Economic Policy Uncertainty, Trust and Inflation Expectations*

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Abstract

Theory and evidence suggest that in an environment of well-anchored expectations, temporary news or shocks to economic variables, 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 sensible to policy-related uncertainty shocks. A rise of long-term inflation expectations in times of economic contraction, in response to such shocks, suggests that heightened policy uncertainty observed during the recent years indeed raises concerns about future inflation. Furthermore, both monetary and fiscal policy-related uncertainties are significant for the negative dynamics in citizens' trust in the ECB.

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1 Introduction

Policy-induced uncertainty is discussed by academics and market participants as being a prominent source of economic uncertainty during the recent crisis. In the latest World Economic Outlook (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 recessionary effects of uncertainty on economic activity[1]. So far the literature has focused on the effects of policy uncertainty on economic outcomes, such as output, investment, consumption and unemployment (see among others Baker, Bloom, and Davis (2012) and Fernandez-Villaverde, Guerron-Quintana, Rubio-Ramirez, and Uribe (2011b)). However, less is known whether such uncertainty has an effect on the beliefs and perceptions of agents about policies and institutions responsible for them[2]. In other words, whether uncertainty caused by economic policy undermines the credibility of policies and institutions. Our aim is to investigate this issue for monetary authorities and their policy. It is commonly stated, by academics and policy makers, that the anchoring of inflation expectations is the best way to check for the credibility of monetary policy[3]. Therefore, in this paper we provide empirical evidence on the dynamic relationship between policy-induced uncertainty and measures of short- and long-term inflation expectations.

Our investigation comes at times 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 to provide support to the transmission mechanism of monetary policy. Some 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[4]. Furthermore,

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[1]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, Bai, and Kehoe (2011), Gilchrist, Sim, and Zakrajsek (2011) and Christiano, Motto, and Rostagno (2011)), managerial risk aversion (Panousi and Papanikolaou (2011)) and precautionary motives.

[2]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 (2010) among others.

[3]"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)

[4]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.

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. Given this situation, our hypothesis is that in the light of increased overall policy uncertainty (not necessarily only uncertainty about monetary policy) the agents begin to question the ability (expertise) and the commitment of policy makers to their promises (targets). With respect to monetary authorities, this means to question their credibility. Shedding light on this issue is of great importance taking in account the role of credibility for policy effectiveness.

We estimate structural Bayesian VARs, linking policy uncertainty with inflation expectations while accounting for a measure of economic activity, for the US, UK, Germany and the euro area. Policy uncertainty is a new measure based on the index of Baker et al. (2012) and it is supposed to capture uncertainty about what policy action the decision makers will undertake, uncertainty about economic effects of current and future actions and/or inactions. This can be uncertainty about fiscal, monetary or other regulatory policies, altogether. In our estimations we account even for specific types of policy uncertainty and for the monetary policy reaction to uncertainty shocks. Regarding inflation expectations we use one- and five- years ahead inflation expectations of professional forecasters as measured by Consensus Economics.

We identify an innovation to policy uncertainty with a recursive identification strategy, where the impact response of policy uncertainty to other shocks is excluded, while an innovation to policy-induced uncertainty has an immediate effect on the variables ordered next. This assumption is in line with how policy uncertainty or other types of uncertainties are treated in theoretical models. Our results show that short- and long-term inflation expectations are sensitive to unexpected shocks to policy uncertainty. Short-term inflation expectations fall, reflecting the slack economy. On the other hand, long-term inflation expectations rise in response to these shocks. 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 and that long-term inflation expectations are not perfectly anchored. This result is fairly robust when looking at different countries and when taking into account more specific measures for policy uncertainty, different measures for inflation expectations and different orderings of the variables in the structural VARs.

In our estimations, monetary policy seems to face a trade-off between responding to the state of the economy and to long-run inflation expectations. Monetary policy responds to policy uncertainty shocks with lowering 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. When taking into account specific-types of policy uncertainty, our results show that 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. We find significant negative responses to policy uncertainty shocks even for measures of citizens perceptions on central banks, like trust in ECB and satisfaction with the way Bank of England does its job. In overall, these results support our hypothesis that in an environment of increased policy uncertainty the agents begin to question the ability and the commitment of policy makers to their promises.

Our work adds to the existing empirical literature of macroeconomic effects of uncertainty shocks (see Alexopoulos and Cohen (2009), Baker et al. (2012), Leduc and Liu (2012) and Bahmann and Sims (2012) among others) and to the empirical literature of inflation expectations (see Clark and Davig (2008) for a survey). We bridge these strands of literature by providing evidence on the effect of policy-related uncertainty on beliefs and perceptions of agents towards policy and policy makers. We confirm previous findings that uncertainty shocks generate economic contractions, at least for the US and the euro area. Our findings on the response of inflation expectations and other measures of citizens perceptions on central banks to such type of shocks are new to the literature. Furthermore, we use a novel data set on specific types of policy uncertainty to dig deeper on what type of uncertainty is more important for general public and professional forecasters perceptions. To our knowledge, we are the first to use this dataset and to undertake this type of analysis.

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

2   Economic policy uncertainty and citizens' beliefs on central banks

In this section we discuss the measurement and the evolution of economic policy-induced uncertainty along with public beliefs on central banks and inflation expectations. Episodes

that are considered to have generated policy uncertainty are discussed as well.

2.1   Economic policy-related uncertainty

Uncertainty is hard to quantify and most of the literature that studies the impact of uncertainty on economic activity has relied on proxy measures for it. These proxies can be generally 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. To our purpose we use the index of policy uncertainty as measured by Baker et al. (2012). It is an index constructed for several developed countries and is based on two components[5]: newspaper coverage of policy-related economic uncertainty and the disagreement of professional forecasters on 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 or/and inactions. This can be uncertainty about fiscal, monetary or other regulatory policies. Usages of this index are found as well in other empirical and theoretical works, see for example Leduc and Liu (2012), Bachmann, Elstner, and Sims (2012) and Fernandez-Villaverde, Guerron-Quintana, Kuester, and Rubio-Ramirez (2011a).

In our estimations we use only the news-based[6] component of the policy-related uncertainty index for several reasons. First of all, 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 as measured from Consensus Economics. Furthermore, a policy uncertainty measure based on news coverage has useful features for our analysis. It is a flexible approach that allows us to check for different categories of policy uncertainty, for e.g. uncertainty coming from monetary policy, fiscal or labor market policies. In this way, we are able to identify whether other kinds of policy uncertainty are affecting the beliefs of citizens on inflation expectations

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[5]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.

[6]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 (2008) for fiscal policy shocks and Doms and Morin (2004) explore the linkages between media coverage of economic events, consumers' perceptions, and economic outcomes.

and on the job of central bankers. Figure 1 shows the evolution of two of the uncertainty proxies we mentioned above, the news-based policy uncertainty and stock market volatility for the US, UK and the euro area (EA). Even though these measures are different, they both vary over time and have increased sharply during the recent crisis.

Figure 1: Recent developments of selected proxy measures for economic uncertainty
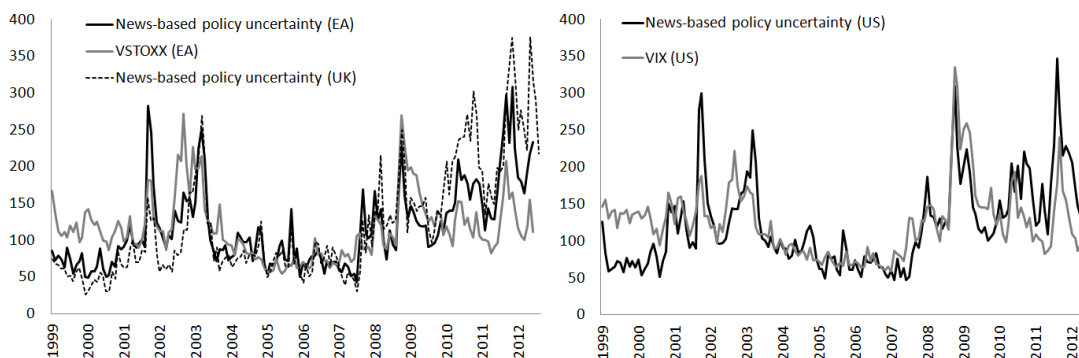
Notes: Newspaper-based policy uncertainty for euro area (EA), UK and US, as in Baker et al. (2012) and stock market volatility-based uncertainty for EA (VSTOXX) and US (VIX). The stock market volatility indices have been scaled such that they have the same mean with the news-based policy uncertainty indices for EA and US.

There have been increases in the levels of policy-induced uncertainty especially around events that had unsure outcomes. During the recent years, among the events surrounded by uncertainty that have led to concerns about the future economic outlooks one could mention: the haircut on the Greek debt, the French elections, the implementation of the SMP (Securities Market Programme) and the OMT (Outright Monetary Transactions) programs by the ECB, the decision to build the EFSF (European Financial Stabilization Fund) and then the ESM (European Stability Mechanism), the debates about a banking union in Europe, the elections in the US and the fiscal consolidation issues around the world. For instance, the uncertainty surrounding Greece and its political future (before the elections in 2012) has affected the investors decisions, as well as the financial markets. The situation remained alarmed over the euro zone crisis, despite Greek election results, because of the escalating problems in Spain and Italy.

During the recent years we have observed as well specific types of policies which have raised concerns and uncertainty, especially with respect to inflation expectations. For instance, there has been continuous criticism about the ECB acting beyond its mandate through the bond buying programs. These debates have raised concerns about a potential loss of the ECB independence and about the ECB being at risk of operating under fiscal

dominance. The possible loss of ECB independence may be perceived as a difficulty of the central bank to commit to its core-objectives and to ensure price stability in the long run. Another example of policy uncertainty that might feed into expectations, could be coming form the highly discussed exit strategies of the central banks that have implemented quantitative easing measures. If not done at the right time and in a careful manner, 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-induced uncertainty, these concerns have translated into public perceptions regarding policy makers and have affected inflation expectations.
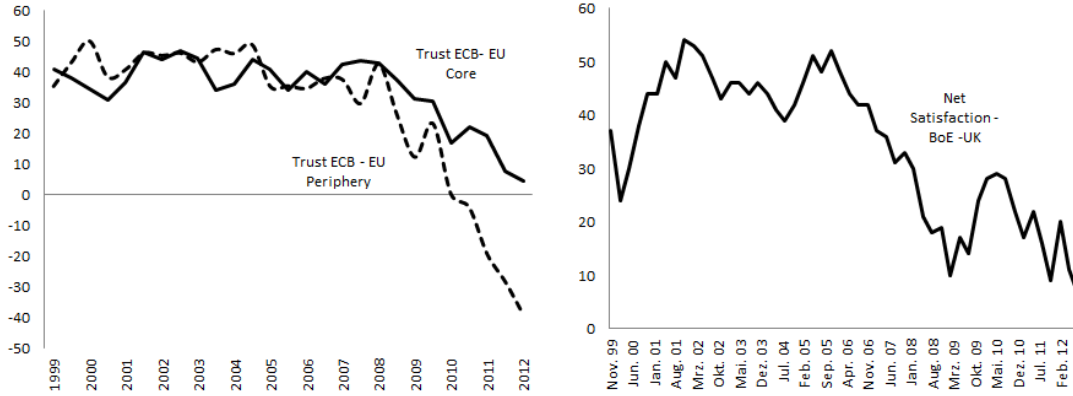
2.2 Public perceptions about central banks and inflation expectations

In the light of extraordinary events, monetary authorities around the world responded with very low interest rates and a wide range of unprecedented non-standard measures. However, the general public in Europe and the US share the feeling that monetary authorities did not respond appropriately to the challenges of the economic turndown and only a small part of the public was confident in their policies to manage the crisis (FT/Harris poll (2008, 2009)). Regular surveys on public opinion and attitudes in Europe show, as well, a clear declining trend in the measures of trust and satisfaction with the way central banks have been doing their job. This is bad news for policy makers since it appears that they are losing citizens' trust and support when mostly needed.

Public trust in central banks is important in order to have well-anchored inflation expectations, both in good and bad times. Trust also plays a crucial role for securing the legitimacy of an institution (Kaltenthaler, Anderson, and Miller (2010) and Kosfeld, Heinrichs, Zak, Fischbacher, and Fehr (2005)). Monetary authorities acknowledge that they depend on citizens trust to secure their independence and credibility. Furthermore, trust is particularly essential at times of crisis, when economic uncertainty increases markedly and policy makers might need flexibility to change tactics or take unpleasant actions (Blinder (2000)).

In the recent years, there has been a general loss of public trust in institutions. In Europe, the European Parliament, the European Commission and the European Union,

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Figure 2: General public opinion towards central banks in Europe

experienced a decline in institutional trust but this was less severe than in the case of the ECB. Between autumn of 2008 and the beginning of 2009 the drop in trust was equivalent to over seven times the standard deviation observed since 1999. Studies show that the ECB is being blamed by European citizens for the increases in inflation and unemployment and for the decrease in growth rates. They assume it also responsible for not being able to avoid the economic, financial and political turmoil in the last years (see Roth, Nowak-Lehmann, and Otter (2011) and Waelti (2012)).

On the other hand, there is no significant decline in the support that Europeans have for the euro currency (Roth, Jonung, and Nowak-Lehmann (2012)). Public support for the euro (which plays an important role for the sustainability of the monetary union) has maintained its relatively high level and it is only marginally affected by the crisis. This indicates that the European citizens support the idea of a single European currency but they are skeptical with respect to the crisis measures taken by the ECB. Satisfaction with the way central banks do their job has also deteriorated for central banks outside the euro area. As figure 2 shows, the net satisfaction of British citizens with the Bank of England has dropped considerably in the recent years.

Given the evidence of less positive public perceptions with respect to monetary authorities, it is important to see if these perceptions have been translated into inflation expectations. However, with respect to the general public, only measures of short-term

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inflation expectations are available (current and one year ahead expectations). Usually, short-term expectations are vulnerable to short time shocks and they present a higher volatility than the long-term expectations. Because long-term expectations can profoundly influence current economic behavior[7], monetary authorities monitor them carefully with the aim to maintain private sector expectations stable over the cycle, as well as to provide a long-term nominal anchor for the economy. Expectations that are poorly managed could represent an independent source of macroeconomic instability. Well-anchored long-term inflation expectations are key to the functioning of the monetary 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. 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).*

There are different measures of long-term inflation expectations: survey-based measures (form surveys of professional forecasters) and financial market-based measures (break-even inflation rates). Market-based inflation expectations are available at higher frequency and present a larger magnitude and volatility than the survey-based ones, as they also reflect short-term shocks to inflation. Measures extracted from inflation-linked financial market instruments are assumed to incorporate other factors in addition to perceptions towards the commitment of monetary authorities, such as information on risk premia as well as changes related to the trading conditions. The different measures of inflation expectations might reflect heterogeneities in the mechanism of expectations formation for different types of agents. 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.

As shown in figure 3, the evolution of survey-based measures of long-term inflation expectations has been different across countries during the recent crisis. Long-term inflation

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[7]Current economic behavior could be affected by changes in expectations through multiple channels. Higher inflation expectations apply an 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).

Figure 3: Recent developments of short- and long-term inflation expectations

Inflation Expectations SPF median (short-term)

Inflation Expectations SPF median (long-term)

Inflation Expectations CF (short-term)

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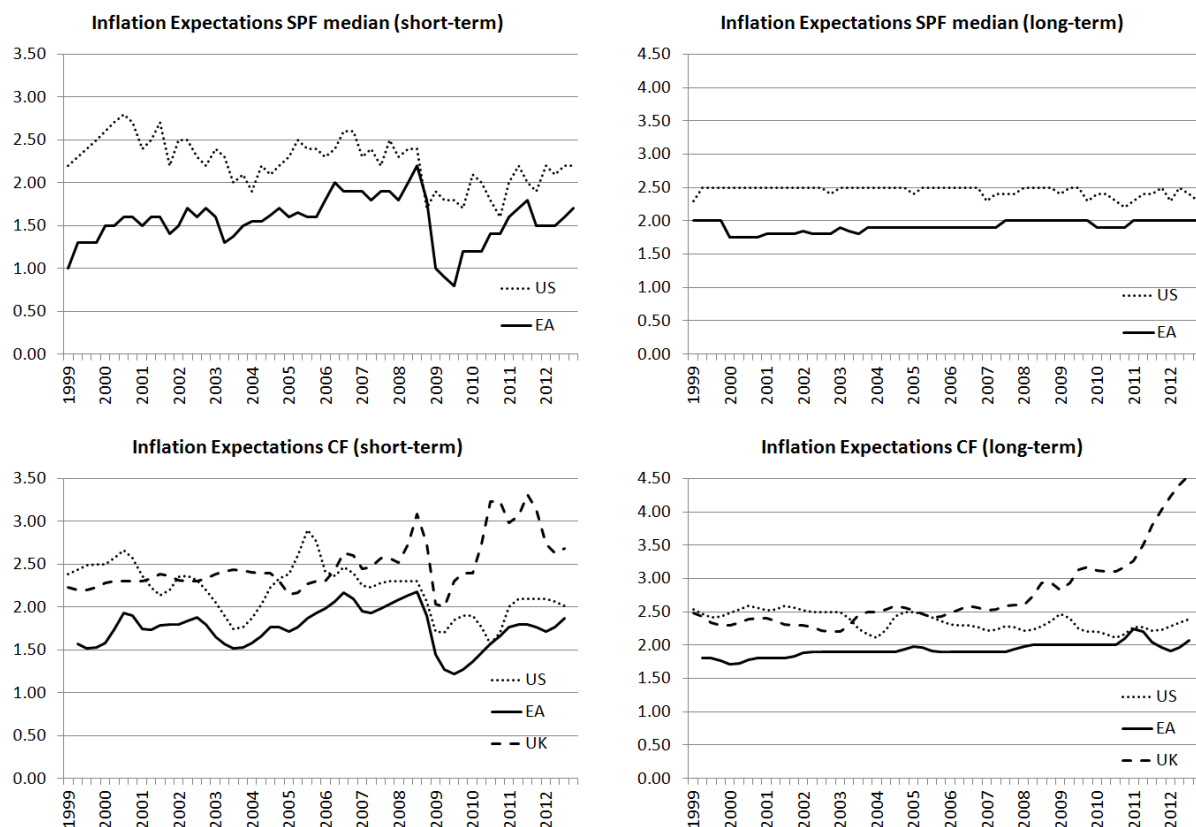
Notes: Long-term (5 years ahead) and short-term (1 year ahead) survey-based inflation expectations obtained from the SPF (Survey of Professional Forecasters) and from the CF (Consensus Forecasts).

expectations in the euro area, measured by the Consensus Forecasts, have generally been lower, during the last decade than in the UK and the US and have moved within a narrow band, being relatively stable. After the Lehman bankruptcy, long-term inflation expectations have shown a higher volatility. This volatility is observed as well in the case of expectations as collected in the Survey of Professional Forecasters (SPF) of Fed Philadelphia and the ECB but also the Euro Zone Barometer (see ECB Monthly Bulletin, July 2012). Several analyses on the development of inflation expectations during the crisis show that long-term inflation expectations may 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, Poelhekke, and Zhou (2011)). On the other hand, long-term market-based measures of inflation expecations have clearly been more volatile and more responsive to news in the post-Lehman period as they also incorporate other financial market related risks (for more details see the Appendix).

2.3   Linking economic policy uncertainty to public perceptions

In this subsection we report the contemporaneous correlations between our variables of interest. Such statistics will give us an idea about the relationship between economic policy uncertainty, trust and dissatisfaction measures, as well as with the whole term structure of inflation expectations. We observe a consistent countercyclical behavior of economic policy induced uncertainty with respect to economic activity, which is in line with previous findings (Bachmann et al. (2012), Bloom (2009) and Baker et al. (2012)). Moreover, our measure of uncertainty shows a consistently negative link to the satisfaction of citizens regarding monetary authorities (both in the case of the ECB and in the case of the BoE).

Short-term inflation expectations do not show clear correlations neither with trust, nor with policy induced uncertainty, when looking at the euro area. However, the correlations with net trust turn negative and get stronger the more forward looking the expectations are, meaning higher levels of trust are associated with lower inflation expectations. Strong correlations of satisfaction with longer term inflation expectations are also observed in the case of the UK. We also notice strong positive contemporaneous correlations between policy uncertainty and long-term inflation expectations in both the EA and the UK. High policy uncertainty seems to be more firmly related with the longer terms of inflation expectations. Thus, we can argue that trust and uncertainty are more strongly correlated with longer term inflation expectations and therefore with the credibility of central banks, in Europe. On the other hand, for the US, the correlation between news-based policy uncertainty and long-term inflation expectations is relatively low.

Table 1: Contemporaneous cross-correlations

| Variables | Euro area | | United Kingdom | | United States |
	Net Trust	News-based Policy Uncertainty	Net Satisfaction	News-based Policy Uncertainty	News-based Policy Uncertainty
News-based Policy Uncertainty	-0.5629***	1.0000	-0.3477**	1.0000	1.0000
GDP	0.2649*	-0.2792**	0.6453***	-0.1628	-0.3867***
IE (+1)	0.2213	-0.0101	-0.5120***	0.3412***	-0.2527**
IE (+2)	0.4159***	-0.0896	-0.6374***	0.3476***	-0.2101**
IE (+3)	-0.1101	0.2763**	-0.7901***	0.4177***	-0.1732
IE (+4)	-0.5461***	0.4456***	-0.8067***	0.4740***	-0.1534
IE (+5)	-0.6301***	0.4826***	-0.7947***	0.3998***	-0.1530
IE (+6 to 10)	-0.7220***	0.5753***	-0.7829***	0.4515***	-0.1784*

Notes: This table lists the contemporaneous unconditional contemporaneous correlations between the variables listed on the rows and our measures for uncertainty and public trust. The measures of public beliefs are illustrated by the trust in the ECB and the satisfaction with the BoE. "News-based Policy Uncertainty" is the news-based policy induced uncertainty index, as in Baker et al. (2012). "GDP" is the annual growth rate of real GDP. "IE (.)" stands for survey-based inflation expectations at different horizons (from one year ahead up to six to ten years ahead). For more details about the data please see the Appendix A. ***,** 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-induced uncertainty shocks on inflation expectations using VAR techniques. First we introduce the estimation methodology and the data used. Then, we present and discuss 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 the news-based overall policy uncertainty, y_t the real GDP and $ie_{t+5|t}$ and $ie_{t+1|t}$ the five- and one- year ahead inflation expectations, respectively. $A(L) \equiv I + A_1L - A_2L^2 - ...A_pL^p$ is the autoregressive lag order polynomial and ϵ_t represents the reduced-form errors with covariance matrix, $\sum_\epsilon$.

The structural VAR estimation with variables as in z_t will be followed by extensions

in several directions. With respect to the measure of policy uncertainty we extend our analysis to explore also the effects of specific-types of policy uncertainty, such as monetary or fiscal policy-induced uncertainty. 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. Instead, the specific measures are supposed to distinguish between different types of policy-related uncertainties. If the structural VAR estimations show that the overall policy uncertainty is significant for the dynamics of inflation expectations, being able to identify what type of policy is more responsible for these dynamics is important. On the other hand, specific-types of policy uncertainty could have a higher importance for the dynamics of certain variables, even when the overall policy uncertainty does not. Our framework allows us to study these options.

Measures of monetary policy- and fiscal policy-related uncertainty are constructed by Baker et al. (2012) only for the US, UK and Germany. To our knowledge we are the first to use this novel data set in the empirical literature of uncertainty shocks. In our analysis we will use the German specific measures of policy uncertainty as proxies for the specific uncertainties for the euro area. Taking into account that there is only one monetary policy in the euro area, a monetary policy uncertainty as measured in Germany is a reasonable proxy for the whole euro area. On the other hand, we can not argue the same for the fiscal policy-related uncertainty measure, even though during the crisis the discussions on fiscal policy in the euro area have been more or less in the same direction for all countries. Nevertheless, we acknowledge that in this case this is a poor proxy and comment on the results with caution[8].

The benchmark structural VAR allows us to study our question of interest in a parsimonious way, linking policy uncertainty with inflation expectations while accounting for a measure of economic activity. In a further step, we augment our econometric model in order to observe, in addition, 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 with respect to a different measure of inflation expectations, namely the expectations as measured by the Survey of Professional Forecasters (SPF)[9] of the Federal Reserve Bank of Philadelphia and of the ECB, respectively. Finally, we use a bivariate structural VAR for Germany and UK, to see how the dynamics of measures of trust in the ECB and satisfaction with the

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[8]Details on the construction of each index are presented in the Appendix.

[9]More details can be found in the Appendix.

Bank of England are affected by an innovation to policy uncertainty. Further details for each of the new VAR estimations will be discussed along the analysis.

The identification of uncertainty shocks is relatively new in the empirical literature. The existing literature has mostly relied on a recursive identification strategy for such shocks, see Alexopoulos and Cohen (2009), Baker et al. (2012), Leduc and Liu (2012) and Bahmann and Sims (2012)[10], among others. We use as well this identification strategy with the following ordering of the variables: $pu_t, y_t, ie_{t+5|t}, ie_{t+2|t}$. With this ordering, the impact response of policy uncertainty to other shocks is excluded while an innovation to policy-induced uncertainty has an immediate effect on the variables ordered next. To some degree[11], this assumption is in line with how policy uncertainty or other types of uncertainties are treated in theoretical models. For example, in Fernandez-Villaverde et al. (2011a) and in 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.

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-run inflation expectations are usually more volatile and responsive to temporary shocks and ordering them last allows for this possibility. When adding interest rates to the set of variables, we order them last. This allows monetary policy to be contemporaneously responsive to shocks hitting the economic activity and inflation expectations, which is usually the case in practice.

We estimate structural VARs for the US, UK, Germany and the euro area. The choice of countries is mostly 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 constructed by Baker et al. (2012). Quarterly, seasonally adjusted data on real GDP are taken from Eurostat. Inflation expectations are the respective 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

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[10]Bahmann and Sims (2012) have used in addition long-term restriction to identify uncertainty shocks.

[11]In DSGE models, as in Fernandez-Villaverde et al. (2011a) and Born and Pfeifer (2011) among others, the process for variables representing policy uncertainty or other types of uncertainties is exogenous. In the VAR considered here, the variable representing policy uncertainty is also a function of other variables included in the estimation, through the A(L).

expectations from Consensus Economics start relatively early, beginning of 90s, and are available for many countries. The drawback is the biannual frequency of the data.

In the following, we present 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 sample for the euro area data (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 on quarterly frequency[12]. 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. Optimal lag is selected based on the BIC information criteria.

## 3.2   Results and Discussion

Figure 4 reports the impulse responses of policy uncertainty, real GDP, and five- and one-year ahead inflation expectations to an innovation to policy-related uncertainty, from the estimation of the US-euro area panel-SVAR. In panel (a) of this figure we present the responses to an overall policy uncertainty shock and in the second and third panel the responses to a monetary policy- and a fiscal policy- related uncertainty shock, respectively. We present the same information for country-SVARs in the Appendix. 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.

In all three panels of figure 4, a one standard deviation innovation in the respective measure of policy uncertainty is associated with an economic contraction. The real GDP

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[12]Our variables of interest are available in different frequencies (monthly, quarterly and biannual) and we decided to use them all in 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 results are comparable.

Figure 4: IRFs to a policy uncertainty shock for the US-euro area panel-VAR

(a) Overall policy uncertainty

(b) Monetary policy uncertainty

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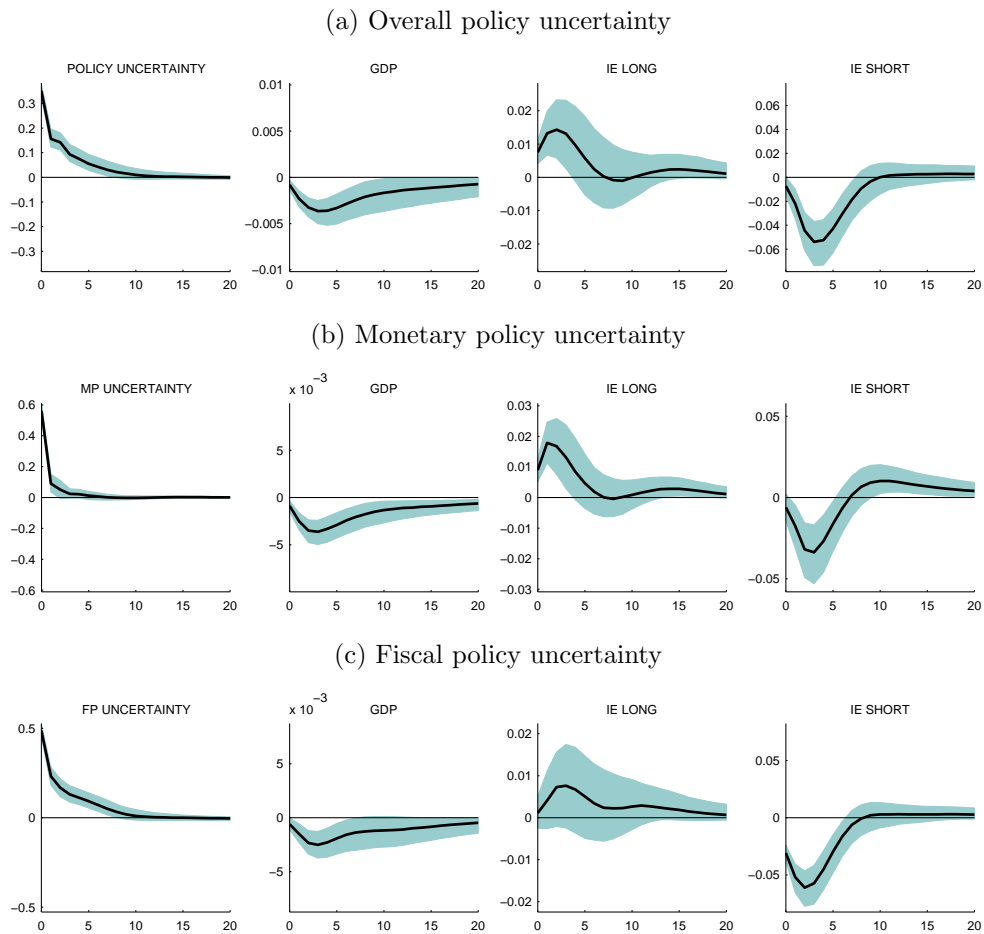
Notes: The solid line in black denotes median impulse response from the estimated VAR(2) for the US - euro area panel and the shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, crude oil prices. Policy uncertainty and GDP are in log levels. IE Long and IE Short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

declines consecutively for about three quarters and the recovery phase lasts long, up to 20 quarters. On the other hand, individual SVARs for the US and 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. Germany and UK also show signs of contraction given a policy uncertainty shock but not statistically significant ones.

In all panels of figure 4 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 UK, the median response of inflation expectations is delayed, stronger and persistent. Fiscal policy uncertainty appears to be more important for these dynamics. 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.

With respect to short-term inflation expectations, except for UK, their response to policy uncertainty shocks is always negative. The direction of the response goes in line with the slack economy. Keeping in mind that short term inflation expectations are usually highly correlated with actual inflation, we could say that the Cholesky-identified policy uncertainty shocks produce "demand-side" effects on output and prices. For UK, the responses are more in the direction of "supply-side" effects. The response of these expectations to an innovation to fiscal policy uncertainty is stronger. Compared with long-term inflation expectations, they show a higher degree of responsiveness and volatility. In fact, such behavior is expected and acceptable. For central banks it is important that these movements do not feed into 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 observe in addition the reaction of monetary policy to a Cholesky-identified policy uncertainty shock. Results for the US-euro area panel-SVAR are presented in figure 5. Monetary policy responds with lowering interest rates strongly given positive innovations to all types of policy uncertainty measures 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 a monetary policy-related uncertainty.

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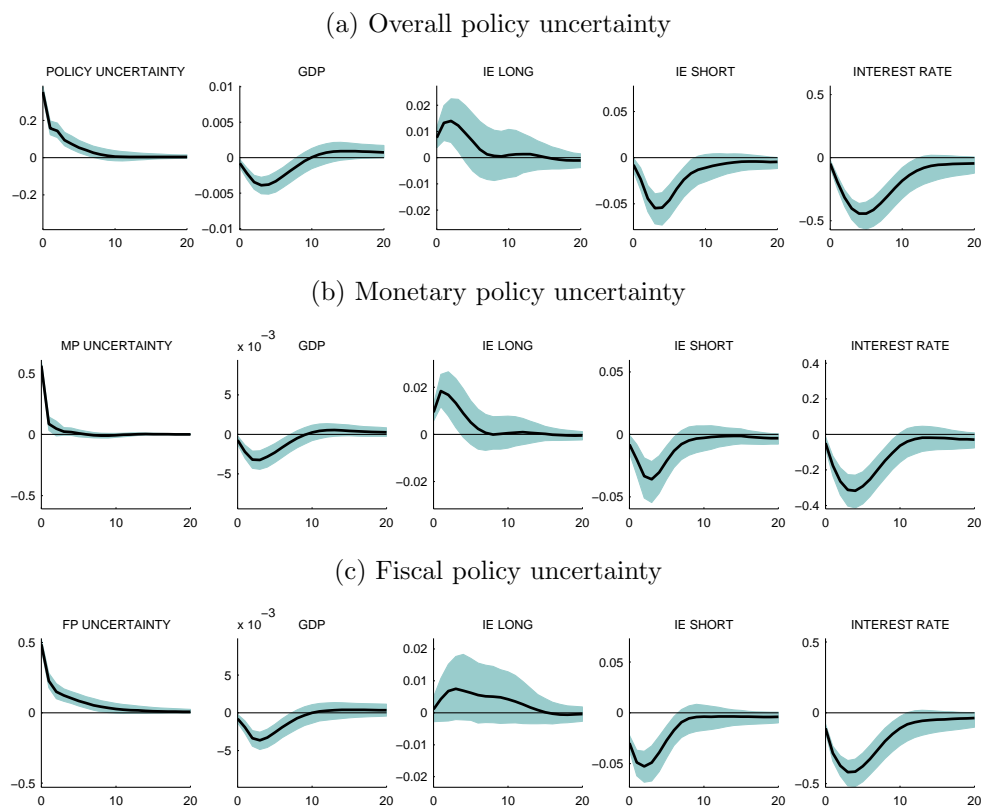
(a) Overall policy uncertainty

(b) Monetary policy uncertainty

(c) Fiscal policy uncertainty

Notes: The solid line in black denotes median impulse response from the estimated VAR(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 empirical literatures of macroeconomic effects of uncertainty shocks. The magnitude effect that we find is also comparable[13]. Different channels through which policy uncertainty affects economic activity could be at

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[13]Actually, 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.

work, such as the precautionary saving motive or the "wait and see" dynamics, the former affecting negatively the aggregate consumption and the latter affecting the investments.[14]

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 sensible to policy uncertainty shocks in our SVAR analysis. 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[15]. This result is in line with the predictions of recent theoretical models on inflation expectations and how policy affects them (see Eusepi and Preston (2010) and Bianchi and Melosi (2010) among others). For instance, Bianchi and Melosi (2010) 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.

We also check if the above results hold when taking into account dynamics of inflation expectations as measured by different surveys. To this aim, we perform the same VAR analysis as discussed above with inflation expectations as measured by the Survey of Professional Forecasters (SPF)[16] of the Federal Reserve Bank of Philadelphia and the ECB, respectively. We present the results for the SVARs that take into account SPF inflation expectations in figure 8 in the Appendix. SVAR results show that long-term inflation expectations measured by the SPF are less sensitive to the overall policy uncertainty. On

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[14]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, Floetotto, Jaimovich, Saporta-Eksten, and Terry (2012)).

[15]One could argue that even though statistically significant, the magnitude of the response of long-term inflation expectations is not alarming. To us, the magnitude effect of such shocks is not negligible when taking in account two facts: (1) how persistent the series of long-term inflation expectations have been during the last 10 years and (2) that we are considering only a small sized policy uncertainty shock in contrast to what usually the literature has explored (two to three standard deviation shocks). Having in mind that impulse responses under our framework are linear in the size of the shock, one could easily calculate the magnitude effects of double or triple sized uncertainty shocks on our variables of interest.

[16]Details are found in the Appendix.

the other hand, monetary policy-related uncertainty continues to play an important role for their dynamics. Results related with output, interest rate and short-term inflation expectations remain the same as in the previous cases.

Overall, we can argue that even though the commitment of central banks to a stable and low inflation has not changed during the last years (at least in the case of the Bank of England and the ECB this remains the paramount objective), agents seem to perceive that it would be more difficult for central banks to commit to their targets. Such a scenario is likely when taking into account the unprecedented policies monetary authorities took in response to the recent crisis; if they are not well-managed they risk fueling inflationary pressures.

Furthermore, we are interested in analyzing the responses of trust in the ECB and of satisfaction with the BoE to policy uncertainty shocks. These measures of beliefs can also be considered to reflect the credibility of central banks in public. For this analysis we estimate country-specific bivariate VARs for Germany and for UK. The results of these estimations are presented in figure 6. Identification of the uncertainty shock is again done with the recursive strategy, with policy uncertainty measures ordered first.

We observe that an increase in policy related uncertainty is associated with a decline in net trust, of German citizens, in the ECB. This response is significant to both a monetary policy and a fiscal policy-related uncertainty shock, and it takes more than two years to restore to its initial levels. Furthermore, we observe that in response to an innovation to fiscal policy uncertainty, the net trust drops earlier and stronger than in response to a monetary policy uncertainty shock. It is surprising to find that trust in monetary authorities is affected more strongly by fiscal policy uncertainty shocks. One would have expected a stronger response of beliefs about monetary authorities in response to a monetary policy uncertainty shock. This result suggest that the beliefs of citizens with respect to the ECB are also affected by factors that are not directly related to monetary policy. Our result goes in line with existing literature on trust that find that ECB is being blamed for problems concerning fiscal policies, unemployment and slow economic growth (see, among others, Roth et al. (2011) and Waelti (2012)) and is not always being judged with respect to its actual actions and performance.

For UK, the net satisfaction of citizens responds negatively and significantly to a monetary policy uncertainty shock. The drop is immediate and the reversal period last for several years. On the other hand, the beliefs of British citizens with respect to BoE do not

seem to be negatively affected by an overall policy uncertainty shock or by a fiscal policy uncertainty shock. One could see also that the volatility of uncertainty shocks in UK is not as strong as in Germany. However, these results suggest that British citizens mainly take into account the monetary policy actions and the uncertainty around them when forming beliefs about the performance of the BoE.

Figure 6: Responses of trust in the ECB and satisfaction with BoE to policy uncertainty shocks
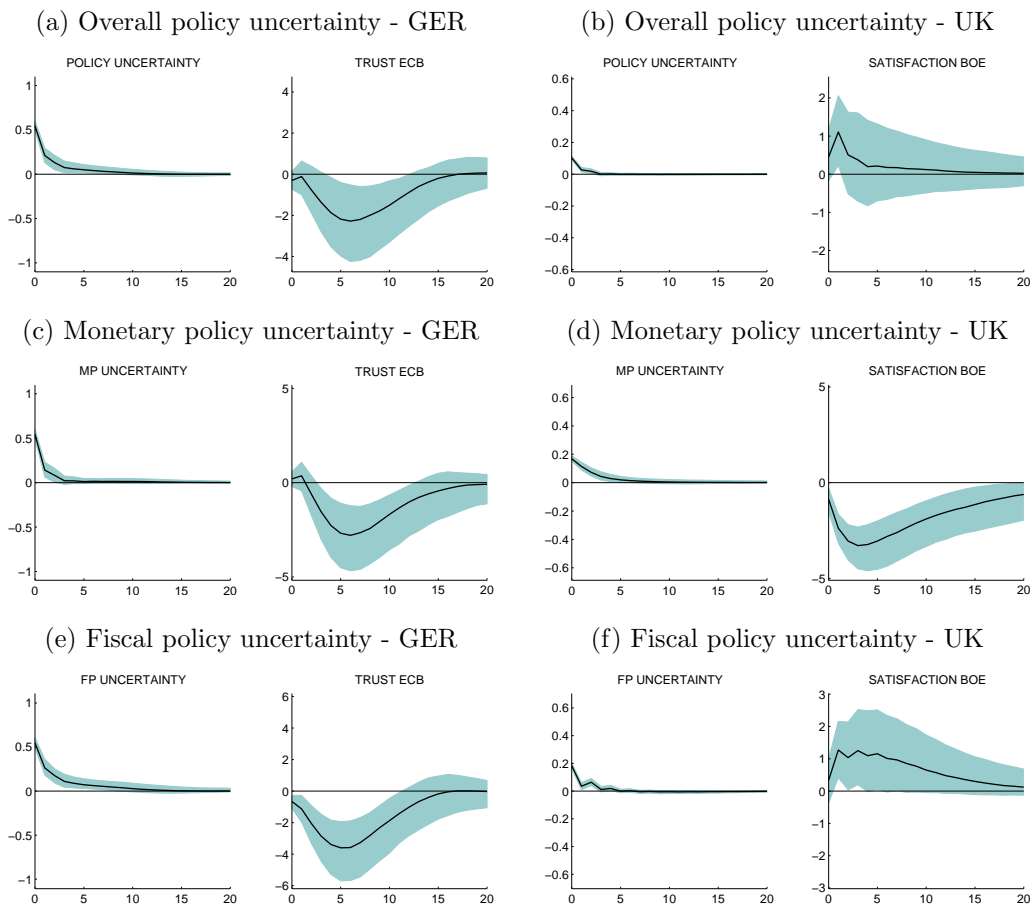
Notes: The solid line in black denotes median impulse response from an estimated Bayesian SVAR(2) for Germany and UK. The shaded area the corresponding 68 percent error band. SVARs include an exogenous variable, US industrial production. Period: 1999Q1-2012Q1. Horizontal axis is lag horizon in quarters.

4 Concluding remarks

We bridge the existing empirical literature of macroeconomic effects of uncertainty shocks and the empirical literature of inflation expectations by providing evidence on the effect of policy-related uncertainty on beliefs and perceptions of agents towards policy makers. We use structural Bayesian VAR techniques to investigate whether high policy induced uncertainty coming from extraordinary events and actions of decision makers translated into public perceptions regarding policy makers and have affected the inflation expectations in the US, UK, Germany and the euro area. Academics and policy makers alike agree that well anchored long-term inflation expectations reflect the credibility of monetary policy.

Using a new policy uncertainty measure based on the index of Baker et al. (2012) we find a positive reaction of long-term inflation expectations in response to a policy-induced uncertainty shock. This result is relatively robust even when we consider different countries, more specific measures for policy uncertainty, different measures for inflation expectations and different orderings of the variables in the VARs. When taking into account specific types of policy uncertainty, our results show that monetary policy-related uncertainty is not always the driver behind the dynamics of inflation expectations. For certain countries, fiscal policy related uncertainty seems to play an important role. Therefore, we can argue that long-term inflation expectations of professional forecasters are not perfectly anchored and that policy-induced uncertainty poses upside risks to the anchoring of long-term inflation expectations.

In line with the results of previous studies, our analysis shows that a policy uncertainty innovation leads to a decline in economic activity. Moreover, in our estimations, monetary policy seems to face a trade-off between responding to the state of the economy and to long-run inflation expectations. Monetary policy responds to policy uncertainty shocks with lowering interest rates strongly. Our results also show significant responses to policy uncertainty shocks for measures of citizens perceptions on central banks, like trust in ECB and satisfaction with the way Bank of England does its job.

In a nutshell, we show that, indeed, the observed uncertainty about the stance and perceived effectiveness of policy should be troubling for central bankers[17]. Such uncertainty seems to entail risks to their hard-won inflation credibility.

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[17]Governor of Bank of Canada, Mark Carney, made such remark on policy uncertainty in his speech "Uncertainty and Global Recovery" in October 2012, at Vancouver Island Economic Summit.

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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)	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)	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)	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)	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 7: Recent developments of inflation and long-term market-based inflation expectations

Inflation

**Inflation Expectations BEIR (long-term)**
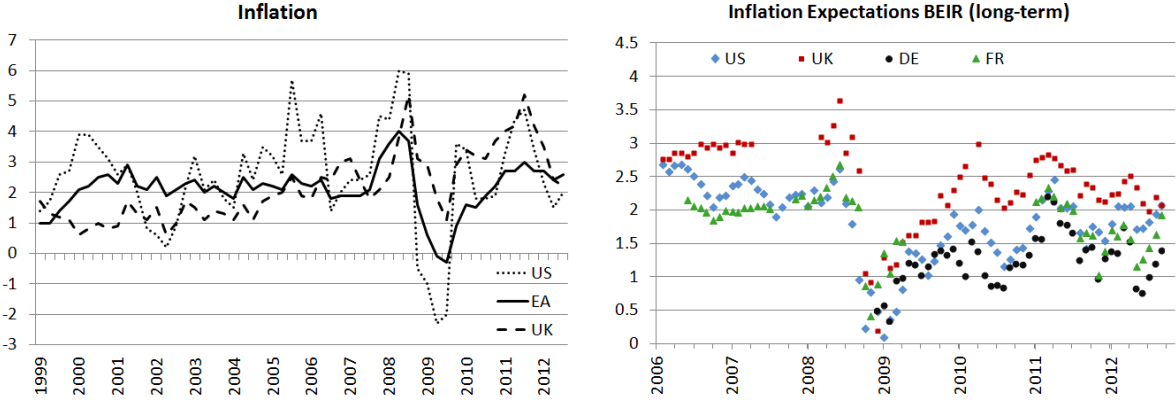
Notes: Actual inflation and long-term (5 years ahead) market-based inflation expectations obtained from Bloomberg (Break Even Inflation Rates).

Figure 8: IRFs to a policy uncertainty shock for the US-euro area VAR-panel with SPF expectations
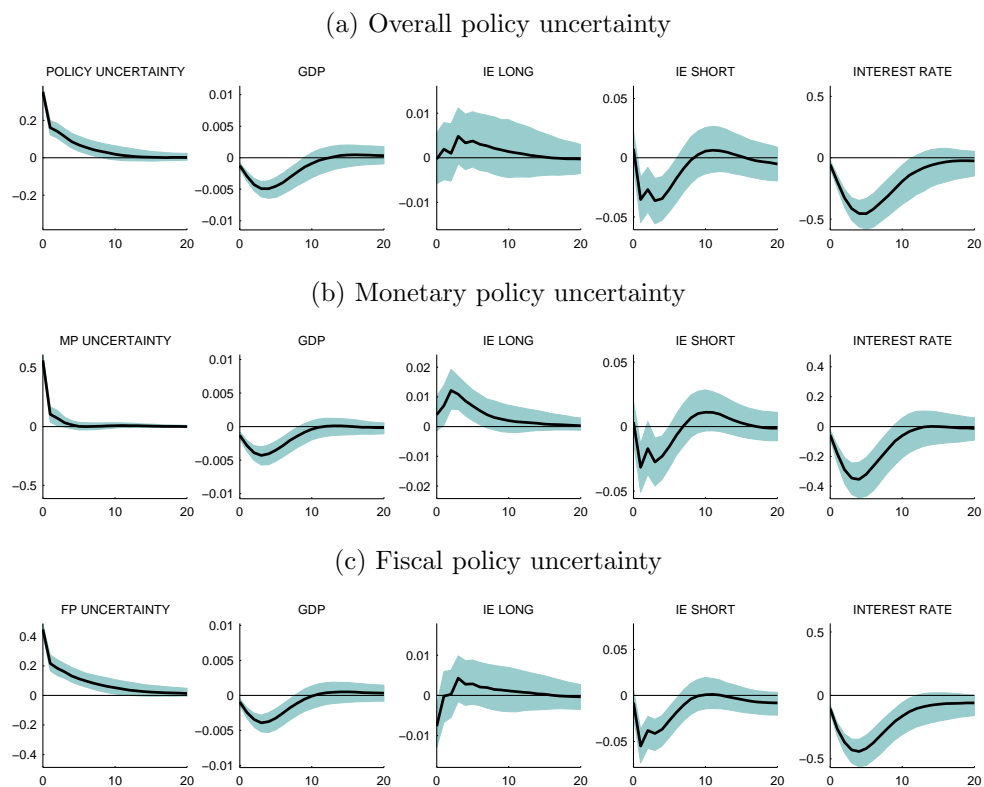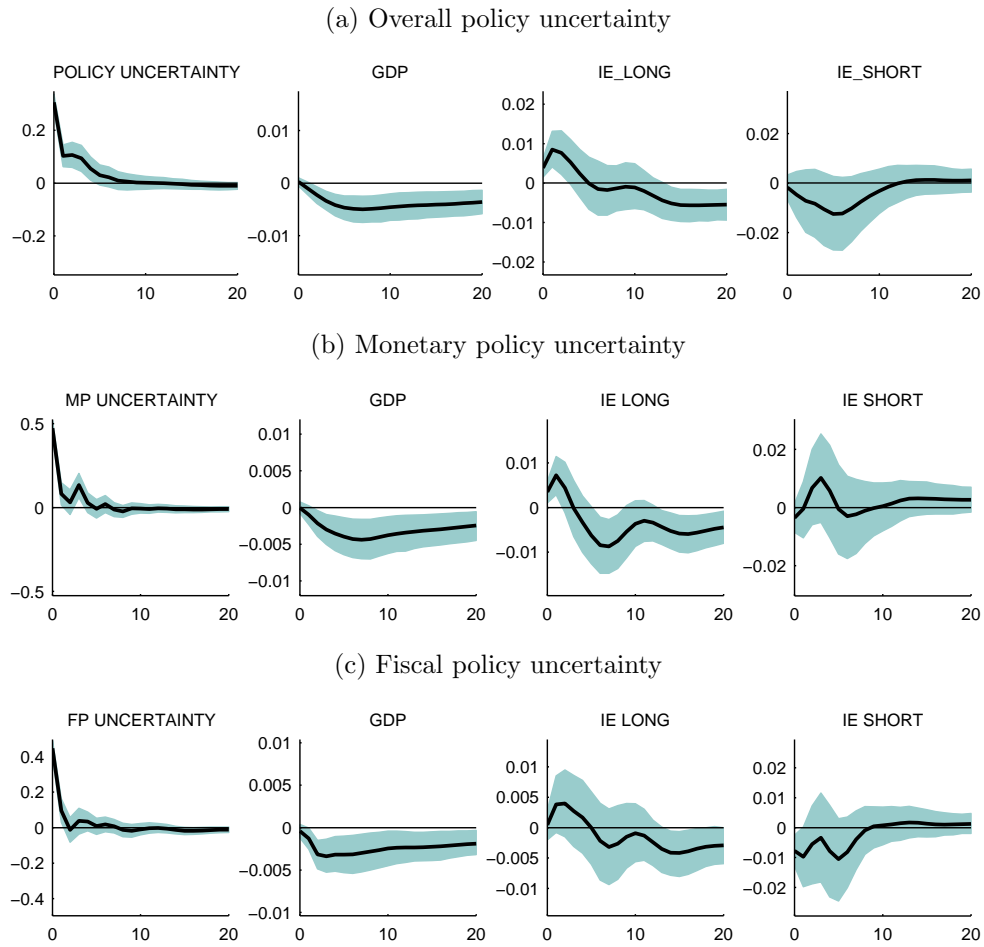
(a) Overall policy uncertainty

(b) Monetary policy uncertainty

(c) Fiscal policy uncertainty

Notes: The solid line in black denotes median impulse response from the estimated VAR(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 9: IRFs to a policy uncertainty shock for US
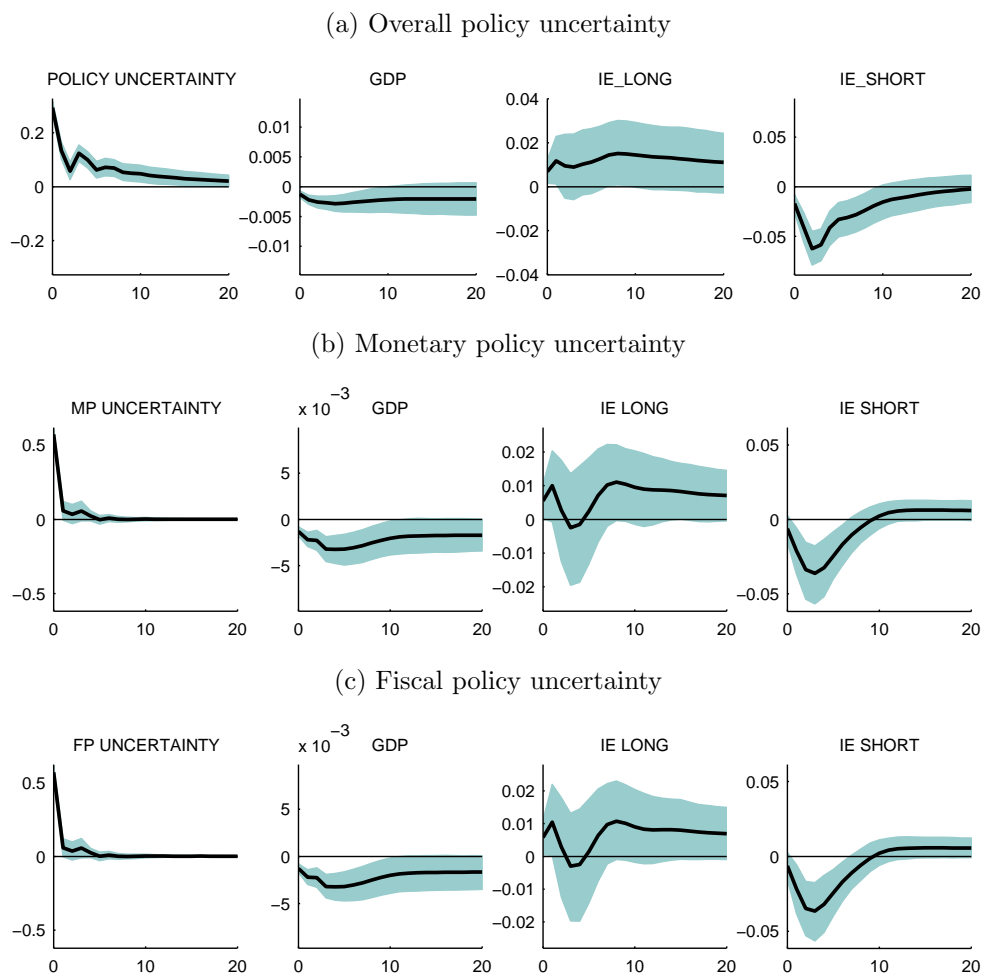
(a) Overall policy uncertainty

(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, 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.

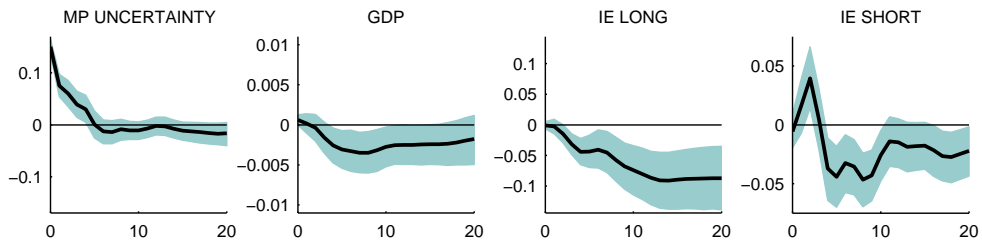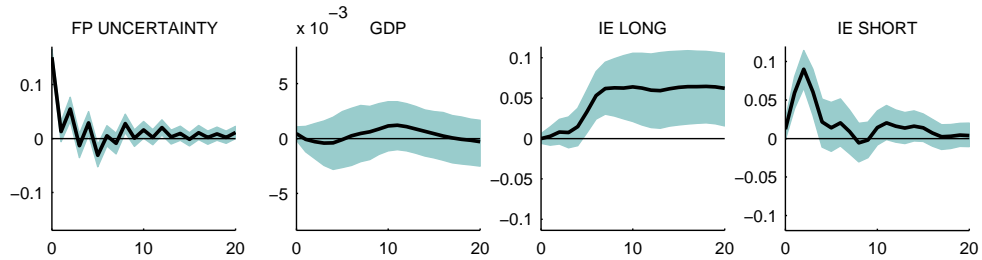## Figure 10: IRFs to a policy uncertainty shock for the euro area

(a) Overall policy uncertainty

(b) Monetary policy uncertainty

(c) Fiscal policy uncertainty

Notes: *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 11: IRFs to a policy uncertainty shock for UK

(a) Overall policy uncertainty
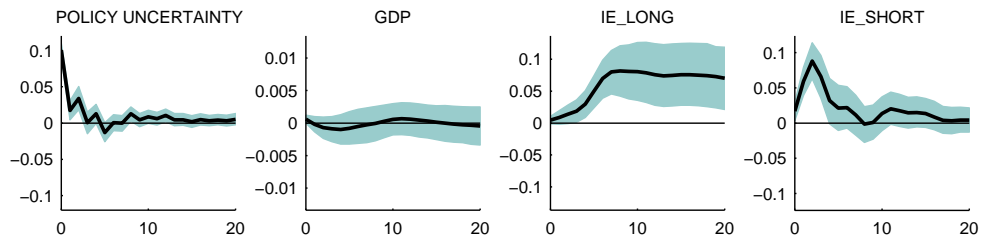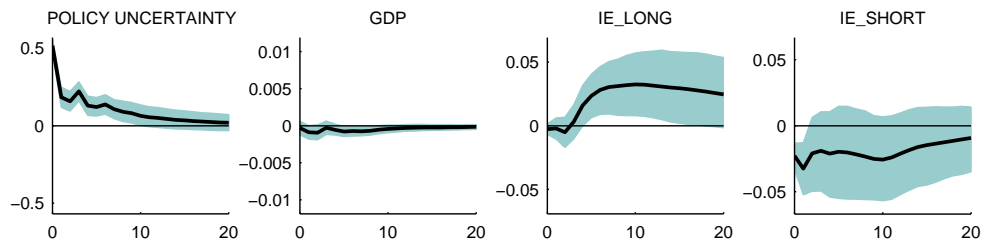

(b) Monetary policy uncertainty

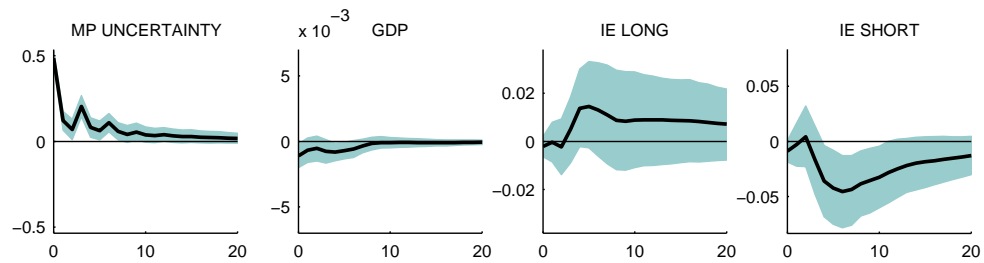## (c) Fiscal policy uncertainty

Notes: *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.

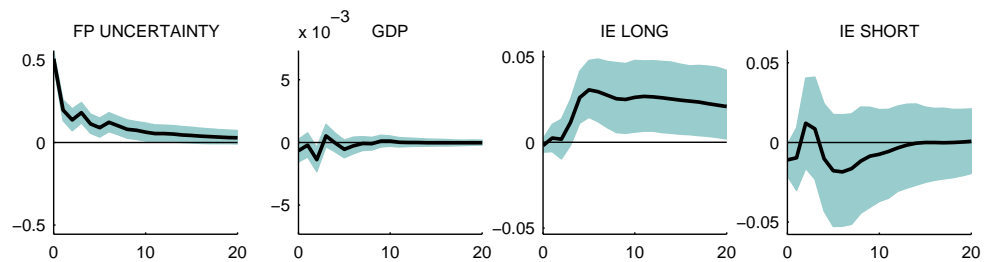## Figure 12: IRFs to a policy uncertainty shock for Germany

(a) Overall policy uncertainty

(b) Monetary policy uncertainty

(c) Fiscal policy uncertainty

Notes: *Notes*: *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.