JOURNAL OF
GENERAL MANAGEMENT RESEARCH

Impact of Macroeconomic News Announcements on the Correlation of Exchange Rates

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ISSN 2348-2869 Print

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Journal of General Management Research, Vol. 5, Issue 2, July 2018, pp. 1–15

Abstract

The study on impact of macroeconomic announcements on exchange rate volatility and returns is very extensive but literature on exchange rate correlation, although an important factor in risk management and portfolio diversification is very scarce. This paper aims to understand the impact of four macroeconomic variables – GDP, CPI, Unemployment rate and International Trade Balance on the correlation of exchange rates. The announcements considered under the study are from the European Commission and Switzerland, and the exchange rates are USD/EUR and USD/CHF. The study considers only the surprise effect; the announcements that are not in line with the expectations. The realized correlations are transformed through Fisher transformations in order to remove the constraint of [–1, +1]. The fisher transformation of the realized correlation between exchange rates is linearly regressed on the standardized surprise element of each of the variables, but the standard errors are computed through the Newey West method. Further, the effect of business cycles is also incorporated and the results are checked for effect from an external variable – CHF's temporary peg to the EUR. It was found that the

Eurozone Trade Balance and Switzerland GDP are important announcements that significantly affect the correlation between the euro and franc. Both these announcements lead to a positive change of around 30% on the realized correlation. Further, it was found that the effect of Eurozone's GDP and Switzerland's CPI significantly change during an expansion and recession respectively.

Keywords: *Macroeconomics, Exchange Rates, Trade Balance, GDP, CPI*

INTRODUCTION

In the subject matter of financial economics, the prices of assets and what affects the volatility of these asset prices is a topic that has been widely researched. Along the lines of research on factors that affect the prices of financial instruments, a lot has been said about the impact of macroeconomic news on different assets. Research is vast on news and its effect on instruments like bonds, stocks, interest rates, commodity futures and exchange rates (Burckhardt, 2012).

In regard to the effect of macroeconomic news on exchange rates, a lot of literature focussed on the returns and volatility of exchange rates. Existing literature confirms the conditional mean and volatility jumps that occur due to a news announcement and has also delved further into research on the type of news and the magnitude of effect that it has on the returns and volatility of exchange rates (Almeida, Goodhart, & Payne, 1998; Andersen, Bollerslev, Diebold, & Vega, 2003; Laakkonen, 2007; Ojstersek, 2014; Vrugt, 2010). However, correlation, although an important indicator that affects returns, has attracted much less attention. This is even more surprising, given the role correlation plays in risk management and portfolio diversification.

Volatility might be an important risk measure while considering only one asset but when a group of different assets are pooled together, correlation between the assets helps determine the returns, thereby making correlation a very significant risk measure. Moreover, each currency is always quoted against another currency. There is no such independent value of a currency; a currency derives its value in relation to another currency. Because of the dependence of one currency on another, correlation between exchange rates is all the more important to understand (Burckhardt, 2012).

Knowing the correlations between exchange rates will help better the returns by investing into the optimal pool of assets. Proper returns would be achieved if investments in two assets are such that they are negatively correlated, in a way that losses from one could be offset by gains from another. This concept of risk management also holds true for portfolio diversification and hedging (Christiansen & Ranaldo, 2006).

Another important application of the knowledge of correlation of exchange rates is in carry trades transactions. Carry trades are essentially borrowings from a country with low interest rates that are invested in a country with high interest rates. The profit incurred through the differentials in interest rates is highly dependent on the exchange rates of the two countries, which is basically the correlation between the two exchange rates. Even a small change in this correlation will lead to huge losses in the foreign exchange market (Burckhardt, 2012).

Often, traders make losses in the foreign exchange market due to poor diversification of assets, mismanagement of risks and risk of exchange rate changes, which are in

turn because of lack of understanding of the exchange rate movements. One of the important factors that affects the exchange rates co-movements are the macroeconomic news releases. Literature has shown the impact of macroeconomic news releases on the volatility of exchange rates but how the news affects correlation between exchange rates is a topic that has been scarcely researched.

Burckhardt (2012) has aimed to correct this gap by studying the affect of US macroeconomic news announcements on the correlation of exchange rate and found that it has significant explanatory power. This study though, only takes into consideration the macroeconomic announcements of the United States. But research on effect of macroeconomic news on exchange rate volatility has proved that news originating from countries other than the US, also has a significant affect on the exchange rates (Andersen et al., 2003; Vrugt, 2010).

We plan to fill this gap by extending the study of Burckhardt (2012) to study the affect of local macroeconomic news announcements on the correlation of exchange rates. We aim to do this by finding out how much of the realized correlation is dependent on the news announcement by using a regression model.

Research Question

Will the announcements originating from countries other than the United States of America, in this case the European Commission and Switzerland, have a significant effect on the correlation of exchange rates?

LITERATURE REVIEW

From the early 1970's to the end of 1980's, over 60 per cent of the member countries of IMF had shifted from pegged exchange rates to a floating exchange rate regime (Reinhart, 2000). This major shift in a policy regime that has widespread consequences on the trade and income of an economy has led to much research on the behaviour of exchange rates and the factors that affect it. Most research in the area has been concentrated on the affect of macroeconomic announcements on the exchange rate volatility and returns.

Research points to both the directions when it comes to the impact of macroeconomic variables on exchange rates. After a few positive results, a ground-breaking paper by Meese and Rogoff (1983) suggested that the effect of macroeconomic news on exchange rates is very meagre. The result of their research was that no macroeconomic model explains the change in exchange rates better than the Random Walk model. The paper opinionated that there is some no-visible fundamental element to exchange rates that make them follow a random walk model more robustly than a macroeconomic model. This was observed by generating forecasts from a month to twelve month horizons and through the usage of various structural models (Meese & Rogoff, 1983). This view was iterated in a number of subsequent papers that couldn't find strong linkages between macroeconomic variables and exchange rates. A lot of papers, consequently focussed on how macroeconomic variables affect exchange rates only in the long-horizon (Mark, 1995).

Because of this non-explanatory power of macroeconomic variables in the short-run, to study the factors affecting exchange rates, there was increased concentration on the impact of microeconomic variables on exchange rates. Research has also been done on connecting microeconomic variables like order flows to better establish the relation between macroeconomic news and exchange rates (Love & Payne, 2008). It was found

through this paper that although the textbook theory says that publicly available information affects exchange rates; the truth is that one-third of that affect stems from information order flows incorporated through the trading process. A primary survey research conducted in India also established that foreign exchange dealers are of the opinion that microeconomic variables like speculation, information movement and intervention by the central bank affects exchange rates in the short-run and macroeconomic news affect them in the long run (N.R. Bhanumurthy, 2006).

Over time, with extension of the econometric techniques used for analysis and availability of high frequency data, the results were more optimistic. This was attributed to the reasoning that analysis over long periods of time dilutes the effect of particular variable's news because a lot of events might be taking place in the same interval. It has also been found through research that the effect of the news keeps decreasing as the post-announcement time period is increased (Almeida, Goodhart, & Payne, 1998). They were able to arrive at this conclusion by testing the significance of news announcements in affecting the exchange rate movements from different intervals of five minutes to twelve hours post-announcement for monthly news emerging from the U.S. and Germany over a period of three years. Because of this compelling paper, research in the field then turned towards studying the short-term effect of macroeconomic news on exchange rate returns and volatility.

Many researchers have found that macroeconomic announcements have quite an explanatory power when exchange rates are examined in a high frequency setting. Using six years of high-frequency exchange rate data, it was found that macroeconomic variables do have a significant impact on the exchange rate dynamics and produce almost immediate conditional mean jumps in the spot rates (Andersen, Bollerslev, Diebold, & Vega, 2003). In one of the analysis conducted, large returns are found to be closely associated with announcements and interventions to the extent that the returns were mostly recorded in the interval of first minute to a couple of hours post announcement (Dominguez, 1999; Ederington & Lee, 1993).

All the existing literature on relating macroeconomic announcements to exchange rates involves a primary requisite of taking the expectations of the announcements in advance. Taking expectations of the announcements would help divide the announcement variable into an expected and unexpected element (Almeida et al., 1998; Andersen et al., 2003). When announcements are not in line with forecasts, an efficient market would reflect the surprise element in the exchange rates and when the announcement is the same as expectation, the information would have already been incorporated into the exchange rates and hence will not cause a change (Ojstersek, 2014). But results have also pointed that announcements that are the same as expectations also have quite a positive effect on volatility (Laakkonen, 2007). This was done by analysing the impact of macroeconomic news like Gross Domestic Product and interest rates from the U.S. and Europe on the volatility of five-minute frequency exchange rates. All these papers followed mechanisms to standardize the expectations of different announcements because some might be in percentages whereas others in absolute numbers. All the announcements were divided by the standard deviation of their sample in order to be able to compare them.

The characteristics of the announcements

have also been subject to wide-spread research, ranging from the country the news is evolving from to the size and sign effects of the news. In this regard, a lot of news has been divided into good and bad news and the effect of these two groups of news has been studied on exchange rate volatility. News was termed as good when the experts underestimated the magnitude of the variable and the actual value turned out to be higher. Bad news was when the expectation was overestimated. It was a major finding in almost all the studies conducted that bad news has a relatively larger impact on exchange rate volatility than good news (Andersen et al., 2003; Laakkonen, 2007). Though the importance of negative news was established, it was found in a paper by Laakkonen that even this negative news accounts for only 20% of the jump in volatility of exchange rates.

Moreover, most of the literature present has taken only US news into consideration and have ignored the effect of other nations' news due to the non-availability of information. It was conjectured that other news will also have a discernible impact on the exchange rate when studying the high frequency information. To study this better, a research was conducted with both US and German news announcements which showcases positive results but also shows that US news has a larger impact than Germany's (Almeida et al., 1998). It was also found that US news is incorporated much faster in reflecting the shifts in volatility than German news. The reasoning for this is that U.S. news is given out in a very scheduled manner which provided prior-planning for contingency and discussion. A paper that emphasises especially on the excessive focus of literature on the US news has studied the effect of over fifty announcements of US, Germany, Euro-zone, Japan, U.K. and Canada over a period of fourteen years. It was established through this that non-US news is as important as US news, if not more (Vrugt, 2010).

All this literature that took into account details like expectations and other characteristics of news announcements concentrated on finding their relationship to the returns and volatility of exchange rates. The intra-day volatility pattern and persistence has been studied in detail by taking the German-US exchange rates (Andersen & Bollerslev, 1998). The impact of news announcements on the foreign exchange futures market volatility and the intra-day and intra-week patterns were researched too (Ederington & Lee, 1993). The change in levels and returns in the foreign exchange markets were also studied and it was found that macroeconomic news produces conditional mean jumps, signifying that the exchange rates returns are linked to fundamentals (Almeida et al., 1998; Andersen et al., 2003). These are only a few influential papers that concentrate on studying the returns and volatility of exchange rates.

Historically, most of the literature on asset prices, not just exchange rates, has solely focussed on studying the returns and volatility of these assets. Correlation, although being a relevant factor in asset pricing and risk management, has not been widely researched and literature on this topic is just picking up (Burckhardt, 2012). Literature on changes in correlations of different assets in financial markets around macroeconomic announcements has been quite recent. The effect of United States Department of Agriculture's (USDA) announcements on the covariance's of commodity futures prices was undertaken to study the structure of relationship. This was done since price perceptions, risk level and portfolio returns

will depend majorly on the structure being affected by the type of information (Karali, 2012). The co-movements of US stock, treasury and corporate bond markets asset's returns to the US macroeconomic news announcements have also been studied and their link to fundamentals has been significantly established (Menachem, Pasquariello, & Subrahmanyam, 2009).

The macroeconomic announcements effect on realised bond-stock correlation was studied and gave insights into the correlation being affected by a mere announcement rather than the unexpected or surprise element of the announcement (Christiansen & Ranaldo, 2006). The behaviour of intra-day correlations between S&P 100 stocks around the Federal Open Market Committee's (FOMC) announcements of federal funds target rates have been studied too. It was found that a mere occurrence of bad news is enough to change the correlation but for a good news, the magnitude of the announcement matters (Chulia-Soler, Martens, & Dijk, 2009). With regards to the variation of correlation between exchange rates around macroeconomic news announcements, there has been very less literature.

Burckhardt (2012) aimed to correct this gap and studied the effect of US macroeconomic announcements on foreign exchange rate correlations. The impact of 31 scheduled announcement variables of US on correlations between the currencies Swiss Franc (CHF), British Pound (GBP), Euro (EUR), and Japanese Yen (JPY) was studied. Besides this, the correlations were also investigated based on business cycles and impact of positive and negative news surprises. It was found through this paper that US announcements affect exchange rate correlations even when not directly quoted against the US dollar. It was also accounted that the correlation between exchange rates increases at least by 10% in the wake of an announcement (Burckhardt, 2012). But this research only focuses on the US announcements and ignores other announcements.

U.S. news effects have been given more prominence in literature in the field because of easy availability of data. The significance of these announcements might have been overstated because of two reasons – one being that U.S. news announcements are the first to come out when compared to all other countries and also because most literature studied the effect of U.S. news by quoting currencies against the dollar.

Gap Assessment

In any case, literature that focuses on announcements originating from countries other than the U.S. is quite meagre. We try to fill this gap by taking up the case of Euro and Swiss Franc to show that local news will also have a significant impact in affecting the correlation between exchange rates. We select this currency pair because of the strong geographical and economic integration between both the currencies, thereby hypothesizing that announcements arising from the European Union and Switzerland will affect the Euro-Franc correlation significantly (Fischer, 2002).

METHODOLOGY

To study the effect of macroeconomic announcements on the correlation of exchange rates, we follow a regression model that has been followed in previous existing literature to study realized variance and realized correlation. This regression model was first developed and used by Balduzzi

(2001) and Andersen et al. (2003) and later on, it was used by Christiansen and Ranaldo (2006), Chulia-Soler et al. (2009), Thomakas et al. (2008) and Burckhardt (2012) to study the correlations of asset prices.

Data

The data required for this study includes high frequency exchange rate data, announcement values of considered macroeconomic variables, expectations of the announcements and the timing of the announcement rounded off to the nearest minute.

Macroeconomic Variables

The economic variables that are studied are the Gross Domestic Product, Consumer Price Index, Unemployment Rate and International Trade Balance. The reason why only these particular variables were selected was because the existing literature on volatility emphasized the importance of these variables (Almeida et al., 1998; Andersen & Bollerslev, 1998). Whether the same would be applicable in the case of correlation is a question that can be answered towards the end of this paper. The announcements for the euro would be the ones given by the European Commission on the Eurozone aggregates. The expectations of the four considered announcements are obtained in order to estimate the unexpected element of the announcement. Although there is a strong connection between interest rates and exchange rates, the variable was not considered because of lack of the surprise element; almost all the interest rate announcements are in line with the expectations.

All the data obtained was for the time period between 1st January 2011 and 31st December 2015. This was selected as the time interval because of the data being recent and also relatively higher number of observations would be necessary to obtain reliable results. All the data is obtained from Bloomberg. The exchange rate information and the value of economic variables are easily available on the terminal. Regarding the exact announcement time, Bloomberg releases a World Economic Calendar (WECO) that has the exact announcement times and can be obtained through the Bloomberg terminal. Expectations of the variables can be obtained by the surveys conducted by Bloomberg ten days before the scheduled announcements. The time frame for the survey is good enough to not let any additional information affect the outcome of the expected value. Hence, for these reasons, Bloomberg seems to be a natural choice for data collection. Previous papers in the field have also used Bloomberg as a source for their data procurement (Laakkonen, 2007; Vrugt, 2010).

Exchange Rates

The currencies that are incorporated into the study are the Euro (EUR) and Swiss Franc (CHF)**.** These currencies are quoted against USD and were chosen because of their strong economic linkages and correlations that have been proved through previous research (Fischer, 2002). Although the euro is generally quoted against the dollar as dollars per euro, we choose the reverse quote in this case for the purpose of uniformity.

The high frequency data of the currency pairs USD/EUR and USD/CHF are divided into five-minute intervals so that it accounts for the average time it takes to reflect a change in correlation due to the news and the last traded price in the five-minute interval is taken as the observation. Since there is only one paper that studied the effect of macroeconomic news on correlation of exchange rates, we will have to base the reaction time taken for our study only

on the single paper. Although the reaction time taken in the paper is 100 minutes, it was found that macroeconomic news surprises are absorbed into the correlations half an hour after the announcement (Burckhardt, 2012). For this reason, we take the reaction time as 5 minutes before the announcement and 40 minutes after the announcement, which in total is 45 minutes. We would be calculating our correlation from 10 data points of 5-minute intervals on a 45-minute sample.

All references to time in the Bloomberg terminal are given in the default Eastern Standard Time (EST). Although European Commission announcements are made from Brussels whereas Switzerland announcements are made from Bern, there isn't a time difference that exists, thereby relieving the study of that concern.

Model

There can be two effects that occur when an announcement comes out, an announcement effect and a news effect. Announcement effect is the change in the assets' volatility or correlation merely because an announcement took place whereas news or surprise affect is the change in the assets' volatility or correlation because of unexpected element in the announced data (Christiansen & Ranaldo, 2006; Burckhardt, 2012). We plan to study only the surprise affect because past literature has shown that the fast-paced markets move so quickly that new information is continuously absorbed into the prices of assets (Vrugt, 2010). Hence, any announcement that is in line with the expectations would have already been observed into the exchange rate before the announcement. Therefore, only an unexpected surprise element in the announcement will be affecting the correlation of the exchange rates.

The surprise element for every announcement is the difference between the actual announcement value and the expected value of it. Since the announcements taken for the study are measured differently, for instance unemployment rate is a percentage whereas Industrial Production is the value in currency; it is a common practise to take the standardized results (Andersen et al., 2003; Burckhardt, 2012; Christiansen & Ranaldo, 2006; Chulia-Soler et al., 2009). The standardized news surprise for an announcement is given by –

$$S_{i,c,t} = \frac{A_{i,c,t} - E_{i,c,t}}{\sigma_{i,c}}$$

Where $S_{i,c,t}$ is the news surprise of announcement i of country c at time t, $A_{i,c,t}$ is the actual value of the announcement i of country c at time t and $E_{i,c,t}$ is the expected value of the announcement i of country c at time t. $\sigma_{i,c}$ is the standard deviation of the difference $A_{i,c,t} - E_{i,c,t}$ across the entire sample.

In carrying out the regression, we take the value of this standardized surprise to find the effect on realized correlation. The regressions are conducted separately for each announcement variable segregated on the basis of origin country. The correlation has a constraint of only taking the values between [–1, 1]. In order to remove this constraint, we regress the Fisher transformation of the realized correlation instead of the actual correlation values (Burckhardt, 2012; Christiansen & Ranaldo, 2006). The Fisher transformation of the correlation is as follows:

$$F(RC_t) = \frac{1}{2}\ln\frac{1 + RC_t}{1 - RC_t}$$

where RC_t stands for the realized correlation at time t.

The realized correlation is calculated by dividing realized covariance (cross-products of returns) by the realized variance (sum of squared returns). Formally,

The realized variance of asset *k* for interval *t* and *t+h* is:

$$\tilde{\sigma}^2_{k,t} = \sum_{m=1}^{h} (r_{k,t+m} - \bar{r}_{k,t+1,t+h})^2$$

Where *h* is the number of 5-minute exchange rates within the interval. For example, for an interval of 45 minutes and 5-minutes data, *h =10.*

The realized covariance between assets *k* and *l* is given by the equation:

$$\tilde{\sigma}_{kl,t} = \sum_{m=1}^{h} (r_{k,t+m} - \bar{r}_{k,t+1,t+h})(r_{l,t+m} - \bar{r}_{l,t+1,t+h})$$

The realized correlation (RC) between assets *k* and *l* at time *t* is then given by:

$$RC = \tilde{\rho}_{kl,t} = \frac{\tilde{\sigma}_{kl,t}}{\tilde{\sigma}_{k,t}\tilde{\sigma}_{l,t}}$$

For economic variables that have different announcement times, the following regression equation is followed (Balduzzi et al., 2001; Burckhardt, 2012; Christiansen & Ranaldo, 2006; Thomakos et al., 2008).

$$F(RC_{k,t}) = \alpha_{k,i,c} + \beta_{k,i,c}(S_{i,c,t}) + \varepsilon_{i,c,t}$$

Where $F(RC_{k,t})$ is the fisher transformation of realized correlation of currency *k* at time *t*, *k* stands for currency, *i* for announcement and *c* for country. $\varepsilon_{i,c,t}$ are the residuals obtained from the model estimated by Ordinary Least Squares (OLS). It should be noted that although the mathematical explanation is not given because of its complexity, the standard errors obtained will be corrected by using the Newey-West Estimator. This is to acknowledge the heteroscedasticity and autocorrelation that the error term would be associated with, since an ordinary least squares estimation method was used on time-series data (Balduzzi et al., 2001; Burckhardt, 2012; Christiansen & Ranaldo, 2006; Chulia-Soler et al., 2009).

It usually does not happen that two variables in consideration are announced simultaneously or on the same day. But if that happens and the reaction time we are considering for both the variables overlaps, then another term for the second announcement *j* similar to the surprise term of *i*, is added to the regression equation so as to not overestimate the reaction of realized correlation to announcement *i* (Burckhardt, 2012).

To analyse if the impact of the news announcements varies based on the state of the economy, we incorporated a dummy variable for recession into our model. The data for the business cycles in the European region is obtained from Centre for Economic Policy Research (CEPR). This is a very credible source for research about business cycles in the European region and follows the same methodology of US's well-reputed National Bureau of Economic Research (NBER).

All the regression computations have been done on Stata 13. This was chosen over SPSS because the option of OLS regression with Newey West estimators when a lag is involved isn't available in SPSS. Stata was preferred over R because of the ease it provides in working, in being able to choose the regression method directly or writing the code.

FINDINGS AND ANALYSIS

Data Description

The total number of announcement observations for both the European Union and Switzerland is 213 which correspond to

4260 exchange rate observations. But there are two missing exchange rate observations in the entire sample for the 12th of August 2014 3:10 EST, thereby rendering the number of exchange rate observations to 4258. To get a general idea of the sample of exchange rate observations that we have, we find the correlation between the 2129 USD/EUR rates and their corresponding USD/CHF observations. The correlation between the two sets of data is 0.6972, indicating that the two exchange rates under consideration are very well correlated.

The GDP figures published by European Commission are divided into two categories – Advance and Preliminary. For the purpose of this research, the advance figures have been taken because they are the first estimates of the GDP growth over the last quarter and hence have a better surprise effect. The announcements chosen, the frequency of announcements and the number of observations for both the European Commission and Switzerland announcements are given in the Tables 1 and 2.

Table 1: European Commission Announcements Sample

Name of Announcement	*Frequency of Announcement*	*Number of Observations*
GDP Advance	Quarterly	15
CPI	Monthly	10
Unemployment rate	Monthly	29
International Trade Balance	Monthly	44

Table 2: Switzerland Announcements Sample

Name of Announcement	*Frequency of Announcement*	*Number of Observations*
GDP	Quarterly	19
CPI	Monthly	49
Unemployment rate	Monthly	15
International Trade Balance	Monthly	32

Although the number of announcements for a particular macroeconomic variable is quite high in the sample of 1st January 2011 to 31st December 2015, the sample studied in this research is restricted to the observations where the announcement is not in line with the expectations, thereby resulting in fewer observations than there are announcements in this period. This surprise effect though, is quite prevalent in the announcements chosen, especially in that of international trade balance.

Regression Results

It is to be noted that the regression, although is an OLS with Newey West Estimators, there is no lag that we've considered initially. Newey West Estimator, that corrects for both heteroscedasticity and autocorrelation without a lag is nothing but the Whites estimator that corrects for heteroscedasticity. Previous research proved that realized volatility is affected when including a lag length of one (Burckhardt, 2012). Whether the same is true for the realized correlations is tested by consequently performing the same regressions by taking a lag of one, to correct for any autocorrelation within the exchange rates. In any results henceforth, one asterisk implies significance at the 90% confidence level, two asterisks at the 95% and three asterisks at the 99% levels.

A regression of the realized correlations obtained from the exchange rate information on the standardized surprise of European Commission announcements gave the following result, given in Table 3. In the case of European Commission announcements,

it can be seen that only international trade balance is significant, at the 95% level. The GDP, CPI and unemployment rate turned out to be insignificant for the correlations, in contrast to previous research that judged these variables to be important announcements that affect volatility of exchange rates. The R-squared values for all the variables are quite low, a reiteration of previous research that confirmed low R-squared values. This is quite plausible because the news announcement might be just one factor amongst many others that is affecting the exchange rates, especially since we're considering a 45-minute interval. It should also be noted that the announcements of international trade balance which turned out to be significant has the highest R-squared value, above the 10% mark. These results are in line with the result of impact of US news announcements in the paper written by Burckhardt in 2012.

The results when a lag is included are not shown in Table 3 since all the coefficients are the same but only the p-value changed, although not enough to change the significance of the variable.

Table 3: Impact of European Commission Announcements

Name of the Announcement	β *[lag(0)]*	R^2
GDP	-0.2320	0.088
CPI	-0.0145	0.000
Unemployment rate	0.1428	0.053
International Trade Balance	0.2736**	0.105

In the case of impact of Switzerland announcements given in Table 4, surprisingly, trade balance turned out to be insignificant, in contrast to previous research that analysed US news announcements and the results of European Commission announcements. This might also be a discrepancy because of the number of observations in the sample we've considered. GDP, which is a major variable that affects the volatility of exchange rates, is significant at the 95% confidence interval for Switzerland's announcements. It should also be noted that the R-squared value for GDP is much higher, above 20%, than the same value for other variables.

The result when a lag is involved isn't given in Table 4 because the coefficients are the same for both. But GDP announcements has a p-value of 0.01 when a lag is involved, making it significant at the 99% level. This implies that Switzerland GDP announcements are quite significant in affecting the correlation, a one percent change in GDP changes the realized correlation by one-third percentage.

Table 4: Impact of Switzerland Announcements

Name of the Announcement	β *[lag(0)]*	R^2
GDP	0.3384**	0.205
CPI	0.0989	0.015
Unemployment rate	-0.1441	0.032
International Trade Balance	-0.0970	0.018

To study the impact of announcements of macroeconomic variables that come out when the economy isn't doing well, we consider the inclusion of business cycles into the research. Due to the lack of data about business cycles in Switzerland, we consider only the expansions and recessions of the European region as a whole. The data for this is obtained from the reports published by the Centre for Economic Policy Research (CEPR). According to their reports, the European Region was expanding till September 2011 from when our sample started. The region fell into recession from October 2011 to March 2013. Since April 2013, the researchers have concluded that there has been slow growth in the economy, but not up to the mark of pre-recession levels.

We account for this recession of 18 months

in the European region by creating a recession dummy variable and incorporating it into our model along with interaction effect. The number of recession observations in our sample is 63 accounting for over 29% of the sample. We regress each of the announcements by testing the interaction effect of the dummy variable and found out that only two announcements turned out to be significant when business cycles are taken into account.

Eurozone GDP was found to be significantly affecting the realized correlation during the expansion period and Switzerland CPI was found to be significantly affecting the correlation during recession periods, as shown in Table 5. The Eurozone GDP is quite an obvious result, since GDP announcements are particularly indicative of the strength of expansion that is occurring in the Eurozone area. The Switzerland inflation figures also cause changes to the correlation during recession periods, quite possibly because the two variable are very closely related, economically. Apart from these particular announcements, business cycle didn't have any particular effect on the realized correlation between exchange rates due to any other announcement. Surprisingly, unemployment rate which is one of the important factors during a recession didn't affect the correlation in any way. Again, one asterisk implies significance at the 90%, two asterisks imply significance at the 95% and three asterisks imply significance at the 99% levels.

Table 5: News Announcements Significant Upon Incorporation of Business Cycles

Name of Announcement	*β (Expansion)*	*β (Recession)*
Eurozone GDP	-0.4482*	1.777
Switzerland CPI	0.1018	0.4204***

CONCLUSION

In this paper, we study the impact of four macroeconomic variables announcements, originating from the Eurozone and Switzerland – GDP, CPI, Unemployment and Trade Balance on the realized correlation between euro and franc. We find through this research that Eurozone Trade Balance and Switzerland GDP are important announcements that affect the correlation between EUR and CHF, both being significant at the 95% level. When a lag is included, Switzerland's GDP is significant at the 99% significance level. Both the announcements affect the realized correlation positively by around 30%.

Eurozone GDP seems to affect correlation better during the expansion period while Switzerland CPI seems to affect the correlation during recession periods. Both these results are in line with the expectation that arise from economic linkages. Unemployment rate, though expected to have a significant impact during recessions, did not have so.

The question of why only these announcements affect correlation between exchange rates is outside the scope of this research and would require much more investigation. Previous research, though, concluded that the variable in question, information it contains and the timeliness of it are all factors that affect correlations (Burckhardt, 2012). How the results we've obtained might help is through any trading strategies that may be arrived at by further investigation of the results we've obtained.

Limitations and Scope for Further Research

Although this paper addresses the question of impact of local macroeconomic news on the correlation between exchange rates, it does

so only in the case of the Euro-Franc relation because of their very close geographical and economic integration. Research can be extended to include more pairs of currencies and test the relation between currencies that are prominent for carry trading like the Australian Dollar (AUD) and Japanese Yen (JPY).

This paper only tested the effect of news surprises on the correlations. Previous research showed that announcement effect, which is changes in the correlation of an asset merely due to the release of an announcement, is also quite high (Almeida et al., 1998; Laakkonen, 2007). Whether the same is true in the case of local news announcements and exchange rates is a question that needs further research.

Moreover, this paper only tested the impact of the state of economy on the realized correlations between exchange rates. Further research can be done on whether the sign of the news surprise and the magnitude of the news surprise make any considerable difference to the correlations. A wider sample of macroeconomic variables can be considered to analyse the effect of each one separately. The paper by Burckhardt in 2012 showcased the importance of retail sales, treasury budget and consumer confidence too, which can be studied further.

Previous research also points to the importance of correlations between different assets. Work in this area includes impact of different news announcements on the correlations between S&P 100 stocks and also between stocks and bonds (Christiansen & Ranaldo, 2006; Chulia-Soler et al., 2009). In a similar manner, the correlation between interest rates and exchange rates can be studied in order to understand and theorize their relationship better.

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APPENDICES

In all the following four appendices, only one regression per category is given because of the large number of regressions in each category.

Appendix A

Table 6: Regression of Switzerland GDP with Lag (0)

Regression with Newey West Estimators, lag (0)
newey FisherRC Surprise, lag(0)
Regression with Newey-West standard errors — Number of obs = 19
maximum lag: 0 — F(1, 17) = 4.85
Prob > F = 0.0417

	Newey-West					
FisherRC	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Surprise	.3384252	.1536045	2.20	0.042	.014348	.6625025
_cons	1.103974	.1644682	6.71	0.000	.7569769	1.450972

Appendix B

Table 7: Regression of Switzerland GDP with Lag (1)

Regression with Newey West Estimators, lag (1)
newey FisherRC Surprise, lag(1)
Regression with Newey-West standard errors — Number of obs = 19
maximum lag: 1 — F(1, 17) = 8.33
Prob > F = 0.0102

	Newey-West					
FisherRC	*Coef.*	*Std. Err.*	*t*	*P>|t|*	*[95% Conf. Interval]*	
Surprise	.3384252	.117238	2.89	0.010	.0910746	.5857759
_cons	1.103974	.1877256	5.88	0.000	.7079079	1.500041

Appendix C

Table 8: Eurozone GDP When "dum2: recession" Is Incorporated with Interaction Effect

Regression when business cycles are considered			
Business Cycle	*Freq.*	*Percent*	*Cum.*
Expansion	11	73.33	73.33
Recession	4	26.67	100.00
Total	15	100.00	

. newey FisherRC Surprise i.dum2 i.dum2#c.Surprise, lag(0)
Regression with Newey-West standard errors — Number of obs = 15
maximum lag: 0 — F(3, 11) = 1.47
Prob > F = 0.2766
Newey-West

FisherRC	*Coef.*	*Std. Err.*	*t*	*P>|t|*	*[95% Conf. Interval]*	
Surprise	-.4482584	.2216968	-2.02	0.068	-.9362098	.0396931
1.dum2	-.2301572	.405477	-0.57	0.582	-1.122606	.6622917
dum2#c.Surprise						
1	.5908876	.345041	1.71	0.115	-.1685425	1.350318
_cons	1.186275	.2402922	4.94	0.000	.6573958	1.715155