

# Economic Policy Uncertainty and Inflation Expectations\*

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## **Abstract**

Theory and evidence suggest that in an environment of well-anchored expectations, temporary economic news or shocks should not affect agents' expectations of inflation in the long term. Our estimated structural VARs show that both long- and short-term inflation expectations are sensitive to policy-related uncertainty shocks. While economic activity contracts, long-term inflation expectations raise in response to such shocks. These results suggest that observed uncertainty about the stance and perceived effectiveness of policy raises concerns about future inflation and entails additional risks to central banks' hard-won inflation credibility.

JEL CLASSIFICATION: E02, E31, E58, E63, P16

KEYWORDS: Policy uncertainty; central banks; inflation expectations; structural VAR.

# 1 Introduction

Policy-related uncertainty is seen by academics and market participants as a prominent contributor to the overall economic uncertainty observed during the recent crisis. In the World Economic Outlook of October 2012, the IMF states: "The biggest factor weighing on the world economy was uncertainty among investors over whether policymakers in advanced economies will deliver on promises." These worries are grounded when taking into account a rapidly growing theoretical and empirical literature suggesting that uncertainty has recessionary effects on economic activity.<sup>1</sup> To date, the literature has focused on the effects of policy uncertainty on economic outcomes, such as output, investment, consumption and unemployment (see among others Baker et al. (2012) and Fernandez-Villaverde et al. (2011b)). However, less is known whether uncertainty caused by economic policy undermines the credibility of policies and institutions.<sup>2</sup> Our aim is to investigate this question for monetary authorities. Academics and policy makers often state that the extent to which inflation expectations are anchored is the best measure of the credibility of monetary policy. To this aim, we study the dynamic relationship between policy-related uncertainty and measures of inflation expectations of professional forecasters.

Our investigation comes at a time when central banks are still at the center stage to resolve the crisis. During the last years they resorted to standard and non-standard measures, aimed at providing support to the transmission mechanism of monetary policy. Some observers criticize them for this, some claim they go beyond their mandate and the general public shares the feeling they have not done enough to prevent the crisis.<sup>3</sup> Furthermore, regular surveys on public opinion and attitudes in Europe show a clear declining trend of trust and satisfaction with the way central banks have been doing their job (see Figure 9 in Appendix). Given this situation, our hypothesis is that in the light of increased overall policy uncertainty (not necessarily only uncertainty about monetary policy) agents begin to question the ability (expertise) of policy makers as well as their

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<sup>1</sup>Theoretically, uncertainty is supposed to reduce hiring, investment and consumption of durables in presence of adjustment costs (Bernanke (1983), Dixit and Pindyck (1994) and Bentolila and Bertola (1990)), financial frictions (Arellano et al. (2011), Gilchrist et al. (2010) and Christiano et al. (2010)), managerial risk aversion (Panousi and Papanikolaou (2011)) and precautionary motives.

<sup>2</sup>In the theoretical literature there are examples of models with incomplete information where agents beliefs and sentiments change in response to policy, see Eusepi and Preston (2010) and Bianchi and Melosi (2012) among others.

<sup>3</sup>This is based on the results from the FT/Harris poll, conducted online among 6,237 adults in France, Germany, the UK, Spain, Italy and the US, April 2008, August 2008 and February 2009.

commitment to their promises (targets). With respect to monetary authorities, this means to question their credibility. Shedding light on this issue is of great importance, considering the role that credibility and reputation have for policy effectiveness.<sup>4</sup>

We estimate structural VARs, linking policy uncertainty with inflation expectations while accounting for a measure of economic activity, using data for the US, UK, Germany and the euro area. We use the index of Baker et al. (2012) as a measure of policy uncertainty. This index is supposed to capture uncertainty about what policy action the decision makers will undertake, uncertainty about the economic effects of current and future actions and/or inactions. This can be uncertainty about different economic policies altogether but in our estimations we provide evidence even for specific types of uncertainties related with fiscal and monetary policy. Regarding inflation expectations, we use one- and five- years ahead survey-based inflation expectations of professional forecasters as measured by Consensus Economics.

We find several effects of policy uncertainty. First, economic activity contracts given a surprise innovation to policy uncertainty. Second, inflation expectations are also responsive: short-term ones fall, reflecting the slack economy while long-term inflation expectations rise. Third, monetary policy-related uncertainty is not always the important factor behind the dynamics of inflation expectations. For certain countries, fiscal policy-related uncertainty seems to play an important role. Furthermore, monetary policy appears to face a trade-off between responding to the state of the economy and to long-term inflation expectations. Given an unexpected innovation to policy uncertainty, central banks lower interest rates strongly, resembling the response of a central bank that follows a typical Taylor rule, accommodating the economy in response to falling output and prices.

Theory and evidence suggest that in an environment of well-anchored expectations, temporary news or shocks to economic variables, should not have an effect on long-term inflation expectations. However, we show that they increase in response to policy uncertainty shocks. This result is fairly robust when looking at different countries, when taking into account specific policy-related uncertainties, different measures of inflation expectations and different orderings of the variables in the structural VARs. A rise of long-term inflation expectations at times of economic contraction suggests that heightened policy uncertainty indeed raises concerns about an increase in future inflation. Overall, these results support

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<sup>4</sup>The importance of reputation and credibility of central banks is well-recognized in theoretical works, starting with Kydland and Prescott (1977) and Barro and Gordon (1983).

our hypothesis that, in an environment of increased policy uncertainty, agents begin to question the ability and the commitment of policy makers to deliver on their promises.

Our work is related to different strands of literature. First it relates to the literature on the macroeconomic effects of uncertainty in general (e.g. Bernanke (1983), Dixit and Pindyck (1994), Bentolila and Bertola (1990)), (Arellano et al. (2011), Gilchrist et al. (2010) and Christiano et al. (2010)) and of policy uncertainty in particular (e.g. Fernandez-Villaverde et al. (2011) and Born and Pfeifer (2011)). It also relates to the theoretical literature that studies changes in agents' beliefs in response to policy (e.g. Eusepi and Preston (2010) and Bianchi and Melosi (2012) among others). Specifically, our work adds to the existing empirical literature on the macroeconomic effects of uncertainty shocks (see Alexopoulos and Cohen (2009), Baker et al. (2012), Leduc and Liu (2012), Bachmann et al. (2013) and Mumtaz and Zanetti (2013) among others) and to the empirical literature of inflation expectations (see Clark and Davig (2008) for a survey).

We bridge these two strands of the empirical literature and provide first evidence on the effect of policy-related uncertainty shocks on beliefs and perceptions of agents towards policy and policy makers. Furthermore, to our knowledge we are the first to provide empirical evidence on the impact of different types of policy-related uncertainty on aggregate outcomes. We confirm previous findings that uncertainty shocks generate economic contractions, at least for the US and the euro area. Our finding that policy uncertainty shocks pose upward risks to the anchoring of long-term inflation expectations is new to the literature.

The structure of the paper is as follows. Section 2 presents the policy uncertainty measure, an overview of the recent developments in inflation expectations and their link to the measure of policy uncertainty. Section 3 presents the empirical methodology (structural VAR estimations) and the discussion of results. Section 4 concludes.

## 2 Economic policy uncertainty and inflation expectations: an overview

In this section we discuss how economic policy-related uncertainty and inflation expectations are measured. We also show their evolution throughout the years and point out main episodes associated with policy uncertainty.

### 2.1 Measuring economic policy uncertainty

Uncertainty is hard to quantify and most of the literature that studies how it impacts economic activity has relied on proxy measures for it. These proxies can be divided in different categories: uncertainty measures based on surveys (business surveys or professional forecasters surveys), uncertainty measures based on the corporate bond spread over treasuries, uncertainty measures based on stock market volatility and on stochastic volatility of macroeconomic variables. We use the index of economic policy uncertainty (hereafter EPU) proposed by Baker et al. (2012). The EPU index is constructed for several developed countries and is based on two components<sup>5</sup>: newspaper coverage of policy-related economic uncertainty and the disagreement of professional forecasters on expected inflation and government expenditures. This measure is supposed to capture uncertainty about what policy actions the decision makers will undertake and uncertainty about the economic effects of current and future actions and/or inactions. This can be uncertainty about fiscal, monetary or other regulatory policies. Usages of the EPU index are found as well in recent empirical and theoretical works, see for example Leduc and Liu (2012), Bachmann et al. (2013) and Fernandez-Villaverde et al. (2011a).

In our estimations we use only the news-based<sup>6</sup> component of EPU for several reasons. First, we want to avoid a potential correlation between the “disagreement” component of the index with the inflation expectations we use in our VAR estimation. They are both based on expectations of professional forecasters from Consensus Economics. Furthermore,

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<sup>5</sup>For the US it has an additional component, the number of federal tax code provisions set to expire in future years. For more information, visit [www.policyuncertainty.com](http://www.policyuncertainty.com).

<sup>6</sup>Literature knows uses of narrative as variables: Romer and Romer (1989) and Romer and Romer (2004) to identify monetary policy shocks, Ramey and Shapiro (1998) and Ramey (2011) for fiscal policy shocks and Doms and Morin (2004) explore the linkages between media coverage of economic events, consumers’ perceptions, and economic outcomes.

working with the news-coverage component allows us to distinguish between uncertainty coming from monetary, fiscal or labor market policies, for example. In this way, we are able to study whether other kinds of policy uncertainty are affecting the beliefs of agents about inflation expectations and about the ability of central bankers to deliver on their mandates.

However, the EPU index is a proxy variable and subject to measurement errors. For example, it is often questioned whether this index is just another measure of the state of the economy or whether it suffers from political slant. Certainly, policy uncertainty is part of overall economic uncertainty and Baker et al. (2012) show that at certain times, it is its main contributor. In response to potential measurement errors, they evaluate the index in several ways and argue that, although present to a small extent, they do not undermine the accuracy of the index. For example, they find a strong correlation between the computerized newspaper component<sup>7</sup> of the EPU index and a measure of what a human reader would call economic policy uncertainty. They also show that the EPU index is consistent with the frequency of the word "uncertain" in the FOMC Beige Book and with the responses of the stock market generated by policy news. Moreover, the EPU index does not appear to be strongly affected by newspaper political slant.

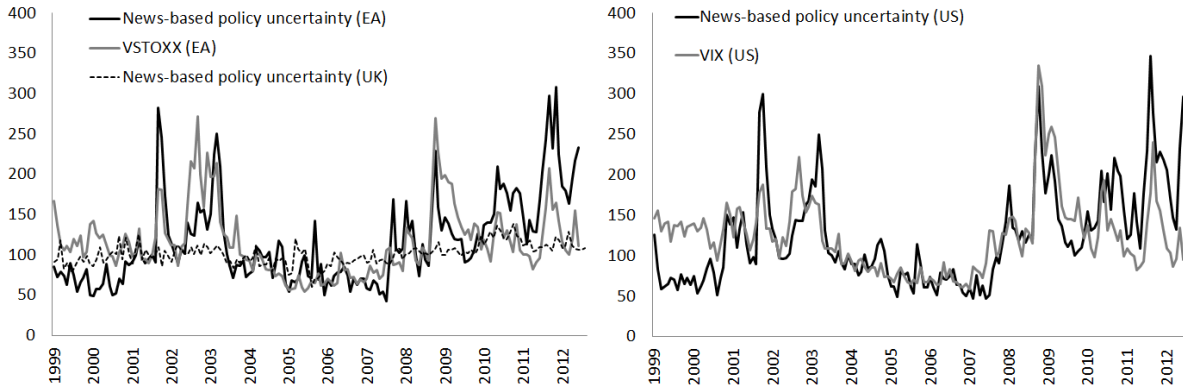
Figure 1 shows the evolution of two of the uncertainty proxies we mentioned above, the news-based policy uncertainty and the stock market volatility for the US, UK and the euro area. Even though these measures are different, they have both varied over time and increased sharply during the recent crisis. Increases in the levels of policy-related uncertainty are observed especially around events with unpredictable outcomes. For the euro area and the US one can identify common spikes corresponding to 9/11, the Gulf War II in 2003, the Lehman Brothers collapse in 2008 and the intensification of the European debt crisis in 2012. Specific spikes for the euro area appear around events related with the Treaty referendums in 2001 and 2005, the Greek bailout in 2010, the rating cuts in 2011 and the call for referendum by Greece's prime minister in 2011. For the US they correspond to the presidential elections in 1992, 2000 and 2008, and to the debates on the fiscal stimulus (2008), on the debt ceiling (2011) and on the fiscal cliff (2012). For the UK, the index of news-based policy uncertainty appears to be quite flat when compared with the ones for the euro area and the US.

Especially in recent years, we have observed policies that have generated uncertainty

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<sup>7</sup>The newspaper component of the EPU index is based on automatic searches of specific terms related to economic uncertainty and policy in the largest newspapers for each country.

Figure 1: Recent developments of selected proxy measures for economic uncertainty



*Notes:* Newspaper-based policy uncertainty for euro area (EA), UK and US, as in Baker et al. (2012) and stock market volatility-based uncertainty for EA (VSTOXX) and US (VIX). The stock market volatility indices have been scaled such that they have the same mean with the news-based policy uncertainty indices for EA and US.

about future inflation. For instance, there has been criticism towards the ECB potentially acting beyond its mandate through the bond-buying programs, first announced in 2010. These programs raised concerns about the ECB being at risk of operating under fiscal dominance, thereby harming its independence. This, in turn, would lead to a difficulty for the ECB to ensure price stability. Policy uncertainty that might feed into expectations about future inflation has also arisen from the discussions of exit strategies of the central banks that implemented quantitative easing. If not done carefully, exit from massive monetary stimulus could jeopardize future price stability. Moreover, uncertainty arising from fiscal pressures in the US, also raises concerns about the Fed being able to deliver price stability in the future. Therefore, it seems important to investigate whether in an environment of high policy-related uncertainty, these concerns have fed into agents' perceptions regarding policy makers and their policies.

## 2.2 Inflation expectations

There are different measures of inflation expectations: survey-based expectations of general public or professional forecasters, and financial market-based ones. These different measures might reflect heterogeneities in the expectation formation mechanism across agents. Financial market-based inflation expectations, the so-called breakeven inflation rates (BEIRs), result from the difference between nominal Treasury bonds and Treasury inflation-protected securities. In our study, we focus on the survey-based measures of inflation expectations



since they reflect the beliefs of the agents only on inflation and do not include financial market-related risks.<sup>8</sup>

Inflation expectations are measured at different horizons. Usually, expectations up to two years ahead are referred as short-term expectations and expectations five years ahead and more as long-term inflation expectations. Short-term expectations are vulnerable to temporary shocks and more volatile than long-term expectations. Because long-term expectations can profoundly influence current economic behavior<sup>9</sup>, monetary authorities monitor them carefully with the aim to provide a long-term nominal anchor for the economy. Well-anchored long-term inflation expectations are key to the functioning of the monetary policy transmission mechanisms and they appear to be a crucial indicator of central bank credibility and, indirectly, of central banks' success (ECB, Monthly Bulletin, May 2009). This becomes especially central in periods characterized by large shocks to the economic and financial activity, and also in periods with extraordinary levels of uncertainty.<sup>10</sup>

As shown in Figure 2, the evolution of survey-based measures of long-term inflation expectations has been different across countries. Long-term inflation expectations in the euro area have generally been lower than in the UK and the US and have moved within a narrow band. However, they have been more volatile after the Lehman bankruptcy. On the other hand, long-term BEIRs show a greater volatility throughout the whole sample (see Figure 10 in the Appendix). They are especially more responsive to news in the post-Lehman period, reflecting liquidity and risk premia concerns in financial markets. Several analyses on the development of inflation expectations during the crisis show that long-term inflation expectations have become less firmly anchored, to a larger extent in the UK and in the US, relative to the euro area (see among others, Galati et al. (2011)).

In Table 1 we show how inflation expectations from Consensus Economics relate to the news-based component of the EPU index. The reported contemporaneous correlations

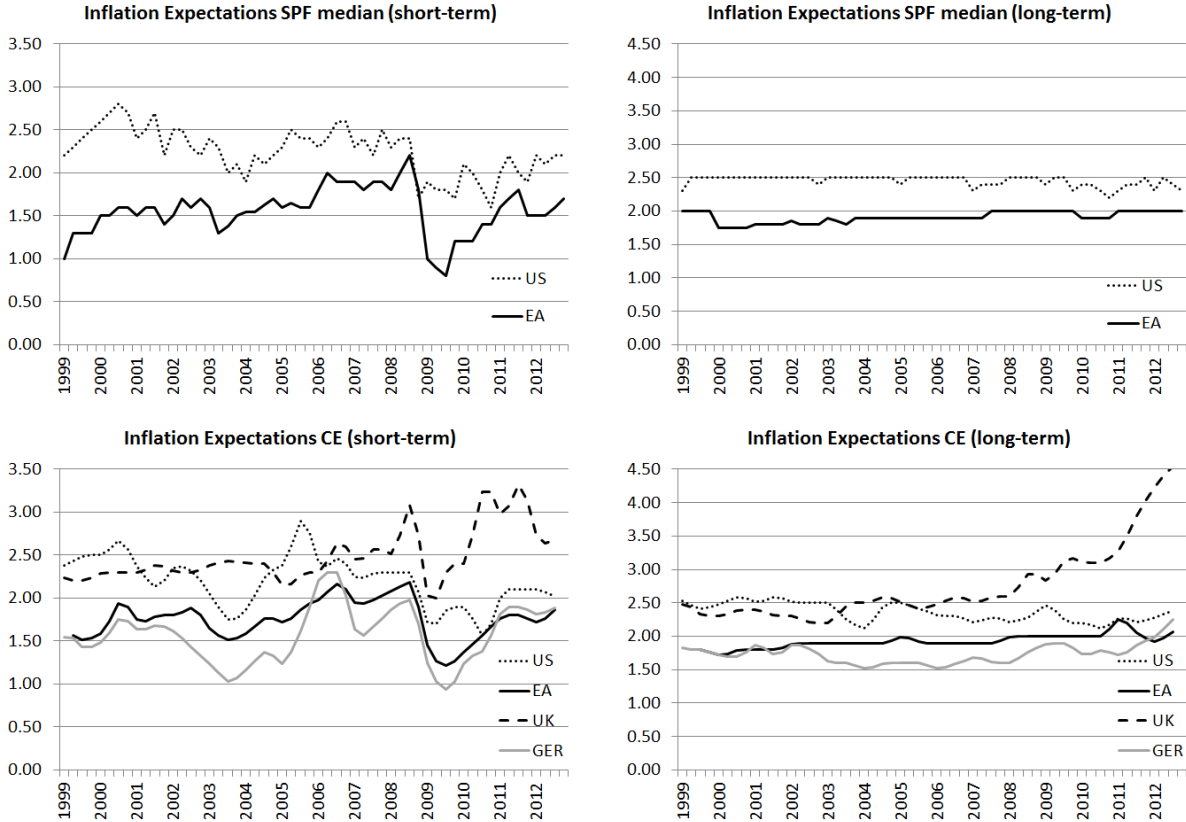
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<sup>8</sup>BEIRs are available at higher frequency but incorporate other factors in addition to concerns about inflation, such as information on risk premia as well as changes related to the trading conditions.

<sup>9</sup>Current economic behavior could be affected by changes in expectations through multiple channels. Higher inflation expectations put upward pressure on wages, as workers demand increases in wages to offset the expected loss of purchasing power in the future, and on prices, as firms try to raise the prices to offset the expected rise in their marginal costs. Moreover, asset prices and investment plans are affected by changes in inflation expectations (see ECB, Monthly Bulletin, May 2009).

<sup>10</sup>Policy makers acknowledge that well-anchored inflation expectations provide an assessment of the suitability of the monetary policy stance: *"Ultimately, the firm anchoring of inflation expectations remains the best way to check the appropriateness of monetary policy in an uncertain environment."* (Bini-Smaghi 2009).

Figure 2: Recent developments of short- and long-term inflation expectations



Notes: Long-term (5 years ahead) and short-term (1 year ahead) survey-based inflation expectations obtained from the Survey of Professional Forecasters (SPF) and from the Consensus Economics (CE).

give us an idea about the relationship between economic policy uncertainty and the whole term structure of inflation expectations. We observe a negative correlation between policy uncertainty and the growth of real GDP. This reflects a counter-cyclical behavior of uncertainty, compatible with previous findings (Bachmann et al. (2013), Bloom (2009) and Baker et al. (2012)). Higher policy uncertainty seems to be more firmly linked to the longer terms of inflation expectations. The correlations between policy uncertainty and long-term inflation expectations are strongly positive for both the euro area and the UK. For the US, the correlation between news-based policy uncertainty and long-term inflation expectations is relatively low.

Table 1: Contemporaneous cross-correlations

Variables	News-based Policy Uncertainty		
	Euro area	United Kingdom	United States
GDP growth	-0.2792**	-0.1628	-0.3867***
IE (+1)	-0.0101	0.3412***	-0.2527**
IE (+2)	-0.0896	0.3476***	-0.2101**
IE (+3)	0.2763**	0.4177***	-0.1732
IE (+4)	0.4456***	0.4740***	-0.1534
IE (+5)	0.4826***	0.3998***	-0.1530
IE (+6 to 10)	0.5753***	0.4515***	-0.1784*

*Notes:* This table lists the contemporaneous unconditional contemporaneous correlations between the variables listed on the rows and our measures for policy uncertainty. "IE (.)" stands for inflation expectations at different horizons (from one year ahead up to six to ten years ahead), from Consensus Economics. \*\*\*, \*\* and \* stand for statistical significance at levels of 1%, 5% and 10%, respectively.

### 3 Policy uncertainty shocks - a VAR analysis

In this section we study the effects of policy-related uncertainty shocks on inflation expectations using VAR techniques. We introduce the estimation methodology and the data used before discussing the results.

#### 3.1 Estimation, data and identification strategy

The reduced-form VAR model has the following standard representation:

$$A(L)z_t = \epsilon_t \tag{1}$$

where  $z_t = (pu_t, y_t, ie_{t+5|t}, ie_{t+1|t})$  represents the vector of our variables of interest, with  $pu_t$  being news-based overall policy uncertainty,  $y_t$  real GDP and  $ie_{t+5|t}$  and  $ie_{t+1|t}$  five- and one- year ahead inflation expectations, respectively.  $A(L) \equiv I + A_1L - A_2L^2 - \dots - A_pL^p$  is the autoregressive lag order polynomial and  $\epsilon_t$  represents the reduced-form errors with covariance matrix,  $\Sigma_\epsilon$ .

The overall policy uncertainty measure,  $pu_t$ , incorporates uncertainty about different types of policy altogether, like fiscal, monetary, financial or any other type of regulatory policies. However, we are interested in studying the effects of uncertainty related with specific policies separately, as well. If the structural VAR estimations show that the overall

policy uncertainty is significant for the dynamics of inflation expectations, being able to identify the specific policy responsible for these dynamics is important. On the other hand, specific-types of policy uncertainty could have a higher relevance for the dynamics of certain variables, even when the overall policy uncertainty does not. Our framework allows us to study these options.

We extend our analysis to also explore the effects of monetary and fiscal policy-related uncertainty, separately. Measures of monetary policy- and fiscal policy-related uncertainty are constructed by Baker et al. (2012) only for the US, UK and Germany.<sup>11</sup> To our knowledge we are the first to use this novel data set in the empirical literature on the macroeconomic effects of uncertainty. In our analysis we use the measures for Germany as proxies for the euro area. One should keep in mind that these measures capture the policy uncertainty as discussed in the German media. This uncertainty is often related with important policies or developments outside the country as well. For the monetary policy-related uncertainty the approximation seems reasonable, given that there is a single monetary policy in the euro area. With respect to fiscal policy this match might appear weak at first sight. However, especially during the last years, fiscal issues across the euro area have been closely followed by the German public and heavily discussed in the media. Observing the evolution of the German index for fiscal policy uncertainty (Figure 8 in Appendix) after 2008 one can see that it spikes around the Greek bailout at the beginning of 2010, the rating cuts of periphery countries in 2011, and the call of the prime minister of Greece for referendum on a new bailout at the end of 2011. This shows that the German measure is picking up the main concerns about fiscal policy in the euro area.

The benchmark structural VAR allows us to study the impact of policy uncertainty on inflation expectations, while accounting for a measure of economic activity, in a parsimonious way. In a further step, we augment our econometric model to show the response of monetary policy to uncertainty shocks. In this case, the vector of variables used for estimation is:  $z'_t = (pu_t, y_t, ie_{t+5|t}, ie_{t+1|t}, i_t)$ , with  $i_t$  being the short term interest rate. In addition, we perform robustness checks by using expectations as measured by the Survey of Professional Forecasters (SPF) of the Federal Reserve Bank of Philadelphia and of the ECB, respectively.<sup>12</sup>

The identification of uncertainty shocks is recent in the empirical literature and most

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<sup>11</sup>Details on the construction of each index are presented in the Appendix.

<sup>12</sup>More details on these data can be found in the Appendix.

of the studies have identified them using the recursive Cholesky decomposition, see for example Alexopoulos and Cohen (2009), Baker et al. (2012), Leduc and Liu (2012) and Bachmann et al. (2013)<sup>13</sup>, among others. We use this identification strategy with the following order of variables:  $pu_t, y_t, ie_{t+5|t}, ie_{t+2|t}$ . Under this ordering, policy uncertainty does not contemporaneously respond to other shocks while an innovation to it has an immediate effect on the variables ordered after. This assumption is broadly in line with how uncertainty is treated in theoretical models. For example, in Fernandez-Villaverde et al. (2011a) and Born and Pfeifer (2011), the process for policy uncertainty, represented by the stochastic volatility of the policy instrument, is exogenous and an innovation to it has an immediate impact on economic activity.

Under our identification strategy, we relax the exogeneity restriction on policy uncertainty and allow it to respond with delay to other shocks through the lag polynomial,  $A(L)$ . Policy uncertainty as measured in practice could arise not only from unexpected innovations to policy but also as a response to other shocks in the economy. For example, a contractionary shock hitting the economy could also lead to a rise in policy uncertainty if the public does not know how policy will respond. In the benchmark SVAR we assume that uncertainty about policy is affected only with delay. In our robustness checks we show that re-ordering policy uncertainty in the SVAR does not change the empirical results.

Long-term inflation expectations are ordered before short-term expectations; if the forecaster revises the long-term inflation expectations, then she will most likely revise the short-term expectations, as well, but not necessarily the other way around (Clark and Davig (2008)). In addition, short-term inflation expectations are usually more volatile and responsive to temporary shocks and ordering them at the end allows for this fact. When adding interest rates to the set of variables, we order them last. This allows monetary policy to respond contemporaneously to shocks to economic activity and to inflation expectations.

We estimate structural VARs for the US, UK, Germany and the euro area. The choice of countries is constrained by the availability of the policy uncertainty variable. As a proxy for policy uncertainty we use the corresponding country-specific, news-based policy uncertainty index of Baker et al. (2012). Quarterly, seasonally adjusted data on real GDP are taken from Eurostat. Inflation expectations are the country-specific, one- and five-years ahead expectations of professional forecasters as measured by Consensus Economics. Compared with other sources, both short- and long-term measures of inflation expectations from

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<sup>13</sup>Bachmann et al. (2013) have used in addition long-term restriction to identify uncertainty shocks.

Consensus Economics start relatively early, in the beginning of 1990s, and are available for many countries. The drawback is the biannual frequency of the data.

We present below the results from the estimation of a panel-SVAR with country fixed effects for the US and the euro area and individual country-SVARs. We follow the panel-VAR approach for the US and the euro area in order to get more statistical power and to increase the precision of our estimates, given the relatively short data sample available for the euro area (starting in 1999). This approach allows us to uncover common dynamic relationships for the US and the euro area while accounting for country-specific fixed effects. All SVARs are estimated at a quarterly frequency.<sup>14</sup> For the panel-SVAR estimation, the period covered is 1999Q1-2012Q3, constrained by the availability of the data for the euro area. For individual country-SVARs our samples are longer and vary according to the availability of data for country-specific variables. We present details for each sample along the results. We provide inference through the median response and its 68% posterior distribution, based on 2000 draws. VAR coefficients are drawn from a normal-inverse-Wishart distribution with uninformative prior. The optimal lag is selected based on the BIC information criteria.

## 3.2 Results and discussion

In the following we present the results from the estimation of the US-euro area panel-SVAR and the country specific SVARs. In all figures, the solid line, in black, denotes the point-wise posterior median impulse response from the estimated SVARs and the shaded area represents the corresponding 68 percent posterior distribution. Figure 3 reports the impulse responses of policy uncertainty, real GDP, and five- and one- year ahead inflation expectations to a positive innovation to policy-related uncertainty, from the estimation of the US-euro area panel-SVAR. Panel (a) presents the responses to an overall policy uncertainty shock and panel (b) and (c) the responses to a monetary policy- and to a fiscal policy-related uncertainty shock, respectively.

In all three panels of Figure 3, a one standard deviation innovation in the respective measure of policy uncertainty is associated with an economic contraction. Real GDP

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<sup>14</sup>Our variables of interest are available in different frequencies (monthly, quarterly and biannual) and we use them all at quarterly frequency. Biannual data are linearly interpolated to monthly frequency. Then for all monthly series we use the end quarter observation. We have estimated our SVARs in monthly and biannual frequency as well and the results are comparable.

declines for about three quarters and the recovery phase lasts long, up to 20 quarters. On the other hand, individual SVARs for the US and the euro area reveal the same information, although the GDP contraction appears on impact in the case of the US and delayed for the euro area (see Figure 4). Germany and the UK also show signs of contraction given a policy uncertainty shock but not a statistically significant one.

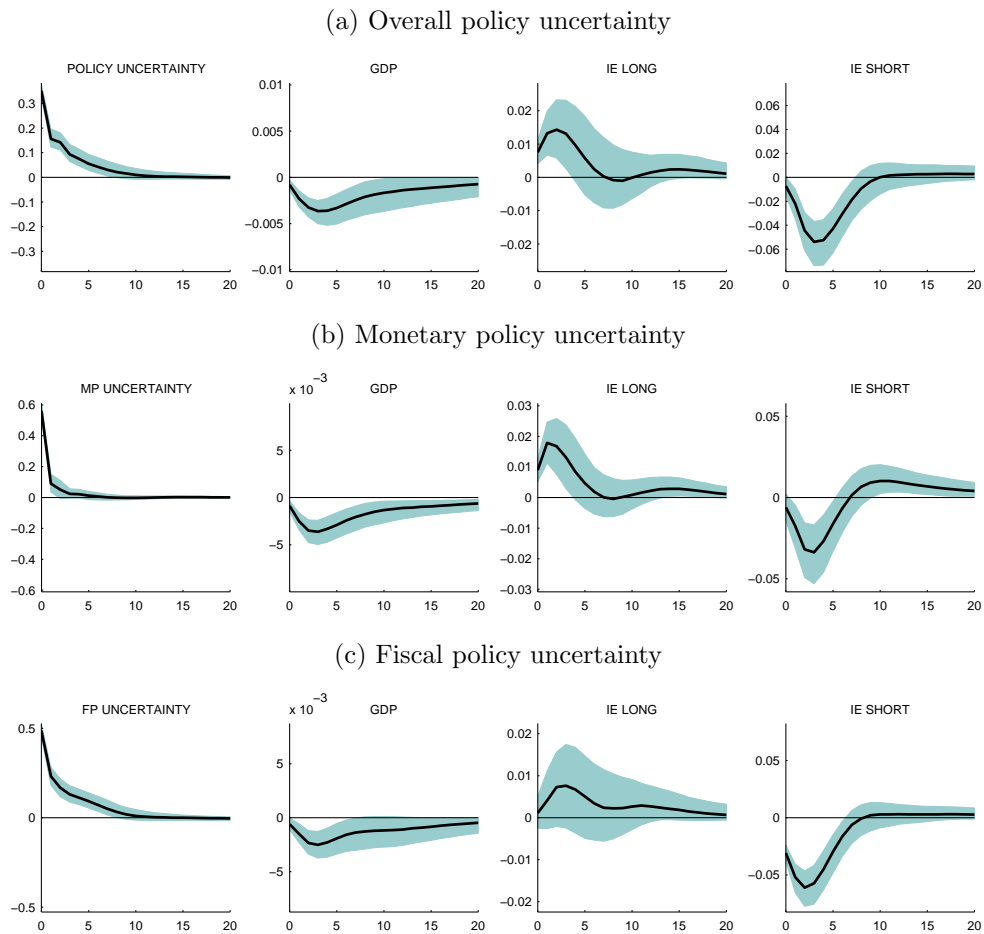
Furthermore, in all panels of Figure 3, we observe an immediate jump in the median response of long-term inflation expectations followed by an additional rise for about two to three quarters. The rise appears slightly stronger in response to a monetary policy related uncertainty shock. On the other hand, the evidence from individual SVARs is mixed. For Germany and the UK, the median response of inflation expectations is delayed, stronger and persistent. For the US, the median response of long-term inflation expectations is persistent but not statistically significant. For the euro area, the jump in long-term inflation expectations is short lived, followed by an undershooting.

The response of short-term inflation expectations to policy uncertainty shocks is, except for the UK, negative. This reflects the slack economy. When compared with the response of long-term inflation expectations, they show a higher degree of responsiveness and volatility. In fact, such behavior is expected. For central banks it is important that these movements do not feed into long-term inflation expectations. Keeping in mind that short-term inflation expectations are usually highly correlated with actual inflation, we could argue that the Cholesky-identified policy uncertainty shocks produce “demand-side” effects on output and prices. For the UK, the responses are more in the direction of “supply-side” effects.

Specific policy uncertainty shocks produce qualitatively comparable responses for the real GDP and inflation expectations. For the US and the euro area panel, the decline of short-term inflation expectations is immediate and stronger especially for the case when uncertainty is related with fiscal policy. Such uncertainty appears to be important even for the dynamics of long-term inflation expectations in Germany and UK (see Figures 14 and 15 in the Appendix). On the other hand, differently from the cases observed so far, a monetary policy uncertainty shock in the UK leads to a permanent decline in long-term inflation expectations.

Further, we augment our econometric model by including the short-term interest rate in the vector of variables for the SVAR estimation. Using this version of the model we are able to additionally observe the reaction of monetary policy to a Cholesky-identified policy uncertainty shock. The results for the US-euro area panel-SVAR are presented in Figure

Figure 3: IRFs to a policy uncertainty shock for the US-euro area panel-VAR

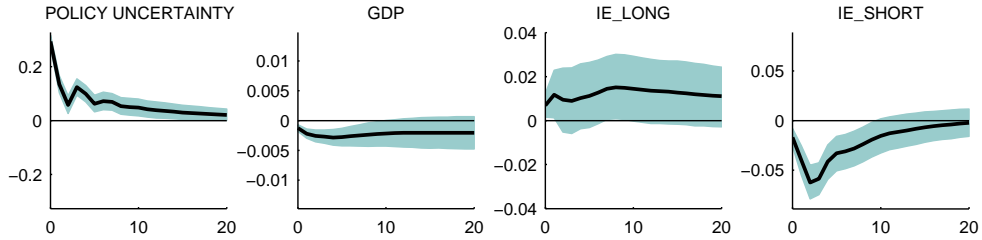


*Notes:* The solid line in black denotes median impulse response from the estimated VAR(2) for the US - euro area panel and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, crude oil prices. Policy uncertainty and GDP are in log levels. IE Long and IE Short represent five- and one- year ahead inflation expectations, in percent. Period: 1999Q1-2012Q3. Horizontal axis is lag horizon in quarters.

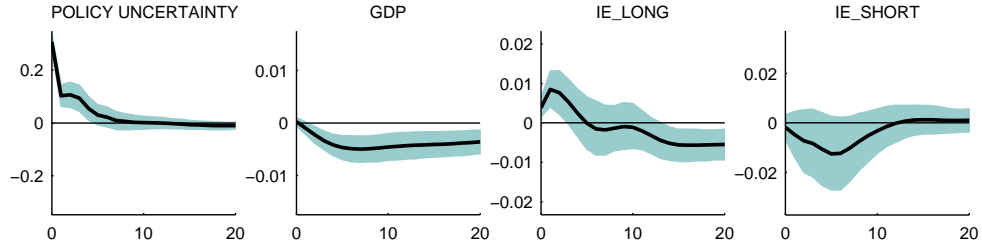


Figure 4: IRFs to overall policy uncertainty shock for country SVARs

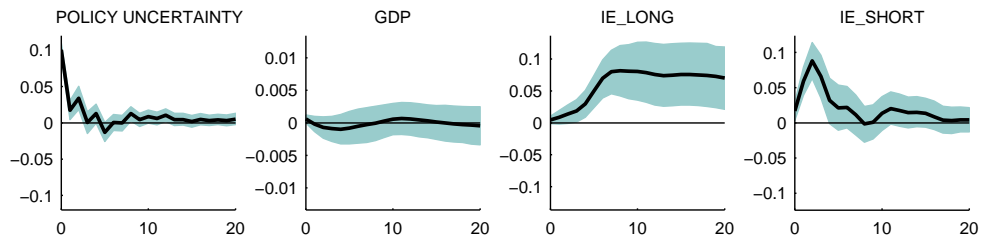
(a) US



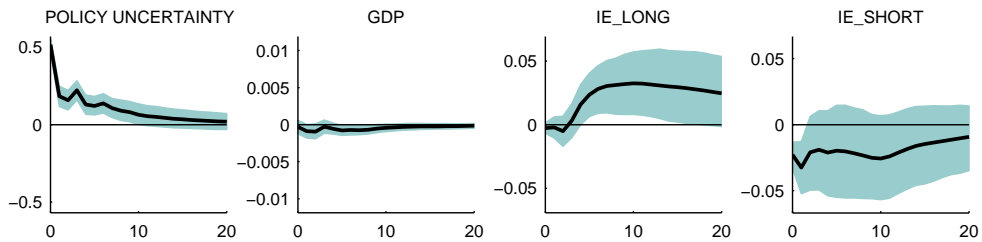
(b) Euro area



(c) UK



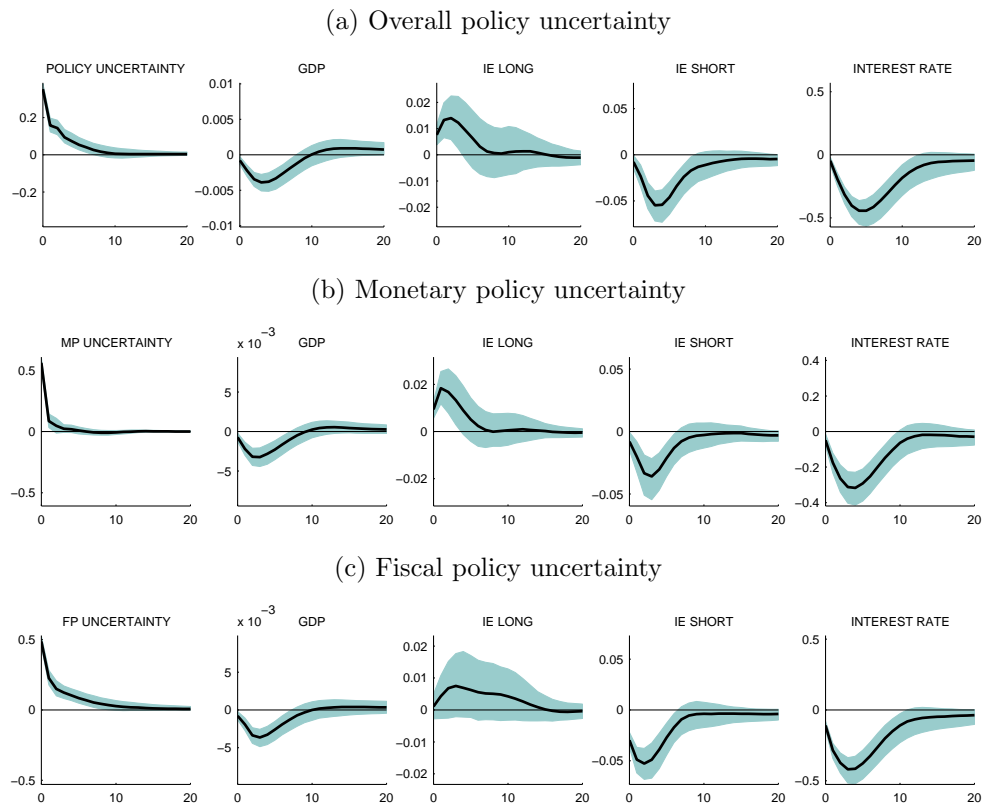
(d) Germany



*Notes:* The solid line in black denotes median impulse response from the estimated country specific SVARs(3) and the shaded area the corresponds to the 68 percent error band. Policy uncertainty and GDP are in log levels. IE Long and IE Short represent five- and one- year ahead inflation expectations, in percent. The period considered in the estimations differs across countries: 1990Q1-2012Q3 (US), 1999Q2-2012Q3 (euro area), 1998Q1-2012Q3 (UK), and 1994Q1-2012 (Germany). The exogenous variable included in the US SVAR is crude oil prices whereas in the other SVARs it is the log of US industrial production. Horizontal axis is lag horizon in quarters.

5. Central banks respond with lowering interest rates strongly given a positive innovation to all types of policy uncertainty measures that we consider. This move resembles the response of a central bank that follows a typical Taylor rule, accommodating the economy in response to falling output and prices. Under this model, the persistence in the response of output and the magnitude of short-term inflation expectations are slightly different. When monetary policy is taken into account, output rebounds faster (after 10 quarters) and the drop in short-term inflation expectations is slightly smaller. On the other hand, there is no difference in the response of long-term inflation expectations. Again, they rise immediately given policy uncertainty shocks, with the response being slightly stronger to monetary policy-related uncertainty.

Figure 5: IRFs to a policy uncertainty shock identified with Cholesky



*Notes:* The solid line in black denotes median impulse response from the estimated VAR(2) for US - euro area panel and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, crude oil prices. Policy uncertainty and GDP are in log levels. IE Long and IE Short represent five- and one- year ahead inflation expectations, in percent. Period: 1999Q1-2012Q3. Horizontal axis is lag horizon in quarters.

The GDP decline, immediate or not, and its relatively quick reversal seem to be in line with previous findings in both the theoretical and the empirical literature on the

macroeconomic effects of uncertainty shocks. The magnitudes are also comparable.<sup>15</sup> The empirical finding on the effect of specific types of policy uncertainty is new to the literature. We find that monetary- and fiscal policy-related uncertainties are equally harmful to economic growth. Different channels through which policy uncertainty affects economic activity could be at work, such as the precautionary saving motive or the "wait and see" dynamics, the former affecting negatively aggregate consumption and the latter affecting investment.<sup>16</sup>

With regard to long-term inflation expectations, theory and evidence suggest that in an environment of well-anchored expectations, temporary news or shocks to economic variables, should not have an effect on them. However, they appear sensitive to policy uncertainty shocks in our SVAR analysis. We observe that long-term inflation expectations increase and that is statistically significant in most cases. A rise of long-term inflation expectations at times of economic contraction suggests that heightened policy uncertainty indeed raises concerns about an increase in future inflation. Furthermore, our results show that monetary policy-related uncertainty does not seem to always be the reason for this.

This result is new to the empirical literature and compatible with the predictions of recent theoretical models that study inflation expectations in relation with changes in policy (see Eusepi and Preston (2010) and Bianchi and Melosi (2012), among others). For instance, Bianchi and Melosi (2012) build a DSGE model where under incomplete information, inflation expectations risk becoming unanchored as monetary policy shifts between periods of active inflation stabilization (active regime) and periods during which the emphasis is mainly on output stabilization (passive regime). Deviations from low inflation policies are not penalized immediately because agents are "optimistic" that the deviation is short lasting. Once there is uncertainty about the duration of the passive regime, inflation expectations rise.

Moreover, the opposite directions of the responses of short- and long-term inflation expectations to a policy uncertainty shock provide us with further evidence on low probability events (i.e. policy regime switches) being taken into account when forming expectations.

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<sup>15</sup>The majority of previous studies in the literature have considered the response to a two standard deviation innovation of such shocks, to approximate the level of uncertainty that was observed during the recent crisis.

<sup>16</sup>The idea behind this concept is that in the presence of high uncertainty and adjustment frictions, firms pause hiring and investment, and wait for calmer periods to expand. Under these conditions, production falls but pick-ups quickly due to pent-up demand for production factors (Bernanke (1983), Dixit and Pindyck (1994), Bloom (2009) and Bloom et al. (2012)).

For example, agents might believe that there is a likelihood of switching to a high inflation regime, hence long-term inflation expectations rise. But because this regime has a low probability of occurring it is unlikely that we observe it in our data sample. Therefore, short-term inflation expectations do not rise on medium term.

Overall, we argue that even though the commitment of central banks to a stable and low inflation has not changed, agents seem to perceive that it would be more difficult for central banks to achieve their targets. Such a scenario is likely when taking into account the unprecedented policies monetary authorities took in response to the recent crisis and the problems with large fiscal deficits; if they are not well-managed they risk fueling inflationary pressures.

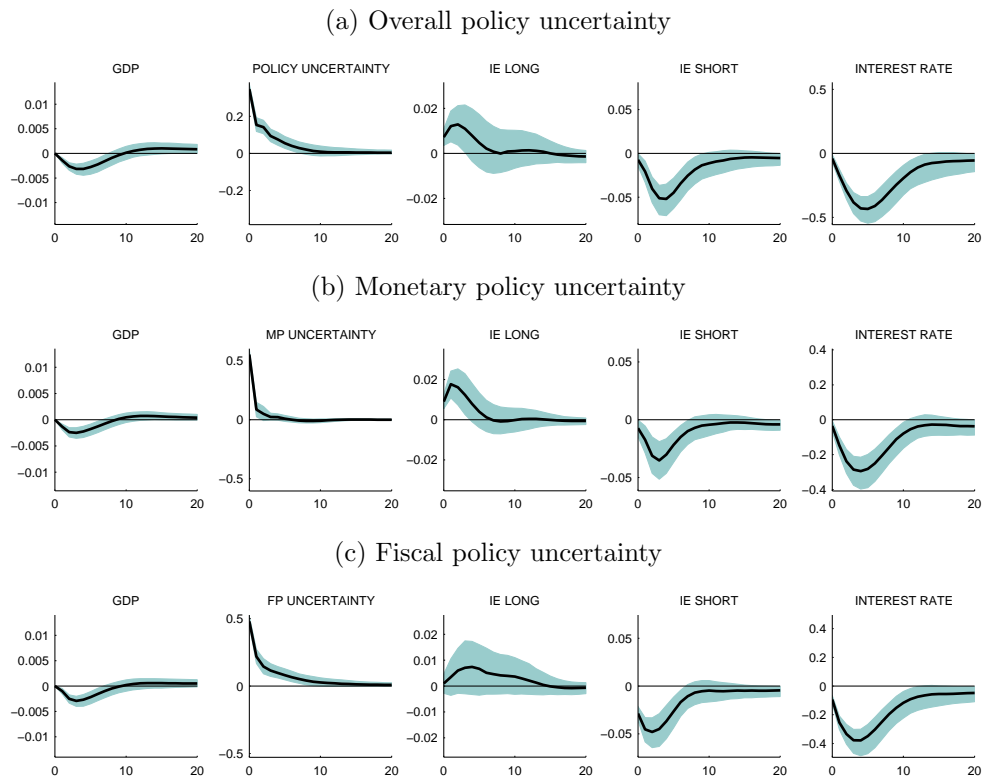
### 3.3 Robustness checks

We already showed that the results of our analysis are robust to expanding the model to a five variable SVAR. In the following, we perform two additional robustness checks, one related with the re-ordering of the variables in the SVAR and the other related with the use of a different measure for inflation expectations. As discussed above, the identification of uncertainty shocks is recent and a consensus on the best identifying restrictions is yet to be reached in the literature. In our benchmark identification, policy uncertainty responds immediately only to its innovations and with a delay to other shocks. In Figure 6 we show the results from the panel SVAR where this assumption is relaxed and the ordering of the variables is:  $y_t, pu_t, ie_{t+5|t}, ie_{t+2|t}$ . Under this ordering, policy uncertainty is allowed to be affected immediately by a shock that hits the economy. Furthermore, an innovation to policy uncertainty is assumed to have an immediate effect on inflation expectations while real GDP responds with a delay to it.

The responses presented in the Figure 6 show that the results from the baseline analysis hold even when the assumption on the exogeneity of the policy uncertainty variable is relaxed. Compatible with the restrictions imposed by the new ordering, the response of the real GDP is delayed. Still, the GDP contracts for about three quarters given a policy uncertainty shock. All the previous results on the responses of inflation expectations and interest rates hold as well.

Next, we check whether the results from the baseline analysis hold if inflation expectations are measured by the Survey of Professional Forecasters (SPF) of the Federal Reserve Bank

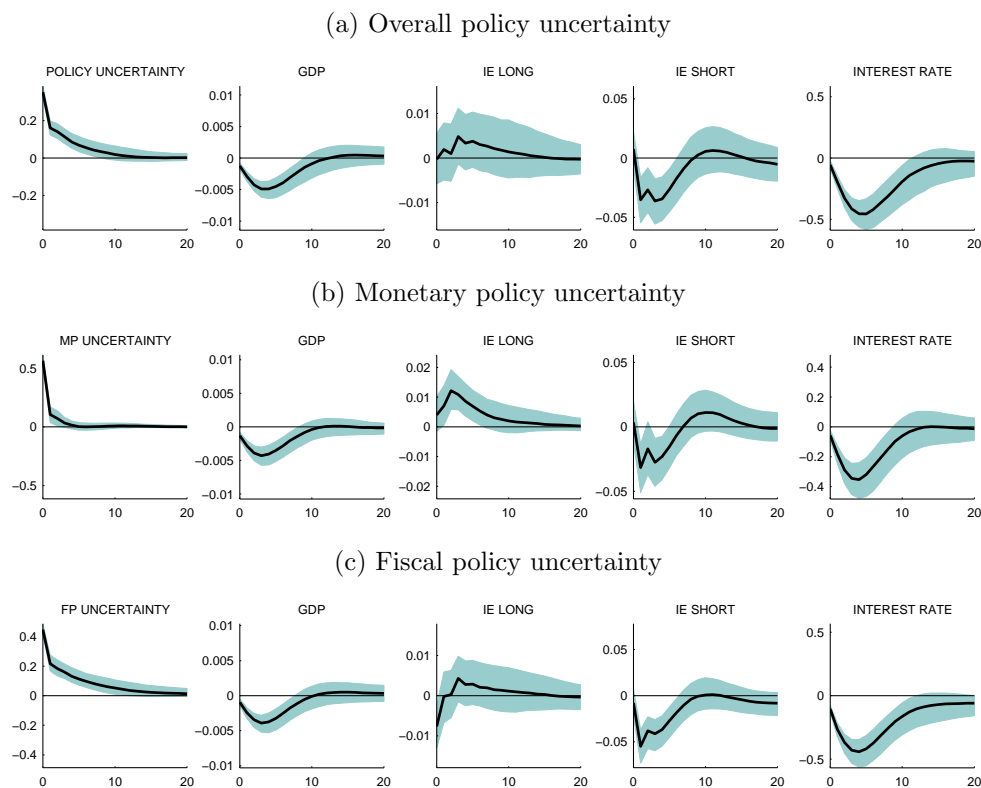
Figure 6: IRFs to a policy uncertainty shock for the US-euro area panel-VAR: Alternative identification



*Notes:* The solid line in black denotes median impulse response from the estimated VAR(2) for US - euro area panel and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, crude oil prices. Policy uncertainty and GDP are in log levels. IE Long and IE Short represent five- and one- year ahead inflation expectations, in percent. Period: 1999Q1-2012Q3. Horizontal axis is lag horizon in quarters.

of Philadelphia and the ECB, respectively. The SPF's respondents are usually banks, universities, financial firms, consulting groups, and economic forecasters at large companies. Sometimes they overlap with the respondents of the Consensus Economics but in general the composition is different. Furthermore, in the case of the Fed's SPF, long-term inflation expectations refer to expectations over the next ten years.<sup>17</sup> In the case of the ECB's SPF, long-term inflation expectations refer to expectations five years ahead, the same period as in the Consensus Economics survey.

Figure 7: IRFs to a policy uncertainty shock for the US-euro area panel-VAR with SPF expectations



*Notes:* The solid line in black denotes median impulse response from the estimated VAR(2) for US - euro area panel and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, crude oil prices. Policy uncertainty and GDP are in log levels. IE Long for US corresponds to ten years ahead inflation expectations while for euro area it represent five years ahead inflation expectations. In both cases, IE Short represents one year ahead inflation expectations, in percent. Period: 2000Q1-2012Q3. Source of inflation expectations, SPF of Fed Philadelphia and ECB. Horizontal axis is lag horizon in quarters.

Another option would be to also check for the effect of policy uncertainty shocks on the financial market-based inflation expectations, the so-called breakeven inflation rates

<sup>17</sup>Starting from 2005, SPF Fed is also collecting the inflation expectations over the next five years.

(BEIRs) resulting from the difference between nominal Treasury bonds and Treasury inflation-protected securities. Although BEIRs are attractive because of their availability in high frequency, two issues arise. First, these rates do not reflect only inflation risks but also liquidity and risk premium concerns. Second, even though the literature offers methods to distinguish the inflation expectations component from the other two risks, there is still no consensus about the best way of doing this.

Figure 7 reports the responses of our variables of interest to an innovation to policy uncertainty for the US and euro area panel. The SVAR results show that long-term inflation expectations measured by the SPF are less sensitive to overall policy uncertainty. On the other hand, monetary policy-related uncertainty continues to play an important role for their dynamics. The results related with output, interest rate and short-term inflation expectations remain the same as in the benchmark estimation.

## 4 Concluding remarks

We bridge the existing empirical literature on the macroeconomic effects of uncertainty shocks and the empirical literature on inflation expectations and provide first evidence on the effects of policy-related uncertainty, coming from extraordinary events and actions of decision makers, on beliefs and perceptions of agents towards them. Previous studies have shown that policy uncertainty is harmful for investments, consumption and employment. In this paper we show that the observed uncertainty about the stance and perceived effectiveness of policy should be troubling for central bankers<sup>18</sup> as it seems to entail additional risks to their hard-won inflation credibility.

Using SVARs we investigate whether policy-related uncertainty, as quantified by Baker et al. (2012), has fed into inflation expectations in the US, UK, Germany and the euro area. We find that while economic activity contracts, long-term inflation expectations rise in response to a policy-related uncertainty shock. This finding is robust when we consider different countries, more specific measures for policy uncertainty, different measures of inflation expectations, and different orderings of the variables in the SVARs. Our results show that long-term inflation expectations of professional forecasters are not perfectly anchored and that policy-related uncertainty poses upside risks to them.

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<sup>18</sup>Governor of Bank of Canada, Mark Carney, made such a remark on policy uncertainty in his speech “Uncertainty and Global Recovery” in October 2012, at Vancouver Island Economic Summit.

Given that well-anchored long-term inflation expectations reflect the credibility of monetary policy, we find support for the hypothesis that, in an environment of increased policy uncertainty, agents begin to question the ability and the commitment of policy makers to deliver on their promises. This result is of current relevance especially for central banks conducting policy in an environment of near-zero interest rates. The credibility of central bank's commitment in the eyes of the public becomes crucial for the success of monetary policy at the zero lower bound. But credibility is in doubt when there exists uncertainty about the details of the policy put in place, its effectiveness, the firmness of the commitment to future policies but also uncertainty about other policies (i.e. fiscal). A clear communication on what policy makers can do and what they know, a prompt response to present challenges, and a long-term consistency of policies would help reduce policy uncertainty.

In this paper we study the expectations of professional forecasters, which are some of the most informed agents in the economy. However, it would also be interesting to study how general public's expectations and perceptions towards central banks are affected by policy uncertainty. Examining this issue is of interest for several reasons: the general public constitutes a large proportion of the agents in the economy, they are generally less financially literate than the professional forecasters, and they are more likely to get the information from and be influenced by the media. Particularly, one could study the role of policy uncertainty for the dynamics of trust in the ECB and of satisfaction with the way BoE is doing its job to preserve price stability, given the negative trends observed in these measures during the last years. We plan to investigate this issues in future works.



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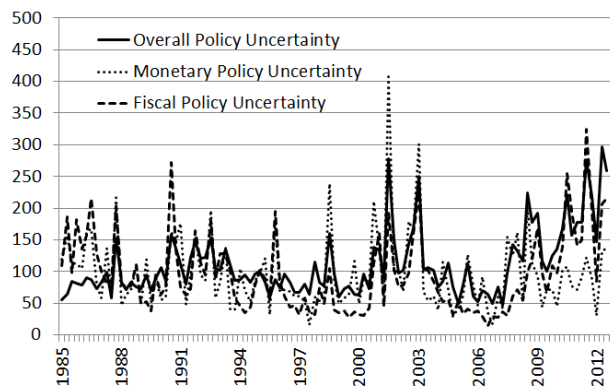
# APPENDIX

Table 2: Data description

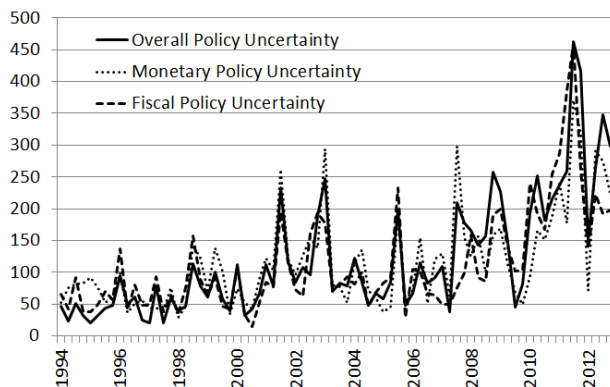
Variable	Description	Source	Frequency
Overall Policy Uncertainty	Based on two components. One component quantifies newspaper coverage of policy-related economic uncertainty. A second component uses disagreement among economic forecasters as a proxy for uncertainty.	Baker, Davis and Bloom (2012), data as in December 2012	Monthly
News-based Policy Uncertainty	The number of news articles containing the terms 'uncertain' or 'uncertainty', 'economic' or 'economy', as well as policy relevant terms (scaled by the smoothed number of articles containing 'today'). Policy relevant terms include: 'policy', 'tax', 'spending', 'regulation', 'central bank', 'budget', and 'deficit'.	Baker, Davis and Bloom (2012), data as in December 2012	Monthly
Monetary Policy Uncertainty	The number of news articles containing the terms 'uncertain' or 'uncertainty', 'economic' or 'economy', as well as monetary policy relevant terms (scaled by the smoothed number of articles containing 'today'). Monetary policy relevant terms include: 'monetary policy', 'interest rates', 'inflation', 'central bank'.	Baker, Davis and Bloom (2012), data as in December 2012	Monthly
Fiscal Policy Uncertainty	The number of news articles containing the terms uncertain or uncertainty, economic or economy, as well as fiscal policy relevant terms (scaled by the smoothed number of articles containing 'today'). Fiscal policy relevant terms include: 'fiscal policy', 'fiscal stimulus', 'stimulus debate', 'government debt', 'debt ceiling', 'tax', 'taxes', 'taxation', 'government spending', 'budget', and 'deficit'.	Baker, Davis and Bloom (2012), data as in December 2012	Monthly
Industrial Production	Industrial production index (2005 = 100).	Eurostat, Federal Reserve statistics	Monthly
Real GDP	Real Gross Domestic Product (chain-linked volumes, reference year 2005 (at 2005 exchange rates)), seasonally adjusted and adjusted data by working days.	Eurostat	Quarterly
Interest rates	Short term interest rates (3-month money market rates).	Eurostat	Quarterly
Net Trust - ECB	The difference between the share of respondents who state they tend to trust and the share of respondents who state they tend not to trust the ECB.	Eurobarometer surveys, European Commission	Biannual
Net Satisfaction - BoE	The difference between the shares of satisfied and non-satisfied respondents.	Bank of England	Quarterly
IE (+1), ..., (+6) - Europe and US	Inflation expectations for one, two, three, four, five and six to ten years ahead of professional forecasters.	Consensus Economics	Biannual
SPF (+1), (+2), (+5) - Europe	Inflation expectations for one, two and five years ahead of professional forecasters. Participants are asked to provide their expectations for the calendar year x years ahead.	Survey of Professional Forecasters (ECB)	Quarterly
SPF (+1), (+2), (+5), (+10) - US	Forecasts for the annual average rate of CPI inflation over the next one, two, five and 10 years of professional forecasters.	Survey of Professional Forecasters (Philadelphia Fed)	Quarterly

Figure 8: Recent developments of news-based policy uncertainty

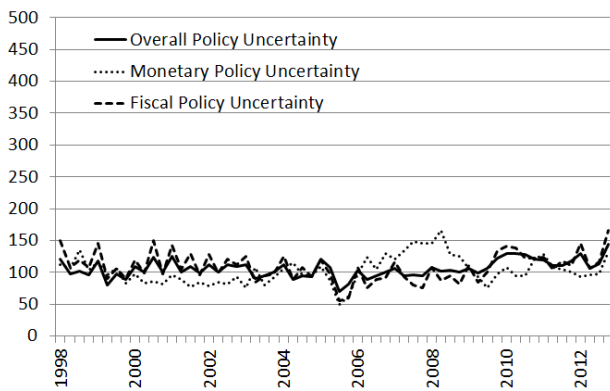
(a) United States



(b) Germany

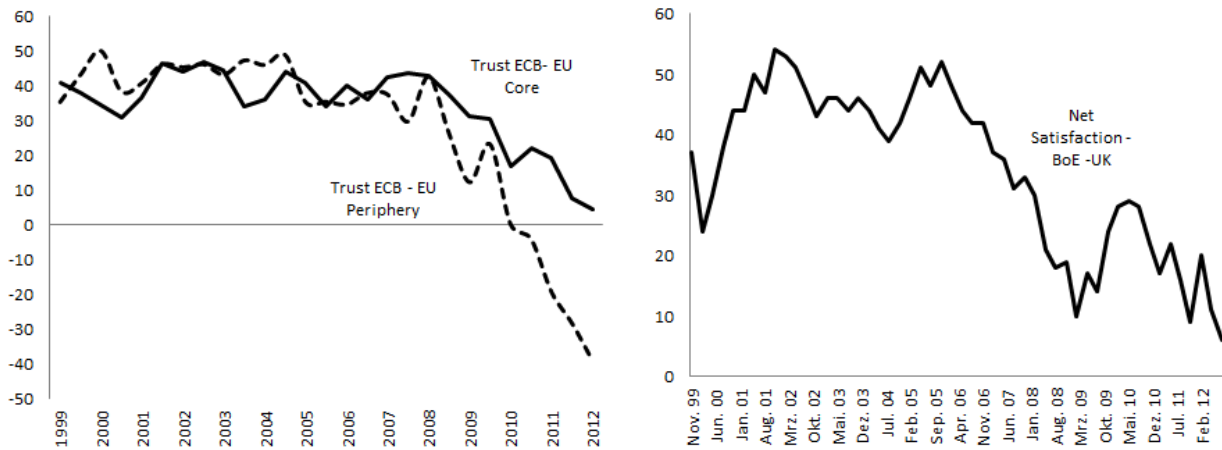


(c) United Kingdom



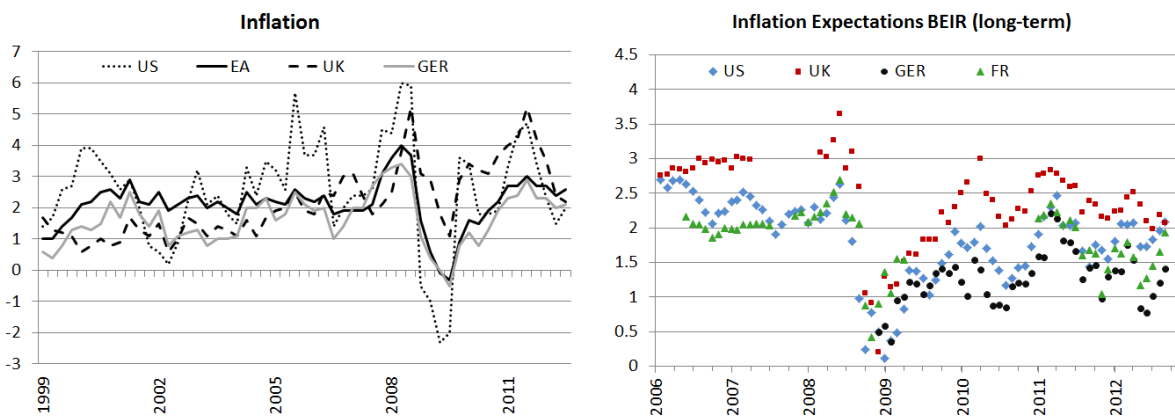
Notes: All the measures of policy uncertainty displayed above are newspaper-based measures and are taken from Baker et al. (2012)

Figure 9: General public opinion towards central banks in Europe



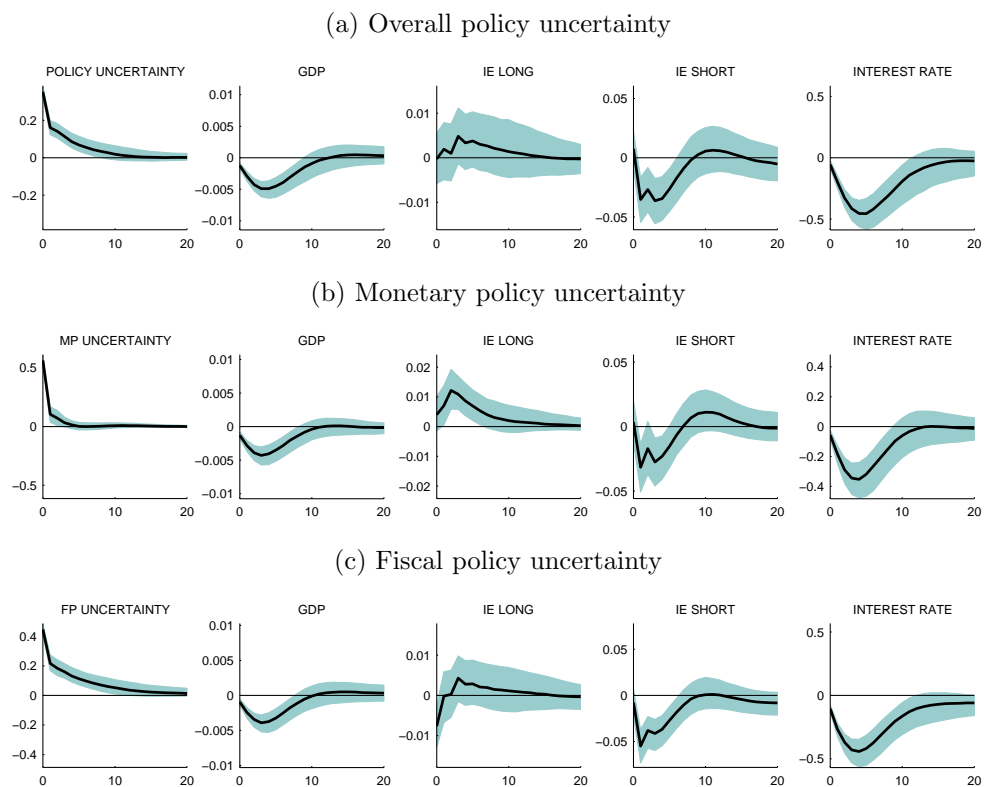
Notes: Net trust in the ECB is defined as the difference between the share of respondents who state they tend to trust and the share of respondents who state they tend to not trust the ECB. Net satisfaction with Bank of England (BoE) is the share of satisfied minus the dissatisfied respondents when asked to assess the way the BoE is doing its job to set interest rates to control inflation. Sources: Standard Eurobarometer Survey, BoE.

Figure 10: Recent developments of inflation and long-term market-based inflation expectations



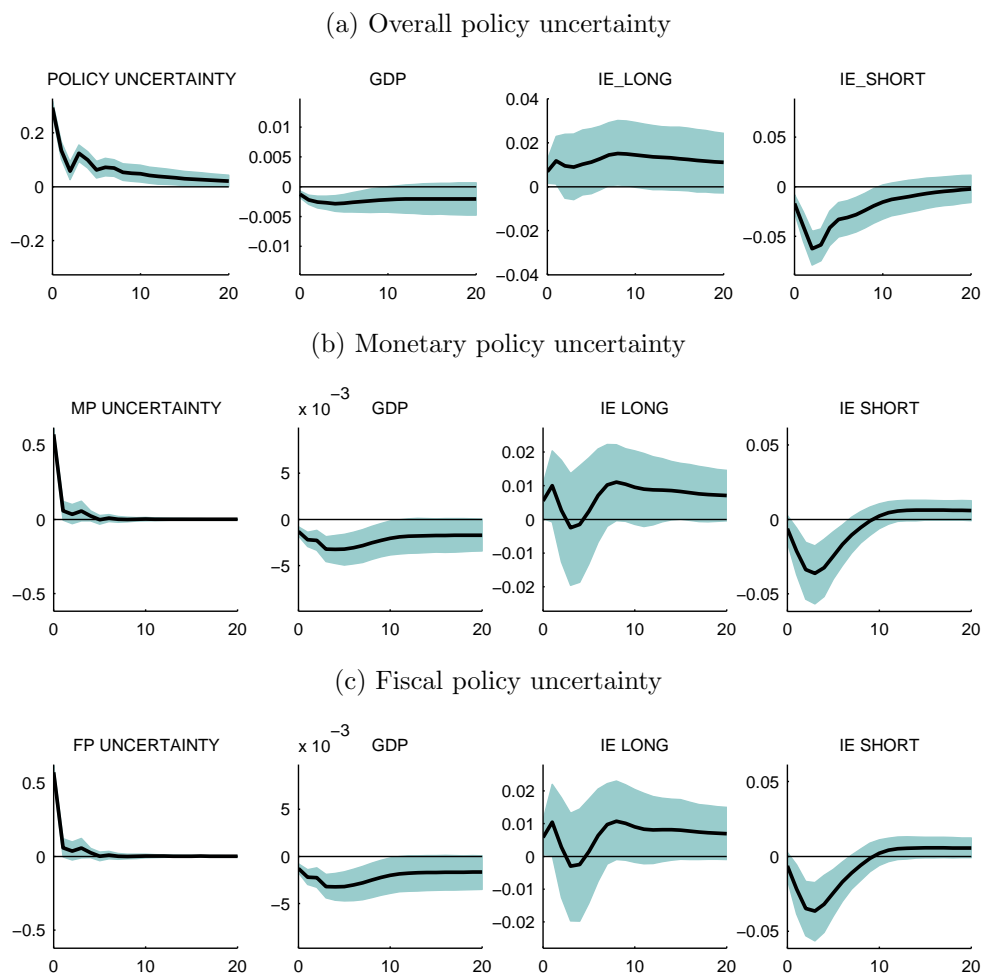
Notes: Actual inflation (HICP) and long-term (5 years ahead) Break Even Inflation Rates (BEIR). Source: Bloomberg .

Figure 11: IRFs to a policy uncertainty shock for the US-euro area VAR-panel with SPF expectations



*Notes:* The solid line in black denotes median impulse response from the estimated VAR(2) for US - euro area panel and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, crude oil prices. Policy uncertainty and GDP are in log levels. IE Long for US corresponds to ten years ahead inflation expectations while for euro area it represent five years ahead inflation expectations. In both cases, IE Short represents one year ahead inflation expectations, in percent. Period: 2000Q1-2012Q3. Source of inflation expectations, SPF of Fed Philadelphia and ECB. Horizontal axis is lag horizon in quarters.

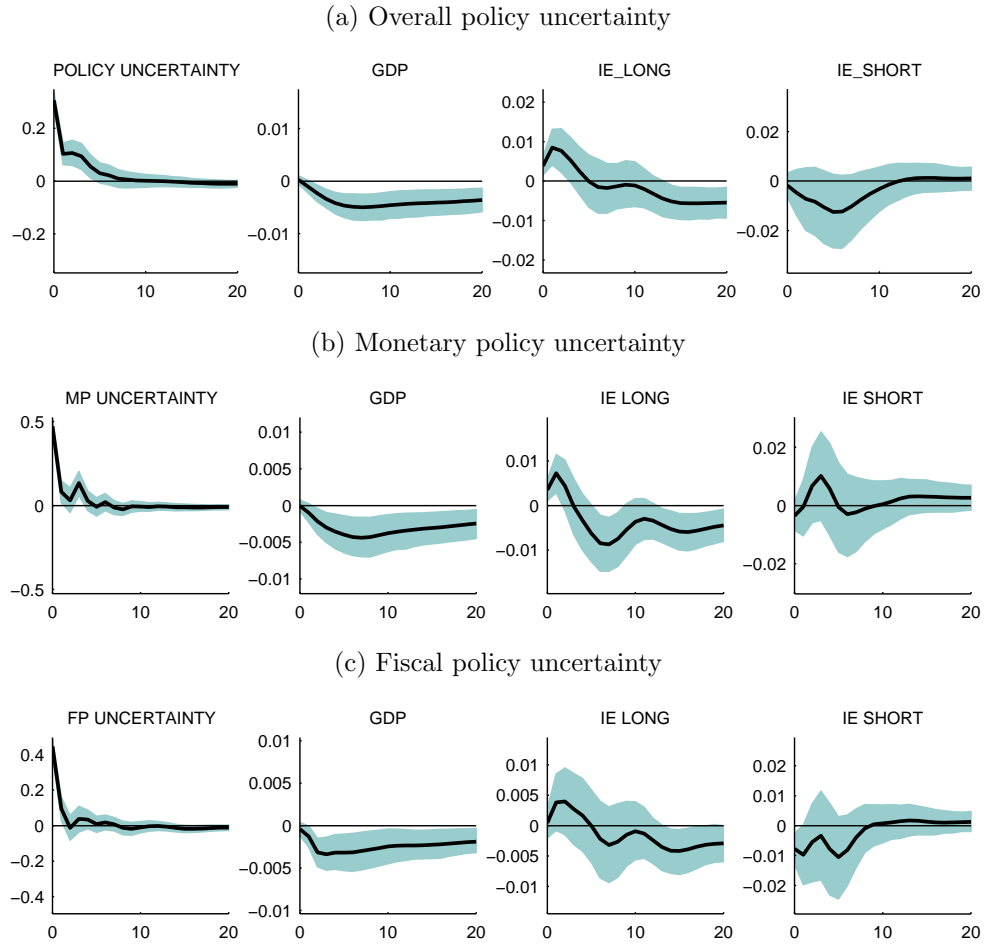
Figure 12: IRFs to a policy uncertainty shock for US



*Notes:* The solid line in black denotes median impulse response from the estimated VAR(3) and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, crude oil prices. Period: 1990Q1-2012Q3. Source of inflation expectations: Consensus Economic. Policy uncertainty and GDP are in log levels. IE Long corresponds to five years ahead inflation expectations and IE Short represents one year ahead inflation expectations, in percent. Horizontal axis is lag horizon in quarters.



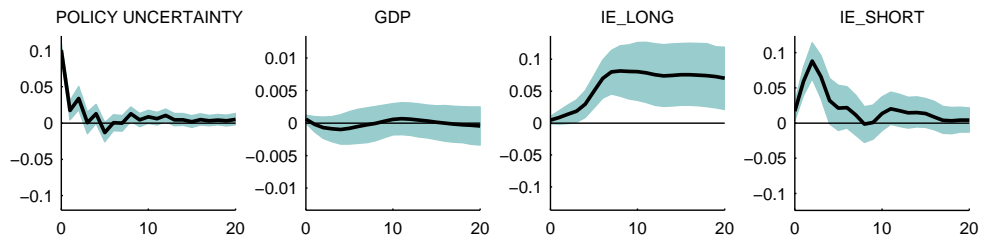
Figure 13: IRFs to a policy uncertainty shock for the euro area



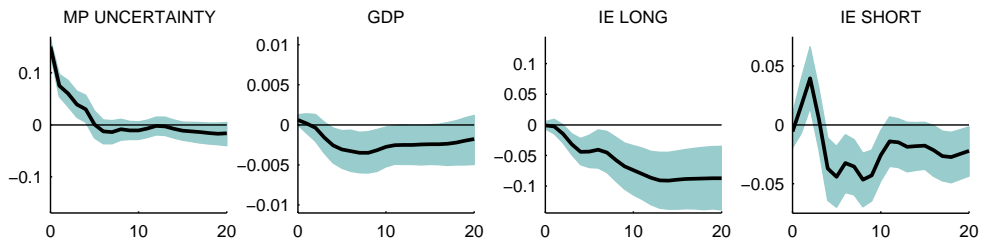
*Notes:* The solid line in black denotes median impulse response from the estimated VAR(3) and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, log industrial production of US. Period: 1999Q2-2012Q3. Source of inflation expectations: Consensus Economic. Policy uncertainty measures and GDP are in log levels. IE Long corresponds to five years ahead inflation expectations and IE Short represents one year ahead inflation expectations, in percent. Horizontal axis is lag horizon in quarters.

Figure 14: IRFs to a policy uncertainty shock for UK

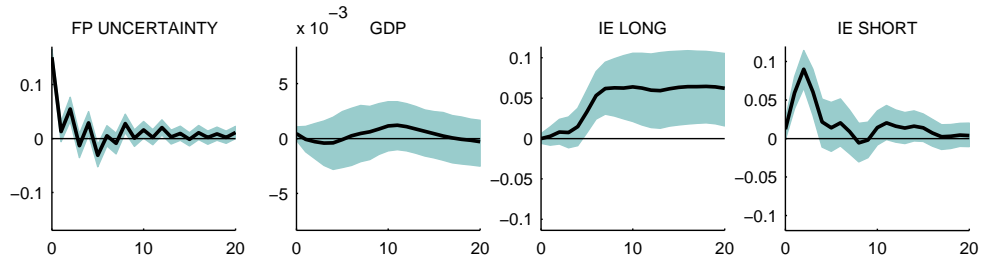
(a) Overall policy uncertainty



(b) Monetary policy uncertainty

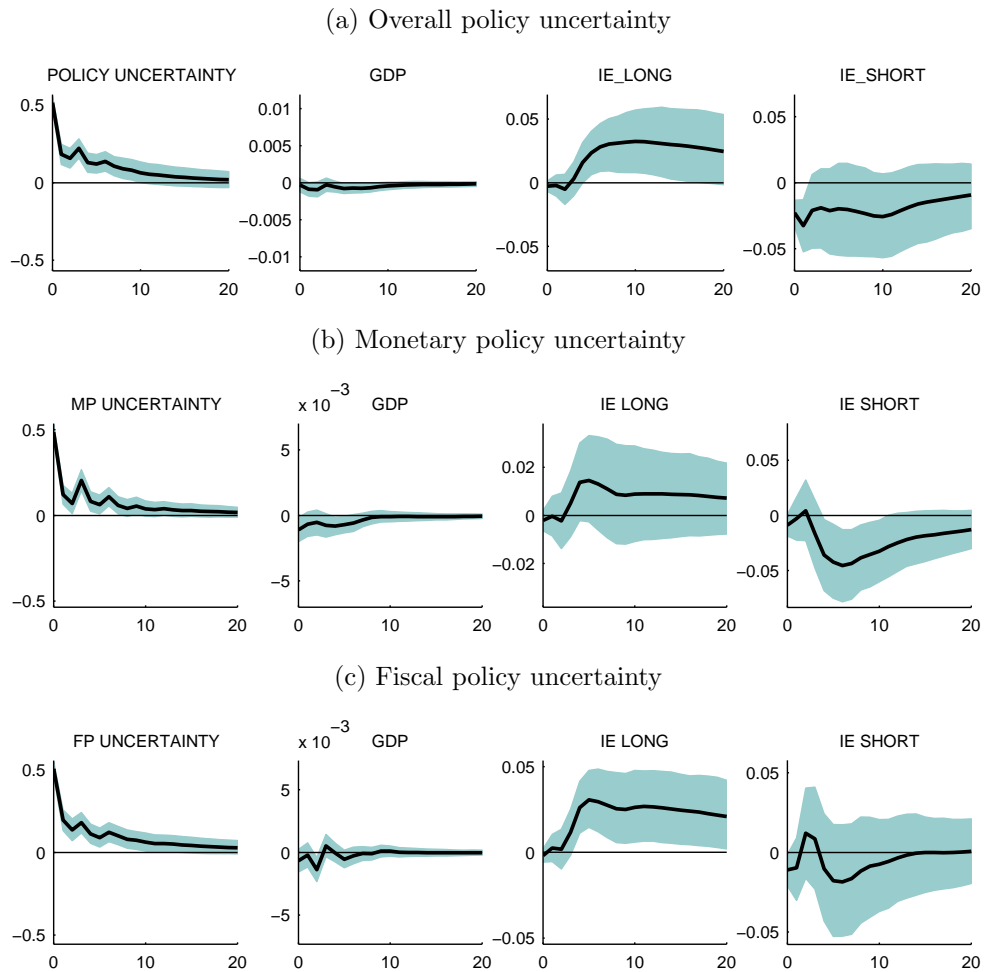


(c) Fiscal policy uncertainty



*Notes:* The solid line in black denotes median impulse response from the estimated VAR(3) and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, log of US industrial production. Period: 1998Q1-2012Q3. Source of inflation expectations: Consensus Economic. Policy uncertainty and GDP are in log levels. IE Long corresponds to five years ahead inflation expectations and IE Short represents one year ahead inflation expectations, in percent. Horizontal axis is lag horizon in quarters.

Figure 15: IRFs to a policy uncertainty shock for Germany



*Notes:* The solid line in black denotes median impulse response from the estimated VAR(3) and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, log of US industrial production. Period: 1994Q1-2012Q3. Source of inflation expectations: Consensus Economic. Policy uncertainty and GDP are in log levels. IE Long corresponds to five years ahead inflation expectations and IE Short represents one year ahead inflation expectations, in percent. Horizontal axis is lag horizon in quarters.