The time-varying response of high yield currencies to economic news*

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Abstract

We demonstrate that low yield currencies predominantly react to macroeconomic announcements consistent with predictions from the monetary models, but high yield currencies also regularly react in the opposite way. The frequency of reactions consistent with the theory is negatively related to the global volatility, but unrelated to the U.S. business cycle or good or bad news. We construct fundamental and sentimental news indices based on combining news surprises with the frequency of consistent and inconsistent high yield currency reactions, respectively. These news-related indices can explain 14% of the variation in monthly carry returns, and 19% of the variation in monthly S&P500 returns. For both carry and the S&P500 the majority of the explanatory power comes from sentimental news. Hence our novel news indices are important to improve our understanding of the relation between macroeconomic news announcements and asset prices in the medium term.

Keywords: Exchange rates; Disconnect puzzle; Macroeconomic news announcements; High yield currencies; Asset pricing; Equities; Treasuries

***JEL classification*:** F3, F4, G1.

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1. Introduction

Financial media provides seemingly *inconsistent* interpretations of news about economic fundamentals – based on the market reaction the news is sometimes interpreted as good and sometimes as bad[1]. Most attempts to explain exchange rate moves with economic news confirm the disconnect puzzle of Meese and Rogoff (1983). Surprisingly, the most concrete evidence of finding a relation between exchange rates and fundamentals has been based on a *consistent* exchange rate reaction to macroeconomic news, see for example Andersen et al. (2003).

Studies on the link between economic news and exchange rates largely concentrate on low yield currencies, such as the Euro and the Japanese Yen vis-à-vis the U.S. dollar. Recent studies, however, suggest risk exposures of high and low yield currencies are different. First, Lustig et al. (2011) and Menkhoff et al. (2012) propose a risk factor to which high yield currencies are exposed positively and low yield currencies - negatively. The factor is directly related to global equity and foreign exchange volatility[2], with low yield currencies appreciating and high yield currencies depreciating when volatility increases.

Second, Christiansen et al. (2011) demonstrate that the currency exposure to equity and bond markets depends on currency market volatility. On average the risk exposure of low yield currencies is dominated by the bond market in both high and low volatility regimes. On the other hand the risk exposure of high yield currencies is on average dominated by the bond market in the low volatility regime and by the equity market in the high volatility regime[3]. In the macroeconomic announcement literature, Andersen et al. (2007) show negative (positive) news is always good (bad) for the bond market, whereas for the equity market the same news can be interpreted as good or bad depending on the state of the economy. Boyd et al. (2005) explain the time-variation in the reaction of the equity market by the information the news carries - sometimes the news provides information about growth whereas at other times it provides information about the discount factor.

In this paper we combine the findings from the announcement event studies with the insights from the FX risk attribution literature. First, do low and high yield currency portfolios react differently to economic surprises and thus confirm the cross-sectional asymmetry in risk exposure found by Lustig et al. (2011) and Menkhoff et al. (2012)? Second, the findings in the two streams of literature suggest time-variation of high yield currency reactions to macroeconomic news. We expect all currencies to have bond-like (positive news is bad for bonds and the foreign currency) reactions in a low risk environment,

[1] "The dollar fell against most rivals after a better-than-expected U.S. jobs report lead investors to abandon the safety of the greenback and seek higher-yielding currencies" Source: The Wall Street Journal Online, September 4, 2010, "Dollar Falls as Data Lead to Growth Bets"; "The dollar fell sharply Friday as a dismal U.S. employment report for August set the stage for cuts in U.S. interest rates and touched off an across-the-board selloff of the U.S. currency". Source: The Wall Street Journal, September 8, 2007, "In a Dollar Selloff, Yen Surges".

[2] Menkhoff et al. (2012) consider a global foreign exchange volatility factor, while Lustig et al. (2011) investigate a slope (currency carry) factor. Lustig et al. (2011) show the slope factor is related to equity volatility.

[3] The estimates of multiple logistic smooth transition regression of currency returns on equity and bond returns in Christiansen et al. (2011) show that on average high interest rate currencies have larger bond market coefficients in a low volatility regime and larger equity market coefficients in a high volatility regime.

whereas mainly high yield currencies change the reaction direction to react like equity (positive news is good for equity and the foreign currency) in a high risk environment. Does the increase of high yield currency exposures to the equity market during times of elevated risk also materialize in the currency reaction to macroeconomic news?

We contribute by investigating two types of asymmetry[4]. First, we investigate differences in reaction to the same news of high and low yield currency portfolios. We expand the set of currencies to include previously not studied high yield currencies in the news announcement literature. Using a broader set of currencies we form interest-rate-based currency carry portfolios and explore their reactions to the macroeconomic announcements. To our best knowledge interest rate-based currency portfolio reactions to economic news has not been analyzed in the literature before.

Second, we contribute by considering a new type of asymmetry, namely, the asymmetry arising from the reactions that are in line or opposite to the predictions of exchange rate models. The time-varying direction of equity market responses to macroeconomic announcements (Andersen et al., 2007) and the time-varying high yield currency exposures to the equity market (Christiansen et al., 2011) imply such asymmetry is more likely in high yield currency reactions. Are the high yield currency portfolio reactions more often subject to this type of asymmetry than low yield currency portfolio reactions as the studies imply? Is there a category of announcements that bring about this type of asymmetry more often? To provide the answers, we consider an extensive set of macroeconomic announcements that are grouped into eight categories by the type of announcement, such as real activity and forward looking measures.

Our results provide evidence of a time-varying response of high yield currencies to economic news that is consistent with the findings of recent studies (Christiansen et al., 2011; Andersen et al., 2007, Menkhoff et al., 2012). We document a new asymmetry within the currency market. The response of the AUDUSD to surprises in payrolls announcements, for example, is sometimes according to monetary models (which we will label “fundamental”), but sometimes it is quite the opposite (“sentimental”). There is a significant rise in volatility, but due to the time-varying direction of the response the standard return regression fails to find a significant direction in returns.

We also find that forward looking measures such as consumer and producer confidence more often than not cause high yield currencies to react contrary to expectations from monetary models, whereas the opposite is true for price announcements such as the Consumer Price Index (CPI) and the Producer Price Index (PPI). Positive surprises in confidence figures lead to an appreciation of high yield currencies vis-à-vis the USD.

[4] Multiple asymmetries have been considered in the announcement literature that include the business cycle (Andersen et al., 2007), good and bad news (Andersen et al., 2003), country of origin (Fatum et al., 2010), bull and bear markets (Kurov, 2010), and asymmetries of reactions within asset classes. Surprisingly only few studies consider the latter asymmetry, notable exceptions being Fleming and Remolona (2001), Brenner, Pasquariello, and Subrahmanyam (2009), and Vrugt (2009); however, they concentrate on Treasury and corporate bond markets.

We use these insights to construct several news indices. First, we construct a news index that aggregates the surprises in 45 macroeconomic news announcements[5]. Second, we split the news index into a fundamental news index based on surprises triggering a reaction of high yield currencies in accordance with monetary models; and a sentimental news index based on surprises resulting in high yield currencies reacting opposite to predictions from monetary models.

We then proceed with linking news to asset prices in a novel way. For each calendar month we compute the news indices based on all the US announcements in that month. We then regress monthly carry and equity returns on the news indices. Contrary to many other studies we do find a highly significant relationship between news and asset returns. The news-related indices can explain 14% of the variation in monthly carry returns and 19% of the variation in monthly S&P500 returns. For both the carry and the S&P500 the majority of the explanatory power comes from the sentimental news index. Hence our novel sentimental news index is important to improve our understanding of the relation between macroeconomic news announcements and asset prices in the medium term.

The remainder of this paper is structured as follows. Section 2 briefly introduces the exchange rate and macroeconomic announcement data. In Section 3 we document the time-varying response of high yield currencies to economic news and analyse the response in more detail. In Section 4 we provide details on the construction of the global sentiment index and link this index to the business cycle, good and bad news, volatility and the returns of the FX carry strategy, equity returns and bond returns. Section 5 concludes.

2. Data

2.1 Exchange Rates

Midpoint spot exchange rates are collected from Dukascopy[6] at the 5-minute frequency for G10 currencies (AUD, CAD, CHF, EUR, GBP, JPY, NOK, NZD, and SEK[7]) versus the U.S. dollar (USD) for the period October 1, 2003 - October 1, 2012. The starting date is motivated by the availability of quality Bloomberg survey data on macroeconomic figures. Exchange rates are reported in U.S. dollars per unit of foreign currency, so an increase in the exchange rate represents an appreciation of the foreign currency against the dollar. Exchange rate returns are multiplied by 10,000 to reflect changes in basis points (bps).

Measuring asset returns in a short 5-minute window is motivated by the nature of the event study. Efficient market hypothesis (EMH) states that information is impounded into asset prices immediately,

[5] Here we closely follow the methodology used in the Citigroup economic surprise index (Bloomberg code: CESIUSD Index).

[6] www.dukascopy.com. Dukascopy offers direct access to the Swiss Foreign Exchange Marketplace. This market provides the largest pool of electronic communication network spot forex liquidity available for banks, hedge funds, other institutions and professional traders. In contrast to indicative quotes Dukascopy quotes are tradable.

[7] AUD - Australian Dollar, CAD - Canadian Dollar, CHF - Swiss Franc, EUR - Euro, GBP - Pound Sterling, JPY - Japanese Yen, NOK - Norwegian Krone, NZD - New Zealand Dollar, and SEK - Swedish Krona.

that is supported by the finding in the literature that the adjustment occurs quickly and is short-lived (e.g. Andersen et al., 2003; Dominguez, 2003). The finding of a strong relation between fundamentals and exchange rates relies upon avoiding contaminating the return with other events that may happen around the announcement[8]. Thus the most pure relation between fundamentals and asset prices can only be established at high frequency.

Table 1 displays the summary statistics of the daily exchange rate returns. Standard descriptive statistics show foreign currencies on average appreciated against the U.S. dollar during the sample period. In comparison to the daily averages, the standard deviation is 24 to 51 times larger. The returns are approximately symmetric, but not Gaussian due to excess kurtosis.

[Insert Table 1 about here]

2.2 Yield Portfolios

We construct yield portfolios by ranking currencies according to 3-month London Interbank Offered Rates (LIBORs). Each day the three highest interest rate currencies are included in the equally weighted high yield currency portfolio, and the bottom three currencies are included in the equally weighted low yield portfolio. All the currency returns are measured against USD, thus USD itself can included into one of the two portfolios with a zero return. Summary statistics of the top 3, bottom 3 and long 3 short bottom 3 portfolios are given in the last three columns of Table 1. Buying currencies in the top 3 portfolio and selling currencies in the bottom portfolio (using currency forwards) is known as the popular carry strategy.

Table 2 shows how often a currency has a particular yield rank in the sample period, and hence how often it is included in the high yield and low yield portfolios. The top 3 portfolio always includes the AUD and NZD. NOK and GBP are in the top 3 portfolio 48% and 36% of the time respectively. On the other side of the interest rate range the JPY and CHF are always in the bottom 3 portfolio, with the USD being included in this portfolio 46% of the time and the SEK 29% of all days.

[Insert Table 2 about here]

2.3 Macroeconomic Announcements

We use real-time data on 45 expected and realized U.S. macroeconomic announcement figures (including the 24 U.S. announcements used by Andersen et al. (2003, 2007)) that we collect from Bloomberg. In studies covering the period after 2003, Bloomberg replaced previously popular International Money Market Services (MMS) data that was discontinued in 2003[9]. Bloomberg is a widely

[8] Almost every announcement of macroeconomic indicator is followed by a story in the media regarding its interpretation. In this study we focus on the market interpretation of the indicator, thus stories in the media poses a possibility of return contamination.

[9] In September 2003 Informa acquired MMS, a popular source of survey data, and discontinued the survey. The resulting sharp increase of replies to Bloomberg surveys implies market participants regarded it as the new source of market consensus. Brenner, Pasquariello, and Subrahmanyam (2009) notes that joining several sources of survey data is not viable because of potentially different survey methodologies (e.g. MMS survey is closed on the

used data source by market participants thus an issue of forecasts not reflecting true market expectations is mitigated. Bloomberg screens display consensus and actual figures as they appear thus providing a point of reference for traders who react to news. Vrugt (2009) verifies that Bloomberg data is efficient and unbiased.

Table 3 provides a brief description of the U.S. economic data used in this paper. We show starting and ending dates, number of observations, time and frequency of the announcements. Most of the announcement data covers 2003 October – 2012 September and includes both consensus (median of economists') forecasts and actual announced figures.

[Insert Table 3 about here]

The surprise part of the announcement is calculated as the difference between actual and consensus values. In order to compare the market impact across the announcements we standardize the surprises by dividing by its full sample standard deviation following Balduzzi et al. (2001). Hence standardized news for announcement k at time t is

$$S_{k,t} = \frac{A_{k,t} - E_{k,t}}{\hat{\sigma}_k}, \tag{1}$$

where $E_{k,t}$ is the expected and $A_{k,t}$ the announced figure of announcement k at time t, and $\hat{\sigma}_k$ is the full sample standard deviation of surprises $A_{k,t} - E_{k,t}$.

Following Faust et al. (2007) we define the sign of the surprise such that positive surprises represent for example stronger-than-expected growth or higher-than-expected inflation, i.e. good news. As a result the sign of six announcements - treasury budget, initial and continuing jobless claims, business and wholesale inventories, and unemployment rate - is changed. Studies uniformly find high-frequency exchange rate reactions[10] to macroeconomic news to be in line with the predictions of Taylor rule models (see for example Engel and West, 2005). Upon the arrival of news that raises market expectations about the future path of the home country short term interest rates, the currency of the country tends to appreciate. Hence larger-than-expected growth or inflation figures would raise expectations of higher interest rates, thus immediate U.S. dollar appreciation against foreign currencies. The mechanism is that the central is expected to increase interest rates, which makes U.S. assets more attractive, inducing a dollar appreciation to equilibrate the asset market (Engel et al., 2007). Therefore our definition of good news is consistent both with theoretical exchange rate models and empirical findings in the literature.

Following Andersen et al. (2003) we group the U.S. announcements into eight categories: GDP, real activity, four components of GDP (consumption, investment, government purchases, and net exports),

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last Friday the week before the announcement, while Bloomberg's last chance to give a reply is 3 days before the announcement).

[10] See for example Edison (1997), Almeida et al. (1998), Andersen et al. (2003), Chaboud et al. (2004), Ehrmann and Fratzscher (2005), Clarida and Waldman (2008), Faust et al. (2007), D'Arcy and Poole, (2010), and Fatum et al. (2010).

prices, and forward-looking announcements. The announcements within each group are in chronological order[11].

In our analysis we include seemingly overlapping figures (e.g. headline CPI and CPI Core) for several reasons. First, headline CPI and PPI news announcements are moderately correlated with their core[12] versions (0.42), thus information in these figures differs. Second, market participants often choose to put more weight on the versions of the data that exclude more volatile components – energy and food. This motivates to leave both versions of CPI and PPI in our analysis to determine if there is a difference in importance market participants assign to the announcements. Finally, although core figures are expected to provide more information we include the headline versions to be consistent with previous studies (Andersen et al., 2003, Faust et al., 2007).

3. Response Differences of High and Low Yield Currencies

We specify and estimate two models of the impact of macroeconomic news on exchange rates. One model estimates the impact on the conditional mean and relies on the consistent direction of the reaction, whereas the other model estimates effects on conditional volatility, thus allowing for time-variation in response direction. We show that the estimated impact on high yield currencies depends on the model used to estimate announcement impact.

3.1 Methodology

To provide evidence that economic fundamentals are relevant for asset prices large and active event study literature has developed[13]. The basic tool in this literature is the following univariate regression

$$R_{k,t} = \alpha_k + \beta_k S_{k,t} + \varepsilon_t, \qquad (2)$$

where $R_{k,t}$ is the change in the asset price in a small window following the announcement k at time t, and $S_{k,t}$ is the standardized surprise of the announcement at time t, see equation (1). The coefficient β_k measures the impact of the announcement k on the asset return.

Recent literature suggests that the impact of an announcement can be time-varying. Findings of Andersen et al. (2007) and Fratzscher (2009) point towards a changing sign of the reaction that depends on the business cycle and/or market level of stress. Changes over time in the reaction sign means that the impact of an announcement estimated using equation (2) is biased towards zero (McQueen and Roley, 1993).

[11] To arrange monthly announcements in chronological order we use median rank of announcement appearance in our sample. Standard deviations of ranks are low providing evidence for consistent chronological ordering in our sample.

[12] Core inflation is the headline excluding volatile components such as energy and food.

[13] The literature studies impact of macroeconomic announcements on different asset classes. For example, Andersen et al. (2003) investigates currencies, Faust et al. (2007) currencies and interest rates, Balduzzi et al., (2001) bonds, Andersen et al. (2007) the joint reaction of T-bills, equities and exchange rates, Kilian and Vega (2011) energy commodities, and Elder et al. (2012) metals.

To avoid biased estimates due to variation in the reaction sign we relate the absolute surprise to the absolute size of the currency reaction

$$\left|R_{t_k} - \bar{R}_{t_k}\right| = \alpha_k + \beta_k D_{t_k} \left|S_{k,t}\right| + \varepsilon_t \qquad (3)$$

where R_{t_k} are all trading day returns in the interval of the day (time t_k, for example for nonfarm payrolls announcements is 8:30-8:35) when the announcement k occurs, excluding days when announcement k does not occur but other announcements occur. By including days without macroeconomic news we control for the increase in volatility that is not related to the news.

Andersen and Bollerslev (1998), find that the distinct intraday volatility pattern of DEMUSD is related to the activity cycle of financial centers. The same study finds there is very little evidence of predictability of the intraday conditional mean thus such control is not necessary in equation (2). $\bar{R}_k$ is the sample mean of the returns. Although none of the analyzed mean returns is statistically different from zero we deduct the average return to be consistent with volatility studies (e.g. Andersen and Bollerslev, 1998; Ederington and Lee, 1993). $D_{k,t}$ is a dummy for the announcement k at time t. Thus α_k estimates background volatility (e.g. bid-ask bounce, time-of-the day activity patterns) unrelated to macroeconomic news and β_k estimates the impact (in excess of background noise) on returns of a one standard deviation surprise in announcement k.

This approach is similar to Ederington and Lee (1993), however they regress the absolute centered return on a dummy for the announcement. The authors do not use the surprise component arguing the forecast should accurately reflect market expectations. Since traders receive the actual value next to the consensus value on the Bloomberg screen, it is likely that economists' consensus is an anchor for the market participants and thus acts as the true market expectation. The use of absolute surprises and control for volatility patterns is similar to the approach in Fleming and Remolona (1997).

3.2 Effect on the mean

Following the literature we start with the estimates of equation (2) for each currency separately. This approach leads to the conclusion that few U.S. announcements have a significant effect on USD crosses with high yield currencies, whereas crosses with low yield currencies do react significantly to most news announcements (for detailed results see Table A.1 of the Appendix).

Figure 1 shows the number of significant announcements and number of significant announcements with expected ("fundamental") reaction sign for each of the currencies analyzed. The currencies are in an increasing order of average interest rate rank in our sample period, with JPY most often being the lowest interest rate currency and NZD most often the highest. There is a distinctive pattern that the lower the yield of the currency the more announcements are significant. Quite often we see "sentimental" reactions (good news for the U.S. is good news for the foreign currency). Eliminating those cases leaving only significant "fundamental" reactions (good news for the U.S. is good news for the USD) makes the difference between low and high yielding currencies even more pronounced. The effect is strongest between the currencies that are almost always in high and low yield portfolios. Confidence intervals for the Japanese Yen (JPY) and Swiss Franc (CHF) do not overlap with those of the

New Zealand Dollar (NZD) and the Australian Dollar (AUD), demonstrating that high yield currencies have a significantly lower number of significant "fundamental" responses to news announcements when judged by the results from equation (2).

[Insert Figure 1 about here]

3.2.1 Nonfarm Payrolls

To gain more insight into the difference between the responses to news announcements of high and low yield currencies, we provide an example for nonfarm payrolls. Several studies find that nonfarm payrolls is one of the most influential announcements, see for example Andersen and Bollerslev (1998).

Table 4 provides the estimates of equation (2) for nonfarm payrolls. Our results for the JPY, CHF, EUR and GBP are consistent with the findings of previous studies (Andersen et al., 2003; Faust et al., 2007). These currencies react strongly to nonfarm payrolls announcements in a "fundamental" way (good news for the U.S. is good news for the USD). Results for the currencies generally not analyzed in the high-frequency macroeconomic reaction literature are striking. None of the other currencies has on average a significant reaction to nonfarm payrolls.

[Insert Table 4 about here]

An important question to ask is whether U.S. news really has no impact on some currencies or our model estimates are biased downwards because we do not take into account possible changes in the sign of the reaction to news. We compare two currencies: AUD is the least significant, and JPY is the most significant. The currencies differ in yields as well – The Australian short-term interest rate is on average the highest, whereas the Japanese short-term interest rate is on average the lowest (see Table 2).

In Figure 2 we plot the sign of the surprise and return relation. A "+1" indicates that a positive (negative) surprise leads to appreciation (depreciation) of the foreign currency and "-1" indicates that a positive (negative) surprise leads to depreciation (appreciation) of the foreign currency. The figure reveals a strong pattern: the Japanese Yen predominantly has the same (i.e. "fundamental") reaction to payrolls surprises. But the Australian Dollar often reacts in the opposite ("sentimental") way. Before 2008 the AUD mostly reacts in the same direction as the JPY - both are appreciating (depreciating) in response to bad (good) nonfarm payrolls news. After 2008 AUD reactions are mostly opposite to the JPY reactions. The changed sign in the response of the AUD is not constrained to the recession period[14] as in Andersen et al. (2007)[15], or the crisis period[16] as in Fratzscher (2009). The finding suggests that the model in equation (2) used to estimate announcement effects is inappropriate for high yield currencies. Because

[14] NBER recession: 2007 December - 2009 June.

[15] McQueen and Roley (1993) use industrial production to define the state of the economy. Alternatively, Andersen et al. (2007) use changes in non-farm payrolls as expansion-recession classification. The authors claim such classification is close both NBER and industrial production based classification.

[16] 2008 July - 2009 January (Fratzscher, 2009).

the results for the highest and the lowest yield currencies differ the most, we proceed with the analysis using dynamic yield-based currency portfolios[17].

[Insert Figure 2 about here]

3.2.2 Return responses of high and low yield currency portfolios

Table 5 shows re-estimated equation (2) for the high and low yield portfolios. For 31 of 45 announcements the response of the low yield portfolio is significant at least at the 10% confidence level, but for the high yield currencies only 10 announcements draw on average a significant response. For the low yield portfolio the sign of all but one significant announcement (civilian cost) is ”fundamental”, but for the high yield portfolio the average response to 5 of the 10 significant announcements is “sentimental”. In this respect the forward looking category stands out – all announcements in this category that are significant for the high yield portfolio are also significant for the low yield portfolio, but with opposite sign. These announcements are the Philadelphia Fed Survey of Business Outlook, the Conference Board Consumer Confidence and ISM Prices Paid. In the real activity category Consumer Credit also on average draws a “sentimental” response from high yield currencies.

[Insert Table 5 about here]

Interestingly the announcements in the price category on average draw a “fundamental” response. Higher than expected import prices, PPI and CPI core result in an appreciation of the USD and a depreciation of high yield currencies. This is consistent with findings of previous studies (for example Faust et al. (2007) or Andersen et al. (2003) for low-yielding currencies) showing that the USD appreciates following higher-than-expected U.S. inflation. Contrary to the studies, our findings are statistically significant. Since U.S. central bank is not targeting inflation, significant appreciation of USD against foreign currencies is inconsistent with Clarida and Waldman (2008) findings. The results in Table 5 also show that CPI announcement has a larger impact on both high and low yield portfolios than PPI, a finding consistent with Andersen et al. (2003) for JPY, CHF, GBP and EUR. The fact that only core measures of inflation are significant for the two portfolios is consistent with Clarida and Waldman (2008) findings. Our results support the claim that US central bank and market participants consider core measures of inflation more important than headline ones. This findings may explain why previous studies (e.g. Faust et al., 2007; Andersen et al., 2003) using headline inflation measures do not find a significant effect.

The set of significant announcements for the high yield portfolio largely overlaps with the set of significant announcements for the low yield portfolio. Only three announcements that are important for high yield currencies are not important for the low yield currencies. These are Consumer Credit, CPI and Unit Labor Costs. Although statistically significant, the impact of these announcements is smallest (0.8-1.2 basis point per 1 standardized surprise) among the set of significant announcements.

[17] Detailed results for the 9 individual currencies are available upon request.

The different findings for high and low yield currencies relate to the literature in two ways. Empirical pricing models (Lustig et al., 2011; Menkhoff et al., 2012) show two factors - "Dollar" and "Global[18]" risk - are important in currency pricing. All currencies load equally on Dollar risk, whereas low and high yield currencies load with opposite sign on "Global" risk. An increase in global risk on average leads to an appreciation of low yield currencies and a depreciation of high yield currencies. An increase in dollar risk means appreciation of all currencies against USD. First, assuming good U.S. news reduces global risk and bad news increases global risk, our findings show that reactions to forward looking announcements of high and low yield currencies are in line with the predictions of the pricing model. Second, all currencies have the same reaction direction to the U.S. price announcements thus they are related to "Dollar" risk.

The question remains why so few U.S. announcements seem to have significant impact on high yield currencies whereas for low yield currencies most of the announcements are important. We hypothesize that while price and forward looking announcements may give more information on the dollar and global risks, other announcements may have time-varying information content. For example Boyd et al. (2005) and Andersen et al. (2007) explain the time-variation in reaction of equity market by the information the news carries - sometimes the news provides information about growth whereas at other times about the discount factor. In addition, Christiansen et al. (2011) results show high yield currency exposure to equity market is time-varying and positively related to currency market volatility, increase in the market volatility strengthens the relationship between the high yield currencies and equities.

3.3 Volatility responses of high and low yield currency portfolios

We hypothesize that the low number of announcements significantly affecting high yield currencies may be due to variation in the reaction sign. We therefore proceed with estimating equation (3) for both high and low yield currency portfolios. Table 5 shows the results. First, the number of significant announcements increases to 44 and 45 (of 45) for low and high yield currency portfolios respectively. The increase is especially large for high yield currencies that according to estimates of equation (2) significantly react to only 10 macroeconomic announcements. Second, the low yield portfolio estimates for coefficient β_k in equations (2) and (3) having a strong correlation of -0.76, whereas the correlation is only -0.08 for the high yield portfolio (detailed results are provided in the Appendix, Table A.1.). Estimates of coefficient β_k in equation (3) for high yield and low yield portfolios are highly correlated (0.95) whereas correlation of equation (2) estimates is only 0.21, pointing towards the conclusion that the absolute importance of the announcements is similar for high and low yield currencies. In combination with equation (2) estimates we conclude that the interpretation of the same information (the direction of the reaction) is different for high and low yield currencies. In light of these findings we conclude that insignificant results of the traditional approach in equation (2) must be caused by the changing sign in the response of high yield currencies to surprises in news, and not because these announcements are not important for high yield currencies.

[18] Dollar risk factor is equally weighted foreign currency portfolio. Menkhoff et al. (2012) defines global risk as average of absolute currency returns. Lustig et al.(2011) show that their global risk factor (carry portfolio) is closely related to volatility of equity markets around the world. The global factor is intended to measure the common innovation, whereas the Dollar factor measures the U.S. specific risk.

3.4. Time-variation in the frequency of sentimental reactions

The sign of the response of especially high yield currencies varies over time. When good (bad) news leads to appreciation (depreciation) of the USD we dubbed it a “fundamental” reaction. When good (bad) news leads to depreciation (appreciation) of the USD we called it a “sentimental” reaction.

We want to investigate (1) the persistence and (2) variation over time of "fundamental" and "sentimental" reactions. Using Kalman filter and all the U.S. announcements we estimate the fraction of "sentimental" reactions. For comparison we also estimate the fraction of good news (positive surprises).

Figure 3 shows the news-based sentiment measure, i.e. the fraction of sentimental reactions to surprises in news announcements. The average sign of the response of the high yield currency portfolio to news is time-varying. Firstly, from 2004 to 2008 the high yield currency portfolio responds more often in a “fundamental” way. In 2009, however, the reactions are predominantly “sentimental”. The 2010 is more balanced, with frequent switches between fundamental and sentimental reactions to news, rendering the fraction of sentimental reactions close to 50%. From mid-2011 onwards the reactions are predominantly sentimental again and the fraction of sentimental reactions is as high as it was in 2009.

In contrast the low yield currency portfolio does not have any period where the fraction of sentimental reactions to news exceeds that of fundamental reactions. Still, there is variation in the ratio of sentimental and fundamental reactions that is similar to that for high yield currencies.

[Insert Figure 3 about here]

Figure 4 displays Kalman estimates for the fraction of good news, where good news indicates the surprise element in the news announcement was positive. The direction of the news is largely unpredictable from 2004 to 2007, i.e. probability of positive and negative news surprises is not different from 0.5. . In 2008-2012 news sign fluctuates much more than in 2004-2007. The first part of the 2008 sees more positive news only to become more negative in the second half. In 2009 there is a sharp rise in the fraction of good new. Years 2010 and 2011 include episodes of better than expected macroeconomic fundamentals. However 2012 begins on a negative note and stays that way until the end of our sample.

[Insert Figure 4 about here]

Combined Figures 4 and 5 suggest that the fraction of sentimental reactions is largely unrelated to the fraction of good news. Hence the changing sign in the response to news is not confined to only bad news as found in Fratzscher (2009). The variation in the response sign is also not limited to business cycle effects found for the equity market in Andersen et al. (2007) and McQueen and Roley (1993) as periods of predominantly sentimental or fundamental reactions exist both during and outside recessions. We test this formally in the next section.

3.5 News, business cycle and FX reactions

Andersen et al. (2003) show the reactions of exchange rates to positive and negative news are asymmetric - stronger reactions to negative news in economic expansion periods. Andersen et al. (2007) find an asymmetric reaction of the equity market over the business cycle. Good news during expansion periods is bad for stocks, whereas it is good for stocks during recession periods. Veronesi (1999) assumes investors believe the economy follows a two stage process, the low and high stages corresponding to recessions and expansions, respectively. Because good (bad) news in the low (high) state increase the uncertainty about the stage of the economy investors require additional compensation for the state risk. This makes stock prices overreact to bad news in good times and underreact to good news in bad times.

Here we test for the high yield currency portfolio whether the frequency of fundamental and sentimental reactions to news depends on the stage of the business cycle and the sign of the news. Panel A of Table 6 shows that during both recessions and expansions the frequency of positive and negative news surprises does not significantly differ from 50 percent.

[Insert Table 6 about here]

Panel B in Table 6 shows that good news slightly more often triggers a fundamental response of the high yield currency portfolio, i.e. good U.S. news leads to appreciation of the U.S. Dollar. There is no significant difference in the case of bad news. A similar result is obtained for expansions and recessions, with expansions slightly more often seeing a fundamental response to news. Combining the distinction between good news and bad news with the business cycle we see that it is mainly positive news during expansions that leads to a significantly higher fraction of "fundamental" reactions of the high yield currency portfolio to news.

In general the results in Table 6 at best indicate a weak dependence between the number of sentimental reactions on the one hand and the sign of news surprises and the status of the business cycle on the other hand. Hence a sentimental reaction is something new beyond the sign of news surprises and the business cycle. We therefore look for other explanatory variables for the time-variation in the sentiment.

3.6 The sentimental reactions and currency volatility

Implied volatility indices are thought to measure investor fear. The VIX, based on implied volatilities of options on the S&P500 index, is a commonly used proxy to gauge investor fear about U.S. economy. In the foreign exchange market the fear cannot be assigned to a particular country thus should be regarded as *global*. We, therefore, use the implied currency market volatility index (CVIX) of Deutsche Bank [19] as global proxy for investor fear. We divide all trading days into quintiles based on the CVIX at the close of the previous day. For each trading day and each announcement we have the response sign of the high yield currency portfolio. We then count for each CVIX quintile how often we see a "fundamental" or "sentimental" response of the high yield currency portfolio to news.

[19] http://www.globalmarkets.db.com/new/docs/DBGuideToFXIndices.pdf (Bloomberg: CVIX3I Index).

The results in Table 7 show a strong relationship between the level of implied currency volatility and the frequency of sentimental reactions of the high yield currency portfolio to news. The fraction of sentimental reactions increases monotonically with the level of implied volatility - from 42% in the lowest quintile to 58% in the highest volatility quintile[20]. In the following section we directly link carry performance to the economic news.

[Insert Table 7 about here]

3.7 News and carry strategy returns

Fratzscher (2009) demonstrates that in the second half of 2008 most of the currencies depreciated against the USD, with the exception being the Japanese Yen that in the same period appreciated strongly. This coincided with predominantly negative economic news and a change in the reaction sign to U.S. macroeconomic news. Fratzscher hypothesizes that the bad economic news "may either have been perceived as even worse news for other economies, or have triggered an actual or expected repatriation of capital from foreign markets". Brunnermeier at al. (2009) "conjecture that sudden exchange rate moves unrelated to news can be due to the unwinding of carry trades". The period analyzed by Fratzscher (2009) is characterized by large losses on carry trade, thus the two studies disagree whether carry unwinding can be related to the news. Besides providing additional facts to the dispute, we shed some light on the relationship between sentimental reactions, news and carry performance in the year September 2008 to September 2009 when the carry strategy experienced large losses and gains.

To relate carry performance to news and sentimental reactions we divide the September 2008 to September 2009 period in two half-year periods. In support to Fratzscher (2009) the period September 2008 to March 2009 is dominated by negative economic news (65% of the time the surprises in news announcements are negative) and carry losses (-22.6 percent in total). Interestingly, March 2009 - September 2009 is dominated by good news (57% good news) and positive carry performance (19 percent in total).

The period is dominated by sentimental reactions[21] and increased volatility (CVIX) that is larger in the first period, but remains elevated in the second period. The carry strategy demonstrates large losses in the first half and large gains in the second half of the period. Hence we add to the conclusion of Menkhoff et al. (2012) who find carry currencies are negatively related to the innovations in global FX volatility. We find that in the "sentimental" environment carry can both gain and loose depending on the dominance of good or bad economic news. This also adds to the conclusion of Brunnermeier et al. (2009) that there is no relation between carry performance and news.

4. News-based indices and asset returns

[20] The findings are similar when using VIX or currency volatility in the past month.

[21] In both periods majority of the reactions are sentimental, however statistical significance is found only in the second period.

Announcement studies find a strong relation between economic news and asset returns in short windows around announcement times. Yet few studies find a link between economic fundamentals and asset returns in the medium term. In this section we bridge the two streams of literature and connect macroeconomic news to monthly asset returns. We construct macroeconomic news indices and show that the impact of news on asset prices extends into the medium-term.

4.1 Construction of the news indices

Combining the findings in the literature and in this paper we construct three indices: general news, sentimental news and fundamental news. In constructing these indices we found a number of aspects to be crucial, and these aspects could explain why many other studies failed to connect macroeconomic fundamentals and asset prices:

i. Include all available announcements. Only including the 20 announcements studied by Andersen et al. (2003, 2007) provides much less strong results. More announcements provide a more complete picture.
ii. Consider surprises in news announcements, not the announcements themselves.
iii. Include the size of standardized surprises, because larger surprises have a larger impact on the market (e.g. Andersen et al., 2003).
iv. Weight surprises by their impact on return volatility, not returns. Given the time-varying response of high-yield currencies and equities positive and negative responses to the same (e.g. good) news will average return reactions towards zero. Also some news is more important than other news, and this should be reflected in the weighting scheme.
v. Weights are time-varying to account for the changing importance of announcements (scapegoat models of Bacchetta and Van Wincoop (2004)).
vi. We need to take into account the time-variation in the response sign to news of high yield currencies.

The general news index is based on the weighted sum of standardized macroeconomic surprises. We aim to relate news and monthly asset returns, thus the news index is the weighted sum of news in month τ

$$N_\tau = \sum_{k \in A} \sum_{t \in \tau} w_{k,t} S_{k,t}, \tag{5}$$

where weights $w_{k,t}^N$ are averages of the rolling one year estimates of equation (3) for the high yield portfolio[22].

Based on our insights on the response of high yield currencies we split the news index into two parts. First, we consider only news that draws a fundamental response from the high yield currency portfolio,

[22] This news index and also several of the aforementioned five considerations in constructing the index are largely inspired by the Citigroup economic surprise indices (see Bloomberg: CESIUSD Index). The end of month US Citigroup economic news index has correlations of 0.61, 0.43 and 0.48 with our general, fundamental and sentimental news indices, respectively.

$$F_\tau = \sum_{k \in A} \sum_{t \in \tau} w_{k,t} S_{k,t} D_{k,t}, \tag{6}$$

where $D_{k,t}$ equals 1 if high yield portfolio appreciates (depreciates) in response to bad (good news). Second, we consider only news that draws a sentimental response from the high yield currency portfolio

$$S_\tau = \sum_{k \in A} \sum_{t \in \tau} w_{k,t} S_{k,t} (1 - D_{k,t}) \tag{7}$$

Figure 5 presents the monthly plots of each of three indices.

[Insert Figure 5 about here]

4.2 News indices and asset returns

We regress monthly returns of the carry and S&P 500 index on the news indices. We also control for innovations in the available forward looking volatility indices. News affects changes in volatility. Hence to separate the volatility and news effects we regress changes in the volatility on the general, fundamental and sentimental news indices and use the residuals (changes in volatility orthogonal to news) in the asset return regressions. For the carry we use the currency volatility index (CVIX) and for the S&P 500 index we use the S&P500 implied volatility index (VIX). We find sentimental news to be negative related to the innovations in implied volatility indices (correlations up to -0.3). On the other hand positive fundamental news does not coincide with negative innovations in the implied volatility.

The estimates are reported in Table 8. Panel A shows the results for the carry. The news index N explains 9 percent of the variation in the monthly carry returns. The explanatory power increases to 14 percent when replacing the news index by the fundamental and sentimental indices. The carry returns only load significantly on the sentimental index. Hence news that draws a response of high yield currencies opposite to that predicted by monetary models is most important for carry returns. One explanation is that in the case of fundamental news both the low yield and the high yield currencies move in the same direction vis-à-vis the USD, reducing the impact on the high minus low yield returns, i.e. the carry. The changes in the CVIX explain 30 percent of the variation in carry returns, consistent with the conclusions of Lustig et al. (2011) and Menkhoff et al. (2012). Combining CVIX with the fundamental and sentimental news indices raises the regression R-squared to 43 percent. Hence adding the news indices increases the explanatory power by 13 percent compared to just using innovations in CVIX.

[Insert Table 8 about here]

Panel B of Table 8 shows the results for the S&P500 index. The news index N explains 18 percent of the variation in monthly S&P500 returns. This increases to 19 percent when replacing the general news index by the fundamental and sentimental news index. Contrary to the carry results here both fundamental and sentimental news are important. The fundamental news index, however, explains only

3% of the variation in S&P returns, compared to 15% for the sentimental news index. Hence good US news is especially good for the US equity market when carry does well. Depending on the different theories this coincides with episodes that good news for the US is good for the world and/or investor sentiment being fuelled by the good news triggering a rally in risky assets. Again adding the relevant volatility index does not change the conclusions. The news indices F and S together with changes in the VIX explain 62% of the variation in monthly S&P 500 returns[23], compared to 42% when only including the VIX. Our results are much better than previously found in the literature. For example McQueen and Roley (1993) find that macroeconomic news explains up to 4% of S&P 500 returns.

Hence for carry and the S&P 500 we show that also at the monthly horizon news is important. This fills a gap in the literature that has so far found it difficult to link fundamentals to asset prices in the medium term.

5. Conclusion

The strong and systematic high frequency reaction of currencies to macroeconomic news has been celebrated as concrete support for monetary models and the connection between economic fundamentals and exchange rates. We show that the consistent relation between exchange rates and economic fundamentals is only valid for low yield currencies. The unconditional reaction of high yield currencies to surprises in most of the announcements is insignificant and the sign of significant news responses is often inconsistent with the predictions of monetary models. High yield currencies do respond significantly to surprises in macroeconomic news announcements, but the sign of the response changes over time. The direction of the response of high yield currencies is strongly related to global volatility. Whereas in the run-up to the credit crisis high yield currencies do often respond as predicted by the Taylor rule models, at the height of the crisis this was not the case. In the period after the Lehman default in good (bad) news for the U.S. often meant even better (worse) news for the rest of the world, resulting in an appreciation (depreciation) of high yield currencies. During the recovery of risky assets from March 2009 onwards good U.S. news led to jumps in the Australian and New Zealand dollar. With the signs of U.S. economic recovery and the worsening situation in Europe, fragile global growth was in limelight in 2012, at the same time high yield currencies again were showing reactions inconsistent with the models.

We construct a monthly news index, aggregating the news surprises from 45 US macroeconomic announcements. We then split this index into a fundamental news index selecting only news surprises triggering a response from high yield currencies in accordance with monetary models; and a sentimental news index based on all news surprises triggering a reaction of high yield currencies opposite to that predicted by monetary model. We then link the monthly news indices to monthly FX carry and equity returns. The results indicate that the sentiment index is an important explanatory variable. Only considering good versus bad news explains 9% of the variation in monthly carry returns. This rises to

[23] Cutler et al. (1989) find that news and volatility can explain only 18.8% of equity volatility.

14% when using the sentimental news index. For the S&P 500 18% of the variation in monthly returns is explained by the general news index, with only the sentimental index explaining 15% compared to just 3% for the fundamental index. Hence we fill a gap in the literature that has so far found it difficult to link fundamentals to asset prices in the medium term.

Our findings also have implications for the exchange rate models. The models prescribe a fixed response sign of exchange rates to fundamentals. While for the low yield currencies such as JPY or CHF the theoretical prediction is consistent with empirical findings, high yield currencies, such as AUD or NZD systematically change the direction of the reaction over time. The issue of differences across currencies and over time needs to be addressed in future developments of exchange rate models. For example financial media regards the differences in reaction as investor or global growth sentiment, thus suggesting added value of investor behavior variables in exchange rate models.

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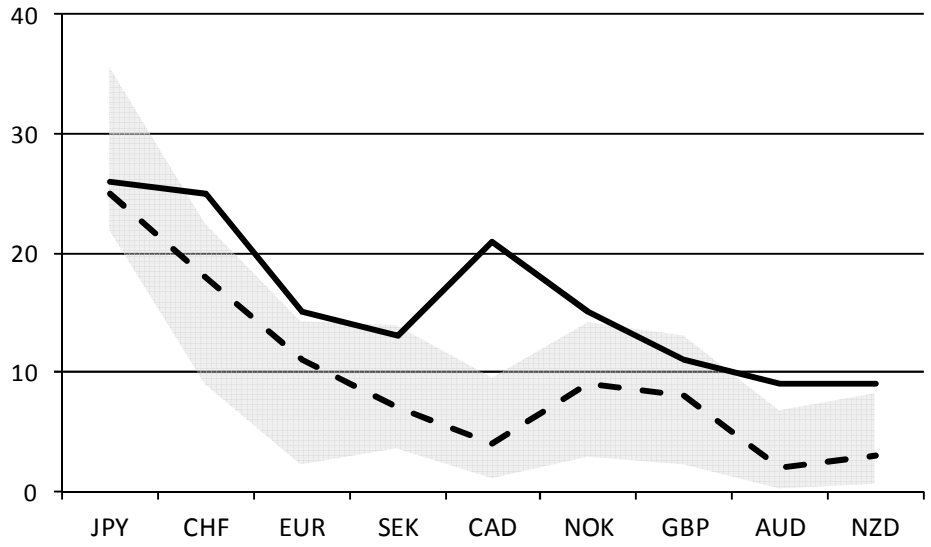
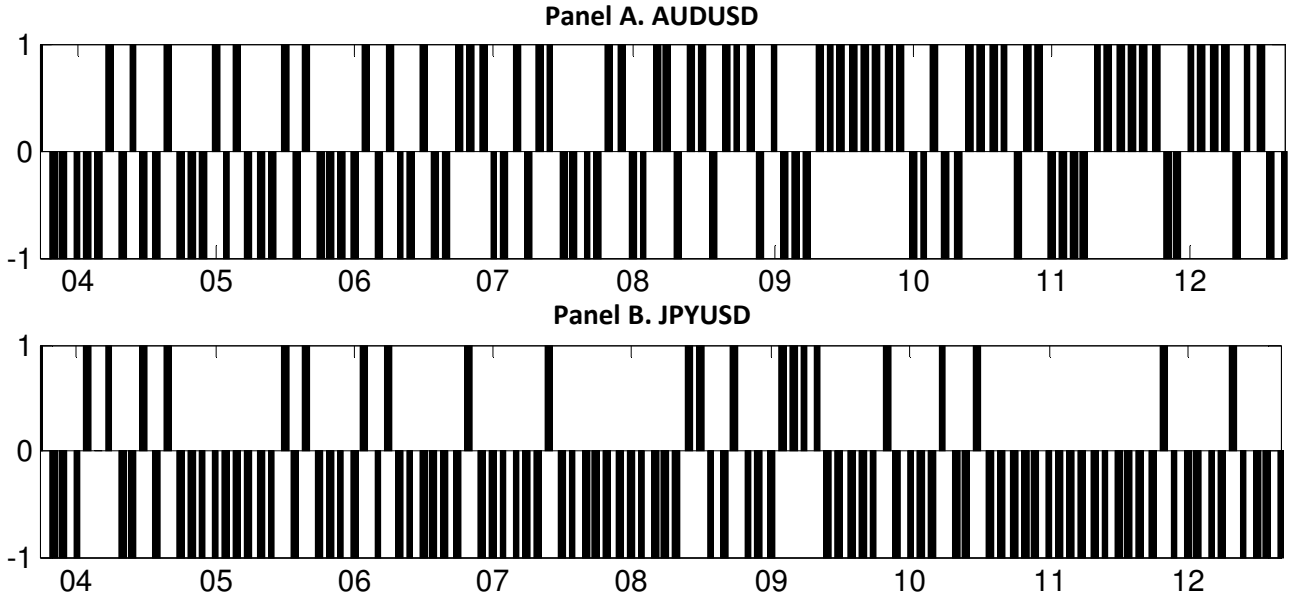
Figures

Figure 1. Number of Significant Announcements



The figure summarizes for each currency how often β_k in equation (2) is significant at the 10% significance level for the 45 announcements *k* listed in Table 3. The solid line depicts the number of statistically significant U.S. announcements and the dashed line depicts the number of significant announcements with on average a "fundamental" response (good news for the U.S. is good news for the USD). The shaded area provides a 90% confidence interval for the dashed line, based on the Clopper-Pearson (1934)(method assuming the significance of each announcement *k* is independent. Currencies are sorted on their average interest rate rank in the full-sample (Oct 2003 – Sept 2012) as shown in the Table 2.

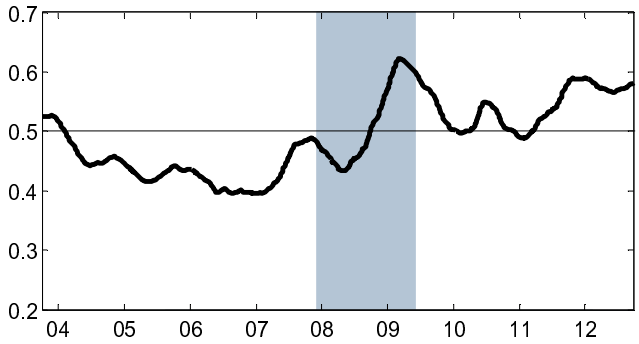
Figure 2. Payroll Surprise and 5-min Currency Reaction Relationship, 2003 October – 2011 September



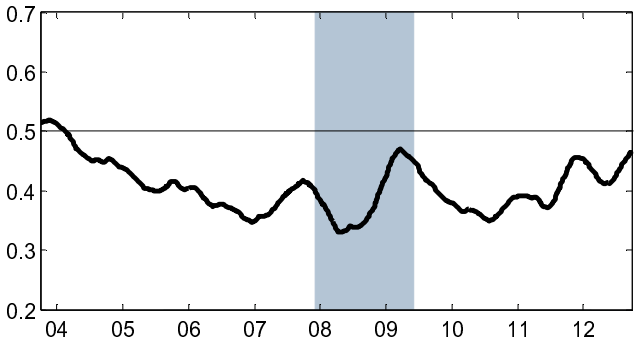
The relationship of surprise in nonfarm payroll and exchange rate reaction (AUDUSD and JPYUSD) is represented by "-1" bar if the surprise and currency return are of opposite signs, and "+1" otherwise. Taylor rule exchange rate model predicts the negative relation of surprises and returns - improvement in U.S. economic conditions leads to a depreciation of foreign currency.

Figure 3. Time-varying Sign of Macroeconomic Reactions

Panel A. High Yield

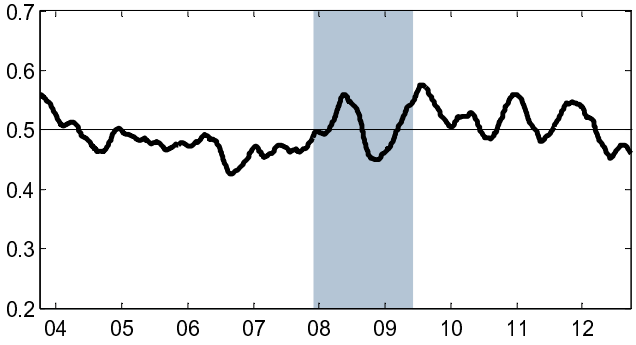


Panel B. Low Yield



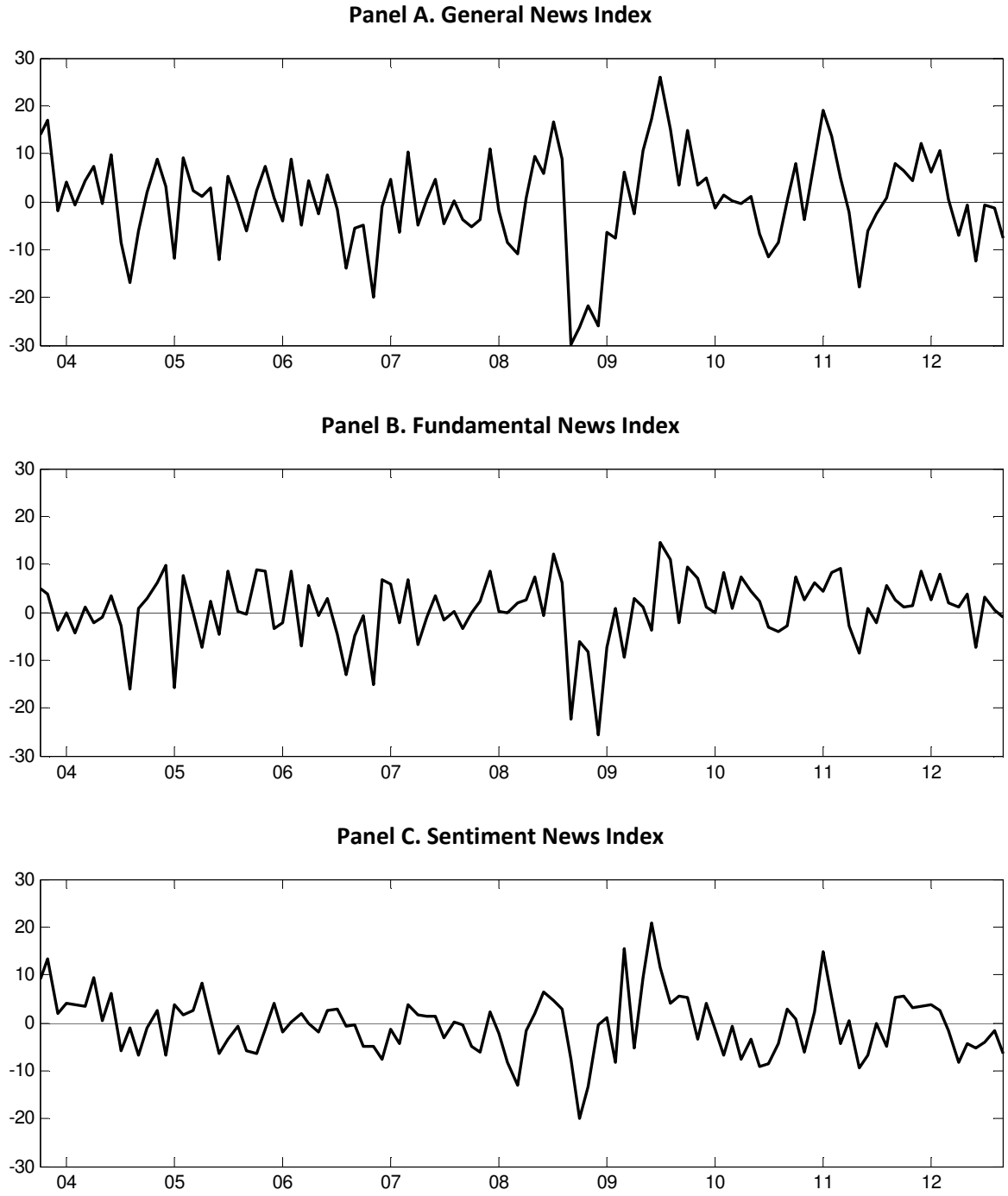
These figures show the frequency of sentimental reactions of currency portfolios to surprises in macroeconomic news announcements. When good (bad) news leads to an appreciation of the currency portfolio we label it sentimental (fundamental), and when good (bad) news leads to a depreciation of the high yielding currencies we label it fundamental (sentimental). We then use Kalman filter to estimate the frequency of sentimental reactions aggregated over all 45 macroeconomic announcements shown in Table 3. Panel A shows the frequency of sentimental reactions for the high yield currencies and Panel B for the low yield currencies. The shaded area highlights the NBER recession period from December 2007 to June 2009.

Figure 4. Fraction of Positive News



This figure shows the frequency of good macroeconomic news. The announcement is labeled good if the surprise (difference survey and actual figure) is positive. We then use Kalman filter to estimate the frequency of good news aggregated over all 45 macroeconomic announcements shown in Table 3. The shaded area highlights the NBER recession period from December 2007 to June 2009.

Figure 5. News Indices



The figure shows the monthly news indices defined in equations (5) (general news index), (6) (fundamental news index) and (7) (sentiment news index).

Tables

Table 1. Summary Statistics of Daily Exchange Rate Returns

	AUD	CAD	CHF	EUR	JPY	GBP	NOK	SEK	NZD	Top	Bottom	Top - Bottom
Mean	2.2	1.6	1.7	0.6	1.7	0.1	1.3	1.1	1.8	3.4	1.9	1.6
St.Dev	92.2	66.1	72.9	64.2	65.2	62.7	87.4	84.7	93.5	79.4	45.4	72.9
Skewness	-0.7	0.2	-0.4	0.2	0.3	0.0	0.4	0.4	-0.3	-0.2	0.3	-0.7
Kurtosis	14.1	7.1	14.7	5.4	7.0	7.8	15.3	7.0	7.6	9.0	6.8	10.3

The table shows the mean, standard deviation, skewness and kurtosis for daily currency returns versus the U.S. dollar in basis points. Top (Bottom) are portfolio returns of equally weighting the 3 highest (lowest) interest rate currencies rebalanced daily. The sample period is October 1, 2003 - October 1, 2012. The currency abbreviations used throughout the paper are: AUD - Australian Dollar; CAD - Canadian Dollar; CHF - Swiss Franc; EUR - Euro; JPY - Japanese Yen; GBP - British Pound; NOK - Norwegian Krone; SEK - Swedish Krona; NZD - New Zealand Dollar.

Table 2. Currency Rank by Interest Rate 2003 October - 2012 September

	1	2	3	4	5	6	7	8	9	10	Average rank
JPY	59%	33%	7%	-	-	-	-	-	-	-	1.5
CHF	38%	58%	4%	-	-	-	-	-	-	-	1.7
USD	2%	7%	36%	3%	2%	5%	19%	11%	-	-	4.0
SEK	-	-	29%	9%	16%	14%	28%	5%	-	-	5.2
NOK	-	-	7%	11%	17%	8%	8%	36%	12%	-	6.6
CAD	-	-	4%	22%	21%	46%	9%	-	-	-	5.3
EUR	-	1%	2%	35%	34%	18%	9%	-	-	-	4.9
GBP	-	-	-	17%	10%	9%	28%	36%	-	-	6.6
NZD	-	-	-	-	-	-	-	11%	30%	59%	9.5
AUD	-	-	-	-	-	-	-	1%	57%	41%	9.4

The table displays the percentage of days currency assumes a rank position in 2003 October - 2012 September period. G10 currencies are ranked daily on their interest rate from the lowest (1) to the highest (10). For each currency average rank is calculated over the sample period.

Table 3. Summary of the U.S. Macroeconomic Announcement Data

	Announcement	Time (EST)	Dates			Frequency	Number of observations
	Consumption						
1	Existing Home Sales	8:30	06/27/06	-	09/19/12	M	76
2	New Home Sales	10:00	10/27/03	-	09/26/12	M	108
3	PCE	8:30	10/31/03	-	09/28/12	M	108
4	Pending Home Sales	10:00	06/01/05	-	09/27/12	M	89
	Forward looking						
5	Empire State Manufacturing	8:30	10/15/03	-	09/17/12	M	108
6	NAHB Index	13:00/10:00‡	10/16/03	-	09/18/12	M	108
7	Philadelphia Fed Survey	10:00	10/16/03	-	09/20/12	M	108
8	CB Consumer Confidence	10:00	10/28/03	-	09/25/12	M	108
9	Michigan Consumer Sentiment	9:55	10/31/03	-	09/28/12	M	108
10	Chicago PMI	9:45	10/31/03	-	09/28/12	M	108
11	ISM Manufacturing[a]	10:00	10/01/03	-	09/04/12	M	108
12	ISM Prices Paid[a]	10:00	10/01/03	-	09/04/12	M	108
13	ISM Non-Manufacturing	10:00	02/05/08	-	09/06/12	M	56
14	Building Permits[b]	8:30	10/17/03	-	09/19/12	M	108
15	Housing Starts[b]	8:30	10/17/03	-	09/19/12	M	108
16	Leading Indicators	10:00	10/20/03	-	09/20/12	M	108
	GDP						
17	GDP Advance	8:30	10/30/03	-	07/27/12	Q	36
18	GDP Preliminary	8:30	11/25/03	-	08/29/12	Q	36
19	GDP Final	8:30	12/23/03	-	09/27/12	Q	36
	Government Purchases						
20	Treasury Budget	14:00	10/20/03	-	09/13/12	M	108
	Investment						
21	Durable Goods Orders	8:30	10/28/03	-	09/27/12	M	108
22	Construction Spending	10:00	10/01/03	-	09/04/12	M	108
23	Factory Orders	10:00	10/02/03	-	08/31/12	M	108
24	Wholesale Inventories	10:00	10/08/03	-	09/12/12	M	108
25	Business Inventories	10:00	10/16/03	-	09/14/12	M	108
	Net exports						
26	Trade Balance	8:30	10/10/03	-	09/11/12	M	108

Table 3. Continued

	Announcement	Time (EST)	Dates	Frequency	Number of observations
	Prices				
27	Import Prices	8:30	08/13/03 - 09/12/12	M	107
28	PPI[c]	8:30	08/14/03 - 09/13/12	M	108
29	PPI Core[c]	8:30	08/14/03 - 09/13/12	M	108
30	CPI[d]	8:30	08/15/03 - 09/14/12	M	108
31	CPI Core[d]	8:30	08/15/03 - 09/14/12	M	108
32	Cost Civilian Workers	8:30	10/30/03 - 07/31/12	Q	36
33	Unit Labor Costs	8:30	09/04/03 - 09/05/12	Q	36
34	GDP Price Index	8:30	06/29/05 - 09/27/12	Q	30
	Real Activity				
35	ADP Employment	8:15	08/30/06 - 09/06/12	M	73
36	Nonfarm Payroll Employment[e]	8:30	09/05/03 - 09/07/12	M	108
37	Unemployment[e]	8:30	09/05/03 - 09/07/12	M	108
38	Retail Sales	8:30	08/13/03 - 09/14/12	M	108
39	Capacity Utilization	9:15	08/15/03 - 09/14/12	M	108
40	Industial Production	9:15	08/15/03 - 09/14/12	M	108
41	Personal Income	8:30	08/29/03 - 09/28/12	M	108
42	Consumer Credit	15:00	09/08/03 - 09/10/12	M	108
43	Nonfarm Productivity	8:30	09/04/03 - 09/05/12	Q	36
	Weekly Real Activity				
44	Initial Jobless Claims[f]	8:30	08/14/03 - 09/27/12	W	470
45	Continuing Jobless Claims[f]	8:30	09/11/03 - 09/27/12	W	460

The table gives starting and ending dates (mm/dd/yyyy), number of observations, time and frequency of the macroeconomic announcements. The data is collected from Bloomberg. Following Andersen et al. (2003) we group the U.S. announcements into eight categories: GDP, four components of GDP (consumption, investment, government purchases, and net exports), real activity, prices, and forward-looking. Within each group the announcements are in chronological order. Announcements marked with the same superscripts (e.g. *a, b, c, d, e, f)* occur at the same time. Frequency: Q - quarterly, M - monthly, W - weekly. In previous studies (e.g. Andersen et al., 2003) ISM announcements are known under the name NAPM.

[‡] in 5/15/2003-6/15/2010 announcement time is 13:00 EST.

Abbreviations: EST - eastern standard time, PCE - personal consumption expenditures, NAHB - National Association of Home Builders, CB - Conference Board, PMI - Purchasing Managers Index, ISM - Institute of Supply Management (former NAPM - National Association of Purchasing Managers), GDP - gross domestic product, PPI - producer price index, CPI - consumer price index, ADP - Automatic Data Processing.

Table 4. Impact of Nonfarm Payrolls

	Intercept		Standardized Surprise		
	α	p-value	β	p-value	R^2
JPY	-2.3	0.45	-25.6	0.00	0.34
CHF	0.8	0.79	-20.6	0.00	0.25
EUR	-1.6	0.57	-13.8	0.00	0.17
GBP	1.2	0.64	-11.0	0.00	0.14
NOK	0.3	0.93	-9.2	0.08	0.07
SEK	0.7	0.85	-7.8	0.15	0.05
CAD	4.9	0.07	3.7	0.38	0.02
NZD	3.7	0.29	-2.8	0.64	0.01
AUD	5.7	0.10	-0.9	0.85	0.00

Estimates of the regression $R_t = \alpha + \beta S_t + \varepsilon_t$, with R_t the 5-minute returns following surprises, S_t, in nonfarm payrolls. All currencies are measured against USD and the sample period covers October, 2003 to September, 2012. P-values are calculated using HAC consistent errors. The first four currencies are the same as analyzed in Andersen et al. (2003).

Table 5. Announcement Effects Using Two Methodologies

		Low (2)		High (2)		Low (3)			High (3)		
	Announcement	β	R^2	β	R^2	α	β	R^2	α	β	R^2
	Consumption										
1	Existing Home Sales	-3.06***	0.16	3.22*	0.08	1.75***	3.40***	0.05	3.08***	5.75***	0.05
2	New Home Sales	-4.47***	0.28	-1.11	0.01	1.96***	4.44***	0.08	2.93***	3.11***	0.02
3	PCE	-0.63	0.01	0.08	0.00	1.32***	2.15***	0.04	2.03***	1.67***	0.01
4	Pending Home Sales	-2.41***	0.11	1.59	0.03	1.91***	2.63***	0.03	2.95***	3.25***	0.02
	Forward looking										
5	Empire State Manufacturing	-3.87***	0.22	-0.01	0.00	1.35***	4.50***	0.14	2.09***	3.42***	0.04
6	NAHB Index	-1.58***	0.19	-0.90	0.02	1.43**	1.06**	0.01	2.19***	1.88***	0.01
7	Philadelphia Fed Survey	-3.73***	0.28	3.54***	0.16	1.69***	3.88***	0.08	2.50***	4.78***	0.05
8	CB Consumer Confidence	-2.63***	0.11	3.91**	0.10	1.95***	3.73***	0.05	2.82***	6.97***	0.08
9	Michigan Consumer Sentiment	0.25	0.00	-0.04	0.00	1.94***	1.68***	0.01	3.21***	1.52***	0.00
10	Chicago PMI	-1.55*	0.06	-1.08	0.02	1.86***	2.80***	0.04	3.07***	2.36***	0.01
11	ISM Manufacturing[a]	-5.73***	0.31	1.89	0.03	1.97***	5.80***	0.12	2.95***	4.86***	0.04
12	ISM Prices Paid[a]	-2.09**	0.04	2.57**	0.06	2.00***	4.73***	0.08	2.93***	5.05***	0.05
13	ISM Non-Manufacturing	-4.81***	0.32	1.36	0.02	1.73***	4.53***	0.09	3.68***	3.87***	0.02
14	Building Permits[b]	-0.62	0.01	0.40	0.00	1.35***	3.99***	0.11	2.10***	3.41***	0.04
15	Housing Starts[b]	-1.11	0.02	0.34	0.00	1.37***	3.73***	0.11	2.13***	2.79***	0.03
16	Leading Indicators	-1.25**	0.04	-0.01	0.00	1.93***	1.89***	0.02	2.88***	2.40***	0.01
	GDP										
17	GDP Advance	-8.50***	0.27	-1.70	0.01	1.42***	10.33***	0.18	2.13***	8.89***	0.08
18	GDP Preliminary	-2.84**	0.16	-0.73	0.01	1.32***	4.03***	0.07	2.03***	3.96***	0.03
19	GDP Final	-2.66***	0.15	-1.19	0.03	1.28***	2.45***	0.02	2.00***	2.71***	0.01
	Government Purchases										
20	Treasury Budget	-0.28	0.01	-0.55	0.01	1.31	0.32	0.00	2.06*	0.50*	0.00
	Investment										
21	Durable Goods Orders	-4.23***	0.14	-0.26	0.00	1.40***	5.80***	0.16	2.09***	4.92***	0.06
22	Construction Spending	1.20	0.01	0.68	0.00	2.00***	4.08***	0.06	2.91***	5.19***	0.05
23	Factory Orders	-1.75***	0.09	-0.84	0.01	1.94***	2.21***	0.02	2.86***	2.81***	0.02
24	Wholesale Inventories	0.79	0.03	0.64	0.01	1.96***	1.77***	0.02	2.85***	2.28***	0.01
25	Business Inventories	0.25	0.00	0.02	0.00	1.84***	2.00***	0.02	2.77***	2.13***	0.01

Table 5. Continued

		Low (2)		High (2)		Low (3)			High (3)		
	Announcement	β	R^2	β	R^2	α	β	R^2	α	β	R^2
	Net exports										
26	Trade Balance	-5.07***	0.16	-2.57	0.05	1.38***	6.37***	0.19	2.08***	5.61***	0.11
	Prices										
27	Import Prices	-1.92*	0.04	-1.84*	0.03	1.34***	4.39***	0.12	2.05***	4.75***	0.07
28	PPI[c]	-2.19***	0.06	-1.02	0.01	1.41***	4.10***	0.12	2.11***	4.08***	0.06
29	PPI Core[c]	-2.47**	0.07	-1.79***	0.03	1.36***	4.46***	0.14	2.10***	3.46***	0.04
30	CPI[d]	-1.31	0.02	-1.80*	0.03	1.33***	4.38***	0.15	2.08***	4.51***	0.08
31	CPI Core[d]	-3.53***	0.11	-4.17***	0.14	1.28***	6.05***	0.24	2.04***	5.84***	0.12
32	Cost Civilian Workers	4.43***	0.09	0.73	0.00	1.35***	6.48***	0.09	2.05***	3.80***	0.02
33	Unit Labor Costs	-0.42	0.01	-1.22*	0.03	1.32***	2.09***	0.02	2.09**	2.10**	0.01
34	GDP Price Index	0.57	0.01	-0.49	0.01	1.25**	3.07**	0.04	2.03***	1.82***	0.00
	Real Activity										
35	ADP Employment	-6.78***	0.49	0.53	0.00	1.59***	6.54***	0.21	2.74***	5.23***	0.05
36	Nonfarm Payroll Employment[e]	-17.35***	0.33	-3.08	0.01	1.65***	19.48***	0.42	2.29***	20.15***	0.38
37	Unemployment[e]	-3.26	0.01	0.78	0.00	1.55***	14.47***	0.37	2.23***	14.19***	0.27
38	Retail Sales	-6.65***	0.22	2.00	0.02	1.36***	7.66***	0.19	2.04***	9.93***	0.18
39	Capacity Utilization	-0.98*	0.04	0.49	0.00	1.86***	1.75***	0.02	2.73***	2.20***	0.01
40	Industial Production	-1.09**	0.06	0.40	0.00	1.86***	1.39***	0.01	2.73***	2.07***	0.01
41	Personal Income	-0.19	0.00	0.15	0.00	1.38***	1.86***	0.04	2.08***	1.18***	0.01
42	Consumer Credit	0.39	0.03	0.83**	0.03	1.17***	0.55***	0.00	2.04***	1.23***	0.00
43	Nonfarm Productivity	-1.74**	0.09	-0.40	0.00	1.32***	2.27***	0.02	2.06***	3.85***	0.02
	Weekly Real Activity										
44	Initial Jobless Claims[f]	-2.50***	0.08	0.92	0.01	1.58***	4.29***	0.22	2.21***	4.56***	0.15
45	Continuing Jobless Claims[f]	-0.70*	0.01	0.62	0.00	1.73***	3.08***	0.13	2.32***	3.84***	0.12

Estimates of equations (2) $R_{k,t} = \alpha_k + \beta_k S_{k,t} + \varepsilon_t$ and (3) $\left|R_{k,t} - \bar{R}_k\right| = \alpha_k + \beta_k D_{k,t}\left|S_{k,t}\right| + \varepsilon_t$ for 5 minute returns of high and low yield currency portfolios, where $S_{k,t}$ is standardized surprise of announcement k, and $R_{k,t}$ 5-minute return. Estimating equation (2) only returns following an announcement are used. Equation (3) uses all returns that occur in the same 5-minute interval of the day as the announcement thus dummy $D_{k,t}$ is equal 1 if the return is associated with the macroeconomic surprise $S_{k,t}$ and zero otherwise. $\bar{R}_k$ is the sample mean, $\bar{R}_k = \frac{1}{T_k}\sum_{t=1}^{T_k} R_{k,t}$, of the returns, dummy $D_{k,t}$ is equal to 1 if announcement k occurs at t. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels using HAC errors. Announcements marked with superscripts *a, b ,c ,d, e ,f* occur at the same time.

Table 6. Summary of Announcement Effects

	β_I		β_{II}		(I)	(II)				
	Max	**Mean**	**Max**	**Mean**	**Obs.**	**Obs.**	**p-value**	$\beta_I > \beta_{II}$	$\beta_I < \beta_{II}$	**Total**
Consumption	3.49	2.02	8.61	6.03	179	167	0.24	-	4	4
Forward looking	4.33	2.96	8.73	4.09	586	614	0.22	-	3	12
GDP	12.00	7.04	5.91	3.45	46	40	0.23	1	-	3
Government Purchases	1.11	1.11	-0.12	-0.12	53	56	0.42	1	-	1
Investment	4.82	3.50	5.62	3.59	276	237	0.04	-	-	5
Net exports	7.40	7.40	3.56	3.56	64	44	0.02	1	-	1
Prices	7.05	4.30	6.59	3.62	279	233	0.02	2	1	8
Real Activity	20.02	6.75	20.51	7.11	377	411	0.12	-	1	9
Weekly Real Activity	4.37	4.23	4.89	4.38	485	431	0.03	-	-	2

Table presents a summary of Table A.2. of the Appendix. Estimates of regression $\left|R_{k,t} - \bar{R}_k\right| = \alpha + \beta D_{k,t}\left|S_{k,t}\right| + \varepsilon_t$ separately for the reactions that are consistent with Taylor rule model predictions (type I) and opposite (type II) are summarized giving maximum and mean values within announcement category (see Table 3). Mean is a simple average of all estimated coefficients within announcement category. Returns are measured in basis points. Number of type I and II observations are tested using binomial test for equal probability of each type of reaction. Hypothesis of reaction coefficient equality ($\beta_I = \beta_{II}$) is tested using Wald test for auxiliary regression $\left|R_{k,t}\right| = \alpha_k + \beta_I D_{k,I}\left|S_{k,t}\right| + \beta_{II} D_{k,II}\left|S_{k,t}\right| + \varepsilon_t$. Hypotheses are tested using HAC errors. In the last three columns the number of statistically significant asymmetries is given with the total number of announcements within a category. Detailed information on individual announcements within the category is available in Table A.2. of the Appendix.

Table 6. Business Cycle, News and FX reactions

Panel A.

	Good	Bad	%Good	p-value
Recession	372	408	0.48	0.11
Expansion	1870	1877	0.5	0.46

Panel B.

	Fundamental	Sentimental	%Sentimental	p-value
Good	1162	1078	0.48	0.04**
Bad	1157	1125	0.49	0.24
Expansion	1924	1818	0.49	0.04**
Recession	395	385	0.49	0.35
Good Recession	193	179	0.48	0.22
Good Expansion	969	899	0.48	0.05*
Bad Recession	202	206	0.5	0.44
Bad Expansion	955	919	0.49	0.2

The table shows in panel A the frequency of good news ('Good') and bad news ('Bad') as measured by surprises in macroeconomic announcements during recessions and expansions as classified by the NBER. In panel A we also consider the interaction of good and bad news and expansions and recessions with the frequency of times that the high yield currency portfolio responds in a fundamental or sentimental way to news. When good (bad) news leads to an appreciation of the high yielding currencies we label it sentimental (fundamental), and when good (bad) news leads to a depreciation of the high yielding currencies we label it fundamental (sentimental). The reported p-values test the null hypothesis that the frequency of the object does not deviate from 50 percent. The sample period is Oct 2003 to Sept 2012.

***, **, * indicate parameter significance at 1%, 5% and 10% levels, respectively.

Table 7. CVIX and the Reactions to Macroeconomic News

	CVIX	Fundamental	Sentimental	%Sentimental	p-value
Low	7.2	501	365	0.42	0.00***
2	8.8	493	394	0.44	0.00***
3	10.1	454	425	0.48	0.16
4	11.7	463	456	0.50	0.40
High	15.4	407	561	0.58	0.00***

This table shows the relation between Deutsche Bank's currency volatility index (CVIX) and the frequency of fundamental and sentimental reactions to surprises in macroeconomic news announcements for the high yield currency portfolio. When good (bad) news leads to an appreciation of the high yielding currencies we label it sentimental (fundamental), and when good (bad) news leads to a depreciation of the high yielding currencies we label it fundamental (sentimental).

The high yield currency portfolio reactions are divided over implied volatility quintiles (low, 2, 3, 4, high CVIX). The quintiles are formed using all daily observations of the currency VIX (CVIX) index in the sample period October 2003 to September, 2012. Average CVIX level within the quintiles are given in the second column. The reactions are matched with the volatility quintile a day before the news. The reported p-values are for the null hypothesis that the fraction of sentimental is equal to 50 percent. ***, **, * indicate significance at 1%, 5% and 10%.

Table 8. News Indices and Asset Returns

	N	F	S	$\Delta IV^{\perp}$	$\overline{R}^2$
Panel A. Carry					
1	1.87**	-	-	-	0.09
2	-	0.42	-	-	-0.01
3	-	-	3.35***	-	0.14
4	-	-	-	-1.22***	0.30
5	-	0.5	3.36***		0.14
6	-	0.5	3.36***	3.35***	0.43
Panel B. S&P 500					
1	3.90***	-	-	-	0.18
2	-	2.59**	-	-	0.03
3	-	-	5.12***	-	0.15
4	-	-	-	-0.62***	0.42
5	-	2.71***	5.19***		0.19
5	-	2.71***	5.19***	-0.62***	0.62

The table presents the results from regressing monthly Carry (panel A), SP500 (panel B) returns on monthly news indices: news (N), fundamental (F) and sentiment news (S). $\Delta IV^{\perp}$ denotes implied volatility orthogonalized to the news indices. We use changes in currency VIX for the carry and changes in the VIX for the S&P 500. Estimates for intercept are not significant thus not reported in the table. Sample includes 108 monthly observations October 2003 - September 2012. A positive value of the news indices indicate good news dominates. ***, **, * indicate significance at 1%, 5% and 10%, using HAC adjusted errors.

Appendix

Table A.1 Individual Currency Impact of Macroeconomic Announcements

		JPY		CHF		EUR		GBP		NOK		SEK		NZD		AUD		CAD	
	Announcement	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2
	Consumption																		
1	Existing Home Sales	-6.67***	0.24	-2.71	0.05	-0.38	0.00	0.86	0.01	2.56	0.04	2.51	0.04	3.65*	0.07	3.23**	0.08	3.93***	0.12
2	New Home Sales	-5.66***	0.23	-4.86***	0.18	-3.33***	0.13	-2.42***	0.10	-2.10*	0.04	-2.71**	0.06	-0.94	0.01	-1.08	0.01	-0.32	0.00
3	PCE	-1.42**	0.02	-0.80	0.01	-0.67	0.01	-0.36	0.00	-0.26	0.00	-0.12	0.00	0.51	0.00	0.25	0.00	0.12	0.00
4	Pending Home Sales	-4.76***	0.18	-2.80**	0.09	-1.16	0.02	-0.03	0.00	0.03	0.00	0.82	0.01	2.00	0.04	2.54	0.07	2.64**	0.08
	Forward Looking																		
5	Empire State Manufacturing	-5.74***	0.21	-4.22***	0.16	-3.07***	0.11	-1.71**	0.04	-1.59	0.02	-1.12	0.01	0.10	0.00	0.07	0.00	1.19	0.01
6	NAHB Index	-1.85***	0.16	-2.07***	0.14	-2.00***	0.14	-1.59***	0.11	-2.27***	0.10	-2.19***	0.09	-1.73**	0.05	-0.70	0.01	-1.02**	0.04
7	Philadelphia Fed Survey	-6.30***	0.31	-4.06***	0.15	-0.91	0.01	0.09	0.00	0.89	0.01	0.43	0.00	4.75***	0.18	4.77***	0.17	3.36***	0.12
8	CB Consumer Confidence	-5.77***	0.27	-1.95	0.03	0.58	0.00	0.54	0.00	2.91	0.04	4.46*	0.06	4.11*	0.09	4.08**	0.10	5.22***	0.20
9	Michigan Consumer Sentiment	0.24	0.00	0.11	0.00	0.13	0.00	-0.01	0.00	-0.77	0.01	0.72	0.01	0.21	0.00	0.19	0.00	-0.41	0.00
10	Chicago PMI	-2.05**	0.07	-1.32	0.02	-1.12	0.02	-0.80	0.01	-1.85*	0.04	-1.50	0.03	-1.11	0.02	-0.84	0.01	-0.47	0.00
11	ISM Manufacturing[a]	-8.83***	0.36	-6.69***	0.19	-2.43*	0.04	-1.63	0.03	-0.57	0.00	-0.99	0.01	1.92	0.02	3.29*	0.06	3.17**	0.08
12	ISM Prices Paid[a]	-4.26***	0.09	-2.26*	0.02	-0.28	0.00	0.06	0.00	0.54	0.00	0.27	0.00	3.42**	0.07	3.76***	0.08	2.14**	0.04
13	ISM Non-Manufacturing	-8.84***	0.41	-5.88**	0.19	-2.23	0.04	-0.72	0.01	-0.20	0.00	0.08	0.00	1.57	0.01	2.71*	0.05	2.74**	0.06
14	Building Permits[b]	-1.03	0.01	-0.07	0.00	0.02	0.00	-0.43	0.00	-0.15	0.00	0.63	0.00	0.46	0.00	0.58	0.00	0.49	0.00
15	Housing Startsb[b]	-1.83**	0.03	-1.07	0.01	-0.52	0.00	-0.05	0.00	-0.21	0.00	0.04	0.00	0.36	0.00	0.73	0.01	1.15	0.02
16	Leading Indicators	-2.58***	0.07	-0.85	0.01	-0.71	0.01	-0.42	0.01	0.08	0.00	-0.71	0.01	-0.57	0.00	0.47	0.00	-0.35	0.00
	GDP																		
17	GDP Advance	-9.75***	0.19	-12.12***	0.26	-8.19***	0.22	-6.47**	0.14	-5.40*	0.11	-4.18	0.05	-2.77	0.02	-0.99	0.00	1.10	0.00
18	GDP Preliminary	-5.83***	0.22	-2.87	0.08	-1.93	0.04	-0.48	0.00	-1.27	0.01	-1.02	0.01	-0.60	0.00	-1.02	0.01	-0.62	0.00
19	GDP Final	-3.63***	0.09	-3.61***	0.17	-2.10***	0.11	-0.81	0.02	0.60	0.01	-1.89	0.06	-2.21*	0.06	-0.91	0.01	-0.79	0.01
	Government Purchases																		
20	Treasury Budget	0.43	0.01	-0.27	0.00	-0.38	0.01	-0.90	0.04	-0.45	0.01	0.50	0.01	1.68***	0.05	0.56	0.01	0.88**	0.04
	Investment																		
21	Durable Goods Orders	-5.83***	0.16	-4.80***	0.09	-2.96**	0.06	-2.66**	0.06	-1.89	0.02	-1.82	0.01	0.10	0.00	-0.33	0.00	1.86	0.02
22	Construction Spending	0.98	0.00	2.88**	0.04	1.31	0.01	0.48	0.00	2.25	0.03	0.97	0.01	0.23	0.00	-0.26	0.00	-0.05	0.00
23	Factory Orders	-2.12***	0.07	-3.06***	0.11	-1.66**	0.04	-1.59***	0.06	-2.17***	0.05	-1.54**	0.03	-0.13	0.00	-0.50	0.00	0.35	0.00
24	Wholesale Inventories	-0.74	0.01	-1.36	0.03	-0.72	0.01	-0.81	0.02	-0.42	0.00	-0.54	0.00	-0.31	0.00	-0.82	0.01	-0.75	0.01
25	Business Inventories	-0.48	0.00	-0.99	0.01	-0.14	0.00	0.05	0.00	0.24	0.00	-0.43	0.00	0.51	0.00	-0.33	0.00	0.36	0.00

Table A.1. Continued

		JPY		CHF		EUR		GBP		NOK		SEK		NZD		AUD		CAD	
	Announcement	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2
	Net Exports																		
26	Trade Balance	-5.64***	0.14	-6.25***	0.17	-4.41***	0.10	-3.67**	0.09	-3.33*	0.05	-4.44***	0.09	-2.99*	0.06	-2.77	0.04	-4.20*	0.05
	Prices																		
27	Import Prices	-1.60	0.02	-2.41**	0.04	-1.72*	0.03	-1.57	0.02	-2.49**	0.05	-2.39*	0.04	-1.86	0.02	-2.20	0.03	-3.27**	0.06
28	PPI[c]	-3.27***	0.06	-1.62*	0.02	-1.59*	0.02	-1.30	0.02	-1.74*	0.02	-2.09**	0.04	-1.37	0.02	-0.40	0.00	-1.17	0.01
29	PPI Core[c]	-3.00***	0.04	-1.86	0.02	-2.28*	0.04	-2.04*	0.04	-2.47**	0.04	-2.43*	0.04	-2.63***	0.05	-2.36**	0.04	-1.80**	0.02
30	CPI[d]	-1.07	0.01	-1.31	0.01	-1.05	0.01	-1.19	0.01	-1.64	0.02	-1.39	0.01	-1.92*	0.02	-2.91**	0.05	0.13	0.00
31	CPI Core[d]	-4.31**	0.10	-4.08***	0.09	-3.15**	0.07	-3.24**	0.09	-3.98***	0.08	-3.51**	0.07	-4.61***	0.13	-6.05***	0.20	-2.07*	0.04
32	Cost Civilian Workers	4.46**	0.05	6.89**	0.11	2.95**	0.05	2.56**	0.04	3.18**	0.05	1.57	0.01	1.03	0.01	0.90	0.00	-1.52	0.01
33	Unit Labor Costs	0.12	0.00	-0.47	0.00	-1.20	0.02	-0.59	0.01	-0.50	0.00	-1.24	0.02	-1.35*	0.04	-1.66*	0.05	-0.44	0.00
34	GDP Price Index	1.49	0.01	0.54	0.00	0.28	0.00	0.08	0.00	0.36	0.00	1.19	0.03	-0.72	0.01	-1.61	0.04	0.68	0.00
	Real Activity																		
35	ADP Employment	-12.70***	0.58	-7.14***	0.29	-4.32***	0.20	-2.86***	0.16	-1.07	0.01	-1.48	0.01	0.86	0.01	1.37	0.02	3.31***	0.15
36	Nonfarm Payroll Employment[e]	-25.60***	0.34	-20.59***	0.25	-13.79***	0.17	-10.96***	0.14	-9.17*	0.07	-7.83	0.05	-2.82	0.01	-0.95	0.00	3.70	0.02
37	Unemployment[e]	4.18	0.01	5.17	0.02	2.73	0.01	2.27	0.01	2.35	0.01	1.29	0.00	-1.92	0.00	-1.33	0.00	-1.38	0.00
38	Retail Sales	-11.44***	0.28	-5.37**	0.09	-3.34	0.05	-2.91	0.04	-1.36	0.01	-1.86	0.01	1.84	0.01	4.00	0.04	2.45	0.03
39	Capacity Utilization	-1.59***	0.06	-1.43	0.04	-0.39	0.00	-0.22	0.00	-0.01	0.00	0.23	0.00	1.05	0.01	0.63	0.01	1.21**	0.04
40	Industial Production	-1.77***	0.09	-1.35*	0.03	-0.34	0.00	-0.47	0.01	-0.17	0.00	0.43	0.00	0.67	0.01	0.77	0.01	1.18**	0.04
41	Personal Income	0.14	0.00	-0.42	0.00	0.02	0.00	0.27	0.00	0.20	0.00	-0.30	0.00	-0.23	0.00	0.37	0.00	0.77	0.00
42	Consumer Credit	-0.35	0.01	0.87**	0.06	1.14***	0.12	0.71***	0.05	0.89**	0.04	0.72**	0.03	0.65	0.01	1.05**	0.03	1.35***	0.12
43	Nonfarm Productivity	-2.70***	0.13	-2.05*	0.06	-0.32	0.00	-1.20*	0.03	-2.46**	0.06	-1.91*	0.04	0.31	0.00	-0.61	0.01	-0.44	0.00
	Weekly Real Activity																		
44	Initial Jobless Claims[f]	4.50***	0.13	2.18**	0.03	0.20	0.00	0.60	0.00	-0.20	0.00	-0.39	0.00	-0.88	0.01	-1.25	0.01	-1.65***	0.02
45	Continuing Jobless Claims[f]	1.55**	0.02	0.51	0.00	-0.18	0.00	0.18	0.00	-0.56	0.00	-1.19**	0.01	-0.92	0.01	-0.40	0.00	-1.10*	0.01

Estimates of equation $R_{k,t} = \alpha_k + \beta_k S_{k,t} + \varepsilon_t$, for G10 currencies against USD. $R_{k,t}$ is 5 minute return following the macroeconomic surprise $S_{k,t}$. All currency returns are expressed in basis points. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, using HAC errors. Announcements marked with superscripts *a, b ,c ,d, e ,f* occur at the same time.