# Business Uncertainty and the Effectiveness of Fiscal Policy in Germany

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**Abstract**

This paper explores how business uncertainty affects the effectiveness of fiscal policy in Germany in the years 1970 to 2014. I use measures of business uncertainty that are derived from the firm-level data of the Ifo Business Climate Survey and interact them with the parameters of a structural vector autoregression to produce state-dependent spending multipliers. I observe that fiscal policy is most effective when uncertainty is high and that the difference in multipliers across uncertainty levels is largest for longer-term horizons. The results also point to a prominent role for business confidence in the state-dependent transmission of spending shocks to output. The findings have an important implication for stabilization policies. Since monetary policy is less effective during volatile episodes, fiscal policy is the better tool to stimulate the economy in uncertain times.

*Keywords:* Business Uncertainty, Government Spending Multiplier, Interacted Vector Autoregression, Germany

*JEL-Codes:* E32, E62

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# 1 Introduction

Is the effectiveness of fiscal policy in Germany affected by time-varying business uncertainty? In this paper I use measures of business uncertainty that are derived from the firm-level data of the Ifo Business Climate Survey (Ifo-BCS) and interact them with the parameters of a structural vector autoregression (VAR) to produce state-dependent spending multipliers. I find that fiscal policy is most effective when uncertainty is high. While there exist articles on the state-dependent transmission of spending shocks to output on the one side and the impact of uncertainty on the business cycle on the other side, the evidence on the empirical relationship between fiscal policy and business uncertainty is lacking.[1] Furthermore, this finding has an important implication for stabilization policy. Since monetary policy is less effective during volatile episodes, fiscal policy is the better tool to stimulate the economy in uncertain times.

The effectiveness of discretionary government spending received considerable attention in the recent past since governments around the world implemented large fiscal stimulus packages to counteract the economic downturn of 2008/09.[2] After 2010 most countries switched to fiscal austerity to address concerns about rising deficits and public debt sustainability. Since estimates of spending multipliers varied a lot across countries and periods, several authors suspected that fiscal policy effectiveness could be state-dependent (see, e.g., Müller, 2014).

Some provided evidence for both the United States (see, e.g., Auerbach and Gorodnichenko, 2012b; Bachmann and Sims, 2012; Shoag, 2015) and Germany (see, e.g., Baum and Koester, 2011; Baum, Poplawski-Ribeiro, and Weber, 2012) that fiscal stimulus is more effective during recessions than expansions, while others suggested financial market stress as a determinant (see, e.g. Corsetti, Meier, and Müller, 2012; Rafiq, 2014). Consistent with standard economic theory, some authors also found that multipliers are larger when only a small share of domestic absorption falls on imports (see, e.g., Ilzetzki, Mendoza, and Végh, 2013) or when the exchange rate is less flexible (see, e.g., Born, Juessen, and Müller, 2013). Similarly, fiscal policy is more effective when monetary policy is constrained by the zero lower bound on the nominal interest rate (see, e.g., Christiano, Eichenbaum, and Rebelo, 2011; Eggertsson, 2011; Wieland, 2012) or due to the mem-

[1] Alloza (2015) argues that fiscal policy effectiveness in the United States is reduced when stock market volatility is heightened. However, I focus on the uncertainty of firms, not financial market participants. I also show that business uncertainty and stock market volatility are not related in Germany, which could, besides different estimation and identification methods, explain the different results. See also Berg (2015) who reports that fiscal multipliers in Germany positively correlate to business uncertainty, but negatively to financial market stress.

[2] For example, in November 2008 and February 2009, the German parliament passed two fiscal stimulus packages summing up to 74.5 billion euro or 3.1% of GDP.

bership in a currency union (see, e.g., Illing and Watzka, 2014; Flotho, 2015). And when public finances are weak, concerns about future tax rises or even government solvency could dampen the impact of spending shocks on output (see, e.g., Corsetti, Kuester, Meier, and Müller, 2013).

The economic downturn of 2008/09 also coincided with a sharp rise in volatility measures, leading several authors to suspect that increased uncertainty contributed to the Great Recession and the slow recovery thereafter. Inspired by the seminal article of Bloom (2009), some authors pointed to exogenous changes in uncertainty ("uncertainty shocks") as a potential contributor (see, e.g., Born, Breuer, and Elstner, 2014; Grimme, Henzel, and Bonakdar, 2015). Others argued that causation ran the opposite way, namely that first moment macroeconomic shocks, not uncertainty shocks, lead to the Great Recession, but that the endogenous response of uncertainty to such shocks then indeed amplified the economic downturn (see, e.g., Bachmann and Moscarini, 2012). In addition, some authors suggested that monetary policy effectiveness was reduced due to high uncertainty, thus providing an explanation for the slow recovery after the crisis (see, e.g., Aastveit, Natvik, and Sola, 2013; Vavra, 2013).

Since uncertainty is not observable, several measures have been proposed as proxies. These measures capture different dimensions of uncertainty and include: stock market volatility (see, e.g., Bloom, 2009), corporate bond spreads (see, e.g., Aastveit et al., 2013), factor-based estimates of macroeconomic uncertainty (see, e.g, Henzel and Rengel, 2014; Jurado, Ludvigson, and Ng, 2015; Henzel and Wieland, 2016), a measure based on unpredictable macroeconomic now- and forecast errors (see, e.g., Rossi and Sekhposyan, 2015), a Google News based index of economic uncertainty and an economic policy uncertainty index based on newspaper coverage frequency (see, e.g., Baker, Bloom, and Davis, 2015), as well as the forecast disagreement among firms (see, e.g., Bachmann, Born, Elstner, and Grimme, 2013; Bachmann, Elstner, and Sims, 2013).

In this paper I follow the latter approach and consider uncertainty measures that are derived from the firm-level data of the Ifo-BCS. Each month, the survey polls a representative sample of about 5,000 firms in the manufacturing sector on their past and expected production activities.[3] Following Bachmann et al. (2013) I use the ex-ante forecast dispersion across firms to proxy for business uncertainty. Moreover, I also consider two alternative measures that are based on ex-post forecast errors in a robustness check. The firm-level survey data are well-suited to measure business uncertainty since they capture the uncertainty of actual decision-makers, as opposed to outside analysts or financial market participants. In particular, I show that all three measures significantly correlate with economic activity, while stock market volatility does not.

[3]The Ifo Business Climate Index – a much-followed leading indicator for economic activity in Germany – is based on this survey. See Becker and Wohlrabe (2008) for further details on the survey design.

To estimate a potential nonlinearity in the transmission of spending shocks to output, I use the interacted VAR model of Towbin and Weber (2013) and Sá, Towbin, and Wieladek (2014). In the interacted VAR, parameter variation is directly linked to an exogenous indicator variable, which is business uncertainty in this paper. This model hence allows me to compute spending multipliers at various uncertainty levels and to explore how time-varying business uncertainty affects the effectiveness of fiscal policy in Germany. While several recent applications to monetary policy are available (see, e.g., Aastveit et al., 2013; Castelnuovo, Caggiano, and Pellegrino, 2015; Jannsen, Potjagailo, and Wolters, 2015; Pellegrino, 2015), few authors have studied asymmetric fiscal policy within this framework so far.[4]

The baseline results are obtained from an interacted VAR that includes government spending, business confidence and output as endogenous variables, while the ex-ante forecast dispersion measure serves as the exogenous indicator. The model is estimated at quarterly frequency over the period 1970:1 to 2014:4 and spending shocks are identified in a recursive form.

Overall, I obtain evidence in favor of a state-dependent transmission of spending shocks to output in Germany. In particular, I observe that fiscal policy is most effective when business uncertainty is high and that the difference in multipliers across uncertainty states is largest for longer-term horizons. The empirical results are consistent with the predictions of the theoretical model of Bloom, Floetotto, Jaimovich, Saporta-Eksten, and Terry (2014), which suggests that fiscal policy is temporarily less effective when the economy has been hit by an uncertainty shock since firms become more cautious in responding to price changes. Indeed, I also find that multipliers are smaller, though not significantly, in the immediate aftermath of an uncertainty shock, but are much larger after a few years. This differential effect of fiscal stimulus on output in the short and long-run could be explained by its impact on business confidence. In uncertain times, confidence shows a strong, but delayed, improvement after a spending shock, leading firms to produce more in the years that follow. In addition, I show that the findings are robust to several alternative model specifications. In particular, the positive correlation between business uncertainty and fiscal policy effectiveness at longer-term horizons does not depend on the uncertainty measure used, the frequency of the data, or the sample period. Furthermore, I demonstrate that the baseline results are not contaminated by anticipation effects or an endogeneity bias.

The remainder of this paper is organized as follows. Section 2 explains the computation of the business uncertainty measures and develops the interacted VAR model. Section 3 presents the baseline results. Section 4 provides some robustness checks. The final section concludes.

[4]For example, Nickel and Tudyka (2014) use an interacted VAR with the debt-to-GDP ratio as an indicator and find that fiscal policy effectiveness is negatively correlated to the degree of public indebtedness.

# 2 Methodology and Data

This section compares business uncertainty measures that are derived from the Ifo-BCS. I also develop the interacted VAR model, explain its estimation and identification, as well as the data and baseline specification used to compute conditional impulse responses to spending shocks.

## 2.1 Measuring Business Uncertainty

To obtain measures of business uncertainty, I use the forward-looking question of the Ifo-BCS. Each month, the survey polls a representative sample of about 5,000 firms in the manufacturing sector on their expected production activities for the next three months. In particular, the survey question reads as follows:[5]

(**Q1**) "*Expectations for the next three months: Our domestic production activities (without taking into account differences in the length of months or seasonal fluctuations) with respect to XY will increase, roughly stay the same, decrease.*"

The answers to this question fall into one of three qualitative categories: "increase", "decrease", and "stay the same". Following Bachmann et al. (2013) I proxy for unobserved uncertainty with ex-ante forecast dispersion and construct the first measure of business uncertainty as

$$\text{FDISP}_t = \sqrt{QE_t^+ + QE_t^- - \left(QE_t^+ - QE_t^-\right)^2}, \tag{1}$$

where $QE_t^+$ ($QE_t^-$) is the fraction of firms expecting an increase (decrease) in production. This dispersion measure serves as the baseline uncertainty proxy because its computation is simple, a long time series is available, and it is also readily at hand in real-time.

Figure 1 plots the dispersion measure at quarterly frequency for the period 1970:1 to 2014:4. The quarterly data are obtained by taking the average of monthly figures. In addition, I remove any remaining seasonality using X-13ARIMA-SEATS and rescale the measure to have zero mean and unit variance. The figure also contains a shaded area which indicates periods of subdued growth according to the Composite Leading Indicator (CLI) of the Organisation for Economic Co-operation and Development (OECD). Table A.1 provides a description of the data used.

The figure reveals that business uncertainty undergoes large swings during the sample period and is countercyclical. The correlation with the CLI dates is 0.31 (p-value: 0.000) as shown

[5] Own translation – the German original reads "*Erwartungen für die nächsten 3 Monate: Unsere inländische Produktionstätigkeit (ohne Berücksichtigung unterschiedlicher Monatslängen und saisonaler Schwankungen) bezüglich XY wird voraussichtlich steigen, etwa gleich bleiben, abnehmen*".

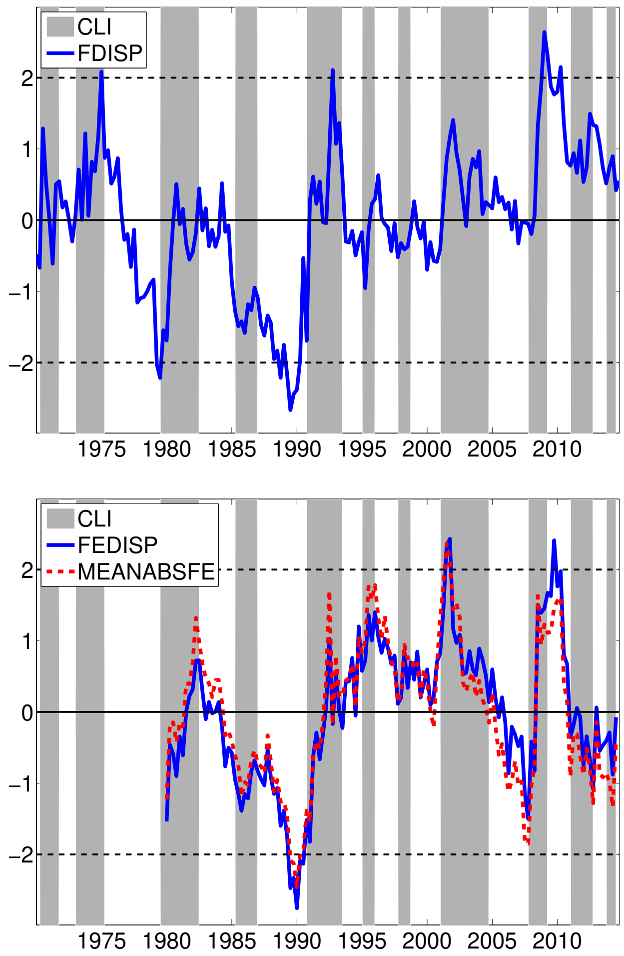


Figure 1: Business Uncertainty Measures. Notes: this figure shows measures of business uncertainty (solid and dashed lines) together with periods of subdued growth according to the OECD Composite Leading Indicator (CLI) (shaded area) for the period 1970:1 to 2014:4 (upper panel) and 1980:1 to 2014:3 (lower panel), respectively. The measures are rescaled to have zero mean and unit variance.

in Table 1. Periods of high uncertainty coincide with the 1973-74 oil price shock, the crisis of the European Exchange Rate Mechanism in 1992, and the collapse of the investment bank Lehman Brothers in 2008. Business uncertainty is low in the late 1970s and late 1980s.

In a robustness check I also consider two alternative measures of business uncertainty that are based on ex-post forecast errors. To obtain such errors, I use the backward-looking question of the Ifo-BCS, which reads as follows:[6]

[6]Own translation – the German original reads "*Tendenzen im vorangegangenen Monat: Unsere inländische Produktionstätigkeit (ohne Berücksichtigung unterschiedlicher Monatslängen und saisonaler Schwankungen) bezüglich XY ist gestiegen, in etwa gleich geblieben, gesunken*".

Table 1: Correlation between Uncertainty Measures and Activity Variables

| | FDISP | FEDISP | MEANABSFE | VDAX |
|---|---|---|---|---|
| FEDISP | $0.64^{***}$ | | | |
| | [0.000] | | | |
| MEANABSFE | $0.50^{***}$ | $0.94^{***}$ | | |
| | [0.000] | [0.000] | | |
| VDAX | 0.07 | $0.16^{*}$ | 0.13 | |
| | [0.417] | [0.058] | [0.115] | |
| OECD CLI | $0.31^{***}$ | 0.13 | $0.19^{**}$ | 0.06 |
| | [0.000] | [0.114] | [0.027] | [0.496] |
| Output Growth | $-0.33^{***}$ | $-0.31^{***}$ | $-0.30^{***}$ | $-0.08$ |
| | [0.000] | [0.000] | [0.000] | [0.339] |
| Output Gap | $-0.13$ | $-0.29^{***}$ | $-0.27^{***}$ | 0.01 |
| | [0.137] | [0.000] | [0.001] | [0.922] |

Notes: this table shows the correlation between uncertainty measures and activity variables. $^{***}$, $^{**}$, and $^{*}$ denote significance at the 1%, 5%, and 10% level, respectively. p-values are provided in brackets.

(**Q2**) "*Trends in the last month: Our domestic production activities (without taking into account differences in the length of months or seasonal fluctuations) with respect to XY have increased, roughly stayed the same, decreased.*"

The computation of forecast errors is difficult in this context due to the nature of the survey data (qualitative) and the different timing of (Q1) and (Q2) (next 3 months vs. last month). However, Bachmann et al. (2013) argue that under certain assumptions quantitative forecast errors ($\epsilon_{i,t+3}$) can be constructed for each firm $i$ and derive two alternative uncertainty proxies by taking their cross-sectional standard deviation and mean absolute value, respectively:[7]

$$\text{FEDISP}_t = \text{std}\,(\epsilon_{i,t+3}) \quad \text{and} \quad \text{MEANABSFE}_t = \text{mean}|\epsilon_{i,t+3}|. \tag{2}$$

Business uncertainty in period $t$ hence depends on realized forecast errors in three months' time, implying that both measures are not available in real-time, but with a lag of one quarter only. In addition, the underlying firm-level data for the years prior to 1980 are irrecoverable, such that the longest quarterly time series at hand for both measures runs from 1980:1 to 2014:3.

Figure 1 shows both business uncertainty measures at quarterly frequency together with the CLI. The quarterly data are again obtained by taking the average of monthly figures. Seasonality

[7]See also Bachmann et al. (2013). The computation of forecast errors is explained in Table A.2.

is also removed and series are standardized. The figure reveals that both measures closely move together (correlation: 0.94; p-value: 0.000), are countercyclical, and peaks and troughs coincide with those according to FDISP. Their correlation with FDISP is 0.64 (p-value: 0.000) and 0.50 (p-value: 0.000), respectively (see again Table 1). While their correlation with the CLI is lower than that of FDISP, both correlate significantly with other activity variables, such as output growth and the output gap.[8] In fact, a close connection to such variables is a feature of all three proxies, suggesting that those indeed measure uncertainty about business activity. In contrast, the table shows that this is not the case for stock market volatility (VDAX), which is also a frequently used uncertainty proxy.[9] The German VDAX is not significantly correlated to any activity variable.

## 2.2 Interacted VAR Model

In order to study the conditional impulse responses to government spending shocks, I estimate a structural interacted VAR of the recursive form:

$$\underbrace{\begin{pmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{pmatrix}}_{A} \underbrace{\begin{pmatrix} g_t \\ c_t \\ y_t \end{pmatrix}}_{Y_t} = \underbrace{\begin{pmatrix} b_{0,1} \\ b_{0,2} \\ b_{0,3} \end{pmatrix}}_{B_0} + \sum_{l=1}^{p} \underbrace{\begin{pmatrix} b_{l,11} & b_{l,12} & b_{l,13} \\ b_{l,21} & b_{l,22} & b_{l,23} \\ b_{l,31} & b_{l,32} & b_{l,33} \end{pmatrix}}_{B_l} \underbrace{\begin{pmatrix} g_{t-l} \\ c_{t-l} \\ y_{t-l} \end{pmatrix}}_{Y_{t-1}} + \underbrace{\begin{pmatrix} \epsilon_{1,t} \\ \epsilon_{2,t} \\ \epsilon_{3,t} \end{pmatrix}}_{\epsilon_t}, \quad (3)$$

where $g_t$ denotes government spending, $c_t$ is a measure of business confidence, and $y_t$ denotes output. The lag length is $p$, while data are available for $t = 1, ..., T$. The $\epsilon_{i,t}$'s are Gaussian shocks with zero mean and diagonal covariance matrix $\Sigma$. In contrast to a classical VAR, coefficients are not fixed, but vary with an exogenous indicator variable $x_t$:[10]

$$a_{ij} = a_{ij}^0 + a_{ij}^1 x_t, \quad b_{0,i} = b_{0,i}^0 + b_{0,i}^1 x_t, \quad \text{and} \quad b_{l,ij} = b_{l,ij}^0 + b_{l,ij}^1 x_t, \quad (4)$$

for $i = 1, 2, 3$; $j = 1, 2, 3$; and $l = 1, ..., p$, where $a_{11} = a_{22} = a_{33} = 1$ and $a_{12} = a_{13} = a_{23} = 0$, implying that the contemporaneous response of endogenous variables to shocks as well as their transmission depend on $x_t$. In this paper the indicator is a measure of business uncertainty.

[8]Output growth is the quarterly change in (log) real gross domestic product (GDP). The output gap is obtained by applying the Hodrick-Prescott filter to (log) real GDP with smoothing parameter $\lambda = 1,600$.

[9]Stock market volatility is a concatenated series of the quarterly volatility of daily DAX returns (1970:1 to 1991:4) and the implied volatility from DAX options (1992:1 to 2014:4). The Datastream mnemonics are DAXINDX and VDAXNEW, respectively. See Bloom (2009) for a similar proceeding.

[10]Parameter variation is hence deterministic and directly linked to an indicator, which distinguishes the approach from the time-varying parameter VAR of Cogley and Sargent (2002, 2005) or Primiceri (2005).

The recursive form has important implications for both estimation and identification. First, the residual $\epsilon_{1,t}$ can be interpreted as a spending shock. Following Blanchard and Perotti (2002) I hence assume that government spending is predetermined, reflecting the delays that are inherent in the political system. No structural interpretation is attached to the remaining shocks. Second, the structural coefficients can be consistently estimated by applying ordinary least squares (OLS) to each equation separately since error terms do not correlate with regressors.

Once estimated, the structural VAR can be brought into its reduced-form for any given value of the indicator variable ($x_t = \bar{x}$):

$$Y_t = \hat{A}(\bar{x})^{-1} \hat{B}_0(\bar{x}) + \hat{A}(\bar{x})^{-1} \sum_{l=1}^{p} \hat{B}_l(\bar{x}) Y_{t-l} + \hat{A}(\bar{x})^{-1} \epsilon_t, \tag{5}$$

and conditional impulse responses to a spending shock can be computed.

In order to quantify the estimation uncertainty surrounding impulse responses, I use Monte Carlo integration. Following Koop (2003) I impose a noninformative natural conjugate Normal-Gamma prior on structural coefficients and covariances in each equation. This prior has the nice property that the marginal posterior for structural coefficients (stacked in $\beta$) after integrating out the uncertainty about covariances is multivariate-t with posterior mean and covariance:

$$\mathrm{E}(\beta|y) = \hat{\beta} \quad \text{and} \quad \mathrm{var}(\beta|y) = \frac{\nu s^2}{T-p-2}\left(X'X\right)^{-1}, \tag{6}$$

where $\hat{\beta}$ denotes the OLS estimate, $\nu s^2 = \left(y - X\hat{\beta}\right)' \left(y - X\hat{\beta}\right)$, and $y$ and $X$ are the appropriate data and regressor matrices, respectively.[11] Note that both posterior moments only involve data information and are equal to OLS quantities.

The posterior distribution for the impulse responses is obtained as follows. First, I fix the indicator at a particular value $\bar{x}$. Second, I draw structural coefficients equationwise from their marginal posterior. Third, I compute the reduced-form of the VAR. Fourth, I calculate impulse responses to a unit spending shock and save them. The latter three steps are repeated 1,000 times for any point on the equally spaced discrete grid $\bar{x} \in [-2, 2]$ with step length 0.1, which approximates the continuous distribution of the indicator. In addition, I follow Cogley and Sargent (2002, 2005) and impose a stability condition, which is implemented by discarding draws with autoregressive roots inside the unit circle, hence avoiding explosive outcomes of the model. The retained impulse responses are used for inference.[12]

[11]The subscript $i$ denoting the respective equation is suppressed for better readability.

[12]On average less than 10% of all draws are discarded.

## 2.3 Baseline Specification and Data

The baseline results are obtained from an interacted VAR that is specified as follows. For spending I use the government consumption expenditures and for output the gross domestic product (GDP). Both series are expressed in real terms and enter the VAR in log-levels, hence allowing for cointegration between them. The series are provided by the *Deutsche Bundesbank* at quarterly frequency for the period 1970:1 to 2014:4 and sourced from Datastream.[13] Business confidence is measured using (Q1) of the Ifo-BCS as the fraction of firms with an optimistic outlook minus the fraction with a pessimistic outlook plus 100 and included in levels. While the scaling has no meaning, a higher number represents more confidence. Bachmann and Sims (2012) have shown that the confidence channel is crucial for the transmission of spending shocks to output.

Moreover, I consider the dispersion in production expectations (Q1) as the measure of business uncertainty (FDISP). To allow for a lagged response of endogenous variables to uncertainty, I follow Aastveit et al. (2013) and construct the indicator as a simple moving average:[14]

$$x_t = \frac{1}{1+p} \sum_{l=0}^{p} FDISP_{t-l}. \tag{7}$$

Finally, I set the lag length according to the Hannan-Quinn Criterion (HQC), which suggests $p = 2$.[15]

# 3 Baseline Results

Figure 2 provides the impulse responses for government spending, business confidence and output to spending shocks of one euro conditional on the level of business uncertainty for the baseline specification. Because spending and output enter the VAR in log-levels, I rescale their responses by the average spending share of output over the sample period (which is 0.18) to convert them to euro terms. The size of the output response may then be interpreted as a spending multiplier, i.e. $\partial y/\partial g$, which is the standard measure of fiscal policy effectiveness (see, e.g., Blanchard and Perotti, 2002; Bachmann and Sims, 2012). Each three-dimensional (3D) graph exhibits the median multipliers at horizons 0 to 20 for uncertainty levels from -2 to 2. The x-axis

[13] The mnenomics are BDNA0106G and BDNA0000, respectively.

[14] The results are similar for $x_t = FDISP_t$ and for a moving average with weights decreasing in lags.

[15] In a simulation study Ivanov and Kilian (2005) show that the HQC is preferable to the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC) for quarterly VAR models with more than 120 observations. Still, the results are similar for $p = 1$ and $p = 4$, which are chosen by BIC and AIC.

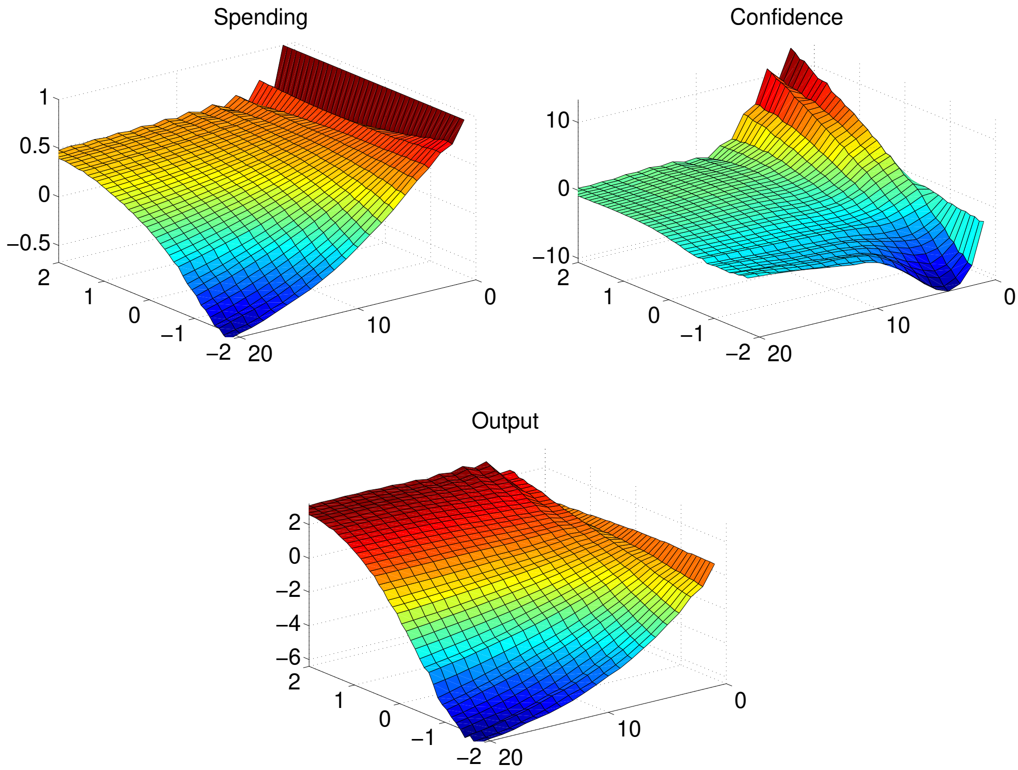


Figure 2: Conditional Distribution of Impulse Responses – Baseline Specification. Notes: this figure shows the impulse responses to spending shocks conditional on the level of business uncertainty (FDISP). x-axis: horizon (quarter); y-axis: uncertainty (standard deviation); z-axis: response (euro).

plots the horizon in quarters, the y-axis denotes the level of uncertainty in standard deviations below (above) the sample mean, and the z-axis shows the multiplier in euro.

The figure reveals that the effectiveness of fiscal policy in Germany is not stable across uncertainty states. For most horizons the output response tends to increase with the level of business uncertainty. When uncertainty is below its sample mean, an additional euro of spending has a small and short-lived positive impact on output, which turns even negative after a few quarters. During normal times, with uncertainty close to its sample mean, the spending multiplier is flat and the extra stimulus has neither a positive nor a negative impact on output after a while. For high levels of uncertainty, however, output shows a hump-shaped response, and the stimulus leads to a persistent rise in overall economic activity.

Figure 2 also suggests that business confidence is a potential transmission channel for the observed positive correlation of fiscal policy effectiveness and business uncertainty. When uncertainty is low, confidence declines after an expansionary spending shock, while it exhibits a small positive response during normal times. In contrast, firms are much more optimistic with

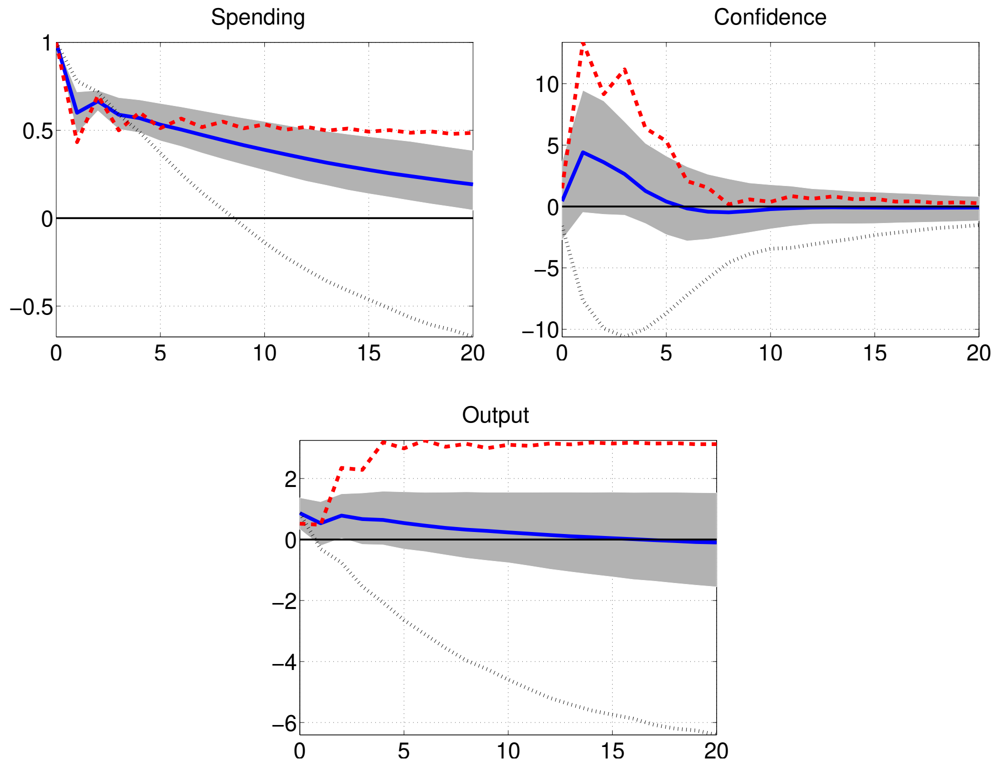


Figure 3: Impulse Responses for Selected Uncertainty States – Baseline Specification.
Notes: this figure provides the impulse responses to spending shocks (solid line) at the average level of business uncertainty ($\bar{x} = 0$) together with a 90% error band (shaded area). The figure also exhibits the impulse responses when uncertainty is high ($\bar{x} = 2$; thick dashed line) or low ($\bar{x} = -2$; thin dashed line), respectively. x-axis: horizon (quarter); y-axis: response (euro).

respect to their prospective production activities when the additional stimulus is announced in times of high uncertainty. In the following, firms will most likely invest more in equipment and buildings or higher more staff, hence boosting overall economic activity.

Since the 3D plots do not account for estimation uncertainty, I provide the impulse responses at the average level of business uncertainty ($\bar{x} = 0$) together with a 90% error band in Figure 3. The plots also include the median responses when uncertainty is high ($\bar{x} = 2$) and low ($\bar{x} = -2$).

During normal times, an additional euro of spending leads to an increase in output of about 80 cent within the quarter. The spending multiplier declines thereafter and is not different from zero after a year and later. For the high and low uncertainty states, the multipliers are of similar magnitude on impact and lie within the 90% error band. The size of the multipliers is, however, different for longer-term horizons. While the extra fiscal stimulus induces an increase in output of about 3 euro after five years when announced in times of high uncertainty, the same euro spend during a low uncertainty period leads output to decline by more than 6 euro.

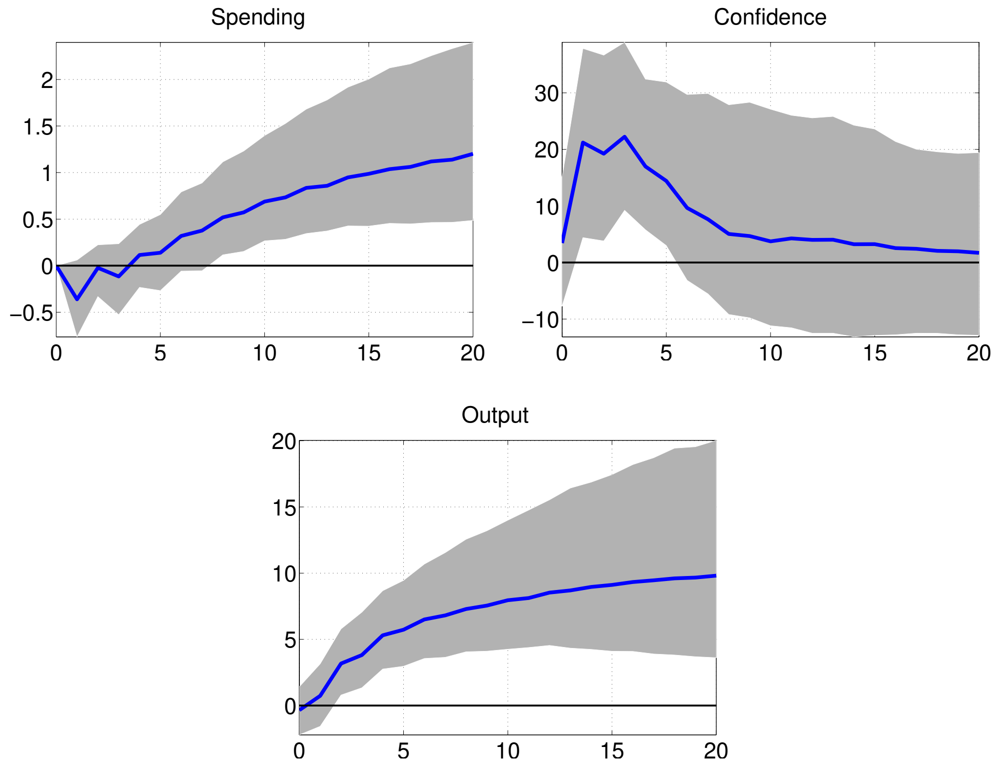


Figure 4: Difference in Impulse Responses between High and Low Uncertainty State – Baseline Specification. Notes: this figure shows the difference in impulse responses between the high ($\bar{x} = 2$) and low ($\bar{x} = -2$) uncertainty state (solid line) together with a 90% error band (shaded area). x-axis: horizon (quarter); y-axis: difference (euro).

The state-dependent transmission of spending shocks to output is also reflected in business confidence. Following a fiscal stimulus, confidence moves in opposite directions for $\bar{x} = 2$ and $\bar{x} = -2$, while both responses are also well outside the 90% error band most of the time.

In order to test more formally whether the transmission of spending shocks is significantly different across uncertainty states, I compute for each draw the difference between the impulse responses at $\bar{x} = 2$ and $\bar{x} = -2$. Figure 4 shows the median difference together with a 90% error band for government spending, business confidence, and output at horizons 0 to 20.

The figure suggests that the contemporaneous response of output and confidence to spending shocks is not state-dependent, while the transmission thereafter is. The median difference for output is increasing over time and settles at around 10 euro after five years. The 90% error band is well above zero after a half year and later, indicating that the state-dependent transmission of spending shocks to output is statistically significant. Moreover, I obtain that confidence improves significantly stronger after a stimulus for several quarters when uncertainty is high.

In sum, I obtain that fiscal policy in Germany is most effective when business uncertainty is high. Moreover, I find that the difference in spending multipliers across uncertainty states is largest for longer-term horizons, and then both statistically significant as well as of economic relevance. The results also suggest a prominent role for business confidence in the state-dependent transmission of spending shocks to output.

# 4 Robustness

In this section I explore the robustness of the baseline results with respect to several alternative model specifications. First, I assess whether the exogeneity assumption for the uncertainty measure is not too rigid. Second, I add professional forecasts for government spending and output to the VAR to account for possible anticipation effects. Third, I use FEDISP and MEANABSFE as alternative uncertainty measures. The full set of results for output is provided in Figure 5.[16]

**Controlling for Endogeneity** The first robustness check concerns the exogeneity assumption for the business uncertainty measure. While it is not uncommon to treat uncertainty as exogenous, the indicator variable is strictly speaking not an uncertainty shock in the sense of Bloom et al. (2014), but may well respond itself to a spending shock. To assess the relevance of a potential endogeneity bias, I use the following two-step approach.[17] In the first step, I estimate a VAR on business uncertainty (FDISP), government spending, business confidence and output, including two lags of each variable. Following Bloom (2009) I assume a recursive order and interpret the residual of the first VAR equation as an uncertainty shock ($\epsilon_t^{unc}$). In the second step, I use $\epsilon_t^{unc}$ rather than FDISP to compute the indicator variable ($x_t$) and then proceed as before.[18]

Figure 5 shows that controlling for endogeneity does not affect the shape of the output response, but impacts on the size of the multiplier when uncertainty is low. While the stimulating effect on output in times of high uncertainty is only slightly lower in comparison to the baseline specification, the decline in output at $\bar{x} = -2$ is much smaller. After five years output has fallen by less than 2 euro compared to 6 euro when the baseline specification is considered. However, the difference between the high and low uncertainty state is still of economic relevance (more than 4 euro) and statistically significant at most horizons.

[16]The plots for government spending and business confidence are available upon request.

[17]Kilian (2009) considers a similar two-step approach in the context of oil price shocks.

[18]In fact, I use a smoothed uncertainty shock series to compute $x_t$, which is obtained by the Hodrick-Prescott filter ($\lambda = 1,600$). Removing some of the high frequency movements in $\epsilon_t^{unc}$ before estimation makes inference more stable, but has little impact on the qualitative results.

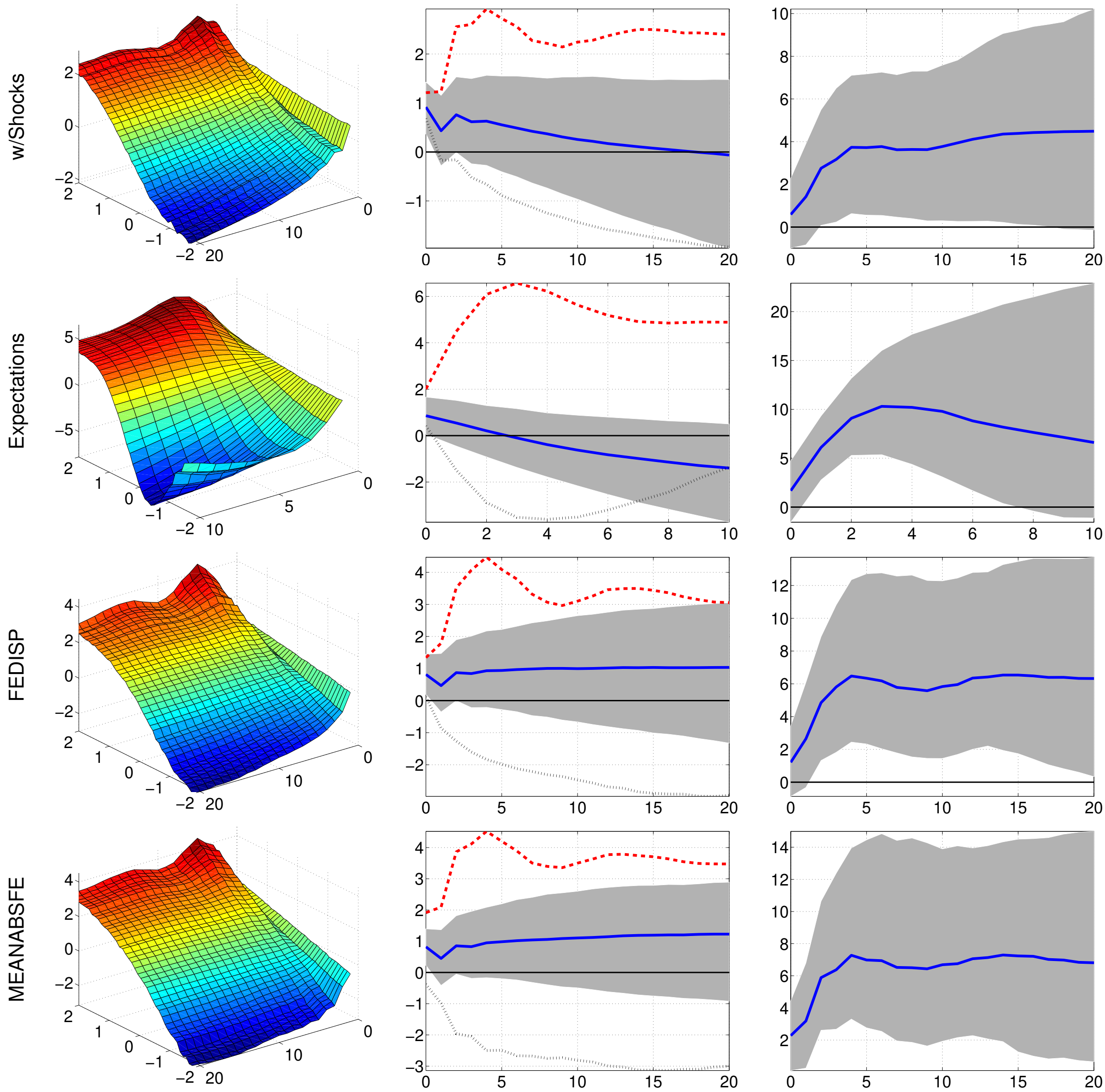


Figure 5: Output Response for Alternative Specifications. Notes: this figure shows the output response to spending shocks for alternative specifications. See also Figures 2 and 3.

**Controlling for Expectations** The second robustness check addresses anticipation effects with respect to government spending shocks. Ramey (2011) emphasizes that neglecting anticipation effects can render impulse responses biased and proposes to include news about future fiscal policy to overcome this potential problem. In this paper I add forecasts for both real government consumption growth ($\Delta g^f_{t|t-1}$) and real GDP growth ($\Delta y^f_{t|t-1}$) from the OECD Economic Outlook to control for anticipated movements in spending and output.[19] The Economic Outlook is prepared twice a year in July and December and provides predictions for the following half year. In accordance with the timing of the forecasts, I estimate the VAR at semi-annual frequency for this robustness check. Since forecasts are made in $t-1$, I order them before spending such that the augmented VAR reads as $Y_t = \left[\Delta g^f_{t|t-1}\ \Delta y^f_{t|t-1}\ g_t\ c_t\ y_t\right]'$, and the residual $\epsilon_{3,t}$ can then be interpreted as a spending shock.[20] [21]

Figure 5 reveals that controlling for expectations and switching to semi-annual frequency does not alter the qualitative results of the baseline specifications. While multipliers are larger at both $\bar{x} = 2$ and $\bar{x} = -2$ compared to the baseline specification, the difference between them is again approximately 10 euro and significantly larger than zero at most horizons.

**Alternative Uncertainty Measures** In the final robustness check I replace FDISP by the alternative measures FEDISP and MEANABSFE. The estimation period is then 1980:1 to 2014:3.

Figure 5 suggests that using the alternative business uncertainty measures produces similar output responses compared to the baseline specification. However, I again observe a less pronounced decline in output for $\bar{x} = -2$, which is also reflected in a smaller value of the difference statistic (about 6 euro).

In sum, I find that the baseline results are robust to several alternative model specifications. In particular, the positive correlation between business uncertainty and fiscal policy effectiveness does not depend on the uncertainty measure used, the frequency of the data, or the sample period. Moreover, I obtain that the baseline results are not contaminated by anticipation effects or an endogeneity bias.

[19]The forecasts from the OECD Economic Outlook are considered as reasonable and hence frequently utilized to control for anticipation effects in fiscal VARs (see, e.g., Auerbach and Gorodnichenko, 2012a, 2013; Born et al., 2013; Berg, 2015). In Berg (2015) it is shown that spending and output growth forecasts for Germany are unbiased, efficient and closely track actual values.

[20]Observe that by controlling for expected changes in government spending and output, $\epsilon_{3,t}$ is indeed a surprise innovation to spending and not mixed up with an anticipated increase in $g_t$ or $y_t$.

[21]While the assumption that spending is predetermined is standard for quarterly time series, one may suspect that it is too restrictive for semi-annual data. However, Born and Müller (2012) test this restriction and find that even annual spending is predetermined. See also Beetsma, Giuliodori, and Klaassen (2009).

# 5 Summary and Conclusion

In this paper I explore how business uncertainty affects the effectiveness of fiscal policy in Germany. For that purpose, I consider measures of business uncertainty that are derived from the firm-level data of the Ifo-BCS and interact them with the parameters of a structural VAR to produce state-dependent spending multipliers. I observe that fiscal policy is most effective when uncertainty is high and that the difference in multipliers across uncertainty states is largest for longer-term horizons. The evidence also suggest a prominent role for business confidence in the state-dependent transmission of spending shocks to output. Moreover, I show that the findings are robust to several alternative model specifications. To summarize the main results, I provide the spending multipliers for each specification at different uncertainty-states in Table 2. The table shows the median multipliers after five years together with the 5th and 95th percentiles. Of course, the size of the multiplier varies across specifications. Nevertheless, the numbers provide strong evidence in favor of state-dependent fiscal policy effectiveness.

Table 2: Output Response after Five Years for Selected Uncertainty States

| Specification | Average ($\bar{x} = 0$) | High ($\bar{x} = 2$) | Low ($\bar{x} = -2$) | Diff. (High/Low) |
|---|---|---|---|---|
| Baseline | $-0.10$ | $3.13$ | $-6.40$ | $9.81$ |
| | $[-1.55,\ 1.53]$ | $[2.08,\ 5.29]$ | $[-16.74, -0.47]$ | $[3.61,\ 20.04]$ |
| w/ Shocks | $-0.06$ | $2.40$ | $-1.94$ | $4.49$ |
| | $[-1.96,\ 1.48]$ | $[0.54,\ 4.06]$ | $[-7.50,\ 1.96]$ | $[-0.14,\ 10.22]$ |
| Expectations | $-1.40$ | $4.89$ | $-1.36$ | $6.61$ |
| | $[-3.73,\ 0.50]$ | $[2.86,\ 8.19]$ | $[-18.17,\ 5.40]$ | $[-1.11,\ 22.92]$ |
| FEDISP | $1.04$ | $3.05$ | $-2.96$ | $6.33$ |
| | $[-1.32,\ 3.05]$ | $[0.86,\ 6.83]$ | $[-9.21,\ 2.01]$ | $[0.34,\ 13.72]$ |
| MEANABSFE | $1.23$ | $3.48$ | $-3.00$ | $6.81$ |
| | $[-0.92,\ 2.89]$ | $[0.98,\ 7.57]$ | $[-10.03,\ 2.23]$ | $[0.65,\ 14.98]$ |

Notes: this table shows the output response in euro after five years for selected uncertainty states and all the specifications. The table also shows the difference in responses between the high and low uncertainty state. The 5th and 95th percentiles are provided in brackets below the median.

Against this background I conclude that fiscal policymakers should take the level of business uncertainty into account when deciding on extra stimulus. In contrast to other important determinants of fiscal policy effectiveness, such as the output gap, the baseline uncertainty measure also has the advantage that it is available in real-time and need not to be estimated. And since monetary policy is less effective during volatile episodes, fiscal policy is the better tool to stimulate the economy when uncertainty is high. In uncertain times, additional spending could be entertained to boost confidence in the business sector, hence stimulating overall economic activity over time. While this positive correlation between business uncertainty and confidence conditional on a spending shock is in the data, more work appears to be needed to understand the theoretical mechanism behind this relationship.

# A Additional Tables

Table A.1: Data Description

| Label | Mnemonic | Source | Period | Frequency |
|---|---|---|---|---|
| DAX30 Performance Index | DAXINDX | Deutsche Börse | 1970:1 to 1991:4 | Q |
| VDAX New Volatility Index | VDAXNEW | Deutsche Börse | 1992:1 to 2014:4 | Q |
| Forecast Dispersion (FDISP) | n/a | Ifo-BCS | 1970:1 to 2014:4 | Q |
| Business Confidence | n/a | Ifo-BCS | 1970:1 to 2014:4 | Q |
| Forecast Error Dispersion (FEDISP) | n/a | Ifo-BCS | 1980:1 to 2014:3 | Q |
| Mean Absolute Forecast Error (MEANABSFE) | n/a | Ifo-BCS | 1980:1 to 2014:3 | Q |
| Composite Leading Indicator: Turning Points | n/a | OECD | 1970:1 to 2014:4 | Q |
| Real Government Consumption | BDNA0106G | Deutsche Bundesbank | 1970:1 to 2014:4 | Q |
| Real Gross Domestic Product | BDNA00000 | Deutsche Bundesbank | 1970:1 to 2014:4 | Q |
| Real Government Consumption Growth Forecast | n/a | OECD | 1970:1 to 2014:2 | S |
| Real Gross Domestic Product Growth Forecast | n/a | OECD | 1970:1 to 2014:2 | S |

Notes: this table describes the series used. The format is: series label, series mnemonic in Datastream (if available), the original data source, and the period and frequency considered. Series that are available at a higher frequency are converted by taking averages.

Table A.2: Computation of Forecast Errors

| Expectation (Q1) | Realization (Q2) | Forecast Error |
|---|---|---|
| $y_{i,t+3\|t} = \ \ 1$ | $y_{i,t+3} > 0$ | $\epsilon_{i,t+3} = 0$ |
| $y_{i,t+3\|t} = \ \ 1$ | $y_{i,t+3} \leq 0$ | $\epsilon_{i,t+3} = y_{i,t+3} - 1$ |
| $y_{i,t+3\|t} = \ \ 0$ | $y_{i,t+3} > 0$ | $\epsilon_{i,t+3} = y_{i,t+3}$ |
| $y_{i,t+3\|t} = \ \ 0$ | $y_{i,t+3} = 0$ | $\epsilon_{i,t+3} = 0$ |
| $y_{i,t+3\|t} = \ \ 0$ | $y_{i,t+3} < 0$ | $\epsilon_{i,t+3} = y_{i,t+3}$ |
| $y_{i,t+3\|t} = -1$ | $y_{i,t+3} < 0$ | $\epsilon_{i,t+3} = 0$ |
| $y_{i,t+3\|t} = -1$ | $y_{i,t+3} \geq 0$ | $\epsilon_{i,t+3} = y_{i,t+3} + 1$ |

Notes: this table explains the computation of quantitative ex-post forecast errors underlying FEDISP and MEANABSFE. The expectation ($y_{i,t+3,|t}$) is based on (Q1) and coded as $1$ (increase), $0$ (stay the same) and $-1$ (decrease) for each firm $i$. The corresponding realization ($y_{i,t+3}$) is the sum of responses to (Q2), which are coded as $1$ (increased), $0$ (stayed the same) and $-1$ (decreased). Example: Firm $i$ expects production to increase over the next three months. In the following three months the firm responds to (Q2) as follows: decreased, stayed the same, decreased, such that $y_{i,t+3} = -2$. Thus $\epsilon_{i,t+3} = -2 - 1 = -3$.

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