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Fiscal Policy Uncertainty and its Effects on the Real Economy: German Evidence

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Abstract

This paper introduces a new measure of fiscal policy uncertainty based on the disagreement among professional forecasters. We analyze different patterns of this measure for the German economy for a sample period from November 1995 to April 2018 and also use Italian data for comparison. Especially, we examine the impact of the introduction of the German 'debt brake' on fiscal policy uncertainty. Finally, we conduct an impulse response analysis to investigate the effect of fiscal policy uncertainty on the real economy and we provide robust evidence that fiscal policy uncertainty significantly decreases the growth rate of industrial production. The corresponding effect is robust to various sensitivity checks and exceeds the impact of a general measure of economic policy uncertainty. In general, the negative effect on the real economy might be explained by lower hiring and investment by firms, higher costs of financing due to risk premia and lower consumption spending as a result of precautionary savings.

Keywords: Disagreement, Expectations, Fiscal policy, Survey data, Uncertainty, VAR
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1 Introduction

Macroeconomic effects of fiscal policy are among the most controversial topics in economics, triggering fundamental disagreement between Keynesian and neoclassical economists. The zero lower bound constraint of monetary policy many central banks faced after the global financial crisis has reinvigorated this debate with several governments introducing large fiscal stimulus packages. At the same time, an emerging literature strand has focused on measurement and effects of uncertainty, establishing different dimensions and transmission channels of uncertainty (Bachmann *et al.*, 2013; Jurado *et al.*, 2015; Baker *et al.*, 2016).

This paper contributes to these two strands of the literature by introducing a new measure of fiscal policy uncertainty based on the disagreement among professional forecasters about the future budget balance presented for the German economy. The first key question we tackle is whether fiscal policy uncertainty based on survey data shows plausible patterns and has the potential to provide additional insights compared to survey-based measures for other variables. In addition, we evaluate the impact of fiscal policy uncertainty on the real economy, implicitly arguing that a reliable uncertainty measure should display substantial negative effects. Analyzing the effect of uncertainty regarding the budget balance is appealing from a theoretical perspective. Negative effects might arise due to lower hiring and investment by firms, higher costs of financing due to risk premia and lower consumption spending as a result of precautionary savings (Fernández-Villaverde *et al.*, 2015; Basu and Bundick, 2017; Pellegrino *et al.*, 2020). The government budget incorporates tax and spending decisions by the government which directly affects firms and therefore an increase in fiscal policy uncertainty is likely to affect the real economy. In addition, the famous Ricardian equivalence proposition directly argues that uncertainty regarding maturity and other characteristics of the debt structure increases precautionary savings of households (Barro, 1996).

The existing literature has introduced several uncertainty measures (Bloom, 2014). The popular economic policy uncertainty index introduced by Baker *et al.* (2016) is based on newspaper coverage but does not capture expectations directly. Recent research has addressed measurement and effects of monetary policy uncertainly (see e.g. Bauer *et al.*, 2019; Husted *et al.*, 2020) while fiscal policy uncertainty has attracted less attention. The only study dealing with fiscal policy uncertainty based on survey data is provided by Ricco *et al.* (2016). Their approach is based on disagreement from the survey of professional forecasters from the US. However, no comparable measure is available for other economies. Other studies use indirect model based proxies or reaction functions to capture fiscal policy uncertainty which are discussed in Section 2 (Fernández-Villaverde *et al.*, 2015; Anzuini *et al.*, 2020; Popiel, 2020).

We especially focus on fiscal policy uncertainty in Germany given its important role within the Euro Area and the lasting controversies regarding its policy stance. We examine Germany's fiscal policy uncertainty variation over time, examine if and how it has been caused by the introduction of the so-called 'debt brake'[1] and finally, how it effects the real economy. In doing so, we make use of survey-based expectations data for the budget balance provided by Consensus Economics for the sample period from November 1995 to April 2018. To examine the effect of the 'debt brake' on fiscal policy uncertainty, we also construct the same measure for Italy as a country, which is also part of the European Monetary Union but has not adopted a 'debt brake' in their constitution. Italy also provides an interesting comparison given that the government budget has been subject to significant fluctuations and controversial discussions while the political landscape is also characterized by great uncertainty (Anzuini *et al.*, 2020).

[1]The Maastricht Treaty fixes that the debt-to-GDP ratio of each Euro Area country must not exceed the 60% threshold. To fulfil this aim the German government decided in 2009 to adopt a 'debt brake' (*Schuldenbremse*), which should guarantee a balanced budget.

In the second part of our study we conduct an impulse response analysis to investigate the effect of fiscal policy uncertainty on industrial production and unemployment. Our findings provide robust evidence that fiscal policy uncertainty significantly decreases the growth rate of industrial production and therefore has a substantially negative effect on the German economy. Strikingly, we find that the corresponding effect of fiscal policy uncertainty exceeds the effect of the newspaper-based economic policy uncertainty measure by Baker *et al.* (2016).

The remainder of this paper is organized as follows. The next section provides an overview of theoretical evidence regarding the effect of fiscal policy uncertainty on the real economy and a review of the existing literature. Section 3 introduces our data set, discusses fiscal policy uncertainty patterns and describes our empirical framework. In Section 4 we provide and discuss our empirical findings. Section 5 concludes.

2 Theory and Literature Review

Our study relates to the literature on fiscal policy effects and the measurement of uncertainty. We start by a general classification of the literature on modeling uncertainty, summarize previous studies which use survey-based measures and discuss measurement and effects of fiscal policy uncertainty.

The various empirical measures which have been proposed in the literature can be broadly classified into survey-based indicators, measures based on residuals from VAR estimates and newspaper-based indicators. The popular economic policy uncertainty index based on word-coverage in newspaper articles proposed by Baker *et al.* (2016) has been provided for various sub-categories and countries.[2] Husted *et al.* (2018, 2020) apply a similar concept to calculate a monetary policy uncertainty measure. Related studies also rely on google search queries for the measurement of uncertainty (Castelnuovo and

[2]See `https://www.policyuncertainty.com/` for details.

Tran, 2017).

An increase in policy uncertainty may for example reflect a changing perception of monetary policy uncertainty, fiscal policy uncertainty or other dimensions of policy uncertainty. The existing literature which explicitly models fiscal policy uncertainty mostly relies on the estimation of policy reaction functions for the identification of fiscal policy uncertainty (Fernández-Villaverde *et al.*, 2015; Anzuini *et al.*, 2020; Popiel, 2020). The latter is approximated via volatility of shocks to such a function which is for example based on average tax rates. The advantage of these specifications is that they take the actual stance of fiscal policy into account. However, the measurement of survey data as conducted by Ricco *et al.* (2016) has the benefit that it is based on expectations which are of crucial importance for the transmission of fiscal policy shocks from a theoretical perspective. A key argument is that private agents receive public and private signals about the future stance of fiscal policy. The precision of public signals affects disagreement which for example increases in case of poor communication (Ricco *et al.*, 2016).

Uncertainty indexes U_t based on forecast surveys often measure uncertainty by the sum of disagreement among forecasters and the perceived variability of future aggregate shocks:

$$U_t^h = D_t^h + V_t^h \tag{1}$$

where h represents the forecasting horizon, D_t denotes disagreement among professional forecasters and V_t corresponds to the variance of forecast errors based on mean forecasts. Lahiri and Sheng (2010) rely on GARCH-type models while Istrefi and Mouabbi (2018) suggest stochastic volatility models to construct the latter. Similar to Ricco *et al.* (2016), our uncertainty measure is solely based on the disagreement component D_t since the calculation of forecast errors is complicated by the fact that forecasts of the budget balance correspond to the fiscal year. Given that the corresponding full budget balance is not available at a monthly frequency, we are unable to achieve monthly forecast errors. However, we also estimate our model at a quarterly frequency as a robustness test to account for a potential sensitivity to the choice of the data frequency. There is some discussion whether disagreement and forecast errors share similar dynamics (Lahiri and Sheng, 2010; Rich and Tracy, 2020) but the overall consensus emerging from the literature is that disagreement constitutes an important dimension of uncertainty. Disagreement is an ex ante measure of uncertainty among professional forecasters and does not address the ex post unpredictable component of the budget balance. Therefore, it can be argued that this measure is a conservative proxy for uncertainty. However, previous studies have also generally shown that disagreement among forecasters is correlated with uncertainty due to the fact that professionals forecasts deviate stronger when uncertainty increases (Giordani and Söderlind, 2003). A clear benefit of our measure is the fact that it is an ex ante measure and therefore indicates an increase in uncertainty regarding the budget balance earlier than measures based on ex post forecast errors.

Survey data provided by Consensus Economics has been used by various authors in the context of measuring uncertainty. Istrefi and Mouabbi (2018) use data on interest rates from Consensus Economics and find substantial effects from interest rate uncertainty which directly relates to monetary policy uncertainty. Ozturk and Sheng (2018) establish country-specific and global macroeconomic uncertainty measures based on data from Consensus Economics for 45 economies. Lahiri and Zhao (2019) rely on GDP growth forecasts for a large set of countries and use forecast revisions to real GDP growth as an uncertainty measure.

Several studies have established a link between uncertainty and the effects of fiscal policy. Nonlinear effects of fiscal policy have been frequently identified with one pattern emerging that uncertainty affects the size of fiscal multipliers (Mittnik and Semmler, 2012; Michaillat, 2014; Alloza, 2017; Berg, 2019). There is also a long-lasting discussion about the role of expectations and confidence for the propagation of fiscal policy shocks. Anticipated fiscal policy shocks potentially already change expectations and decision making of households before a policy is actually implemented (Figueres, 2015). Ricco *et al.* (2016) find that increases in investment are more likely in periods of low uncertainty which results in stronger effects of fiscal policy in periods of low uncertainty. Berg (2019) adopts business uncertainty measures to estimate state-dependent spending multipliers for Germany. He identifies a significant impact of uncertainty on the size of long-run multipliers.[3] Special attention has also been paid to the crucial role of consumer confidence for the transmission of fiscal policy shocks. Bachmann and Sims (2012) find that confidence only matters during recessions while it does not affect the fiscal policy reaction on output in normal times.

The finding that uncertainty matters for the effects of fiscal policy has led to direct measures of fiscal policy uncertainty. Macroeconomic effects of fiscal policy uncertainty have mostly been assessed for the US. Fernández-Villaverde *et al.* (2015) find that high fiscal policy uncertainty increases inflation, reduces output and increases output volatility. They also find that such effects are stronger once the central bank is constrained by the zero lower bound. Born and Pfeifer (2014) reach a different conclusion based on their assessment of data-based policy risk within a New Keynesian framework. For both fiscal and monetary policy, they find that the uncertainty part of policy risk is small and does not constitute an important transmission channel of shocks. Anzuini *et al.* (2020) focus on Italian data and find that the degree of fiscal policy uncertainty affects the size of fiscal multipliers.

[3]See also Castelnuovo and Lim (2019) and the references cited therein for a recent overview of the literature on fiscal multipliers.

3 Data and Fiscal Policy Uncertainty

3.1 Data

Survey data on budget balance forecasts is provided by Consensus Economics (see `https://www.consensuseconomics.com/`) on a monthly basis. The consensus is based on individual responses of professionals, mostly banks. Budget balance forecasts are available for the sample period from November 1995 to April 2018 for Germany and Italy.

These forecasts are provided as fixed event forecasts, which means that they are provided for the current and the next year at each point in time. This implies that the disagreement about the current year naturally decreases over time, that is the uncertainty about this year's budget balance is much lower in November than in January. We therefore rely on the approach proposed by Patton and Timmermann (2011) and also been applied by Dovern *et al.* (2012) and Czudaj (2020) to transform fixed event into fixed horizon forecasts via weighted averaging. The basic idea is to use the weighted average of fixed event forecasts for the current and the next year with the weight of the former (latter) linearly decreasing (increasing) as time evolves based on the following formula

$$\hat{g}_{t,t-12} = w\hat{g}_{1,0} + (1-w)\hat{g}_{2,1}, \tag{2}$$

where $\hat{g}_{t,t-12}$ denotes the approximated fixed horizon forecast for a horizon of 12 months while $\hat{g}_{1,0}$ and $\hat{g}_{2,1}$ give the fixed event forecasts for the current and the next year and w denotes the ad hoc weight $(24-t)/12$ for $t = 12, 13, \ldots, 23$. All individual fixed horizon forecasts and the mean forecasts for the German budget balance across all forecasters for the 12-month horizon are shown in Figure 1 and exhibit a large drop during the global financial crisis and a fast recovery after the introduction of the 'debt brake', implying that forecasters anticipate fiscal costs of stimulus packages after 2008 and also seem to consider the 'debt brake' as credible.

*** Insert Figure 1 about here ***

Due to the availability of individual forecasts, we are also able to compute a measure of forecasters' disagreement, which can be interpreted as a proxy for ex ante uncertainty about the stance of fiscal policy. As our measure of fiscal policy uncertainty we therefore use the standard deviation of individual forecasts made by professionals. The individual forecasts provided in Figure 1 illustrate that there are hardly any exceptional outliers so that our disagreement measure is an appropriate characterization of the underlying distribution.

Figure 2 displays the time series pattern of our fiscal policy uncertainty measure relative to its starting value in November 1995 for Germany and Italy and Table 1 reports some descriptive statistics for German fiscal policy uncertainty. Both series display a small correlation (0.11) and fiscal policy uncertainty displays a higher volatility for Italy, in particular before the introduction of the euro. For Germany uncertainty regarding fiscal policy has not been higher during the first years of the sample compared to the period after 2014. This is somehow surprising considering that the introduction of the euro increased the overall economic uncertainty. A potential explanation is that the fiscal requirements of the Maastricht criteria lowered fiscal policy uncertainty. The variation of the fiscal policy uncertainty measure does not change remarkably by the introduction of the German 'debt brake' in May 2009[4] according to the standard deviation but its mean has increased from 0.8699 to 0.9857 according to Table 1.

[4]This date refers to the decision of the German Bundestag on the introduction of the 'debt brake'.

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

For the full sample and both sub-sample periods our measure of fiscal policy uncertainty is positively skewed, which indicates that upturns are generally steeper than downturns. The Augmented Dickey-Fuller (ADF) test result shows that the unit root null can at least be rejected for the full sample period as well as for the second sub-sample period at the 5% level. Considering the generally low power of the ADF test to reject the null, we see this as evidence in favor of stationarity of our fiscal policy uncertainty measure. Therefore, we do not run into spurious regression problems, when using this measure in the following.

To check for robustness of our choice of the break date in May 2009, we have also applied the Bai and Perron (2003) breakpoint test, which endogenously determines the break date by the supremum of the F-statistic testing the null of no change in the mean of our fiscal policy uncertainty measure for each date in the sample period. The starting point is a regression of the fiscal policy uncertainty measure on a constant and Figure 3 shows the time series of the F-statistic, which peaks in August 2008. This illustrates that the endogenously determined break date differs only slightly from the date of the decision to introduce the 'debt brake'.

*** Insert Figure 3 about here ***

To ensure that our fiscal policy uncertainty proxy includes incremental information compared to other survey measures based on macroeconomic aggregates, we have also assessed correlations to other disagreement and uncertainty measures for Germany.

Fiscal policy disagreement over the next 12 months is positively correlated with GDP growth disagreement (0.59), uncertainty regarding inflation (0.09), long-term interest rate uncertainty (0.4), current account uncertainty (0.28) and also the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (0.13). In line with theory, we also find that fiscal policy uncertainty is negatively correlated with GDP growth expectations (-0.28). This illustrates that our measure shares the path of other disagreement and uncertainty measures but also has the potential to offer additional insights. The negative correlation with growth expectations is in line with the perception that fiscal policy uncertainty propagates into GDP growth via expectation and spending.

For the further analysis we also use data on industrial production, the unemployment rate, the inflation rate, the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (EPU) for Germany and Italy and the policy rate of the ECB. Especially, the inclusion of EPU in our estimation is useful since it enables us to analyze whether macroeconomic effects of fiscal policy uncertainty materialize once we control for EPU in general. Data sources are provided in Appendix A.

3.2 Effect of the Introduction of the Debt Brake

To examine the effect of the introduction of the 'debt brake', we have started by regressing the fiscal policy uncertainty measure on a dummy variable, which takes the value of unity since May 2009 (i.e. the date of the decision of the German Bundestag on the introduction of the 'debt brake') and zero prior to this date. We use seven different specifications by the inclusion of the year-on-year growth rate of industrial production (IP), the inflation rate (INF) and the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (EPU) as control variables. The corresponding results are provided in Table 2. In each case the debt brake dummy is significantly positive at least at the 10% level and the corresponding level shift lies pretty robust around 0.1.

*** Insert Table 2 about here ***

This significant level shift in the second part of the sample period might have also been caused by something different than the introduction of the ‘debt brake’ such as for example the global financial crisis. Thus we attempt to account for this issue by measuring the corresponding effect for Germany relative to Italy as a country, which is also part of the European Monetary Union but has not adopted a ’debt brake’ in their constitution. In doing so, we rely on the following difference-in-differences (DiD) regression

$$FPU_{it} = \alpha_0+\alpha_1 DB_t+\alpha_2 TG_i+\alpha_3 DB_t \cdot TG_i+\sum_{k=1}^{K}\beta_k X_k+\varepsilon_{it}, \quad i = 1,\ldots,n, \quad t = 1,\ldots,T, \tag{3}$$

of our fiscal policy uncertainty (FPU) measure on dummy variables for the debt brake (DB)

$$DB_t = \begin{cases} 1, & \text{since May 2009} \\ 0, & \text{prior to May 2009} \end{cases} \tag{4}$$

and the treatment group (TG)

$$TG_i = \begin{cases} 1, & \text{Germany} \\ 0, & \text{Italy} \end{cases} \tag{5}$$

and their interaction $DB_t \cdot TG_i$, which gives the DiD estimator and therefore the corresponding effect of the introduction of the ‘debt brake’. We again include some controls X_k such as the year-on-year growth rate of industrial production (IP), the inflation rate (INF) and the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (EPU). Table 3 reports our findings, which show that the ‘debt brake’ effect on fiscal policy uncertainty is significantly positive in all seven specifications and the effect size is even higher compared to the findings of our simple dummy variable approach reported in Table 2.[5]

*** Insert Table 3 about here ***

3.3 VAR Model and Shock Identification

Having introduced a new measure of fiscal policy uncertainty (FPU) and discussed its features, we proceed by analyzing the effect of a fiscal policy uncertainty shock on the real economy in the next section. In doing so, we conduct an impulse response analysis relying on the vector autoregression (VAR)

$$Y_t = B_0 + \sum_{i=1}^{p} B_i Y_{t-i} + \nu_t, \tag{6}$$

where Y_t includes the FPU measure, the unemployment rate and the year-on-year growth rate of industrial production in our baseline model and the lag length p is selected to be equal to six months following Baker *et al.* (2016) in a similar case. In the following we also perform several robustness checks by varying the lag length and including further variables into the VAR such as the inflation rate, the ECB monetary policy rate and the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty.

The FPU shock is identified recursively by a Cholesky decomposition relying on different orderings (the baseline ordering is the one given above) and also by conducting the following sign restrictions:

Shock/Variable	FPU	UR	IP
Restriction	≥ 0	≥ 0	≤ 0.

[5]This finding is also robust to a variation of the control group. Instead of Italy we have also used France and the 'debt brake' effect on fiscal policy uncertainty turned out to be significantly positive as well. See Table A.2 provided in the Appendix for the detailed results.

To apply sign restrictions we rely on three different frameworks: the rejection method by Uhlig (2005), the rejection method by Rubio-Ramírez *et al.* (2010) and the penalty function method by Uhlig (2005). More details can be found in Appendix F.

In addition, to allow for the time-variation observed for the FPU measure, we also account for the possibility that the effect of a FPU shock on the real economy also differs over time. Therefore, as a final step we also apply a Bayesian time-varying parameter VAR approach with stochastic volatility (B-TVP-VAR-SV) following Primiceri (2005). Details can be found in Section 4.4 and the MCMC approach used for estimation is illustrated in Appendix G.

4 Empirical Results

This section reports and discusses our results of the impulse response analysis for the German economy. We examine the reaction of a FPU shock on the growth rate of industrial production and the unemployment rate. In Section 4.1 we start with our baseline specification mentioned above while Section 4.2 provides several robustness checks. In addition, Section 4.3 discusses the same reactions to shocks identified by sign restrictions and Section 4.4 allows for time-variation in the baseline model.

4.1 Baseline VAR Model

Figure 4 reports the impulse response of a FPU shock on the year-on-year growth rate of industrial production together with 95% and 68% confidence intervals. The impulse response is based on the trivariate VAR model including the FPU measure, the unemployment rate and the year-on-year growth rate of industrial production with six lags as mentioned above. The shock is identified by a Cholesky decomposition using the order of appearance in the previous sentence. As can be seen, an increase of FPU has a negative effect on the growth of industrial production in Germany, which is statistically significant over seven months before the shock starts to decay. The reaction to the shock is the strongest after five months and decreases the annual growth rate of industrial production by more than 0.8 percentage points. This finding is in line with the theory. Due to uncertainty regarding government spending such as investments in infrastructure, firms temporarily pause their investment decisions and this slows down the growth of industrial production. We have also considered the reaction of the unemployment rate to the FPU shock. However, the corresponding effect is insignificant and has therefore not been reported at this stage. One reason for the insignificance of the FPU shock on unemployment might be the rigidity of the German labor market in the short-run. The effect of fiscal policy uncertainty on unemployment will be further discussed in the following.

*** Insert Figure 4 about here ***

4.2 Robustness Checks

In order to check for robustness of the impulse response of our FPU measure on the year-on-year growth rate of industrial production we have varied our baseline model into several directions. The most relevant robustness checks are illustrated in Figure 5. The red line in Figure 5 refers to our baseline model (already displayed in Figure 4) for comparison. The blue line is based on a VAR with five lags minimizing the Akaike information criterion (AIC), the green line displays the response using a Cholesky decomposition with a reversed ordering compared to the baseline VAR, the violet line is based on a VAR model including the inflation rate as additional variable in the VAR, the orange line refers to a VAR model also including the ECB policy rate as a measure of monetary policy, the cyan line is based on a VAR model also including the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (EPU), the black solid line refers to a VAR model, which includes the Hachula, Piffer and Rieth (2019) measure of unconventional monetary policy instead of the ECB policy rate in order to better account for unconventional monetary policy, the pink line represents a VAR model including the debt brake dummy variable[6] introduced in Section 3.2 and finally, the grey and the dark green lines are based on a VAR model including a measure of inflation uncertainty or interest rate uncertainty proxied by the 12-month-ahead disagreement among forecasters for German inflation and the German 10-year government bond yield, respectively. We have also used further lag lengths and Cholesky orderings, which are not shown since these provide very similar results to the ones displayed in Figure 5. As can be seen in the graph, the finding of a significantly negative effect of FPU on industrial production growth is clearly not sensitive to all these variations. Both the magnitude to the response and its persistence over time is roughly the same in all cases. Therefore, we conclude that the theory consistent and substantial negative effect is clearly robust.

*** Insert Figure 5 about here ***

As an additional robustness check we have also estimated the benchmark model based on quarterly instead of monthly data and have also replaced the growth rate of industrial production by the growth rate of real gross domestic production (GDP) as a different measure of economic growth. This is an important sensitivity check given that

[6]See also Figure A.2 provided in the Appendix for confidence bands for the VAR model including the debt brake dummy variable.

official and harmonized fiscal statistics are provided at the annual and quarterly but not at the monthly frequency. Hence, variations of monthly fiscal policy uncertainty are mostly not driven by reporting of fiscal authorities. Figure 6 gives the corresponding effect of a FPU shock while the benchmark model is represented by a dark green line and the model relying on real GDP instead of industrial production by a dark blue line. The effect remains negative and increases slightly for quarterly data while the effects for the GDP are slightly weaker. However, although the magnitude differs to some extent, the general finding is robust.[7]

*** Insert Figure 6 about here ***

As a next step, we also compare the response of the annual growth rate of industrial production to a FPU shock with its reaction to an economic policy uncertainty (EPU) shock using the Baker *et al.* (2016) measure. EPU is a natural candidate for a comparison given that it is a widely established measure of uncertainty in the literature and also relates to the stance of policy in a more general sense. In doing so, we rely on the four-variable VAR model including our FPU measure, the EPU index, the unemployment rate and the growth rate of industrial production with six lags. The reaction of industrial production growth to a FPU shock has already been shown as part of the robustness tests in Figure 5 by the cyan colored line. In contrast, the corresponding

[7]Confidence bands for both responses are also provided in Figure A.3 in the Appendix (see Panels (a) and (b)). The FPU effect is also significantly negative over the first two quarters when using quarterly data, although only at the 68% and not at the 95% level. This might be attributed to the lower number of observations when using quarterly data (90 instead of 270). In addition, we have also accounted for the growth rate of government final consumption expenditure as a measure of public spending within the VAR model according to Blanchard and Perotti (2002). However, the FPU response on the growth rate of industrial production is not sensitive to this variation as can be seen by a comparison of Panel (a) with Panel (c) in Figure A.3.

effect to an EPU shock is displayed in Panel (a) in Figure 7. In line with the theory, the effect of an overall economic policy uncertainty shock is also negative, however clearly lower in magnitude compared to the impact of the fiscal policy uncertainty shock and not significantly different from zero when considering the 95% confidence level (solely on a 68% level). This implies that our measure, which refers directly to uncertainty regarding the budget balance provides additional information compared to the more general measure of economic policy uncertainty. One explanation is that economic policy uncertainty reflects several dimensions of uncertainty which are not necessarily related to the real economy while fiscal policy uncertainty provides a narrow measure which is closely tied to expectations and information regarding the business cycle and the stance of fiscal policy.[8]

*** Insert Figure 7 about here ***

In addition, to compare our findings for Germany we have also computed our fiscal policy uncertainty measure for the US based on data provided by Consensus Economics and have examined its effect on the growth rate of US industrial production in the same way (see Figure A.1 provided in the Appendix). As can be seen the FPU measure itself shows a completely different pattern for the US compared to Germany. It solely

[8]As EPU is based on newspaper-appearances of several word combinations, it might also be subject to time-varying media attention. Therefore, to further strengthen the robustness of our findings, we have also used uncertainty measures based on the disagreement among professional forecasters regarding inflation and interest rate forecasts as alternatives. However, the FPU effect on the growth of industrial production is clearly robust as shown in Figure 5 (see robustness checks (09) and (10)). In addition, these two measures seem to be more relevant for the growth of industrial production compared to the EPU. However, their effect is still less pronounced than the FPU effect according to both the magnitude and the significance (see Panels (b) and (c) in Figure 7). We see this as further verification of our finding that ex ante uncertainty regarding the budget balance provides additional information compared to other measures.

displays a peak around the global financial crisis due to fiscal programs discussed and implemented during this time. The FPU effect on the growth of industrial production is also significantly negative at the 68% level, however magnitude, duration and significance of this effect are clearly lower compared to Germany.

4.3 Sign Restrictions

Furthermore, Figure A.4 shows the impulse response of our FPU measure on the annual unemployment rate (Panel (a)) and the year-on-year growth rate of industrial production (Panel (b)) computed based on our trivariate baseline VAR model including the FPU measure, the unemployment rate and the year-on-year growth rate of industrial production with six lags while the FPU shock has been identified by the sign restrictions mentioned in Section 3.3 using the rejection method by Uhlig (2005). Consistent with our expectations, a positive FPU shock results in a significant increase of the unemployment rate as well as a significant reduction of industrial production growth. The former effect is now significant compared to a Cholesky-type identification strategy while the latter effect is roughly robust although the magnitude is even a bit stronger compared to the previous subsections.

In order to also check for robustness with respect to the chosen implementation method of sign restrictions, in Figure A.5 we have also plotted the impulse responses of industrial production growth to a FPU shock by conducting the rejection method by Rubio-Ramírez *et al.* (2010) and the penalty function method by Uhlig (2005). In both cases the pattern of the reaction is very similar although the magnitude is even stronger. The corresponding reaction of the unemployment rate is not reported again but is also robust to the chosen method.

4.4 Time-Varying Parameter VAR

Section 3 has provided robust evidence that our fiscal policy uncertainty measure varies over time and that the introduction of the debt brake has significantly increased fiscal policy uncertainty. As discussed in Section 2, the empirical literature also agrees that effects of fiscal policy might vary over time. Therefore, as a final step we also want to check, whether the reaction of the growth rate of industrial production and the unemployment rate to a FPU shock also changes over time. Thus, we conduct the Bayesian time-varying parameter VAR approach with stochastic volatility (B-TVP-VAR-SV) in the spirit of Primiceri (2005), which allows both the coefficients and the variance covariance matrix to change over time. The B-TVP-VAR-SV model can be formalized by

$$Y_t = X_t' B_t + A_t^{-1} \Sigma_t \epsilon_t \quad \text{with} \quad X_t' = I_3 \otimes [1, Y_{t-1}, \ldots, Y_{t-p}] \quad \text{and} \quad B_t = \{B_{j,t}\}_{j=0}^{p}, \tag{7}$$

$$B_t = B_{t-1} + \upsilon_t, \quad a_t = a_{t-1} + \xi_t \quad \text{and} \quad \log \varsigma_t = \log \varsigma_{t-1} + \eta_t, \tag{8}$$

where Y_t again includes the FPU measure, the unemployment rate and the year-on-year growth rate of industrial production (in this ordering) with six lags. A_t is a lower triangular matrix with ones on the main diagonal and a_t is a vector stacking all free elements of A_t row-wise. Σ_t is a diagonal matrix with positive elements $\varsigma_t = \text{diag}(\Sigma_t)$, ϵ_t includes the models' innovations distributed as $N(0, I_3)$ and $\{B_{j,t}\}_{j=0}^{p}$ are coefficient matrices for $p = 6$ lags that are allowed to vary over time. Such a TVP-VAR approach has the benefit that structural breaks such as potentially caused by the implementation of the debt brake can well be accounted for as it provides (potentially) different parameters for each period (i.e. each month). Therefore, any changes in the parameters due to a structural break will be implemented within this approach, although not by an abrupt change but by a smooth transition from the pre-debt brake model to the debt brake-model. We see this smooth parameter change as a benefit compared to structural breaks models since the exact timing of such a break is not straightforward due to expectation effects resulting from debates prior to the introduction of a debt brake and due to potential delays in the effect of such a policy change.

The B-TVP-VAR-SV model given by Eqs. (7) and (8) is computed by a Markov Chain Monte Carlo (MCMC) algorithm using 10,000 iterations excluding the burn-in period of 1,000. More precisely, we use Gibbs sampling to sample from the joint posterior distribution of $\{B^T, A^T, \Sigma^T, V\}$, where B^T denotes the entire path of the coefficients $\{B_t\}_{t=1}^T$, Σ^T gives the entire path of the variance covariance matrices and A^T is the entire path of the lower triangular matrices. Appendix G provides details on the Gibbs sampling algorithm in line with Del Negro and Primiceri (2015) and Czudaj (2019). It is also worth mentioning that $\hat{B}_{OLS}$, $\hat{V}(\hat{B}_{OLS})$, $\hat{A}_{OLS}$, $\hat{V}(\hat{A}_{OLS})$ have been estimated by OLS within a training sample period using the first 60 months (i.e. the period running from November 1995 to October 2000) to initialize the priors (see Appendix G for details). We have also checked the convergence of the Markov chains for all parameters included in our B-TVP-VAR-SV model relying on different diagnostics. The corresponding results are available upon request.

Figure A.6 shows the time-varying impulse responses of our FPU measure on the annual unemployment rate (Panel (a)) and the year-on-year growth rate of industrial production (Panel (b)) in three-dimensional graphs. Each graph is presented twice using different view angles. First of all, the reaction of the unemployment rate to a FPU shock is positive for the first half of the sample but switches into the negative territory for the second half of the sample period. This change explains the insignificance of this response for the baseline model without the allowance for time-variation. Second, the response of the industrial production growth rate to a FPU shock is negative for the entire sample period and therefore appears to be robust. However, the magnitude of the effect seems to change over time and has especially increased after 2010 when monetary policy has reached the zero lower bound.

5 Summary and Concluding Remarks

This paper contributes to the existing literature by the introduction of a new measure of fiscal policy uncertainty based on the disagreement among professional forecasters about 12-month-ahead budget balance forecasts. The paper examines different patterns of this measure for the German economy and especially, analyzes the impact of the introduction of the German 'debt brake' on fiscal policy uncertainty. Finally, the present study verifies the effect of fiscal policy uncertainty on industrial production and unemployment and provides robust evidence that fiscal policy uncertainty significantly decreases the growth rate of industrial production and therefore has a substantially negative effect on the German economy. This finding is robust to time-varying dynamics and alternative identification strategies.

Our findings offer an interesting starting point for future research. As discussed by Anzuini *et al.* (2020), fluctuations in fiscal policy uncertainty may partly explain the wide range of fiscal multiplier estimates in the empirical literature. A deeper understanding of the underlying propagation mechanism could for example be achieved by analyzing the link between fiscal policy uncertainty and consumer confidence. Our framework can also easily be extended to additional economies, offering the possibility of establishing a combined fiscal policy uncertainty measure for the Euro Area. The strong performance of our measure compared to economic policy uncertainty also confirms that survey-based measures provide complementary dynamics to other uncertainty proxies. Constructing country-specific uncertainty proxies based on survey data for different variables therefore is another potential avenue for further research.

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Figures

Figure 1: **Individual and mean forecasts for the German budget balance**

The plot shows 12-month-ahead individual and mean forecasts for the German budget balance across forecasters. The forecasts are provided for the sample period from November 1995 to April 2018. Each point represents the 12-month-ahead forecast of an individual forecaster, which has been made on the corresponding date. The red line illustrates mean forecasts across forecasters. The dashed vertical lines display the collapse of Lehman Brothers (September 2008) and the decision of the German Bundestag on the introduction of the debt brake (May 2009).

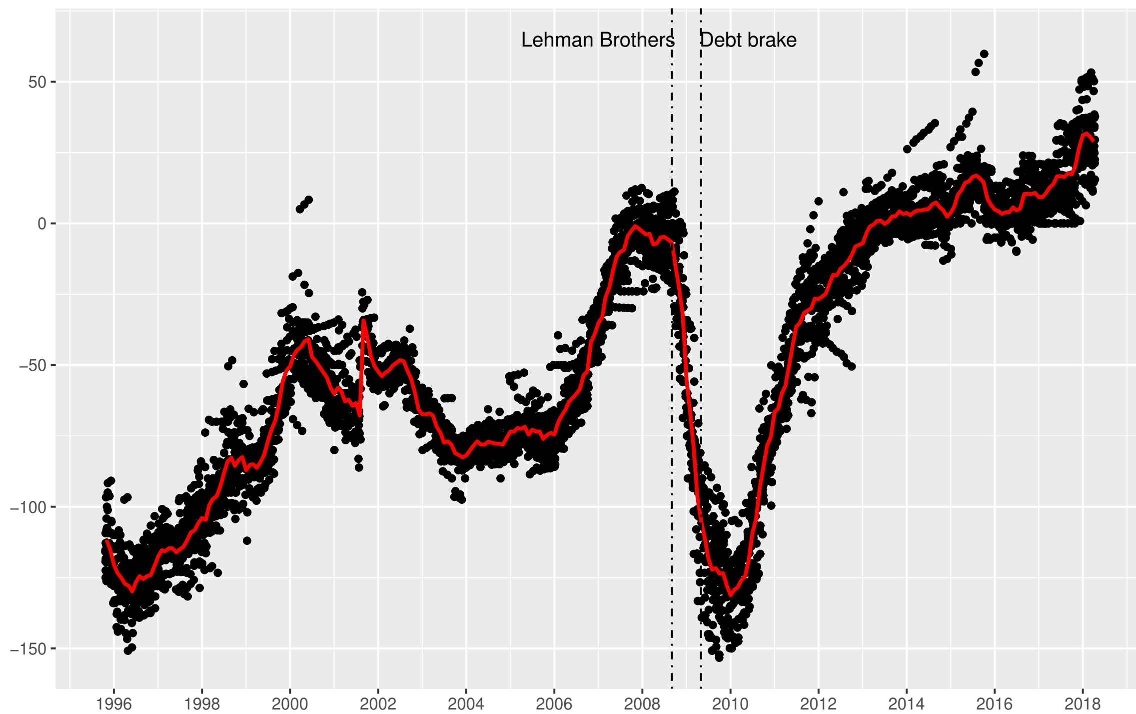


Figure 2: **Fiscal policy uncertainty**

The plot shows our measure of fiscal policy uncertainty – the standard deviation of 12-month-ahead budget balance forecasts across forecasters. This measure is provided for the sample period from November 1995 to April 2018 for Germany (in blue) and Italy (in red) and is shown relative to its starting value in November 1995. The dashed vertical lines display the collapse of Lehman Brothers (September 2008) and the decision of the German Bundestag on the introduction of the debt brake (May 2009).

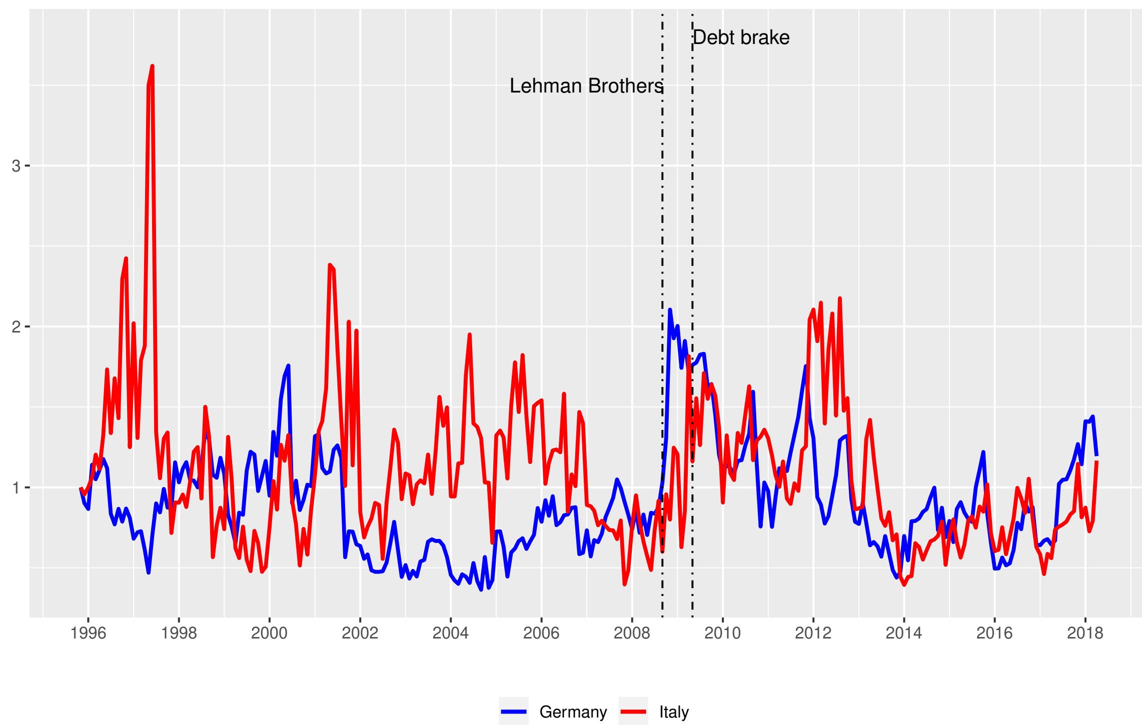


Figure 3: **Bai and Perron (2003) breakpoint test**

The plot shows the supremum of the F-statistic for the Bai and Perron (2003) breakpoint test endogenously determined at August 2008 (vertical dashed line). The horizontal red dashed line represents the critical value at the 5% level. The test checks the null of no change in the mean of our fiscal policy uncertainty measure by regressing it on a constant.

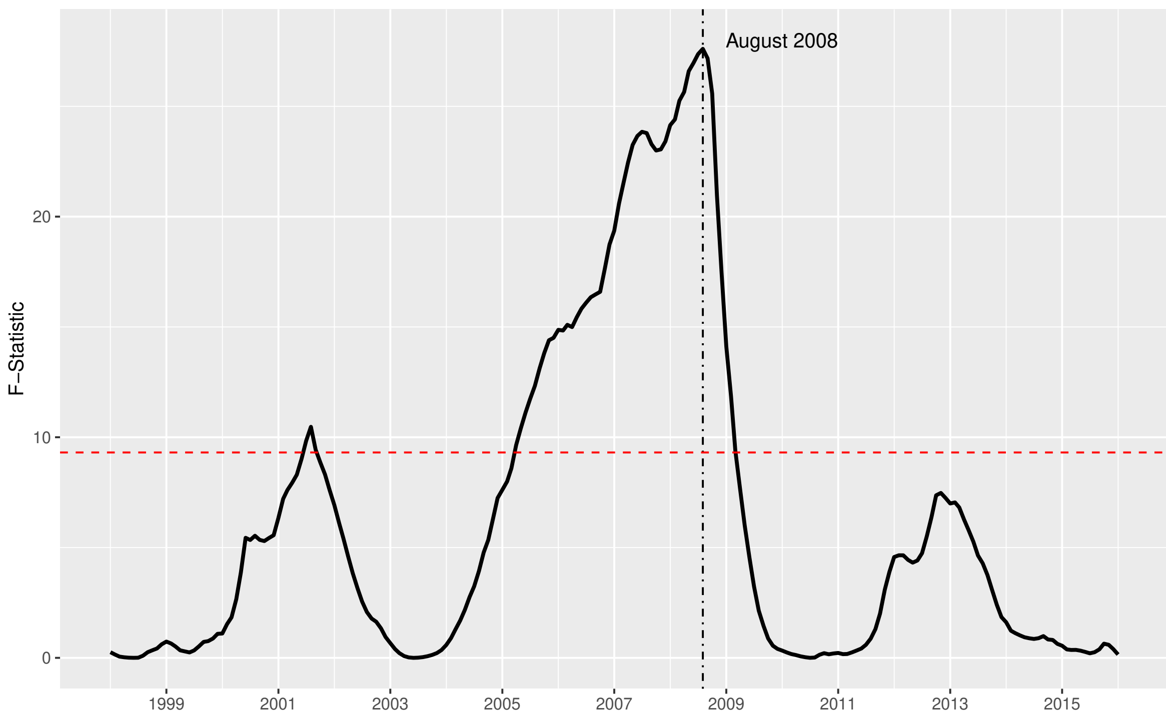


Figure 4: **FPU effect on industrial production**

The plot shows the impulse response of our fiscal policy uncertainty (FPU) measure on the year-on-year growth rate of industrial production. The red solid line gives the response over a horizons of 24 months, the black dashed line represents the zero line (no effect) and the light (dark) blue shadings give the 95% (68%) confidence interval. The impulse response is computed based on a trivariate vector autoregression (VAR) model including the FPU measure, the unemployment rate and the year-on-year growth rate of industrial production with six lags. Shocks have been identified by a Cholesky decomposition using the order of appearance in the previous sentence.

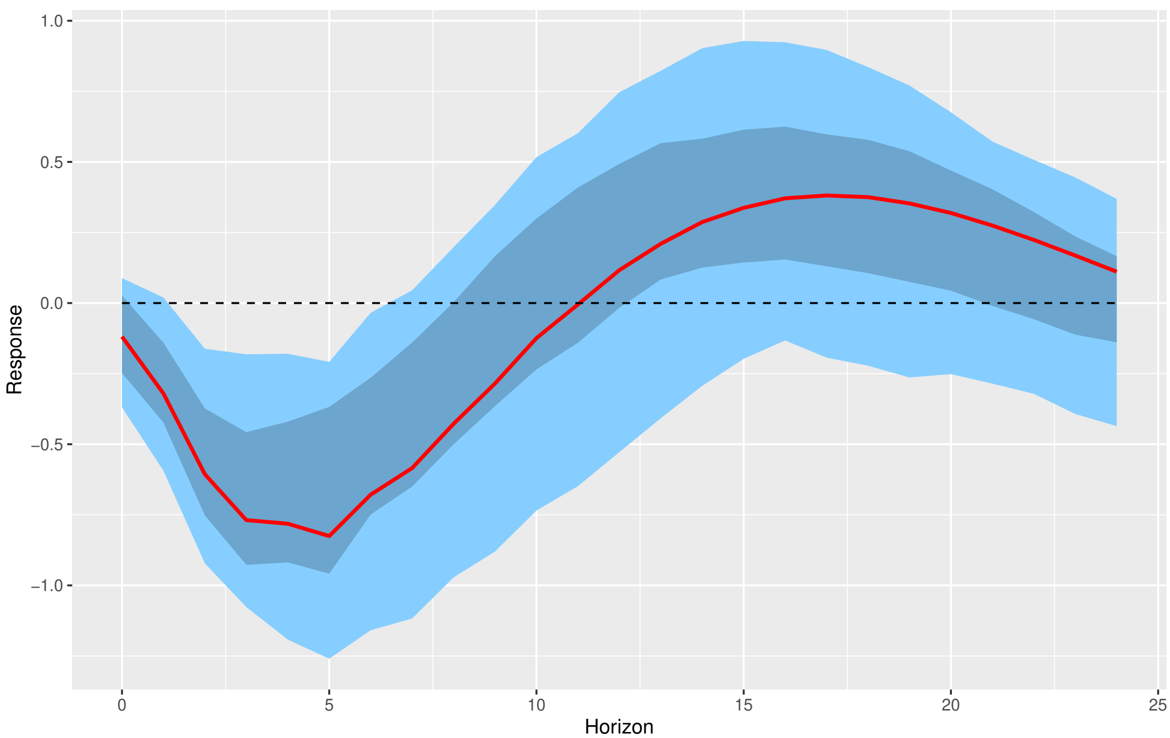


Figure 5: **Robustness of FPU effect on industrial production**

The plot shows the robustness of the impulse response of our fiscal policy uncertainty (FPU) measure on the year-on-year growth rate of industrial production. The black dashed line represents the zero line (no effect) and the colored solid lines give the response over a horizons of 24 months based on different VAR settings: (01) the red line refers to our baseline model (already displayed in Figure 3), (02) the blue line is based on a VAR with five lags minimizing the Akaike information criterion (AIC), (03) the green line displays the response using a Cholesky decomposition with a reversed ordering compared to the baseline VAR, (04) the violet line is based on a VAR model including the inflation rate as additional variable in the VAR, (05) the orange line refers to a VAR model also including the ECB policy rate as a measure of monetary policy, (06) the cyan line is based on a VAR model also including the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (EPU), (07) the black solid line refers to a VAR model also including the Hachula, Piffer and Rieth (2019) measure of unconventional monetary policy, (08) the pink line represents a VAR model including the debt brake dummy variable, (09) the grey line is based on a VAR model including a measure of inflation uncertainty (INFU) proxied by the 12-month-ahead disagreement among forecasters for German inflation and (10) the dark green line refers to a VAR model including a measure of interest rate uncertainty (IRU) proxied by the 12-month-ahead disagreement among forecasters for the German 10-year government bond yield.

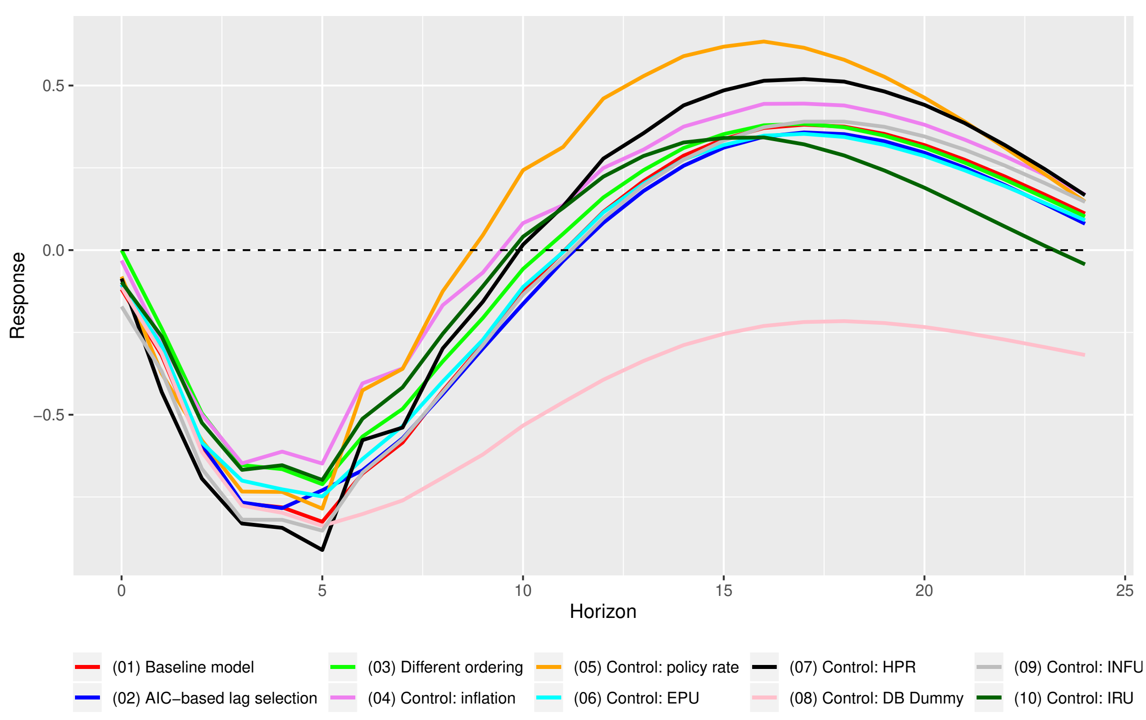


Figure 6: **Robustness of FPU effect on industrial production**

The plot shows the robustness of the impulse response of our fiscal policy uncertainty (FPU) measure on the year-on-year growth rate of industrial production using quarterly data. The black dashed line represents the zero line (no effect) and the colored solid lines give the response over a horizons of 12 quarters based on two different VAR settings: the dark green line refers to our baseline model but uses quarterly instead of monthly data and the dark blue line is based on a VAR model, in which the year-on-year growth rate of industrial production is replaced by the corresponding growth rate of real gross domestic production (GDP). For confidence bands see Figure A.3.

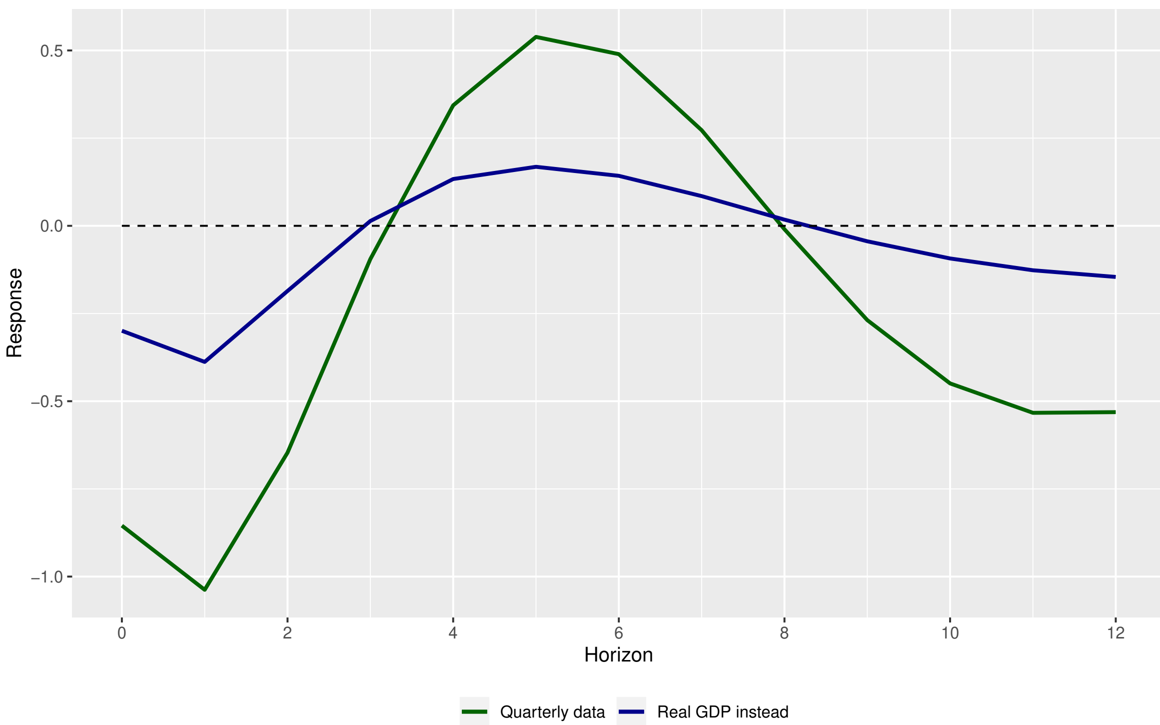
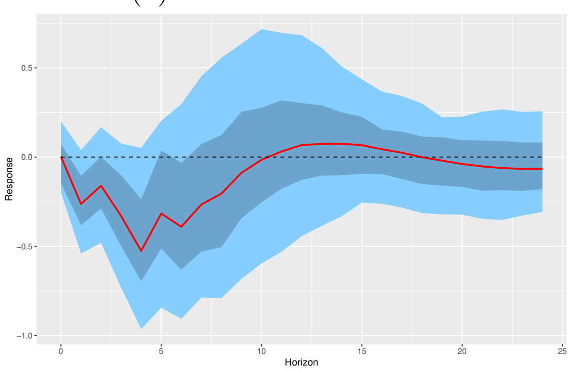


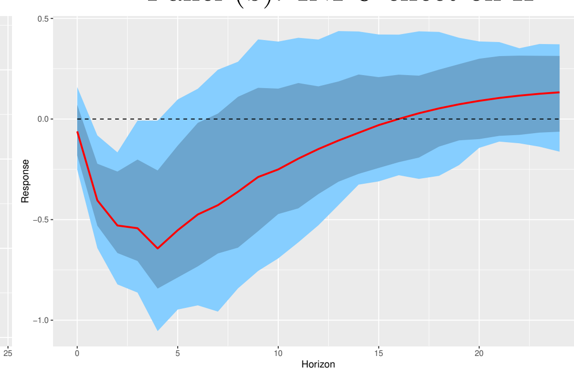
Figure 7: **Effect of other measures on industrial production**

The plot shows the impulse response of the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (EPU, Panel (a)), of a measure of inflation uncertainty (INFU) proxied by the 12-month-ahead disagreement among forecasters for German inflation (Panel (b)) and of a measure of interest rate uncertainty (IRU) proxied by the 12-month-ahead disagreement among forecasters for the German 10-year government bond yield (Panel (c)) on the year-on-year growth rate of industrial production (IP). The red solid line gives the response over a horizons of 24 months, the black dashed line represents the zero line (no effect) and the light (dark) blue shadings give the 95% (68%) confidence interval. The impulse responses are all computed based on a four-variable vector autoregression (VAR) model including our fiscal policy uncertainty (FPU) measure, the corresponding alternative measure, the unemployment rate and the year-on-year growth rate of industrial production with six lags. Shocks have been identified by a Cholesky decomposition using the order of appearance in the previous sentence.

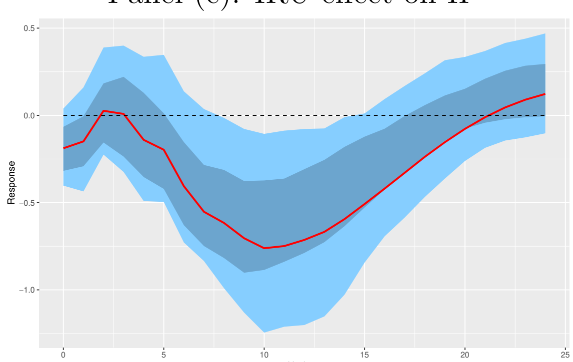
Panel (a): EPU effect on IP



Panel (b): INFU effect on IP



Panel (c): IRU effect on IP



Tables

Table 1: **Descriptive statistics**

	1995:11 - 2018:04	**1995:11 - 2009:04**	**2009:05 - 2018:04**
Mean	0.9162	0.8699	0.9857
SD	0.3414	0.3369	0.3378
Median	0.8597	0.8307	0.9183
Min	0.3635	0.3635	0.4394
Max	2.1049	2.1049	1.8304
Skewness	0.9314	1.1858	0.6330
Excess Kurtosis	0.7893	1.8417	-0.2760
JB	46.9929	63.0995	7.6442
p**-value**	0.0000	0.0000	0.0219
ADF	-3.6044	-2.0989	-2.9085
Crit	-2.87	-2.88	-2.88
N	270	162	108

Note: The table reports descriptive statistics for our fiscal policy uncertainty measure shown in Figure 1 for the full sample period (November 1995 to April 2018) and two sub-sample periods marked by the decision of the German Bundestag on the introduction of the debt brake (May 2009). SD denotes standard deviation, JB stands for Jarque-Bera statistic testing non-normality and ADF gives the Augmented Dickey-Fuller test statistic for the null of a unit root. The ADF test regression includes a constant but no trend since the series do not show any trending tendency. The number of lags has been selected by minimizing the Bayesian Schwarz criterion. Crit provides the corresponding critical value and N gives the number of observations.

Table 2: **Debt brake dummy variable**

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
DB	0.1159	0.1169	0.1021	0.0957	0.1253	0.1071	0.1169
se	(0.0421)	(0.0405)	(0.0446)	(0.0572)	(0.0437)	(0.0505)	(0.0536)
p**-value**	[0.0063]	[0.0042]	[0.0230]	[0.0957]	[0.0045]	[0.0349]	[0.0301]
Intercept	0.8699	0.9013	0.9268	0.8382	0.8685	0.8857	0.8579
se	(0.0266)	(0.0281)	(0.0667)	(0.0490)	(0.0565)	(0.0509)	(0.0698)
p**-value**	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
IP		-0.0174			-0.0182	-0.0173	-0.0181
se		(0.0045)			(0.0048)	(0.0045)	(0.0048)
p**-value**		[0.0002]			[0.0002]	[0.0002]	[0.0002]
INF			-0.0366		0.0221		0.0208
se			(0.0346)		(0.0303)		(0.0302)
p**-value**			[0.2908]		[0.4674]		[0.4925]
EPU				0.0003		0.0002	0.0001
se				(0.0005)		(0.0005)	(0.0005)
p**-value**				[0.5238]		[0.7440]	[0.7898]
Adj. R^2	0.0241	0.1177	0.0257	0.0230	0.1161	0.1150	0.1131
N	270	270	270	270	270	270	270

Note: The table reports coefficient estimates, robust standard errors (se) with respect to heteroskedasticity and serial correlation, p-values, the adjusted R^2 and the number of observations (N) for a regression of our fiscal policy uncertainty measure on a dummy variable for the debt brake (DB) and some controls including the year-on-year growth rate of industrial production (IP), the inflation rate (INF) and the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (EPU).

Table 3: **Difference-in-differences regression**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Effect	0.2453	0.2513	0.1779	0.1738	0.1685	0.1881	0.1294
se	(0.0699)	(0.0678)	(0.0751)	(0.0726)	(0.0712)	(0.0695)	(0.0713)
p**-value**	[0.0005]	[0.0002]	[0.0182]	[0.0170]	[0.0183]	[0.0070]	[0.0700]
DB	-0.1294	-0.1346	-0.0337	-0.1302	-0.0166	-0.1312	-0.0210
se	(0.0558)	(0.0545)	(0.0668)	(0.0579)	(0.0644)	(0.0571)	(0.0686)
p**-value**	[0.0207]	[0.0139]	[0.6136]	[0.0249]	[0.7963]	[0.0221]	[0.7592]
TG	-0.2789	-0.2478	-0.2122	-0.2541	-0.1611	-0.2268	-0.1538
se	(0.0470)	(0.0477)	(0.0513)	(0.0474)	(0.0532)	(0.0489)	(0.0537)
p**-value**	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0026]	[0.0000]	[0.0043]
Intercept	1.1487	1.1442	0.9655	1.0106	0.9163	1.0269	0.8335
se	(0.0388)	(0.0392)	(0.0719)	(0.0532)	(0.0698)	(0.0520)	(0.0696)
p**-value**	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
IP		-0.0147			-0.0165	-0.0132	-0.0153
se		(0.0035)			(0.0036)	(0.0036)	(0.0038)
p**-value**		[0.0000]			[0.0000]	[0.0002]	[0.0001]
INF			0.0749		0.0929		0.0954
se			(0.0237)		(0.0222)		(0.0255)
p**-value**			[0.0016]		[0.0000]		[0.0002]
EPU				0.0011		0.0009	0.0007
se				(0.0004)		(0.0004)	(0.0004)
p**-value**				[0.0109]		[0.0306]	[0.1020]
Adj. R^2	0.0624	0.1052	0.0824	0.0662	0.1363	0.1021	0.1297
N	540	540	540	512	540	512	512

Note: The table reports coefficient estimates, robust standard errors (se) with respect to heteroskedasticity and serial correlation, p-values, the adjusted R^2 and the number of observations (N) for the following difference-in-differences (DiD) regression

$$FPU_{it} = \alpha_0 + \alpha_1 DB_t + \alpha_2 TG_i + \alpha_3 DB_t \cdot TG_i + \sum_{k=1}^{K} \beta_k X_k + \varepsilon_{it}, \quad i = 1, \ldots, n, \quad t = 1, \ldots, T,$$

of our fiscal policy uncertainty (FPU) measure on dummy variables for the debt brake (DB):

$$DB_t = \begin{cases} 1, & \text{since May 2009} \\ 0, & \text{prior to May 2009} \end{cases}$$

and the treatment group (TG):

$$TG_i = \begin{cases} 1, & \text{Germany} \\ 0, & \text{Italy} \end{cases},$$

their interaction $DB_t \cdot TG_i$ (Effect; DiD estimator) and some controls X_k including the year-on-year growth rate of industrial production (IP), the inflation rate (INF) and the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (EPU).

Appendix

A. Data Sources

Table A.1: **Data set**

Time series	Country	Unit	Frequency	Source
Budget balance forecasts	Germany	Euro, Billions	Monthly	Consensus Economics: https://www.consensuseconomics.com/
Budget balance forecasts	Italy	Euro, Billions	Monthly	Consensus Economics: https://www.consensuseconomics.com/
Budget balance forecasts	France	Euro, Billions	Monthly	Consensus Economics: https://www.consensuseconomics.com/
Budget balance forecasts	USA	Euro, Billions	Monthly	Consensus Economics: https://www.consensuseconomics.com/
CPI inflation forecasts	Germany	Percent p.a.	Monthly	Consensus Economics: https://www.consensuseconomics.com/
10-year gov. bond yield forecasts	Germany	Percent p.a.	Monthly	Consensus Economics: https://www.consensuseconomics.com/
GDP growth forecasts	Germany	Percent p.a.	Monthly	Consensus Economics: https://www.consensuseconomics.com/
Economic policy uncertainty	Germany	Index	Monthly	Baker *et al.* (2016): https://www.policyuncertainty.com/
Economic policy uncertainty	Italy	Index	Monthly	Baker *et al.* (2016): https://www.policyuncertainty.com/
Economic policy uncertainty	France	Index	Monthly	Baker *et al.* (2016): https://www.policyuncertainty.com/
Industrial production	Germany	Index, 2015=100	Monthly	OECD: http://dx.doi.org/10.1787/data-00052-en
Industrial production	Italy	Index, 2015=100	Monthly	OECD: http://dx.doi.org/10.1787/data-00052-en
Industrial production	France	Index, 2015=100	Monthly	OECD: http://dx.doi.org/10.1787/data-00052-en
Industrial production	USA	Index, 2015=100	Monthly	OECD: http://dx.doi.org/10.1787/data-00052-en
Industrial production	Germany	Index, 2015=100	Quarterly	OECD: http://dx.doi.org/10.1787/data-00052-en
Unemployment rate	Germany	Percent p.a.	Monthly	OECD: http://dx.doi.org/10.1787/data-00052-en
Unemployment rate	USA	Percent p.a.	Monthly	OECD: http://dx.doi.org/10.1787/data-00052-en
Unemployment rate	Germany	Percent p.a.	Quarterly	OECD: http://dx.doi.org/10.1787/data-00052-en
CPI inflation rate	Germany	Percent p.a.	Monthly	OECD: http://dx.doi.org/10.1787/data-00052-en
CPI inflation rate	Italy	Percent p.a.	Monthly	OECD: http://dx.doi.org/10.1787/data-00052-en
CPI inflation rate	France	Percent p.a.	Monthly	OECD: http://dx.doi.org/10.1787/data-00052-en
Government final consumption	Germany	Euro	Quarterly	OECD: http://dx.doi.org/10.1787/data-00052-en
Deposit facility rate	ECB	Percent p.a.	Monthly	ECB: https://sdw.ecb.europa.eu/
Real gross domestic product	Germany	Euro, Millions	Quarterly	Eurostat: http://ec.europa.eun

B. Robustness of Diff-in-Diff Regression

Table A.2: **Difference-in-differences regression (Control: France)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Effect	0.3449	0.3509	0.3536	0.2573	0.3581	0.2568	0.2693
se	(0.0583)	(0.0572)	(0.0584)	(0.0589)	(0.0573)	(0.0584)	(0.0590)
***p*-value**	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
DB	-0.2290	-0.2345	-0.2686	-0.0785	-0.2693	-0.0720	-0.1117
se	(0.0403)	(0.0403)	(0.0420)	(0.0519)	(0.0419)	(0.0496)	(0.0513)
***p*-value**	[0.0000]	[0.0000]	[0.0000]	[0.1307]	[0.0000]	[0.1471]	[0.0297]
TG	0.2692	0.2798	0.2844	0.2762	0.2922	0.2887	0.2981
se	(0.0438)	(0.0454)	(0.0441)	(0.0428)	(0.0452)	(0.0442)	(0.0444)
***p*-value**	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Intercept	0.6007	0.6071	0.7131	0.6924	0.7068	0.7074	0.7807
se	(0.0348)	(0.0356)	(0.0480)	(0.0430)	(0.0478)	(0.0436)	(0.0539)
***p*-value**	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
IP		-0.0094			-0.0084	-0.0106	-0.0097
se		(0.0042)			(0.0040)	(0.0041)	(0.0039)
***p*-value**		[0.0258]			[0.0366]	[0.0094]	[0.0134]
INF			-0.0821		-0.0732		-0.0592
se			(0.0268)		(0.0254)		(0.0249)
***p*-value**			[0.0023]		[0.0041]		[0.0178]
EPU				-0.0010		-0.0011	-0.0010
se				(0.0002)		(0.0002)	(0.0002)
***p*-value**				[0.0000]		[0.0000]	[0.0000]
Adj. R^2	0.2815	0.2944	0.2942	0.3021	0.3041	0.3187	0.3245
N	540	540	540	512	540	512	512

Note: The table reports coefficient estimates, robust standard errors (se) with respect to heteroskedasticity and serial correlation, p-values, the adjusted R^2 and the number of observations (N) for the following difference-in-differences (DiD) regression

$$FPU_{it} = \alpha_0 + \alpha_1 DB_t + \alpha_2 TG_i + \alpha_3 DB_t \cdot TG_i + \sum_{k=1}^{K} \beta_k X_k + \varepsilon_{it}, \quad i = 1, \dots, n, \quad t = 1, \dots, T,$$

of our fiscal policy uncertainty (FPU) measure on dummy variables for the debt brake (DB):

$$DB_t = \begin{cases} 1, & \text{since May 2009} \\ 0, & \text{prior to May 2009} \end{cases}$$

and the treatment group (TG):

$$TG_i = \begin{cases} 1, & \text{Germany} \\ 0, & \text{France} \end{cases},$$

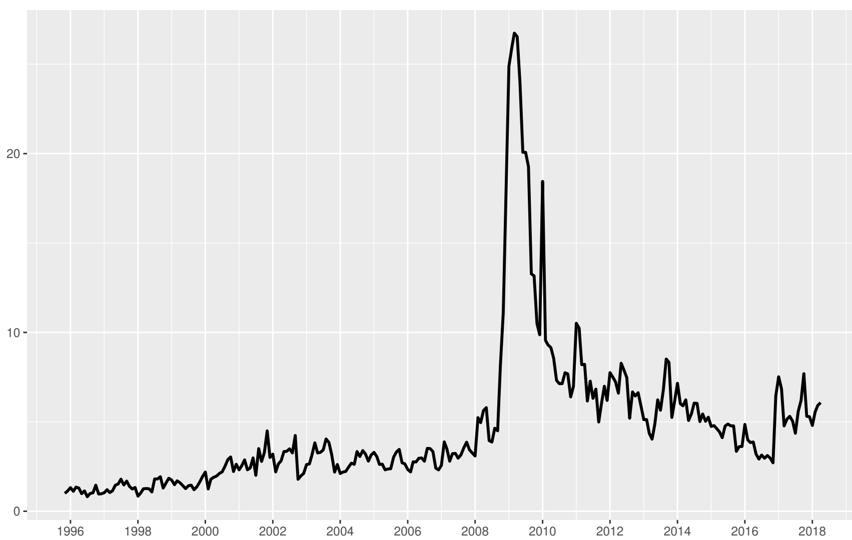
their interaction $DB_t \cdot TG_i$ (Effect; DiD estimator) and some controls X_k including the year-on-year growth rate of industrial production (IP), the inflation rate (INF) and the newspaper-based Baker *et al.* (2016) measure for economic policy uncertainty (EPU).

C. FPU and the US Economy

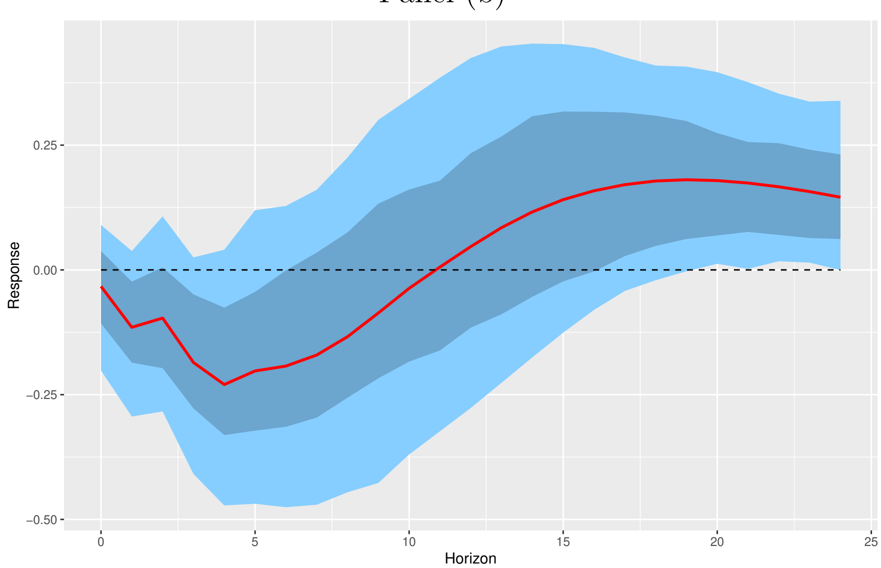
Figure A.1: **US FPU and its effect on industrial production**

Panel (a) shows our measure of fiscal policy uncertainty (FPU) – the standard deviation of 12-month-ahead budget balance forecasts across forecasters for the US. Panel (b) displays the impulse response of our FPU measure on the year-on-year growth rate of industrial production for the US. The red solid line gives the response over a horizons of 24 months, the black dashed line represents the zero line (no effect) and the light (dark) blue shadings give the 95% (68%) confidence interval. The impulse response is computed based on a trivariate vector autoregression (VAR) model including the FPU measure, the unemployment rate and the year-on-year growth rate of industrial production with six lags. Shocks have been identified by a Cholesky decomposition using the order of appearance in the previous sentence. See Figure 4 for comparison.

Panel (a)



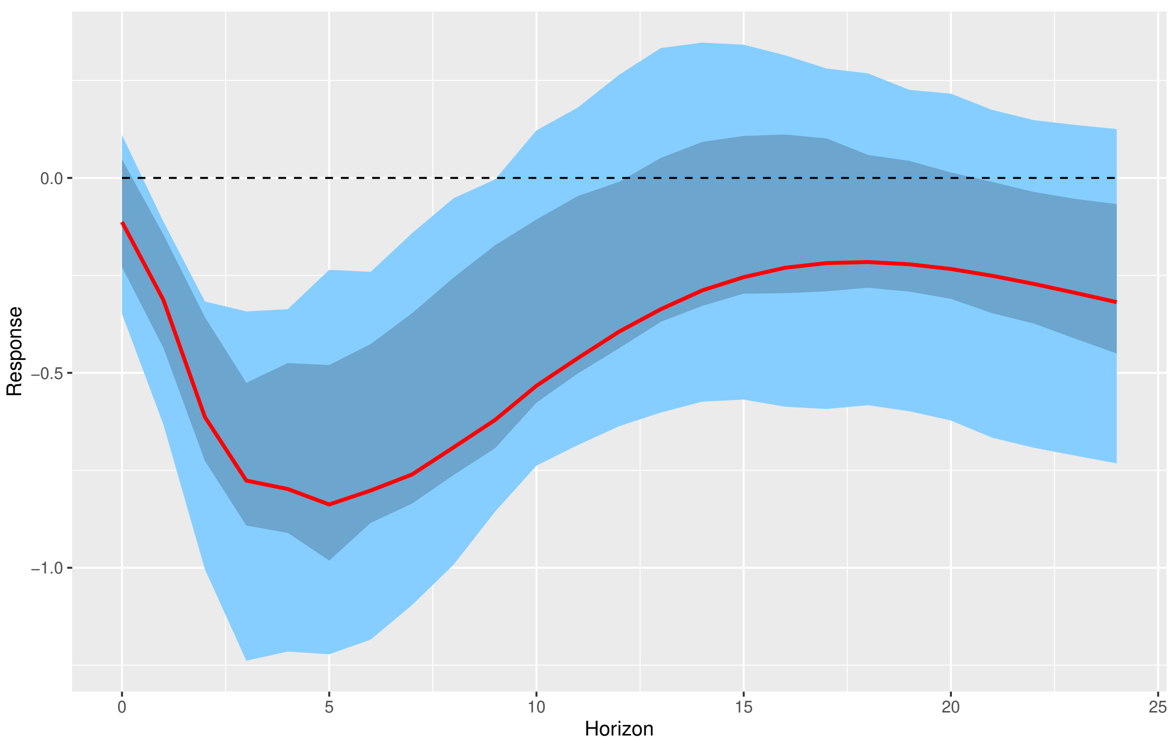
Panel (b)



D. FPU Effect and Debt Brake

Figure A.2: **FPU effect on industrial production accounting for the introduction of the debt brake**

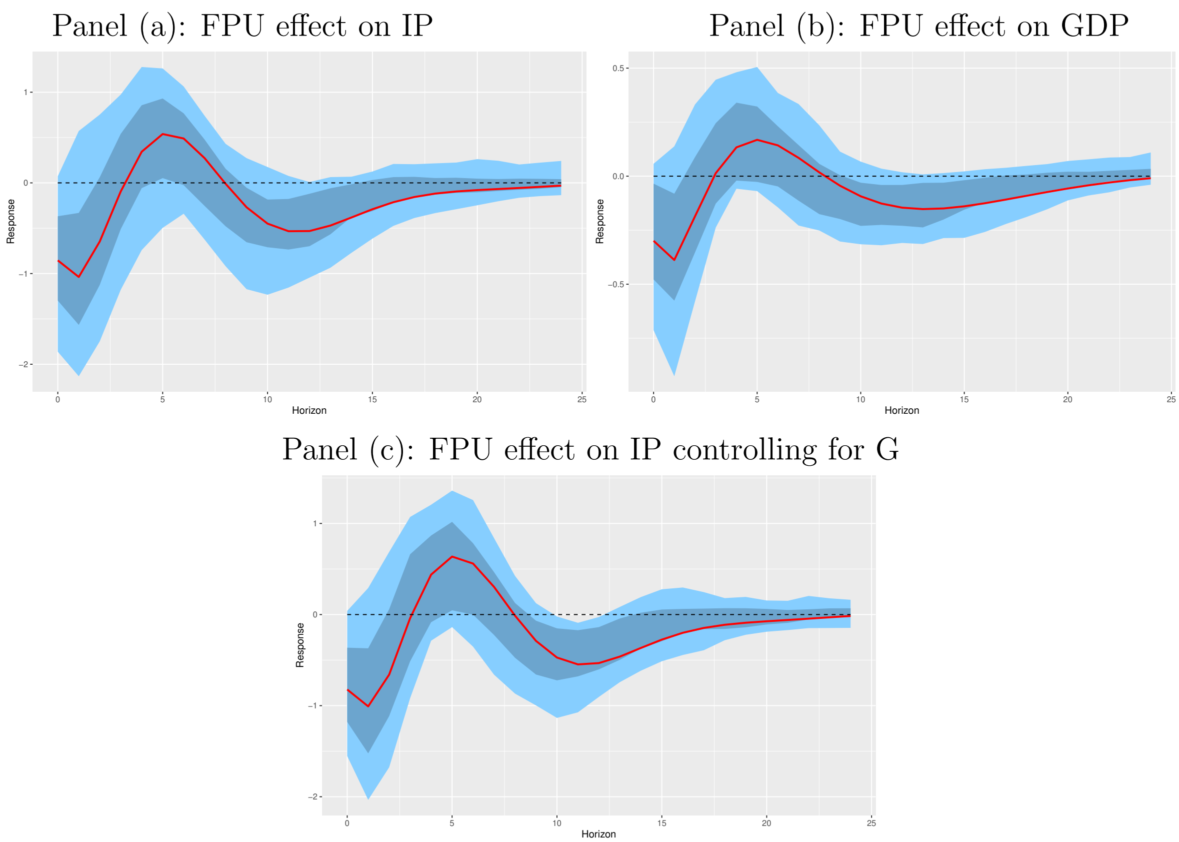
The plot shows the impulse response of our fiscal policy uncertainty (FPU) measure on the year-on-year growth rate of industrial production. The red solid line gives the response over a horizons of 24 months, the black dashed line represents the zero line (no effect) and the light (dark) blue shadings give the 95% (68%) confidence interval. The impulse response is computed based on a trivariate vector autoregression (VAR) model including the FPU measure, the unemployment rate and the year-on-year growth rate of industrial production with six lags and a dummy variable as additional deterministic term accounting for the introduction of the debt brake, which takes a value of unity since May 2009 and zero prior to this date. Shocks have been identified by a Cholesky decomposition using the order of appearance in the previous sentence.



E. Quarterly Data

Figure A.3: **Quarterly FPU effect**

Panel (a) shows the robustness of the impulse response of our fiscal policy uncertainty (FPU) measure on the year-on-year growth rate of industrial production using quarterly data. It relies on our baseline trivariate model but uses quarterly instead of monthly data. In Panel (b) the year-on-year growth rate of industrial production is replaced by the corresponding growth rate of real gross domestic production (GDP). Panel (c) displays the same effect as Panel (a) but also controls for the year-on-year growth rate of government final consumption expenditure in Germany (G). The red solid line gives the response over a horizons of 24 months, the black dashed line represents the zero line (no effect) and the light (dark) blue shadings give the 95% (68%) confidence interval. See Figure 6 for comparison.



F. Shock Identification through Sign Restrictions

Adopting sign restrictions basically explores the space of orthogonal shock decompositions to examine whether the reactions are in line with the imposed restrictions (Canova and De Nicolo, 2002). Sign restrictions are imposed as follows, given a set of sign restrictions:

1. Estimate the unrestricted VAR given by Eq. (6) to get estimates for the coefficients $\hat{B}_i$ for $i = 0, 1, \ldots, p$ and the variance covariance matrix of the innovations $\hat{\Sigma}$.

2. Extract orthogonalized shocks from the estimated model relying on a Cholesky decomposition.

3. Compute orthogonalized impulse responses based on the shocks given by Step 2.

4. Randomly draw an orthogonal impulse vector α while $\alpha = \tilde{A}a$ and $\tilde{A}\tilde{A}' = \tilde{\Sigma}$. See Uhlig (2005) and Rubio-Ramírez *et al.* (2010) for details and the three different approaches to generate the impulse vector.

5. Multiply the responses from Step 3 with the impulse vector α from Step 4 and check if the responses match the imposed sign restrictions.

6. If yes, then keep the response. If not, drop the draw.

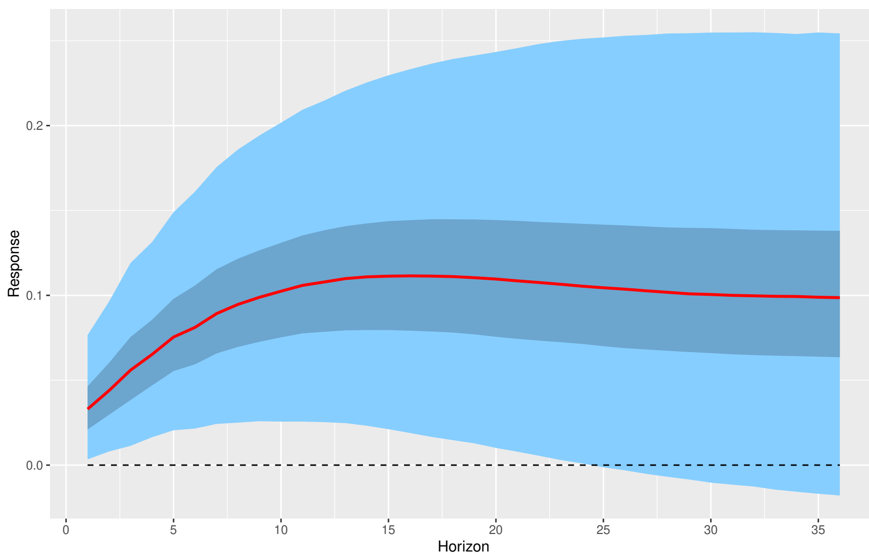
7. Repeat Steps 2 to 6 until reaching 1,000 accepted draws.

Figure A.4: **FPU effect using sign restrictions**

The plot shows the impulse response of our fiscal policy uncertainty (FPU) measure on the annual unemployment rate (Panel (a)) and the year-on-year growth rate of industrial production (Panel (b)). The red solid line gives the response over a horizons of 24 months, the black dashed line represents the zero line (no effect) and the light (dark) blue shadings give the 95% (68%) confidence interval. The impulse response is computed based on a trivariate vector autoregression (VAR) model including the FPU measure, the unemployment rate (UR) and the year-on-year growth rate of industrial production (IP) with six lags. Shocks have been identified by the following sign restrictions using the rejection method by Uhlig (2005):

Shock/Variable	FPU	UR	IP
Restriction	≥ 0	≥ 0	≤ 0

Panel (a)



Panel (b)

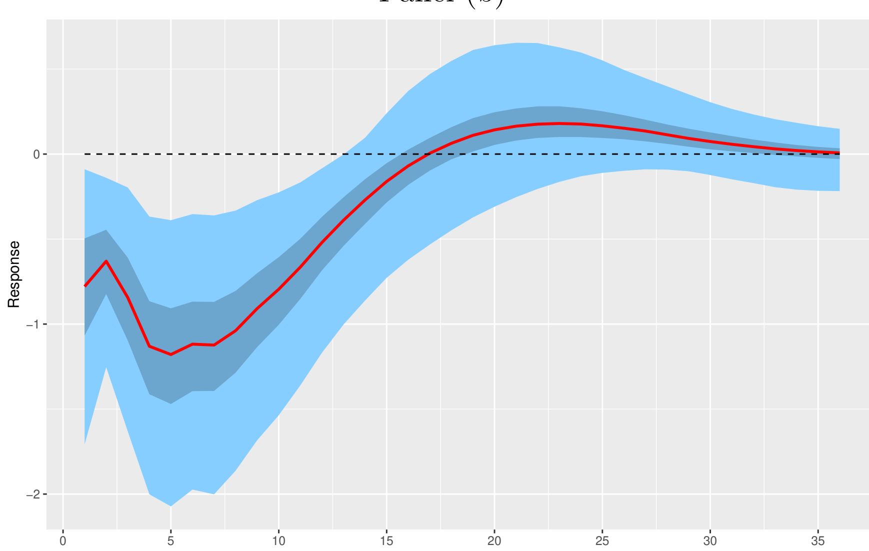
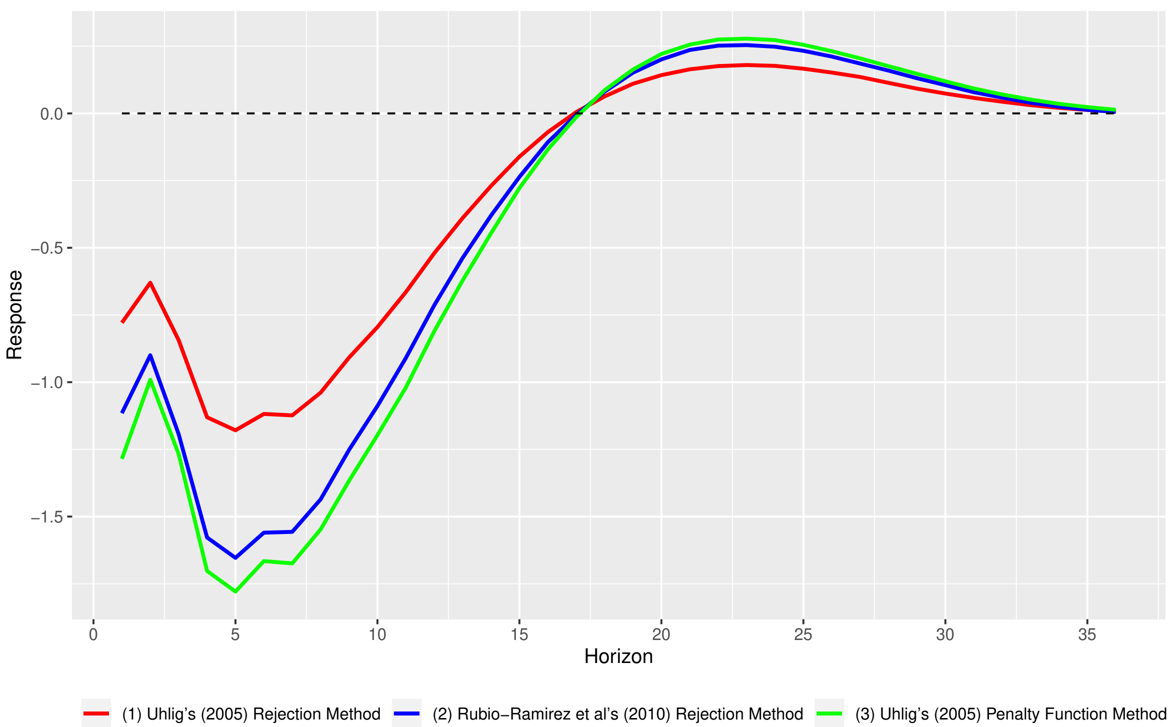


Figure A.5: **Robustness of FPU effect using sign restrictions**

The plot shows the impulse response of our fiscal policy uncertainty (FPU) measure on the year-on-year growth rate of industrial production using three different methods to apply sign restrictions: (1) the rejection method by Uhlig (2005) in red, (2) the rejection method by Rubio-Ramírez *et al.* (2010) in blue and (3) the penalty function method by Uhlig (2005) in green. The impulse response is computed based on a trivariate vector autoregression (VAR) model including the FPU measure, the unemployment rate (UR) and the year-on-year growth rate of industrial production (IP) with six lags. Shocks have been identified by the following sign restrictions:

Shock/Variable	FPU	UR	IP
Restriction	≥ 0	≥ 0	≤ 0



G. MCMC Algorithm for Time-Varying Parameter VAR with Stochastic Volatility

The B-TVP-VAR-SV model given by Eqs. (7) and (8) is estimated by a Bayesian MCMC algorithm using uninformative priors given below

$$p(B_0) = N(\hat{B}_{OLS}, k_B \cdot \hat{V}(\hat{B}_{OLS})) \quad \text{with} \quad k_B = 4, \tag{9}$$

$$p(A_0) = N(\hat{A}_{OLS}, k_A \cdot \hat{V}(\hat{A}_{OLS})) \quad \text{with} \quad k_A = 4, \tag{10}$$

$$p(\log \varsigma_0) = N(\log \hat{\varsigma}_{OLS}, k_\varsigma \cdot I_3) \quad \text{with} \quad k_\varsigma = 1, \tag{11}$$

$$p(Q) = IW(k_Q^2 \cdot pQ \cdot \hat{V}(\hat{B}_{OLS}), pQ) \quad \text{with} \quad k_Q = 0.01, pQ = 80, \tag{12}$$

$$p(W) = IW(k_W^2 \cdot pW \cdot I_3, pW) \quad \text{with} \quad k_W = 0.01, pW = 4, \tag{13}$$

$$p(S_j) = IW(k_S^2 \cdot pS_j \cdot \hat{V}(\hat{A}_{j,OLS}), pS_j) \quad \text{with} \quad k_S = 0.01, pS_j = 1 + j, \quad j = 1, 2 \tag{14}$$

where $N(.)$ stands for the normal and $IW(.)$ for the inverse Wishart distribution. To initialize the priors, $\hat{B}_{OLS}$, $\hat{V}(\hat{B}_{OLS})$, $\hat{A}_{OLS}$, $\hat{V}(\hat{A}_{OLS})$ have been estimated by OLS within a training sample period using the first 60 months.

We apply the Gibbs sampling algorithm by Del Negro and Primiceri (2015) with 10,000 draws excluding a burn-in sample of 1,000 as follows:

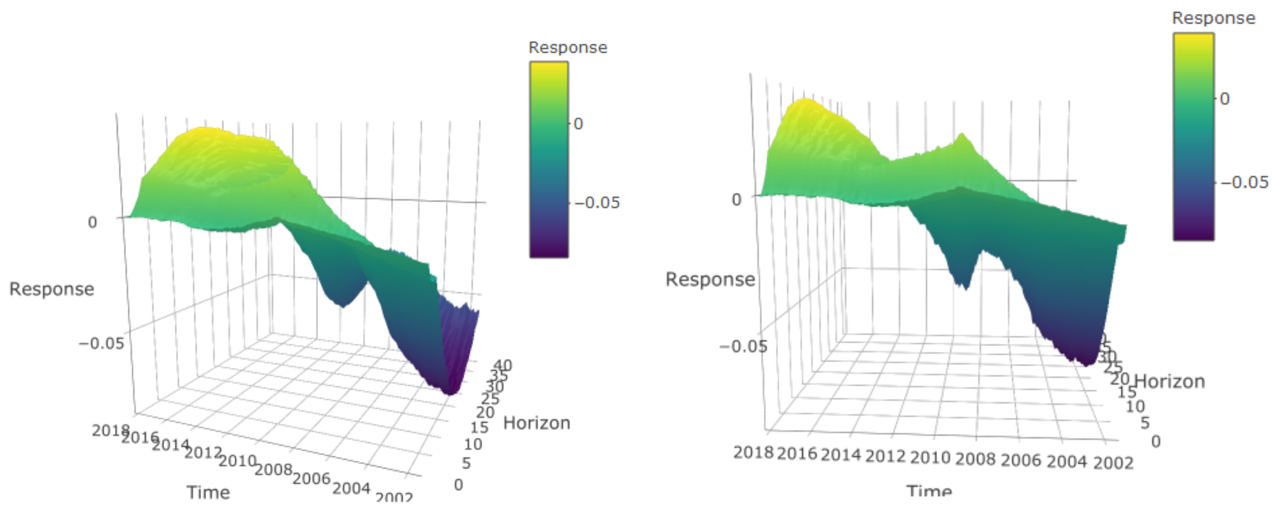
1. Initialize A^T, Σ^T, s^T and V^T,
2. Sample B^T from $p(B^T|\vartheta^{-B^T}, \Sigma^T)$ by applying the Carter and Kohn (1994) algorithm,
3. Sample Q from the inverse Wishart posterior $p(Q|B^T)$,
4. Sample A^T from $p(A^T|\vartheta^{-A^T}, \Sigma^T)$ by applying the Carter and Kohn (1994) algorithm,
5. Sample S from the inverse Wishart posterior $p(S|\vartheta^{-S}, \Sigma^T)$,
6. Sample s^T from $p(s^T|\Sigma^T, \vartheta)$ by applying the Kim *et al.* (1998) algorithm,
7. Sample Σ^T from $p(\Sigma^T|\vartheta, s^T)$ by applying the Carter and Kohn (1994) algorithm,
8. Sample W from the inverse Wishart posterior $p(W|\Sigma^T)$,
9. Go back to step 2,

where s^T denotes the entire path of auxiliary discrete variables necessary to conduct inference on the volatilities given in Σ^T (Czudaj, 2019). ϑ is defined as $\vartheta = [B^T, A^T, V]$ and ϑ^{-B^T} means $\vartheta \setminus B^T$.

Figure A.6: **Time-varying FPU effect**

The plot shows the time-varying impulse responses of our fiscal policy uncertainty (FPU) measure on the annual unemployment rate (Panel (a)) and the year-on-year growth rate of industrial production (Panel (b)) in three-dimensional graphs. The impulse response is computed based on a trivariate time-varying parameter vector autoregression model with stochastic volatility (TVP-VAR-SV) according to Primiceri (2005) and including the FPU measure, the unemployment rate (UR) and the year-on-year growth rate of industrial production (IP) with six lags. Shocks have been identified by a Cholesky decomposition using the order of appearance in the previous sentence. The MCMC algorithm follows Del Negro and Primiceri (2015).

Panel (a)



Panel (b)