# DISCUSSION PAPER SERIES

DP18119

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**INTERNATIONAL MACROECONOMICS AND FINANCE**

CEPR

ISSN 0265-8003

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Discussion Paper DP18119
Published 26 April 2023
Submitted 24 April 2023

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## Abstract

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JEL Classification: N/A

Keywords: N/A



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# A Fundamental Connection: Exchange Rates and Macroeconomic Expectations

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This draft: April 17, 2023

**Abstract**

One of the most famous puzzles in international finance is the disconnect between exchange rates and macroeconomic fundamentals at business cycle frequencies. We disprove this puzzle by showing that the majority of variation in exchange rates at monthly and quarterly frequencies can be explained by macroeconomic news, which account for as much as 91 percent of the quarterly exchange rate variation during periods of US economic recessions and 64 percent over all periods. The main driver of the reconnect is exchange rates responding to past rather than contemporaneous news—a result inconsistent with the theory of uncovered interest rate parity (UIP). We discuss a number of theoretical models that can explain this surprising result. These include models featuring deviation from UIP due to the presence of currency risk premia, regulatory or institutional frictions, or models featuring deviation from full information rational expectations.

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Emails: vstavrakeva@london.edu, jenny.tang@bos.frb.org. The views expressed in this paper are those of the authors and do not necessarily represent the views of the Federal Reserve Bank of Boston or the Federal Reserve System. We thank Domenico Giannone, Pierre-Olivier Gourinchas, Tarek Hassan, Sebnem Kalemli-Ozcan, Juan Antolin Diaz, Hélène Rey, Kenneth Rogoff, Stefanie Stantcheva, Liliana Varela and the participants at various seminars and conferences for their useful comments.

# 1 Introduction

Currencies are at the center of the global trade of goods and services and cross-country financial flows, playing a key role in the transmission of shocks. Exchange rate fluctuations can have a major impact on domestic inflation, real GDP growth, and financial stability of global economies. For these reasons, exchange rates are also key variables that policy makers target, directly or indirectly, when setting monetary policy and choosing the currency regime of a country. Yet, despite their central role in international economics and finance, exchange rates are some of the least understood variables.

The debate in international economics as to whether exchange rates are disconnected from macroeconomic fundamentals has permeated the field for almost four decades. There is a vast empirical literature devoted to explaining and forecasting exchange rate fluctuations. This literature has generally concluded that exchange rates are largely disconnected from fundamental economic variables such as GDP, interest rates, money aggregates, trade balances, and price levels at short to medium horizons.[1] The empirical exchange rate literature has moved, instead, toward documenting contemporaneous relationships between exchange rates and financial variables.[2] Overall, a perception has emerged that exchange rates are closer to asset prices than to macroeconomic fundamentals and, even then, the literature has failed to find variables that can account for a sizable fraction of exchange rate movements over a longer sample, including before the 2008 financial crisis.

Using novel econometric techniques, nine advanced economy currency crosses against the USD and a data sample between the end of 2001 and the end of 2020, we revisit the debate and argue that the notion of such a disconnect between exchange rates and macroeconomic fundamentals is incorrect. We find that macroeconomic news explain the majority of the

[1]See the seminal papers of Meese and Rogoff (1983a;b) and also Frankel and Rose (1995), Obstfeld and Rogoff (2001), Engel and West (2005), and Rogoff and Stavrakeva (2008) for an overview.

[2]Valchev (2020), Jiang, Krishnamurthy, and Lustig (2021), and Engel and Wu (Forthcoming) document a link between exchange rates and convenience yields; Avdjiev et al. (2019) between exchange rates and deviations from covered interest parity; and Adrian and Xie (2020) and Lilley et al. (2022) between exchange rates and cross-border asset holdings.

variation in monthly and quarterly exchange rate changes—50 and 64, respectively, in a panel regression. Macroeconomic news are announcement surprises in a number of macroeconomic indicators defined as the actual released value of each indicator minus the latest consensus professional forecast of that indicator prior to the announcement (usually as of at most a few days prior). The explanatory power tends to be stronger for currencies of global financial centers with macroeconomic news explaining 74 percent of the EUR/USD quarterly exchange rate change variation. The fraction of exchange rate variation that can be attributed to macroeconomic news is higher during US recessions (91 percent of quarterly variation) and periods of high financial uncertainty (73 percent of quarterly variation). As a result, we argue that exchange rates co-move very strongly with macroeconomic news even at business cycle frequencies.

We find that past surprises play a substantially more important role in explaining exchange rates at monthly and quarterly frequency than their contemporaneous counterparts.[3] This finding explains why the previous literature, which focused only on the contemporaneous correlation between news and exchange rates, failed to establish a strong correlation between exchange rates and macroeconomic news. This discrepancy between our paper and the previous literature can be traced back to the theory of UIP, traditionally at the core of international finance models. Aside from lagged interest rate differentials, which have been shown to have very low explanatory power, UIP predicts that exchange rate changes are driven by only contemporaneous news about future interest rates and inflation.[4] As a result, prior research that examined the link between macroeconomic news and exchange rates only focused on the one-day or intra-day movements of the exchange rate around data releases,

[3]Considering the impulse responses of exchange rates with respect to various macroeconomic news reveal that the effect is often tens of times larger a month or more after the release of the macroeconomic indicator than on the day of the release itself. Moreover, it is not uncommon to find statistically significant reversal in the impulse responses over time. Such a delayed response to news is also present for other asset prices. With respect to government bond markets, post-monetary-policy-announcement drift has been shown to exist by Hanson and Stein (2015), Hanson, Lucca, and Wright (2018) and Brooks, Katz, and Lustig (2020). There is a similar well known post-earnings-announcement drift with respect equity prices first documented in Bernard and Thomas (1989; 1990); for a recent literature review see Fink (2021).

[4]For a recent review of the literature see Engel et al. (2022).

without considering the delayed responses of exchange rates to macroeconomic news (see Andersen et al. 2003 and Faust et al. 2007, among others).

Currently, it is widely acknowledged that the theory of UIP is not the correct model of exchange rate determination. A newer generation of exchange rate models that have the potential to explain currency movements at business cycle frequencies feature either a UIP wedge or deviation from full information rational expectations (FIRE) or both, which allow for lagged macroeconomic news to be a significant driver of exchange rate changes. Another contribution of the paper is to examine, from the perspective of this new class of models, the potential theoretical channels through which macroeconomic news propagate to exchange rates. More specifically, we decompose exchange rate changes into lagged interest rate differentials, the expected excess return (or UIP wedge), and the exchange rate forecast error. The sum of the last two terms is the realized excess return, which also explains almost all of the exchange rate change variation. Based on this decomposition, we find that the reason why past macroeconomic news explain a large fraction of exchange rate variation is because realized excess returns are strongly correlated with macroeconomic news, with past news being the most important driver.

Under the traditional assumption of full information and rational expectations (FIRE), the forecast error must be orthogonal to past macroeconomic news and, as a result, any correlation between realized excess returns and this past news must reflect a relationship between past news and the objective expected excess return. Models featuring rational expectations that can reconcile this finding include those with time-varying currency risk premia (see Gourinchas, Rey, and Govillot 2018 and Stavrakeva and Tang 2021), or regulatory or institutional constraints (see Gabaix and Maggiori 2015, Itskhoki and Mukhin 2021a and Bacchetta and van Wincoop 2021, among others).

Another class of models that can reconcile the link between lagged macroeconomic news and exchange rate changes are those that feature deviation from FIRE. In these models, the link can be due to the subjective expected excess return and/or the subjective forecast error being correlated with lagged macroeconomic news. To test which of these two channels is most relevant for the reconnect between lagged macroeconomic news and exchange rates, we use survey data on professional exchange rate forecasts as proxies for the marginal foreign currency trader's beliefs.[5,6] Our findings suggest that the link between exchange rates and macroeconomic news is driven primarily by the subjective forecast error, with past news playing the most important role. The subjective currency risk premium is less strongly correlated with lagged macroeconomic news. This holds true both when using average and individual-level exchange rate forecasts, indicating that the results are robust to alternative proxies of the marginal trader's beliefs.

A number of theoretical models can generate this finding, including Stavrakeva and Tang (2022) who build a model where subjective expectations deviate from rational expectations in a manner consistent with the theory of internal rationality pioneered by Adam and Marcet (2011) and Adam, Beutel, and Marcet (2017). They estimate the model and show that it can explain a very large fraction of realized and expected exchange rate changes and subjective forecast errors at the individual level. Examples of other types of models with deviation from FIRE that can also potentially explain the results in this paper include models where agents don't know a structural parameter (see Gourinchas and Tornell 2004, Angeletos, Huo, and Sastry 2020, and Afrouzi et al. 2023, among others).

We consider a few different approaches to document the link between exchange rate changes and macroeconomic news. The main econometric approach builds on the work of Altavilla, Giannone, and Modugno (2017), who studied the link between macroeconomic news and asset prices at a monthly frequency. However, by not incorporating lagged dynam-

[5]We are, to our knowledge, the first to use the Consensus Economics *individual-level* professional forecasts of exchange rates. Such data is crucial for analyzing questions of rationality in beliefs.

[6]Stavrakeva and Tang (2022) have shown that professional exchange rate forecasts are inconsistent with FIRE beliefs and are consistent with the average futures positions of OTC forex derivatives traders, where the OTC market is the largest currency market, thus, justifying the use of survey professional forecasts for this purpose. Other papers that conclude that professional exchange rate forecasts are inconsistent with the assumption of FIRE include Dominguez (1986), Frankel and Froot (1987), Froot and Frankel (1989), Ito (1990), Frankel and Chinn (2002), Chinn and Frankel (2019) and Kalemli-Ozcan and Varela (2022), among others.

ics in the relationship between exchange rate changes and macroeconomic news, their study failed to find a reconnect. We extend their methodology in the following way. Similarly to their paper, we first construct a macroeconomic news index as the fitted value of a regression of the daily exchange rate change on news, but we importantly also include lagged macroeconomic news in addition to contemporaneous news. We then regress monthly or quarterly changes of the exchange rate on this daily macroeconomic news index aggregated to the relevant frequency. In addition to including lagged news in the first-stage regression, another contribution relative to Altavilla, Giannone, and Modugno (2017), is that we further tease out the surprises that matter the most as explanatory variables of exchange rates and disentangle what type of theoretical models can be consistent with the reconnect that we document. We do so by constructing macroeconomic news subindices that capture only lagged or contemporaneous surprises, as well as news split by region or by type of news.

Given the large number of regressors introduced by adding lags, we avoid overparameterization by imposing restrictions on the regression coefficients in the first-stage regression. As a robustness check, we address the large number of parameters in another way with Bayesian estimation of the first-stage regression. More specifically, we impose a prior on the macroeconomic surprises' coefficients which is centered around zero and that is tighter the further back in time the lags are. Despite using a prior that effectively biases toward finding no effect of lagged news on exchange rates, we still find lagged news to be a very important driver of exchange rate changes. On average, 49 and 46 percent of the exchange rate change variation at monthly and quarterly frequency can be attributed to macroeconomic news, with lagged news still playing the most important role, once again confirming the importance of relaxing the assumption that news gets incorporated in exchange rates instantaneously.

Finally, given the finding that lagged macroeconomic surprises drive the majority of the reconnect, we also run predictive regressions. It's an additional robustness check as it allows us to relax the constraint that macroeconomic news impact the exchange rate subcomponents in the same way they impact the realized exchange rate change and allows for additional lags to be included. In this less constrained specification, past news explain, on average, 45 percent and 58 percent of exchange rate changes in sample at one-month and one-quarter ahead horizons, respectively. The adjusted $R^2$'s for the realized excess return are similar suggesting that around a half of the objective expected excess return can be explained by macroeconomic news. Next, we consider the survey exchange rate expectations, which allow us to decompose realized excess returns into subjective expected excess returns and forecast errors. At the one-month horizon, on average, 33 percent of the variation of the subjective expected excess return and 62 percent of the variation of the forecast error can be attributed to the macroeconomic surprises. The equivalent adjusted $R^2$'s for the one-quarter horizon are 28 percent and 68 percent, respectively.

The paper's results should be interpreted in the context of a number of other literatures. It links to studies showing that financial market participants interpret news within a broader macroeconomic context. Forex traders, as noted by Cheung and Chinn (2001), have pointed out that market reactions to macroeconomic announcements can be quite nuanced and can depend on the context of the news.[7] Allowing for lagged and other contemporaneous news is one way to capture such contextual relationships.

The order flow literature also studies the impact of macroeconomic news on exchange rates, though via the market micro-structure. Evans (2010) finds that up to 30 percent of the variation in realized currency returns at a one- to two-month horizon can be traced back to macroeconomic news through its impact on order flows.[8] Finally, relying on a structural estimation of an asset demand model, a paper contemporaneous to ours by Koijen and Yogo

[7] "[S]ome traders have pointed out that there are some ambiguities in the interpretation of GDP announcements. GDP is the sum of many components, so the growth rate of aggregate output may not be a sufficient statistic, and in fact may require more analysis in order to determine the true impact of the economic release. One concrete example of this factor is the distinction between growth arising from an export surge, versus that arising from inventory accumulation. The former has a positive implication for future output growth, while the latter has the converse and hence the two have different implications on exchange rate movements." (p.457, Cheung and Chinn 2001).

[8] See also Bacchetta and van Wincoop (2006), Evans and Lyons (2008), Love and Payne (2008) and Evans and Rime (2012) for further empirical evidence and a discussion of the market micro-structure mechanics of how news affects exchange rates through trading behavior.

(2020) finds that macroeconomic variables explain 36 percent of the monthly exchange rate variation while foreign exchange reserves of central banks account for another 19 percent.

The paper proceeds as follows. Section 2 presents evidence on the importance of macroeconomic news for explaining the variation in the exchange rate changes at lower frequencies. Section 3 explores the theoretical implications of this reconnect between exchange rates and macroeconomic surprises using a decomposition of exchange rate changes into lagged interest rate differentials, expected excess return, and forecast errors. Section 4 concludes.

# 2 Exchange Rate News from Macroeconomic Fundamentals

In this section, we present our main empirical exercise, which confirms the link between exchange rate changes and macroeconomic surprises.

We study the main nine currency crosses against the USD: CHF/USD, JPY/USD, EUR/USD, GBP/USD, CAD/USD, AUD/USD, NZD/USD, NOK/USD and SEK/USD. We use news about macroeconomic fundamentals measured with surprises generated by releases of data on macroeconomic variables. These surprises are the differences between actual releases and median forecasts obtained in surveys conducted by Bloomberg and Informa Global Markets (IGM; formerly known as Money Market Services).

In our analysis, we include surprises for a variety of indices for each country chosen based on sample length as well as the popularity of each indicator as measured by Bloomberg's relevance value. The set of indicators includes measures of activity, inflation, trade, and the labor market.[9] The median forecasts for these indicators are generally measured at most a few days before the data release. In the case of IGM, a survey is conducted each Friday regarding the following week's data releases. For each currency pair, we include the

[9]See the Appendix, Section C.3, for the full list of surprises.

indicators of the two countries.[10]

Given the large number of explanatory variables, particularly because we introduce lags into the estimation, we first reduce the dimensionality of our macroeconomic news by applying a two-stage mixed-frequency analysis that builds on Altavilla, Giannone, and Modugno (2017).[11] In the first stage, we construct an exchange rate macroeconomic news index calculated as the fitted value from a regression of the daily exchange rate changes on contemporaneous and lagged macroeconomic surprises. The benchmark specification is to use OLS to estimate this first regression, where we impose some restrictions on the estimated coefficients, cognizant of the large number of regressors and the possibility of overparameterization. We relax this assumption later on and take a different approach to the overparameterization problem by estimating this daily regression using Bayesian estimation. In the second stage, we regress a longer-horizon exchange rate change on this macroeconomic news index summed over the corresponding horizon.

To summarize, we estimate:

$$s_{t+h} - s_t = \alpha^2 + \gamma \left( \sum_{i=1}^{h} \widehat{\Delta s_{t+i}}^{macro} \right) + error_t^2, \tag{1}$$

where $s_{t+h} - s_t$ is an $h$-day log exchange rate change, and $\sum_{i=1}^{h} \widehat{\Delta s_{t+i}}^{macro}$ is the sum of the daily exchange rate macroeconomic news index over the same corresponding horizon $h$. Throughout the paper, exchange rates will be expressed in units of local currency per USD. Thus an increase in $s_t$ would be an appreciation of the USD. This daily macroeconomic news index is constructed from fitted values of the following daily regression (first stage):

$$\Delta s_t = \alpha^1 + \sum_{k=1}^{K} \left( \sum_{j=0}^{126} \beta_j^k Surp_{t-j}^k \right) + error_t^1, \tag{2}$$

where $t$ indexes trading days and $k$ indexes the surprises. To avoid overparameterization,

[10]For the euro, we include euro-area indicators as well as some for Germany, the largest European economy.

[11]Since macroeconomic surprises are not very highly correlated with each other by nature of being surprises, typical dimension reduction techniques such as principal components or factor analysis are not suitable.

we constrain lags beyond the first three to have the same coefficient within months (more specifically, 21 trading days). That is, we impose a step-wise shape on the $\beta_j$ such that $\beta_j = \delta_1$ for $4 \leq j \leq 21$, $\beta_j = \delta_2$ for $22 \leq j \leq 42$, and so on until $\beta_j = \delta_6$ for $106 \leq j \leq 126$. This is set of coefficient restrictions is basically equivalent to summing up surprises, beyond the first three lags, that occurred one month ago, two months ago, and so on. Since most of the macroeconomic indicators that we consider are released once a month, these sums often just reflect the most recent past surprise, the second most recent surprise, and so on. In other words, for most indicators, our restrictions are similar to constraining a surprise to have the same effect on future one-day exchange rate changes until the next data release.

In sum, we capture a dynamic effect of each macroeconomic surprise on exchange rates that is summarized by 10 coefficients; four coefficients for the effect on the day of the announcement and the next three days, and six coefficients that capture the response over the next six months. We leave the coefficients on the contemporaneous and first three daily lags of surprises unconstrained to allow the regression flexibility in accounting for news that, due to differences in time zones, may occur after the time that our end-of-day exchange rates are recorded and sometimes on weekends or holidays. To include all macroeconomic surprises in one daily regression, we follow the literature in setting the surprise measure for an indicator to zero on days with no announcements for that indicator.

Due to the limited availability of expectations data for many of our indicators, the sample starts on the October 1, 2001 for the first-stage regressions (not including lags) and ends on December 9, 2020, where for Switzerland we exclude the period when the CHF was pegged to the euro (from September 6, 2011 through January 14, 2015). The sample for the second-stage regressions starts on March 25, 2002 and ends on November 9, 2020 for the 30-day horizon and September 9, 2020 for the 91-day horizon.[12]

Table 1 presents unadjusted $R^2$s from the first-stage daily estimation of regression (2).

[12]Data for a small number of the indicators starts later than October 2001. In such cases, we use zeros where we do not observe surprises in the early part of our sample for these indicators and recognize that the explanatory power of macroeconomic announcements may be understated due to measurement error.

Macroeconomic surprises do explain some exchange rate variation at the daily frequency, but they are far from explaining a majority of the variation. For example, two highest unadjusted $R^2$ from regressing the daily exchange rate changes on the surprises are 17 and 10 percent. Therefore, high adjusted $R^2$s in the second-stage regression (1) will not be a mechanical consequence of overfitting the daily data in the first stage.

Tables 2 and 3 show adjusted $R^2$s from the second-stage regressions in equation (1) for horizons $h = 30$ and $h = 91$. We present both the bilateral regressions against the USD and the panel version (last column). News about macroeconomic fundamentals can consistently explain the majority of the longer-horizon exchange rate change variation, with an adjusted $R^2$ of 50 percent and 64 percent in the panel regression for the 30- and 91-day horizons, respectively. The highest adjusted $R^2$ is for the EUR/USD cross where the respective values are 59 percent and 74 percent for the monthly and quarterly frequencies respectively.

The fact that the explanatory power of macroeconomic surprises is significantly higher at a lower frequency than at a daily frequency can be attributed to macroeconomic news having persistent effects on exchange rates while other sources of exchange rate movements have more short-lived effects. This fact is also consistent with the evidence regarding the ability of macroeconomic variables to explain and even forecast exchange rates well at annual and lower frequencies (for a literature review, see Rossi 2013). However, we are the first to show such a strong relationship at business cycle frequencies and, moreover, to explain such a large fraction of monthly and quarterly exchange rate change movements.

To understand the importance of longer-term dynamics in the response of exchange rates to macroeconomic announcements, we can further separate our macroeconomic news index in each of these regressions into the part of the sum $\sum_{i=1}^{h} \widehat{\Delta s_{t+i}}^{macro}$ that stems from surprises that occurred within the $t+1$ through $t+h$ time range, which we call the "contemporaneous" component, and those that occurred on date $t$ or prior, the "lagged" component. For detailed expressions of these components, see Section A in the Appendix.

Tables 4 and 5 present the unadjusted $R^2$s from regressing the exchange rate change on each of these components separately and jointly. Stars denote the significance of the estimated coefficients in the univariate regressions on individual exchange rate macroeconomic index subcomponents. The tables show that the bulk of the macroeconomic news index's explanatory power is due to reactions to lagged macroeconomic surprises. The importance of the lagged macroeconomic news index is stronger when we consider 30- rather than 91-day exchange rate changes, potentially because there are more lags in the daily regression that are also categorized as lagged with respect to 30-day changes compared to 91-day changes.

Also in Tables 4 and 5, we decompose the exchange rate macroeconomic news index into subindices associated with different types of macroeconomic news: inflation, real economic activity, external sector and monetary policy news. We also do a similar split for local vs US news.[13] We compute these subindices simply by assigning each macroeconomic indicator into one of these categories and adding up the fitted values from the first-stage regression within each category.[14] For both monthly and quarterly frequencies, real activity news, monetary policy news and inflation news play similar roles, followed by external sector news. Between US vs local news, US news plays a more important role.

Finally, in Table 6, we assess whether macroeconomics news are a more important driver of exchange rate movements during periods of high economic or financial uncertainty. We report the adjusted $R^2$s from the second-stage regressions when the sample is split into time periods that are US recessions or not or when the VIX is higher or lower than its median value. It becomes clear that exchange rates are more strongly connected to macroeconomic fundamentals during times of economic or financial turmoil, with our macroeconomic news indices explaining 91 percent of the variation in 91-day exchange rate changes during US recessions compared with 53 percent during normal times. The respective numbers for the high VIX vs low VIX regimes for the 91-day exchange rate change are 73 versus 47 percent. Furthermore, this pattern is consistent in time-series regressions of each bilateral exchange

[13]Note that the oil news shocks are placed in external sector news or under US news.

[14]See Section C.3 in the Appendix for the categorizations of our surprises.

rate as well and when we consider the 30-day horizon. This result is consistent with beliefs being more sensitive to news (public signals) when there is greater uncertainty about the economy, as discussed in Stavrakeva and Tang (2021).

## 2.1 Robustness Checks

Appendix B presents, as a robustness check, a version of this estimation where the macroeconomic news index is created using a Bayesian estimation of the first-stage daily regression. This allows us to remove explicit restrictions on the coefficients on all the contemporaneous and lagged macroeconomic surprises. We instead impose an informative prior based on the standard Minnesota prior. More specifically, the prior for the coefficients on the macroeconomic surprises is centered around zero and we choose a shrinkage parameter such that the prior distribution is tighter the further back in time the lag is. Essentially, the estimates will be a weighted average between zero and unrestricted OLS estimates so we are biasing ourselves against finding in-sample explanatory power of the macroeconomic surprises for exchange rate changes. All the results are reported in Tables A1-A6.

We find that the unadjusted $R^2$s for the daily regressions are substantially higher when we use Bayesian estimation, reaching as high as 46 percent. This result implies that the constraints we impose on the estimated OLS coefficients in the daily regression in our benchmark specification significantly decrease the explanatory power of the macroeconomic news at daily frequency.

The explanatory power of the macroeconomic news index in the second-stage regressions remains high using Bayesian estimation in the first stage (albeit a bit lower relative to our benchmark OLS specification) and we still see an increase in explanatory power when moving from the daily to lower frequencies. The explanatory power is similar at monthly and quarterly frequencies. Thus, even using Bayesian estimation to construct our macroeconomic news index, we continue to see that there is a high-frequency source of exchange rate fluctuations not attributed to our observed macroeconomic news that cancels out at longer horizons.

Furthermore, the result that responses to lagged macroeconomic surprises are relatively more important is also confirmed using this alternate Bayesian estimation of the first-stage regression despite the estimation procedure inherently biasing against this finding. We find similar patterns regarding the relative importance of the various categories of macroeconomic news and the state-dependence of the relevance of macroeconomic news when we partition the data into periods of high versus low economic and financial uncertainty.

In another important robustness check, we also assess whether our high explanatory power is artificially generated by the large number of surprises, and particularly lags, included in our estimation. To do so, we take random draws from our set of surprises and re-estimate both the first- and second-stage regressions using these randomly drawn surprises. To be more precise, we draw the surprises in blocks of 24 months to preserve any potential autocorrelation patterns within surprises. We also maintain cross-surprise correlations by randomly reordering the time periods and drawing entire vectors of surprises in each given time period. After re-estimating both stages using these randomly drawn surprises, we then compute the percentage of these simulated second-stage adjusted $R^2$s that are lower than our second-stage adjusted $R^2$s based on actual data.

The results of this exercise are presented in Table 7. In 15 out of the 18 cases across the 30- and 91-day horizons for nine currency pairs, our actual adjusted $R^2$s are higher than over 90 percent of the cases with randomly drawn data. In over half of these cases, these percentiles are 99 percent or higher. This evidence shows that the high explanatory power of macroeconomic surprises for exchange rates found in our exercise is not due simply to the large number of variables that are included in the construction of our macroeconomic news index.

## 2.2 Impulse Responses

In order to shed further light onto why we find lagged macroeconomic news to be so important regarding explaining exchange rate changes, consider the dynamic responses of exchange rates to macroeconomic surprises implied by the Bayesian estimates of equation (2) estimated as discussed in section 2.1.

The response of the exchange rate level at time $t+h$, relative to the level at time $t-1$, to a shock to surprise variable $k$ that occurred in time $t$ would be given by the cumulated coefficients $\sum_{j=0}^{h} \beta_j^k$. If the exchange rate only responds to contemporaneous surprises, then the response would be an immediate jump at horizon zero and then a flat line thereafter.

For example, Figures 1-8 show the estimated responses of the GBP/USD, EUR/USD, JPY/USD and AUD/USD exchange rates to local and US macroeconomic surprises. A consistent result across all impulse responses and currency pairs is that the response of the exchange rate to surprises in all of these variables grows over time to be many times larger than on the day of the surprise or even a few days after. This is the case even though we assume a Bayesian prior in the estimation that is more tightly centered around zero for longer lags. Moreover, one can see statistically significant reversals over time in the signs of the estimated coefficients.

As a result, it is clear that there is an important difference between contemporaneous and lagged dynamics, and based on these impulse responses, it is not surprising that incorporating lagged news is crucial for the "reconnect" that we document.

To summarize, while the previous literature finds a tenuous link between exchange rates and macroeconomic variables at policy-relevant frequencies, we show that, at such frequencies, exchange rate changes are indeed predominantly driven by news about macroeconomic fundamentals. Moreover, we show that lagged macroeconomic news play a crucial role, which can also be confirmed with the impulse responses of exchange rate changes with respect to these macroeconomic news.

# 3 Theoretical Implications

## 3.1 UIP

The fact that lagged news (period $t$ and before) explain such a large fraction of exchange rate changes between periods $t$ and $t+h$ seems surprising if one takes as a starting point the theory of UIP, which implies that contemporaneous macroeconomic news should be the main driver of exchange rate changes. UIP assumes traders are risk neutral, markets are frictionless, and FIRE holds. More specifically, UIP implies that the objective expected excess currency return from being long the $h$-period US bond and short the $h$-period bond of country $j$, each denominated in the local currency, is equal to zero:

$$E_t s_{t+h} - s_t + \left(i_t^{h,US} - i_t^{h,j}\right) = 0, \tag{3}$$

where $i_t^{h,US}$ is the yield on a $h-$period US bond, $i_t^{h,j}$ is the yield on a $h-$period bond of country $j$ and $E_t$ stands for the objective expectations operator. Equation (3) can be re-written as:

$$s_{t+h} - s_t = \underbrace{(s_{t+h} - E_t s_{t+h})}_{\text{objective surprise}} + \left(i_t^{h,j} - i_t^{h,US}\right). \tag{4}$$

According to the theory of UIP, there are two components driving realized exchange rate changes—the period $t$ interest rate differential and the objective surprise. The reconnect between exchange rates and lagged macroeconomic news cannot be attributed to the period $t$ interest rate differential for the following reasons. First, the interest rate differential is significantly less volatile than exchange rate changes and, thus, explains a very small fraction of exchange rate movements.[15] The adjusted $R^2s$ from regressing exchange rate changes on interest rate differentials at one and three month horizons are close to zero.[16] Therefore, even if our lagged macroeconomic news index could fully explain the interest rate differential, this would not contribute meaningfully to their explanatory power for the overall exchange rate

[15] See Itskhoki and Mukhin (2021b) for a review of the literature on the Mussa puzzle, which studies the volatility disconnect between macroeconomic variables such as interest rates and exchange rates.

[16] See Burnside (2019) and Engel et al. (2022), for example.

change. Second, Tables 8 and 9 show that our lagged macroeconomic news index is not a major driver of the interest rate differential.

The second component, the objective surprise, can be decomposed further as:[17]

$$s_{t+h} - E_t s_{t+h} = (E_{t+h} - E_t) \sum_{l=1}^{\infty} \left( \pi^j_{t+l*h} - \pi^{US}_{t+l*h} \right) - (E_{t+h} - E_t) \sum_{k=1}^{\infty} \left( i^{h,j}_{t+k*h} - i^{h,US}_{t+k*h} \right).$$

Thus, macroeconomic news can affect exchange rate changes through revisions in expectations of the relative interest rate and inflation paths. However, under the theory of UIP which assumes FIRE, the objective surprise is orthogonal to all information available as of period $t$ and, hence, cannot be correlated with lagged macroeconomic news.

Thus, it is clear that the theory of UIP is not consistent with the reconnect that we document to the extent that, empirically, lagged news drive the majority of the macroeconomics news reconnect, while the theory of UIP predicts that only contemporaneous news should be an important driver.

Next we consider the types of models that can potentially be consistent with our empirical findings and discuss the ways in which they deviate from the theory of UIP.

## 3.2 Models with UIP Wedge

The first category of models that can potentially reconcile our findings are models that microfound a UIP wedge. These tend to be models where agents are risk averse and/or markets are not frictionless. One can amend the UIP model by introducing a wedge as follows:

$$D_t = E_t s_{t+h} - s_t + \left( i^{h,US}_t - i^{h,j}_t \right), \tag{5}$$

[17] For derivations, see Section A in the Appendix.

where $D_t$ is the objective expected excess return. Equation (5) can be re-written as:

$$s_{t+h} - s_t = \underbrace{\underbrace{D_t}_{\text{expected excess return}} + \underbrace{\left(s_{t+h} - E_t\left(s_{t+h}\right)\right)}_{\text{objective surprise}}}_{\text{realized excess returns}} - \left(i_t^{h,US} - i_t^{h,j}\right) \tag{6}$$

As discussed in subsection 3.1, the objective surprise and the interest rate differential cannot explain the reconnect between lagged macroeconomic news and exchange rate changes. As a result, the reconnect can only come from the objective expected excess return being correlated with period $t$ and earlier macroeconomic news. We can formally test whether $D_t$ can account for the reconnect with lagged news as follows. While we don't observe the objective exchange rate expectation, we can use realized excess returns to infer a relationship between lagged news and the objective expectation of excess returns because objective surprises must be orthogonal to lagged news under an assumption of FIRE. Tables 8 and 9 present the unadjusted $R^2$ from regressing the realized excess return on contemporaneous, lagged or both components of the exchange rate macroeconomic news index. We find that the realized excess currency return is to a large extent explained by the lagged macroeconomic news index, with the panel $R^2$ being 37 percent at monthly frequency and 25 percent at quarterly frequency.

A wide variety of models of $D_t$ would potentially generate a correlation between lagged macroeconomic fundamentals and exchange rates. In these models, the expected excess return is a function of persistent endogenous or exogenous variables which themselves correlate with current and lagged macroeconomic news. These include models where the currency risk premia is time varying due to investors' effective risk aversion being correlated with the state of the macroeconomy (see Campbell and Cochrane 1999, Brandt and Wang 2003, Gourinchas, Rey, and Govillot 2018, Campbell, Pflueger, and Viceira 2020, Stavrakeva and Tang 2021, and Pflueger and Rinaldi 2022). Naturally, news about the economy will be the key driver of the risk premium, $D_t$, in these models. Another class of models generates an expected excess return which is correlated with the positions of the foreign exchange rate trader (see

Gabaix and Maggiori 2015, Itskhoki and Mukhin 2021a, and Kekre and Lenel 2021, among many others). To the extent that positions are endogenous and a function of the same state variables that drive macroeconomic surprises, these models can also potentially rationalize our findings under certain calibrations.

Models with regulatory or other financial frictions such as value-at-risk constraints, where the Lagrange multiplier on the binding constraint is a key driver of $D_t$, can be an alternative explanation of the reconnect that we document. Usually in these models the constraints are tighter when the economy performs poorly. Models with value-at-risk constraints include Adrian, Etula, and Muir (2014), Adrian, Etula, and Shin (2015), and Coimbra and Rey (2021), and examples of models with regulatory constraints can be found in Jiang, Krishnamurthy, and Lustig (2021). Intuitively, in all these models, demand cannot respond fully and instantaneously to macroeconomic news up to the point where the objective expected excess return equals zero as there is a limit to the size of the financiers' balance sheets.

Furthermore, models where agents re-balance their portfolios infrequently or where there is some other friction that generates slow moving capital can also potentially generate a UIP wedge that correlates with lagged macroeconomic news even when agents are risk neutral. Some examples of such models, applied to exchange rate determination, include Bacchetta and van Wincoop (2010), Bacchetta and van Wincoop (2021), and Bacchetta, van Wincoop, and Young (Forthcoming).

Regardless of the microfoundation, the interpretation of $D_t$ being correlated with lagged macroeconomic news is that lagged macroeconomic news drive the "effective" risk premia and the in-sample "predictability" of exchange rates is due to compensation for some form of risk, broadly defined.

### 3.3 Models with Deviation from FIRE

A second class of models, which can reconcile our results, is related to the hypothesis that financiers' beliefs are not consistent with FIRE and traders make forecast errors.[18] The subjective expected excess return of trader $i$ from being long the $h$-period US bond and short the $h$-period bond of country $j$ is given by:

$$\tilde{D}_{i,t} = \tilde{E}_t^i s_{t+h} - s_t + \left( i_t^{h,US} - i_t^{h,j} \right),$$

where $\tilde{E}_t^i$ is the subjective expectations operator. Using the Froot and Frankel (1989) decomposition of the subjective surprise into an objective surprise and a deviation from FIRE component, we obtain:

$$s_{t+h} - s_t = (i_t^{h,j} - i_t^{h,US}) + \underbrace{\underbrace{\tilde{D}_{i,t}}_{\text{subjective expected excess return}} + \underbrace{(s_{t+h} - E_t[s_{t+h}])}_{\text{objective surprise}} + \underbrace{\left( E_t s_{t+h} - \tilde{E}_t^i s_{t+h} \right)}_{\text{deviation from FIRE}}}_{\text{realized excess returns}}. \tag{7}$$

In contrast to the expression in equation (6), equation (7) features an additional term, $\left( E_t s_{t+h} - \tilde{E}_t^i s_{t+h} \right)$, which is the difference between the objective and subjective expectations. Moreover, $\tilde{D}_{i,t}$, is the subjective rather than objective expected excess return. If we deviate from the assumption that agents have beliefs consistent with FIRE, the source of the reconnect between lagged macroeconomic news and exchange rate changes could be due to correlations between lagged macroeconomic news and either agents' mistakes, $\left( E_t s_{t+h} - \tilde{E}_t^i s_{t+h} \right)$, or the subjective expected excess return, $\tilde{D}_{i,t}$. Notice that we can measure $\tilde{D}_{i,t}$ directly by using survey data on exchange rate expectations as a proxy for $\tilde{E}_t^i s_{t+h}$. While we do not measure the deviation from FIRE term directly, we observe the subjective forecast error defined as $s_{t+h} - \tilde{E}_t^i s_{t+h}$ which is equal to the sum of the objective surprise and the deviation from FIRE term. As the objective surprise is orthogonal to information avail-

[18] Notice that the macroeconomic surprises will be zero unless one assumes deviation from FIRE at least with respect to the beliefs of the forecasters that report their expectations of macroeconomic fundamentals, who technically can be a different set of agents from the marginal forex traders.

able as of period $t$, the co-movement between the subjective forecast error and the lagged macroeconomic news index can be attributed entirely to the mistakes that forecasters make being correlated with the lagged macroeconomic news index.

The beliefs of marginal forex traders are assumed to be reflected in Consensus Economics professional forecasts, an assumption that is shown to be supported by the data in Stavrakeva and Tang (2022). They found that the average Consensus Economics exchange rate forecasts are correlated with the futures positions of the average trader in the largest forex market, the over-the-counter market, in a theory-consistent way. Therefore, these forecasts should represent the beliefs of the marginal forex trader. In Tables 8 and 9, we use mean exchange rate Consensus Economics forecast data for 1- and 3-month ahead horizons that are available at the monthly frequency. These forecasts are matched to our daily exchange rate and interest rates data, using the dates on which forecasters were surveyed for their expectations.

Restricting the sample to only days on which we have forecast data, Tables 8 and 9 clearly show that, if the beliefs of the marginal trader are consistent with the mean Consensus Economics forecast, the macroeconomic news reconnect is due to the lagged macroeconomic surprises being an important driver of the forecast error rather than the subjective expected excess return. This result implies that the mistakes professional forecasters make are correlated with lagged macroeconomic news.

As a robustness check, we also estimate the same regressions using individual-level subjective currency risk premia and subjective surprises, given that it is unclear that the *average* Consensus Economics exchange rate forecast is the best proxy for the beliefs of the marginal trader. For example, a model with trading constraints would imply that not all traders are marginal at every single point of time. Note that moving to individual-level forecasts is an important step toward understanding whether there is a deviation from rationality because, as shown in Coibion and Gorodnichenko (2015), aggregate forecast errors in noisy-information models can exhibit predictability even if individual forecasters are rational.

Tables 10 and 11 present the evidence regarding forecast error surprises and expected excess returns using 37 individual forecasters for whom we observe at least 24 months' worth of forecasts. We report the median unadjusted $R^2$s and the $5^{th}$ and $95^{th}$ percentiles of the unadjusted $R^2$ in square brackets. For univariate regressions, we also report the percent of individual-level regressions that have regressors significant at the 10 percent level. We confirm that even when using individual-level exchange rate forecasts, rather than the average Consensus Economics forecast, the source of the reconnect is lagged macroeconomic surprises explaining the deviation from FIRE term, since they explain the forecast errors.

Stavrakeva and Tang (2022) is an example of a theoretical model of exchange rate determination that matches these empirical facts and builds on the idea of internal rationality pioneered by Adam and Marcet (2011) and Adam, Beutel, and Marcet (2017). In Stavrakeva and Tang (2022), the forex trader does not know the true data generating process of exchange rates, thus generating an endogenous deviation from FIRE and a forecast error that are both functions of endogenous and exogenous macroeconomic state variables. Internal rationality equilibria models nest a number of deviation from FIRE theories extensively discussed in Adam and Marcet (2011), Adam, Beutel, and Marcet (2017), and Angeletos, Huo, and Sastry (2020). For example, these include models where the agents do not know the true persistence of some exogenous process such as the interest rate differential (see for example the applications in Gourinchas and Tornell 2004 and Candian and De Leo 2022) or do not know some other model parameters.

Finally, note that in order for models in which agents are rational but do not have full information to be consistent with the documented correlation between the *individual-level* subjective forecast error and lagged macroeconomic surprises, one must also assume that the surprises are not observed by individual forecasters. However, as Stavrakeva and Tang (2022) show, the individual-level forecast errors can also be predicted by individual-level forecast revisions, which must be in the information set of the forecaster, a fact that can only be explained by a deviation from rationality in addition to deviation from full information. Thus, rational Bayesian updating models would not be able to jointly explain the properties of individual-level survey-based exchange rate expectations and the reconnect between exchange rates and macroeconomic fundamentals that we document in this paper.

### 3.4 Additional Robustness Checks

We conclude with a set of additional robustness checks that are intended to drive home the point that past macroeconomic surprises matter for exchange rate variation. To do so, we now run predictive in-sample regressions of future exchange rate changes on only past macroeconomic surprises, rather than on the lagged surprises subindex of our macroeconomic news index. Our main exercise imposes the same weights in the relationship between the exchange rate subcomponents and macroeconomic news as between the exchange rate change itself and the macroeconomic news, up to a scalar. Here we allow the exchange rate subcomponents to potentially respond differently to the macroeconomic surprises. Moreover, here we have the same number of lags that we include regardless of the in-sample forecast horizons, which effectively allows for more lags relative to the benchmark specification.

We estimate a version of our first-stage regression using future exchange rate changes as the dependent variable:

$$s_{t+h} - s_t = \alpha^1 + \sum_{k=1}^{K} \left( \sum_{j=0}^{126} \beta_j^k Surp_{t-j}^k \right) + error_t, \tag{8}$$

where we maintain the same set of coefficient restrictions that impose a step-wise shape on the $\beta_j$ such that $\beta_j = \delta_1$ for $4 \leq j \leq 21$, $\beta_j = \delta_2$ for $22 \leq j \leq 42$, and so on until $\beta_j = \delta_6$ for $106 \leq j \leq 126$. Note that we use end-of-day exchange rates in our analysis so that $s_t$ is the market exchange rate recorded after the macroeconomic surprises on day $t$ are observed.

Tables 12–14 report results from this estimation for 1-, 30-, and 91-day changes. Based on the adjusted $R^2$s for 1-day changes, we again confirm that there is little in-sample predictive power of these surprises even with the large number of regressors that we have.[19] However,

[19] Relative to the daily regression specification in Table 1, here we don't include the contemporaneous macroeconomic news and also we report adjusted rather than unadjusted $R^2$s.

tables 13 and 14 show that this predictive power increases dramatically at longer horizons. At the 91-day horizon, we see adjusted $R^2$s of over 50 percent for all but the CAD/USD pair and up to 65 percent for the CHF/USD and JPY/USD pairs. Looking at the statistical significance of the estimated coefficients of the various types of surprises, we find that most of the surprises, across both geographies and different categories of economic data, are statistically significant. The US activity and monetary news tend to be the most statistically significant across currencies and horizons, including the one-day regressions. At longer horizons, both US and local news are statistically significant predictors of the exchange rate change.

Tables 13 and 14 also contain adjusted $R^2$s of analogous regressions with the rate differential and realized excess returns as dependent variables. Unlike in our previous regressions where the lagged news subindex of our exchange rate macroeconomic news index explained little of the interest rate variation, we now see that macroeconomic surprises can explain the vast majority of interest rate variation. This implies that the constraints imposed on the relationship between lagged news and interest rate differentials by using an index that weighed news according to their ability to explain exchange rate changes were very restrictive. Having said that, the interest rate differential explains a very small fraction of the exchange rate change movement (less than 2 percent) and, thus, cannot contribute to the macroeconomic reconnect.

We still find that the predictive power of past macroeconomic surprises for future realized excess currency returns is nearly as high as for the exchange rate changes themselves. Under the assumption of rational expectations, the objective surprise cannot be correlated with past news. Therefore, the results imply that about 50 percent of the objective currency risk premium can be explained by macroeconomic surprises.

Lastly, we further relax the assumption of rationality and examine whether past macroeconomic news can predict expected excess returns or forecast errors based on professional forecasts in sample. Since we have a much larger set of coefficients to estimate relative to our previous regressions based on the lagged news subindex of our macroeconomic news index, and we only have monthly forecast observations, we now use the full panel of individual-level forecasts in a fixed-effect panel regression. Tables 15 and 16 present the results and show that while this more flexible specification can predict expected excess returns reasonably well with adjusted $R^2$s in the 25-36 percent range for both the 30- and 91- day horizons, the predictive power is still much stronger for forecast errors. We see adjusted $R^2$s in excess of 60 percent across all currencies and for both the 30-day and 91-day horizons in all but one case, where the adjusted $R^2$s reach as high as 76 percent for the AUD/USD pair at the 91-day horizon.

# 4 Conclusion

This paper presents evidence countering the commonly held belief that exchange rates are disconnected from macroeconomic fundamentals. Using data on macroeconomic surprises, we show that the new information revealed by announcements about macroeconomic indicators can explain over half of the variation in exchange rate changes at lower frequencies and a vast majority of the variation during times of economic or financial turmoil. Furthermore, the explanatory power, most surprisingly, is primarily driven by past macroeconomic surprises.

If we assume that agents are rational and have full information, the models that would be consistent with our findings will feature an objective expected excess return that correlates with past macroeconomic news. That is, the reconnect that we document can be interpreted as compensation for risk. Alternatively, if we allow for the marginal trader's beliefs to deviate from FIRE and assume that these beliefs are consistent with survey data on exchange rate professional forecasts, we further conclude that the reconnect comes mainly from the link between past macroeconomic surprises and the subjective exchange rate forecast errors. That is, the mistakes that traders make when forecasting exchange rates are correlated with past macroeconomic news. This evidence can be used to motivate theories of exchange rate determination that can potentially empirically account for a very large fraction of exchange rate variation as documented by this paper.

# References


Adam, Klaus, Johannes Beutel, and Albert Marcet. 2017. "Stock Price Booms and Expected Capital Gains." *American Economic Review* 107 (8):2352–2408.

Adam, Klaus and Albert Marcet. 2011. "Internal Rationality, Imperfect Market Knowledge and Asset Prices." *Journal of Economic Theory* 146 (3):1224–52.

Adrian, Tobias, Erkko Etula, and Tyler Muir. 2014. "Financial Intermediaries and the Cross-Section of Asset Returns." *Journal of Finance* :2557–2596.

Adrian, Tobias, Erkko Etula, and Hyun Song Shin. 2015. "Risk appetite and exchange rates." Staff Report 750, Federal Reserve Bank of New York.

Adrian, Tobias and Peichu Xie. 2020. "The Non-U.S. Bank Demand for U.S. Dollar Assets." IMF Working Papers 20/101, International Monetary Fund.

Afrouzi, Hassan, Spencer Y Kwon, Augustin Landier, Yueran Ma, and David Thesmar. 2023. "Overreaction in Expectations: Evidence and Theory*." *The Quarterly Journal of Economics* .

Altavilla, Carlo, Domenico Giannone, and Michele Modugno. 2017. "Low frequency effects of macroeconomic news on government bond yields." *Journal of Monetary Economics* 92:31–46.

Andersen, Torben G., Tim Bollerslev, Francis X. Diebold, and Clara Vega. 2003. "Micro Effects of Macro Announcements: Real-Time Price Discovery in Foreign Exchange." *American Economic Review* 93 (1):38–62.

Angeletos, George-Marios, Zhen Huo, and Karthik Sastry. 2020. "Imperfect Macroeconomic Expectations: Evidence and Theory." *NBER Macroeconomics Annual* 35.

Avdjiev, Stefan, Wenxin Du, Cathérine Koch, and Hyun Song Shin. 2019. "The Dollar, Bank Leverage, and Deviations from Covered Interest Parity." *American Economic Review: Insights* 1 (2):193–208.

Bacchetta, Philippe and Eric van Wincoop. 2006. "Can Information Heterogeneity Explain the Exchange Rate Determination Puzzle?" *American Economic Review* 96:552–576.

———. 2010. "Infrequent Portfolio Decisions: A Solution to the Forward Discount Puzzle." *American Economic Review* 100 (3):870–904.

———. 2021. "Puzzling exchange rate dynamics and delayed portfolio adjustment." *Journal of International Economics* 131:103460.

Bacchetta, Philippe, Eric van Wincoop, and Eric R Young. Forthcoming. "Infrequent Random Portfolio Decisions in an Open Economy Model." *The Review of Economic Studies* .

Bernard, Victor and Jacob Thomas. 1989. "Post-earnings-announcement drift: Delayed price response or risk premium?" *Journal of Accounting Research* 27:1–36.

———. 1990. "Evidence that stock prices do not fully reflect the implications of current earnings for future earnings." *Journal of Accounting and Economics* 13:305–340.

Brandt, Michael W. and Kevin Q. Wang. 2003. "Time-Varying Risk Aversion and Unexpected Inflation." *Journal of Monetary Economics* 50 (7):1457–1498.

Brooks, Jordan, Michael Katz, and Hanno Lustig. 2020. "Post-FOMC Announcement Drift in U.S. Bond Markets." Mimeo, Stanford University.

Burnside, Craig. 2019. "Exchange Rates, Interest Parity, and the Carry Trade." *Oxford Research Encyclopedia of Economics and Finance* .

Campbell, John and John Cochrane. 1999. "By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior." *Journal of Political Economy* 107 (2):205–251.

Campbell, John, Carolin Pflueger, and Luis Viceira. 2020. "Macroeconomic Drivers of Bond and Equity Risks." *Journal of Political Economy* 128 (8):3148–3185.

Candian, Giacomo and Pierre De Leo. 2022. "Imperfect Exchange Rate Expectations." *Working Paper* .

Cheung, Yin-Wong and Menzie David Chinn. 2001. "Currency traders and exchange rate dynamics: a survey of the US market." *Journal of International Money and Finance* 20 (4):439 – 471.

Chinn, Menzie and Jeffrey Frankel. 2019. "A Third of a Century of Currency Expectations Data: The Carry Trade and the Risk Premium."

Coibion, Olivier and Yuriy Gorodnichenko. 2015. "Information Rigidity and the Expectations Formation Process: A Simple Framework and New Facts." *The American Economic Review* 105 (8):2644–2678.

Coimbra, Nuno and Helene Rey. 2021. "Financial Cycles with Heterogeneous Intermediaries." Mimeo, London Business School.

Dominguez, Kathryn. 1986. "Are foreign exchange forecasts rational? New evidence from survey data." *Economics Letters* 21 (3):277–281.

Engel, Charles, Katya Kazakova, Mengqi Wang, and Nan Xiang. 2022. "A reconsideration of the failure of uncovered interest parity for the U.S. dollar." *Journal of International Economics* 136.

Engel, Charles and Kenneth D. West. 2005. "Exchange Rates and Fundamentals." *Journal of Political Economy* 113 (3):485–517.

Engel, Charles and Steve Pak Yeung Wu. Forthcoming. "Liquidity and Exchange Rates: An Empirical Investigation." *Review of Economic Studies* .

Evans, Martin D. D. and Richard K. Lyons. 2008. "How is macro news transmitted to exchange rates?" *Journal of Financial Economics* 88 (1):26 – 50.

Evans, Martin D. D. and Dagfinn Rime. 2012. "Micro Approaches to Foreign Exchange Determination." In *Handbook of Exchange Rates*. John Wiley & Sons, Ltd, 73–110.

Evans, Martin D.D. 2010. "Order flows and the exchange rate disconnect puzzle." *Journal of International Economics* 80 (1):58 – 71.

Faust, Jon, John H. Rogers, Shing-Yi B. Wang, and Jonathan H. Wright. 2007. "The High-Frequency Response of Exchange Rates and Interest Rates to Macroeconomic Announcements." *Journal of Monetary Economics* 54 (4):1051–1068.

Fink, Jose. 2021. "A review of the Post-Earnings-Announcement Drift." *Journal of Behavioral and Experimental Finance* 29.

Frankel, Jeffrey and Menzie Chinn. 2002. "Survey Data on Exchange Rate Expecatations: More Currencies, More Horizons, More Tests." In *Monetary Policy, Capital Flows and Financial Market Developments in the Era of Financial Globalisation: Essays in Honour of Max Fry*, edited by D. Dickinson and W. Allen. Routledge, London and New York.

Frankel, Jeffrey A. and Kenneth A. Froot. 1987. "Using Survey Data to Test Standard

Propositions Regarding Exchange Rate Expectations." *The American Economic Review* 77 (1):133–153.

Frankel, Jeffrey A. and Andrew K. Rose. 1995. "Chapter 33 Empirical research on nominal exchange rates." Elsevier, 1689 – 1729.

Froot, Kenneth and Jeffrey Frankel. 1989. "Forward Discount Bias: Is it an Exchange Risk Premium?" *Quarterly Journal of Economics* 104 (1):139–261.

Gabaix, Xavier and Matteo Maggiori. 2015. "International Liquidity and Exchange Rate Dynamics." *Quarterly Journal of Economics* 130 (3):1369–1420.

Gourinchas, Pierre-Olivier, Hélène Rey, and Nicolas Govillot. 2018. "Exorbitant Privilege and Exorbitant Duty." Mimeo.

Gourinchas, Pierre-Olivier and Aaron Tornell. 2004. "Exchange rate puzzles and distorted beliefs." *Journal of International Economics* 64:303–333.

Hanson, Samuel, David Lucca, and Jonathan Wright. 2018. "Interest rate conundrums in the twenty-first century." Mimeo, Harvard University.

Hanson, Samuel and Jeremy Stein. 2015. "Monetary policy and long-term real rates." *Journal of Financial Economics* 115:429 – 448.

Ito, Takatoshi. 1990. "Foreign Exchange Rate Expectations: Micro Survey Data." *The American Economic Review* 80 (3):434–449.

Itskhoki, Oleg and Dmitry Mukhin. 2021a. "Exchange Rate Disconnect in General Equilibrium." *Journal of Political Economy* 129 (8):2183–2232.

———. 2021b. "Mussa Puzzle Redux." *Working Paper* .

Jiang, Zhengyang, Arvind Krishnamurthy, and Hanno N. Lustig. 2021. "Foreign Safe Asset Demand and the Dollar Exchange Rate." *Journal of Finance* 76.

Kalemli-Ozcan, Sebnem and Liliana Varela. 2022. "Five Facts about the UIP Premium."

Kekre, Rohan and Moritz Lenel. 2021. "The Flight to Safety and International Risk Sharing." Mimeo, Chicago Booth.

Koijen, Ralph and Motohiro Yogo. 2020. "Exchange Rates and Asset Prices in a Global Demand System." *Mimeo* .

Känzig, Diego R. 2021. "The Macroeconomic Effects of Oil Supply News: Evidence from OPEC Announcements." *American Economic Review* 111 (4):1092–1125.

Lilley, Andrew, Matteo Maggiori, Brent Neiman, and Jesse Schreger. 2022. "Exchange Rate Reconnect." *The Review of Economics and Statistics* 104:845–855.

Love, Ryan and Richard Payne. 2008. "Macroeconomic News, Order Flows, and Exchange Rates." *The Journal of Financial and Quantitative Analysis* 43:467–488.

Meese, Richard A. and Kenneth S. Rogoff. 1983a. "Empirical Exchange Rate Models of the Seventies: Do They Fit out of Sample?" *Journal of International Economics* 14 (1–2):3–24.

———. 1983b. "The Out-of-Sample Failure of Empirical Exchange Rate Models: Sampling Error or Misspecification?" In *Exchange Rates and International Macroeconomics*, edited by Jacob Frenkel. Chicago: University of Chicago Press, 67–112.

Obstfeld, Maurice and Kenneth Rogoff. 2001. "The six major puzzles in international macroeconomics: is there a common cause?" *NBER macroeconomics annual* 15:339–390.

Pflueger, Carolin and Gianluca Rinaldi. 2022. "Why does the Fed move markets so much? A model of monetary policy and time-varying risk aversion." *Journal of Financial Economics* 146 (1):71–89.

Rogoff, Kenneth S. and Vania Stavrakeva. 2008. "The Continuing Puzzle of Short Horizon Exchange Rate Forecasting." Working Paper 14071, National Bureau of Economic Research.

Rossi, Barbara. 2013. "Exchange Rate Predictability." *Journal of Economic Literature* 51 (4):1063–1119.

Stavrakeva, Vania and Jenny Tang. 2021. "The Dollar During the Great Recession: The Information Channel of US Monetary Policy and the Flight to Safety." Mimeo.

———. 2022. "Individual Beliefs, Demand for Currency and Exchange Rate Dynamics." Mimeo.

Valchev, Rosen. 2020. "Bond Convenience Yields and Exchange Rate Dynamics." *AEJ: Macroeconomics* 12 (2):124–66.

# Tables and Figures

Table 1: $R^2$s from Daily Regressions of the Exchange Rate Change on Macroeconomic Surprises

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|
| # of Local Surp | 8 | 5 | 6 | 12 | 8 | 11 | 3 | 5 | 6 |
| # of US Surp | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| # of Obs | 4,881 | 4,881 | 4,004 | 4,881 | 4,881 | 4,881 | 4,881 | 4,881 | 4,881 |
| $R^2$ | 0.09 | 0.07 | 0.17 | 0.10 | 0.08 | 0.10 | 0.09 | 0.08 | 0.07 |

Note: Each row presents unadjusted $R^2$s from constrained daily regressions of exchange rate changes on current and up to a 126-trading-day lag of macroeconomic surprises. The constraints are such that the regression is equivalent to an unconstrained regression on current and up to a three-day lag of macroeconomic surprises and sums of past macroeconomic surprises over each of the previous six months, with months being approximated as 21 trading days.

Table 2: Adjusted $R^2$s from Regressions of 30-day Exchange Rate Changes on a Macroeconomic News Index

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| Exch Rate News Index | 1.03*** | 1.04*** | 0.90*** | 1.03*** | 0.97*** | 0.97*** | 1.04*** | 1.03*** | 1.04*** | 1.01*** |
| | (0.02) | (0.03) | (0.02) | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Constant | -0.00 | -0.01 | -0.02 | -0.01 | -0.01 | 0.00 | -0.01 | -0.02 | -0.01 | -0.01*** |
| | (0.04) | (0.03) | (0.04) | (0.03) | (0.03) | (0.03) | (0.03) | (0.04) | (0.03) | (0.00) |
| # of Obs. | 4861 | 4861 | 3983 | 4861 | 4861 | 4861 | 4861 | 4861 | 4861 | 42871 |
| Adjusted $R^2$ | 0.54 | 0.41 | 0.41 | 0.59 | 0.46 | 0.52 | 0.51 | 0.50 | 0.50 | 0.50 |

Note: Each row presents adjusted $R^2$s from regressions of $s_{t+30} - s_t$ on the daily macroeconomic news index correspondingly summed from $t + 1$ through $t + 30$. The daily macroeconomic news index is constructed as fitted values from constrained daily OLS regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises.

Table 3: Adjusted $R^2$s from Regressions of 91-day Exchange Rate Changes on a Macroeconomic News Index

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| Exch Rate News Index | 1.05*** | 1.07*** | 0.89*** | 1.04*** | 1.03*** | 0.99*** | 1.06*** | 1.02*** | 1.06*** | 1.03*** |
| | (0.01) | (0.02) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Constant | 0.02 | 0.02 | -0.04 | 0.03 | -0.01 | 0.01 | 0.01 | 0.04 | 0.00 | 0.02*** |
| | (0.05) | (0.05) | (0.05) | (0.04) | (0.04) | (0.04) | (0.05) | (0.06) | (0.05) | (0.00) |
| # of Obs. | 4818 | 4818 | 3940 | 4818 | 4818 | 4818 | 4818 | 4818 | 4818 | 42484 |
| Adjusted $R^2$ | 0.68 | 0.52 | 0.52 | 0.74 | 0.63 | 0.66 | 0.66 | 0.63 | 0.67 | 0.64 |

Note: Each row presents adjusted $R^2$s from regressions of $s_{t+91} - s_t$ on the daily macroeconomic news index correspondingly summed from $t+1$ through $t+91$. The daily macroeconomic news index is constructed as fitted values from constrained daily OLS regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises.

Table 4: $R^2$s from Regressions of 30-day Exchange Rate Changes on Macroeconomic News Subindices

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| # of Obs. | 4861 | 4861 | 3983 | 4861 | 4861 | 4861 | 4861 | 4861 | 4861 | 42871 |
| | | | | | | | | | | |
| Full | 0.55 | 0.41 | 0.40 | 0.59 | 0.47 | 0.52 | 0.51 | 0.50 | 0.50 | 0.50 |
| Contemp | 0.06*** | 0.05*** | 0.01*** | 0.01*** | 0.07*** | 0.02*** | 0.01*** | 0.05*** | 0.02*** | 0.03*** |
| Lags | 0.31*** | 0.26*** | 0.28*** | 0.38*** | 0.36*** | 0.38*** | 0.34*** | 0.29*** | 0.36*** | 0.33*** |
| | | | | | | | | | | |
| Full | 0.55 | 0.41 | 0.41 | 0.59 | 0.47 | 0.52 | 0.51 | 0.50 | 0.50 | 0.50 |
| Inflation | 0.04*** | 0.01*** | 0.09*** | 0.04*** | 0.07*** | 0.08*** | 0.13*** | 0.03*** | 0.12*** | 0.07*** |
| Activity | 0.09*** | 0.08*** | 0.07*** | 0.09*** | 0.10*** | 0.12*** | 0.09*** | 0.08*** | 0.15*** | 0.09*** |
| External | 0.02*** | 0.02*** | 0.01*** | 0.01*** | 0.00* | 0.04*** | 0.01*** | 0.04*** | 0.02*** | 0.02*** |
| Monetary | 0.15*** | 0.06*** | 0.04*** | 0.11*** | 0.16*** | 0.05*** | 0.09*** | 0.13*** | 0.08*** | 0.10*** |
| | | | | | | | | | | |
| Full | 0.55 | 0.41 | 0.41 | 0.59 | 0.47 | 0.52 | 0.51 | 0.50 | 0.50 | 0.50 |
| US | 0.27*** | 0.17*** | 0.13*** | 0.16*** | 0.22*** | 0.23*** | 0.28*** | 0.33*** | 0.29*** | 0.24*** |
| Local | 0.05*** | 0.01*** | 0.04*** | 0.09*** | 0.09*** | 0.08*** | 0.05*** | 0.04*** | 0.08*** | 0.05*** |

Note: Each row presents $R^2$s from regressions of $s_{t+30} - s_t$ on either the full set of subindices or individual subindices defined by contemporaneous versus lagged news, different economic concepts, or US versus local news. The daily macroeconomic news subindices are correspondingly summed from $t+1$ through $t+30$. The daily macroeconomic news subindices are constructed as fitted values from constrained daily OLS regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises. A subset of macroeconomic surprises or lags is included in the construction of each fitted value for subindices. For regressions on a single subindex, stars denoting the significance of the regressor are included next to the $R^2$ value.

Table 5: $R^2$s from Regressions of 91-day Exchange Rate Changes on Macroeconomic News Subindices

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| # of Obs. | 4818 | 4818 | 3940 | 4818 | 4818 | 4818 | 4818 | 4818 | 4818 | 42484 |
| | | | | | | | | | | |
| Full | 0.68 | 0.52 | 0.48 | 0.74 | 0.63 | 0.66 | 0.66 | 0.63 | 0.67 | 0.64 |
| Contemp | 0.06*** | 0.06*** | 0.01*** | 0.01*** | 0.13*** | 0.03*** | 0.00 | 0.03*** | 0.01*** | 0.02** |
| Lags | 0.21*** | 0.18*** | 0.14*** | 0.19*** | 0.33*** | 0.29*** | 0.29*** | 0.20*** | 0.29*** | 0.23*** |
| | | | | | | | | | | |
| Full | 0.68 | 0.52 | 0.49 | 0.74 | 0.63 | 0.66 | 0.66 | 0.64 | 0.67 | 0.64 |
| Inflation | 0.05*** | 0.02*** | 0.12*** | 0.04*** | 0.12*** | 0.08*** | 0.18*** | 0.04*** | 0.20*** | 0.09*** |
| Activity | 0.07*** | 0.05*** | 0.06*** | 0.05*** | 0.06*** | 0.18*** | 0.05*** | 0.07*** | 0.14*** | 0.08*** |
| External | 0.01*** | 0.01*** | 0.03*** | 0.03*** | 0.00*** | 0.05*** | 0.01*** | 0.04*** | 0.01*** | 0.02*** |
| Monetary | 0.19*** | 0.08*** | 0.01*** | 0.14*** | 0.24*** | 0.04*** | 0.13*** | 0.13*** | 0.13*** | 0.12*** |
| | | | | | | | | | | |
| Full | 0.68 | 0.52 | 0.48 | 0.74 | 0.63 | 0.66 | 0.66 | 0.63 | 0.67 | 0.64 |
| US | 0.28*** | 0.20*** | 0.08*** | 0.11*** | 0.32*** | 0.35*** | 0.34*** | 0.42*** | 0.35*** | 0.27*** |
| Local | 0.09*** | 0.00*** | 0.05*** | 0.17*** | 0.10*** | 0.05*** | 0.04*** | 0.02*** | 0.08*** | 0.06*** |

Note: Each row presents $R^2$s from regressions of $s_{t+91} - s_t$ on either the full set of subindices or individual subindices defined by contemporaneous versus lagged news, different economic concepts, or US versus local news. The daily macroeconomic news subindices are correspondingly summed from $t+1$ through $t+91$. The daily macroeconomic news subindices are constructed as fitted values from constrained daily OLS regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises. A subset of macroeconomic surprises or lags is included in the construction of each fitted value for subindices. For regressions on a single subindex, stars denoting the significance of the regressor are included next to the $R^2$ value.

Table 6: Adjusted $R^2$s from Regressions of 30- and 91-day Exchange Rate Changes on a Macroeconomic News Index with the Sample Split by Recessions and High Financial Volatility Periods

| Horizon | | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $h = 30$ | US Recession | 0.78 | 0.65 | 0.76 | 0.77 | 0.78 | 0.66 | 0.62 | 0.78 | 0.72 | 0.73 |
| | Non-Recession | 0.44 | 0.32 | 0.33 | 0.53 | 0.36 | 0.49 | 0.47 | 0.41 | 0.43 | 0.43 |
| | High VIX | 0.63 | 0.52 | 0.49 | 0.66 | 0.59 | 0.53 | 0.57 | 0.56 | 0.60 | 0.58 |
| | Low VIX | 0.35 | 0.23 | 0.29 | 0.44 | 0.29 | 0.49 | 0.40 | 0.38 | 0.33 | 0.36 |
| $h = 91$ | US Recession | 0.94 | 0.88 | 0.85 | 0.90 | 0.95 | 0.83 | 0.88 | 0.93 | 0.91 | 0.91 |
| | Non-Recession | 0.50 | 0.39 | 0.47 | 0.69 | 0.43 | 0.63 | 0.56 | 0.51 | 0.56 | 0.53 |
| | High VIX | 0.79 | 0.66 | 0.59 | 0.81 | 0.76 | 0.67 | 0.73 | 0.69 | 0.77 | 0.73 |
| | Low VIX | 0.38 | 0.33 | 0.38 | 0.59 | 0.37 | 0.63 | 0.54 | 0.51 | 0.45 | 0.47 |

Note: Each row presents the adjusted $R^2$s from a regression of 30- or 91-day exchange rate changes on the daily macroeconomic news index correspondingly summed from $t+1$ through $t+30$ or $t+91$ for over a specified subsample of dates. The daily macroeconomic news index is constructed as fitted values from constrained daily OLS regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises. We use NBER recession dates, and the VIX is split by the median value over the full regression sample.

Table 7: Percentiles of Actual Adjusted $R^2$s from Regressions of 30- and 91-day Exchange Rate Changes on a Macroeconomic News Index Within a Distribution of Adjusted $R^2$s Estimated Using Random Surprises

| Horizon | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|
| 30 | 1.00 | 0.86 | 0.93 | 1.00 | 0.93 | 0.97 | 1.00 | 1.00 | 0.99 |
| 91 | 0.96 | 0.71 | 0.94 | 1.00 | 0.86 | 0.91 | 1.00 | 0.97 | 0.99 |

Note: Each row presents the percentiles of our actual adjusted $R^2$ estimates from Tables 2 and 3 within a distribution of adjusted $R^2$s obtained from repeating the same two-step estimation using a set of randomly drawn surprises. The surprises are drawn as entire vectors of surprises in each time period in blocks of 24 months to preserve cross-sectional and cross-time correlation patterns.

Figure 1: Bayesian Estimates of Impulse Responses of the GBP/USD Exchange Rate to UK Macroeconomic Surprises

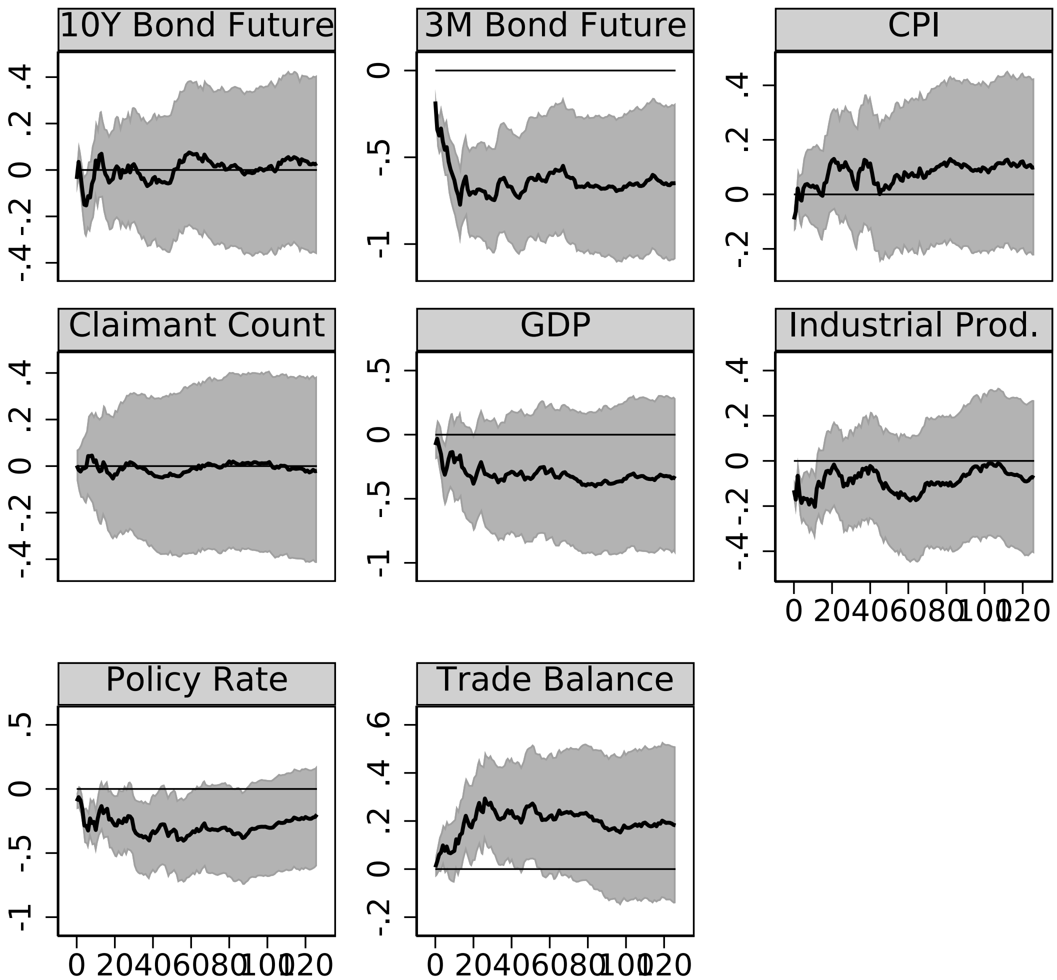

Figure 2: Bayesian Estimates of Impulse Responses of the GBP/USD Exchange Rate to US Macroeconomic Surprises

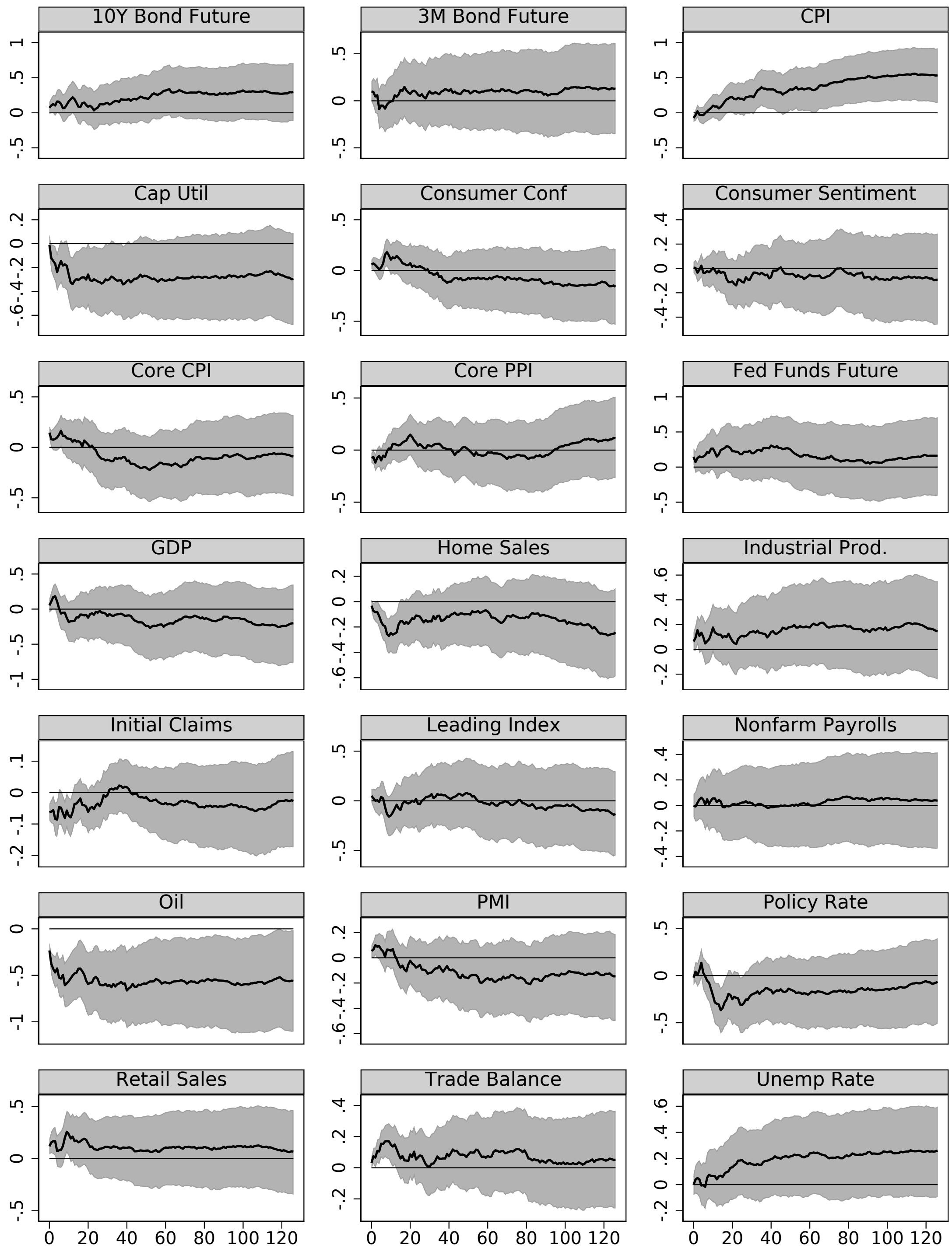

Figure 3: Bayesian Estimates of Impulse Responses of the EUR/USD Exchange Rate to Euro Area or German Macroeconomic Surprises

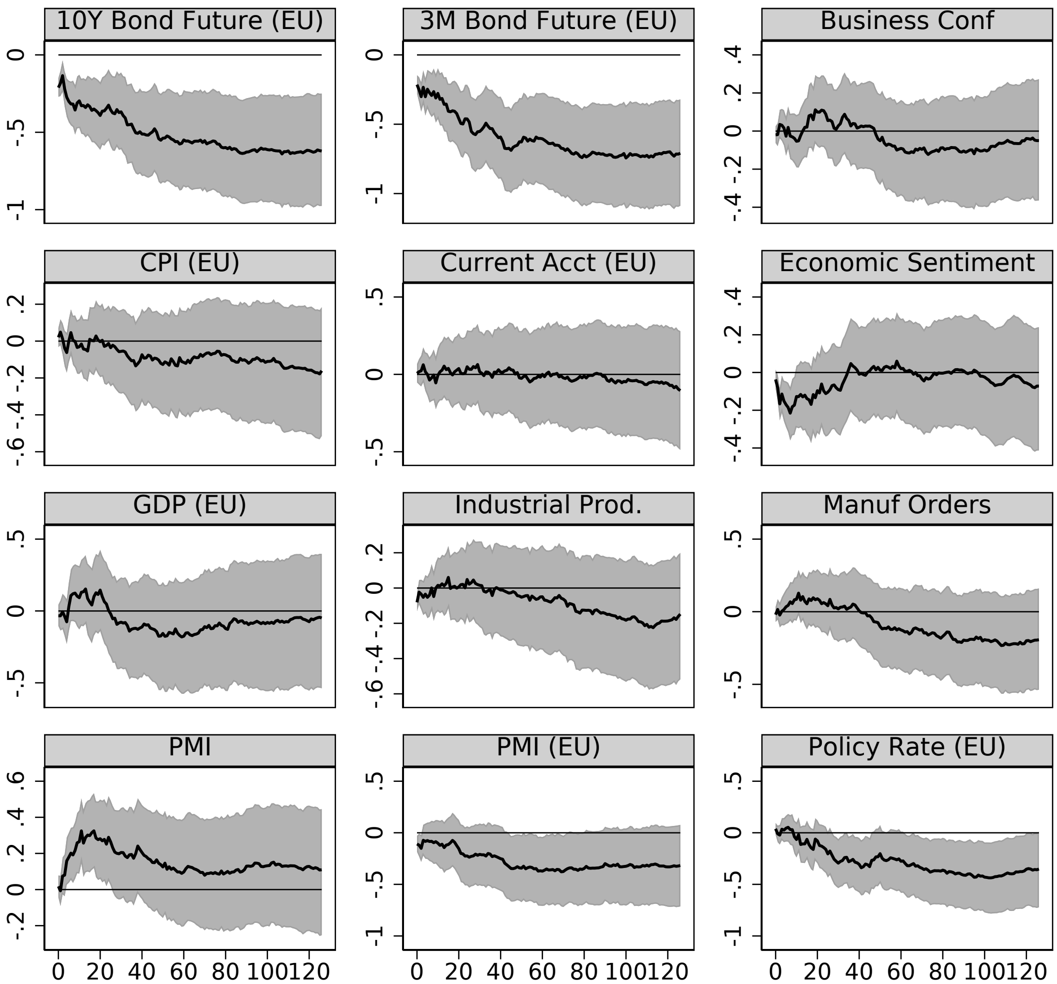

Figure 4: Bayesian Estimates of Impulse Responses of the EUR/USD Exchange Rate to US Macroeconomic Surprises

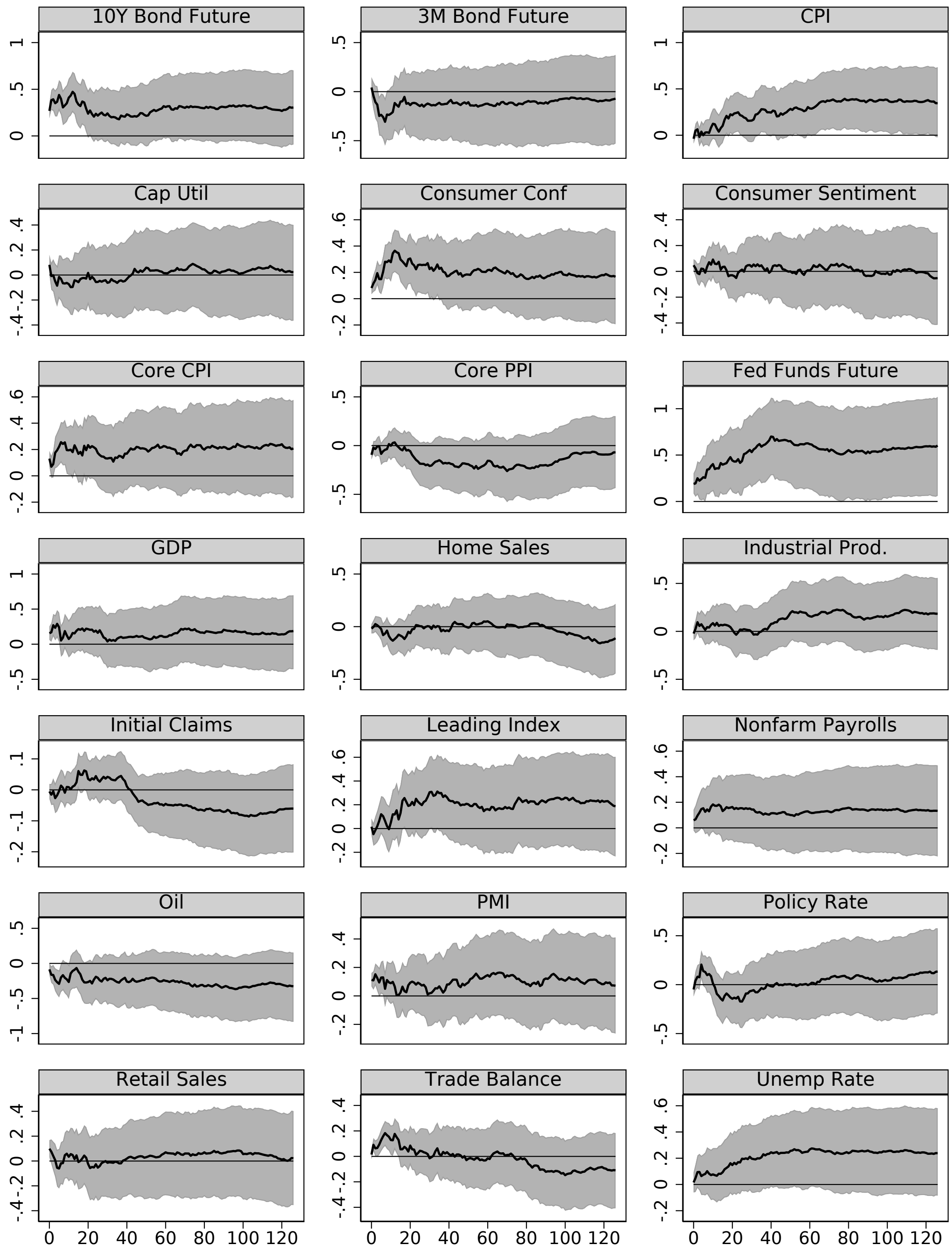

Figure 5: Bayesian Estimates of Impulse Responses of the JPY/USD Exchange Rate to Japan Macroeconomic Surprises

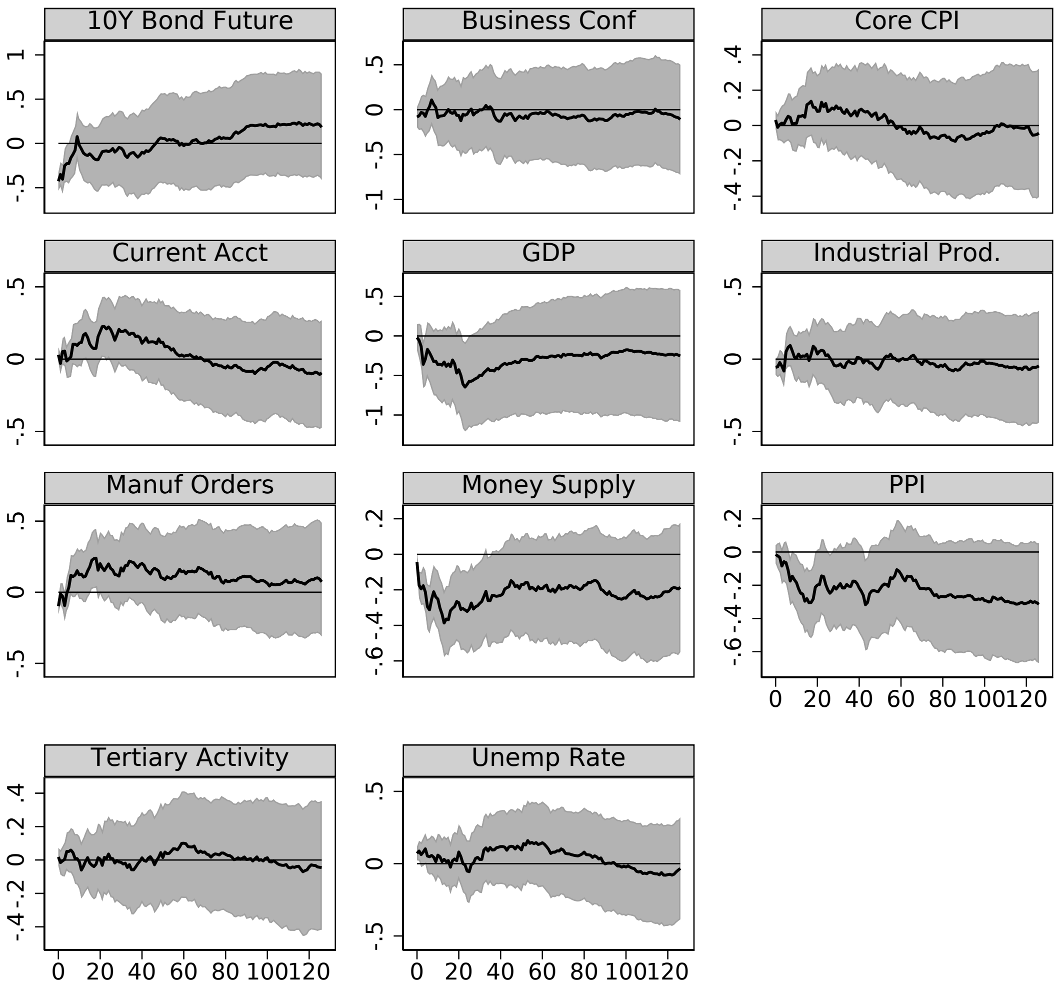

Figure 6: Bayesian Estimates of Impulse Responses of the JPY/USD Exchange Rate to US Macroeconomic Surprises

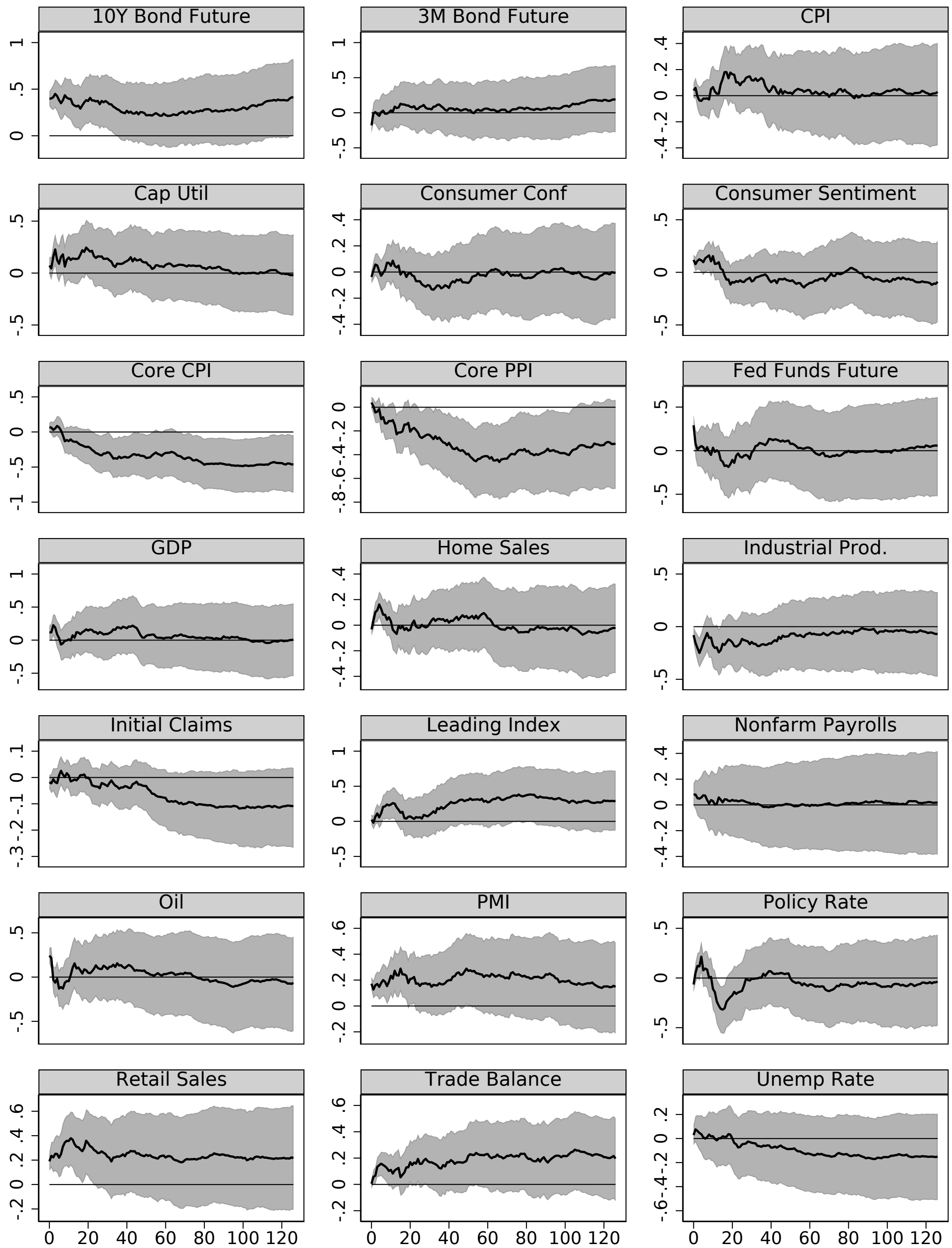

Figure 7: Bayesian Estimates of Impulse Responses of the AUD/USD Exchange Rate to Australia Macroeconomic Surprises

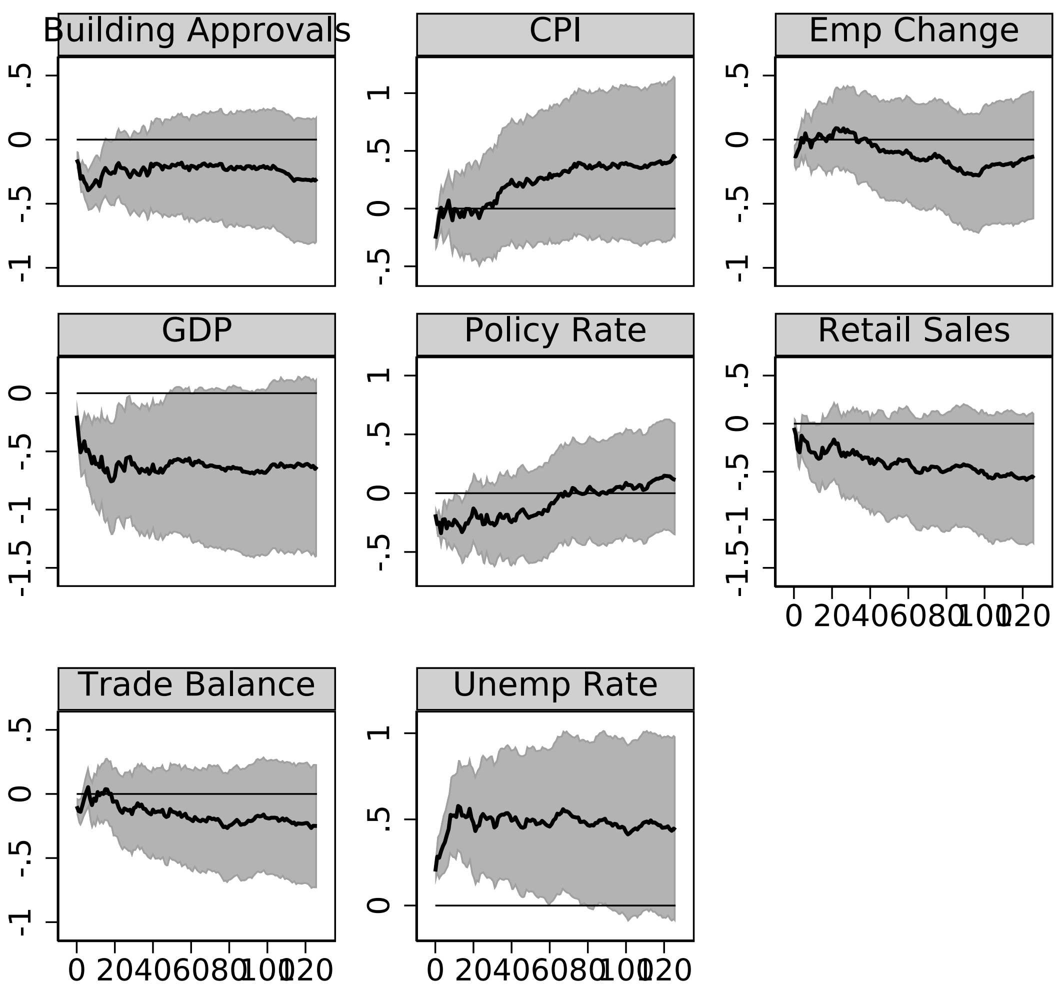

Figure 8: Bayesian Estimates of Impulse Responses of the AUD/USD Exchange Rate to US Macroeconomic Surprises

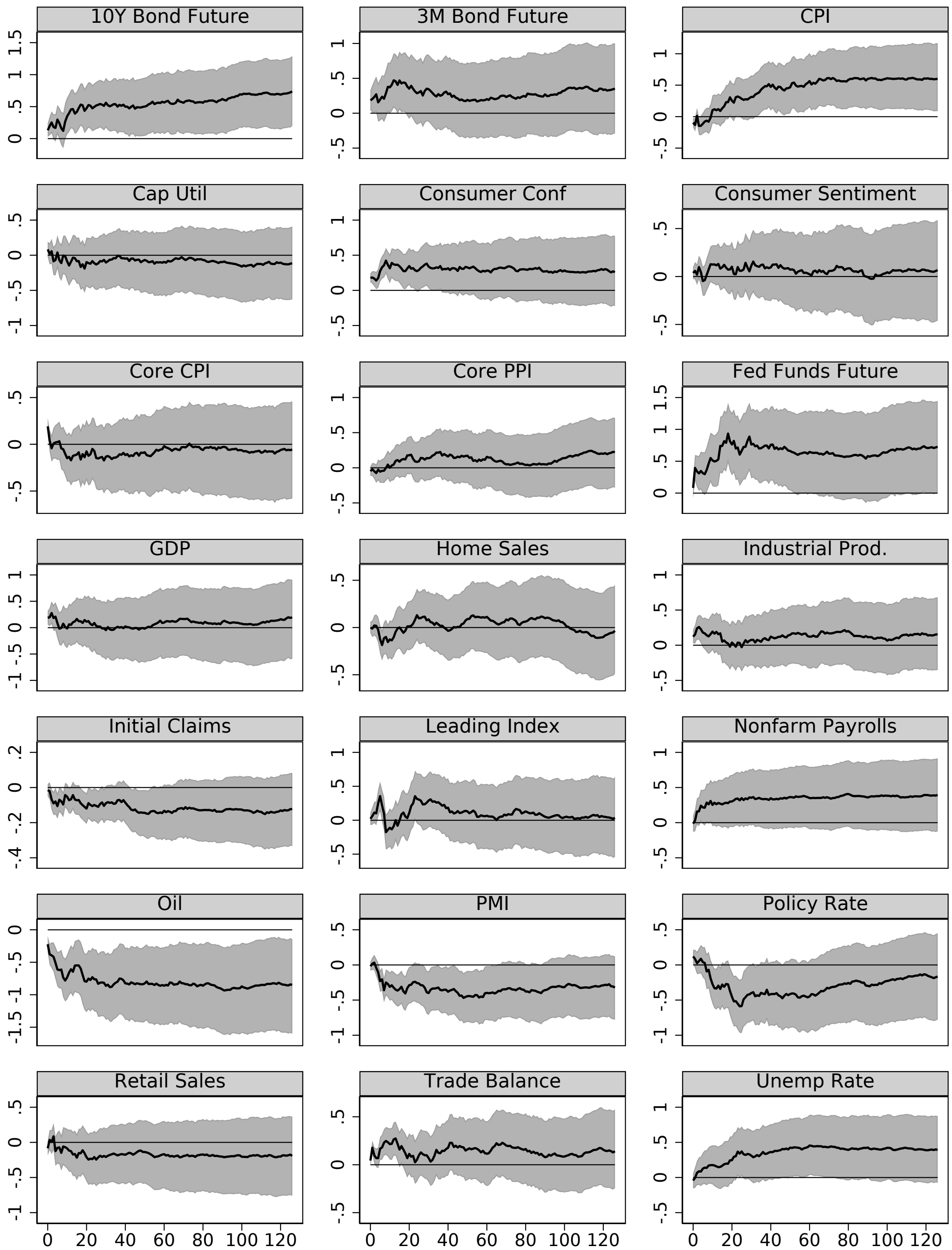

Table 8: $R^2$s from Regressions of 30-day Exchange Rate Change Subcomponents on Macroeconomic News Subindices

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| # of Obs. | 224 | 224 | 183 | 224 | 224 | 224 | | 209 | 219 | 1731 |
| | | | | | Rate Differential | | | | | |
| Full | 0.01 | 0.01 | 0.03 | 0.00 | 0.00 | 0.01 | | 0.00 | 0.01 | 0.00 |
| Contemp | 0.01 | 0.00 | 0.03** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.01 | 0.00 |
| Lags | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | | 0.00 | 0.00 | 0.00 |
| | | | | | Realized Excess Return | | | | | |
| Full | 0.59 | 0.45 | 0.41 | 0.60 | 0.53 | 0.52 | | 0.51 | 0.53 | 0.52 |
| Contemp | 0.10** | 0.07*** | 0.02* | 0.01 | 0.05 | 0.02** | | 0.09*** | 0.03** | 0.05*** |
| Lags | 0.41*** | 0.28*** | 0.28*** | 0.44*** | 0.44*** | 0.38*** | | 0.30*** | 0.43*** | 0.37*** |
| | | | | | Expected Excess Return | | | | | |
| Full | 0.03 | 0.04 | 0.01 | 0.05 | 0.01 | 0.01 | | 0.03 | 0.01 | 0.02 |
| Contemp | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 |
| Lags | 0.02* | 0.04* | 0.01 | 0.05*** | 0.01 | 0.01 | | 0.03** | 0.01 | 0.02*** |
| | | | | | Forecast Error | | | | | |
| Full | 0.49 | 0.39 | 0.40 | 0.61 | 0.48 | 0.46 | | 0.46 | 0.46 | 0.47 |
| Contemp | 0.08** | 0.04*** | 0.02* | 0.00 | 0.03 | 0.02* | | 0.06** | 0.02 | 0.03*** |
| Lags | 0.34*** | 0.28*** | 0.26*** | 0.48*** | 0.42*** | 0.34*** | | 0.30*** | 0.38*** | 0.35*** |

Note: Each row presents $R^2$s from regressions of the separate components of the expression $s_{t+30} - s_t = (i_t^{1M,j} - i_t^{1M,US}) + \tilde{E}_t[s_{t+30} - s_t + i_t^{1M,US} - i_t^{1M,j}] + (s_{t+30} - \tilde{E}_t[s_{t+30}])$ on either the full set of subindices or individual subindices defined by contemporaneous versus lagged news. The daily macroeconomic news subindices are correspondingly summed from $t$+1 through $t$+30. The daily macroeconomic news subindices are constructed as fitted values from constrained daily OLS regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises. The contemporaneous news subindex contains surprises that occurred from $t+1$ through $t+30$ while the lagged news subindex contains surprises that occurred in period $t$ or earlier. For regressions on a single subindex, stars denoting the significance of the regressor are included next to the $R^2$ value.

Table 9: $R^2$s from Regressions of 91-day Exchange Rate Change Subcomponents on Macroeconomic News Subindices

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| # of Obs. | 221 | 221 | 180 | 221 | 221 | 221 | 221 | 221 | 221 | 1948 |
| | | | | | Rate Differential | | | | | |
| Full | 0.01 | 0.02 | 0.06 | 0.00 | 0.02 | 0.01 | 0.01 | 0.02 | 0.00 | 0.01 |
| Contemp | 0.00 | 0.02* | 0.06*** | 0.00 | 0.01* | 0.00 | 0.01 | 0.02* | 0.00 | 0.00** |
| Lags | 0.01* | 0.00 | 0.03** | 0.00 | 0.00 | 0.01* | 0.01* | 0.02** | 0.00 | 0.01*** |
| | | | | | Realized Excess Return | | | | | |
| Full | 0.70 | 0.55 | 0.49 | 0.72 | 0.63 | 0.65 | 0.65 | 0.65 | 0.68 | 0.65 |
| Contemp | 0.07* | 0.06*** | 0.03** | 0.02 | 0.11*** | 0.04** | 0.00 | 0.06** | 0.01 | 0.03*** |
| Lags | 0.26*** | 0.22*** | 0.11*** | 0.22*** | 0.39*** | 0.28*** | 0.32*** | 0.22*** | 0.33*** | 0.25*** |
| | | | | | Expected Excess Return | | | | | |
| Full | 0.01 | 0.02 | 0.03 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Contemp | 0.01 | 0.02 | 0.02** | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Lags | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00* |
| | | | | | Forecast Error | | | | | |
| Full | 0.60 | 0.49 | 0.54 | 0.68 | 0.59 | 0.51 | 0.60 | 0.57 | 0.61 | 0.58 |
| Contemp | 0.04 | 0.03** | 0.05*** | 0.02 | 0.12*** | 0.04*** | 0.00 | 0.04* | 0.01 | 0.02*** |
| Lags | 0.26*** | 0.22*** | 0.09*** | 0.20*** | 0.35*** | 0.21*** | 0.30*** | 0.22*** | 0.30*** | 0.23*** |

Note: Each row presents $R^2$s from regressions of the separate components of the expression $s_{t+91} - s_t = (i_t^{3M,j} - i_t^{3M,US}) + \tilde{E}_t[s_{t+91} - s_t + i_t^{3M,US} - i_t^{3M,j}] + (s_{t+91} - \tilde{E}_t[s_{t+91}])$ on either the full set of subindices or individual subindices defined by contemporaneous versus lagged news. The daily macroeconomic news subindices are correspondingly summed from $t$+1 through $t$+91. The daily macroeconomic news subindices are constructed as fitted values from constrained daily OLS regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises. The contemporaneous news subindex contains surprises that occurred from $t+1$ through $t+91$ while the lagged news subindex contains surprises that occurred in period $t$ or earlier. For regressions on a single subindex, stars denoting the significance of the regressor are included next to the $R^2$ value.

Table 10: Distribution of $R^2$s from Regressions of 30-day Individual-Level Expected Excess Returns and Exchange Rate Forecast Errors on Contemporaneous vs Lagged Macroeconomic News Indices

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Expected Excess Return | | | | |
| Full | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.01 | | 0.03 | 0.01 |
| | [0.00, 0.14] | [0.00, 0.12] | [0.00, 0.21] | [0.00, 0.09] | [0.00, 0.12] | [0.00, 0.09] | | [0.00, 0.18] | [0.00, 0.07] |
| Contemp | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | | 0.01 | 0.01 |
| | [0.00, 0.08] | [0.00, 0.05] | [0.00, 0.07] | [0.00, 0.04] | [0.00, 0.09] | [0.00, 0.04] | | [0.00, 0.07] | [0.00, 0.05] |
| | 11% | 6% | 32% | 13% | 24% | 6% | | 11% | 17% |
| Lags | 0.01 | 0.02 | 0.01 | 0.02 | 0.00 | 0.01 | | 0.01 | 0.01 |
| | [0.00, 0.07] | [0.00, 0.09] | [0.00, 0.05] | [0.00, 0.08] | [0.00, 0.07] | [0.00, 0.05] | | [0.00, 0.11] | [0.00, 0.05] |
| | 25% | 28% | 6% | 47% | 15% | 16% | | 31% | 17% |
| | | | | | Forecast Error | | | | |
| Full | 0.36 | 0.28 | 0.26 | 0.41 | 0.28 | 0.35 | | 0.32 | 0.28 |
| | [0.20, 0.61] | [0.15, 0.45] | [0.12, 0.46] | [0.26, 0.61] | [0.12, 0.58] | [0.17, 0.49] | | [0.14, 0.55] | [0.16, 0.51] |
| Contemp | 0.06 | 0.02 | 0.02 | 0.01 | 0.03 | 0.01 | | 0.03 | 0.02 |
| | [0.00, 0.15] | [0.00, 0.07] | [0.00, 0.06] | [0.00, 0.11] | [0.00, 0.12] | [0.00, 0.11] | | [0.00, 0.15] | [0.00, 0.05] |
| | 72% | 63% | 42% | 9% | 42% | 31% | | 46% | 24% |
| Lags | 0.24 | 0.21 | 0.16 | 0.33 | 0.24 | 0.23 | | 0.20 | 0.23 |
| | [0.10, 0.51] | [0.06, 0.33] | [0.06, 0.30] | [0.21, 0.46] | [0.12, 0.51] | [0.08, 0.39] | | [0.06, 0.37] | [0.13, 0.42] |
| | 100% | 97% | 94% | 100% | 97% | 97% | | 97% | 100% |

Note: Each row presents the median, across individual forecasters, of $R^2$s from regressions of $s_{t+30} - \tilde{E}_t^i[s_{t+30}]$ on either the full set of subindices or individual subindices defined by contemporaneous versus lagged news. The daily macroeconomic news subindices are correspondingly summed from $t+1$ through $t+30$. The daily macroeconomic news index is constructed as fitted values from constrained daily OLS regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises. The contemporaneous news subindex contains surprises that occurred from $t+1$ through $t+30$ while the lagged news subindex contains surprises that occurred in period $t$ or earlier. 5th and 95th percentiles are presented in brackets below the medians. For univariate regressions, we also report the percent of individual-level regressions that have regressors significant at the 10 percent level below these percentiles.

Table 11: Distribution of $R^2$s from Regressions of 91-day Individual-Level Expected Excess Returns and Exchange Rate Forecast Errors on Contemporaneous vs Lagged Macroeconomic News Indices

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Expected Excess Return | | | | |
| Full | 0.03 | 0.04 | 0.04 | 0.02 | 0.01 | 0.01 | 0.02 | 0.03 | 0.02 |
| | [0.00, 0.19] | [0.00, 0.13] | [0.01, 0.16] | [0.00, 0.10] | [0.00, 0.26] | [0.00, 0.14] | [0.00, 0.20] | [0.00, 0.20] | [0.00, 0.12] |
| Contemp | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| | [0.00, 0.17] | [0.00, 0.07] | [0.00, 0.07] | [0.00, 0.05] | [0.00, 0.23] | [0.00, 0.08] | [0.00, 0.09] | [0.00, 0.11] | [0.00, 0.03] |
| | 29% | 15% | 34% | 9% | 17% | 32% | 17% | 19% | 10% |
| Lags | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 |
| | [0.00, 0.14] | [0.00, 0.11] | [0.00, 0.04] | [0.00, 0.07] | [0.00, 0.08] | [0.00, 0.06] | [0.00, 0.15] | [0.00, 0.11] | [0.00, 0.07] |
| | 34% | 18% | 9% | 15% | 9% | 18% | 24% | 31% | 19% |
| | | | | | Forecast Error | | | | |
| Full | 0.48 | 0.33 | 0.38 | 0.50 | 0.41 | 0.36 | 0.44 | 0.44 | 0.45 |
| | [0.21, 0.74] | [0.20, 0.55] | [0.18, 0.51] | [0.32, 0.73] | [0.24, 0.67] | [0.15, 0.60] | [0.30, 0.62] | [0.16, 0.74] | [0.25, 0.70] |
| Contemp | 0.07 | 0.02 | 0.04 | 0.04 | 0.08 | 0.04 | 0.02 | 0.04 | 0.02 |
| | [0.00, 0.39] | [0.00, 0.07] | [0.00, 0.12] | [0.00, 0.33] | [0.02, 0.29] | [0.01, 0.13] | [0.00, 0.26] | [0.00, 0.31] | [0.00, 0.17] |
| | 58% | 41% | 59% | 59% | 66% | 59% | 38% | 53% | 42% |
| Lags | 0.21 | 0.18 | 0.09 | 0.19 | 0.22 | 0.14 | 0.26 | 0.17 | 0.24 |
| | [0.06, 0.49] | [0.03, 0.30] | [0.02, 0.28] | [0.09, 0.35] | [0.02, 0.52] | [0.03, 0.26] | [0.14, 0.46] | [0.04, 0.32] | [0.13, 0.45] |
| | 95% | 82% | 88% | 100% | 91% | 94% | 100% | 94% | 100% |

Note: Each row presents the median, across individual forecasters, of $R^2$s from regressions of $s_{t+91} - \tilde{E}_t^i[s_{t+91}]$ on either the full set of subindices or individual subindices defined by contemporaneous versus lagged news. The daily macroeconomic news subindices are correspondingly summed from $t+1$ through $t+91$. The daily macroeconomic news index is constructed as fitted values from constrained daily OLS regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises. The contemporaneous news subindex contains surprises that occurred from $t+1$ through $t+91$ while the lagged news subindex contains surprises that occurred in period $t$ or earlier. 5th and 95th percentiles are presented in brackets below the medians. For univariate regressions, we also report the percent of individual-level regressions that have regressors significant at the 10 percent level below these percentiles.

Table 12: P-values and $R^2$s from Regressions of 1-day Exchange Rate Change on Past Macroeconomic News

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|
| Local Inflation | 0.32 | 0.56 | 0.17 | 0.83 | 0.00 | 0.83 | 0.00 | 0.28 | 0.26 |
| Local Activity | 0.86 | 0.21 | 0.06 | 0.84 | 0.00 | 0.40 | 0.26 | 0.51 | 0.10 |
| Local External | 0.18 | 0.77 | 0.45 | 0.25 | 0.00 | 0.03 | 0.00 | 0.52 | 0.72 |
| Local Monetary | 0.51 | 0.11 | 0.40 | 0.10 | 0.00 | 0.28 | 0.10 | 0.46 | 0.32 |
| US Inflation | 0.64 | 0.95 | 0.15 | 0.10 | 0.19 | 0.47 | 0.16 | 0.74 | 0.29 |
| US Activity | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| US External | 0.44 | 0.12 | 0.73 | 0.56 | 0.93 | 0.33 | 0.45 | 0.93 | 0.86 |
| US Monetary | 0.00 | 0.09 | 0.02 | 0.01 | 0.41 | 0.12 | 0.00 | 0.00 | 0.04 |
| # of Obs. | 4881 | 4881 | 4003 | 4881 | 4881 | 4881 | 4881 | 4881 | 4881 |
| Adjusted $R^2$ | 0.01 | 0.00 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 | -0.00 | 0.01 |

Note: This table presents p-values from tests of joint significance and adjusted $R^2$s from constrained regressions of $s_{t+1} - s_t$ on macroeconomic surprises announced at time $t$ through $t - 126$. The constraints are such that the regression is equivalent to an unconstrained regression on surprises at times $\{t, t-1, t-2, t-3\}$ and sums of past surprises over each of the previous six months, with months being approximated as 21 trading days. The tests of joint significance group together surprises in different categories for the local economy and the US.

Table 13: P-values and $R^2$s from Regressions of 30-day Exchange Rate Change and Subcomponents on Past Macroeconomic News

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Realized Exchange Rate Change | | | | | |
| Local Inflation | 0.55 | 0.10 | 0.22 | 0.00 | 0.00 | 0.10 | 0.00 | 0.02 | 0.00 |
| Local Activity | 0.00 | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Local External | 0.03 | 0.12 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.15 |
| Local Monetary | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 |
| US Inflation | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| US Activity | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| US External | 0.07 | 0.00 | 0.37 | 0.00 | 0.52 | 0.00 | 0.02 | 0.00 | 0.25 |
| US Monetary | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| # of Obs. | 4861 | 4861 | 3983 | 4861 | 4861 | 4861 | 4861 | 4861 | 4861 |
| Adjusted $R^2$ | 0.45 | 0.35 | 0.54 | 0.52 | 0.45 | 0.46 | 0.44 | 0.41 | 0.48 |
| | | | | Rate Differential | | | | | |
| Adjusted $R^2$ | 0.71 | 0.61 | 0.75 | 0.78 | 0.74 | 0.79 | | 0.66 | 0.65 |
| | | | | Realized Excess Return | | | | | |
| Adjusted $R^2$ | 0.45 | 0.36 | 0.54 | 0.52 | 0.45 | 0.46 | | 0.43 | 0.48 |

Note: This table presents p-values from tests of joint significance and adjusted $R^2$s from constrained regressions of $s_{t+30} - s_t$ on macroeconomic surprises announced at time $t$ through $t-126$. The constraints are such that the regression is equivalent to an unconstrained regression on surprises at times $\{t, t-1, t-2, t-3\}$ and sums of past surprises over each of the previous six months, with months being approximated as 21 trading days. The tests of joint significance group together surprises in different categories for the local economy and the US. Adjusted $R^2$s for analogous regressions of $i_t^{1M,j} - i_t^{1M,US}$ and $s_{t+30} - s_t + i_t^{1M,US} - i_t^{1M,j}$ are also included.

Table 14: P-values and $R^2$s from Regressions of 91-day Exchange Rate Change and Subcomponents on Past Macroeconomic News

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Realized Exchange Rate Change | | | | |
| Local Inflation | 0.65 | 0.73 | 0.00 | 0.06 | 0.00 | 0.06 | 0.00 | 0.24 | 0.00 |
| Local Activity | 0.00 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.39 | 0.21 |
| Local External | 0.22 | 0.47 | 0.04 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Local Monetary | 0.01 | 0.13 | 0.00 | 0.39 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| US Inflation | 0.01 | 0.31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 0.00 |
| US Activity | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| US External | 0.00 | 0.00 | 0.17 | 0.00 | 0.93 | 0.00 | 0.02 | 0.01 | 0.16 |
| US Monetary | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| # of Obs. | 4818 | 4818 | 3940 | 4818 | 4818 | 4818 | 4818 | 4818 | 4818 |
| Adjusted $R^2$ | 0.55 | 0.41 | 0.65 | 0.64 | 0.61 | 0.65 | 0.62 | 0.54 | 0.59 |
| | | | | | Rate Differential | | | | |
| Adjusted $R^2$ | 0.72 | 0.67 | 0.75 | 0.79 | 0.76 | 0.80 | 0.67 | 0.66 | 0.65 |
| | | | | | Realized Excess Return | | | | |
| Adjusted $R^2$ | 0.54 | 0.41 | 0.65 | 0.64 | 0.61 | 0.65 | 0.62 | 0.54 | 0.58 |

Note: This table presents p-values from tests of joint significance and adjusted $R^2$s from constrained regressions of $s_{t+91} - s_t$ on macroeconomic surprises announced at time $t$ through $t - 126$. The constraints are such that the regression is equivalent to an unconstrained regression on surprises at times $\{t, t-1, t-2, t-3\}$ and sums of past surprises over each of the previous six months, with months being approximated as 21 trading days. The tests of joint significance group together surprises in different categories for the local economy and the US. Adjusted $R^2$s for analogous regressions of $i_t^{3M,j} - i_t^{3M,US}$ and $s_{t+91} - s_t + i_t^{3M,US} - i_t^{3M,j}$ are also included.

Table 15: $R^2$s from Regressions of 30-day Individual-Level Expected Excess Returns and Exchange Rate Forecast Errors on Past Macroeconomic News

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|
| # of Obs. | 4453 | 4063 | 3038 | 4180 | 4172 | 4242 | | 3791 | 3778 |
| | | | | Expected Excess Return | | | | | |
| Adjusted $R^2$ | 0.36 | 0.29 | 0.26 | 0.29 | 0.27 | 0.33 | | 0.30 | 0.29 |
| | | | | Forecast Error | | | | | |
| Adjusted $R^2$ | 0.69 | 0.56 | 0.65 | 0.65 | 0.63 | 0.62 | | 0.61 | 0.60 |

Note: This table presents adjusted $R^2$s from fixed effect panel constrained regressions of individual forecaster level $\tilde{E}_t^i[s_{t+30} - s_t + i_t^{1M,US} - i_t^{1M,j}]$ and $s_{t+30} - \tilde{E}_t^i[s_{t+30}]$ on macroeconomic surprises announced at time $t$ through $t-126$. The constraints are such that the regression is equivalent to an unconstrained regression on surprises at times $\{t, t-1, t-2, t-3\}$ and sums of past surprises over each of the previous six months, with months being approximated as 21 trading days.

Table 16: $R^2$s from Regressions of 91-day Individual-Level Expected Excess Returns and Exchange Rate Forecast Errors on Past Macroeconomic News

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|
| # of Obs. | 4713 | 4277 | 3204 | 4424 | 4419 | 4481 | 3752 | 4250 | 3955 |
| | | | | Expected Excess Return | | | | | |
| Adjusted $R^2$ | 0.32 | 0.25 | 0.28 | 0.29 | 0.24 | 0.35 | 0.25 | 0.25 | 0.30 |
| | | | | Forecast Error | | | | | |
| Adjusted $R^2$ | 0.76 | 0.60 | 0.65 | 0.72 | 0.70 | 0.71 | 0.62 | 0.65 | 0.71 |

Note: This table presents adjusted $R^2$s from fixed effect panel constrained regressions of individual forecaster level $\tilde{E}_t^i[s_{t+91} - s_t + i_t^{3M,US} - i_t^{3M,j}]$ and $s_{t+91} - \tilde{E}_t^i[s_{t+91}]$ on macroeconomic surprises announced at time $t$ through $t-126$. The constraints are such that the regression is equivalent to an unconstrained regression on surprises at times $\{t, t-1, t-2, t-3\}$ and sums of past surprises over each of the previous six months, with months being approximated as 21 trading days.

# Appendix

# A Derivations

## A.1 Decomposing the Macroeconomic News Index

$\mathbf{\Pi}_{t_d-j}$ is a column vector of period $t$ surprises $\left[Surp^1_{t_d-j}, ..., Surp^K_{t_d-j}\right]$ while $\beta_j$ is a column vector of the associated coefficients in the first-stage regression $[\beta^1_j, ...\beta^K_j]$ so that

$$\Delta s_{t_d} = \alpha^1 + \sum_{j=0}^{J} \beta'_j \mathbf{\Pi}_{t_d-j} + error^1_{t_d}$$

Assuming the lags in the first-stage regression are more than the horizons over which we sum, $J > h$, the second-stage regression can be re-written as:

$$
\begin{aligned}
s_{t+h}-s_t &= \sum_{k=1}^{h}\left(s_{t+k}-s_{t+k-1}\right)=h\alpha^1+\sum_{k=1}^{h}\sum_{j=0}^{J}\beta_j'\mathbf{\Pi}_{t_d+k-j}+\sum_{k=1}^{h}error_{t_d+k}^1\\
&= h\alpha^1+\sum_{k=1}^{h}\left(\beta_0'\mathbf{\Pi}_{t+k}+\beta_1'\mathbf{\Pi}_{t+k-1}+\beta_2'\mathbf{\Pi}_{t+k-2}...+\beta_J'\mathbf{\Pi}_{t+k-J}\right)+\sum_{k=1}^{h}error_{t_d+k}^1\\
&= h\alpha^1+\beta_0'\mathbf{\Pi}_{t+h}+\left(\beta_0'+\beta_1'\right)\mathbf{\Pi}_{t-1+h}+...+\left(\beta_0'+...+\beta_{J-1}'+\beta_J'\right)\mathbf{\Pi}_{t-J+h}\\
&\quad +\beta_J'\mathbf{\Pi}_{t+1-J}+\left(\beta_J'+\beta_{J-1}'\right)\mathbf{\Pi}_{t+2-J}+...+\left(\beta_0'+...+\beta_{J-1}'+\beta_J'\right)\mathbf{\Pi}_{t-(J+1)+h}+\sum_{k=1}^{h}error_{t_d+k}^1\\
&= h\alpha^1+\left(\left(\sum_{i=1}^{i=h}\beta_i'\right)\mathbf{\Pi}_t+\left(\sum_{i=2}^{i=h+1}\beta_i'\right)\mathbf{\Pi}_{t-1}+...+\left(\sum_{i=J-h+1}^{i=J}\beta_i'\right)\mathbf{\Pi}_{t+h-J}\right)\\
&\quad +\left(\left(\sum_{i=J-h+2}^{i=J}\beta_i'\right)\mathbf{\Pi}_{t+h-J-1}+\left(\sum_{i=J-h+3}^{i=J}\beta_i'\right)\mathbf{\Pi}_{t+h-J-2}+...\beta_J'\mathbf{\Pi}_{t+1-J}\right)\\
&\quad +\left(\sum_{i=0}^{i=h-1}\beta_i'\right)\mathbf{\Pi}_{t+1}+\left(\sum_{i=0}^{i=h-2}\beta_i'\right)\mathbf{\Pi}_{t+2}+\left(\sum_{i=0}^{i=h-3}\beta_i'\right)\mathbf{\Pi}_{t+3}+...\beta_0'\mathbf{\Pi}_{t+h}+\sum_{k=1}^{h}error_{t_d+k}^1\\
&= h\alpha^1+\underbrace{\sum_{j=1}^{j=h}\left(\sum_{i=0}^{i=h-j}\beta_i'\right)\mathbf{\Pi}_{t+j}}_{\text{Contemp Surprise Macroeconomic News Index, }\Lambda_{t+1,t+h}^{c,news}}\\
&\quad +\underbrace{\sum_{j=0}^{j=J-h}\left(\sum_{i=j+1}^{i=h+j}\beta_i'\right)\mathbf{\Pi}_{t-j}+\sum_{j=J-h+1}^{j=J-1}\left(\sum_{i=j+1}^{i=J}\beta_i'\right)\mathbf{\Pi}_{t-j}}_{\text{Lagged Surprise Macroeconomic News Index, }\Lambda_{t-J,t}^{l,news}}+\sum_{k=1}^{h}error_{t_d+k}^1
\end{aligned}
$$

## A.2 UIP—Decomposing the Objective Surprise

First, we iterate the UIP equation forward and take changes between $t$ and $t+h$ :

$$
s_t=E_t s_{t+K*h}+\sum_{k=1}^{K-1}E_t\left(i_{t+k*h}^{h,US}-i_{t+k*h}^{h,j}\right)+\left(i_t^{h,US}-i_t^{h,j}\right), \tag{9}
$$

$$
s_{t+h}=\sum_{k=1}^{K-1}E_{t+h}\left(i_{t+k*h}^{h,US}-i_{t+k*h}^{h,j}\right)+E_{t+h}s_{t+K*h}
$$

$$
\begin{aligned}
s_{t+h} - s_t \;&=\; \sum_{k=1}^{K-1} \left(E_{t+h} - E_t\right)\left(i_{t+k*h}^{h,US} - i_{t+k*h}^{h,j}\right) + E_{t+h}s_{t+K*h} - E_t s_{t+K*h} \\
&\quad - \left(i_t^{h,US} - i_t^{h,j}\right)
\end{aligned}
$$

Define the real exchange rate as $RER_t = \frac{S_t P_t^{US}}{P_t^j}$, where $P_t^j$ is the price index in country $j$ and $P_t^{US}$ is the price index in the US and $lnRER_t = s_t + p_t^{US} - p_t^j$

$$
s_{t+K*h} = lnRER_{t+K*h} - \left(p_{t+K*h}^{US} - p_{t+K*h}^{j}\right)
$$

$P_{t+K*h}^{US}$ can be expressed as:

$$
P_{t+K*h}^{US} = \left(P_{t+K*h}^{US}\frac{P_{t+(K-1)*h}^{US}}{P_{t+(k-1)*h}^{US}}\cdots\frac{P_{t+h}^{US}}{P_{t+h}^{US}}\frac{P_t^{US}}{P_t^{US}}\right).
$$

After taking the logarithm on both sides we obtain

$$
p_{t+K*h}^{US} = \left(\pi_{t+K*h}^{US} + \pi_{t+(K-1)*h}^{US} + \pi_{t+h}^{US}\right) + p_t^{US},
$$

where the logarithm is denoted as $x = \ln(X)$, and there is a similar expression for $P_{t+K*h}^{j}$. As a result, we can re-write $\lim_{K\to\infty}\left(E_{t+h} - E_t\right)s_{t+K*h}$ as:

$$
\begin{aligned}
&\lim_{K\to\infty}\left(E_{t+h} - E_t\right)s_{t+K*h} \\
=\;&\lim_{K\to\infty}\left(E_{t+h} - E_t\right)lnRER_{t+K*h} \\
&-\left(\left(E_{t+h} - E_t\right)p_{t+K*h}^{US} - \left(E_{t+h} - E_t\right)p_{t+K*h}^{j}\right) \\
=\;&\lim_{K\to\infty}\left(E_{t+h} - E_t\right)lnRER_{t+K*h} - \left(E_{t+h} - E_t\right)\sum_{k=1}^{K}\left(\pi_{t+k*h}^{US} - \pi_{t+k*h}^{j}\right).
\end{aligned}
$$

Thus, if the real exchange rate reverts to a deterministic trend in the long run, $\lim_{K\to\infty}\left(E_{t+h} - E_t\right)lnRER_{t+K*h} = 0$, one can derive the following decomposition of the exchange rate change under UIP:

$$\begin{aligned} s_{t+h} - s_t &= -\left(E_{t+h} - E_t\right) \sum_{k=1}^{\infty} \left(\pi_{t+k*h}^{US} - \pi_{t+k*h}^{j}\right) \\ &\quad + \left(E_{t+h} - E_t\right) \sum_{k=1}^{\infty} \left(i_{t+k*h}^{h,US} - i_{t+k*h}^{h,j}\right) - \left(i_t^{h,US} - i_t^{h,j}\right). \end{aligned}$$

# B Bayesian Estimation of the First-Stage Regression

This section considers a robustness check featuring Bayesian estimates of the first-stage regression that's used to create the macroeconomic news indices. In particular, we estimate

$$\Delta s_{t_d} = \alpha + \sum_{k=1}^{K} \left( \sum_{j=0}^{126} \beta_j^k Surp_{t_d - j}^k \right) + error_{t_d}, \tag{10}$$

for each country in our sample. Unlike our baseline specification, we do not impose any constraints on the $\beta_j^k$. However, given that this results in thousands of coefficients to be estimated, we impose some structure through an informative prior based on the often-used Minnesota prior which in our case simply translates to zero coefficients on the surprises (i.e., that $s_t$ is a random-walk independent of the macroeconomic surprises). We choose a value of 0.2 for the hyperparameter controlling overall tightness of the prior, 3 degrees of freedom for the error variance, and a prior standard deviation of .001; all of these parameters are values standard in the Bayesian VAR literature. However, we use a hyperparameter of 1 for controlling the exponential tightening of the prior. This is looser than values used in typical macroeconomic applications with monthly or quarterly VARs since our lags are specified at a daily frequency.

Unadjusted $R^2$s from these first-stage regressions are presented in Table A1 below. With the vast amount of flexibility allowed in this regression, the unadjusted $R^2$s are as high as 52 percent.

At longer horizons, using these news indices generally still produces a higher fraction of explained exchange rate change variation. For example, Tables A2 and A3 show that the

Table A1: $R^2$s from Daily Bayesian Regressions of the Exchange Rate Change on Macroeconomic News Indices

| | | AUD | CAD | CHF | DEM/EUR | GBP | JPY | NOK | NZD | SEK |
|---|---|---|---|---|---|---|---|---|---|---|
| Exchange Rate | # of Obs. | 4882 | 4882 | 4005 | 4882 | 4882 | 4882 | 4882 | 4882 | 4882 |
| | $R^2$ | 0.44 | 0.38 | 0.42 | 0.46 | 0.41 | 0.44 | 0.39 | 0.39 | 0.40 |

Note: Each row presents $R^2$s from daily Bayesian regressions of exchange rate changes on macroeconomic news surprises. The regressors include current and up to a 126-trading-day lag of macroeconomic surprises.

adjusted $R^2$ in the 91-day horizon regression is up to 13 percentage points higher than the unadjusted $R^2$ in the first-stage daily regression. Tables A2 and A3 also present the $R^2$s of the contemporaneous and lagged news index components. In particular, our conclusions about the relative importance of the lag terms continue to hold in this case. Moreover, the same tables present the split into types of news and by region. It still appears that activity, monetary policy and inflation news play the most important role and US news tend to be more important than local news.

Table A2: Adjusted $R^2$s from Regressions of 30-day Exchange Rate Changes on a Macroeconomic News Index

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| Exch Rate News Index | 1.59*** | 1.67*** | 1.55*** | 1.64*** | 1.49*** | 1.72*** | 1.63*** | 1.66*** | 1.73*** | 1.63*** |
| | (0.03) | (0.04) | (0.03) | (0.02) | (0.02) | (0.03) | (0.04) | (0.03) | (0.03) | (0.02) |
| Constant | 0.07** | 0.06** | 0.34*** | 0.07*** | -0.02 | 0.08*** | -0.01 | 0.12*** | 0.05* | 0.08*** |
| | (0.04) | (0.03) | (0.04) | (0.03) | (0.03) | (0.03) | (0.04) | (0.04) | (0.03) | (0.00) |
| # of Obs. | 4861 | 4861 | 3983 | 4861 | 4861 | 4861 | 4861 | 4861 | 4861 | 42871 |
| Adjusted $R^2$ | 0.54 | 0.44 | 0.37 | 0.59 | 0.49 | 0.49 | 0.46 | 0.51 | 0.52 | 0.49 |

Note: Each row presents adjusted $R^2$s from regressions of $s_{t+30} - s_t$ on the daily macroeconomic news index correspondingly summed from $t + 1$ through $t + 30$. The macroeconomic news index is constructed as fitted values from daily Bayesian regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises.

Lastly, we again split the second-stage quarterly regression sample into periods of US recessions versus other periods or periods when the VIX is above versus below its median. The results are consistent with those in the main text with macroeconomic surprises being more important for explaining variation in exchange rate changes during US recessions and times of financial turmoil.

Table A3: Adjusted $R^2$s from Regressions of 91-day Exchange Rate Changes on a Macroeconomic News Index

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| Exch Rate News Index | 1.56*** | 1.67*** | 1.57*** | 1.70*** | 1.45*** | 1.81*** | 1.72*** | 1.68*** | 1.85*** | 1.66*** |
| | (0.04) | (0.04) | (0.05) | (0.02) | (0.02) | (0.03) | (0.04) | (0.03) | (0.03) | (0.04) |
| Constant | 0.22*** | 0.20*** | 1.07*** | 0.29*** | -0.03 | 0.27*** | 0.04 | 0.44*** | 0.21*** | 0.29*** |
| | (0.07) | (0.05) | (0.08) | (0.05) | (0.05) | (0.05) | (0.07) | (0.07) | (0.06) | (0.01) |
| # of Obs. | 4818 | 4818 | 3940 | 4818 | 4818 | 4818 | 4818 | 4818 | 4818 | 42484 |
| Adjusted $R^2$ | 0.51 | 0.36 | 0.30 | 0.59 | 0.46 | 0.44 | 0.44 | 0.46 | 0.53 | 0.46 |

Note: Each row presents adjusted $R^2$s from regressions of $s_{t+91} - s_t$ on the daily macroeconomic news index correspondingly summed from $t+1$ through $t+91$. The macroeconomic news index is constructed as fitted values from daily Bayesian regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises.

Table A4: $R^2$s from Regressions of 30-day Exchange Rate Changes on Macroeconomic News Subindices

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| # of Obs. | 4861 | 4861 | 3983 | 4861 | 4861 | 4861 | 4861 | 4861 | 4861 | 42871 |
| | | | | | | | | | | |
| Full | 0.55 | 0.46 | 0.40 | 0.60 | 0.50 | 0.52 | 0.47 | 0.53 | 0.52 | 0.51 |
| Contemp | 0.20*** | 0.13*** | 0.04*** | 0.14*** | 0.14*** | 0.06*** | 0.10*** | 0.16*** | 0.12*** | 0.12*** |
| Lags | 0.36*** | 0.34*** | 0.34*** | 0.42*** | 0.36*** | 0.41*** | 0.33*** | 0.35*** | 0.42*** | 0.37*** |
| | | | | | | | | | | |
| Full | 0.54 | 0.45 | 0.38 | 0.59 | 0.49 | 0.50 | 0.46 | 0.52 | 0.52 | 0.50 |
| Inflation | 0.07*** | 0.05*** | 0.07*** | 0.06*** | 0.11*** | 0.13*** | 0.10*** | 0.05*** | 0.11*** | 0.08*** |
| Activity | 0.21*** | 0.19*** | 0.18*** | 0.27*** | 0.16*** | 0.23*** | 0.15*** | 0.22*** | 0.21*** | 0.20*** |
| External | 0.05*** | 0.06*** | 0.04*** | 0.06*** | 0.06*** | 0.06*** | 0.08*** | 0.05*** | 0.06*** | 0.06*** |
| Monetary | 0.20*** | 0.16*** | 0.09*** | 0.25*** | 0.20*** | 0.09*** | 0.13*** | 0.18*** | 0.20*** | 0.17*** |
| | | | | | | | | | | |
| Full | 0.54 | 0.44 | 0.38 | 0.59 | 0.49 | 0.50 | 0.46 | 0.51 | 0.52 | 0.49 |
| US | 0.42*** | 0.39*** | 0.33*** | 0.33*** | 0.35*** | 0.33*** | 0.41*** | 0.40*** | 0.39*** | 0.38*** |
| Local | 0.11*** | 0.05*** | 0.06*** | 0.25*** | 0.20*** | 0.18*** | 0.07*** | 0.13*** | 0.18*** | 0.13*** |

Note: Each row presents $R^2$s from regressions of $s_{t+30} - s_t$ on either the full set of subindices or individual subindices defined by contemporaneous versus lagged news, different economic concepts, or US versus local news. The daily macroeconomic news subindices are correspondingly summed from $t+1$ through $t+30$. The daily macroeconomic news subindices are constructed as fitted values from daily Bayesian regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises. A subset of macroeconomic surprises or lags is included in the construction of each fitted value for subindices. For regressions on a single subindex, stars denoting the significance of the regressor are included next to the $R^2$ value.

Table A5: $R^2$s from Regressions of 91-day Exchange Rate Changes on Macroeconomic News Subindices

| | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|
| # of Obs. | 4818 | 4818 | 3940 | 4818 | 4818 | 4818 | 4818 | 4818 | 4818 | 42484 |
| | | | | | | | | | | |
| Full | 0.53 | 0.38 | 0.36 | 0.59 | 0.48 | 0.47 | 0.45 | 0.49 | 0.53 | 0.48 |
| Contemp | 0.29*** | 0.19*** | 0.06*** | 0.25*** | 0.28*** | 0.13*** | 0.18*** | 0.22*** | 0.28*** | 0.21*** |
| Lags | 0.30*** | 0.20*** | 0.26*** | 0.31*** | 0.30*** | 0.31*** | 0.27*** | 0.24*** | 0.31*** | 0.28*** |
| | | | | | | | | | | |
| Full | 0.53 | 0.36 | 0.33 | 0.59 | 0.48 | 0.45 | 0.46 | 0.47 | 0.53 | 0.47 |
| Inflation | 0.14*** | 0.05*** | 0.10*** | 0.05*** | 0.20*** | 0.13*** | 0.14*** | 0.11*** | 0.16*** | 0.12*** |
| Activity | 0.17*** | 0.13*** | 0.14*** | 0.20*** | 0.12*** | 0.22*** | 0.08*** | 0.17*** | 0.18*** | 0.15*** |
| External | 0.07*** | 0.07*** | 0.05*** | 0.07*** | 0.06*** | 0.08*** | 0.11*** | 0.07*** | 0.06*** | 0.07*** |
| Monetary | 0.18*** | 0.10*** | 0.03*** | 0.28*** | 0.21*** | 0.04*** | 0.13*** | 0.14*** | 0.20*** | 0.14*** |
| | | | | | | | | | | |
| Full | 0.51 | 0.36 | 0.30 | 0.59 | 0.46 | 0.44 | 0.45 | 0.46 | 0.53 | 0.46 |
| US | 0.41*** | 0.33*** | 0.27*** | 0.21*** | 0.37*** | 0.34*** | 0.36*** | 0.34*** | 0.37*** | 0.34*** |
| Local | 0.15*** | 0.02*** | 0.02*** | 0.32*** | 0.20*** | 0.12*** | 0.10*** | 0.14*** | 0.19*** | 0.14*** |

Note: Each row presents $R^2$s from regressions of $s_{t+91} - s_t$ on either the full set of subindices or individual subindices defined by contemporaneous versus lagged news, different economic concepts, or US versus local news. The daily macroeconomic news subindices are correspondingly summed from $t + 1$ through $t + 91$. The daily macroeconomic news subindices are constructed as fitted values from daily Bayesian regressions of exchange rates on the current and up to a 126-trading-day lag of macroeconomic surprises. A subset of macroeconomic surprises or lags is included in the construction of each fitted value for subindices. For regressions on a single subindex, stars denoting the significance of the regressor are included next to the $R^2$ value.

Table A6: Adjusted $R^2$s From Regressions of 30- and 91-day Exchange Rate Changes on Macroeconomic News Indices with the Sample Split by Recessions and High Financial Volatility Periods

| Horizon | | AUD | CAD | CHF | EUR | GBP | JPY | NOK | NZD | SEK | Panel |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $h = 30$ | US Recession | 0.85 | 0.72 | 0.64 | 0.85 | 0.86 | 0.74 | 0.65 | 0.84 | 0.83 | 0.78 |
| | Non-Recession | 0.41 | 0.35 | 0.30 | 0.50 | 0.36 | 0.44 | 0.42 | 0.40 | 0.42 | 0.40 |
| | High VIX | 0.63 | 0.55 | 0.42 | 0.68 | 0.62 | 0.55 | 0.54 | 0.58 | 0.63 | 0.58 |
| | Low VIX | 0.31 | 0.26 | 0.24 | 0.40 | 0.28 | 0.43 | 0.32 | 0.36 | 0.31 | 0.33 |
| $h = 91$ | US Recession | 0.88 | 0.72 | 0.37 | 0.90 | 0.94 | 0.79 | 0.66 | 0.82 | 0.87 | 0.80 |
| | Non-Recession | 0.31 | 0.25 | 0.31 | 0.50 | 0.19 | 0.36 | 0.36 | 0.32 | 0.37 | 0.33 |
| | High VIX | 0.61 | 0.47 | 0.32 | 0.70 | 0.67 | 0.46 | 0.52 | 0.53 | 0.64 | 0.56 |
| | Low VIX | 0.20 | 0.19 | 0.21 | 0.35 | 0.11 | 0.41 | 0.30 | 0.29 | 0.27 | 0.26 |

Note: Each row presents the adjusted $R^2$s from a regression of 30- or 91-day exchange rate changes on the daily macroeconomic news index correspondingly summed from $t + 1$ through $t + 30$ or $t + 91$ for over a specified subsample of dates. The daily macroeconomic news index is constructed as fitted values from daily Bayesian regressions of exchange rates and yield curve factors on the current and up to a 126-trading-day lag of macroeconomic surprises. We use NBER recession dates, and the VIX is split by the median value over the full regression sample.

# C Data Details

## C.1 Macroeconomic and Financial Variables

- *Exchange rates*: Daily data from Global Financial Data.
- *Short-term rates*:
  - Australia, Canada, New Zealand, Norway, Sweden, Switzerland, United Kingdom, and United States: Central bank data obtained through Haver Analytics.
  - Germany: Reuters data obtained through Haver Analytics. German three-month bill rates are replaced with three-month EONIA OIS swap rates starting in 1999:Q1.
  - Japan: Bloomberg
- *US VIX and NBER Recession Indicators:* Federal Reserve Bank of St. Louis FRED database.

## C.2 Exchange Rate Forecast Survey Data Details

*Consensus Economics*

- Country coverage: Australia, Canada, Germany/euro area, Japan, Norway, New Zealand, Sweden, Switzerland, United Kingdom, United States
- Date range: 1997 through 2020
- Horizons:1- and 3-months-ahead.
- Other details: Forecasts for the DEM are replaced with EUR forecasts as they become available. Some forecasts are published only with the DEM/EUR as the base currency and we convert these to exchange rates with a USD base using forecasts for the DEM/EUR.

## C.3 Macroeconomic Announcement Surprises

We use surprises for the following indicators for each country. When both Bloomberg and Informa Global Markets (IGM) publish expectations for the same indicator, we choose the source based on data availability. In a few rare cases in which indicators are discontinued, we splice the surprise series with a close substitute.

- Australia: (Inflation) CPI all groups goods component; (Activity) employment change, unemployment rate, GDP, building approvals, retail sales; (External) trade balance, (Monetary) RBA cash rate target
- Canada: (Inflation) CPI; (Activity) unemployment rate, GDP; (External) trade balance; (Monetary) Bank of Canada overnight lending rate
- Euro area:
  - Germany: (Activity) ifo Business Climate Index, industrial production, total manufacturing new orders, manufacturing PMI, ZEW Indicator of Economic Sentiment
  - Euro area: (Inflation) CPI; (Activity) GDP, manufacturing PMI; (External) current account balance, (Monetary) ECB main refinancing operations announcement rate, 3-month and 10-year interest rate futures
- Japan: (Inflation) Tokyo core CPI, PPI; (Activity) unemployment rate, industrial production, GDP, core machinery orders, tertiary industry activity, manufacturing PMI, (External) current account balance; (Monetary) M2 money supply, 10-year interest rate futures
- New Zealand: (Inflation) CPI; (Activity) GDP, unemployment rate, (External) trade balance, (Monetary) Reserve Bank of New Zealand official cash rate
- Norway: (Inflation) CPI; (Activity) unemployment rate; (Monetary) Norges bank deposit rate
- Sweden: (Inflation) CPI; (Activity) unemployment rate; (External) trade balance;

(Monetary) Sweden repo rate, 3-month and 10-year interest rate futures

- Switzerland: (Inflation) CPI; (Activity) procure.ch PMI; (External) trade balance; (Monetary) policy rate (LIBOR target rate spliced with the interest rate on sight deposits), 3-month and 10-year interest rate futures
- United Kingdom: (Inflation) CPI; (Activity) claimant count rate, GDP, industrial production; (External) trade balance; (Monetary) Bank of England official bank rate, 3-month and 10-year interest rate futures
- United States: (Inflation) CPI, core CPI, core PPI; (Activity) capacity utilization, Conference Board consumer confidence, University of Michigan consumer sentiment, new home sales, initial jobless claims, industrial production, leading indicators index, nonfarm payrolls, ISM manufacturing index, unemployment rate, GDP, retail sales; (External) trade balance, , oil surprises from Känzig (2021); (Monetary) federal funds target rate, 3-month fed funds rate futures, 4-quarter eurodollar futures, and 10-year Treasury yields