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The Impact of Uncertainty on Professional Exchange Rate Forecasts

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Joscha Beckmann and Robert Czudaj[1]

The Impact of Uncertainty on Professional Exchange Rate Forecasts

Abstract

This paper analyzes the role of uncertainty on both exchange rate expectations and forecast errors of professionals for four major currencies based on survey data provided by FX4casts. We consider economic policy, macroeconomic, and financial uncertainty as well as disagreement among CPI inflation forecasters to account for different dimensions of uncertainty. Based on a Bayesian VAR approach, we observe that effects on forecast errors of professionals turn out to be more significant compared to the adjustment of exchange rate expectations. Our findings are robust to different forecasting horizons and point to an unpredictable link between exchange rates and fundamentals. Furthermore, we illustrate the importance of considering common unpredictable components for a large number of variables. We also focus on the post-crisis period and the relationship between uncertainty and disagreement among exchange rate forecasters and identify a strong relationship between them.

JEL Classification: F31, F37

Keywords: Bayesian VAR; exchange rates; expectations; forecast; uncertainty

September 2016

1 Joscha Beckmann, RUB, UDE and Kiel Institute for the World Economy; Robert Czudaj, UDE. – *Thanks for valuable comments are due to Volker Clausen and the participants of the 20th Annual International Conference on Macroeconomic Analysis and International Finance, Rethymno/Crete, especially Nikiforos T. Laopodis. –* *All correspondence to: Joscha Beckmann, University of Duisburg-Essen, Department of Economics, Chair for Macroeconomics, 45117 Essen, Germany, e-mail: joscha.beckmann@uni-due.de*

1 Introduction

Forecasting exchange rates is notoriously difficult. The path-breaking paper by Meese and Rogoff (1983) highlighted that fundamental exchange rate models are unable to beat a simple random walk benchmark. This finding continues to hold more than 30 years later with exchange rate predictability depending on the choice of the sample period, the currency and the forecasting horizon (Rossi, 2013). It is notable that professional forecasters are also unable to provide adequate exchange rate forecasts. Contrary to theoretical suggestions related to market efficiency, expected and actual exchange rates diverge significantly in terms of point forecasts. Although this does not per se imply that professional forecasts are not useful from an investor's perspective, the finding that even professionals fail to outperform a simple random walk benchmark is still surprising. Several studies have focused on explaining the dispersion of forecasts across professionals, for example based on heterogeneous information and switching across different models (Jongen *et al.*, 2012). On the contrary, less is known about the empirical determinants of forecast errors by professionals. Considering that predictability and forecast errors on financial markets are related, uncertainty should be an important determinant in this context.

Therefore we contribute to the literature by analyzing the role of uncertainty for both expected exchange rate changes by professionals and the resulting forecast errors. From a theoretical perspective, unexpected exchange rate changes are a result of unexpected news or unexpected changes in fundamentals. Recent findings by Dick *et al.* (2015) also suggest that adequate exchange rate forecasts require an understanding of fundamentals. The degree of uncertainty therefore has a potential impact on both expectations and forecast errors. Bacchetta and van Wincoop (2006) argue that dispersed information about fundamentals leads to persistence of non-fundamental exchange rates and confusion about the source of exchange rate fluctuations. Basically, the underlying question we examine is twofold: (1) Do exchange rate forecasters revise their expectations due to uncertainty? (2) Are professional forecasters performing worse in case of higher uncertainty? By putting both questions under closer scrutiny, the core issue we tackle is the role of unpredictable changes in macroeconomic and financial variables for exchange rate predictability. Taking into account that a unique definition of uncertainty does not exist, we distinguish between four different kinds of uncertainty: economic policy uncertainty, macroeconomic uncertainty, financial uncertainty and disagreement among CPI inflation forecasters. We incorporate interest rates over different horizons, industrial production and money supply as macroeconomic fundamentals which provide useful control variables when analyzing effects resulting from uncertainty. Based on a Bayesian vector autoregressive (BVAR) framework, we also consider different forecasting horizons to analyze whether effects resulting from uncertainty are short-lived or also materialize over longer horizons.

We adopt survey data provided by FX4casts as a measure of professional exchange rate expectations. Studies by Fratzscher *et al.* (2015), Bacchetta *et al.* (2009) and Cavusoglu and Neveu (2015) rely on a related data set. Using aggregated data implies the shortcoming that the full distribution of expectations is not considered. On the opposite, using disagreement among forecasters might indeed be useful to provide insights and to improve the forecasting power (Cavusoglu and Neveu, 2015). However, those measures are not available over the full sample period under observation and we are interested in explaining the overall behavior of professionals rather than improving forecasts based on expectations or analyzing disaggregated expectations for a specific currency. Owing to the fact that such measures are not available over the full sample period, we mainly focus on the overall behavior of professionals reflected by the geometric average. However, we also study this relationship for the post-crisis period and assess the link between uncertainty and a measure of disagreement among professional exchange rate forecasters.

The remainder of this paper is organized as follows. Section 2 summarizes both theoretical considerations regarding a link between uncertainty and exchange rate expectations and previous literature while Section 3 provides our data and our empirical approach. Section 4 presents our empirical results and Section 5 concludes.

2 Literature review: exchange rate expectations and uncertainty

Considering the large number of empirical exchange rate studies, it seems reasonable to provide a brief summary of research dealing with uncertainty and exchange rates. In the context of expectations, it is widely recognized that uncertainty affects expected profits in the foreign exchange markets due to regime shifts (Canova and Marrinan, 1993). Changes in the conditional variances of exogenous processes, such as future policies, potentially affect the risk premium in the foreign exchange market and also introduce volatility in spot rates (Hodrick, 1989). In the aftermath of the crisis, the impact of monetary policy uncertainty on expected and realized spot rates has attracted specific interest from researchers (Mueller *et al.*, 2016; Beckmann and Czudaj, 2016).

Generally, exchange rate expectations are hard to measure. Survey data potentially incorporate useful information in this context and can also be used for forecasting. However, subjective survey-based forecasts are frequently found to be biased (So, 2013). In this spirit, survey data of exchange rate expectations has been adopted in a large number of studies without convincingly approximating future exchange rates. Among others, Blake *et al.* (1986), Chinn and Frankel (1994) and Verschoor and Wolff (2002) all reject the hypothesis of unbiased exchange rate expectations based on the following simple regression

$$s_{t+h} - s_t = \alpha + \beta(E_t(s_{t+h}) - s_t) + \varepsilon_{t+h}, \tag{1}$$

where $E_t(s_{t+h})$ denotes the expected exchange rate at t for $t + h$ and s_{t+h} gives the corresponding realization (Jongen *et al.*, 2008). The implied rejection of the rational expectation or perfect foresight hypothesis has been attributed to different factors such as time-varying risk premia or irrational expectations (Jongen *et al.*, 2008). However, it should be emphasized that rejections of the joint hypothesis $\alpha = 0$ and $\beta = 1$ does not necessarily correspond to a test of rational expectations considering that stochastic shocks which drive the exchange rate are not predictable so that agents are not aware of the true model. Acquisition of information usually increases shortly after the occurrence of an aggregate shock and the resulting increase in uncertainty. In this spirit, assessing the response of forecast errors, mean forecasts and survey disagreements after a shock has been used to analyze the role of information rigidities (Coibion and Gorodnichenko, 2012). Coibion and Gorodnichenko (2015) analyze macroeconomic survey data besides exchange rates and find that departures from rational expectations most likely reflect deviations from full information rather than a rejection of rational expectations. Sticky and/or noisy information results in information frictions and bounded rationality might still occur under those circumstances.

Taking such thoughts as a starting point, we address the question whether the forecast error in Eq. (1), ε_{t+h}, which occurs if $E_t(s_{t+h}) \neq s_{t+h}$, is affected by different dimensions of uncertainty. Model uncertainty can be expressed as the ambiguity over the correct structural model or as costly deviations from an optimal forecasting model. Independent of the definition, model uncertainty is an important aspect of expectation formation, resulting for example in a switching between different forecasting models (Branch, 2007). We adopt this idea in the context of exchange rates: A response of the expected exchange rate to uncertainty points to a change of the underlying forecasting model while a significant effect on forecast errors potentially reflects noisy information. Since we analyze exchange rates against the US dollar, the direction of changes also matters as safe haven currencies are expected to appreciate in case of higher uncertainty.

Following an approach in the spirit of Engel and West (2005), the exchange rate reflects the discounted sum of current and future fundamentals. One implication is that expected fundamentals are potentially more important than current fundamentals (Dick *et al.*, 2015). Adopting their framework for exchange rate expectations provides the following equation for the expected exchange rate

$$E_t(s_{t+1}) = (1-b)(f_{1,t} + u_{1,t}) + b(f_{2,t} + u_{2,t}) + bE_t(s_{t+1}). \tag{2}$$

where b represents a discount factor with the property that $0 < b < 1$. A discount factor close to 1 implies that the exchange rate follows a random walk.[1] The exchange rate s_t is defined as the natural logarithm of the domestic currency price of the US dollar (i.e., domestic currency per unit of US dollar). The systematic components $f_{1,t+j}$ and $f_{2,t+j}$ are given by the current path of realized fundamentals while the unsystematic components $u_{1,t+j}$ and $u_{2,t+j}$ denote expected unobservable fundamentals and reflect the unpredictable stochastic shocks outlined above. Hence, uncertainty regarding fundamentals should also affect exchange rates and exchange rate expectations. The no-bubbles forward solution of Eq. (2) provides (Engel *et al.*, 2009)

$$E_t(s_{t+1}) = (1-b)\sum_{j=0}^{\infty} b^j E_t(f_{1,t+j} + u_{1,t+j}) + b\sum_{j=0}^{\infty} b^j E_t(f_{2,t+j} + u_{2,t+j}). \tag{3}$$

Among others, order flow data is considered as an approximation for the unobservable factors $u_{1,t+j}$ and $u_{2,t+j}$ (Rime *et al.*, 2010). However, it can easily be argued that the degree of uncertainty influences those unobservable components so that exchange rate expectations are affected by uncertainty. The same logic can be applied to the forecast error that is the difference between the actual and the expected exchange rate. In this regard, the news approach argues that unanticipated exchange rate movements are due to unexpected news (Hakkio and Pearce, 1985). Overall, uncertainty on exchange rate fundamentals should be directly related to expectations, foreign exchange risk and risk premia (Ter Ellen *et al.*, 2013). If participants expect a currency to act as safe haven, an appreciation is expected. Since all exchange rates are relative to the US dollar, an expected domestic depreciation therefore reflects safe haven considerations for the US dollar. Besides influencing expectations, a positive effect on forecast errors stems from unexpected uncertainty effects on the spot rate which are summarized by the unobservable factors $u_{1,t+j}$ and $u_{2,t+j}$ above. On the contrary, lower forecast errors potentially occur if policy responses or market reactions are correctly anticipated.

[1] Sarno and Sojli (2009) provide evidence that the assumption of a discount factor close to unity is reasonable.

A crucial question is which measure of uncertainty should be adopted. Uncertainty in terms of unexpected news is usually approximated by forecast errors, i.e. unexpected changes in fundamentals. However, the measurement of unexpected changes is usually restricted by data availability. We account for different dimensions of uncertainty by considering various different measures. First, we argue that the cross-sectional unforeseeable component of macroeconomic and financial variables provided by Jurado *et al.* (2015) gives a good approximation of unexpected changes in the underlying drivers of exchange rates. Their measure focuses on predictability of the state of the economy rather than on dispersion or volatility and controls for a predictable component in forecast errors. More precisely, uncertainty for a specific variable $y_{j,t+h}$ is given by

$$\mathrm{UN}^{y}_{j,t}(h) = \sqrt{E_t[(y_{j,t+h} - E_t(y_{j,t+h}))^2]}, \tag{4}$$

where h represents the forecast horizon and $E_t(.)$ denotes expectation conditional on the information set of economic agents available at time t. The underlying idea of the measure provided by Jurado *et al.* (2015) is to control for the systematic component to dissect forecastable variations and the unpredictable components. If today's expectation of the squared forecast error of predicting $y_{j,t+h}$ rises, uncertainty in the corresponding variable increases. The aggregated uncertainty measure displays the common variation of uncertainty across many series $y_{j,t+h}$ but is independent of uncertainty on any particular series (Jurado *et al.*, 2015). Starting with the assumption that the expected exchange rate is based on the state of the economy, such an uncertainty measure should capture unexpected changes in the stochastic components $u_{1,t+j}$ and $u_{2,t+j}$ and might therefore result in $E_t(s_{t+h}) \neq s_{t+h}$. Relying on a broad set of fundamentals as a starting point for uncertainty is also in line with the finding that factor models provide improved exchange rate forecasts (Engel *et al.*, 2015). The results reported by Jurado *et al.* (2015) based on a VAR including 12 variables suggest that their uncertainty measures have significant effects on forecast errors of standard macroeconomic variables such as GDP.

The second uncertainty measure we consider is newspaper-based and provided by Baker *et al.* (2013). While US policy uncertainty has been analyzed in a related context (Beckmann and Czudaj, 2016), the availability of uncertainty measures for other economies allows for the possibility to assess the relative importance of policy uncertainty. Finally, the disagreement among CPI inflation forecasters represents an alternative measure of the unsystematic component. The intuitive idea is related in the sense that disagreement among inflation forecasters should affect exchange rate expectations if the latter incorporates expectations about future fundamentals. This measure is of particular interest when we additionally assess the disagreement of exchange rate forecasters after the financial crisis.

In the context of exchange rates we are analyzing, it is important to consider the effects over different horizons. Theoretical considerations suggest that exchange rates are easier to predict over long horizons due to their volatility over short horizons and potential mean reversion to fundamental values (Taylor and Sarno, 2004). Mark (1995) indeed finds that predictability increases over long horizons while a recent survey by Rossi (2013) concludes that the degree of exchange rate predictability depends on the horizon, the currency and the model and that no clear pattern emerges.[2] We therefore ask the question whether the effect of uncertainty on professional market expectations and the resulting forecast errors differs across horizons.

Overall, we distinguish between expected and unexpected effects on exchange rates stemming from uncertainty by considering both exchange rate expectations and the forecast error that is the difference between realized exchange rates and exchange rates expectations. To control for the systematic components $f_{1,t+j}$ and $f_{2,t+j}$, we adopt interest rates as well as industrial production and money supply growth as a standard set of fundamentals within our framework. Adopting a BVAR methodology assures that all variables are endogenous and also accounts for autocorrelation across errors and uncertainty about the model parameters.

3 Data and Bayesian VAR approach

3.1 The data

We examine exchange rate expectations of major currencies against the US dollar, i.e. the Euro (EUR/USD), the Japanese yen (JPY/USD), the Canadian dollar (CAD/USD), and the British pound sterling (GBP/USD).[3] The exchange rates are measured in units of domestic currency per one unit of the US dollar (i.e. an increase corresponds to a depreciation of the domestic currency). We make use of survey data on a monthly basis collected by FX4casts (formerly known as *The Financial Times Currency Forecaster* or *Currency Forecasters' Digest*, see `http://www.fx4casts.com/`) spanning the period from 1986:08 to 2015:12 as proxy for exchange rate expectations following Bacchetta *et al.*

[2] The fact that an in-sample relationship does not necessarily translate into out-of-sample predictability might be due to the occurrence of structural breaks. The results of Sarno and Valente (2009) suggest that identifying an adequate model in real-time represents a major caveat even if relevant information are embedded in fundamentals. The scapegoat approach of Bacchetta *et al.* (2009) also argues that different fundamentals matter at different points in time.

[3] This choice is restricted to the availability of domestic uncertainty indices for other economies. However, we believe that we have covered the most important currencies in trading volume.

(2009) and Cavusoglu and Neveu (2015).[4] Survey-based expectations are provided as 3-, 6-, and 12-month ahead forecasts. The consensus is based on 48 individual responses by professionals (i.e. large financial institutions) and computed as the geometric mean of all responses in order to reduce the influence of extreme outliers. For the post-crisis sub-sample analysis, we also include disagreement among exchange rate forecasters measured as the difference between the highest and the lowest individual forecast.

We adopt four different measures as proxies for different kinds of uncertainty. First, we consider the newspaper-based economic policy uncertainty (EPU) index proposed by Baker *et al.* (2013).[5] This measure is available for each economy under consideration (i.e. the European Union (EU), Japan, Canada, the UK and the US). Therefore, as will be explained in the next subsection in more detail, we have used these indices to estimate VAR models including both the US EPU and the domestic EPU index as two potential sources of policy uncertainty affecting exchange rate expectations for each currency. This index is based on month-by-month searches of articles published in the largest newspapers in the corresponding economy.[6] The index is constructed based on the number of articles containing the triple of: (1) 'uncertainty' or 'uncertain', (2) 'economic' or 'economy' and (3) at least one policy expression such as: 'Congress', 'deficit', 'Federal Reserve', 'legislation', 'regulation' or 'White House' (Baker *et al.*, 2013). Hence, these measures aggregate different aspects of uncertainty which are directly related to the political situation in the corresponding economy without explicitly referring to macroeconomic fundamentals. The starting period of the newspaper-based economic policy uncertainty measures differs between economies.[7] In order to achieve comparability of the results between the different currencies, we have decided to synchronize the sample period for the EUR/USD, the JPY/USD and the CAD/USD exchange rates to 1988:06 until 2015:12. Solely the sample period for the GBP/USD exchange rate runs from 1997:01 to 2015:12.

Second, we adopt two measures proposed by Jurado *et al.* (2015) as proxies for macroeconomic

[4] Professional forecasts of the euro are approximated by forecasts of the German D-Mark prior to 1999.

[5] See Beckmann and Czudaj (2016) for an analysis of disaggregated US policy uncertainty in a related context.

[6] The newspapers included in the US index are USA Today, the Miami Herald, the Chicago Tribune, the Washington Post, the Los Angeles Times, the Boston Globe, the San Francisco Chronicle, the Dallas Morning News, the Houston Chronicle, and the Wall Street Journal. For the EU index Baker *et al.* (2013) draw on two newspapers per main economy: Le Monde and Le Figaro for France, Handelsblatt and Frankfurter Allgemeine Zeitung for Germany, Corriere Della Sera and La Repubblica for Italy, El Mundo and El Pais for Spain, and The Times of London and Financial Times for the United Kingdom. The UK index is a sub-index of the EU index relying on the latter two newspapers. The Japanese index is constructed based on articles in Japan's two largest-circulation daily newspapers, Asahi and Yomiuri. For the Canadian index Baker *et al.* (2013) include five Canadian newspapers: The Gazette, The Vancouver Sun, The Toronto Star, The Ottawa Citizen, and The Globe and Mail. Additionally, articles from the Canadian Newswire are also included.

[7] The index starts in 1985:01 for Canada and the US, in 1987:01 for the EU, in 1988:06 for Japan and in 1997:01 for the UK.

and financial uncertainty. Macroeconomic uncertainty is measured by the common volatility in the unforecastable component of 132 macroeconomic time series while financial uncertainty is measured in a similar fashion using a broad number 147 monthly financial series which for example include equity valuation ratios, dividend growth rates or risk factors according to Fama and French (1993).[8] Compared to conventional uncertainty measures such as the VIX, the advantage of the Jurado *et al.* (2015) approach is that it relies on conditional expectations. This allows to disentangle uncertainty from forecastable components which potentially also drive stochastic volatility and error terms of forecasts. Finally, our fourth uncertainty measure is the disagreement among CPI inflation forecasters according to the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters. The survey asks the panelists for their projections of the annual average rate of growth in the Consumer Price Index (CPI) over the next 10 years. Taking into account the lack of disaggregated expectation data for fundamentals, using this data set seems to be the best available proxy for fundamentals which are potential drivers of exchange rates. The underlying question is whether uncertainty regarding future fundamentals is transmitted into exchange rate expectations and forecast errors.

We also consider interest rates, industrial production and money supply as a standard set of fundamentals within our framework to control for systematic factors. The choice of current fundamentals is driven by standard exchange rate models such as the monetary approach or a Taylor rule model (Taylor and Sarno, 2004; Rossi, 2013). Interest rates are approximated by 3, 6 and 12 month deposit rates taken from Thomson Reuters Datastream for the four economies under observation (Euro Area, Japan, Canada and the UK) and the US. German deposit rates serve as a proxy for Euro Area rates prior to 1999. Industrial production indices have been downloaded from the OECD statistics for the corresponding economies. As money supply we have considered broad monetary aggregates taken from Thomson Reuters Datastream as follows: M3 for the Euro Area and Japan, M2+ for Canada, M4 for the UK and M2 for the US.

3.2 Bayesian VAR approach

Based on data described in the previous subsection, we estimate several Bayesian vector autoregressions (BVARs) for each of the four currencies including six or five variables as follows. The vector of time series

$$x_t = [\text{US EPU}_t, \text{Dom. EPU}_t, \text{FX}_{t+h}, \tilde{r}_t, \tilde{m}_t, \tilde{y}_t]' \tag{5}$$

[8] The fact that the exchange rate is one of the macroeconomic series used for construction is not an issue since the derived measure is independent from any specific series (Jurado *et al.*, 2015).

includes US EPU_t and Dom. EPU_t as the US and the domestic news-based economic policy uncertainty index (Baker *et al.*, 2013). FX_{t+h} either denotes the expected exchange rate change $E_t(s_{t+h})-s_t$ or the forecast error computed as the absolute difference between the actual and the expected exchange rate ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$) for $h = 3, 6, 12$ (following Bacchetta *et al.* (2009)). Moreover, we also include the following fundamentals: the interest rate differential $\tilde{r}_t = r_t - r_t^*$, where r_t is the h-month deposit rate of the domestic economy and r_t^* its US counterpart (for $h = 3, 6, 12$), the money supply growth differential $\tilde{m}_t = \Delta \log m_t - \Delta \log m_t^*$, where m denotes money supply, and the output growth differential $\tilde{y}_t = \Delta \log y_t - \Delta \log y_t^*$, where y denotes industrial production. To analyze the impact of the other three uncertainty measures, we estimate BVARs for each measure separately using the same set of variables

$$x_t = [\text{UN}_t, \text{FX}_{t+h}, \tilde{r}_t, \tilde{m}_t, \tilde{y}_t]' \quad (6)$$

with UN_t as the uncertainty index (i.e. the macroeconomic uncertainty index, the financial uncertainty index according to Jurado *et al.* (2015) or the US CPI forecast disagreement index, respectively).

Generally, the BVAR model has the following structure

$$x_t = a_0 + a_1 x_{t-1} + \ldots + a_p x_{t-p} + \eta_t, \quad t = 1, \ldots, T, \quad (7)$$

where η_t is i.i.d. $N(0, \Sigma)$. In order to achieve comparability the lag length p has been set to be equal to 2 for all models.[9] Eq. (7) can be stacked in two different ways as follows

$$X = AZ + E \quad (8)$$

or

$$x = (I_n \otimes Z)\alpha + \eta, \quad \eta \sim N(0, \Sigma \otimes I_n), \quad (9)$$

where x is defined as a vector of dimension nT stacking all T observations of each of the n variables below each other and X is defined as a matrix of order $T \times n$ stacking these observations in columns side by side. η and E are defined analogously stacking the corresponding error terms. Z is a $T \times (1 + np)$ matrix of regressors, $A = (a_0, a_1, \ldots, a_p)'$ and $\alpha = vec(A)$ stacks all coefficients in one vector.

The BVAR model given above has been estimated using the Gibbs sampler with a Minnesota prior (sometimes also called Litterman prior) which basically means that Σ is estimated to be diagonal.

[9] This choice is supported by several information criteria in most of the cases.

The elements on the diagonal of $\hat{\Sigma}$ are the simple OLS estimates of the error variance from equation-by-equation estimation of AR(2) models for each variable in the system. Since Σ has been replaced by an estimate, we only require a prior for α as follows

$$\alpha \sim N(\alpha_0, V_0), \tag{10}$$

where α_0 is a vector of zeros ensuring shrinkage of the BVAR coefficients towards zero and lessening the risk of over-fitting (Koop and Korobilis, 2009). The prior variance-covariance matrix V_0 is defined as follows (Koop and Korobilis, 2009)

$$V_{0_{i,j}} = \begin{cases} \frac{0.5}{p^2}, & \text{for coefficients on own lags,} \\ \frac{0.5\sigma_i^2}{p^2\sigma_j^2}, & \text{for coefficients on lags of variable } j \neq i, \\ \sigma_i^2, & \text{for coefficients on exogenous variables (i.e. the constant).} \end{cases} \tag{11}$$

Then, the posterior distribution has the following form

$$p(\alpha|\Sigma, X) = N(\alpha_1, V_1) \tag{12}$$

with

$$V_1 = \left[V_0^{-1} + \left(\hat{\Sigma}^{-1} \otimes (Z'Z)\right)\right]^{-1} \tag{13}$$

and

$$\alpha_1 = V_1 \left[V_0^{-1}\alpha_0 + \left(\hat{\Sigma}^{-1} \otimes Z\right)' x\right]. \tag{14}$$

The BVAR estimates based on a Gibbs sampler with 10.000 iterations after discarding the burn-in period of 5.000 have been used to compute the impulse responses of the forecast error and the change in exchange rate expectations, respectively, to a one-unit shock on the different uncertainty measures. The corresponding results will be discussed in Section 4.2.

4 Empirical results

4.1 Overview

We start this section with descriptive statistics for the four uncertainty measures considered in our study provided in Table 1. Due to the construction based on removing systematic components, macroeconomic and financial uncertainty display a much lower standard deviation relative to conventional volatility or uncertainty measures. Disagreement among inflation forecasters and the different economic policy uncertainty indices display a much higher standard deviation. ADF-test results also provided in Table 1 indicate that all uncertainty measures can be seen as stationary (i.e. the null of a unit root is rejected in each case). Table 2 provides the correlation across the different uncertainty indices. Unsurprisingly, macroeconomic and financial uncertainty display a significant correlation of around 65%, still leaving the consideration of both indices as a useful distinction. On the opposite, the correlation of economic policy uncertainty with macroeconomic and financial uncertainty is only around 30 and 40%, respectively. The correlation of disagreement among CPI forecasters with all other alternative uncertainty measures is below 40%.

*** Insert Tables 1 and 2 and Figure 1 about here ***

Figure 1 shows the pattern of the different uncertainty measures. In line with our descriptive results, the economic policy uncertainty measures display a different behavior compared to macroeconomic and financial uncertainty. Nevertheless uncertainty in general significantly increases around the occurrence of the subprime crisis from 2007-2009. The overall findings suggest that the consideration of all four uncertainty measures potentially exhibits different information. As a next step, we consider the link between current exchange rates and exchange rate forecasts provided in Figure 2. While short-run forecasts (3 month) are closely related to the actual exchange rates we find that medium- (6 month) and long-run forecasts (12 month) deviate significantly from the current exchange rates. Hence, expectations incorporate additional factors besides the current exchange rate if the forecasting horizon increases. How well do professional forecasters perform? In line with previous studies outlined in Section 2, Figure 2 also illustrates significant forecast errors for all horizons, illustrating that $E_t(s_{t+h}) \neq s_{t+h}$ in most cases. All forecast errors display significant spikes during specific periods. Taking uncertainty into account, an interesting pattern is that the forecast error increases significantly around 2009 for the British pound and the Canadian dollar while this is not the case for the euro and the Japanese yen. This becomes also evident when looking at the actual and expected exchange rate changes reported in Figure 3. Comparing the forecast error of the expected exchange rate with a simple random walk benchmark shows that professionals fail to beat the current exchange rates as a simple predictor.[10] Nevertheless all forecast errors can be considered as stationary as shown in Table 3. This means that shocks are not persistent and the autocorrelation functions provided in Figure 4 die out over time. Unsurprisingly, they die out much faster for shorter forecast horizons.

*** Insert Table 3 and Figures 2 to 4 about here ***

4.2 Impulse response analysis

In the following we explicitly analyze the effects of uncertainty on both expected exchange rates and the resulting forecast errors. Figures 5 to 12 provide impulse response functions of expected exchange rate changes by professionals and the corresponding forecast errors to a one-unit shock on different kinds of uncertainty for each currency under investigation.[11] In each case, we analyze five different uncertainty measures for three forecasting horizons: 3, 6 and 12 months. Expected long-run exchange rates should be directly related to monetary and fiscal policy while uncertainty is potentially more relevant in the short-run. However, uncertainty might also be related to long-run expectations if the stance of economic policy is expected to change as a result. As is usual practice in the VAR literature, we take both 68% and 95% confidence bands into account, of course implying a much stronger significance at a 5% compared to a 32% level. Since the 95% confidence interval is a tough benchmark when analyzing uncertainty and the recent crisis, significance is more frequently observed at the 68% interval in the following. Keeping in mind that an increase denotes an expected appreciation of the US dollar against the domestic currency, we start with the impact on expected exchange rate changes to examine whether exchange rate expectations adjust to a boost in uncertainty.

*** Insert Figures 5 to 8 about here ***

[10] This holds for both the mean squared error and the root mean squared error as a benchmark with the corresponding results available upon request.

[11] See Tables 4 to 7 for the coefficient estimates and standard errors for each model which are given as means and standard deviations of the corresponding posterior density, respectively.

One-unit shocks on domestic and foreign economic policy uncertainty are considered as a first step. For the Canadian dollar (CAD) and the euro, an increase in domestic uncertainty results in an expected depreciation over 3 months while effects over 6 months are insignificant. The 12 month response shows a stronger expected depreciation against the US dollar (USD) for the euro and the CAD while effects for the British pound (GBP) are hardly significant. An increase in US economic policy uncertainty results in an expected appreciation over 3 and 6 months for the Japanese yen (JPY). Effects for the other economies are insignificant except for the 3 month horizon in case of the CAD and the 6 month horizon for the euro and the GBP. Long-term effects are again more significant for both currencies and suggest an expected appreciation against the US dollar for all three currencies. Overall, the direction of economic policy shocks is unambiguous since an increase in domestic policy uncertainty results in an expected depreciation while the opposite is observed if policy uncertainty in the US increases. The only exception is the JPY where higher domestic uncertainty triggers a brief expected appreciation in the long-run.

The effects of increasing CPI disagreement among forecasters are also different across time horizons and vary across currencies. While the corresponding effects for the GBP turn out to be insignificant, an expected appreciation of the USD against the euro is observed over 3 months and against the CAD over 6 months. The JPY and the euro are expected to appreciate over 12 months while a depreciation is expected for the CAD. These mixed findings are hardly surprising considering that an increase in CPI disagreement reflects different scenarios in terms of inflation relative to the US. What we can say, however, is that disagreement related to inflation forecasts partly affects expectations. The effects of macroeconomic and financial uncertainty suggest that a domestic depreciation is expected for the CAD over most horizons. The JPY is expected to appreciate over 3 months while the opposite is observed for the GBP in case of higher financial uncertainty. Over the medium-run of 6 months, an appreciation against the USD is expected for all currencies except for the CAD. The opposite holds for the JPY over 12 months.

The findings so far provide mixed evidence in the sense that effects on expectations are frequently insignificant. Nevertheless, the significant effects are in line with theoretical considerations, for example in the sense that higher policy uncertainty is expected to depreciate the domestic currency. It also reflects previous research which has identified information rigidities as a major issue in the context of macroeconomic expectations (Coibion and Gorodnichenko, 2012). Exchange rate forecaster often change the underlying model in case of shocks (Jongen *et al.*, 2012). The observed effects are overall more pronounced over the long-run which probably reflects the underlying belief in random walk forecasts over the short-run while other fundamental or policy related models are more relevant in the long-run.

*** Insert Figures 9 to 12 about here ***

A related question we now turn to is whether the resulting forecast errors of professionals are also affected by uncertainty which would reflect unexpected effects due to uncertainty. A general observation displayed in Figures 9 to 12 is that the response of forecast errors is more frequently significant at the 68% confidence level compared to the adjustment of expectations. The strongest effects are observed for the CAD where uncertainty increases the forecast error over all horizons if significance is observed. In line with the findings for expectations, the impact of macroeconomic and financial uncertainty on forecast errors is even stronger with the accuracy of forecasts also decreasing for the euro and the GBP while a significant positive effect on the forecast error of the JPY is only observed over 12 months. The effects on the forecast error are relatively persistent and significant even at the 95% confidence interval. CPI disagreement also increases the forecast error in many cases but turns out to be less significant. A shock to US economic policy also results in a higher forecast error for both the GBP and the JPY. Interestingly, an increase in domestic policy uncertainty lowers forecast errors over at least one horizon for the JPY and the GBP. Such a pattern might reflect anticipated domestic policy responses in case of higher uncertainty. Another explanation is that market participants correctly anticipate persistent exchange rate movements, for example by extrapolating existing trends in currency markets. A detailed analysis of such a pattern would require an assessment of the full distribution of expectations but the general line of reasoning corresponds to the findings of Jongen *et al.* (2012).

While macroeconomic and financial uncertainty is based on a cross-section perspective of fundamentals, we have also considered interest rates, money supply growth and industrial production growth relative to the US as a benchmark shock. The impulse response analysis for one-unit shocks on these fundamentals is available upon request but hardly provides significant effects compared to the different uncertainty shocks considered so far. In line with previous findings, this suggests that cross-country factors are more important determinants of exchange rates than country-specific fundamentals. The result that exchange rate expectations react less to uncertainty might for example be driven by either sluggish adjustment of expectations or relying on the current exchange rate as the best predictor for the next period. Taking this pattern as given, the result that forecast errors are affected by uncertainty even if expectations are adjusted reflects an unpredictable impact of fundamentals on exchange rates.

Several studies have illustrated the time-varying and unstable relationship between exchange rates and fundamentals which is referred to as the exchange rate disconnect puzzle. Our findings clearly point to an existing but complex link since a part of exchange rate movements, which is unpredictable by professionals, is directly related to the common unpredictable component of macroeconomic and financial variables. These findings are also in line with recent results provided by Dick *et al.* (2015) who find that the forecast adequacy of fundamentals affects the performance of exchange rate forecasts. In this spirit, we find that the unpredictable common component of macroeconomic and financial variables drives the forecast errors of professionals. The fact that newspaper-based economic policy uncertainty partly also has an impact on expectations and forecasts errors suggests that expected policy decisions also play an important role for exchange rates and the related expectations. Finally, the link between disagreement about CPI forecasters and exchange rate expectations confirms that the expected path of fundamentals affects future and expected exchange rates. Forecast errors of professionals can reflect a scenario where the exchange rate overshoots an expected value while they might also move into the opposite direction as expected.

Our results therefore beg the question whether the effects of uncertainty on future exchange rates occur randomly or whether any systematic influence can be identified and adopted for forecasting exchange rates. This could for example be analyzed in the context of averaging across models which includes uncertainty measures when forecasting exchange rates. Such a proceeding has for example been adopted by Wright (2008) and Beckmann and Schüssler (2016). While the success of factor models for exchange rate forecasting suggests that this is a promising approach, one needs to take into account that some of the uncertainty measures we consider might not be available to a forecaster in real-time. The economic policy uncertainty is standardized over the entire sample period while the dispersion across CPI forecasts is potentially also difficult to obtain in real-time. Our findings indicate that it might be problematic to utilize the degree of uncertainty in a forecasting exercise since the underlying effects occur in a non-systematic fashion. We will come back to the forecasting issue in the next subsection.

4.3 Post-crisis period, disagreements and out-of-sample considerations

Up to this point, we have solely relied on the geometric mean as a measure of exchange rate expectations owing to the fact that a full distribution of forecasts and disagreement measures is not available over the full sample period. It seems reasonable to assume that the disagreement among exchange rate forecasters (i.e. the spread between the largest and lowest individual forecast) is potentially affected even if the geometric mean remains unchanged, that is the distribution of individual forecasts widens. This question is analyzed by considering correlations between our uncertainty measures and the disagreement among exchange rate forecasters over different horizons for the time period after the financial crisis. We have used the collapse of Lehman Brothers (2008:09) as the starting point due to unavailability of disagreements over the full sample.[12] Dispersion among exchange rate forecasters usually arises as a result of heterogeneous information and due to different weight attached to forecasting techniques which might for example be based on fundamentals, technical analysis or carry trades (Jongen *et al.*, 2012). Such weights are adjusted over time depending on the information set and observed forecast errors (Jongen *et al.*, 2012). Our intuitive hypothesis is that an increase in uncertainty related to fundamentals or economic policy results in changing weights and should increase uncertainty regarding the expected exchange rate.

Our results presented in Table 8 show correlations between disagreement among exchange rate forecasters and our four uncertainty measures. A first finding is that both domestic and US economic policy uncertainty displays the lowest correlation with disagreement among exchange rate forecasters and partly results in negative correlations. Economic policy uncertainty in the US is positively related to disagreements regarding the GBP and the JPY with a correlation of around 15%. Domestic policy uncertainty is highly correlated with disagreements for the JPY (around 30%) but negatively correlated for the other three economies. The correlation mostly decreases over longer horizons and partly switches sign. This suggests that only uncertainty regarding the JPY is systematically related to policy uncertainty while the other disagreements are mostly driven by other factors. This possibly reflects the strong role of the Bank of Japan for currency developments in Japan.

*** Insert Table 8 about here ***

[12]Focusing on this period can also be justified based on various reasons. Fratzscher (2009) has for example shown that the perception of US news on currency markets significantly changed after 2008.

On the contrary, the findings for the remaining uncertainty measures are quite strong and display an unambiguous pattern across all currency disagreements. Over the short-run, the correlation of macroeconomic and financial uncertainty is higher than 30% for all currencies. The correlation again frequently becomes weaker over longer horizons but is never below 10% and in many cases higher than 30% or even 50%. CPI disagreement is highly correlated with currency disagreement for the JPY and the GBP over all horizons. Both disagreements also display a correlation of more than 50% with financial uncertainty over all horizons.

Considering that forecasters base their analysis on different models, these findings suggest a strong role of fundamentals in those models. Higher disagreement arises under different circumstances but the strong relationship shows that fundamental disagreements are related to changes of the underlying models. Macroeconomic and financial uncertainty as well as CPI disagreements are directly related to current fundamentals and therefore show a stronger relationship while policy uncertainty is related to expected future policies which potentially affect fundamentals. The strong impact on the JPY disagreements is in line with our previous findings and the history of currency interventions in Japan. A more in-depth analysis would require an assessment of the full distribution of forecasters, an information set which is currently not available to us.

We have also conducted a sample split in September 2008 to disentangle dynamics before and after the financial crisis. The full set of impulse response functions is available in the Appendix. Since the most important patterns remain stable, we only elaborate on important differences in the following. One observation is that expectation dynamics partly have changed in the sense that the US dollar is less frequently expected to serve as a safe haven currency prior to the crisis. For the first sample period running from 1988:06 to 2008:08, we find that the Japanese yen is expected to appreciate over 3 and 6 months in case of higher financial uncertainty. The euro is also expected to appreciate against the USD over 12 months in case of higher policy uncertainty in the US. All these effects are not observed for the second subsample period starting in 2008:09. A similar pattern is observed for forecast errors in case of the JPY. Higher financial and macroeconomic uncertainty lowers forecast errors of the JPY for 3 and 6 months before but not after the financial crisis where such an effect is observed only over 12 months. Forecast errors of the GBP slightly decrease over 3 and 6 months in case of higher financial uncertainty for both sample periods. As discussed before, such a finding might be a result of anticipated policy responses.[13]

[13]We gratefully acknowledge comments from an anonymous referee who has pointed out that lower forecast errors in case of uncertainty might also reflect a successful policy stance due to expected effects.

Our results so far are based on an in-sample impulse response analysis. Taking our findings into account, an interesting question is whether our uncertainty measures are able to improve out-of-sample forecasts. We therefore rely on a configuration which includes survey expectations, fundamentals and uncertainty measures to forecast the spot exchange rates. In line with previous findings, such a model is not able to beat a simple random walk benchmark over the full sample period. In general, previous research has shown that in-sample fit is not necessarily related to out-of-sample predictability (Rossi, 2013). The corresponding findings are available upon request. This pattern is also intuitively plausible taking our finding into account that uncertainty increases the forecast error of professionals. A different question is whether including uncertainty improves the profitability of expectation-based trading. It is also possible that averaging across models in the spirit of Wright (2008) or Beckmann and Schüssler (2016) to achieve a more parsimonious structure might lead to improved results when including uncertainty. However, we leave those questions up to further research.

5 Conclusion

This paper has examined the role of uncertainty on both exchange rate expectations and forecast errors of professionals for four major currencies. We consider macroeconomic, financial and economic policy uncertainty as well as disagreement among CPI inflation forecasters to account for different dimensions of uncertainty. While the first two measures are calculated based on the unpredictable component of a large set of macroeconomic and financial series, the economic policy index is based on newspaper coverage and CPI disagreement is based on the inflation predictions of professionals. In line with previous results, we find that professionals have a hard time predicting exchange rates. We observe that the change of the forecast errors of professionals to uncertainty is more significant compared to the effect on exchange rate expectations. The fact that professional expectations fail to incorporate uncertainty in an effective way can be interpreted as an artifact of the unpredictable link between exchange rates and fundamentals and the unpredictability of exchange rates per se. Our finding that different dimensions of uncertainty translate into uncertainty about expected exchange rates mirrors the findings of Bacchetta and van Wincoop (2006) that expectation errors are unpredictable in markets where this is also the case for excess returns.

Although the considered uncertainty measures differ by construction, the directional effects mostly point to higher forecast errors and an expected appreciation of the US dollar if uncertainty increases. The only exception is increasing disagreement among CPI forecasters where significant effects differ across currencies. Macroeconomic and financial uncertainty overall have the strongest effects, in particular on forecast errors. A notable exception is the Japanese yen. In many cases, professionals seem to expect an appreciation against the US dollar in case of higher uncertainty which points to safe haven consideration of investors. We also find that such an effect is particularly observed for the period before the financial crisis. Safe haven patterns are also observed for the British pound which indeed significantly appreciated after the financial crisis and was for example considered as the main safe haven currency 2014 by Citigroup. Interestingly, professionals have also done a better job when forecasting the yen prior to the crisis. An interesting question is whether expected or actual interventions by the Bank of Japan are important in this context. This illustrates that expected safe haven currencies also vary over time.

Although the directional effects of macroeconomic and financial uncertainty are mostly equivalent, their impact differs across currencies. Macroeconomic uncertainty has a higher impact on forecasts and forecast errors of the pound while the yen is more affected by financial uncertainty. Our findings are also robust across different forecasting horizons with shocks to financial and macroeconomic uncertainty partly displaying more persistence for longer term predictions. This suggests a mostly similar behavior of forecasters across different forecasting horizons, at least from an aggregated perspective. Overall, the findings for macroeconomic and financial uncertainty illustrate the importance of the cross-section when analyzing exchange rates. While previous research of Engel *et al.* (2015) and others has focused on the cross-section of fundamentals across countries based on factor models, we illustrate the importance of considering common unpredictable components obtained from a large number of variables.

While we have focused on changes in expectations and the resulting forecast errors, a related question is whether the performance of forecasters from an investor's perspective is affected by uncertainty when considering a portfolio of currencies. We have not explicitly addressed this question due to a lack of data availability since expectations for a full set of currencies are not available from 1986. Another possible extension could consider factors such as order flow data or expected fundamentals as a potential starting point for understanding the transmission channels for an impact of uncertainty on exchange rates and forecast errors. Considering that individual forecasters might be successful even if aggregated predictions display high forecast errors, the dispersion of forecasts among professionals and the resulting heterogeneity constitutes another open research topic. The response of individual forecasters in the spirit of our disagreement measure to uncertainty also deserves further attention.

Our findings suggest a close link between uncertainty and forecast disagreement after the financial crisis. The full distribution of forecasts is unavailable for our set of currencies but focusing on selected currencies where such a data set is available might allow to assess the role of asymmetric information and herding behavior in the present context. Finally, a more sophisticated set of domestic uncertainty measures for each economy would constitute a welcome addition taking the importance of both domestic and foreign policy uncertainty into account.

References

Bacchetta P, Mertens E, van Wincoop E. 2009. Predictability in financial markets: What do survey expectations tell us? *Journal of International Money and Finance* **28**: 406–426.

Bacchetta P, van Wincoop E. 2006. Can information heterogeneity explain the exchange rate determination puzzle? *American Economic Review* **96**: 552–576.

Baker SR, Bloom N, Davis SJ. 2013. Measuring economic policy uncertainty. *Chicago Booth Research Paper* **No. 13-02**.

Beckmann J, Czudaj R. 2016. Exchange rate expectations and economic policy uncertainty. *European Journal of Political Economy* **forthcoming**.

Beckmann J, Schüssler R. 2016. Forecasting exchange rates under parameter and model uncertainty. *Journal of International Money and Finance* **60**: 267–288.

Blake D, Beenstock M, Brasse V. 1986. The performance of UK exchange rate forecasters. *Economic Journal* **96**: 986–999.

Branch WA. 2007. Sticky information and model uncertainty in survey data on inflation expectations. *Journal of Economic Dynamics and Control* **31**: 245–276.

Canova F, Marrinan J. 1993. Profits, risk, and uncertainty in foreign exchange markets. *Journal of Monetary Economics* **32**: 259–286.

Cavusoglu N, Neveu AR. 2015. The predictive power of survey-based exchange rate forecasts: Is there a role for dispersion? *Journal of Forecasting* **34**: 337–353.

Chinn M, Frankel J. 1994. Patterns in exchange rate forecasts for twenty-five currencies. *Journal of Money, Credit and Banking* **26**: 759–770.

Coibion O, Gorodnichenko Y. 2012. What can survey forecasts tell us about information rigidities? *Journal of Political Economy* **120**: 116–159.

Coibion O, Gorodnichenko Y. 2015. Information rigidity and the expectations formation process: A simple framework and new facts. *American Economic Review* **105**: 2644–2678.

Dick CD, MacDonald R, Menkhoff L. 2015. Exchange rate forecasts and expected fundamentals. *Journal of International Money and Finance* **53**: 235–256.

Engel C, Mark NC, West KD. 2015. Factor model forecasts of exchange rates. *Econometric Reviews* **34**: 32–55.

Engel C, Wang J, Wu JJ. 2009. Can long-horizon forecasts beat the random walk under the Engel-West explanation? *Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper* **No. 36**.

Engel C, West KD. 2005. Exchange rates and fundamentals. *Journal of Political Economy* **113**: 485–517.

Fama EF, French KR. 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* **33**: 3–56.

Fratzscher M. 2009. What explains global exchange rate movements during the financial crisis? *Journal of International Money and Finance* **28**: 1390–1407.

Fratzscher M, Rime D, Sarno L, Zinna G. 2015. The scapegoat theory of exchange rates: The first tests. *Journal of Monetary Economics* **70**: 1–21.

Hakkio CS, Pearce DK. 1985. The reaction of exchange rates to economic news. *Economic Inquiry* **23**: 621–636.

Hodrick RJ. 1989. Risk, uncertainty, and exchange rates. *Journal of Monetary Economics* **23**: 433–459.

Jongen R, Verschoor WF, Wolff CC, Zwinkels RC. 2012. Explaining dispersion in foreign exchange expectations: A heterogeneous agent approach. *Journal of Economic Dynamics and Control* **36**: 719–735.

Jongen R, Verschoor WFC, Wolff CCP. 2008. Foreign exchange rate expectations: Survey and synthesis. *Journal of Economic Surveys* **22**: 140–165.

Jurado K, Ludvigson SC, Ng S. 2015. Measuring uncertainty. *American Economic Review* **105**: 1177–1216.

Koop G, Korobilis D. 2009. Bayesian multivariate time series methods for empirical macroeconomics. *Rimini Centre for Economic Analysis, Working Paper Series* **47/09**.

Mark NC. 1995. Exchange rates and fundamentals: Evidence on long-horizon predictability. *American Economic Review* **85**: 201–218.

Meese RA, Rogoff K. 1983. Empirical exchange rate models of the seventies: Do they fit out of sample? *Journal of International Economics* **14**: 3–24.

Mueller P, Tahbaz-Salehi A, Vedolin A. 2016. Exchange rates and monetary policy uncertainty. *Mimeo* : http://www.columbia.edu/ãt2761/FXUncertainty.pdf.

Rime D, Sarno L, Sojli E. 2010. Exchange rate forecasting, order flow and macroeconomic information. *Journal of International Economics* **80**: 72–88.

Rossi B. 2013. Exchange rate predictability. *Journal of Economic Literature* **51**: 1063–1119.

Sarno L, Sojli E. 2009. The feeble link between exchange rates and fundamentals: Can we blame the discount factor? *Journal of Money, Credit and Banking* **41**: 437–442.

Sarno L, Valente G. 2009. Exchange rates and fundamentals. Footloose or evolving relationship? *Journal of the European Economic Association* **7**: 786–830.

So EC. 2013. A new approach to predicting analyst forecast errors: Do investors overweight analyst forecasts? *Journal of Financial Economics* **108**: 615–640.

Taylor MP, Sarno L. 2004. International real interest rate differentials, purchasing power parity and the behaviour of real exchange rates: The resolution of a conundrum. *International Journal of Finance & Economics* **9**: 15–23.

Ter Ellen S, Verschoor WFC, Zwinkels RCJ. 2013. Risk and uncertainty in the foreign exchange market. *Mimeo* : https://www.ecb.europa.eu/events/pdf/conferences/131216/Third_FX_Workshop_TER_ELLEN_RiskAndUncertainty InTheForeignExchangeMarket_022013.pdf?a13dba1866515eb2e7173f87ea9bfddd.

Verschoor W, Wolff C. 2002. Scandinavian exchange rate expectations. *Applied Economics Letters* **9**: 111–116.

Wright JH. 2008. Bayesian model averaging and exchange rate forecasts. *Journal of Econometrics* **146**: 329–341.

Tables

Table 1 **Descriptive statistics of the uncertainty measures**

	Min	**Max**	**Median**	**Mean**	**Std dev**	**ADF test**
US EPU	44.7828	283.6656	98.1977	108.3188	40.3983	-6.4785***
EU EPU	41.0139	304.6032	104.3271	116.1779	48.2085	-3.4384**
JP EPU	29.9208	204.7343	94.7545	99.3716	34.3531	-7.0899***
CA EPU	30.0971	399.8463	107.9261	119.9747	62.9731	-5.0759***
UK EPU	25.3410	408.4350	111.5063	133.7618	83.8362	-2.8033*
CPI Dis	40.8067	190.4314	85.5853	94.5181	26.8737	-4.3869***
MU	0.5521	1.0811	0.6395	0.6542	0.0858	-3.3841**
FU	0.6406	1.5403	0.8444	0.8902	0.1795	-3.0043**

Note: This table reports descriptive statistics of eight uncertainty measures, i.e. US economic policy uncertainty (US EPU), European economic policy uncertainty (EU EPU), Japanese economic policy uncertainty (JP EPU), Canadian economic policy uncertainty (CA EPU), UK economic policy uncertainty (UK EPU), US CPI disagreement (CPI Dis), macroeconomic uncertainty (MU), and financial uncertainty (FU). The sample period runs from 1988:06 to 2015:12 on a monthly basis. The time series for UK EPU starts in 1997:01. ADF test represents the Augmented Dickey-Fuller test statistic for testing the null hypothesis of a unit root. The test regression includes a constant and a lag length selected automatically by the Schwarz-Bayes information criterion based on a maximum lag length according to $[(T-1)^{1/3}]$, where [.] denotes integer. The critical values are -3.44 (1%), -2.87 (5%), and -2.57 (10%). Asterisks indicate a rejection of the unit root null at the 1% (***), 5% (**), and 10% (*) level, respectively.

Table 2 **Unconditional correlation between the uncertainty measures**

	US EPU	**EU EPU**	**JP EPU**	**CA EPU**	**UK EPU**	**CPI Dis**	**MU**	**FU**
US EPU	1.0000	0.7265	0.4717	0.7136	0.6069	0.1886	0.2723	0.3876
EU EPU	0.7265	1.0000	0.3814	0.8461	0.8826	0.1322	-0.0460	0.0509
JP EPU	0.4717	0.3814	1.0000	0.4338	0.3546	0.2344	0.1288	0.3577
CA EPU	0.7136	0.8461	0.4338	1.0000	0.8159	0.2337	0.1298	0.1467
UK EPU	0.6069	0.8826	0.3546	0.8159	1.0000	0.1910	-0.0006	-0.0468
CPI Dis	0.1886	0.1322	0.2344	0.2337	0.1910	1.0000	0.4441	0.3048
MU	0.2723	-0.0460	0.1288	0.1298	-0.0006	0.4441	1.0000	0.6130
FU	0.3876	0.0509	0.3577	0.1467	-0.0468	0.3048	0.6130	1.0000

Note: This table reports correlation coefficients between eight uncertainty measures, i.e. US economic policy uncertainty (US EPU), European economic policy uncertainty (EU EPU), Japanese economic policy uncertainty (JP EPU), Canadian economic policy uncertainty (CA EPU), UK economic policy uncertainty (UK EPU), US CPI disagreement (CPI Dis), macroeconomic uncertainty (MU), and financial uncertainty (FU). The sample period runs from 1988:06 to 2015:12 on a monthly basis. The time series for UK EPU starts in 1997:01.

Table 3 **Descriptive statistics of the forecast errors**

Currency	Horizon	Min	Max	Median	Mean	RMSE	ADF test
	3	0.0000	0.2926	0.0284	0.0367	0.0379	-9.7300
EUR/USD	6	0.0006	0.3369	0.0452	0.0578	0.0526	-6.8787
	12	0.0006	0.3886	0.0590	0.0790	0.0750	-4.2788
	3	0.0000	25.9000	4.2000	5.4634	4.6201	-9.2025
JPY/USD	6	0.0000	36.1000	7.3000	8.3017	6.3286	-8.1279
	12	0.2000	33.9000	11.8500	12.3265	7.4125	-6.8664
	3	0.0000	0.2250	0.0255	0.0336	0.0314	-9.1663
CAD/USD	6	0.0000	0.2680	0.0390	0.0511	0.0454	-6.5607
	12	0.0000	0.2640	0.0635	0.0745	0.0587	-5.4493
	3	0.0000	0.1421	0.0173	0.0239	0.0228	-9.6209
GBP/USD	6	0.0003	0.2115	0.0340	0.0393	0.0316	-5.3539
	12	0.0004	0.2067	0.0372	0.0487	0.0408	-5.9919

Note: This table reports descriptive statistics of absolute forecast errors for all currencies (EUR/USD, JPY/USD, CAD/USD, GBP/USD) and all horizons ($h = 3, 6, 12$) over a sample period running from 1987:08 until 2016:03. RMSE denotes root mean squared error $1/T \sum_{t=1}^{T} [s_{t+h} - E_t(s_{t+h})]^2$. ADF test represents the Augmented Dickey-Fuller test statistic for testing the null hypothesis of a unit root. The test regression includes a constant and a lag length selected automatically by the Schwarz-Bayes information criterion based on a maximum lag length according to $[(T-1)^{1/3}]$, where [.] denotes integer. The 1% critical value is -3.44.

Table 4 **BVAR coefficient estimates I**

		h		Intercept	US EPU$_{t-1}$	US EPU$_{t-2}$	D EPU$_{t-1}$	D EPU$_{t-2}$	FX$_{t-1}$	FX$_{t-2}$	$\tilde{r}_{t-1}$	$\tilde{r}_{t-2}$	$\tilde{m}_{t-1}$	$\tilde{m}_{t-2}$	$\tilde{y}_{t-1}$	$\tilde{y}_{t-2}$
			$\hat{\beta}$	0.0139	15.0436	-22.2160	4.4764	-23.6016	0.6086	-0.1110	0.1593	-0.7213	761.5391	102.8618	-3.0245	-3.5237
		3	SE	0.0060	48.5209	47.8064	49.5605	48.8561	0.0551	0.0539	0.4798	0.4693	973.7798	964.0085	21.2358	21.0585
			$\hat{\beta}$	0.0184	-16.3069	19.4275	1.2814	-24.9767	0.6372	0.0588	0.2251	-0.4655	-314.1244	694.5916	-8.3100	12.4393
	ε_{t+h}	6	SE	0.0078	40.1687	39.7762	39.9365	39.2510	0.0544	0.0542	0.3845	0.3830	794.3237	781.9206	16.8541	16.8798
			$\hat{\beta}$	0.0084	-43.9579	73.6774	-50.7465	40.4521	0.8582	0.0263	-0.2845	0.2294	463.5740	-317.4331	-9.2688	17.2651
EUR		12	SE	0.0069	44.9175	44.7583	44.6439	44.2606	0.0545	0.0546	0.4533	0.4547	888.5733	882.0676	18.8356	18.9046
			$\hat{\beta}$	-0.0134	41.2755	-33.3400	165.7320	-85.1250	0.3093	0.2443	0.1116	0.7344	-536.9206	-238.4137	85.8657	-52.9578
		3	SE	0.0043	67.9331	67.9708	67.4927	67.1546	0.0535	0.0527	0.6540	0.6500	1347.7323	1322.9887	28.4570	28.8549
			$\hat{\beta}$	-0.0209	3.4240	-6.7705	79.8565	-23.1873	0.3828	0.2817	0.5994	0.2021	-252.1513	-509.8697	6.9631	9.4030
	Exp	6	SE	0.0068	43.6002	43.4229	43.2940	43.1616	0.0530	0.0522	0.4153	0.4132	865.2320	846.2437	18.2681	18.3973
			$\hat{\beta}$	-0.0090	-35.0655	66.2323	34.6770	13.3444	0.6741	0.2081	0.0615	0.0008	-879.5252	571.5560	5.4189	7.2872
		12	SE	0.0049	64.8146	64.2041	64.3385	63.7654	0.0537	0.0529	0.6519	0.6480	1285.0645	1264.6003	27.1727	27.0075
			$\hat{\beta}$	1.3018	-0.2690	0.0755	-0.7623	0.6706	0.6136	-0.0843	0.0027	0.0008	-3.8183	1.9873	-0.1399	0.0630
		3	SE	0.9389	0.4159	0.4101	0.4091	0.4043	0.0556	0.0546	0.0047	0.0046	8.2939	8.1770	0.3344	0.3348
			$\hat{\beta}$	1.8981	0.1225	-0.5254	-0.2634	-0.0562	0.7414	-0.0435	0.0043	-0.0043	3.3503	-5.8531	-0.0872	-0.0224
	ε_{t+h}	6	SE	1.1514	0.3524	0.3486	0.3460	0.3431	0.0558	0.0551	0.0040	0.0040	7.0211	6.9471	0.2834	0.2836
			$\hat{\beta}$	3.4740	-0.2634	0.0912	-0.1513	0.3001	0.9002	-0.1308	0.0030	-0.0036	-1.2128	3.2411	0.2095	-0.2563
JPY		12	SE	1.2464	0.3421	0.3401	0.3352	0.3348	0.0554	0.0551	0.0040	0.0040	6.8071	6.7687	0.2753	0.2761
			$\hat{\beta}$	-0.0030	13.8624	19.3013	110.2433	-33.7833	0.4632	0.2741	-1.6875	-1.6654	800.5644	-2516.7371	25.8779	-137.7422
		3	SE	0.0036	101.8684	102.3965	100.3251	99.7631	0.0531	0.0529	1.1489	1.1385	2031.4312	2029.8120	81.7666	82.7663
			$\hat{\beta}$	-0.0009	106.3519	-33.2670	-38.7377	78.7216	0.6031	0.1939	-1.8218	0.6840	136.3096	-658.5711	-78.1089	54.6833
	Exp	6	SE	0.0056	68.4024	68.1302	67.1611	66.4243	0.0547	0.0541	0.7846	0.7739	1361.7390	1348.0674	54.9767	55.0212
			$\hat{\beta}$	-0.0049	51.4096	-27.9019	-11.0693	40.3849	0.6999	0.1710	-0.8371	0.3975	481.4994	-650.4869	47.9869	-33.0594
		12	SE	0.0062	62.9624	62.3666	61.9022	61.1485	0.0546	0.0538	0.7450	0.7358	1253.8613	1236.2321	50.5906	50.3778
			$\hat{\beta}$	0.0101	-33.1114	12.5202	-11.7188	-79.1425	0.4488	0.0530	1.0178	-0.0686	531.6547	507.3216	-39.0820	-13.9507
		3	SE	0.0048	58.8332	58.6673	81.5979	81.8771	0.0575	0.0573	0.7777	0.7697	1166.5900	1165.0529	21.6974	22.1092
			$\hat{\beta}$	0.0041	-5.9796	-7.3320	-21.5734	-98.2389	0.5895	0.1167	0.5182	-0.5825	297.7811	-167.3892	-22.2252	6.2232
	ε_{t+h}	6	SE	0.0058	48.6526	47.6722	67.4493	66.2410	0.0567	0.0555	0.6006	0.5869	963.0899	943.7917	17.9484	17.8731
			$\hat{\beta}$	0.0099	-8.0327	2.7353	-8.6598	-67.1487	0.7626	0.0568	0.1236	-0.0254	750.2882	-688.0945	14.6864	-7.7242
CAD		12	SE	0.0063	45.0631	44.6020	62.5055	62.0536	0.0561	0.0556	0.5525	0.5483	892.9373	883.9127	16.6153	16.6761
			$\hat{\beta}$	-0.0018	108.3975	105.6278	317.7467	335.7017	0.1482	0.1126	-0.0727	-0.0490	-1026.0554	-1105.0073	63.4680	26.9732
		3	SE	0.0017	164.6625	165.8636	228.5669	225.0002	0.0566	0.0561	2.1798	2.1300	3258.6541	3259.3420	60.6902	61.2571
			$\hat{\beta}$	-0.0029	27.4231	-41.7039	144.0638	36.7144	0.3243	0.3552	-1.0052	0.0689	2689.2838	-7296.2067	10.9149	-5.9251
	Exp	6	SE	0.0022	120.1139	120.5165	166.7528	163.8600	0.0526	0.0519	1.4872	1.4530	2379.0999	2366.2901	44.2306	44.3770
			$\hat{\beta}$	-0.0015	116.0170	-47.1276	175.1833	-101.0360	0.5191	0.3278	1.0630	0.0349	-1540.2126	2728.8798	-8.6485	-21.0192
		12	SE	0.0026	102.5154	103.4456	142.8521	142.0198	0.0538	0.0537	1.2601	1.2463	2031.6215	2033.0919	37.7342	38.1378
			$\hat{\beta}$	0.0047	118.9237	11.3598	-263.8268	79.9921	0.5521	-0.0493	-0.6546	-2.4207	-365.8529	470.0945	-13.6531	40.7667
		3	SE	0.0034	124.7478	121.2070	156.3794	152.5082	0.0670	0.0672	1.0379	1.0360	2729.4951	2689.0530	49.4106	48.6202
			$\hat{\beta}$	0.0033	-6.6017	86.8117	-259.7952	192.5166	0.6182	0.1015	-1.0779	-1.2383	983.3964	-1629.0571	9.3307	45.7340
	ε_{t+h}	6	SE	0.0044	98.4518	97.8482	123.2671	122.8629	0.0662	0.0675	0.8272	0.8403	2153.7887	2154.3892	38.9263	39.0527
			$\hat{\beta}$	0.0049	-19.7839	114.5989	-187.5870	124.5605	0.6806	0.1021	-1.2666	0.1935	-164.9749	1884.9271	31.8937	24.7691
GBP		12	SE	0.0046	93.8717	92.4046	117.5071	116.0656	0.0665	0.0670	0.7577	0.7597	2055.3881	2031.6793	37.0475	36.7909
			$\hat{\beta}$	-0.0008	16.5264	-142.2477	167.1617	-180.5166	0.3332	0.2567	-0.1553	-1.4046	-1019.5905	2096.5262	-19.4154	-110.5117
		3	SE	0.0025	156.9122	153.0480	195.9723	192.9325	0.0639	0.0649	1.3039	1.3067	3420.3635	3411.0595	62.0568	61.7702
			$\hat{\beta}$	-0.0015	-16.6025	-37.0140	53.6302	17.4322	0.4031	0.4369	0.2647	-0.8423	824.1634	-993.1393	-53.4615	3.7733
	Exp	6	SE	0.0033	112.6388	109.8187	140.7999	138.7078	0.0597	0.0601	0.9457	0.9435	2457.0945	2437.8932	44.5580	44.2247
			$\hat{\beta}$	-0.0044	-88.0861	27.6689	-80.7445	102.1857	0.5544	0.3270	-0.7836	-0.3175	-478.9079	167.2106	17.2110	-34.3462
		12	SE	0.0042	92.5787	91.6217	115.6275	115.4717	0.0621	0.0631	0.7459	0.7517	2017.9120	2019.9951	36.5978	36.6874

Note: This table reports coefficient estimates ($\hat{\beta}$) and standard errors (SE) for the forecast error (ε_{t+h}) and the expected exchange rate change (Exp) equation, respectively, for all 6-variable BVAR models, i.e. for each currency (EUR/USD, JPY/USD, CAD/USD, GBP/USD) and each horizon ($h = 3, 6, 12$). Each model contains an intercept and the first two lags of the following variables: US economic policy uncertainty (US EPU), domestic economic policy uncertainty (D EPU), the forecast error and the expected exchange rate change, respectively, (FX), the interest rate differential ($\tilde{r}$), the money growth differential ($\tilde{m}$) and the industrial production growth differential ($\tilde{y}$). The sample period for the EUR/USD, the JPY/USD and the CAD/USD exchange rates runs from 1988:06 to 2015:12 and for the GBP/USD exchange rate from 1997:01 to 2015:12.

TABLE 5 **BVAR coefficient estimates II**

		h		Intercept	MU_{t-1}	MU_{t-2}	FX_{t-1}	FX_{t-2}	$\tilde{r}_{t-1}$	$\tilde{r}_{t-2}$	$\tilde{m}_{t-1}$	$\tilde{m}_{t-2}$	$\tilde{y}_{t-1}$	$\tilde{y}_{t-2}$
EUR	ε_{t+h}	3	$\hat{\beta}$	0.0040	0.0110	-0.0231	0.6079	-0.1125	0.2894	-0.6388	809.7160	-91.1033	-3.3109	-0.9215
			SE	0.0125	0.0170	0.0168	0.0551	0.0551	0.4799	0.4778	953.1709	944.2300	20.9251	20.4604
		6	$\hat{\beta}$	0.0008	-0.0160	0.0044	0.6319	0.0635	0.2762	-0.4289	-381.1998	580.0541	-6.8898	13.8534
			SE	0.0154	0.0139	0.0138	0.0553	0.0554	0.3886	0.3878	780.1768	775.3146	17.1254	16.8095
		12	$\hat{\beta}$	0.0061	-0.0116	0.0216	0.8580	0.0271	-0.2549	0.3119	464.3649	-407.8215	-9.0957	19.1180
			SE	0.0138	0.0155	0.0154	0.0553	0.0552	0.4581	0.4585	869.6871	864.6214	19.1057	18.8602
	Exp	3	$\hat{\beta}$	-0.0135	0.0266	-0.0604	0.3257	0.2593	-0.0041	0.5541	-435.1770	48.4328	79.9859	-61.4764
			SE	0.0090	0.0234	0.0234	0.0537	0.0532	0.6582	0.6540	1309.4700	1300.4540	28.7676	28.3898
		6	$\hat{\beta}$	-0.0214	0.0082	-0.0092	0.3976	0.2954	0.4448	0.0257	-65.0095	-304.5767	1.2258	3.3956
			SE	0.0140	0.0149	0.0149	0.0530	0.0520	0.4168	0.4135	838.0620	828.9320	18.4030	18.1725
		12	$\hat{\beta}$	-0.0095	0.0200	-0.0091	0.6902	0.2139	-0.1810	-0.0480	-554.2193	579.4525	-4.0462	5.9009
			SE	0.0098	0.0221	0.0222	0.0537	0.0535	0.6526	0.6565	1241.6167	1235.1339	27.2685	27.4225
JPY	ε_{t+h}	3	$\hat{\beta}$	1.1053	-0.0001	0.0000	0.6197	-0.0841	0.0048	-0.0005	-2.3092	1.1979	-0.1978	0.0775
			SE	1.5145	0.0001	0.0001	0.0549	0.0546	0.0046	0.0046	8.2794	8.1982	0.3370	0.3320
		6	$\hat{\beta}$	2.4685	-0.0001	0.0000	0.7453	-0.0505	0.0060	-0.0059	3.7647	-6.2166	-0.0964	-0.0275
			SE	1.8179	0.0001	0.0001	0.0552	0.0549	0.0040	0.0040	7.0209	6.9710	0.2856	0.2821
		12	$\hat{\beta}$	2.7846	-0.0000	-0.0001	0.8900	-0.1258	0.0041	-0.0045	-1.2386	3.6518	0.2145	-0.2887
			SE	1.8980	0.0001	0.0001	0.0544	0.0544	0.0040	0.0040	6.7558	6.7514	0.2748	0.2731
	Exp	3	$\hat{\beta}$	0.0049	0.0227	-0.0784	0.4664	0.2858	-0.9448	-0.7663	1213.3206	-2229.5077	9.7002	-149.9035
			SE	0.0059	0.0351	0.0353	0.0526	0.0526	1.1318	1.1292	2032.3661	2047.0086	82.6919	82.8732
		6	$\hat{\beta}$	0.0081	0.0444	-0.0588	0.6056	0.1942	-1.4744	1.1583	309.5056	-544.7461	-89.0220	50.9389
			SE	0.0093	0.0236	0.0235	0.0541	0.0536	0.7760	0.7683	1365.5347	1360.6683	55.6019	55.0753
		12	$\hat{\beta}$	0.0073	-0.0241	-0.0007	0.7095	0.1756	-0.5349	0.7230	534.2027	-527.2267	41.7391	-42.9837
			SE	0.0103	0.0217	0.0218	0.0540	0.0539	0.7362	0.7345	1257.2630	1260.5584	51.1767	51.0559
CAD	ε_{t+h}	3	$\hat{\beta}$	-0.0202	-0.0438	-0.0215	0.4028	0.0290	1.3879	-0.1685	813.0119	847.6887	-41.4132	-17.8515
			SE	0.0111	0.0207	0.0209	0.0579	0.0587	0.7814	0.7838	1190.4403	1187.1992	22.3227	22.2411
		6	$\hat{\beta}$	-0.0317	-0.0471	0.0124	0.5557	0.1065	0.6610	-0.8366	375.8981	115.9144	-23.5405	7.6706
			SE	0.0134	0.0170	0.0171	0.0569	0.0572	0.6027	0.5990	981.0029	973.5674	18.4097	18.1956
		12	$\hat{\beta}$	-0.0098	-0.0333	0.0216	0.7510	0.0551	0.3411	-0.2252	757.8670	-610.6606	15.4054	-6.0781
			SE	0.0139	0.0156	0.0157	0.0556	0.0559	0.5459	0.5468	896.5679	894.9682	16.8133	16.7167
	Exp	3	$\hat{\beta}$	0.0003	0.0868	-0.0038	0.1472	0.1087	-0.6865	-0.3424	-1161.0107	-744.0758	53.3497	22.2483
			SE	0.0038	0.0567	0.0570	0.0559	0.0556	2.1471	2.1262	3262.4903	3243.7812	61.2175	60.9829
		6	$\hat{\beta}$	-0.0085	0.0076	0.0277	0.3121	0.3488	-0.8305	-0.3886	2582.7656	-6829.5736	9.7856	-10.1824
			SE	0.0051	0.0417	0.0416	0.0521	0.0519	1.4737	1.4576	2399.1769	2386.8049	45.0180	44.7773
		12	$\hat{\beta}$	-0.0143	-0.0130	-0.0172	0.4962	0.3318	0.6457	0.4442	-814.7716	2751.9575	-11.7759	-13.3072
			SE	0.0063	0.0354	0.0356	0.0531	0.0537	1.2423	1.2411	2036.0548	2053.2155	38.2188	38.5155
GBP	ε_{t+h}	3	$\hat{\beta}$	-0.0213	-0.0864	-0.0397	0.4932	-0.0933	-0.2564	-1.9275	-480.6864	241.8784	-43.6801	15.7588
			SE	0.0080	0.0425	0.0422	0.0696	0.0690	1.0878	1.0893	2821.8324	2785.3599	51.1960	51.4639
		6	$\hat{\beta}$	-0.0292	-0.0776	0.0049	0.5593	0.0930	-0.7366	-1.1721	434.7013	-2492.5693	-10.2883	39.0289
			SE	0.0101	0.0337	0.0341	0.0691	0.0700	0.8720	0.8894	2241.6997	2256.3864	40.5995	41.7479
		12	$\hat{\beta}$	-0.0256	-0.0880	0.0420	0.6444	0.1156	-0.7152	0.3720	-279.6044	1157.9103	15.0739	27.7565
			SE	0.0104	0.0316	0.0316	0.0681	0.0683	0.7832	0.7885	2099.2056	2087.3905	38.0101	38.5897
	Exp	3	$\hat{\beta}$	0.0067	-0.0069	-0.1120	0.3353	0.2569	-0.6910	-2.0053	-418.4970	2768.9168	-3.7436	-94.6412
			SE	0.0059	0.0517	0.0516	0.0645	0.0639	1.3246	1.3286	3440.3744	3416.4868	62.4240	62.9035
		6	$\hat{\beta}$	0.0020	0.0588	-0.0412	0.3957	0.4582	0.0345	-1.0292	1551.7570	-827.4786	-50.1483	9.6618
			SE	0.0075	0.0371	0.0369	0.0601	0.0597	0.9579	0.9579	2464.8378	2446.1543	44.6715	45.1724
		12	$\hat{\beta}$	-0.0055	-0.0041	0.0138	0.5631	0.3300	-0.8231	-0.3854	-121.7118	161.2585	14.3616	-34.8813
			SE	0.0095	0.0304	0.0305	0.0625	0.0624	0.7547	0.7580	2022.8723	2021.0550	36.6915	37.3000

Note: This table reports coefficient estimates ($\hat{\beta}$) and standard errors (SE) for the forecast error (ε_{t+h}) and the expected exchange rate change (Exp) equation, respectively, for the 5-variable BVAR models including macroeconomic uncertainty for each currency (EUR/USD, JPY/USD, CAD/USD, GBP/USD) and each horizon ($h = 3, 6, 12$). Each model contains an intercept and the first two lags of the following variables: macroeconomic uncertainty (MU), the forecast error and the expected exchange rate change, respectively, (FX), the interest rate differential ($\tilde{r}$), the money growth differential ($\tilde{m}$) and the industrial production growth differential ($\tilde{y}$). The sample period for the EUR/USD, the JPY/USD and the CAD/USD exchange rates runs from 1988:06 to 2015:12 and for the GBP/USD exchange rate from 1997:01 to 2015:12.

Table 6 **BVAR coefficient estimates III**

		h		Intercept	FU_{t-1}	FU_{t-2}	FX_{t-1}	FX_{t-2}	$\tilde{r}_{t-1}$	$\tilde{r}_{t-2}$	$\tilde{m}_{t-1}$	$\tilde{m}_{t-2}$	$\tilde{y}_{t-1}$	$\tilde{y}_{t-2}$
EUR	ε_{t+h}	3	$\hat{\beta}$	-0.0071	-0.0517	0.0046	0.5865	-0.1305	0.1918	-0.7014	762.7253	-227.3106	-4.8890	-5.1452
			SE	0.0086	0.0390	0.0391	0.0552	0.0548	0.4750	0.4790	978.8383	959.0979	21.1907	21.2385
		6	$\hat{\beta}$	-0.0087	-0.0231	0.0214	0.6172	0.0462	0.2104	-0.4780	-414.4285	500.5681	-7.0999	12.6974
			SE	0.0106	0.0318	0.0317	0.0553	0.0545	0.3838	0.3851	798.9873	780.0651	17.3021	17.2480
		12	$\hat{\beta}$	-0.0071	-0.0201	0.0499	0.8451	0.0239	-0.2712	0.2618	371.1822	-356.9113	-10.9126	22.0218
			SE	0.0095	0.0354	0.0354	0.0552	0.0547	0.4517	0.4539	890.1439	879.7962	19.2606	19.2605
	Exp	3	$\hat{\beta}$	-0.0081	0.0167	-0.0530	0.3269	0.2606	-0.0400	0.5014	-464.2906	-16.9465	79.0519	-62.0601
			SE	0.0062	0.0529	0.0529	0.0532	0.0533	0.6444	0.6455	1329.2495	1323.7006	28.7385	28.6007
		6	$\hat{\beta}$	-0.0156	-0.0207	0.0339	0.4005	0.2992	0.4290	0.0081	-96.2515	-341.0531	0.5348	3.2182
			SE	0.0097	0.0339	0.0337	0.0527	0.0526	0.4091	0.4084	852.7092	844.0859	18.4286	18.2161
		12	$\hat{\beta}$	-0.0047	0.0046	0.0217	0.6909	0.2151	-0.1979	-0.0809	-520.2812	568.6499	-2.8862	6.7534
			SE	0.0068	0.0503	0.0503	0.0534	0.0537	0.6399	0.6453	1262.2584	1262.9325	27.3380	27.3596
JPY	ε_{t+h}	3	$\hat{\beta}$	0.7944	-0.0004	0.0002	0.6156	-0.0904	0.0040	-0.0011	-2.6459	0.8874	-0.1667	0.0758
			SE	1.0586	0.0003	0.0003	0.0556	0.0547	0.0046	0.0045	8.2250	8.1093	0.3420	0.3366
		6	$\hat{\beta}$	1.6593	-0.0002	0.0001	0.7459	-0.0532	0.0055	-0.0063	3.9836	-6.6015	-0.0994	-0.0129
			SE	1.2702	0.0003	0.0003	0.0557	0.0549	0.0040	0.0039	6.9610	6.8575	0.2893	0.2857
		12	$\hat{\beta}$	2.6250	0.0004	-0.0003	0.8911	-0.1285	0.0040	-0.0057	-1.2613	3.7792	0.2158	-0.2448
			SE	1.3365	0.0003	0.0003	0.0549	0.0545	0.0039	0.0039	6.6997	6.6484	0.2782	0.2769
	Exp	3	$\hat{\beta}$	-0.0034	0.0905	-0.0819	0.4632	0.2827	-1.5055	-1.3924	1165.8665	-2192.4950	13.1559	-137.8897
			SE	0.0041	0.0817	0.0810	0.0531	0.0525	1.1297	1.1203	2016.3622	2002.4185	83.9561	82.9150
		6	$\hat{\beta}$	-0.0032	0.0624	-0.0801	0.6090	0.1887	-1.8286	0.8578	230.4145	-412.7289	-77.5414	46.3620
			SE	0.0063	0.0547	0.0540	0.0546	0.0537	0.7706	0.7608	1349.9821	1332.2484	56.2045	55.3003
		12	$\hat{\beta}$	-0.0015	-0.0329	-0.0075	0.7032	0.1738	-0.8317	0.6232	525.3412	-616.6221	50.9764	-44.5631
			SE	0.0069	0.0505	0.0500	0.0546	0.0540	0.7336	0.7265	1246.6660	1232.3906	51.9194	51.3419
CAD	ε_{t+h}	3	$\hat{\beta}$	0.0022	-0.1231	0.0038	0.4457	0.0498	1.2512	-0.3067	703.2327	394.6555	-38.8653	-20.1741
			SE	0.0076	0.0469	0.0471	0.0562	0.0571	0.7633	0.7628	1166.5545	1179.5310	21.9303	22.1070
		6	$\hat{\beta}$	-0.0041	-0.1200	0.0746	0.5833	0.1137	0.6070	-0.8656	219.0769	-255.4759	-25.5151	3.9443
			SE	0.0091	0.0389	0.0387	0.0556	0.0557	0.5913	0.5837	968.2840	967.4877	18.2110	18.1431
		12	$\hat{\beta}$	0.0050	-0.0794	0.0627	0.7538	0.0597	0.2624	-0.1705	800.2527	-844.2314	14.3084	-9.3816
			SE	0.0098	0.0360	0.0360	0.0550	0.0551	0.5437	0.5392	896.4310	899.2114	16.8457	16.8777
	Exp	3	$\hat{\beta}$	0.0028	0.0015	-0.0346	0.1371	0.1002	-0.3784	-0.0544	-924.6188	-274.2646	68.0810	38.4814
			SE	0.0027	0.1327	0.1312	0.0560	0.0559	2.1630	2.1486	3295.2997	3247.5819	62.1109	61.8593
		6	$\hat{\beta}$	-0.0018	0.0646	0.0368	0.3231	0.3540	-0.7620	-0.3199	2722.3103	-6694.1129	12.5855	-10.9795
			SE	0.0034	0.0957	0.0951	0.0514	0.0512	1.4562	1.4520	2384.3970	2339.2864	44.8807	44.8163
		12	$\hat{\beta}$	-0.0062	0.0804	-0.1315	0.5099	0.3353	0.5876	0.4594	-1047.6756	2431.5429	-12.3742	-16.8487
			SE	0.0042	0.0811	0.0816	0.0523	0.0525	1.2247	1.2325	2021.5807	2005.2362	38.0502	38.2475
GBP	ε_{t+h}	3	$\hat{\beta}$	-0.0102	-0.1109	0.0162	0.5050	-0.0888	-0.4182	-1.8295	323.0735	843.5930	-27.5502	29.0216
			SE	0.0056	0.1034	0.0998	0.0689	0.0675	1.0761	1.0565	2780.6780	2713.6269	51.0525	49.8576
		6	$\hat{\beta}$	-0.0170	-0.1184	0.0813	0.5679	0.0666	-0.8573	-0.9313	1182.5877	-1879.3530	5.0854	39.7795
			SE	0.0072	0.0819	0.0808	0.0684	0.0683	0.8614	0.8618	2202.8012	2189.7891	40.4656	40.3752
		12	$\hat{\beta}$	-0.0098	-0.1565	0.1265	0.6675	0.1024	-0.8298	0.6005	219.7996	1247.4992	26.6402	22.4287
			SE	0.0074	0.0764	0.0752	0.0671	0.0668	0.7700	0.7669	2052.5079	2032.0013	37.7176	37.3990
	Exp	3	$\hat{\beta}$	0.0022	-0.0472	0.1940	0.3389	0.2623	-0.3777	-1.6393	-602.5204	2477.7022	-16.7050	-108.2208
			SE	0.0042	0.1260	0.1255	0.0638	0.0643	1.3098	1.3241	3383.9760	3385.5646	62.2740	61.7713
		6	$\hat{\beta}$	0.0017	0.0937	0.0416	0.4086	0.4451	0.0931	-0.9791	1506.4393	-777.8167	-55.1006	3.4475
			SE	0.0055	0.0904	0.0912	0.0595	0.0604	0.9489	0.9651	2426.5537	2437.5745	44.6731	44.6526
		12	$\hat{\beta}$	-0.0051	0.0927	-0.0416	0.5598	0.3290	-0.8229	-0.3823	4.2993	253.4862	12.1689	-38.5597
			SE	0.0071	0.0747	0.0754	0.0624	0.0631	0.7531	0.7637	2007.5210	2015.1930	36.9228	37.0069

Note: This table reports coefficient estimates ($\hat{\beta}$) and standard errors (SE) for the forecast error (ε_{t+h}) and the expected exchange rate change (Exp) equation, respectively, for the 5-variable BVAR models including financial uncertainty for each currency (EUR/USD, JPY/USD, CAD/USD, GBP/USD) and each horizon ($h = 3, 6, 12$). Each model contains an intercept and the first two lags of the following variables: financial uncertainty (FU), the forecast error and the expected exchange rate change, respectively, (FX), the interest rate differential ($\tilde{r}$), the money growth differential ($\tilde{m}$) and the industrial production growth differential ($\tilde{y}$). The sample period for the EUR/USD, the JPY/USD and the CAD/USD exchange rates runs from 1988:06 to 2015:12 and for the GBP/USD exchange rate from 1997:01 to 2015:12.

Table 7 **BVAR coefficient estimates IV**

		h		Intercept	CPI_{t-1}	CPI_{t-2}	FX_{t-1}	FX_{t-2}	$\tilde{r}_{t-1}$	$\tilde{r}_{t-2}$	$\tilde{m}_{t-1}$	$\tilde{m}_{t-2}$	$\tilde{y}_{t-1}$	$\tilde{y}_{t-2}$
EUR	ε_{t+h}	3	$\hat{\beta}$	0.0152	-9.2765	-6.8462	0.6126	-0.1059	0.2840	-0.6012	776.1816	-37.1008	-4.6436	-0.0644
			SE	0.0069	25.5680	25.4595	0.0544	0.0543	0.4774	0.4752	957.6004	960.3670	20.9763	20.6373
		6	$\hat{\beta}$	0.0176	-3.5186	11.0082	0.6383	0.0626	0.3080	-0.4345	-371.8862	591.6534	-6.9326	14.3414
			SE	0.0085	20.8716	20.7838	0.0545	0.0543	0.3857	0.3845	781.4432	782.1535	17.1279	16.9018
		12	$\hat{\beta}$	0.0108	-15.4767	17.1694	0.8603	0.0266	-0.2756	0.3381	445.5390	-375.2940	-9.9245	19.9274
			SE	0.0076	23.3982	23.2947	0.0547	0.0545	0.4565	0.4554	876.7608	874.6712	19.1831	19.0473
	Exp	3	$\hat{\beta}$	-0.0112	13.0267	26.6264	0.3206	0.2571	-0.2113	0.4819	-591.8511	-33.4285	76.3084	-61.6944
			SE	0.0049	35.5304	34.9349	0.0535	0.0532	0.6626	0.6471	1334.7444	1307.6658	29.0113	28.3426
		6	$\hat{\beta}$	-0.0130	13.9662	1.9177	0.3989	0.2979	0.3741	-0.0340	-148.1224	-373.5523	-0.3697	2.8073
			SE	0.0076	22.5881	22.3137	0.0524	0.0524	0.4168	0.4095	847.8539	833.3856	18.4568	18.1412
		12	$\hat{\beta}$	0.0018	50.0916	-5.9047	0.6895	0.2236	-0.1677	-0.1556	-465.6114	334.4661	-4.5111	4.9311
			SE	0.0054	33.4920	33.7561	0.0533	0.0542	0.6537	0.6608	1256.6079	1267.4755	27.4215	27.6527
JPY	ε_{t+h}	3	$\hat{\beta}$	1.7769	0.2756	0.1321	0.6217	-0.0847	0.0052	-0.0011	-3.0146	-0.1427	-0.1855	0.0914
			SE	0.9053	0.2201	0.2196	0.0549	0.0548	0.0046	0.0046	8.2250	8.2302	0.3411	0.3340
		6	$\hat{\beta}$	0.8094	0.0814	0.0593	0.7390	-0.0556	0.0052	-0.0068	2.9932	-7.4688	-0.1255	-0.0183
			SE	1.0703	0.1873	0.1858	0.0553	0.0548	0.0040	0.0039	6.9947	6.9583	0.2901	0.2836
		12	$\hat{\beta}$	1.9640	0.1021	-0.0454	0.8877	-0.1289	0.0038	-0.0053	-1.7275	3.1175	0.2012	-0.2613
			SE	1.1506	0.1800	0.1795	0.0545	0.0543	0.0039	0.0039	6.7239	6.7214	0.2789	0.2750
	Exp	3	$\hat{\beta}$	0.0079	-28.1863	-9.1972	0.4582	0.2851	-0.8977	-0.9146	1506.7192	-2138.7899	21.5757	-139.5691
			SE	0.0035	54.2643	53.9621	0.0528	0.0523	1.1284	1.1183	2026.8582	2013.6115	84.0730	82.2774
		6	$\hat{\beta}$	0.0109	-39.2607	30.1483	0.6062	0.1967	-1.5308	0.9714	277.9961	-445.6837	-73.0706	44.4718
			SE	0.0054	36.4039	36.0686	0.0542	0.0535	0.7712	0.7614	1358.1181	1344.9212	56.3562	55.1427
		12	$\hat{\beta}$	0.0005	-10.4752	-5.8343	0.7074	0.1719	-0.6412	0.5030	434.1489	-449.7733	48.1437	-37.4974
			SE	0.0060	33.4367	33.2638	0.0540	0.0535	0.7311	0.7248	1248.5165	1240.3155	51.7811	50.9514
CAD	ε_{t+h}	3	$\hat{\beta}$	0.0151	36.6074	-9.5562	0.4727	0.0454	1.3214	-0.2148	716.3227	536.1882	-31.7425	-18.1907
			SE	0.0060	30.3508	30.7569	0.0562	0.0566	0.7539	0.7700	1132.0982	1148.4951	21.4567	21.4907
		6	$\hat{\beta}$	0.0116	27.3375	-30.2429	0.6025	0.1098	0.7482	-0.7392	233.0585	-142.1538	-23.6191	6.4436
			SE	0.0070	25.3618	25.2448	0.0561	0.0557	0.5886	0.5899	946.2047	937.2667	17.9306	17.6612
		12	$\hat{\beta}$	0.0115	-21.4383	27.1981	0.7899	0.0313	0.2683	-0.1298	758.8637	-670.6029	19.3608	-12.1345
			SE	0.0078	23.5016	23.5476	0.0556	0.0556	0.5418	0.5455	875.9110	872.2947	16.6390	16.5123
	Exp	3	$\hat{\beta}$	-0.0015	77.8959	-3.3131	0.1502	0.1138	-0.6431	-0.2267	-1212.9932	-830.0254	51.5950	25.1256
			SE	0.0021	85.9789	85.4587	0.0563	0.0554	2.1425	2.1303	3205.3176	3245.9943	60.9533	60.8633
		6	$\hat{\beta}$	-0.0066	47.7494	-65.8804	0.3099	0.3485	-0.6861	-0.3041	2181.3561	-7250.1842	10.3825	-4.2635
			SE	0.0028	63.3264	62.8940	0.0528	0.0519	1.4759	1.4639	2361.3128	2373.7932	44.9378	44.4933
		12	$\hat{\beta}$	-0.0056	150.0947	-117.7714	0.5152	0.3216	0.6701	0.6930	-1159.3275	2337.4129	-7.3179	-20.1977
			SE	0.0034	53.6077	53.7284	0.0537	0.0531	1.2398	1.2409	1997.8958	2012.2704	38.0565	37.8238
GBP	ε_{t+h}	3	$\hat{\beta}$	-0.0002	37.0691	102.4472	0.5466	-0.0566	-0.5309	-2.3148	-317.9236	104.1929	-16.4924	47.7421
			SE	0.0043	54.9449	53.9225	0.0688	0.0670	1.0575	1.0287	2738.5914	2686.5349	50.0416	48.8628
		6	$\hat{\beta}$	0.0045	101.9243	-48.4645	0.6231	0.1045	-1.1093	-1.3117	569.1446	-2528.7660	14.0704	45.8897
			SE	0.0054	43.1557	44.0946	0.0676	0.0687	0.8372	0.8473	2159.8116	2194.9926	39.3512	40.0388
		12	$\hat{\beta}$	-0.0049	59.3790	-58.2542	0.6981	0.0897	-1.0259	0.3832	-347.1691	925.1143	28.1089	26.5439
			SE	0.0057	41.3399	40.8210	0.0682	0.0671	0.7698	0.7572	2057.9770	2031.5680	37.6182	37.1457
	Exp	3	$\hat{\beta}$	0.0005	-74.2699	63.2428	0.3399	0.2617	-0.3697	-1.5370	-596.1002	2666.6495	-16.5358	-110.0643
			SE	0.0033	67.9498	67.8716	0.0648	0.0639	1.3066	1.2998	3392.2232	3406.0355	61.9154	61.6951
		6	$\hat{\beta}$	0.0022	20.6970	4.0603	0.4101	0.4432	0.0995	-0.9529	1474.3994	-904.5081	-54.6594	2.7282
			SE	0.0043	48.7585	48.6784	0.0604	0.0599	0.9461	0.9421	2433.5935	2436.4274	44.4177	44.2254
		12	$\hat{\beta}$	-0.0027	81.1007	-31.2928	0.5660	0.3249	-0.8020	-0.5058	-27.4986	-115.3933	15.0501	-39.2674
			SE	0.0055	40.9346	41.5939	0.0642	0.0651	0.7625	0.7737	2036.3533	2073.0993	37.2382	37.6812

Note: This table reports coefficient estimates ($\hat{\beta}$) and standard errors (SE) for the forecast error (ε_{t+h}) and the expected exchange rate change (Exp) equation, respectively, for the 5-variable BVAR models including the disagreement among CPI forecasters for each currency (EUR/USD, JPY/USD, CAD/USD, GBP/USD) and each horizon ($h = 3, 6, 12$). Each model contains an intercept and the first two lags of the following variables: CPI forecast disagreement (CPI Dis), the forecast error and the expected exchange rate change, respectively, (FX), the interest rate differential ($\tilde{r}$), the money growth differential ($\tilde{m}$) and the industrial production growth differential ($\tilde{y}$). The sample period for the EUR/USD, the JPY/USD and the CAD/USD exchange rates runs from 1988:06 to 2015:12 and for the GBP/USD exchange rate from 1997:01 to 2015:12.

Table 8 **Unconditional correlation between exchange rate forecasters disagreement and the uncertainty measures (post-crisis period)**

Horizon	Currency	US EPU	Dom EPU	CPI Dis	MU	FU
	EUR/USD	-0.0315	-0.2099	0.0869	0.3316	0.3223
	JPY/USD	0.1596	0.2844	0.4047	0.6896	0.7072
3	**CAD/USD**	0.0757	-0.0383	0.2833	0.6962	0.6731
	GBP/USD	0.1661	-0.2082	0.4182	0.5512	0.5940
	EUR/USD	-0.1531	-0.1384	0.0641	0.1605	0.1561
	JPY/USD	0.1008	0.2920	0.5146	0.5849	0.6154
6	**CAD/USD**	0.2241	0.0177	0.3015	0.7272	0.6893
	GBP/USD	0.1745	-0.2189	0.4620	0.5695	0.6174
	EUR/USD	-0.0900	-0.0054	0.1101	0.1181	0.1596
	JPY/USD	0.1657	0.2637	0.5002	0.3888	0.4580
12	**CAD/USD**	-0.0464	0.0663	0.0834	0.2403	0.1999
	GBP/USD	0.1550	-0.1607	0.4363	0.4600	0.5232

Note: This table reports correlation coefficients between exchange rate forecasters disagreement and the eight uncertainty measures, i.e. US economic policy uncertainty (US EPU), European economic policy uncertainty (EU EPU), Japanese economic policy uncertainty (JP EPU), Canadian economic policy uncertainty (CA EPU), UK economic policy uncertainty (UK EPU), US CPI disagreement (CPI Dis), macroeconomic uncertainty (MU), and financial uncertainty (FU). Dom EPU denotes the corresponding domestic economic policy uncertainty measure. Exchange rate forecasters disagreement is measured by the spread between the highest and the lowest individual forecast for all currencies (EUR/USD, JPY/USD, CAD/USD, GBP/USD) and all horizons ($h = 3, 6, 12$). The sample period runs from 2008:09 to 2015:12 on a monthly basis.

Figures

FIGURE 1 **Uncertainty measures**

The plot shows eight measures of uncertainty over a sample period running from 1988:06 until 2015:12 on a monthly frequency: US economic policy uncertainty (US EPU), European economic policy uncertainty (EU EPU), Japanese economic policy uncertainty (JP EPU), Canadian economic policy uncertainty (CA EPU), UK economic policy uncertainty (UK EPU), US CPI disagreement (CPI Dis), macroeconomic uncertainty (MU), and financial uncertainty (FU). The time series for UK EPU starts in 1997:01.

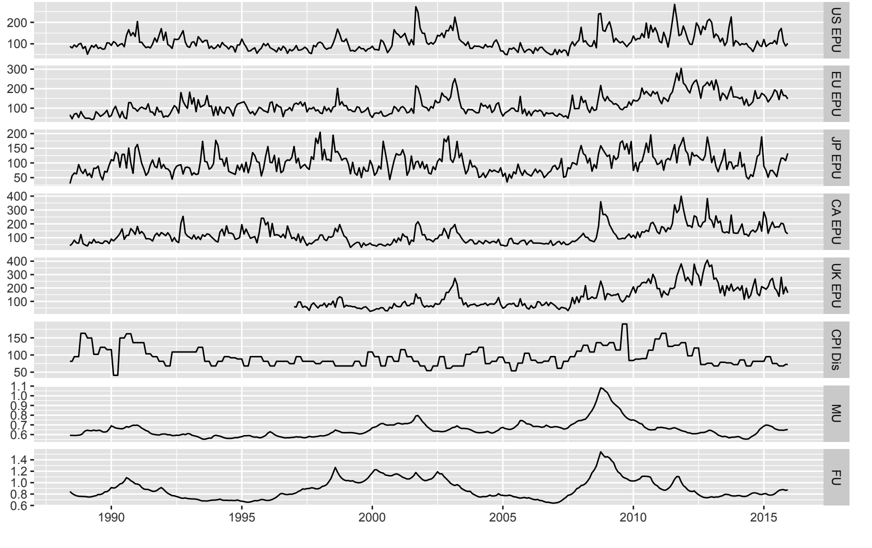
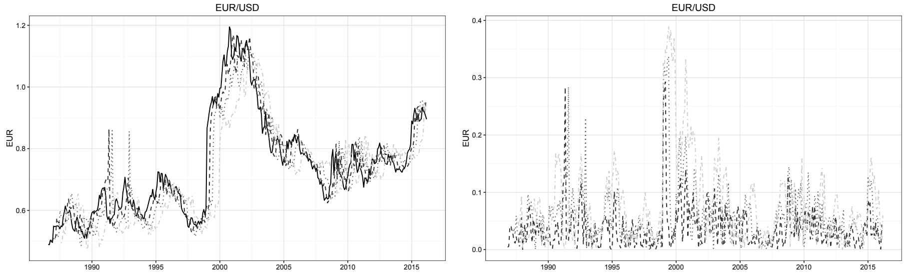


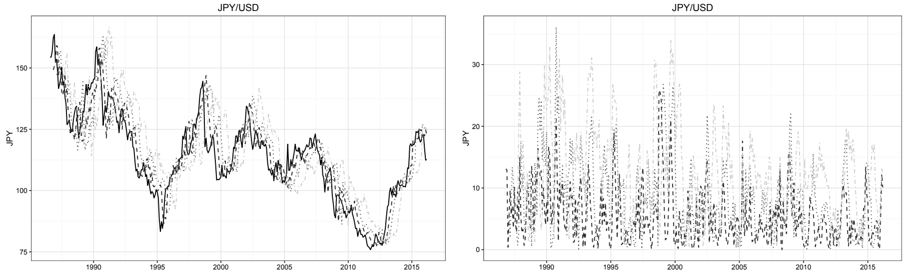
FIGURE 2 **Survey-based exchange rate expectations and forecast errors**

The plots show the actual spot rates (black solid line) compared to survey-based expectations and the resulting forecast errors in absolute terms for all currencies (EUR/USD, JPY/USD, CAD/USD, GBP/USD) and all horizons ($h = 3, 6, 12$) over a sample period running from 1986:08 until 2016:03. The first column reports expectations and the second the corresponding forecast errors. Expectations and forecast errors, respectively, for $h = 3$ are represented by the blue dashed line, for $h = 6$ by the red dotted line and for $h = 12$ by the green dotted and dashed line.

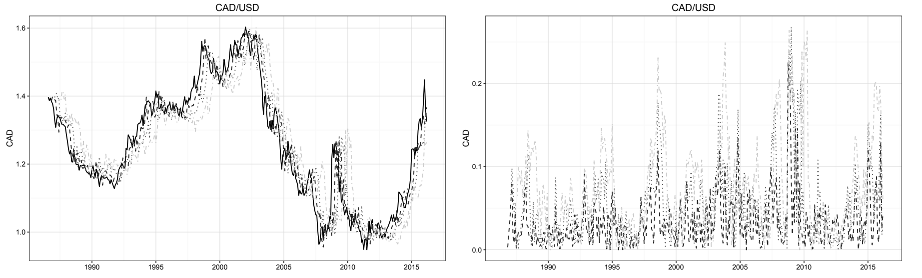
EUR/USD



JPY/USD



CAD/USD



GBP/USD

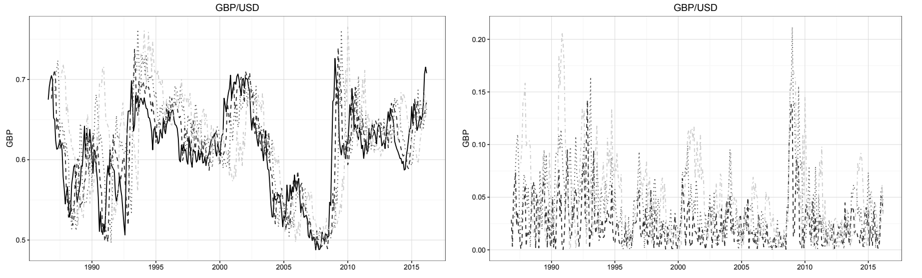
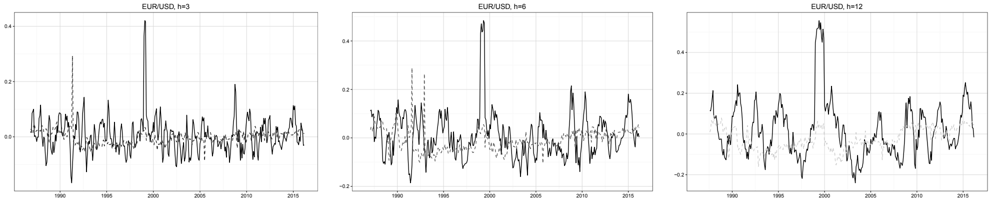


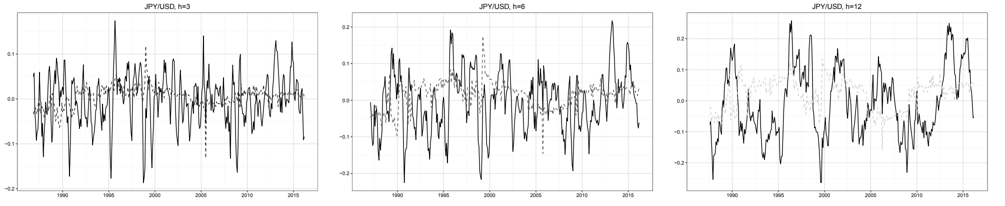
Figure 3 **Actual and expected exchange rate changes**

The plots show the actual exchange rate changes (solid lines) compared to survey-based expected exchange rate changes (dashed lines) for all currencies (EUR/USD, JPY/USD, CAD/USD, GBP/USD) and all horizons ($h = 3, 6, 12$) over a sample period running from 1986:08 until 2016:03.

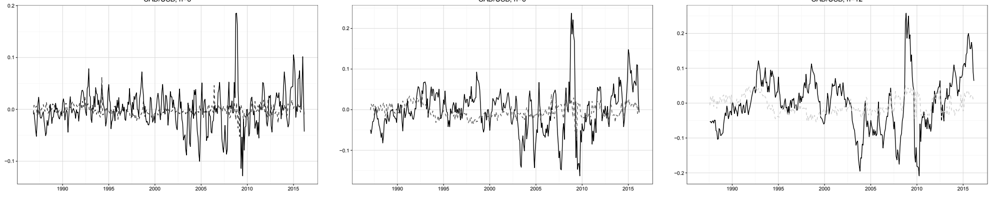
EUR/USD



JPY/USD



CAD/USD



GBP/USD

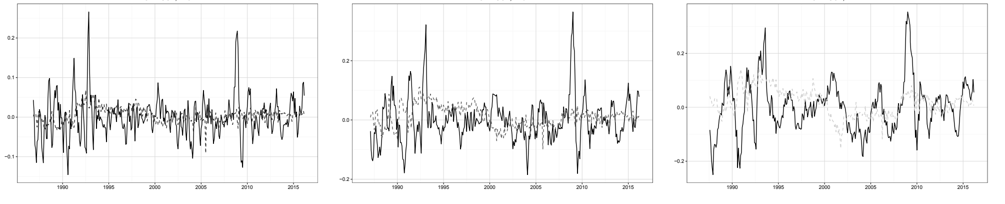
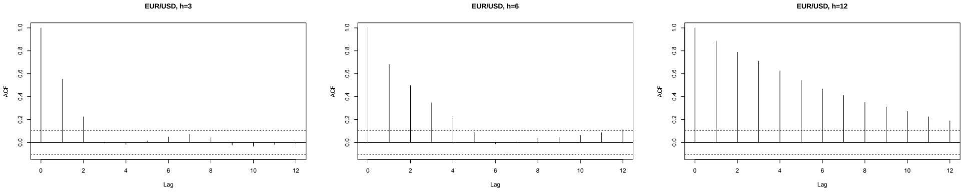


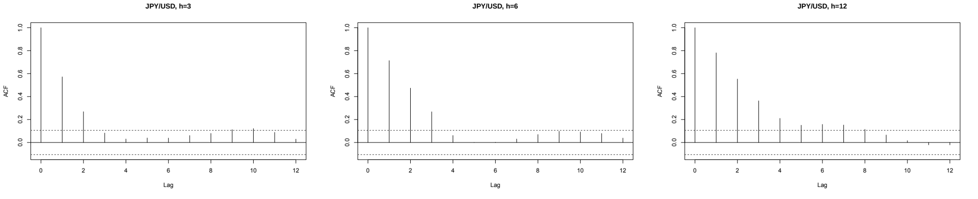
Figure 4 **Autocorrelation of forecast errors**

The plots show the autocorrelation function (ACF) of the absolute forecast errors for all currencies (EUR/USD, JPY/USD, CAD/USD, GBP/USD) and all horizons ($h = 3, 6, 12$). The ACF is reported for 12 lags with 95% confidence intervals.

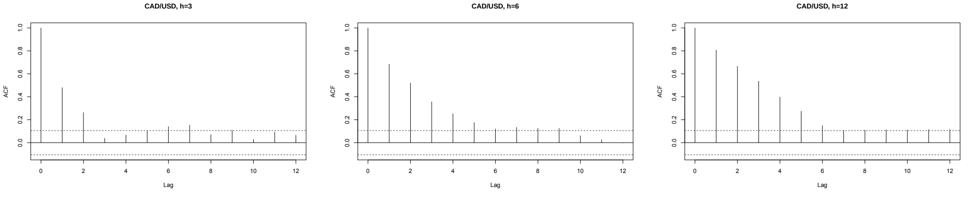
EUR/USD



JPY/USD



CAD/USD



GBP/USD

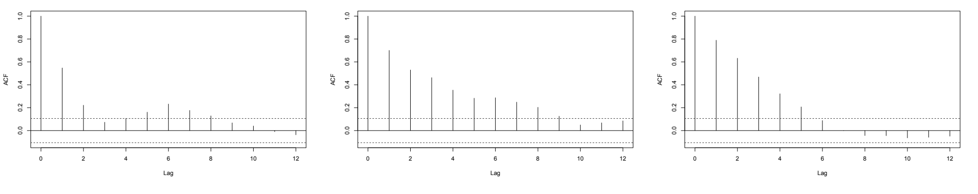


FIGURE 5 **Response of the EUR/USD expected change to a shock on uncertainty**

The plots show the reaction of the EUR/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the European news-based economic policy uncertainty index (EU EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to EU EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2015:12.

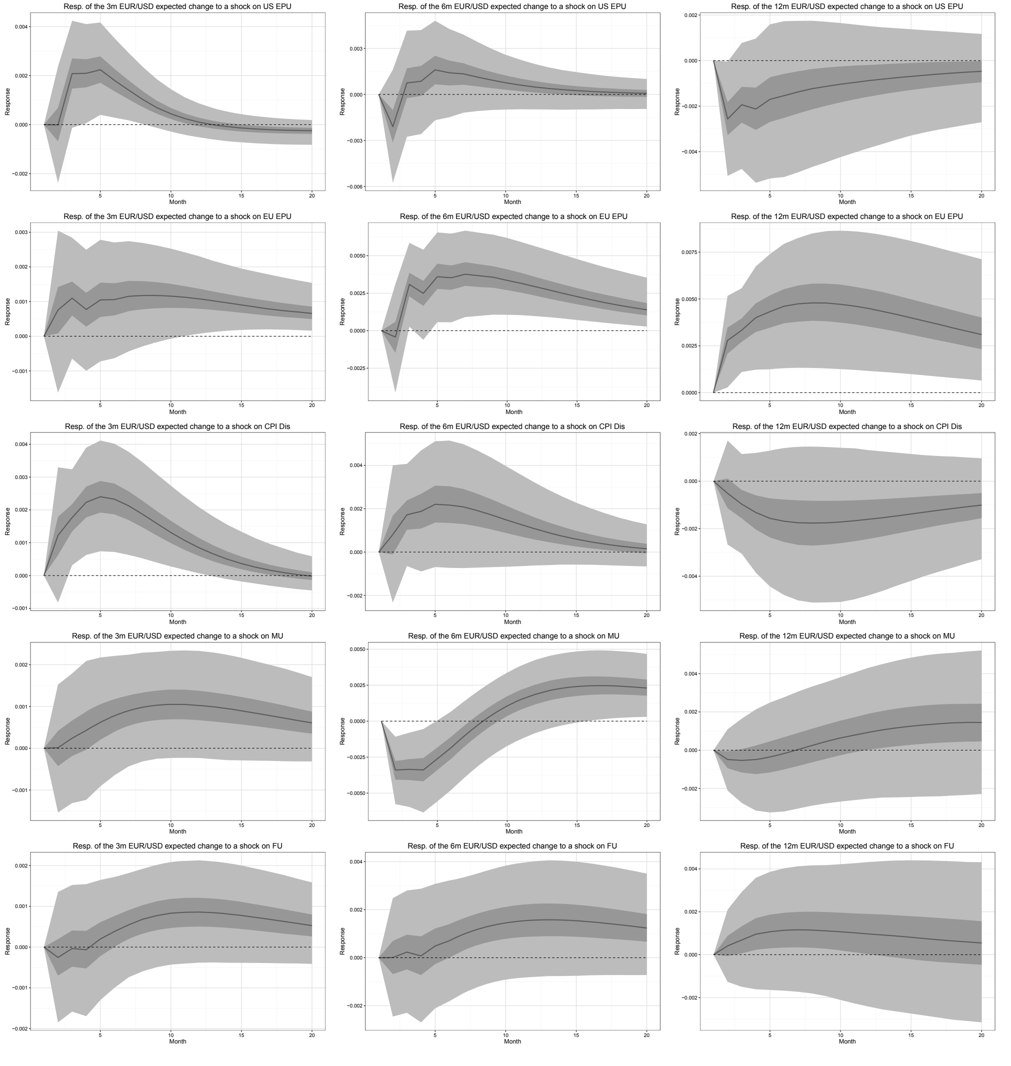


FIGURE 6 **Response of the JPY/USD expected change to a shock on uncertainty**

The plots show the reaction of the JPY/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Japanese news-based economic policy uncertainty index (JP EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to JP EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2015:12.

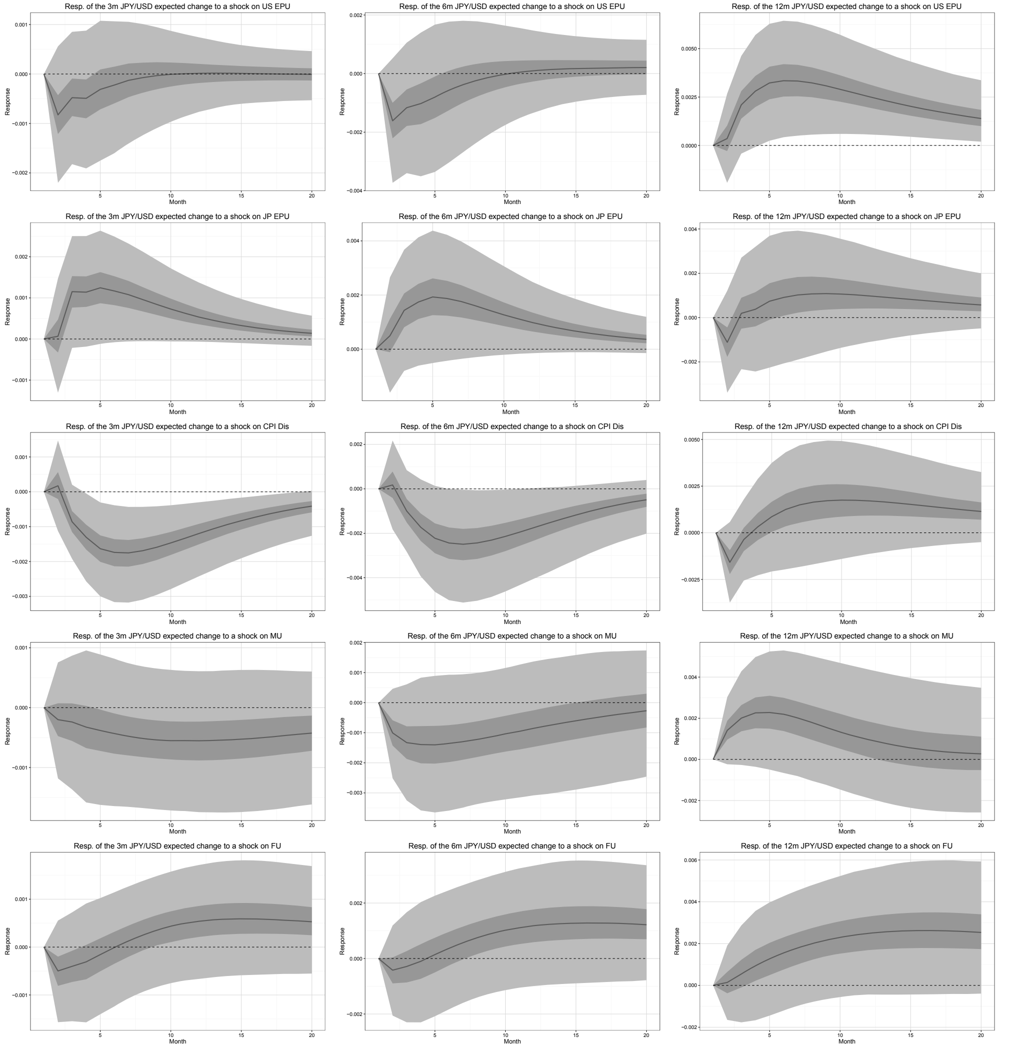


Figure 7 **Response of the CAD/USD expected change to a shock on uncertainty**

The plots show the reaction of the CAD/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Canadian news-based economic policy uncertainty index (CA EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to CA EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2015:12.

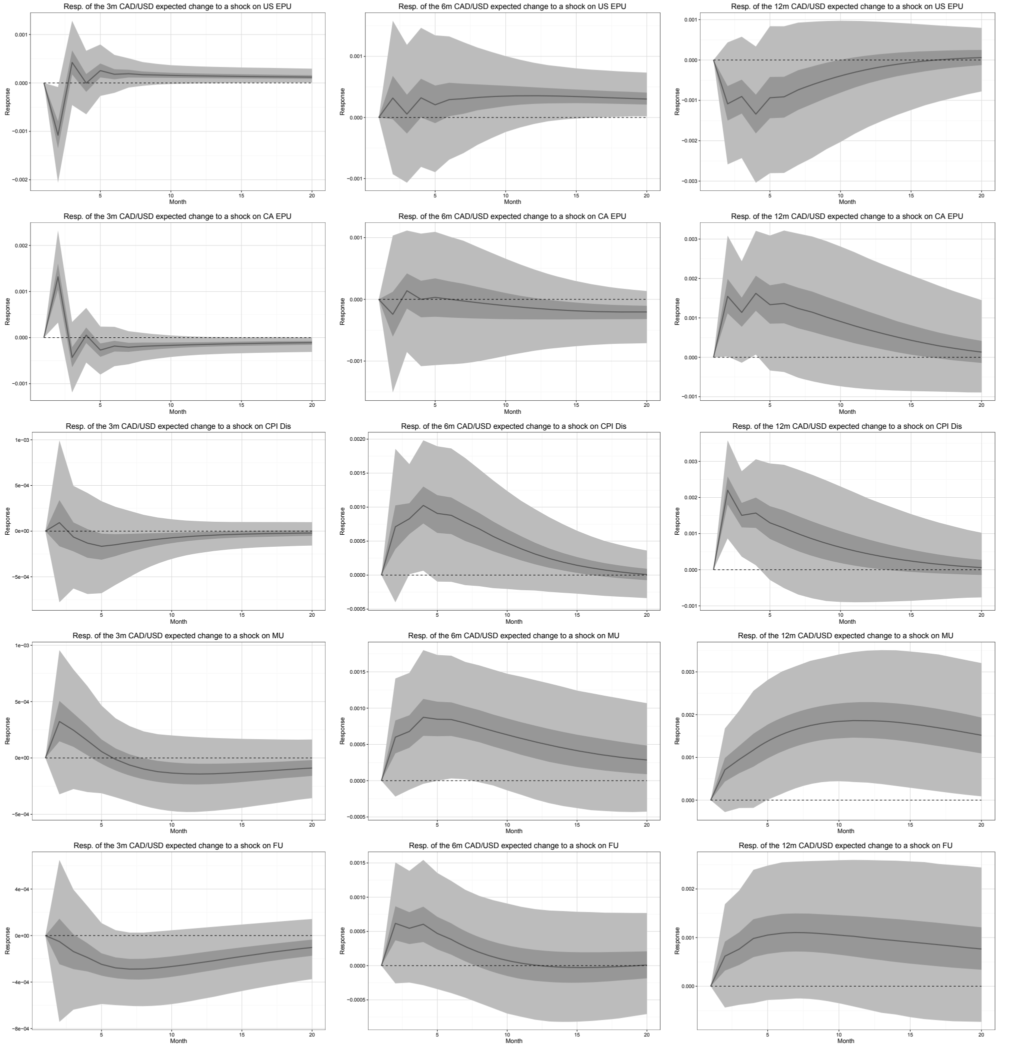


Figure 8 **Response of the GBP/USD expected change to a shock on uncertainty**

The plots show the reaction of the GBP/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the UK news-based economic policy uncertainty index (UK EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to UK EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1997:01 to 2015:12.

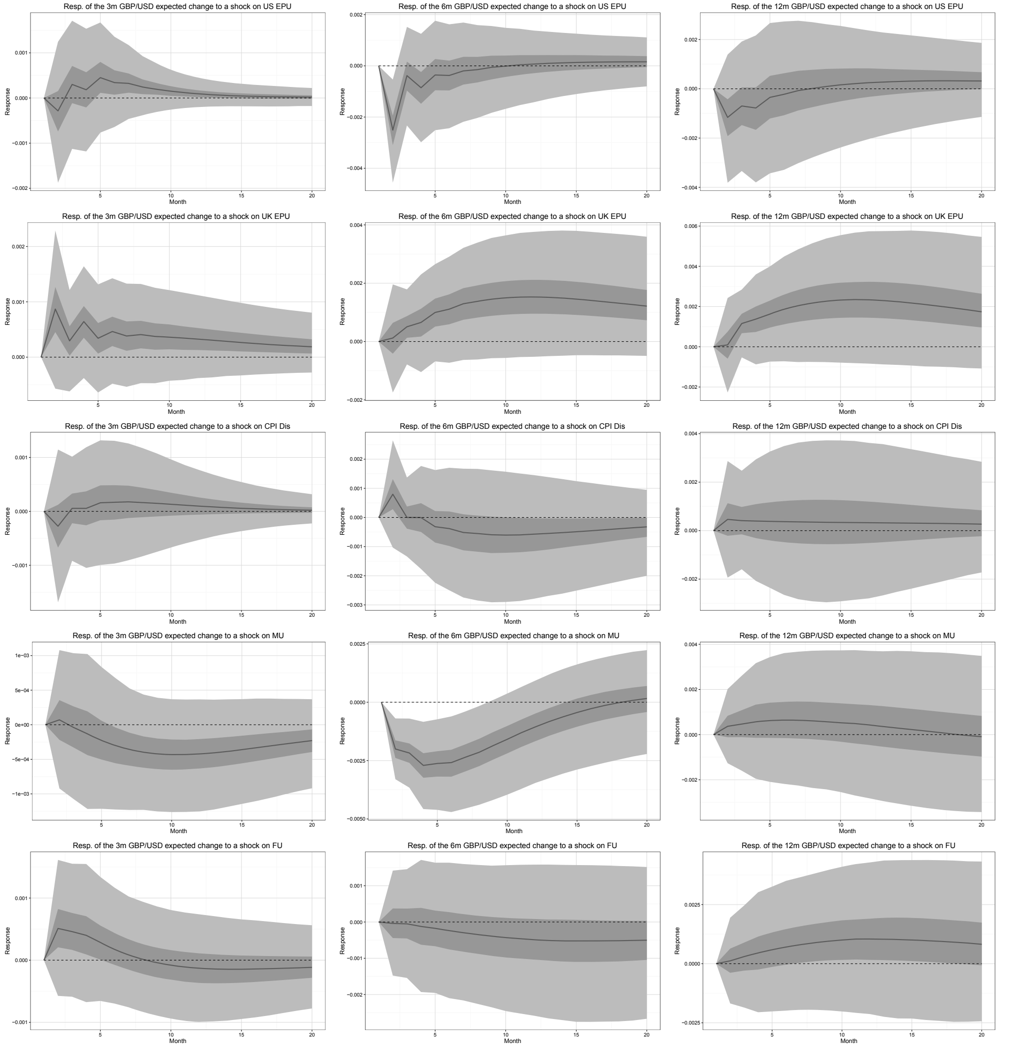


Figure 9 **Response of the EUR/USD forecast error to a shock on uncertainty**

The plots show the reaction of the EUR/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the European news-based economic policy uncertainty index (EU EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to EU EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2015:12.

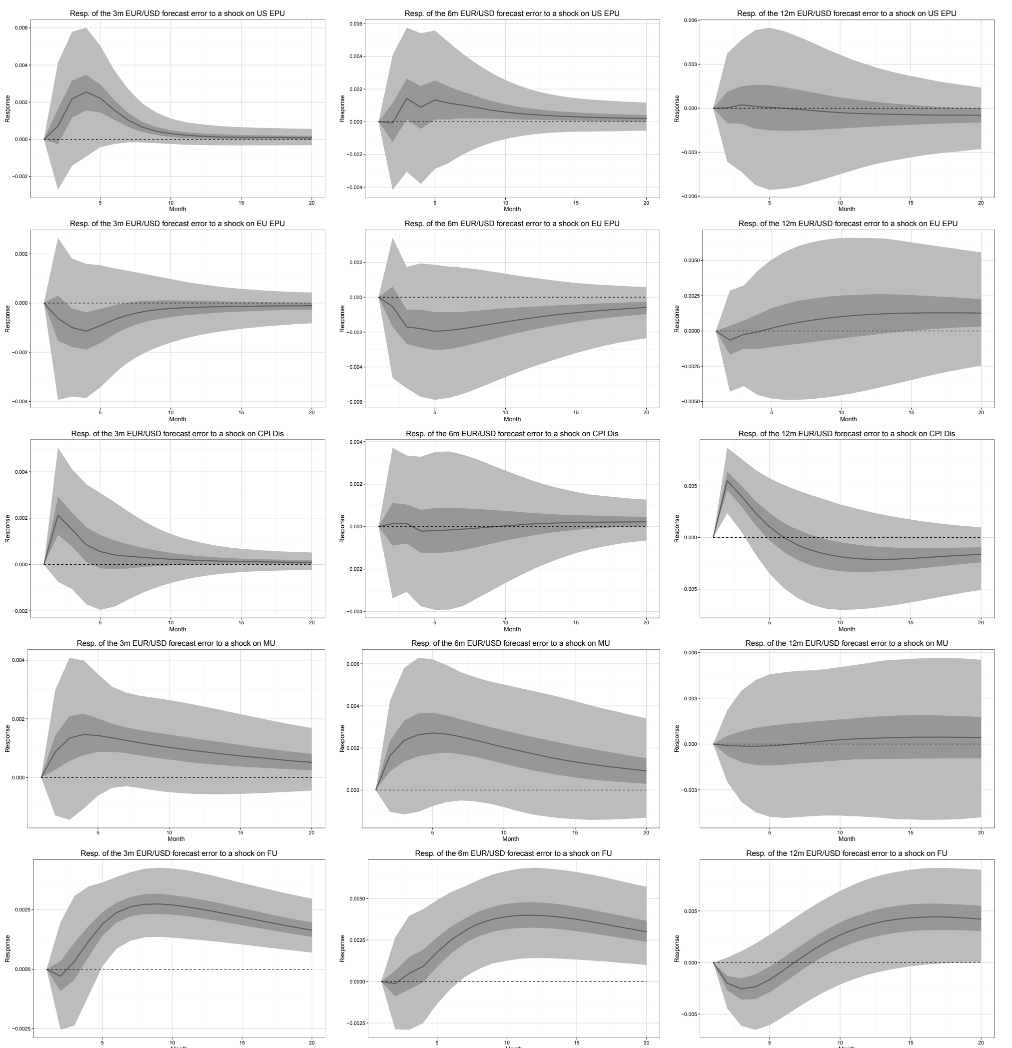


FIGURE 10 **Response of the JPY/USD forecast error to a shock on uncertainty**

The plots show the reaction of the JPY/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Japanese news-based economic policy uncertainty index (JP EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to JP EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2015:12.

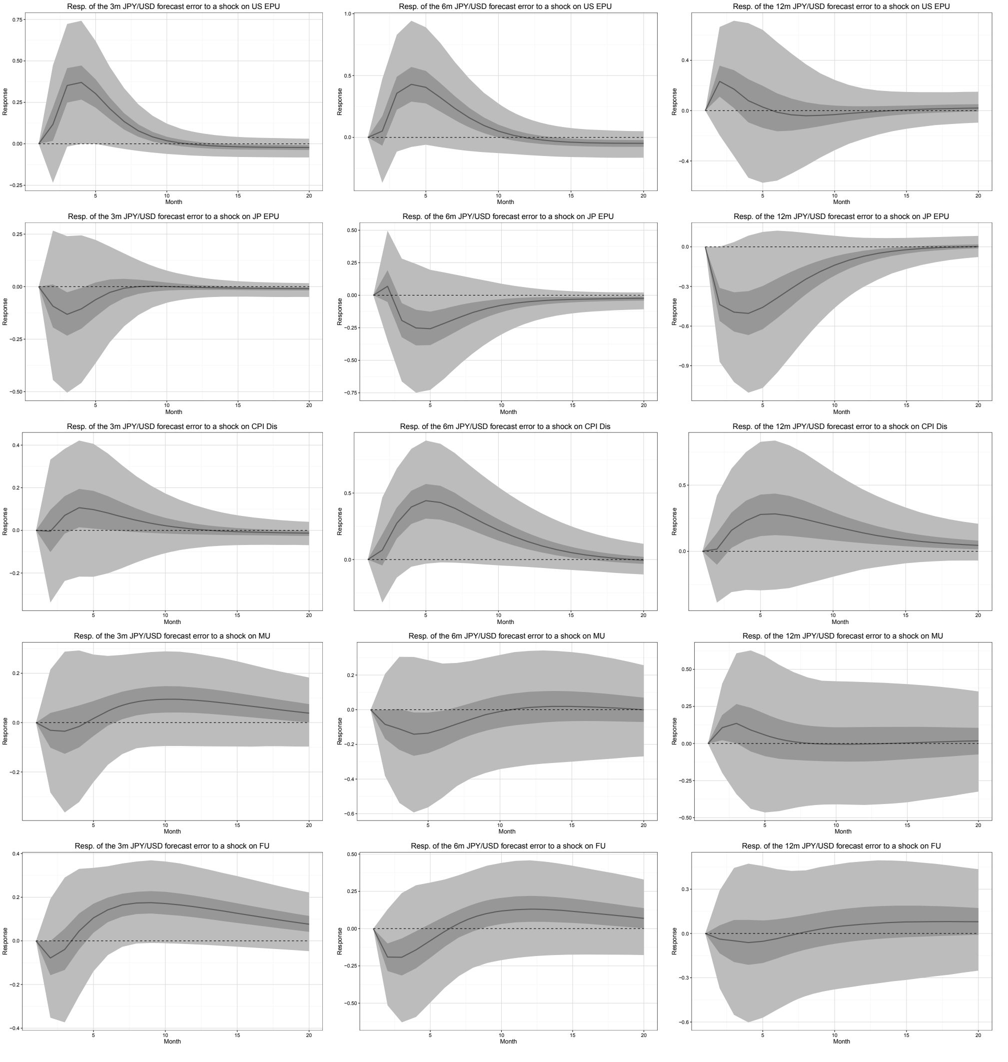


FIGURE 11 **Response of the CAD/USD forecast error to a shock on uncertainty**

The plots show the reaction of the CAD/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Canadian news-based economic policy uncertainty index (CA EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to CA EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2015:12.

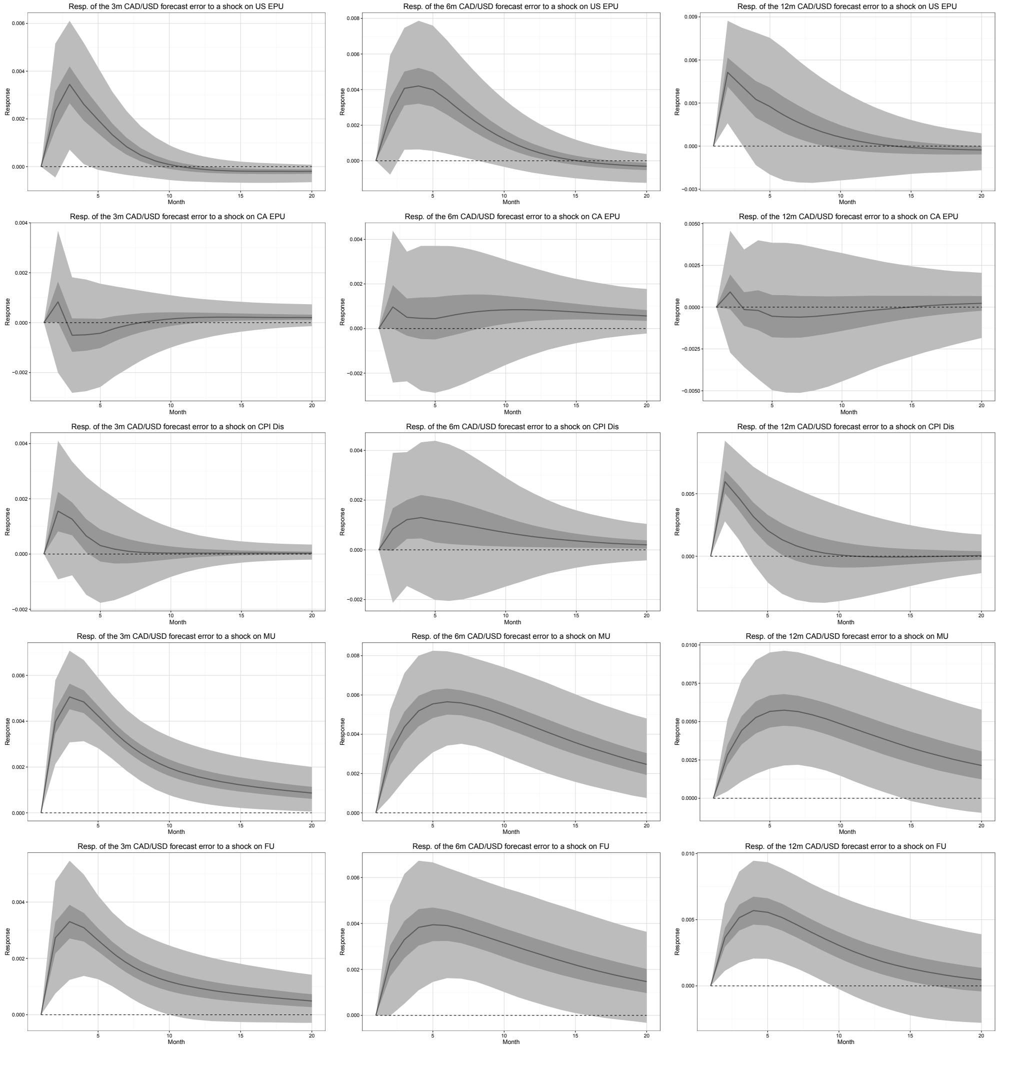
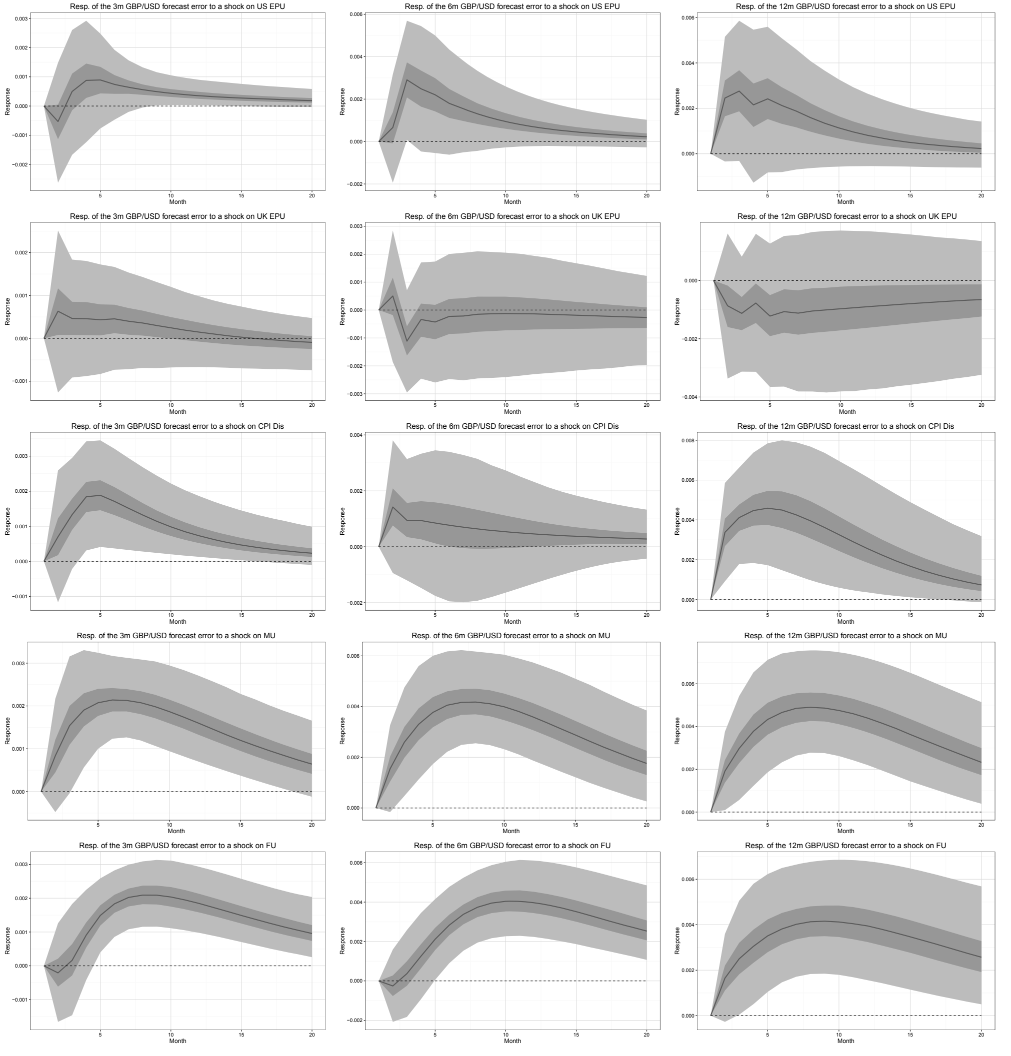


FIGURE 12 **Response of the GBP/USD forecast error to a shock on uncertainty**

The plots show the reaction of the GBP/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the UK news-based economic policy uncertainty index (UK EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to UK EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1997:01 to 2015:12.



Appendix

A.1. First sub-sample period (1988:06-2008:08)

Figure 13 **Response of the EUR/USD expected change to a shock on uncertainty**

The plots show the reaction of the EUR/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the European news-based economic policy uncertainty index (EU EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to EU EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2008:08.

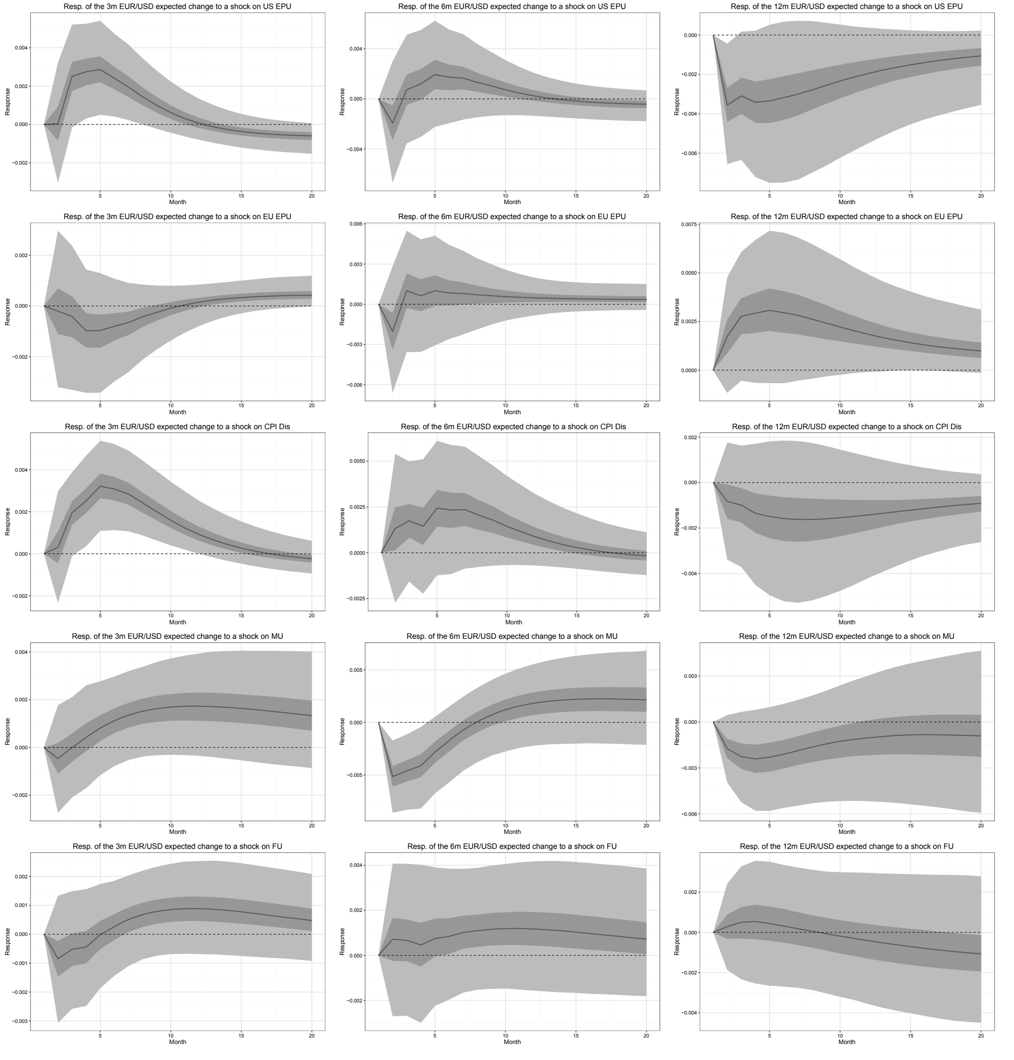


Figure 14 **Response of the JPY/USD expected change to a shock on uncertainty**

The plots show the reaction of the JPY/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Japanese news-based economic policy uncertainty index (JP EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to JP EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2008:08.

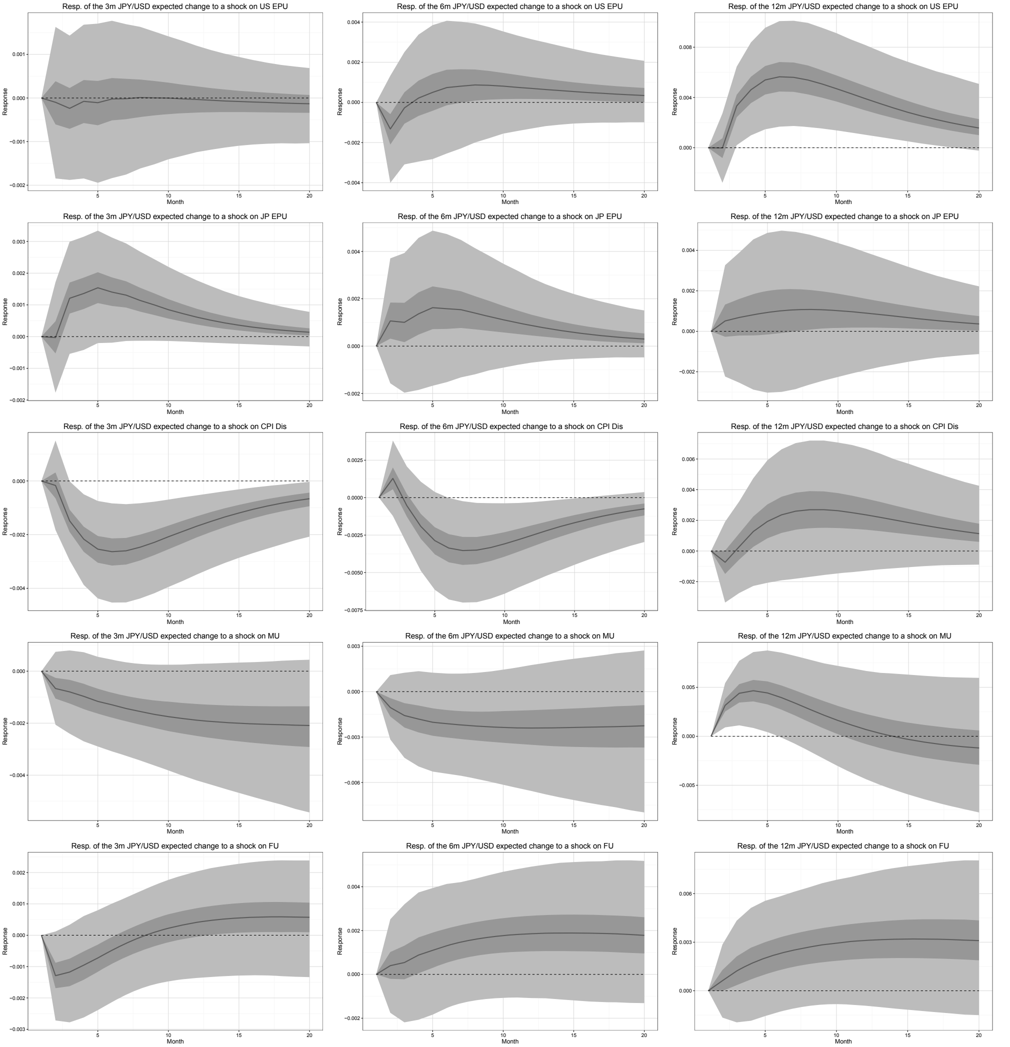


Figure 15 **Response of the CAD/USD expected change to a shock on uncertainty**

The plots show the reaction of the CAD/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Canadian news-based economic policy uncertainty index (CA EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to CA EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2008:08.

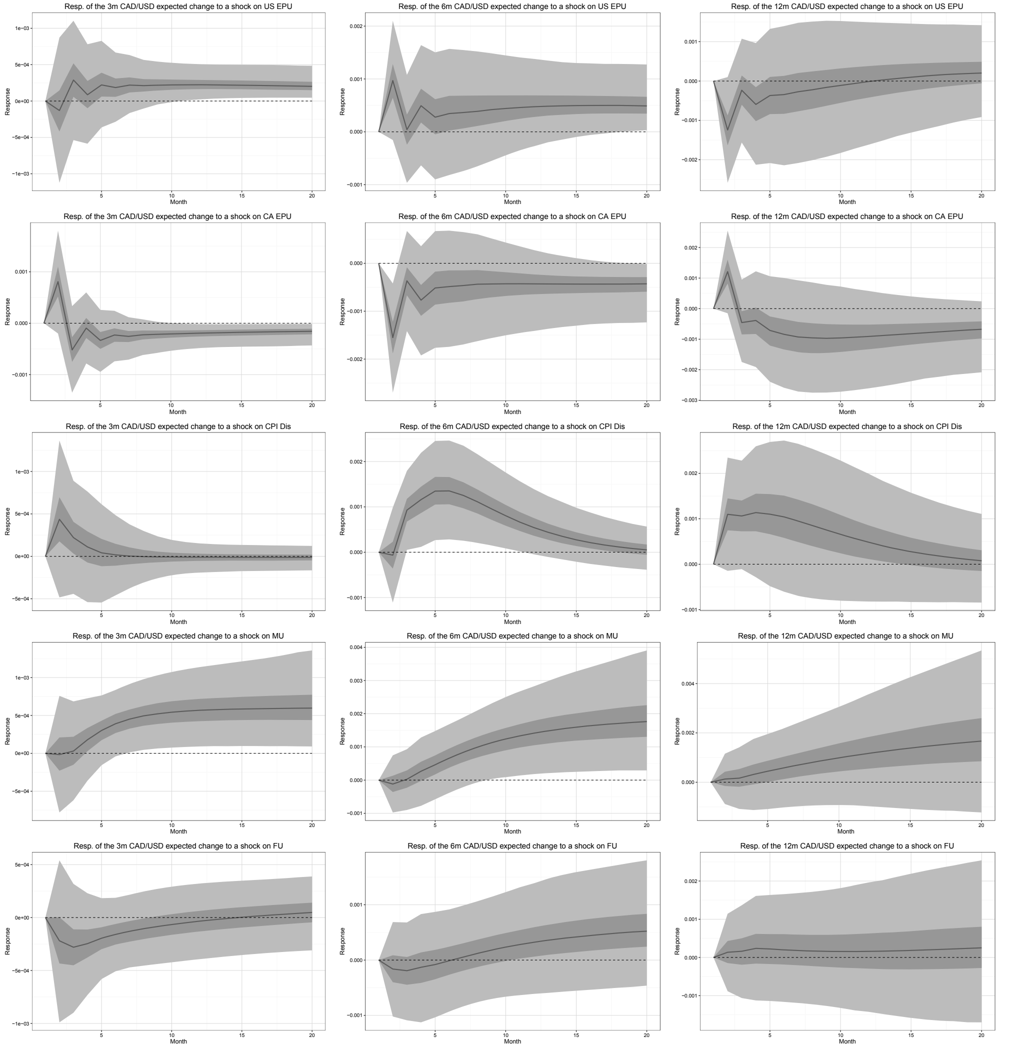


FIGURE 16 **Response of the GBP/USD expected change to a shock on uncertainty**

The plots show the reaction of the GBP/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the UK news-based economic policy uncertainty index (UK EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to UK EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1997:01 to 2008:08.

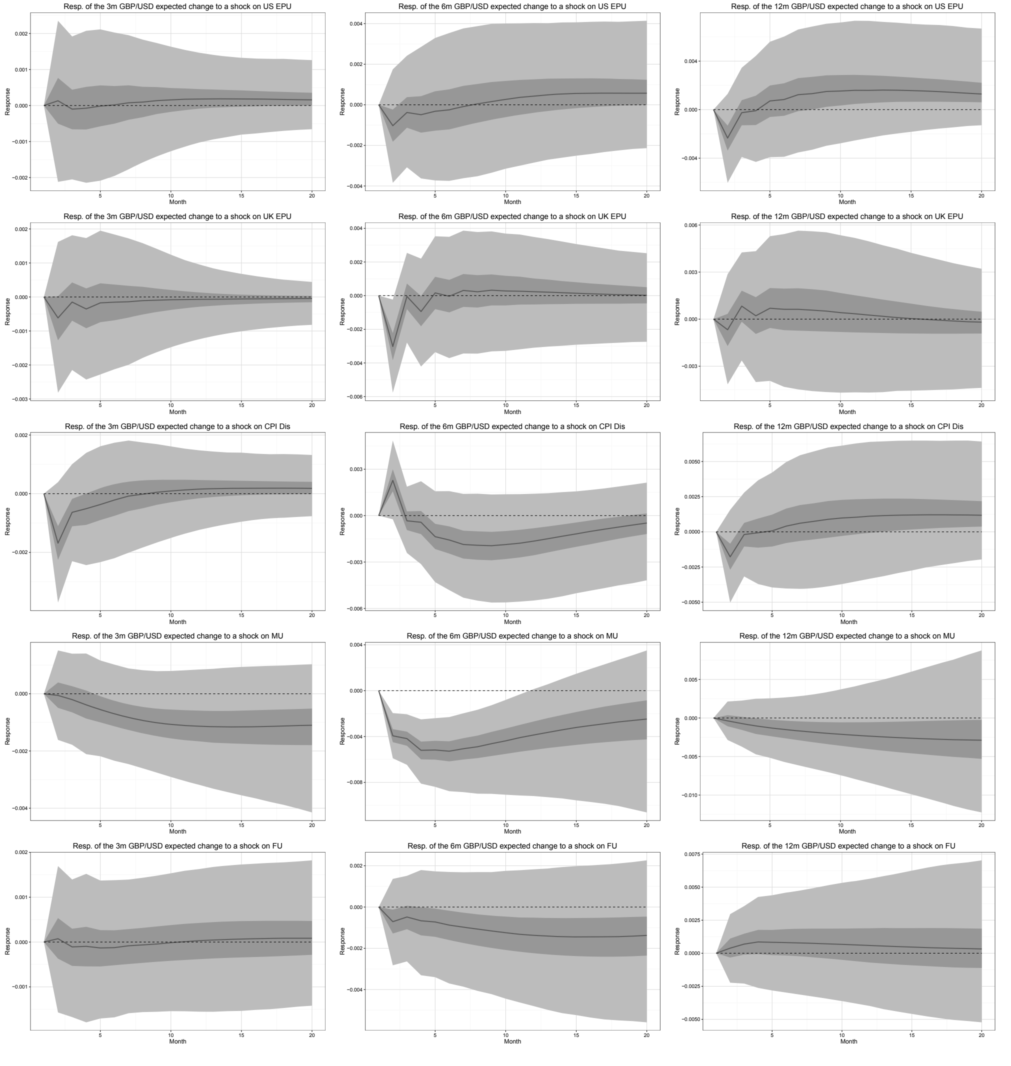


FIGURE 17 **Response of the EUR/USD forecast error to a shock on uncertainty**

The plots show the reaction of the EUR/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the European news-based economic policy uncertainty index (EU EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to EU EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2008:08.

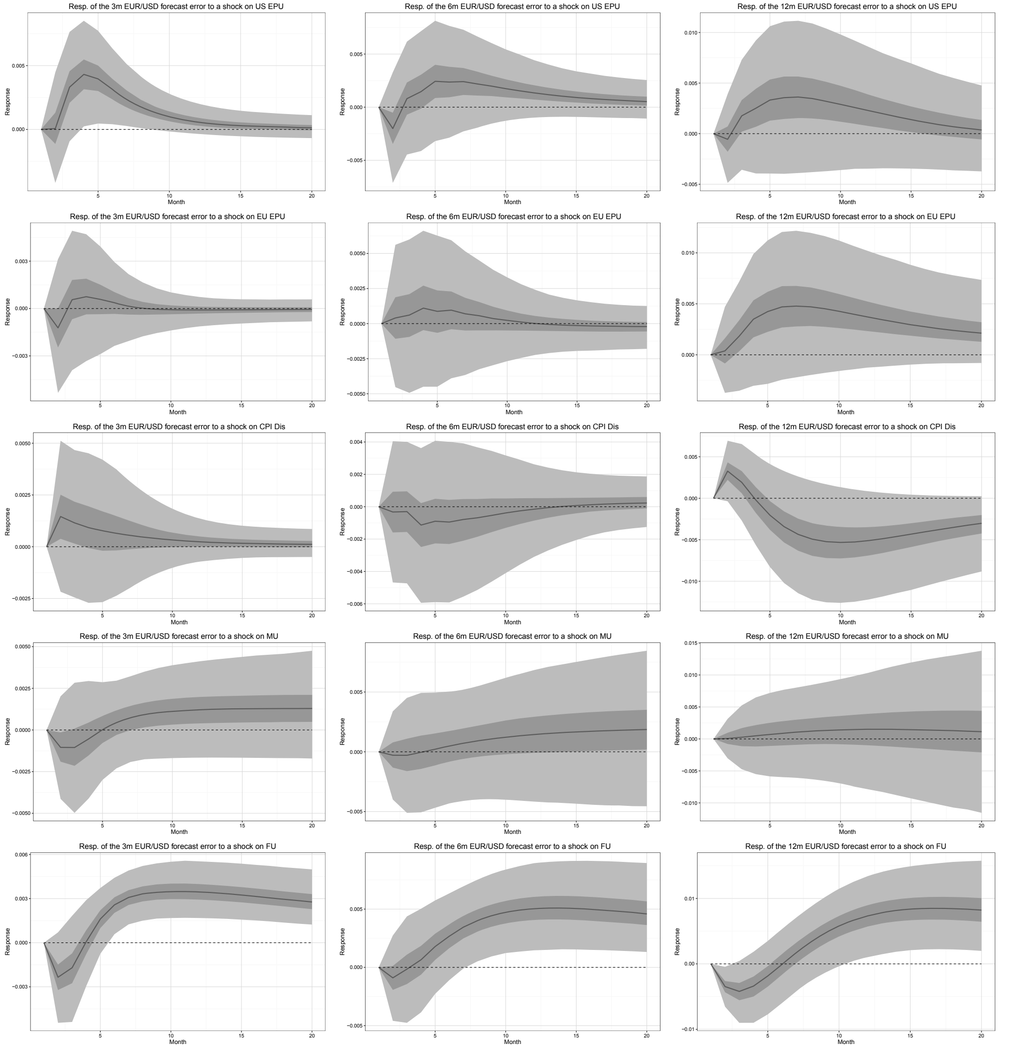


Figure 18 **Response of the JPY/USD forecast error to a shock on uncertainty**

The plots show the reaction of the JPY/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Japanese news-based economic policy uncertainty index (JP EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to JP EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2008:08.

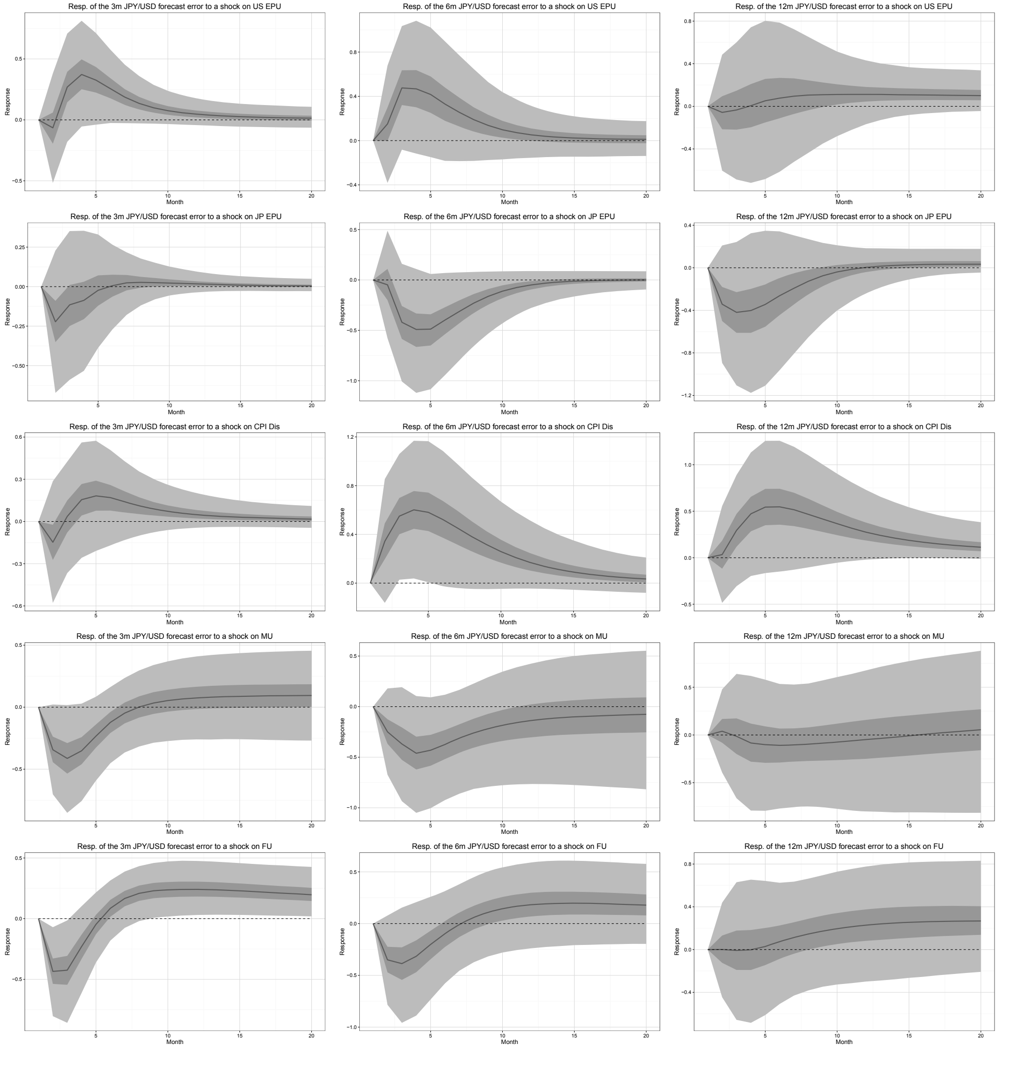


Figure 19 **Response of the CAD/USD forecast error to a shock on uncertainty**

The plots show the reaction of the CAD/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Canadian news-based economic policy uncertainty index (CA EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to CA EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1988:06 to 2008:08.

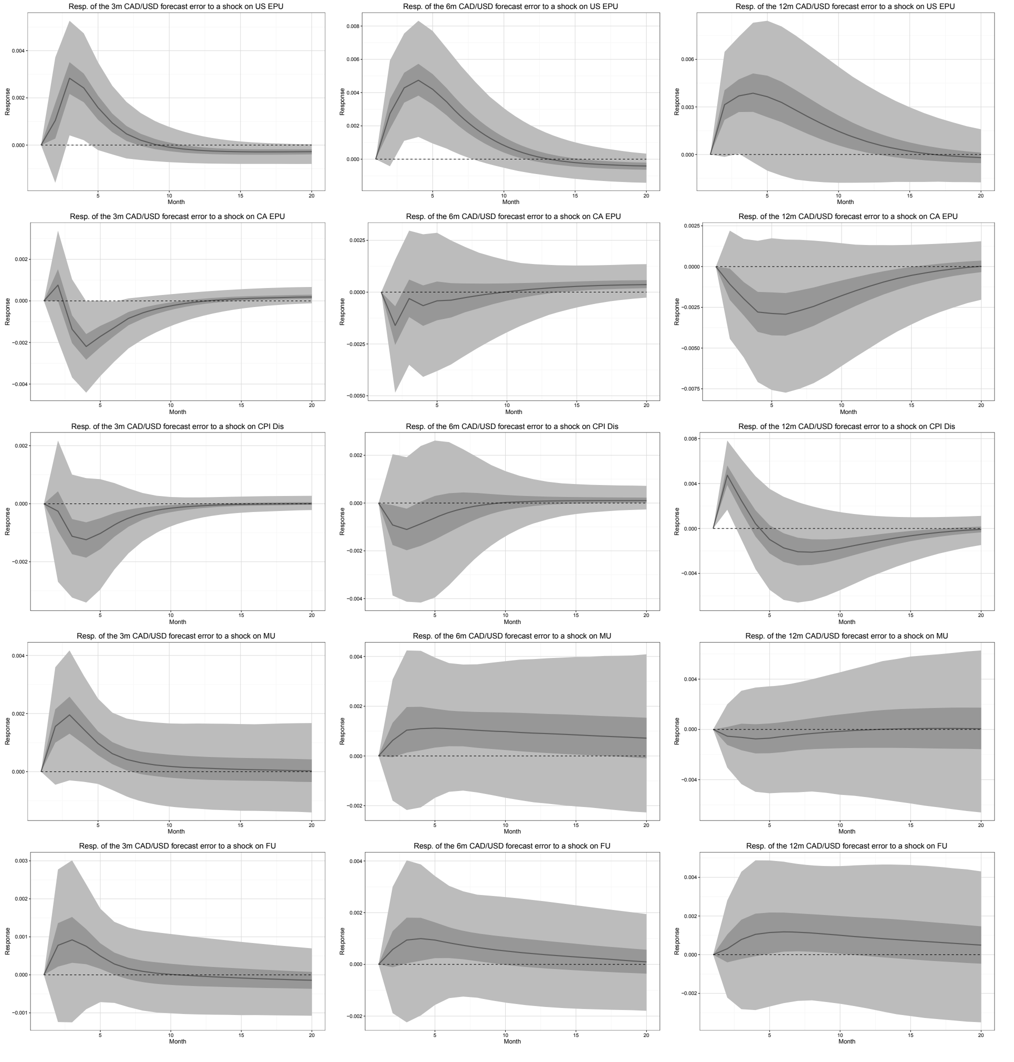
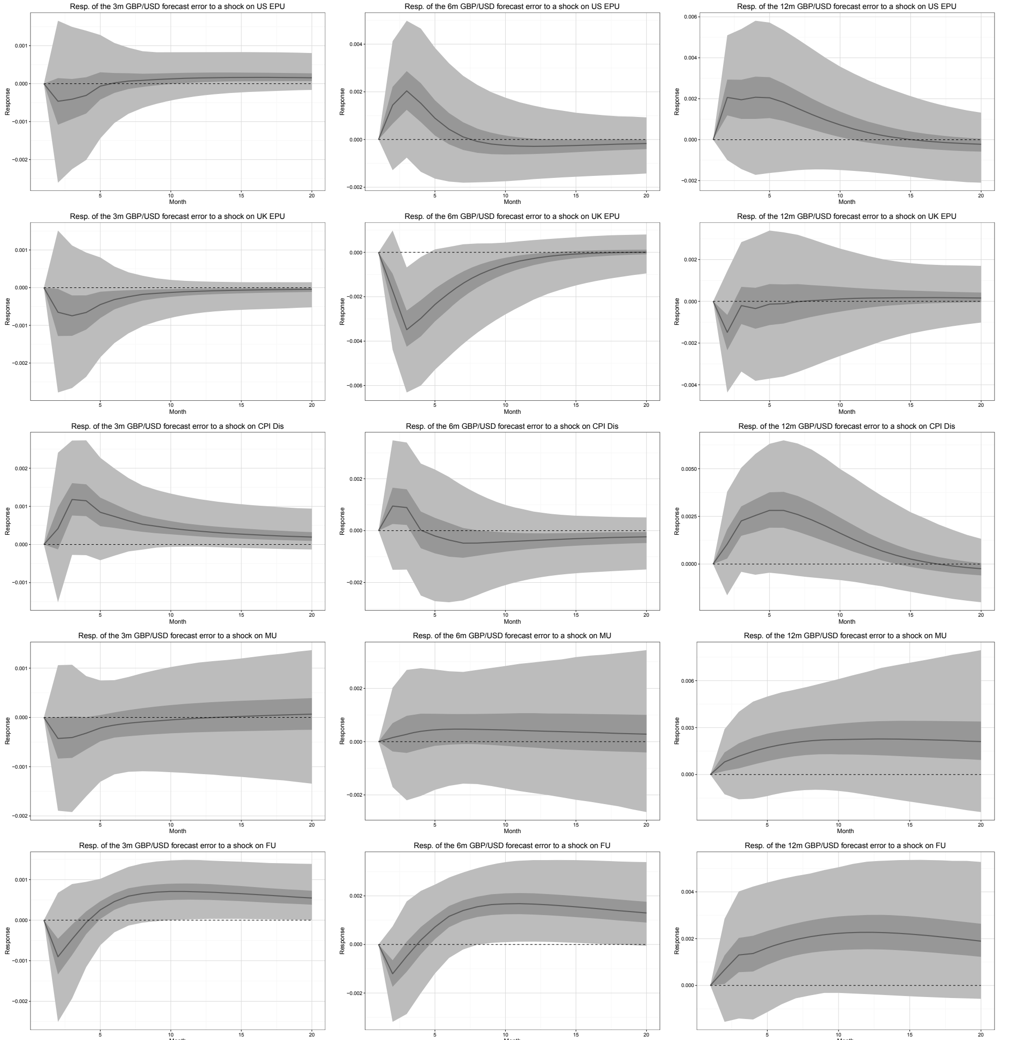


Figure 20 **Response of the GBP/USD forecast error to a shock on uncertainty**

The plots show the reaction of the GBP/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the UK news-based economic policy uncertainty index (UK EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to UK EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 1997:01 to 2008:08.



A.2. Second sub-sample period (2008:09-2015:12)

Figure 21 **Response of the EUR/USD expected change to a shock on uncertainty**

The plots show the reaction of the EUR/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the European news-based economic policy uncertainty index (EU EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to EU EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 2008:09 to 2015:12.

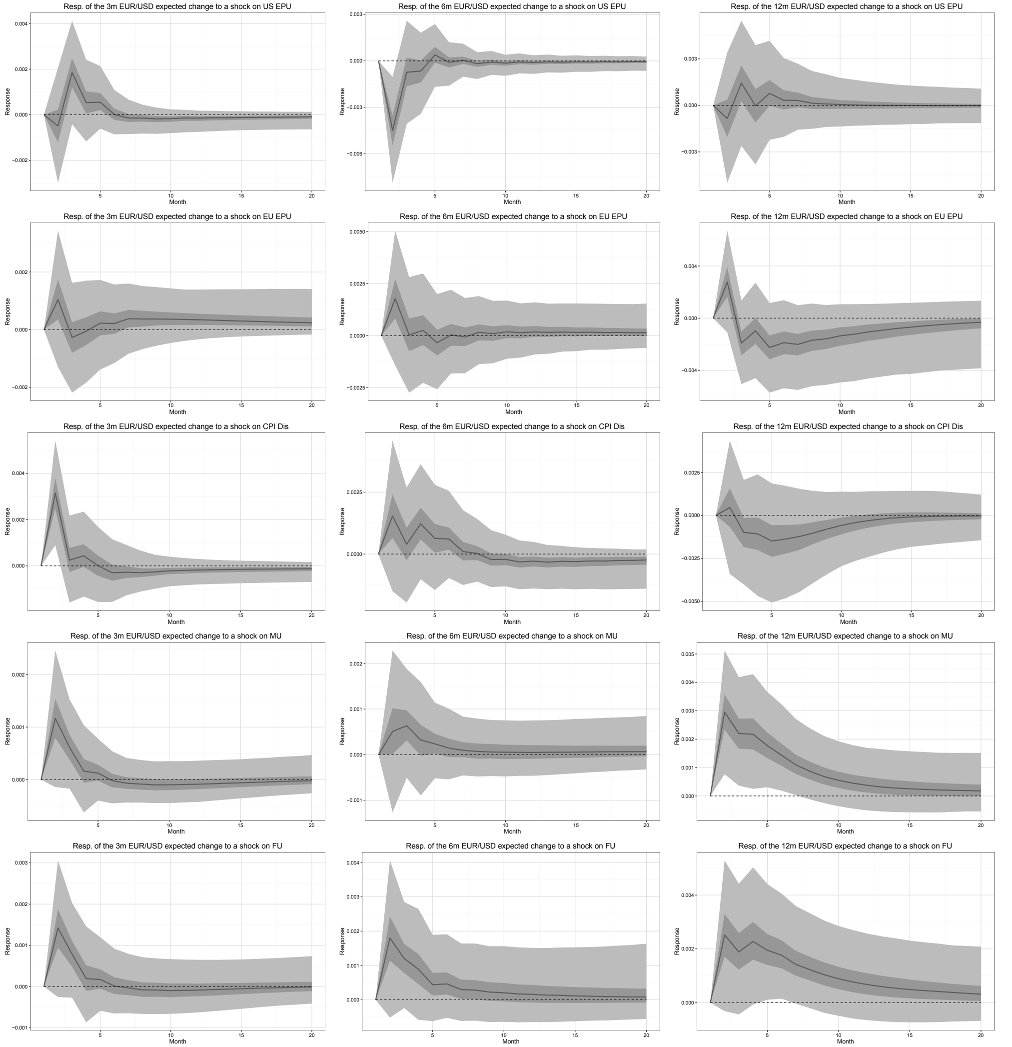


Figure 22 **Response of the JPY/USD expected change to a shock on uncertainty**

The plots show the reaction of the JPY/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Japanese news-based economic policy uncertainty index (JP EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to JP EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 2008:09 to 2015:12.

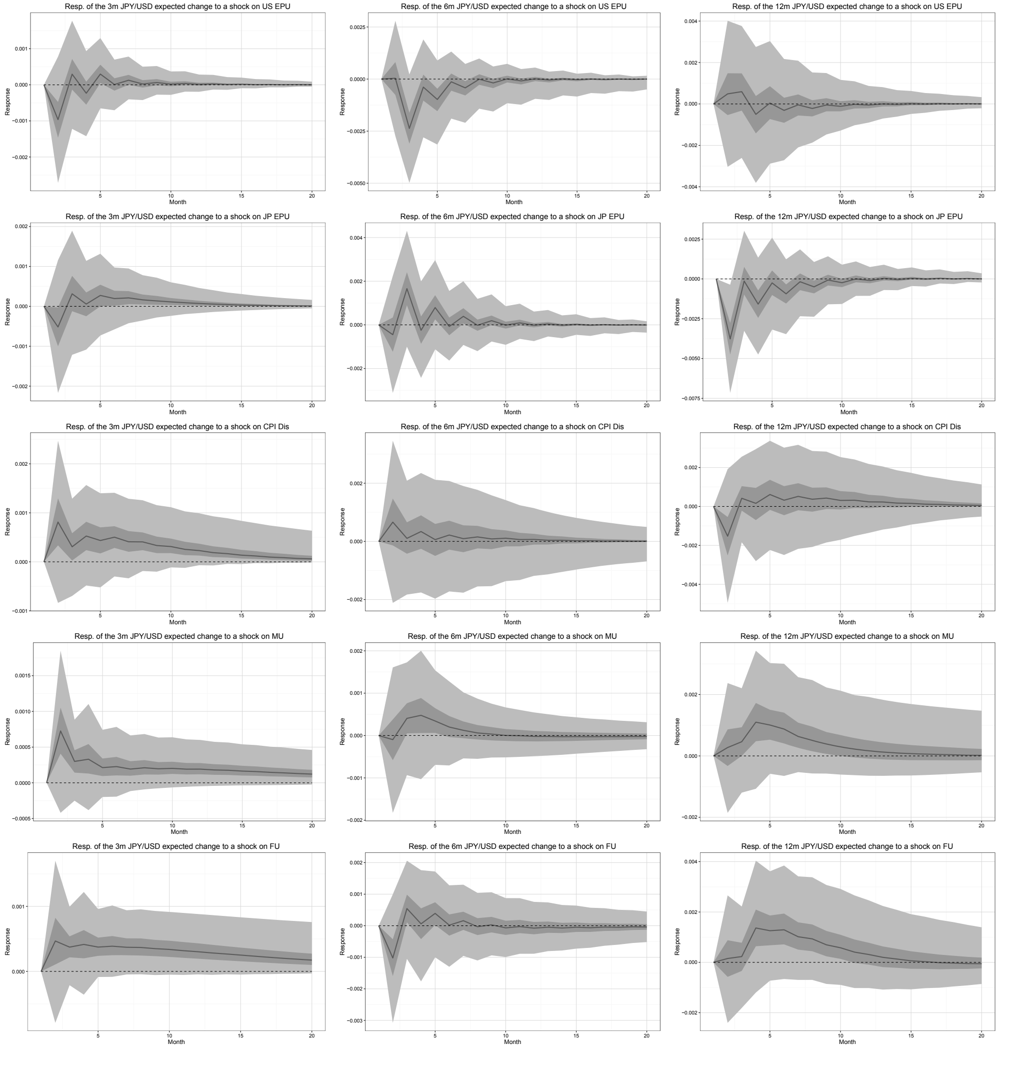


Figure 23 **Response of the CAD/USD expected change to a shock on uncertainty**

The plots show the reaction of the CAD/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Canadian news-based economic policy uncertainty index (CA EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to CA EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 2008:09 to 2015:12.

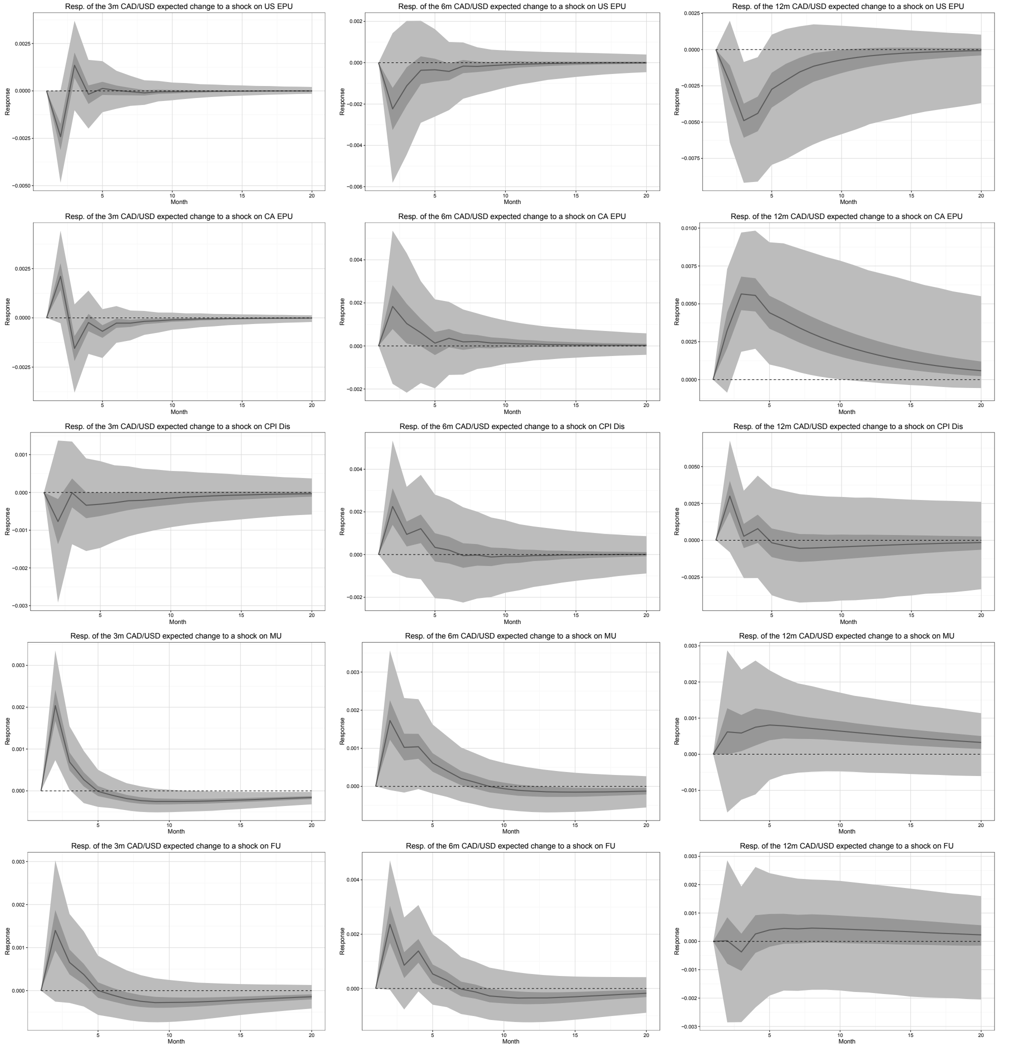


Figure 24 **Response of the GBP/USD expected change to a shock on uncertainty**

The plots show the reaction of the GBP/USD expected change ($E_t(s_{t+h}) - s_t$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the UK news-based economic policy uncertainty index (UK EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the expected change at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to UK EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 2008:09 to 2015:12.

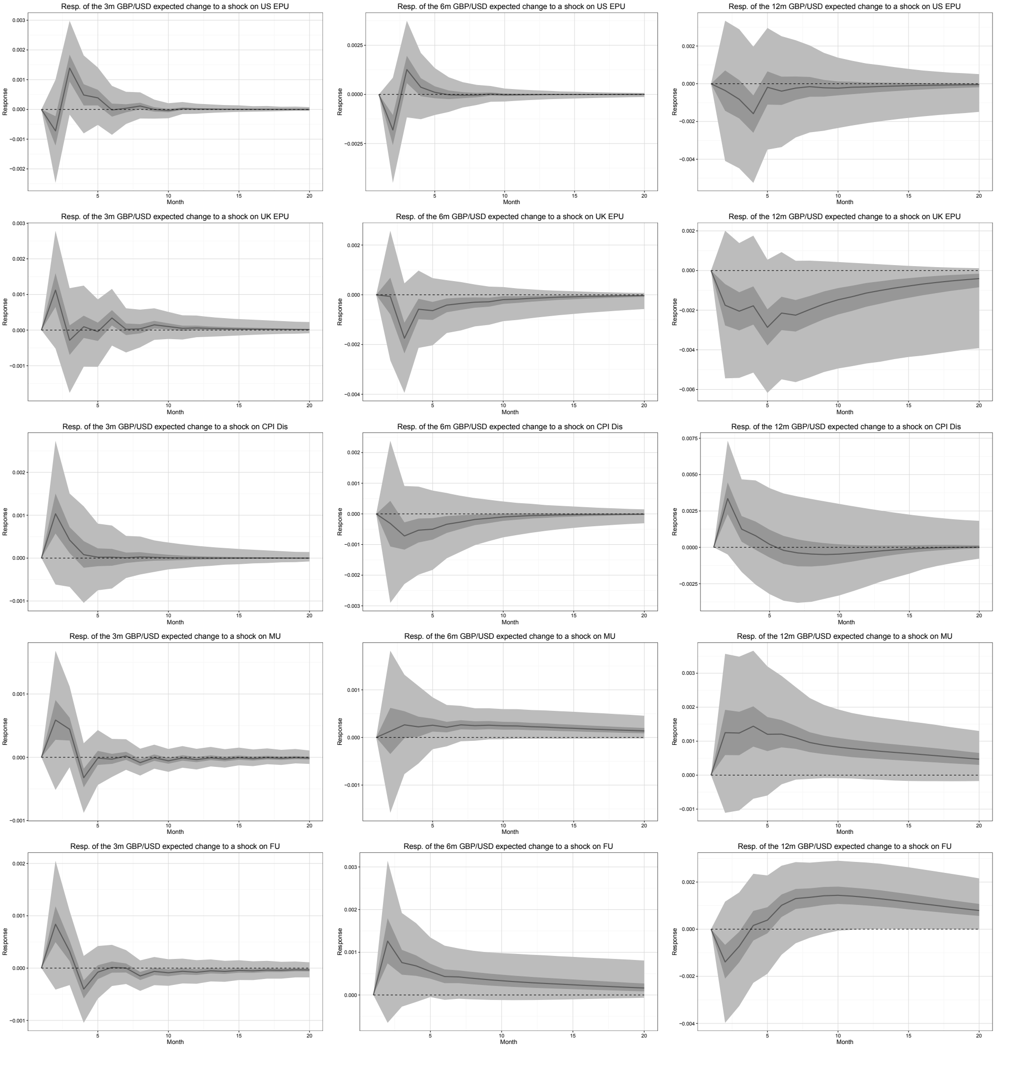


Figure 25 **Response of the EUR/USD forecast error to a shock on uncertainty**

The plots show the reaction of the EUR/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the European news-based economic policy uncertainty index (EU EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to EU EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 2008:09 to 2015:12.

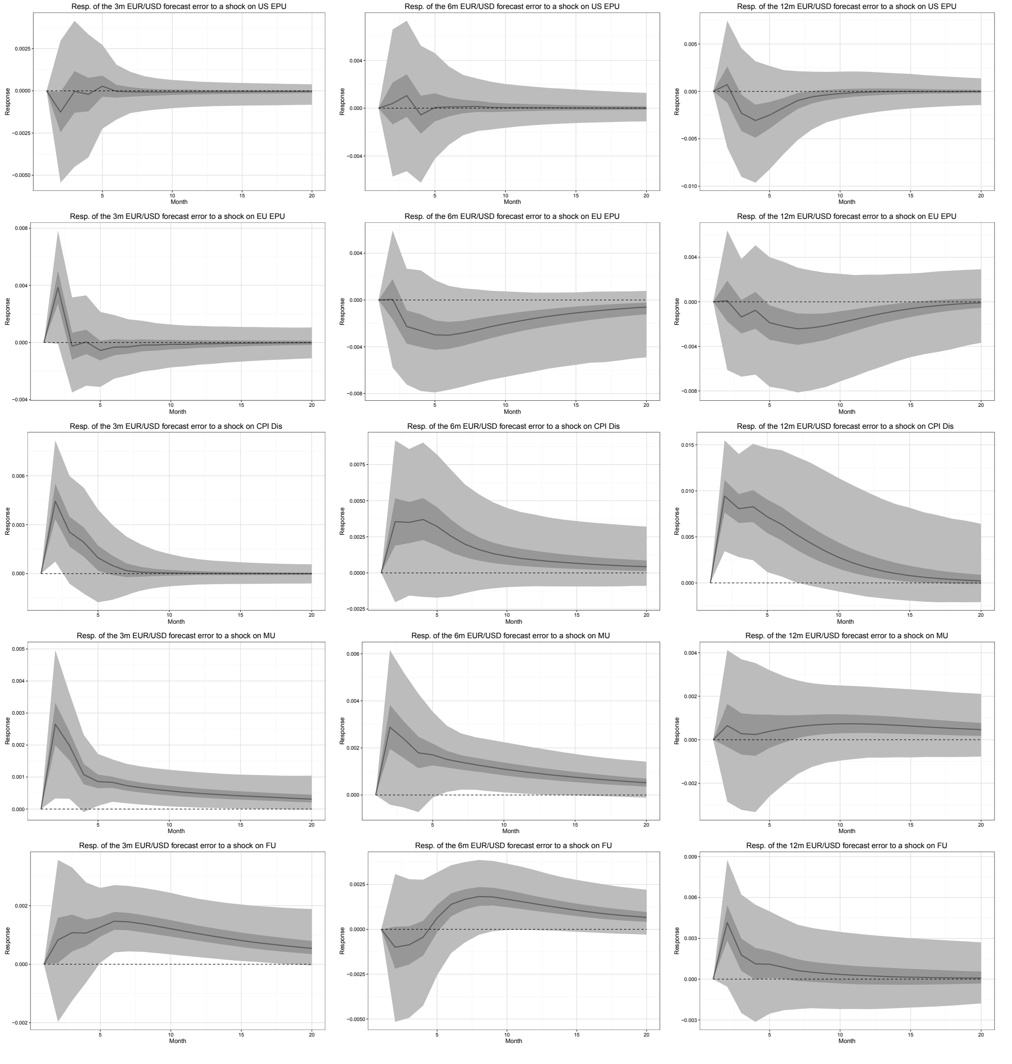


Figure 26 **Response of the JPY/USD forecast error to a shock on uncertainty**

The plots show the reaction of the JPY/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Japanese news-based economic policy uncertainty index (JP EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to JP EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 2008:09 to 2015:12.

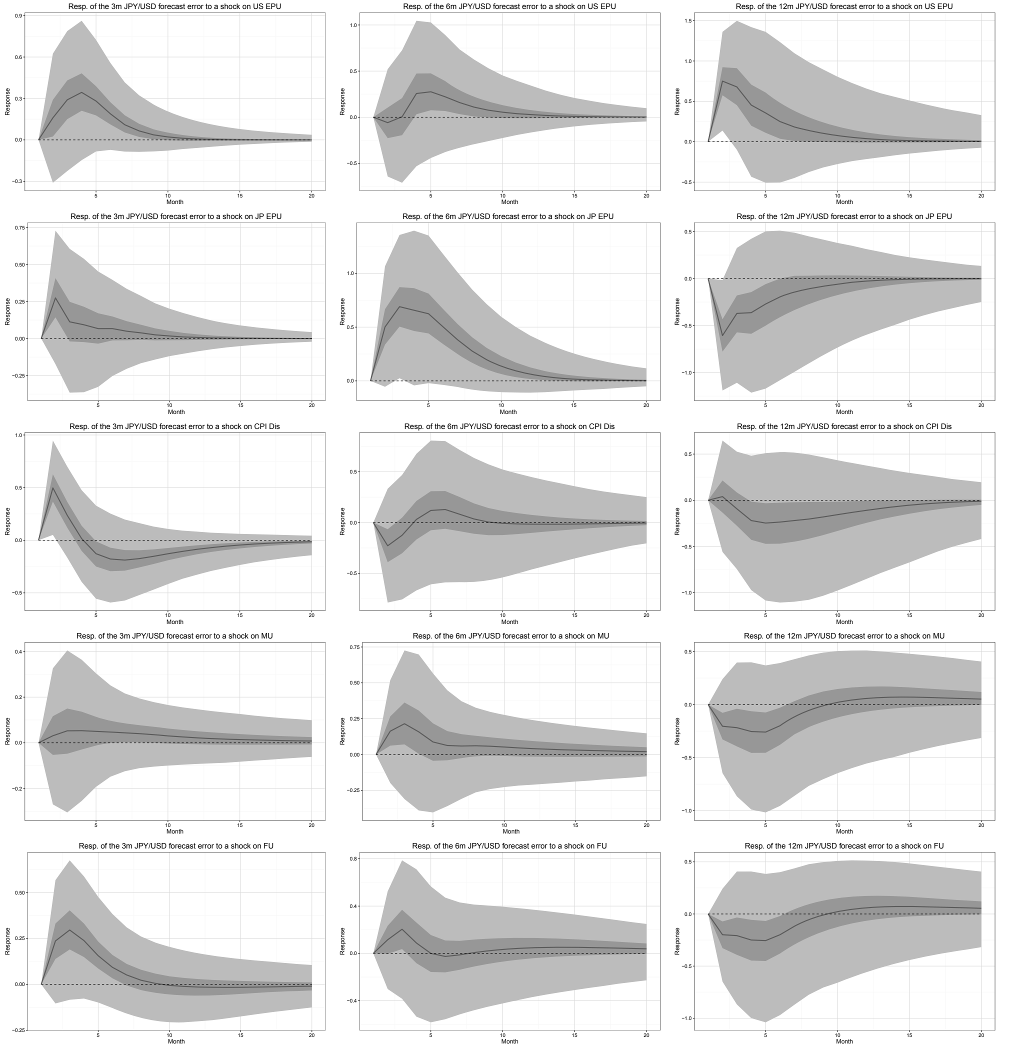


Figure 27 **Response of the CAD/USD forecast error to a shock on uncertainty**

The plots show the reaction of the CAD/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the Canadian news-based economic policy uncertainty index (CA EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to CA EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 2008:09 to 2015:12.

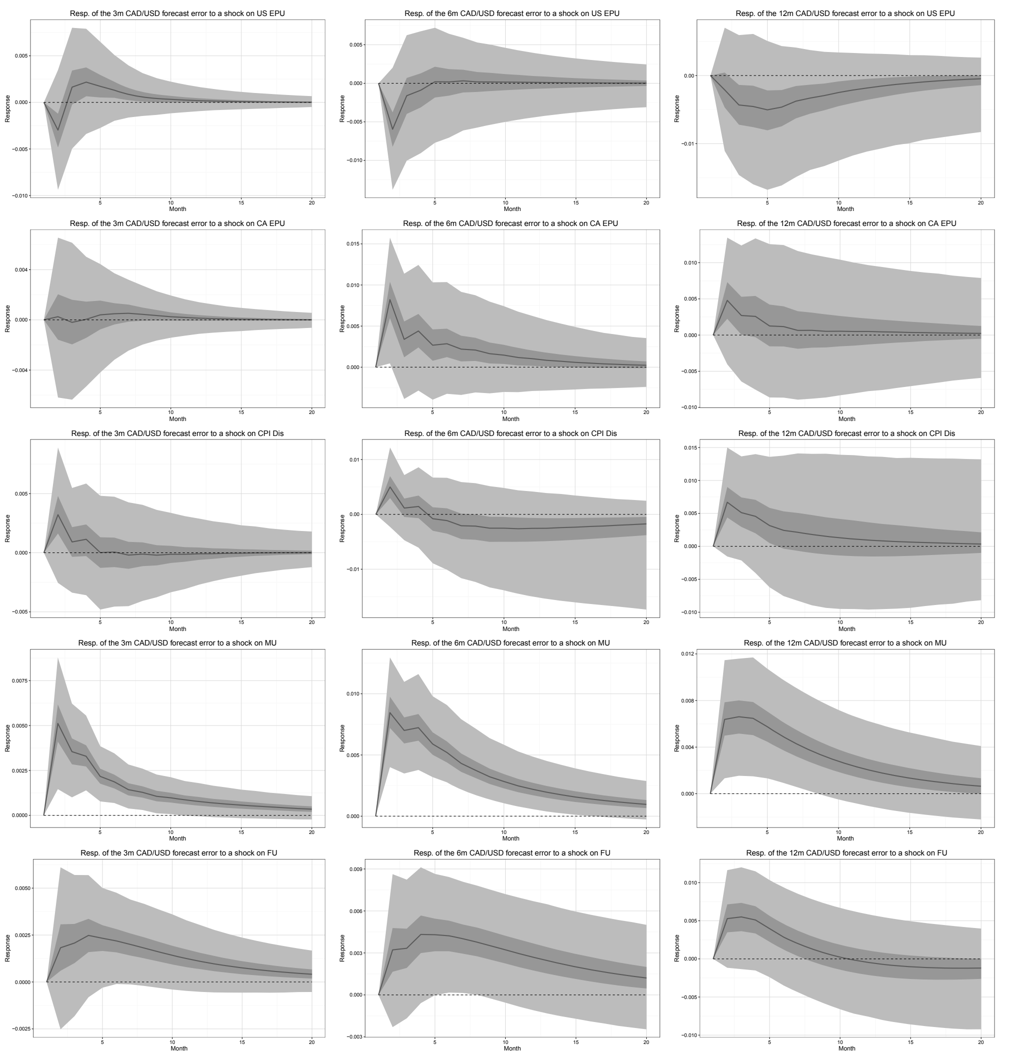
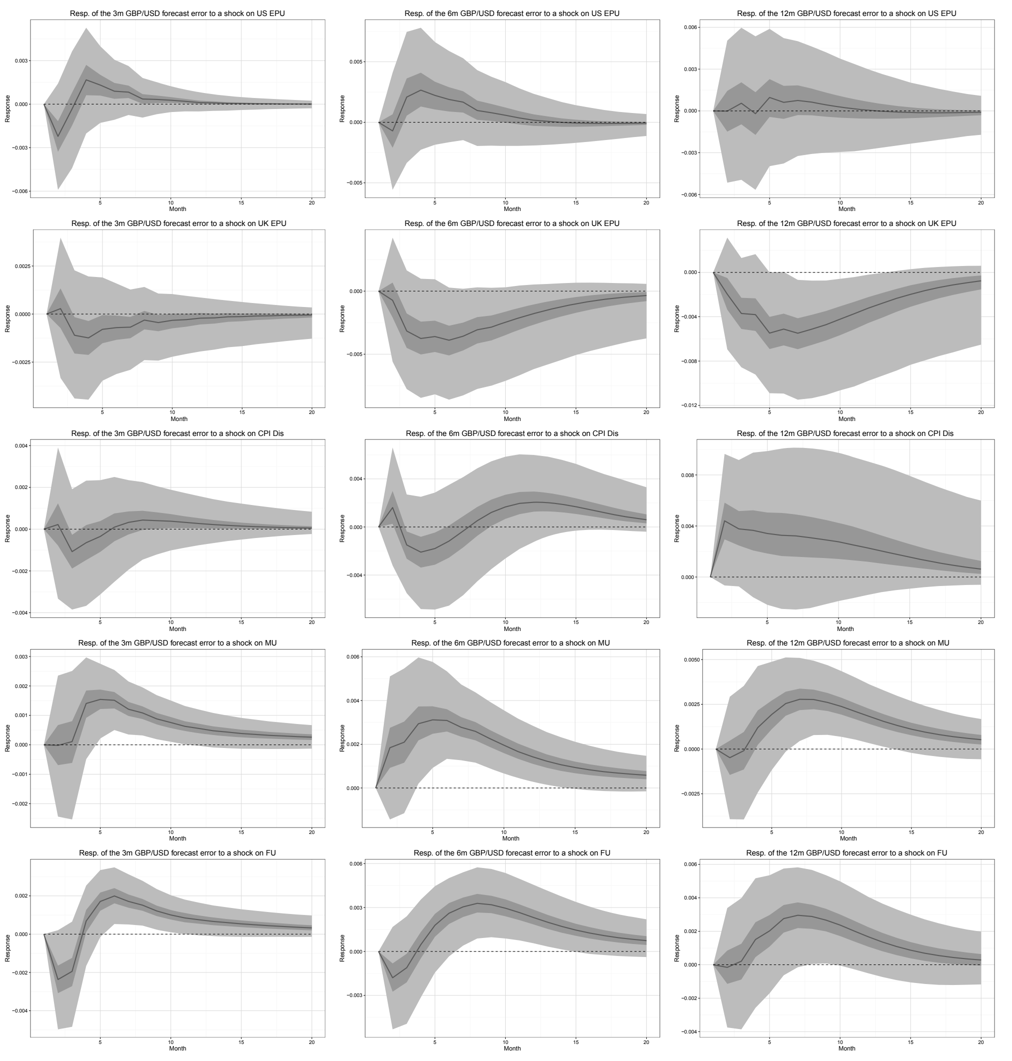


Figure 28 **Response of the GBP/USD forecast error to a shock on uncertainty**

The plots show the reaction of the GBP/USD absolute forecast error ($\varepsilon_{t+h} = |s_{t+h} - E_t(s_{t+h})|$ for $h = 3, 6, 12$) to a one-unit shock of the US news-based economic policy uncertainty index (US EPU), the UK news-based economic policy uncertainty index (UK EPU), the US CPI disagreement index (CPI Dis), the macroeconomic uncertainty index (MU) and the financial uncertainty index (FU). The former two are based on a 6-variable BVAR while the latter three are based on individual 5-variable BVARs. The first column gives the response of the forecast error at a three month horizon, the second at a six month horizon, and the third at a twelve month horizon. The first row gives the reaction to a shock of US EPU, the second to UK EPU, the third to US CPI disagreement, the fourth to macroeconomic uncertainty, and the last to financial uncertainty. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in grey blue). The dashed black line displays the zero line. The sample period runs from 2008:09 to 2015:12.



A.3. Posterior densities

Figure 29 **Posterior density of the coefficients**

The plots show the posterior densities of the coefficients of the forecast error equation for EUR/USD and $h = 3$ as one representative configuration.