the average impact of the U.S. announcements compares to the average impact of the non-U.S. announcements for each exchange rate USD/EUR, USD/JPY, USD/GBP, and USD/CAD.

[Insert Figure 2 about here]

Figure 2 shows that the importance of U.S. and non-U.S. variables varies substantially per currency pair. For USD/EUR-DEM, news emanating from the U.S. is more important than news from Germany. A one-standard-deviation surprise in a typical U.S. variable leads to a change of 13 bp. in the log exchange rate. A surprise of similar magnitude from Germany only leads to a 4 bp. change in the exchange rate. This corroborates the evidence of Andersen, Bollerslev, Diebold and Vega (2003) and Ehrmann and Fratzscher (2005). Interestingly, the dominance of U.S. announcements is not confirmed for the other exchange rate pairs. For USD/JPY and USD/GBP a one-standard-deviation surprise moves the exchange rate with 8 to 10 bp. and U.S. and non-U.S. news is equally important. For USD/CAD, Canadian news is more important than U.S. news: an impact of 8 versus 12 bp. on average.

The next paragraphs provide a discussion of the estimation results for the univariate announcement-day regressions of equation (1) and the final multi-factor models for all days in the sample that follow from eliminating insignificant variables from equation (5).

4.1 USD/EUR-DEM

Most of the empirical literature focuses on USD/DEM-EUR, which is therefore a natural starting point for the analyses. Table 3 shows the univariate impact of U.S. and German announcements on USD/EUR-DEM on announcement days and the final specification using all days in the sample (multi-factor).

[Insert Table 3 about here]

Consistent with the evidence in the previous paragraph, Table 3 further illustrates the greater importance of U.S. news for USD/EUR than German news. Eight of the U.S. announcements are significant in the announcement-day model versus only two German announcements. This corroborates the results of Almeida, Goodhart and Payne (1998), Andersen, Bollerslev, Diebold and Vega (2003) and Ehrmann and Fratzscher (2005). A likelihood ratio test (not shown) in the general unrestricted model to test redundancy of all U.S. announcements jointly is rejected (test statistic of 82.3 with a p-value of less than 0.001). For German news announcements, redundancy cannot be rejected (likelihood ratio test value of 9.0 and a p-value of 0.53).

The theoretical impact of indicators that measure real economic developments is a priori unclear. There are at least three alternative mechanisms through which domestic economic developments can influence exchange rates. If high domestic growth is expected to lead to increased demand for foreign goods, the exchange rate is likely to depreciate. On the other hand, if increased domestic growth leads to increased capital inflow and foreign investment, the currency should appreciate. Finally, if higher economic growth leads to anticipated policy rate increases by the monetary authorities, this is likely to lead to an appreciation of the currency.

The empirical results in Table 3 unambiguously shows that better-than-expected economic developments lead to an appreciation of the exchange rate. This holds both for U.S. and German announcements, but the effects are much stronger for U.S. news. For U.S. announcements, Chicago purchasing managers, ISM manufacturing, the change in nonfarm payrolls, the unemployment rate, the trade balance, and GDP are significant at the 5%-level at least. The release of the U.S. nonfarm payrolls is the most important news release: a positive one-standard-deviation surprise leads to a 28 bp. appreciation of the dollar versus the euro. For Germany, the announcements of the IFO business confidence indicator and the unemployment rate are significant, but the impact is clearly less than for the U.S. variables. Macroeconomic announcements explain up to 14% of the exchange rate variation on announcement days (nonfarm payrolls).

Theory about the link between consumer and producer prices and exchange rates is also ambiguous. Purchasing power parity (PPP) implies that an increase in prices is followed by a depreciation of the nominal exchange rate. On the other hand, if market participants believe that an increase in inflation will be met by monetary policy tightening, the exchange rate is most likely to appreciate. The effect of prices on exchange rates is therefore ultimately an empirical question. A recent paper by Clarida and Waldman (2008) shows that announcements of higher-than-expected inflation lead to an appreciation of the currency over the period 2001 – 2005. This contradicts what would be expected from PPP. The conclusion from the empirical evidence in Table 3 is not clear-cut. Unexpected increases in U.S. producer prices lead to a significant depreciation of the dollar of 12 bp., consistent with PPP. Consumer price increases, however, lead to an appreciation of the USD, but not significantly. For Germany, unexpected increases in consumer prices lead to euro appreciation, inconsistent with PPP and in line with the reaction function hypothesis. Higher consumer prices lead to a depreciation of the euro, but both CPI and PPI are not significantly different from zero. Although the reaction of the USD/EUR exchange rate to news about prices is somewhat of a conundrum, this is not uncommon in the empirical exchange rate literature (see for example Almeida, Goodhart and Payne, 1998).

Moving to monetary policy shocks, Table 3 suggests that positive monetary policy shocks (i.e. monetary tightening) in the U.S. lead to an appreciation of the U.S. dollar. This is consistent with interest rate parity and portfolio balance arguments. ECB and Bundesbank tightening announcements, on the other hand, have only a minor effect on the exchange rate during the sample period. Ehrmann and Fratzscher (2005) also document the higher impact of Fed announcements on USD/EUR.

The results from the automated model selection procedure are shown in the right panel of the table. The number of announcement days in the general unrestricted model is a substantial 1498 (out of 3653 observations in the sample). The estimates for the announcement-day model and the final multi-factor model with all days are consistent with each other. None of the signs of the indicators change, but the announcements of the U.S. Chicago Purchasing Managers index and the German IFO business climate indicator are not selected in the final model. In addition to the macroeconomic variables, the model selects a dummy variable for Monday. The general F-test for significance of all regressors is significant at the 1%-level, but the 2.4% R-squared of the model is fairly low. This is what one would expect: announcements occur relatively infrequently (once a month for most indicators). When moving from the model with announcement days in the left panel to the model with all days (i.e. both announcement and non-announcement days), the explanatory power is therefore likely to deteriorate. Standard errors are corrected for heteroskedasticity using the procedure of White (1980) and misspecification tests do not signal any serious issues.

The overall conclusion is that the USD/EUR-DEM exchange rate reacts significantly to news announcements and that U.S. announcements are more important than German announcements. Improvements in economic conditions lead to an appreciation of the exchange rate and the information from the unemployment report has the biggest impact on the exchange rate. This confirms the importance of the employment report as the key indicator of U.S. economic performance in financial markets. The general conclusions from this section confirm previous studies that use MMS expectations data (see Almeida, Goodhart and Payne, 1998; Andersen, Bollerslev, Diebold and Vega, 2003; and Ehrmann and Fratzscher, 2005).

4.2 USD/JPY

Ito and Roley (1987) investigate the impact of macroeconomic announcements on the USD/JPY exchange rate over the period 1980 – 1985. They find only a minor influence of U.S. macroeconomic releases on the exchange rate and no influence of Japanese announcements. Cai, Cheung, Lee and Melvin (2001) study the causes of the dramatic 1998 swing in USD/JPY. The surprise intervention in June 1998 led the yen to appreciate substantially after a period of steady depreciation. They find that order flow is likely to be the dominant factor for the sharp increase in volatility, while shifting fundamentals also played a role. Finally, Hashimoto and Ito (2010) examine the impact of Japanese announcements on USD/JPY using high-frequency data. For the 13 variables they study, only GDP and the Tankan survey release significantly affect the USD/JPY exchange rate. Table 4 shows the estimation results for the mean return equations (1) for announcement days and (5) for all days.

[Insert Table 4 about here]

A likelihood ratio test for redundancy of all U.S. announcements (not shown) in the general unrestricted model is strongly rejected (test statistic of 32.6, p-value less than 0.001). For Japan, on the other hand, join redundancy cannot be rejected (test statistics of 10.2, p-value: 0.33). None of the individual Japanese announcements is significantly different from zero versus four U.S. announcements. The final multi-factor model, selected using the automated general-to-specific algorithm, looks very similar to the univariate announcement-day models. The only exception is the U.S. Chicago Purchasing Manager announcement, which is significant at the 10% level in the multi-factor model.

Positive news about real economic developments leads, on average, to an appreciation of the currency. U.S. nonfarm payrolls, unemployment rate and retail sales announcements are significantly different from zero. Both positive producer and consumer price announcements in the U.S. lead to an appreciation of the U.S. dollar, whereas the positive announcement of Japanese consumer price news leads to a depreciation of the U.S. dollar (and hence an appreciation of the yen). These results are

consistent with the view of market participants that the monetary authorities increase interest rates in response to higher inflation. Parameter estimates are, however, are only significantly different from zero for U.S. CPI (at the 5% level). Although unexpected monetary tightening in the U.S. (that is, Federal funds target rate increases) leads on average to an appreciation of the dollar, this effect is not statistically significant. For Japan, information on the target rate is lacking because of reasons mentioned in Section 2.2.

Starting with the general unrestricted regression model (with 1360 announcement days out of 3653 observations), the automated model selection algorithm includes five U.S. and no Japanese announcements in the final model specification. There are no signs of autocorrelation or heteroskedasticity in model residuals. The Chow (1960) breakpoint test, however, rejects the null of no structural break in the middle of the sample period. Section 4.6.2 therefore analyzes the stability of the parameters and estimates time-varying response models. The final F-test shows that the resulting multi-factor model is a valid reduction of the GUM. Using a new dataset and a new approach, these estimates confirm the early evidence of Ito and Roley (1987) and the recent high-frequency evidence of Hashimoto and Ito (2010).

4.3 USD/GBP

Table 5 shows the estimation results of equations (1) and (5) for USD/GBP log changes.

[Insert Table 5 about here]

Testing whether news from either country is redundant in the general unrestricted model (not shown), is rejected for both the U.S. and the United Kingdom. The likelihood ratio statistic has a value of 63.3 for the U.S. (p-value less than 0.001) and 34.1 for the U.K. (p-value less than 0.001). Consistent with the previous results, better-than-expected announcements concerning the real economy lead to an appreciation of the respective currencies. For the U.S., a positive (negative) one-standard-deviation surprise in ISM manufacturing, nonfarm payrolls, trade balance, and retail sales (unemployment rate) lead to a significant appreciation of the dollar versus the pound of 11 to 22 bp. Unexpected increases of a similar magnitude in U.K. retail sales lead to an appreciation of the pound of 12 bp. The explanatory power of the announcement-day model is as high as 16% for the U.S. nonfarm payrolls release.

With respect to announcements of consumer and producer prices, U.S. and U.K. PPI releases are significantly different from zero. Increases in prices lead, on average, to a depreciation of the dollar for U.S. announcements, but to an appreciation of the pound for U.K. announcements. An unexpected increase in U.S. (U.K.) producer prices leads to an appreciation of 7 (9) bp. of the GBP. The effect for

the U.K. is consistent with the reaction function of the central bank; in response to increasing inflation, interest rates are raised which leads to an appreciation of the pound. The response coefficient to changes in the BoE target rate confirms this hypothesis: monetary policy tightening leads to a significant appreciation of the pound (effect of 19 bp.). The response to unexpected moves in the Fed funds target rate, on the other hand, are not significantly different from zero.

The final multi-factor model is very similar to the univariate announcement-day estimates. The signs of the selected variables are the same, but U.K. GDP announcements are now also significant (at the 10% level). There is heteroskedasticity in the residuals of the final model and standard errors are therefore corrected using the procedure of White (1980). The final multi-factor model is a valid reduction of the general unrestricted model and the Chow (1960) breakpoint test does not signal evidence of instability.

4.4 USD/CAD

The results for USD/CAD are given in Table 6. A likelihood ratio test in the general unrestricted model (not shown) for the redundancy of all U.S. (Canadian) news surprises is rejected with a test value of 41.1 (70.7) and an associated p-value of less than 0.001 for either country.

[Insert Table 6 about here]

It is again primarily news on developments in the real economy that affects the USD/CAD exchange rate. The influence of monetary policy surprises and especially consumer and producer prices announcements are much weaker. Furthermore, Canadian macroeconomic surprises have a bigger impact on the exchange rate than announcements from the U.S., which is consistent with the summary in Figure 2.

Consistent with the results from the previous paragraphs, positive real news from the U.S. leads, on average, to an appreciation of the U.S. dollar. Positive Canadian news, on the other hand, leads to a depreciation of the U.S. dollar, on average. For the U.S., current account announcements are significantly different from zero and for Canada, the purchasing managers index, the unemployment rate, change in employment, the trade balance and retail sales less autos are significant. Apart from statistical significance, the highest absolute coefficients are in excess of 0.25, indicating that a one-standard-deviation macroeconomic surprise moves the USD/CAD exchange rate by more than 25 bp. This is economically meaningful given that the USD/CAD daily standard deviation is 50 bp. The explanatory power for the univariate regressions is around 15 percent for the most important variables.

The impact of releases of U.S. price news is less strong than the impact of the economic variables. Releases of U.S. producer and consumer are not statistically significant. The release of Canadian consumer price news is negative and significant. This is consistent with the Bank of Canada raising interest rates in response of higher inflation, which in turn leads to an appreciation of the Canadian dollar. Unexpected monetary tightening indeed leads to an appreciation of the respective currencies in the U.S. and Canada. The response coefficient, however, is only significant for U.S. Fed announcements.

Moving from the estimates for announcement days to the all-days estimates, none of the signs of the significant variables change. Furthermore, most of the variables that are significant on announcement days are selected in the final multi-factor model. Compared to the univariate announcement-day results, the final model adds the U.S. nonfarm payrolls announcement while the Canadian purchasing managers announcement is dropped. In addition to the announcement variables, the Monday dummy is significant. There is evidence of significant autocorrelation and heteroskedasticity in the residuals. Adding more lags to the general unrestricted model does not change this. Standard errors are therefore corrected for heteroskedasticity and autocorrelation using the approach of Newey and West (1987). The F-test indicates that the selected final multi-factor model is a valid reduction of the general unrestricted model. The Wald test, however, shows that a structural break in the middle of the sample cannot be rejected.

4.5 General conclusions

There are some general conclusions from Tables 3 through 6.

First and foremost, although the dominance of U.S. news announcements over German announcements is confirmed for USD/EUR, the results are very different for USD/JPY, USD/GBP, and USD/CAD. Overall, non-U.S. news is of similar importance. This suggests that it is important to also include non-U.S. news announcements in fundamental exchange rate models.

Second, macroeconomic announcements are not only statistically significant, but also economically important. A surprise of one standard deviation leads to a change of more than 25 bp. in the foreign exchange market for the most important announcements. This is sizable compared to previously reported results (cf. Andersen, Bollerslev, Diebold and Vega, 2003). The R-squared of the announcement-day regressions is as high as 15 percent.

Third, releases of variables related to real economic news are more important than news about consumer or producer prices and central bank target rate announcements. The results are unambiguous: better-than-expected real economic developments lead to an appreciation of the

currency. This result holds for U.S. and non-U.S. news announcements. The U.S. nonfarm payrolls release is the only variable that is significant for all exchange rate pairs, confirming the previously documented importance for USD/EUR-DEM. The conclusions for price developments and monetary policy announcements are less clear-cut. Monetary tightening tends to lead to currency appreciation. But similar to price information, the empirical evidence is not as strong as for announcements concerning the real economy.

4.6 Robustness

To assess the robustness of the results from the previous sections, three robustness checks are performed. First, the sensitivity to the time of the day at which exchange rates are sampled (5pm EST) is analyzed. Second, parameter instability is considered. Third and finally, the impact of non-German, European news on USD/EUR is examined.

4.6.1 Time of the day

The foreign exchange market trades around the clock and prices are sampled at the end of the New York trading day in this paper (5pm EST). To examine the robustness of the results, the analyses reported in Tables 3-6 are redone with data sampled at the WMR fixing, which is at 4pm London time. Since the results are very similar and the conclusions not affected, these analyses are not reported (but available upon request).

4.6.2 Time-varying parameter estimates

The sample period is characterized by several shocks that may affect how exchange rates respond to macroeconomic surprises over time. Table 7 therefore reports the Andrews (1993) *SupF* breakpoint test for constancy of the response coefficient in equation (1).

[Insert Table 7 about here]

For most announcements and exchange rates, the null of a constant response coefficient over time is not rejected. There are some exceptions, however. Out of the 82 estimated parameters, 16 do not pass the Andrews (1993) *SupF*-test. To assess the robustness of the results from the previous paragraphs, Figure 3 shows the response coefficients and associated 90% confidence bounds obtained from the Kalman filter model with time-varying parameters from equations (2) – (4). The figure plots the response coefficients for the announcements for which parameter constancy is rejected in Table 7.

[Insert Figure 3 about here]

Three interesting observations can be made from Figure 3. First, there is the category of variables for which the time-invariant impact is significant in Tables 3 to 6. For these variables, the impact seems to have strengthened, rather than diminished, over time. This is the case for the U.S. nonfarm payrolls announcement for USD/JPY, BoE target rate announcements for USD/GBP, Fed funds announcements for USD/CAD and Canadian unemployment announcements for USD/CAD. This reduces the potential concern that the significance of these variables is driven by a handful of outliers or a particular time period. Second, there is the category of variables that are not significant on average over the full sample. The estimates of the time-varying parameter model show that these variables are typically also not significant at any particular point in time. Third, the impact of some variables has increased over time, although the full-sample estimates are not significant. Examples are the announcement of Japanese retail trade and jobless rate figures, U.S. GDP announcements for USD/GBP, Fed funds announcements for USD/GBP, U.S. Chicago purchasing manager announcements for USD/CAD and Canadian consumer price announcements. In conclusion, the time-varying parameter estimates do not raise concerns about the robustness of the results found so far. If anything, the importance of significant announcements has increased and several insignificant announcements are gaining strength towards the end of the sample.

4.6.3 Non-German Euro-area announcements

Although Germany is arguably the leading economy in the EMU, it is only one of member states. To rule out that the (un)importance of European news announcements is driven by the use of only German data, I re-estimate the models with six Euro-area announcements. Table 8 shows the parameter estimates for preliminary real GDP, retail sales, industrial production, CPI, PPI, and unemployment. Data is from Eurostat and is collected from Bloomberg in a similar manner as described in Section 2.2.

[Insert Table 8 about here]

Table 8 shows that broadening the definition from German to Euro-area news does not affect any of the conclusions. The only Euro-area announcement with a significant impact on the USD/EUR exchange rate is the unemployment rate. This is consistent with the conclusion from Table 3 with German announcements, where the unemployment rate is one of the few significant variables. The parameter estimates are also comparable: a one-standard-deviation shock in the Euro-area unemployment rate moves USD/EUR by 14 bp. versus 11 bp. for the German unemployment rate. Testing for redundancy of all U.S. announcements in the general unrestricted model (not shown) is strongly rejected with a test statistic of 82.2 and a p-value of less than 0.001. For the Euro-area variables the null of redundancy cannot be rejected: test-value of 8.1 and associated p-value of 0.23. In

conclusion, analyzing non-German Euro-area news does not affect the conclusion that U.S. news is more important for the USD/EUR-DEM exchange rate.

5. Aggregate macroeconomic news indicators and asymmetric responses to news

Andersen, Bollerslev, Diebold and Vega (2003), and Ehrmann and Fratzscher (2005) document asymmetries in the response of the USD/EUR-DEM exchange rate to news. Andersen, Bollerslev, Diebold and Vega (2003) show that bad news has a greater impact than good news. Ehrmann and Fratzscher (2005) confirm the stronger response to bad news, especially for Germany, and find in addition that larger surprises have a greater impact for Germany. Both studies, however, do not test whether the effects are statically significantly different. The set of four exchange rate pairs considered in this paper allows for testing the importance of size and sign effects in an international context.

To increase the number of observations, the approach of Ehrmann and Fratzscher (2005) is taken to construct aggregate indicators of news for each country n, I^n. If there is good news emanating from country n on day t the indicator takes a value of one ($I_t^n = 1$). For bad news, the indicator takes a value of minus one ($I_t^n = -1$) and a value of zero otherwise ($I_t^n = 0$). Good and bad news are defined based on the estimated responses of the currency in the general unrestricted model (5) using domestic news for each country. To be more specific, the release of a higher-than-expected U.S. nonfarm payrolls figure leads, on average, to an appreciation of the U.S. dollar versus the euro-Deutsche Mark. Hence, the dummy takes a value of one on days when the nonfarm payrolls release is higher than expected (i.e. good news for the dollar, bad news for the euro).[7] The model with the two aggregate indicator functions is:

$$\Delta\left(\ln e_t^{USD,n}\right) = \alpha + \gamma\Delta\left(\ln e_{t-1}^{USD,n}\right) + \sum_{l=1}^{4}\delta_l Dum_l + \beta^{US} I_t^{US} + \beta^n I_t^n + \varepsilon_t , \qquad (6)$$

where all variables are as defined before, the lag length is fixed at one and all day-of-the-week dummies are included. The drawback of this formulation is, of course, that the ability to differentiate between the various variables as in equation (5) is lost. The benefit of this specification, on the other hand, is an increase in estimation efficiency because by pooling all macroeconomic variables the number of observations increases substantially. Equality of aggregate U.S. and non-U.S. news is tested with a Wald F-test: $H_0 : \beta^{US} + \beta^n = 0$.

[7] Note that the composite indicator for the U.S. may differ for each exchange rate pair as the signs of the coefficients in the general unrestricted model may differ for each exchange rate pair. If there is both good and bad news announced on the same day this is coded as a no-news day.

Table 9, Panel A reports the results for all exchange rate pairs, where estimation results for the constant and the dummies are omitted.

[Insert Table 9 about here]

Panel A shows the response coefficients for the aggregate news indicators. Pooling all macroeconomic announcements into a single aggregate news indicator indeed strongly improves estimation efficiency. With the exception of Germany, news from all countries is now significant. This shows that although announcements may not be individually significant, the aggregate effect of news from a country can be significantly different from zero. Even for Japan, where many macroeconomic announcements are individually insignificant, the aggregate news indicator is significant. The results from Table 9 strengthen the conclusion from Figure 2: although the impact of U.S. news is greater for USD/EUR-DEM, it is of comparable magnitude for USD/JPY and USD/GBP. For USD/CAD, Canadian news has a bigger impact on the exchange rate. U.S. and German announcements lead, on average, to a 11 bp. and 5 bp. change in the USD/EUR exchange rate, respectively. For USD/JPY, U.S. announcements lead to a change of 11 bp. on average, whereas Japanese announcements have an impact of 9 bp. on USD/JPY. For USD/GBP, both U.S. and U.K. announcements lead a change of 9 bp. in the exchange rate. For USD/CAD, finally, U.S. news surprises lead to only a 4 bp. change in the exchange rate, whereas Canadian news surprises move the exchange rate by 11 bp., on average. In line with the results from the previous sections, equality of the response coefficients cannot be rejected for USD/JPY and USD/GBP. For USD/EUR-DEM and USD/CAD, on the other hand, equality is rejected.

To assess the robustness of the aggregate-news models with respect to the grouping of the variables, the announcements are split between the categories *real economic* and *non real economic* and equation (6) is re-estimated for both categories. The same picture emerges. For USD/EUR-DEM, U.S. announcements from both categories are significantly different from zero, whereas German announcements from both categories are insignificant. For the other exchange rates, aggregate indicators from both categories are mostly significantly different from zero and the impact of real-economic variables is generally higher (consistent with the evidence from the previous sections). The full results from this robustness check are available upon request.

5.1 Sign effects

Both Andersen, Bollerslev, Diebold and Vega (2003) and Ehrmann and Fratzscher (2005) show that there are so-called sign effects in USD/EUR-DEM. This means that the impact of good news is different from the impact of bad news. More specifically, both studies show that bad news has a bigger impact than good news. To test for the presence of sign effects for international exchange rates equation (6) is modified in the following way:

$$\Delta\left(\ln e_t^{USD,n}\right)=\alpha+\gamma\Delta\left(\ln e_{t-1}^{USD,n}\right)+\sum_{l=1}^{4}\delta_l Dum_l+\beta^{US+}I_t^{US}D_t^{US+}+\beta^{US-}I_t^{US}D_t^{US-}+\beta^{n+}I_t^{n}D_t^{n+}+\beta^{n-}I_t^{n}D_t^{n-}+\varepsilon_t \quad (7)$$

where D_t^{US+} (D_t^{US-}) is a dummy variable that takes a value of one if $I_t^{US}>0$ ($I_t^{US}<0$) and zero otherwise. D_t^{n+} and D_t^{n-} are defined analogously for country n. The estimated asymmetric response coefficients β^{US+} and β^{US-} (β^{n+} and β^{n-}) measure the reaction to positive and negative U.S. (non-U.S.) news announcements, respectively. In contrast to the existing literature, panel B in Table 9 also tests for statistical differences in the response to good and bad news with two separate Wald F-tests: $H_0:\beta^{US+}=\beta^{US-}$ and $H_0:\beta^{n+}=\beta^{n-}$.

Negative news emanating from the U.S. is statistically more important for the dollar than positive news. Negative U.S. surprises are significantly different from zero for all exchange rate pairs, whereas positive surprises are only significant for USD/JPY. Moreover, statistical equality of the coefficients is rejected for all but USD/JPY. Differences in the estimated news response coefficients are also economically meaningful: 6 versus 15 bp. for USD/EUR, 4 versus 15 bp. for USD/GBP, and -1 versus 9 bp. for USD/CAD. For non-U.S. announcements, the impact of good and bad news is largely the same.

Overall, the results suggest the presence of sign effects in the foreign exchange market for news emanating from the U.S. These results confirm and extend the conclusions for USD/EUR-DEM of Andersen, Bollerslev, Diebold and Vega (2003) and Ehrmann and Fratzscher (2005) with different data over a different sample period.

5.2 Size effects

A question related to the presence of sign effects is whether the impact of macroeconomic news announcements is different for larger surprises. This may be expected if larger surprises contain more than proportional new information. The set-up is very similar to equation (7) for sign effects, but the dummy variables D_t^{US+} and D_t^{US-} (D_t^{n+} and D_t^{n-}) now measure whether a U.S. (non-U.S.) surprise is large or small, respectively. Large (small) is defined as an announcement for which the surprise is either in the upper or the lower (middle two) quartile(s) of the empirical distributions of surprises.

Panel C of Table 9 reports the parameter estimates, t-values, and Wald F-tests for an equal response to large and small surprises in the U.S. and abroad. The results are again striking for U.S. announcement

surprises. Large surprises from the U.S. have a statistically significant impact on all currency pairs (USD/EUR-DEM, USD/JPY, USD/GBP, and USD/CAD), whereas small shocks are insignificant except for USD/JPY. Response coefficients differ materially: a typical big U.S. surprise leads to a change of more than 15 bp. in the dollar, whereas a small surprise only moves the dollar by 1 bp. The Wald tests show that differences in the response to big and small U.S. surprises are significant for all exchange rate pairs except USD/JPY.

Taken together, the results from this section suggest that both the sign and the size of macroeconomic surprises matter in exchange rate determination. The reaction of exchange rates to news is stronger for negative and larger surprises coming from the U.S.

6. Conclusion

The influence of macroeconomic announcements on asset prices in general and on exchange rates in particular is the subject of various studies. Prior literature, however, almost exclusively focuses on U.S. (and sometimes German) announcements. Using a new data set from Bloomberg, the contribution of this paper to the extant literature is to analyze international macroeconomic announcements from five countries: the U.S., Germany, Japan, the U.K., and Canada. I analyze more than 50 types of key announcements over a sample period of 14 year of daily data. The main conclusions are as follows.

First, macroeconomic announcements affect exchange rates significantly and U.S. and non-U.S. news announcements are roughly of equal importance. The results from previous studies show that U.S. news is more important than German news for USD/EUR-DEM (see Almeida, Goodhart and Payne, 1998, Andersen, Bollerslev, Diebold and Vega, 2003 and Ehrmann and Fratzscher, 2005). The dominance of U.S. news for USD/EUR is also documented in this paper, but for USD/JPY and USD/GBP, U.S. and non-U.S. announcements are equally important and for USD/CAD, Canadian announcements are more important. This main result is confirmed when optimal models are selected using an automated general-to-specific model selection algorithm, as final multi-factor models contain both U.S. and non-U.S. news. Testing for parameter instability and, when found, estimating time-varying parameter models with the Kalman filter do not change this conclusion. Neither does changing the time of the day at which exchange rates are sampled or including non-German European announcements. The empirical results from this paper lend credibility to fundamental models of exchange rate determination, which state that domestic and foreign news are both important.

Second, variables related to the real economy are more important than announcements of prices (consumer and producer) and the central bank target rate. Better-than-expected macroeconomic conditions unambiguously lead to an appreciation of the exchange rate, both in the U.S. and abroad. A one-standard-deviation surprise in the most important variables leads to a change in exchange rates of approximately 25 basis points. This is significant both in the light of the daily standard deviation of log exchange rate movements and compared to response coefficients reported in previous studies.

Third and finally, there is some evidence of sign and size effects in the foreign exchange market. Exchange rates respond asymmetrically to U.S. news: negative news and larger surprises trigger a stronger response than positive news and small surprises.

The results documented in this paper strongly suggest that both U.S. and non-U.S. macroeconomic announcements should be part of models of exchange rate determination. An interesting avenue for future research is to combine these international news announcements with information on order-flow, possibly using high-frequency data.

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Appendix: The general-to-specific model selection algorithm

The algorithm builds on the work of Hoover and Perez (1999, 2004) and Krolzig and Hendry (2001). The steps are as follows:

A. **Estimation of the general unrestricted model**

The general unrestricted model of equation (5) is estimated with all variables from the two countries included as well as one lag of the log exchange rate return and four day-of-the-week dummies.

B. **Eliminating insignificant variables (full path, multiple paths)**

After estimation of the general unrestricted model, I use five reduction paths, where each of the five paths starts with elimination of one of the five least significant variables of the general unrestricted model. Subsequently, the least significant variable is dropped from the specification and the model is re-estimated. Each new specification that starts with a newly deleted variable is subject to the following diagnostic tests (evaluated at the 1%-level of significance):

i. General test for significance of all regressors (F-test).
ii. Test for autocorrelation up to the fifth lag (χ^2–test; Godfrey, 1978 and Breusch and Pagan, 1980).[8]
iii. Test for stability of the regression using the first versus the second half of the sample (F-test; Chow, 1960).
iv. Test whether the new specification is a valid reduction of the general unrestricted model (F-test).

The p-values of the four diagnostic tests are stored at each step. The algorithm stops if all variables are significant (at the 10%-level of significance). If all diagnostic tests are passed, this model is the terminal specification of a search path.

C. **Eliminating insignificant variables (step-by-step, multiple paths)**

If the specification does not pass all diagnostic tests, the algorithm returns to the last specification that did pass the diagnostic tests. Using this specification, the steps are:

i. Delete the least significant variable.
ii. Run the diagnostic tests of step B.
iii. If the specification passes all tests, return to step C.i.
iv. If the specification does not pass all tests, the removed variable is replaced and the next least significant variable (that has not been removed in the run) is removed. The algorithm returns to step C.ii.

The procedure stops if either all variables are significant or the insignificant variables cannot be removed without failing the diagnostic tests. This is the final specification of a search path.

[8] I set the lags of the residuals to zero rather than dropping them, in line with the recommendation of Davidson and MacKinnon (1993).

D. **Encompassing test for terminal specification**

If the final specifications of all search paths are identical, this is the terminal specification. If not, the union of all final specifications is formed and the final specifications are tested against the union (encompassing F-test).

i. If all final specification are rejected, the union is the terminal specification.

ii. If one final model is not rejected, this is the terminal specification.

iii. If more than one final model is not rejected, the final model with the lowest Schwarz criterion is the terminal specification.

If the null hypothesis of no heteroskedasticity in the residuals (White, 1980) is rejected for the final model, the algorithm is run with standard errors that are corrected for heteroskedasticity using the procedure of White (1980). If the residuals contain autocorrelation (using the Breusch and Pagan (1980) LM test with 5 lags), the algorithm is run with Newey and West (1987) corrected standard errors. If the residuals are neither heteroskedastic nor autocorrelated, homoskedastic (or normal) standard errors are used.

Table 1
Summary statistics exchange rate returns

	USD/EUR	USD/JPY	USD/GBP	USD/CAD
Mean	-0.0014	-0.0029	-0.0012	-0.0071
Maximum	4.142	5.494	3.458	3.308
Minimum	-3.451	-6.950	-2.904	-3.905
St. Dev.	0.635	0.709	0.561	0.531
Skewness	-0.093	-0.486	0.279	0.089
Kurtosis	4.988	8.614	5.687	7.570
Jarque-Bera	606.9 ***	4941.8 ***	1146.5 ***	3184.0 ***
LB(1)	-0.028 *	-0.016	0. 040 **	-0.033 **

The table shows the mean, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera test for non-normality, and first order autocorrelation with associated p-value for the Ljung-Box Q-statistic of no first-order serial autocorrelation, LB(1). Returns are continuously compounded and expressed in percentages for the U.S. dollar versus the euro, Japanese yen, British pound and Canadian dollar. The sample period is 1/1/1996 – 12/31/2009 (3654 observations).
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 2
Overview of the Bloomberg international economic survey data

	First obs	Last obs	# of obs	# of forec
US				
US Chicago Purchasing Manager	1997/04/30	2009/12/30	153	51
US ISM manufacturing	1996/11/01	2009/12/01	158	63
US Change in nonfarm payrolls	1997/01/10	2009/12/04	156	65
US Unemployment rate	1996/12/06	2009/12/04	157	68
US Trade balance	1996/12/19	2009/12/10	157	64
US PPI ex food & energy	1996/12/11	2009/12/15	157	63
US Retail sales less autos	2001/06/13	2009/12/11	103	68
US Consumer price index	1996/12/12	2009/12/16	157	67
US Current account balance	1998/03/12	2009/12/16	48	40
US GDP annualized Adv.	1997/01/31	2009/10/29	52	70
US Fed funds target rate	1998/12/22	2009/12/16	88	87
Germany				
GE IFO - Business climate	1997/06/19	2009/12/18	150	36
GE Retail sales (MoM)	1997/03/18	2009/12/01	135	14
GE Unemployment change	1998/09/08	2009/12/01	135	27
GE Unemployment rate	1998/02/05	2009/12/01	140	25
GE Trade balance	1997/05/28	2009/12/09	152	17
GE Current account (euro)	1997/12/19	2009/12/09	142	10
GE Producer prices (MoM)	1997/01/22	2009/12/18	153	25
GE GDP sa (QoQ) Prelim	1998/12/03	2009/11/13	43	33
GE CPI - EU harmonised (MoM)	2003/08/07	2009/12/09	60	21
GE ECB target rate	2000/10/05	2009/12/03	120	36
Japan				
JP All industry activity index (MoM)	2003/01/23	2009/12/21	81	28
JP merchnds trade balance total	2000/02/23	2009/12/21	119	30
JP Natl CPI YoY	2001/09/28	2009/12/25	100	30
JP Retail trade YoY	2003/04/28	2009/12/28	79	18
JP jobless rate	2000/02/29	2009/12/25	119	35
JP Current account total	2001/04/11	2009/12/08	105	26
JP Consumer confidence	2004/05/12	2009/12/11	57	5
JP Tankan Lge Manufacturers Index	1998/10/01	2009/12/14	46	30
JP GDP (QoQ)	1997/12/03	2009/11/16	49	31
UK				
UK GDP QoQ Prel.	1997/02/21	2009/11/25	51	28
UK GfK Consumer confidence survey	2002/06/27	2009/12/17	85	19
UK BoE target rate	1998/10/08	2009/12/10	131	40
UK Visible trade balance	1997/01/28	2009/12/09	156	22
UK PPI input sa (MoM)	1997/02/10	2008/09/08	139	23
UK CPI (MoM)	2004/01/20	2009/12/15	72	29
UK Claimant count rate	1997/09/17	2009/12/16	148	21
UK Jobless claims change	1997/02/12	2009/12/16	154	26
UK Retail sales (MoM)	1997/02/19	2009/12/17	155	28

UK Current account (BP)	1997/03/24	2009/12/22	50	18
Canada				
CA Ivey Purchasing Managers Index	2001/02/08	2009/12/04	107	15
CA Unemployment rate	1997/01/10	2009/12/04	156	19
CA Net change in employment	1999/12/03	2009/12/04	121	21
CA Int'l Merchandise Trade	1997/02/19	2009/12/10	155	18
CA Consumer price index MoM	1997/02/21	2009/12/17	155	16
CA Retail sales less autos MoM	2002/01/21	2009/12/21	96	19
CA Bank of Canada rate	2001/08/28	2009/12/08	67	28
CA Current Account (BoP)	1996/11/29	2009/11/27	48	16
CA Quarterly GDP annualized	1999/11/30	2009/11/30	38	22

The table shows the first observations, last observation, number of observations and median number of forecasters for each variable. The German IFO business climate indicator refers to West Germany for the period 1997:6 – 2004:1 and is the pan German indicator from 2004:2 onwards. The trade balance and balance of payments are pan German and the Deutsche Mark readings for 1997:5 – 2002:1 are converted to euro using the Deutsche Mark-euro exchange rate.

Table 3
The effect of macroeconomic surprises on USD/EUR-DEM

	Univariate: announcement days only			Multi-factor: final model	
	β	T-stat	R^2	β	T-stat
Constant				-0.01	(-0.91)
Lagged exchange rate					
Monday dummy				0.06 **	(2.26)
Tuesday dummy					
Wednesday dummy					
Thursday dummy					
US Chicago Purchasing Manager	0.11 **	(2.19)	0.03		
US ISM manufacturing	0.18 ***	(3.55)	0.07	0.17 ***	(3.12)
US Change in nonfarm payrolls	0.28 ***	(4.98)	0.14	0.26 ***	(4.26)
US Unemployment rate	-0.15 ***	(-2.62)	0.04	-0.15 ***	(-2.89)
US Trade balance	0.14 ***	(2.76)	0.05	0.13 ***	(2.71)
US PPI ex food & energy	-0.12 **	(-2.29)	0.03	-0.11 ***	(-2.65)
US Retail sales less autos	0.02	(0.40)	0.00		
US Consumer price index	0.02	(0.33)	0.00		
US Current account balance	0.09	(0.66)	0.01		
US GDP annualized Adv.	0.25 ***	(2.83)	0.14	0.25 ***	(2.69)
US Fed funds target rate	0.18 **	(2.28)	0.06	0.19 **	(2.14)
GE IFO - Business climate	-0.09 *	(-1.67)	0.02		
GE Retail sales	-0.06	(-0.97)	0.01		
GE Unemployment change	0.07	(1.36)	0.01		
GE Unemployment rate	0.11 **	(2.25)	0.04	0.11 **	(2.20)
GE Trade balance	0.00	(0.03)	0.00		
GE Current account	0.00	(0.00)	0.00		
GE Producer prices	0.03	(0.51)	0.00		
GE GDP	-0.01	(-0.08)	0.00		
GE CPI - EU harmonized	-0.01	(-0.14)	0.00		
GE ECB target rate	0.00	(-0.03)	0.00		
# of days with at least one announcement in GUM				1498	
# of days without announcement in GUM				2155	
R^2				0.024	
General F-test				9.77 ***	
Serial correlation (BG 5)				7.82	
Heteroskedasticity (White)				13.43	
Breakpoint (Chow)				1.41	
Valid restriction of general model (F-test)				0.91	

The table reports the estimated parameters of equations (1) for the univariate model on announcement days (left panel) and (5) for the final multi-factor model on all days in the sample (right panel). T-statistics are in parentheses and are corrected for heteroskedasticity (White, 1980) for the final multi-factor model. GUM is the general unrestricted model.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 4
The effect of macroeconomic surprises on USD/JPY

	Univariate: announcement days only				Multi-factor: final model		
	β		T-stat	R^2	β		T-stat
Constant					0.00		(-0.21)
Lagged exchange rate							
Monday dummy							
Tuesday dummy							
Wednesday dummy							
Thursday dummy							
US Chicago Purchasing Manager	0.10		(1.63)	0.02	0.09	*	(1.65)
US ISM manufacturing	0.09		(1.48)	0.01			
US Change in nonfarm payrolls	0.16	***	(2.73)	0.05	0.13	**	(2.34)
US Unemployment rate	-0.10	*	(-1.78)	0.02	-0.11	**	(-1.98)
US Trade balance	0.07		(1.16)	0.01			
US PPI ex food & energy	0.05		(0.93)	0.01			
US Retail sales less autos	0.21	***	(3.35)	0.10	0.21	***	(2.97)
US Consumer price index	0.13	**	(2.27)	0.03	0.13	**	(2.37)
US Current account balance	0.01		(0.08)	0.00			
US GDP annualized Adv.	0.09		(1.09)	0.02			
US Fed funds target rate	0.09		(1.24)	0.02			
JP All industry act. Index	-0.11		(-1.34)	0.02			
JP Trade balance	-0.06		(-0.87)	0.01			
JP Consumer price index	-0.09		(-1.51)	0.02			
JP Retail trade	-0.11		(-1.16)	0.02			
JP Jobless rate	0.04		(0.70)	0.00			
JP Current account	0.06		(0.95)	0.01			
JP consumer confidence	0.12		(1.21)	0.03			
JP Tankan manufacturers index	-0.10		(-0.84)	0.02			
JP GDP	0.01		(0.09)	0.00			
# of days with at least one announcement in GUM					1360		
# of days without announcement in GUM					2293		
R^2					0.007		
General F-test					5.38	***	
Serial correlation (BG 5)					6.19		
Heteroskedasticity (White)					4.26		
Breakpoint (Chow)					3.02	***	
Valid restriction of general model (F-test)					1.15		

The table reports the estimated parameters of equations (1) for the univariate model on announcement days (left panel) and (5) for the final multi-factor model on all days in the sample (right panel). T-statistics are in parentheses and are based on homoskedastic standard errors. GUM is the general unrestricted model.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 5
The effect of macroeconomic surprises on USD/GBP

	Univariate: announcement days only			Multi-factor: final model		
	β		T-stat	R^2	β		T-stat
Constant					0.01		(0.80)
Lagged exchange rate					0.04	*	(1.76)
Monday dummy							
Tuesday dummy							
Wednesday dummy							
Thursday dummy					-0.04	**	(-2.04)
US Chicago Purchasing Manager	0.03		(0.63)	0.00			
US ISM manufacturing	0.11	**	(2.08)	0.03	0.11	**	(2.01)
US Change in nonfarm payrolls	0.22	***	(5.42)	0.16	0.21	***	(4.92)
US Unemployment rate	-0.11	**	(-2.52)	0.04	-0.10	***	(-3.09)
US Trade balance	0.17	***	(3.84)	0.09	0.16	***	(3.00)
US PPI ex food & energy	-0.07	*	(-1.78)	0.02	-0.07	*	(-1.71)
US Retail sales less autos	0.12	**	(2.16)	0.04	0.13	**	(2.45)
US Consumer price index	0.02		(0.37)	0.00			
US Current account balance	0.09		(0.94)	0.02			
US GDP annualized Adv.	0.10		(1.17)	0.03			
US Fed funds target rate	0.10		(1.50)	0.03			
UK GDP	-0.12		(-1.65)	0.05	-0.12	*	(-1.74)
UK Consumer confidence	-0.04		(-0.49)	0.00			
UK BoE target rate	-0.19	***	(-4.21)	0.12	-0.20	***	(-5.12)
UK Trade balance	-0.07		(-1.41)	0.01			
UK PPI	-0.09	**	(-2.28)	0.04	-0.09	**	(-2.20)
UK Consumer price index	-0.06		(-0.64)	0.01			
UK Claimant count rate	-0.04		(-0.76)	0.00			
UK Jobless claims change	-0.06		(-1.16)	0.01			
UK Retail sales	-0.12	**	(-2.56)	0.04	-0.11	**	(-2.26)
UK Current acount	-0.02		(-0.28)	0.00			
# of days with at least one announcement in GUM					1559		
# of days without announcement in GUM					2094		
R^2					0.025		
General F-test					7.92	***	
Serial correlation (BG 5)					4.26		
Heteroskedasticity (White)					126.17	***	
Breakpoint (Chow)					0.97		
Valid restriction of general model (F-test)					1.08		

The table reports the estimated parameters of equations (1) for the univariate model on announcement days (left panel) and (5) for the final multi-factor model on all days in the sample (right panel). T-statistics are in parentheses and are corrected for heteroskedasticity (White, 1980) for the final multi-factor model. GUM is the general unrestricted model.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 6
The effect of macroeconomic surprises on USD/CAD

	Univariate: announcement days only			Multi-factor: final model		
	β		T-stat	R^2	β		T-stat
Constant					-0.01		(-0.98)
Lagged exchange rate							
Monday dummy					0.04	*	(1.81)
Tuesday dummy							
Wednesday dummy							
Thursday dummy							
US Chicago Purchasing Manager	0.06		(1.30)	0.01			
US ISM manufacturing	0.07		(1.55)	0.02			
US Change in nonfarm payrolls	0.06		(1.27)	0.01	0.09	**	(2.38)
US Unemployment rate	0.02		(0.49)	0.00			
US Trade balance	0.07		(1.56)	0.02			
US PPI ex food & energy	-0.01		(-0.24)	0.00			
US Retail sales less autos	-0.09		(-1.39)	0.02			
US Consumer price index	0.00		(-0.05)	0.00			
US Current account balance	0.22	***	(2.73)	0.14	0.19	***	(2.67)
US GDP annualized Adv.	0.08		(1.01)	0.02			
US Fed funds target rate	0.22	***	(2.85)	0.09	0.25	**	(2.24)
CA Purchasing manager	-0.10	*	(-1.68)	0.03			
CA Unemployment rate	0.16	***	(3.32)	0.07	0.11	**	(2.08)
CA Net change in employment	-0.23	***	(-3.92)	0.11	-0.19	**	(-1.97)
CA Int´l merchandise trade	-0.12	**	(-2.53)	0.04	-0.13	**	(-2.11)
CA Consumer price index	-0.02		(-0.39)	0.00			
CA Retail sales less autos	-0.27	***	(-4.05)	0.15	-0.27	***	(-5.12)
CA Bank of Canada target rate	-0.11		(-1.36)	0.03			
CA Current account	0.08		(0.91)	0.02	0.08	***	(5.61)
CA GDP	-0.04		(-0.45)	0.01			
# of days with at least one announcement in GUM					1323		
# of days without announcement in GUM					2330		
R^2					0.028		
General F-test					11.47	***	
Serial correlation (BG 5)					20.41	***	
Heteroskedasticity (White)					81.40	***	
Breakpoint (Chow)					3.35	***	
Valid restriction of general model (F-test)					1.38		

The table reports the estimated parameters of equations (1) for the univariate model on announcement days (left panel) and (5) for the final multi-factor model on all days in the sample (right panel). T-statistics are in parentheses and are corrected for heteroskedasticity and autocorrelation (Newey and West, 1987) for the final multi-factor model. GUM is the general unrestricted model.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 7
SupF breakpoint test for constant response coefficients

USDEUR	**SupF**		**USDJPY**	**SupF**		**USDGBP**	**SupF**		**USDCAD**	**SupF**	
US Chicago PM	1.26		US Chicago PM	8.80	**	US Chicago PM	1.31		US Chicago PM	8.46	*
US ISM manufacturing	6.93		US ISM manufacturing	2.84		US ISM manufacturing	1.33		US ISM manufacturing	2.16	
US nonfarm payrolls	3.38		US nonfarm payrolls	17.34	***	US nonfarm payrolls	3.29		US nonfarm payrolls	3.77	
US Unemployment rate	0.95		US Unemployment rate	3.94		US Unemployment rate	2.74		US Unemployment rate	1.38	
US Trade balance	2.37		US Trade balance	2.79		US Trade balance	2.91		US Trade balance	5.72	
US PPI ex food & enrg.	4.37		US PPI ex food & enrg.	2.38		US PPI ex food & enrg.	3.41		US PPI ex food & enrg.	4.13	
US Retail sales x-autos	3.18		US Retail sales x-autos	4.94		US Retail sales x-autos	0.51		US Retail sales x-autos	6.96	
US CPI	8.65	**	US CPI	3.27		US CPI	2.57		US CPI	0.83	
US Curr. Acc. Bal.	2.52		US Curr. Acc. Bal.	4.84		US Curr. Acc. Bal.	0.94		US Curr. Acc. Bal.	5.00	
US GDP ann. Adv.	1.78		US GDP ann. Adv.	3.53		US GDP ann. Adv.	13.76	***	US GDP ann. Adv.	0.49	
US Fed funds target rate	3.21		US Fed funds target rate	6.56		US Fed funds target rate	9.42	**	US Fed funds target rate	9.06	**
GE IFO – Bus. climate	7.27	*	JP All ind. act. index	1.38		UK GDP QoQ Prel.	3.33		CA Ivey Purch. Mngr.	3.19	
GE Retail sales (MoM)	5.04		JP merchnds trade bal.	12.02	**	UK GfK Cons. conf.	1.43		CA Unemployment rate	7.37	*
GE Unempl. Chng.	3.86		JP Natl CPI YoY	3.66		UK BoE target rate	7.90	*	CA Net chng. in empl.	6.34	
GE Unemployment rate	1.90		JP Retail trade YoY	7.14	*	UK Visible trade balance	2.26		CA Int'l Merch. Trade	3.98	
GE Trade balance	3.10		JP jobless rate	10.79	**	UK PPI input sa (MoM)	3.43		CA CPI MoM	13.90	***
GE Current account	5.10		JP Current account total	4.61		UK CPI (MoM)	13.73	***	CA Ret. sales x-autos	1.11	
GE Producer prices	2.87		JP Consumer confidence	1.64		UK Claimant count rate	0.55		CA Bank of Canada rate	1.24	
GE GDP sa (QoQ) P.	3.19		JP Tankan Lge Manuf.	1.48		UK Jobless claims change	5.17		CA Current Account	17.40	***
GE CPI - EU harm.	6.50		JP GDP (QoQ)	3.14		UK Retail sales (MoM)	1.86		CA Quarterly GDP ann.	4.72	
GE ECB target rate	2.66					UK Current account (BP)	1.46				

The table shows the Andrews (1993) *SupF* breakpoint test for constancy of the response coefficients in equation (1). Levels of significance are based on Hansen's (1997) approximate asymptotic p-values.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 8
The effect of Euro-Area announcements on USD/EUR-DEM

	β		T-stat	R^2	#of obs	#of forec
EMU real GDP (prelim)	0.10		(0.92)	0.03	31	32
EMU retail sales	-0.02		(-0.39)	0.00	105	17
EMU industrial production	-0.04		(-0.74)	0.01	105	30
EMU CPI	-0.03		(-0.43)	0.00	93	34
EMU PPI	0.04		(0.62)	0.00	102	24
EMU unemployment	0.14	**	(2.03)	0.04	115	25

The table shows the estimated response coefficients, t-values and R-squared of the univariate benchmark model in equation (1) as well as the number of observations and median number of forecasters.
** Significant at the 5% level.

Table 9
Size and sign effects: aggregate news indicators

Panel A: Aggregate News Regressions

	β		T-stat		Beta		T-stat	H_0: $\beta^{US} + \beta^{n} = 0$	
US	0.11	***	(4.56)	Germany	-0.05		(-1.62)	3.30	*
US	0.11	***	(4.31)	Japan	-0.09	***	(-2.67)	0.34	
US	0.09	***	(4.31)	UK	-0.09	***	(-4.19)	0.00	
US	0.04	**	(2.05)	Canada	-0.11	***	(-4.62)	7.62	***

Panel B: Sign Effects (Good versus Bad News)

good	β^{+}		T-stat	*bad*	β^{-}		T-stat	H_0: $\beta^{+} = \beta^{-}$	
US	0.06		(1.63)	US	0.15	***	(4.45)	3.41	*
Germany	-0.04		(-0.89)	Germany	-0.05		(-1.31)	0.09	
US	0.11	***	(2.83)	US	0.11	***	(2.84)	0.01	
Japan	-0.11	**	(-2.56)	Japan	-0.06		(-1.17)	0.65	
US	0.03		(1.09)	US	0.14	***	(4.51)	5.72	**
UK	-0.10	***	(-2.80)	UK	-0.08	***	(-2.74)	0.12	
US	-0.01		(-0.29)	US	0.09	***	(2.91)	5.13	**
Canada	-0.11	***	(-2.87)	Canada	-0.12	***	(-2.87)	0.03	

Panel C: Size Effects (Large versus Small Announcement Surprises)

large	β^{+}		T-stat	*small*	β^{-}		T-stat	H_0: $\beta^{+} = \beta^{-}$	
US	0.20	***	(5.90)	US	-0.01		(-0.28)	21.72	***
Germany	-0.04		(-0.45)	Germany	-0.05		(-0.50)	0.01	
US	0.14	***	(3.89)	US	0.08	**	(2.23)	1.42	
Japan	-0.30		(-1.45)	Japan	0.19		(0.84)	0.97	
US	0.18	***	(6.18)	US	0.00		(-0.02)	19.78	***
UK	-0.06		(-0.33)	UK	-0.04		(-0.24)	0.00	
US	0.09	***	(3.10)	US	-0.03		(-1.04)	9.96	***
Canada	-0.19		(-1.58)	Canada	0.05		(0.40)	1.69	

Panel A shows the estimated coefficients of equation (6) for the models with the aggregate news indicators. The left columns show the response coefficient and t-values for U.S. aggregate news and the middle columns for non-U.S. aggregate news. The right column shows the Wald F-test for the null that the sum of the coefficients is zero. Panel B and C show the response coefficients to positive and negative news (panel B) and large versus small surprises (panel C). The right column shows the Wald F-test for the null of an equal response to good (large) versus bad (small) announcement surprises. T-statistics are corrected for heteroskedasticity for USD/EUR-DEM, USD/JPY, and USD/GBP and are corrected for heteroskedasticity and autocorrelation (Newey and West, 1987) for USD/CAD.

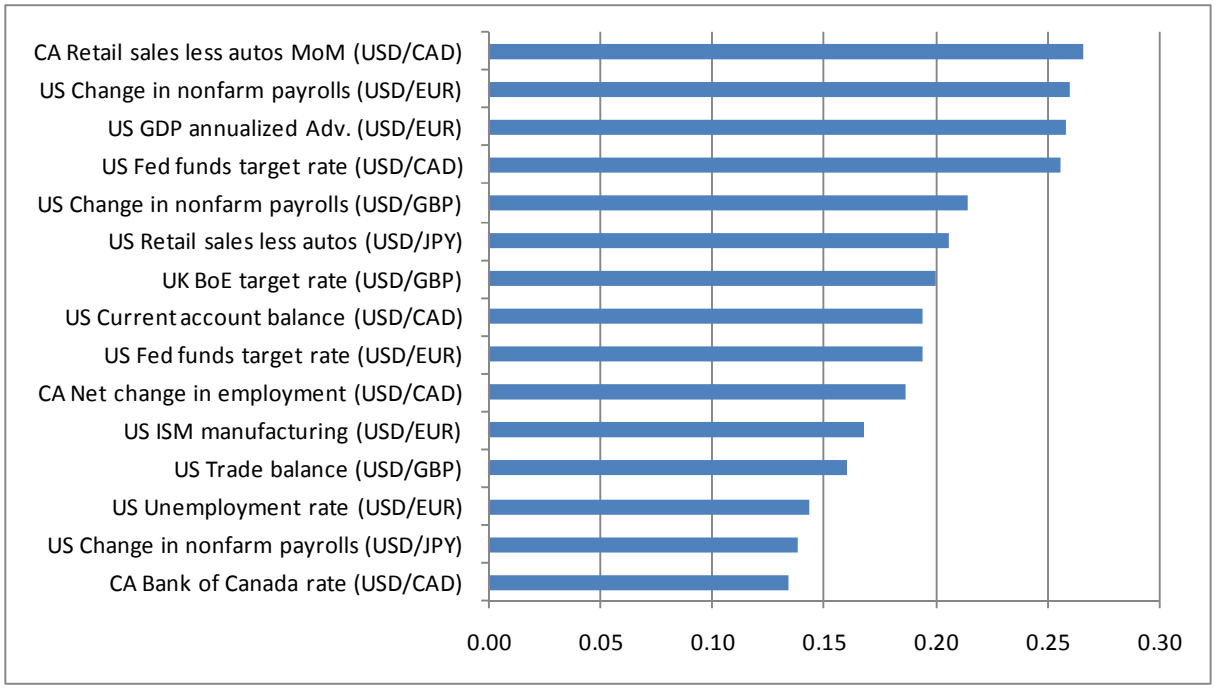
* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Figure 1

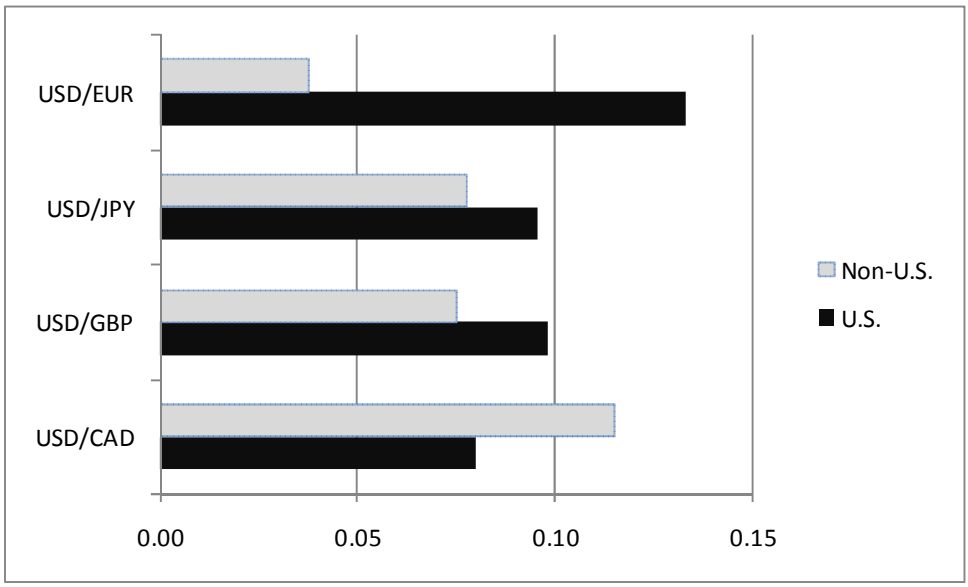
Most Important International Macroeconomic News Announcements



The figure shows the 15 international macroeconomic releases with the highest (absolute) impact on exchange rates. The exchange rate is shown in parentheses and the effects are measured in absolute percentage points.

Figure 2

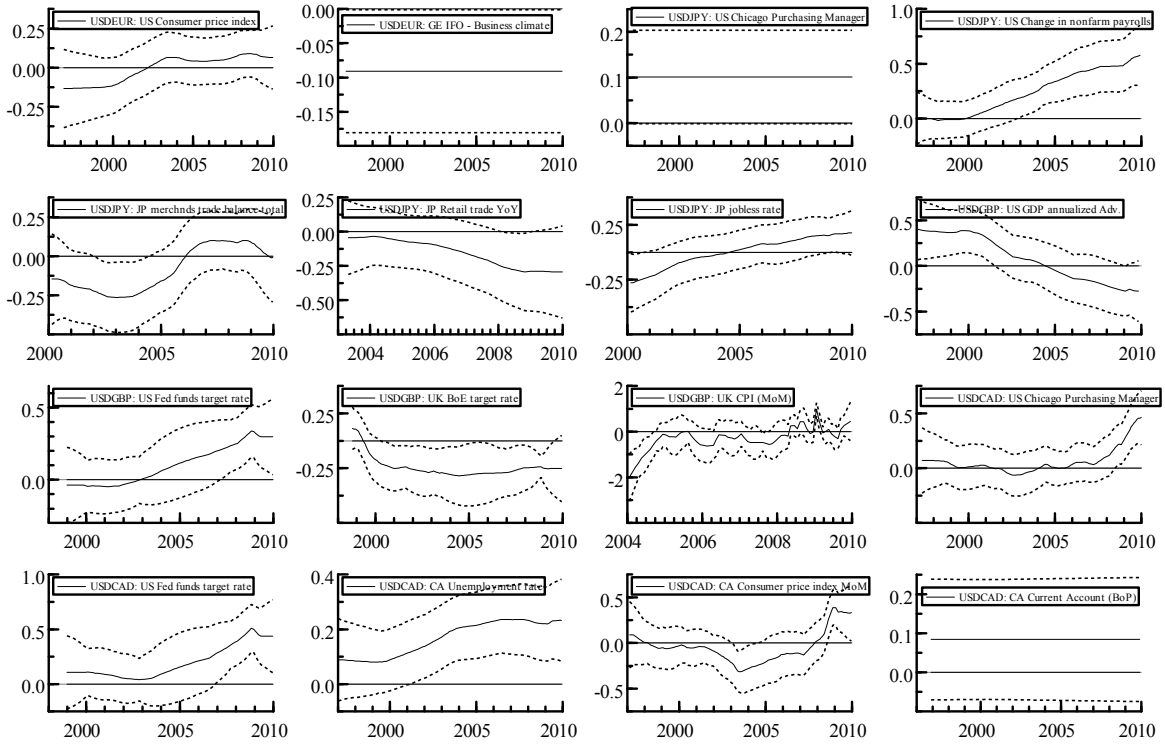
Average News Announcement Response Coefficients



The figure plots the average (absolute) news announcement response for U.S. (dark bars) and non-U.S. news (light bars) for each exchange rate pair (in percentage points).

Figure 3

Time-Varying Response Coefficient Estimates



The figure plots the time-varying response coefficients and associated 90% confidence bounds for the announcements for which parameter constancy is rejected.