Effects of discretionary fiscal policy: new empirical evidence for Germany

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Leibniz University of Hannover, Discussion Paper No. 470

March 2011

Abstract

This paper analyses the effects of discretionary fiscal policy by presenting new empirical evidence for Germany within a structural vector autoregression (SVAR) framework. Following Blanchard and Perotti (2002), the SVAR model is identified by applying institutional information. We find no compelling evidence for the effectiveness of discretionary fiscal policy. Cutting taxes does not tend to stabilise the business cycle. Increasing government expenditure has an ambiguous effect on GDP for the basic specification. However, by controlling for the influence of inflation, higher government expenditure does not either tend to stabilise economic activity. The results are robust to various modifications.

Keywords: Discretionary fiscal policy, Germany, structural vector autoregression

JEL: C32, E62, H30

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1 Introduction

The effectiveness of discretionary fiscal policy is one of the most discussed issues in economics. For many decades, economists have been investigating the topic in an often controversial manner. This is not astonishing since the issue is also of high political importance. Recently, for example, the political importance became obvious again when the world economy fell into a deep recession. In this situation, many governments enacted active stabilisation measures trying to overcome the economic downturn. Discretionary fiscal policy can be defined as cutting taxes or increasing government expenditure due to a political decision in order to stabilise the business cycle by raising aggregate demand. From a theoretical point of view, these measures can have quite opposed effects. Accordingly, evidence is useful to shed further light on the issue.

Our paper analyses the effects of discretionary fiscal policy by providing new empirical evidence for Germany within a structural vector autoregression (SVAR) framework.

The literature which applies the SVAR framework to examine stabilisation policies started with the seminal contribution of Blanchard and Perotti (2002). Similar to the overwhelming part of the papers outlined below, we build on their approach. Blanchard and Perotti find evidence for the effectiveness of discretionary fiscal policy in the U.S. by examining the years 1960 to 1997.

The SVAR literature for Germany has modestly developed over the years, showing research contributions in a subtle way. Thus, still only few studies exist. On the one hand, there are SVAR analyses which consider Germany in combination with other countries, e.g. Perotti (2005), Marcellino (2006) as well as Afonso and Sousa (2009). The stated authors only find small effects of discretionary fiscal policy on gross domestic product (GDP). While the inclusion of several countries enables cross-country comparisons, the studies are, however, also restricted in a number of ways due to this approach. For instance, Perotti (2005) merely uses German data running to the year 1989. Moreover, Afonso and Sousa (2009), applying data until 2006, restrict the government sector to the central government. Thereby, they neglect for example the importance of the local government in Germany in stabilising the economy.

On the other hand, there are SVAR investigations which only examine Germany. Höppner (2003), looking at the time period 1970 – 2000, finds positive effects of discretionary fiscal policy. Breuer and Büttner (2010) also come to results confirming short-term stabilisation regarding a sample from 1960 to 2008, but at the cost of higher medium-term government debt. Using a sample from 1991 to 2005, Bode et al. (2006) tend to find effects as well.[1] On the contrary, the analysis of Heppke-Falk et al. (2006) conveys a sceptical view of stabilising economic activity for the time period 1974 to 2004. With regard to these investigations for Germany, one aspect has to be mentioned especially. The effects of discretionary fiscal policy tend to differ with regard to the inclusion of price variables like inflation as control variables. In contributions which incorporate them, discretionary fiscal policy is questioned (Heppke-Falk et al. (2006)) or weaker (Bode et al. (2006)) than in studies which exclude them (Höppner (2003), Breuer and Büttner (2010)). Started by Bode et al. (2006) and Heppke-Falk et al. (2006), we believe this discrepancy is worth to be further investigated.

Overall, the SVAR literature for Germany is short and inconclusive. Hence, our paper contributes to this literature by presenting further empirical evidence. As stated above, it adopts the approach of Blanchard and Perotti (2002). Moreover, we are standing on the ground of the studies of Heppke-Falk et al. (2006), Bode et al. (2006) and Höppner (2003). Our paper extends the literature in the following way. We are looking at a sample from 1991 up to 2009, thereby able to incorporate the last recession as well as the initiations of the economic stimulus packages. Moreover, by starting after re-unification, we do not need to prolong the series backwards, circumventing the structural break and using non-interpolated data. Additionally, we further investigate the discrepancy of the results in the literature due to the possible influence of price variables.

In sum, we find no compelling empirical evidence for the effectiveness of discretionary fiscal policy for Germany. The effect of a decrease in taxes on GDP tends to be compatible with the neoclassical view. While the response of GDP to an increase in government expenditure is ambiguous for the basic specification, it tends to the neoclassical view as well once inflation is taken into account.

The remainder of the paper is structured as follows. Section 2 outlines the theoretical framework regarding the effects of discretionary fiscal policy. Section 3 provides the methodological approach and depicts the data. Next, section 4 presents the results and robustness checks. Finally, the last section concludes.

[1] It is important to note, however, that the estimated effects in these three studies are much lower than predicted in some theoretical models. Hence, the authors do not come to an unambiguous policy advice of indeed implementing discretionary fiscal policy measures.

2 Theoretical framework

The aim of this section is to sketch the main points of the conflicting theories for classifying our empirical results. We do not try to give a comprehensive overview of the theoretical literature as this would be far beyond the scope of the paper. In general, one can distinguish between the neoclassical view and the Keynesian view concerning the effects of discretionary fiscal policy (see e.g. Blanchard (2009) or Roos (2007)).

According to the neoclassical view in its purest form, discretionary fiscal policy does not have an effect on the business cycle at all. Lowering taxes or raising government expenditure does not influence output, as labour supply is solely determined by the real wage. Instead, government expenditure is crowding-out private consumption and private investment. In extensions of the neoclassical view, so-called New classical theories, individuals perceive tax cuts or higher government expenditure as higher future taxes. Thereby, the present value of their lifetime wealth is reduced. With lump-sum taxation, they increase labour supply, leading to higher output. Moreover, consumption is reduced.

According to the Keynesian view, discretionary fiscal policy stabilises the business cycle. In the short run, a tax cut or an increase in government expenditure leads to an increase in private consumption, thus raising aggregate demand. This is due to market imperfections like myopic behaviour and price rigidities in the labour and goods market. Higher aggregate demand, in turn, results in higher output.

3 Data and methods

Having outlined the theoretical effects of discretionary fiscal policy, this section presents the empirical approach and describes the data.

A. Empirical model

As the starting point of our analysis, due to simultaneity between the variables of interest, we consider a vector autoregression (VAR) model (see Greene (2003) and Bode et al. (2006)). The VAR can be stated as

$$(1) \qquad \mathbf{y}_t = \Gamma_1 \mathbf{y}_{t-1} + \ldots + \Gamma_p \mathbf{y}_{t-p} + \mathbf{u}_t ,$$

where $\mathbf{y}_t$ is the n-dimensional vector of the n endogenous variables, the Γ are $n \times n$ coefficient matrices, $\mathbf{u}_t$ is the n-dimensional vector of residuals with variance-covariance matrix $\Sigma_{\mathbf{u}}$, t is the time index and p is the lag order.

B. Data

Based on Heppke-Falk et al. (2006), we use the following data. The investigation includes the variables GDP (Y), government expenditure (G) and taxes (T) as well as the control variables inflation (π) and interest rate (i). The figures are constructed as follows. Data for GDP is taken from the *Deutsche Bundesbank*. The definition of the two fiscal series deserves special attention as we will show later. Government expenditure is government direct expenditure, consisting of personnel expenditure, other operating expenditure and capital formation. This data comes from the *Statistisches Bundesamt*. Taxes are defined as net revenue, calculated as total revenue[2] minus transfers to social security funds minus interest payments minus current grants paid to the private sector and public enterprises. These current grants are derived by subtracting the following components from total expenditure: personnel expenditure, other operating expenditure, capital formation, financial aid, interest payments as well as transfers to social security funds. The data for constructing net revenue stems from the *Deutsche Bundesbank* and the *Statistisches Bundesamt*. Both fiscal series are cash data and include the central, state and local government. Finally, we take the GDP deflator as a measure of inflation resorting to the *Statistisches Bundesamt* and the nominal short-term interest rate based on *Deutsche Bundesbank* data.

Regarding the sample, we use quarterly data for the time period 1991:1 to 2009:4.[3] All series are seasonally adjusted by X12-ARIMA. Furthermore, except for inflation and the interest rate, they are converted into real terms by the GDP deflator and transformed into logarithms. Graphs for all series and detailed variable descriptions are presented in the appendix.

C. Stationarity properties

To further specify our model, we analyse the stationarity properties of the different variables by applying the Augmented-Dickey-Fuller (ADF) test. The results are summarised in the following table.

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[2] In the third quarter of the year 2000, the central government received a large one-time revenue from auctioning UMTS licenses. This outlier effect is taken into account by subtracting it from total revenue.

[3] For the year 2009, local government data for the fiscal variables suffers from methodological problems due to the introduction of new accounting techniques.

Table 1: Stationarity properties

Variable	Augmented Dickey-Fuller test statistic (logarithmic) levels	Augmented Dickey-Fuller test statistic (logarithmic) first differences
GDP	-1.515852	-8.013355***
Government direct expenditure	-2.783567	-6.841218***
Net revenue	-2.692603	-6.412789***
GDP deflator	-2.149138	-3.214426*
Nominal short-term interest rate	-2.828993	-3.775134**

Notes: Null hypothesis: Series is non-stationary. ***, ** and * indicate significance at the 10 percent, 5 percent and 1 percent level, respectively. A constant and a linear deterministic time trend are included as exogenous variables. Lag length is chosen by the Akaike information criterion. Critical values are taken from MacKinnon (1996).

For all series in levels, the null hypothesis of non-stationarity cannot be rejected. When differencing the five series, we obtain stationarity. Hence, all variables are integrated of order one. In this situation, we could use the first differences of the variables in our model to take account of the non-stationarity. However, this would lead to a large information loss with respect to the interpretation of the coefficients. Thus, as also uniformly done in the literature, we estimate the VAR in levels. This can be justified by the fact that non-stationarity is particularly crucial for long-run relationships, whereas we are considering short-run effects (see Phillips (1998)). We include a linear deterministic time trend as an exogenous variable in our VAR. Moreover, we confirmed that for each specification the VAR satisfies the stability condition.

D. Basic specification

The basic specification contains the three variables GDP, government direct expenditure and net revenue. To be able to interpret the correlations in our VAR causally, we augment it to a *structural* VAR (SVAR).[4] The VAR introduced in equation (1) can then be considered as the reduced-form of the following SVAR (see Amisano and Giannini (1997) as well as Bode et al. (2006)). Premultiplying (1) with a 3×3 matrix A yields

$$(2) \qquad \mathrm{A}\mathbf{y}_t = \mathrm{A}\Gamma_1\mathbf{y}_{t-1} + \ldots + \mathrm{A}\Gamma_p\mathbf{y}_{t-p} + \mathrm{A}\mathbf{u}_t.$$

This leads to

$$(3) \qquad \mathrm{A}\mathbf{y}_t = \mathrm{C}_1\mathbf{y}_{t-1} + \ldots + \mathrm{C}_p\mathbf{y}_{t-p} + \mathrm{B}\boldsymbol{\varepsilon}_t,$$

where B and C are also 3×3 matrices, $\mathrm{A}\Gamma = \mathrm{C}$ for each lag, $\mathrm{A}\mathbf{u}_t = \mathrm{B}\boldsymbol{\varepsilon}_t$ and $\boldsymbol{\varepsilon}_t = \left(\varepsilon_t^Y, \varepsilon_t^G, \varepsilon_t^T\right)'$ is the three-dimensional vector of structural shocks. The structural shocks

[4] For an intuitive introduction of the method see Stock and Watson (2001).

are independent and identically distributed with variance-covariance-matrix $\Sigma_\varepsilon = I_3$, i.e., they are orthogonal. The use of the identity matrix normalises their variance to one. In this setting, discretionary fiscal policy is interpreted as the structural shocks to G and T, respectively. These shocks can be used to estimate the dynamic response of GDP by simulating structural impulse response functions. Additionally, the relationship $A\mathbf{u}_t = B\boldsymbol{\varepsilon}_t$ is important: In the SVAR, the matrices A and B represent the contemporaneous relations between the reduced-form residuals $\mathbf{u}_t$ and the structural shocks $\boldsymbol{\varepsilon}_t$.

In order to determine the contemporaneous links, identifying assumptions are necessary. In this and in the following subsection, we adopt the identification procedure introduced by Blanchard and Perotti (2002) by using institutional information about the German economy.

At least $n^2 + n(n-1)/2$ assumptions have to be made regarding the matrices A and B to achieve identification, i.e. $3^2 + 3\cdot(3-1)/2 = 12$. With the assumptions already made about $\mathbf{u}_t$ and $\boldsymbol{\varepsilon}_t$ and by stating that the fiscal variables do not react contemporaneously to each other, the relationship above can be written as

$$(4) \quad u_t^Y = a_{12}u_t^G + a_{13}u_t^T + \varepsilon_t^Y$$
$$(5) \quad u_t^G = a_{21}u_t^Y + b_{23}\varepsilon_t^T + \varepsilon_t^G$$
$$(6) \quad u_t^T = a_{31}u_t^Y + b_{32}\varepsilon_t^G + \varepsilon_t^T.$$

Equation (4) says that unexpected movements in GDP in the same quarter $\left(u_t^Y\right)$ can be caused by unexpected movements in government direct expenditure $\left(a_{12}u_t^G\right)$, unexpected movements in net revenue $\left(a_{13}u_t^T\right)$ or structural shocks to GDP $\left(\varepsilon_t^Y\right)$. Equation (5) for government direct expenditure and equation (6) for net revenue can be interpreted in the same way.

In matrix notation, the system can be written as:

$$(7) \quad \begin{pmatrix} 1 & -a_{12} & -a_{13} \\ -a_{21} & 1 & 0 \\ -a_{31} & 0 & 1 \end{pmatrix} \begin{pmatrix} u_t^Y \\ u_t^G \\ u_t^T \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & b_{23} \\ 0 & b_{32} & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^Y \\ \varepsilon_t^G \\ \varepsilon_t^T \end{pmatrix}.$$

This leaves six parameters to be identified in A and B. They are determined by the following three steps.

In the *first step,* the parameters a_{21} and a_{31} are constructed, which show the contemporaneous response of government direct expenditure and net revenue to unexpected movements in GDP, respectively. For their construction, one has to take into account that in practice the fiscal variables could be contemporaneously affected by GDP via two channels. In the first channel, they may react automatically by the working of the tax-and-transfer system. In the second channel, they could be adjusted discretionary after an unexpected movement in GDP within the same quarter. However, by using quarterly data, the latter channel can be excluded from the analysis. Due to recognition lags, decision lags and implementation lags, the government is hardly able to change government direct expenditure or net revenue within the current quarter in reaction to changes in GDP. To determine a_{21} and a_{31}, we therefore only have to consider the first channel.

The parameter a_{21}, which then expresses the elasticity of government direct expenditure to GDP, can be set to zero. As described in the data section, transfers are not considered on the expenditure side, but they are rather included in the variable net revenue. Thus, as transfers are the overwhelming part of the expenditure side which reacts to GDP, there is no automatic response of government direct expenditure to GDP.

Regarding the parameter a_{31}, which expresses the elasticity of net revenue to GDP, we assume a value of 0.46 taken from Bode et al. (2006) as the time period observed (1991 – 2005) comes closest to ours.[5]

The *second step* starts with estimating the reduced-form VAR. Besides the endogenous variables, we include as exogenous variables both a linear deterministic time trend as stated above and a constant. The lag order is set to be two as indicated by conventional lag order selection criteria.

Having obtained the estimated reduced-form residuals $\mathbf{u}_t$, we construct cyclically-adjusted reduced-form residuals of government direct expenditure and net revenue according to $u_t^{G,ca} = u_t^G - a_{21}u_t^Y$ and $u_t^{T,ca} = u_t^T - a_{31}u_t^Y$. Finally, the cyclically-adjusted figures can be used as instruments in equation (4) as they are uncorrelated with the error term ε_t^Y. Thereby, we are able to consistently estimate the parameters a_{12} and a_{13} by two-stage least squares (2SLS).

In the *third step*, one has to determine the remaining coefficients b_{23} and b_{32}. As it is not possible to decide whether tax decisions follow expenditure decisions $\left(b_{23} = 0, b_{32} \neq 0\right)$ or *vice versa* $\left(b_{32} = 0, b_{23} \neq 0\right)$, as a benchmark, we assume the former case and estimate b_{32}

[5] Following Höppner (2003), we also estimated a bivariate SVAR including net revenue and GDP to determine the parameter on the basis of our sample. This SVAR is identified recursively by ordering net revenue last. We get a value of 0.27, being significant at the 5 percent level. Regarding the seemingly low values of 0.46 and 0.27, one has to bear in mind that *quarterly* elasticities are used as noted by Höppner (2003). The quarterly elasticity may be different from the common *annual* elasticity. Moreover, in the robustness section, we will re-estimate all specifications with an elasticity of 1.00 and 0.10, respectively.

within the SVAR. In the robustness section, we check whether the results change by making the latter assumption.

Overall, this subsection generates estimates of the matrices A and B as well as estimates of the structural shocks $\boldsymbol{\varepsilon}_t$ for the basic specification. Thus, the contemporaneous and dynamic effects of GDP in response to discretionary fiscal policy are determined.

E. Extended specifications

In the following, we extend the basic specification by controlling for the influence of inflation and/or the interest rate. This is one of the central points of the paper. As suggested by Blanchard and Perotti (2002) and Bode et al. (2006), without these price variables, important relationships could be neglected. In particular, the consideration of inflation, so the argument goes, might be relevant as the other variables are expressed in real terms, but e.g. government direct expenditure and net revenue would be linked to nominal figures.

For all of the following identification schemes, we exploit that, similar to GDP, the government is unable to change the fiscal variables to unexpected movements in inflation and in the interest rate within a quarter. Hence, government direct expenditure and net revenue are contemporaneously affected only by the automatic working of the two price variables.

In the extended specification 1, we add inflation to our three-variable basic specification. The identification scheme $A\mathbf{u}_t = B\boldsymbol{\varepsilon}_t$ becomes

$$(8)\qquad \begin{pmatrix} 1 & -a_{12} & -a_{13} & 0 \\ -a_{21} & 1 & 0 & 1 \\ -a_{31} & 0 & 1 & 0.54 \\ -a_{41} & -a_{42} & -a_{43} & 1 \end{pmatrix} \begin{pmatrix} u_t^Y \\ u_t^G \\ u_t^T \\ u_t^\pi \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & b_{23} & 0 \\ 0 & b_{32} & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^Y \\ \varepsilon_t^G \\ \varepsilon_t^T \\ \varepsilon_t^\pi \end{pmatrix}.$$

In the scheme, we allow the reduced-form residuals of the GDP deflator, u_t^π, to contemporaneously react to the other variables. Concerning the influence of inflation onto the other variables, we follow Heppke-Falk et al. (2006) by assuming that the GDP deflator elasticity is the real GDP elasticity of the nominal fiscal variable minus 1. This implies that $a_{24} = 0 - 1 = -1$ and $a_{34} = 0.46 - 1 = -0.54$. Moreover, we set $a_{14} = 0$.

In the extended specification 2, the interest rate is integrated into the basic specification. The identification scheme can be formulated as

$$(9) \quad \begin{pmatrix} 1 & -a_{12} & -a_{13} & 0 \\ -a_{21} & 1 & 0 & 0 \\ -a_{31} & 0 & 1 & 0 \\ -a_{41} & -a_{42} & -a_{43} & 1 \end{pmatrix} \begin{pmatrix} u_t^Y \\ u_t^G \\ u_t^T \\ u_t^i \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & b_{23} & 0 \\ 0 & b_{32} & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^Y \\ \varepsilon_t^G \\ \varepsilon_t^T \\ \varepsilon_t^i \end{pmatrix}.$$

The reduced-form residuals of the interest rate, u_t^i, can be affected by the other variables. However, we follow the literature (see e.g. Heppke-Falk et al. (2006)) and assume that GDP, government direct expenditure and net revenue do not react to unexpected movements in the interest rate within the same quarter, i.e., $a_{14} = a_{24} = a_{34} = 0$.

Next, in the extended specification 3, we add both inflation and the interest rate. The identification scheme can be derived by combining the two previous schemes and making the additional assumption that inflation contemporaneously influences the interest rate, but not *vice versa*:

$$(10) \quad \begin{pmatrix} 1 & -a_{12} & -a_{13} & 0 & 0 \\ -a_{21} & 1 & 0 & 1 & 0 \\ -a_{31} & 0 & 1 & 0.54 & 0 \\ -a_{41} & -a_{42} & -a_{43} & 1 & 0 \\ -a_{51} & -a_{52} & -a_{53} & -a_{54} & 1 \end{pmatrix} \begin{pmatrix} u_t^Y \\ u_t^G \\ u_t^T \\ u_t^\pi \\ u_t^i \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & b_{23} & 0 & 0 \\ 0 & b_{32} & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^Y \\ \varepsilon_t^G \\ \varepsilon_t^T \\ \varepsilon_t^\pi \\ \varepsilon_t^i \end{pmatrix}.$$

For each of the extended specifications, to identify the remaining parameters in A and B and to derive the structural shocks $\boldsymbol{\varepsilon}_t$, we apply the three steps described for the basic specification, but with modifications.

To start with, one estimates the reduced-form VAR with a linear deterministic time trend and a constant, obtaining the estimated reduced-form residuals $\mathbf{u}_t$. Conventional lag order selection criteria again indicate a lag order of two. Because of the inclusion of additional variables, the cyclically-adjusted reduced-form residuals of the fiscal variables as well as the remaining parameters in A are determined differently, however (see Giordano et al. (2007) and Heppke-Falk et al. (2006)). We explain this point based on the 5-variable extended specification 3 as the other extensions are special cases of the model. Writing the corresponding system in equation form yields

$$(11) \quad u_t^Y = a_{12}u_t^G + a_{13}u_t^T + \varepsilon_t^Y$$

$$(12) \quad u_t^G = a_{21}u_t^Y - u_t^\pi + b_{23}\varepsilon_t^T + \varepsilon_t^G$$

$$(13) \quad u_t^T = a_{31}u_t^Y - 0.54u_t^\pi + b_{32}\varepsilon_t^G + \varepsilon_t^T$$

$$(14) \quad u_t^\pi = a_{41}u_t^Y + a_{42}u_t^G + a_{43}u_t^T + \varepsilon_t^\pi$$

$$(15) \quad u_t^i = a_{51}u_t^Y + a_{52}u_t^G + a_{53}u_t^T + a_{54}u_t^\pi + \varepsilon_t^i.$$

Regarding the equations for the reduced-form residuals of government direct expenditure and net revenue, equations (12) and (13), we can apply the parameter restrictions of the basic specification, $a_{21} = 0$, $a_{31} = 0.46$ and $b_{23} = 0$. Then, these equations become

(16) $u_t^G = -u_t^{\pi} + \varepsilon_t^G$

(17) $u_t^T = 0.46 u_t^Y - 0.54 u_t^{\pi} + b_{32}\varepsilon_t^G + \varepsilon_t^T.$

The cyclically-adjusted reduced-form residuals of the two fiscal variables can now be determined by

(18) $u_t^{G,ca} = u_t^G + u_t^{\pi} = \varepsilon_t^G$

(19) $u_t^{T,ca} = u_t^T - 0.46 u_t^Y + 0.54 u_t^{\pi} = b_{32}\varepsilon_t^G + \varepsilon_t^T.$

Looking at equation (18), it is apparent that for government direct expenditure the cyclically-adjusted reduced-form residuals $u_t^{G,ca}$ equal the structural shock ε_t^G. Next, equation (19) implies that we can regress the cyclically-adjusted reduced-form residuals $u_t^{T,ca}$ on ε_t^G. Thereby, we can estimate the parameter b_{32} by OLS, yielding the structural shock for net revenue, ε_t^T. The two structural fiscal shocks can then be used as instruments in equation (11) as they are uncorrelated with the error term ε_t^Y. By 2SLS, this leads to consistent parameters a_{12} and a_{13}, obtaining the structural shock ε_t^Y. Finally, by iteration, the parameters of the remaining equations (14) and (15) can also be estimated by 2SLS, using the respective structural shocks as instruments.

In sum, we again yield the estimated matrices A and B as well as the estimated structural shocks $\boldsymbol{\varepsilon}_t$ to finally gain the contemporaneous and dynamic effects of GDP to discretionary fiscal policy.

4 Results

This section presents the results for the contemporaneous and dynamic response of GDP to government direct expenditure and net revenue. We show the results of the basic specification, followed by those of the extended specifications. Finally, we analyse whether the findings are robust.

A. Basic specification

The contemporaneous effects for the basic specification are depicted in the following table. The coefficient a_{12} represents the reaction of GDP to government direct expenditure, whereas a_{13} shows the reaction of GDP to net revenue.

Table 2: Contemporaneous effects (basic specification)

	a_{12}	a_{13}	b_{23}	b_{32}
Coefficient	0.21	-0.02	0	0.45
t-value	2.35	-1.33	-	3.88
p-value	0.021	0.188	-	0.000

Notes: The coefficients can be interpreted as elasticities.

Due to the definition of the variables in logarithms, the coefficients can be interpreted as elasticities. Hence, an increase in government direct expenditure by 1 percent increases GDP by 0.21 percent within a quarter. The effect is statistically significant at the 5 percent level. The effect of net revenue on GDP, however, is small and insignificant.

Converted to monetary values evaluated at the means of the variables, this implies that an increase in government direct expenditure by 1 Euro raises GDP by 1.60 Euro.[6] For the insignificant effect of net revenue, we obtain a rise of GDP by 0.17 Euro after lowering taxes by 1 Euro.

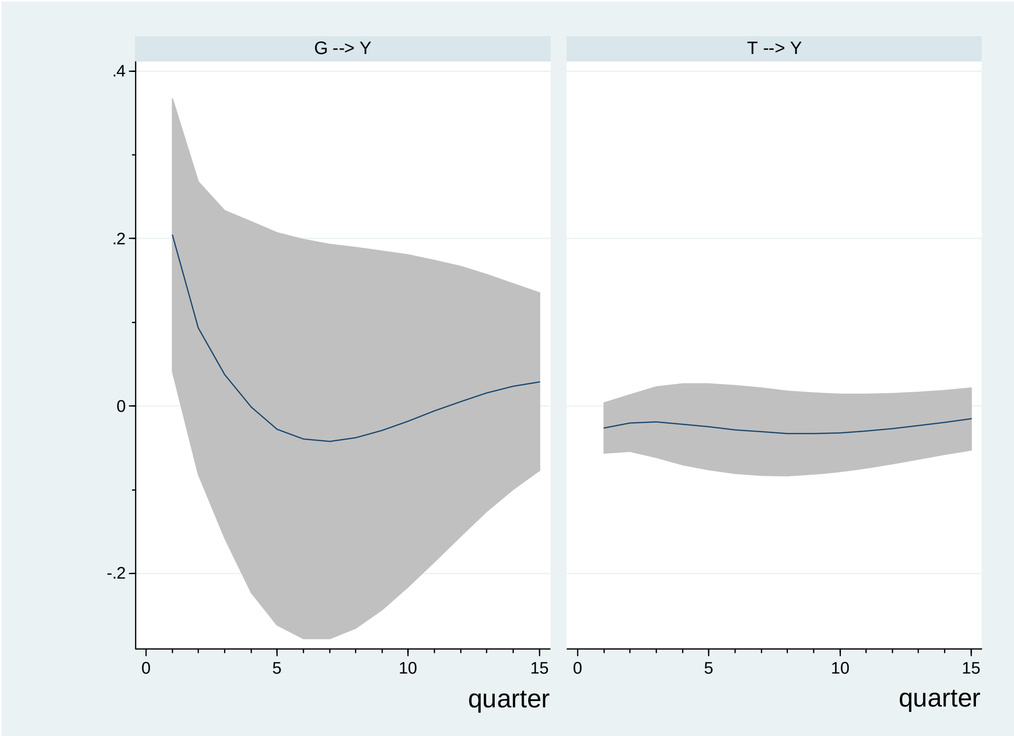
The following figure 1 presents the dynamic response of GDP to a structural shock in government direct expenditure and net revenue, respectively, by showing the estimated structural impulse response functions. The remaining dynamic responses for the basic specification as well as for the extended specifications are given in the appendix.

All structural impulse response functions in this paper can be interpreted as the percentage change of one variable after a one-percent increase in another variable. Thus, figure 1 shows that after an expenditure shock by 1 percent, GDP increases by 0.20 percent on impact. However, the point estimate then falls sharply, being even already negative after 4 quarters and staying negative until quarter 11. From quarter 2 on, the effect is not statistically significant. A 1 percent shock to net revenue has a small effect on GDP and it is insignificant even at all steps.

[6] When converting the elasticities to monetary values, one has to take into account that the values are strongly affected by the point at which the elasticities are derived. For example, when looking at some baseline year instead of the means of the variables, we get a range of the GDP response from 1.28 to 1.90 Euro.

Figure 1: Dynamic response of Y to G and T (in %)

(Basic specification; shaded areas represent 95 % asymptotic confidence intervals)



B. Extended specifications

Extension 1

When adding inflation to our benchmark specification, the results change substantially as theoretically suggested. The contemporaneous effects are shown in table 3.

Table 3: Contemporaneous effects (extended specification 1)

	a_{12}	a_{13}	a_{41}	a_{42}	a_{43}	b_{23}	b_{32}
Coefficient	0.12	-0.02	-0.11	0.09	-0.004	0	0.31
t-value	1.33	-1.27	-2.76	2.66	-0.78	-	2.68
p-value	0.187	0.209	0.007	0.010	0.438	-	0.007

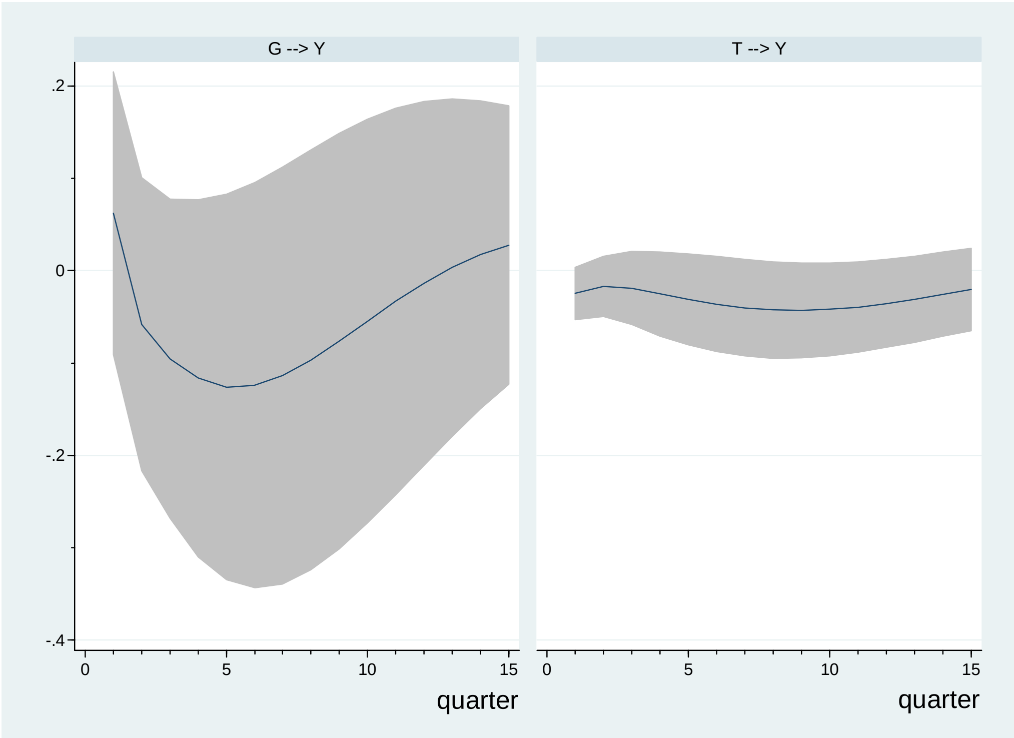
Notes: The coefficients can be interpreted as elasticities.

The effects of both government direct expenditure and net revenue on GDP are now statistically insignificant. Moreover, while the coefficient for taxes is similar to that of the basic specification, the coefficient for government direct expenditure has strongly fallen. Expressed in monetary values, GDP contemporaneously increases by 0.94 Euro and 0.15 Euro after an increase in expenditure and a decrease in taxes by 1 Euro, respectively.

Figure 2 depicts the dynamic effects.

Figure 2: Dynamic response of Y to G and T (in %)

(Extended specification 1; shaded areas represent 95 % asymptotic confidence intervals)



Compared to the basic specification, by controlling for inflation, both a shock to government direct expenditure and to net revenue does not have a statistically significant effect on GDP at the 5 percent level. Regarding the point estimates, the expenditure shock has an impact effect of 0.06 percent, followed by negative effects on GDP until quarter 12. Examining the cumulative response from the first 4 quarters, GDP thereby even falls by 0.21 percent after a shock to government direct expenditure. Similar to the basic specification, the effect of a tax shock on GDP is constant but small.

Extension 2

In extension 2, the nominal short-term interest rate is integrated. The contemporaneous results are as follows.

Table 4: Contemporaneous effects (extended specification 2)

	a_{12}	a_{13}	a_{41}	a_{42}	a_{43}	b_{23}	b_{32}
Coefficient	0.20	-0.01	10.84	1.44	0.55	0	0.42
t-value	2.62	-0.39	2.90	0.56	1.24	-	3.61
p-value	0.011	0.698	0.005	0.575	0.221	-	0.000

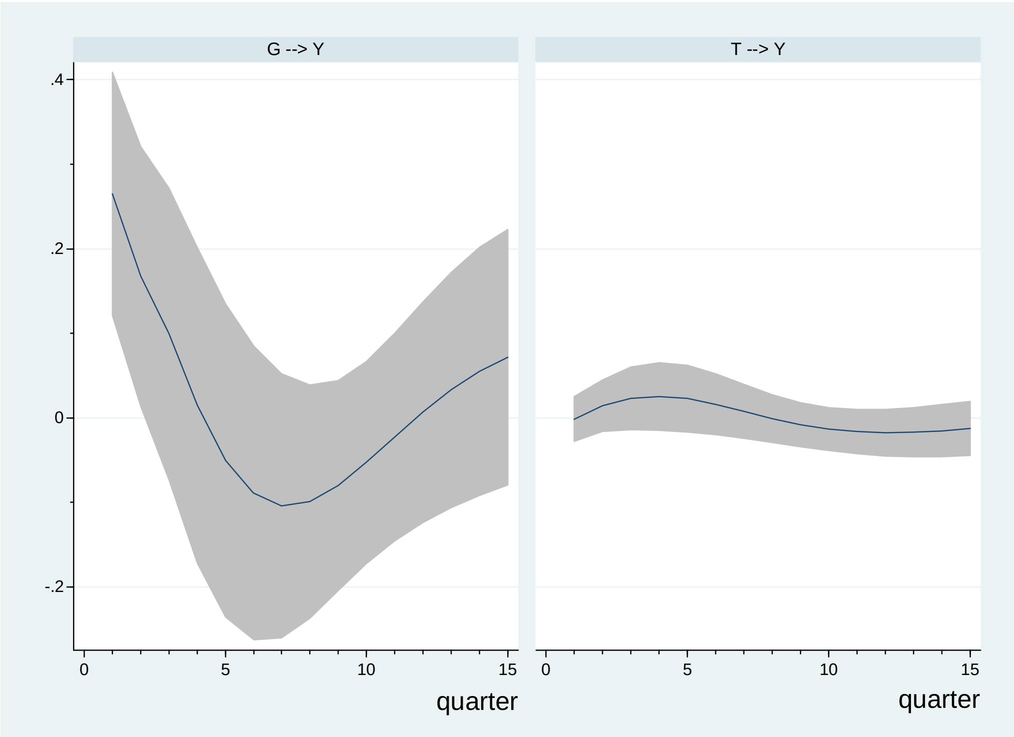
Notes: The coefficients can be interpreted as elasticities.

The inclusion of the interest rate does not alter the results for the parameters of interest, a_{12} and a_{13}, substantially. Within a quarter, an increase in government direct expenditure by 1 percent leads to a significant increase in GDP by 0.20 percent. The effect of net revenue on GDP is small and insignificant. Converted to monetary units, the expenditure effect is 1.54 Euro and the tax effect is 0.04 Euro after an increase and decrease in the variable, respectively.

The dynamic effects are shown in the following figure.

Figure 3: Dynamic response of Y to G and T (in %)

(Extended specification 2; shaded areas represent 95 % asymptotic confidence intervals)



The consideration of the interest rate does not either change the dynamic effects noticeably. A shock to government direct expenditure still leads to a U-shaped response of GDP. This effect is significant up to 2 quarters. A shock to net revenue has a small and insignificant effect. Looking at the cumulative response to a tax shock at quarter 6, the point estimates even indicate a rise in GDP by 0.10 percent.

Extension 3

Finally, in extension 3, we control for inflation as well as the nominal short-term interest rate. Table 5 presents the contemporaneous effects.

Table 5: Contemporaneous effects (extended specification 3)

	a_{12}	a_{13}	a_{41}	a_{42}	a_{43}	a_{51}
Coefficient	0.16	-0.01	-0.04	0.08	-0.01	10.04
t-value	1.87	-0.46	-1.18	2.82	-2.35	2.89
p-value	0.066	0.649	0.243	0.006	0.022	0.005
	a_{52}	a_{53}	a_{54}	b_{23}	b_{32}	
Coefficient	-1.63	0.74	4.04	0	0.23	
t-value	-0.66	1.74	0.36	-	1.94	
p-value	0.513	0.087	0.720	-	0.052	

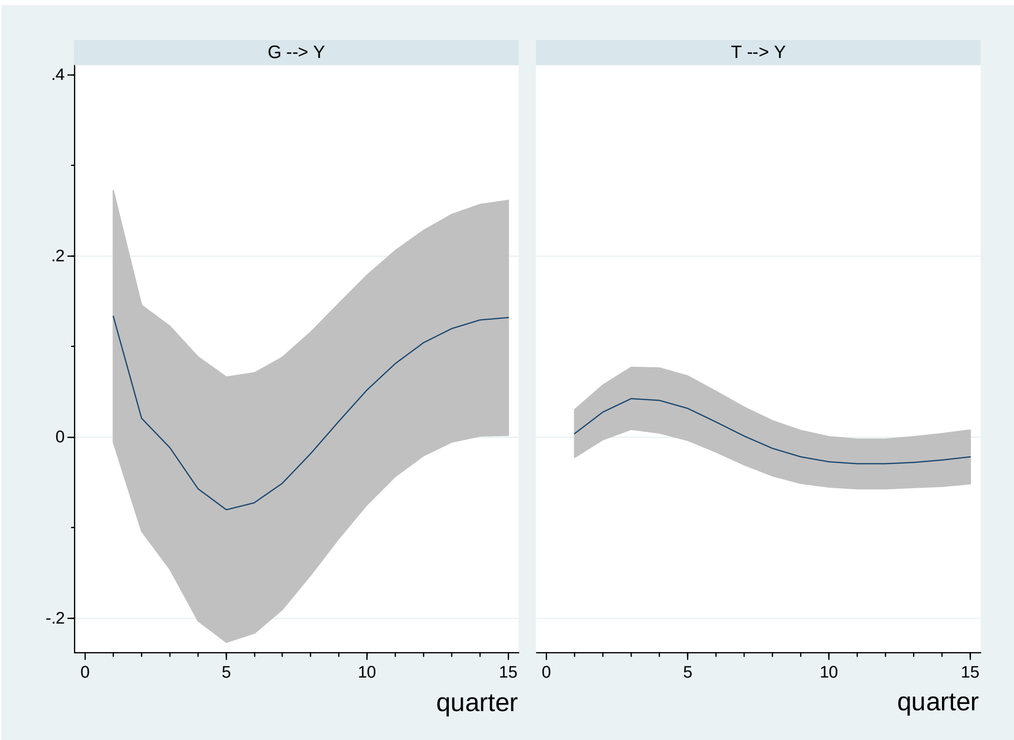
Notes: The coefficients can be interpreted as elasticities.

The effects of government direct expenditure and net revenue on GDP are both not statistically significant at the 5 percent level. A 1 percent increase in expenditure raises GDP by 0.16 percent, while a 1 percent tax decrease increases output by 0.01 percent. In Euro for Euro, this is equivalent to an increase in 1.18 Euro and 0.05 Euro, respectively.

Figure 4 presents the dynamic effects of a shock to government expenditure and net revenue on GDP.

Figure 4: Dynamic response of Y to G and T (in %)

(Extended specification 3; shaded areas represent 95 % asymptotic confidence intervals)



An expenditure shock does not lead to a significant effect on GDP for the first 13 quarters, still having a U-shaped process for the point estimates. Concerning a 1 percent tax shock, GDP does not decrease, but instead increases slightly for the first 7 quarters with significant quarters 3 and 4. Thereby, the cumulative response of GDP to a tax shock is, similar to extension 2, positive with an increase of 0.11 percent after 1 year.

C. Robustness

Besides analysing different specifications as a form of a robustness check, in this subsection, we investigate whether the previously stated findings are robust to variations in the assumptions.

First, we assumed that tax decisions follow expenditure decisions, setting $b_{23} = 0$. When making the opposite assumption ($b_{32} = 0$), the results do not change noticeably. This can be explained by the low correlation between the cyclically-adjusted reduced-form residuals of government direct expenditure and net revenue. Depending on the specification, the correlation only lies between 0.04 and 0.08.

Second, we assumed a value of 0.46 for the elasticity of net revenue to GDP, the parameter a_{31}. As a robustness check, we re-estimate all specifications with an elasticity of 1.00 and 0.10, respectively. Overall, the contemporaneous as well as the dynamic effects of government direct expenditure and net revenue on GDP are highly robust over all specifications. The only changes are the following. The contemporaneous response of GDP to net revenue is modestly weaker for $a_{31} = 0.10$ and modestly stronger for $a_{31} = 1.00$. Moreover, the dynamic response of GDP to net revenue has now a significant step 1 for the basic specification as well as for the extended specification 1 and it now exhibits a significant step 2 for extension 3.

Overall, the previously stated findings are strongly robust to variations in the assumptions.

5 Conclusion

This paper has analysed the effects of discretionary fiscal policy by presenting new empirical evidence for Germany within a structural vector autoregression (SVAR) framework.

In theory, discretionary fiscal policy can have quite opposed effects. Concentrating on the central parts of the theoretical literature, we distinguished between the neoclassical view and the Keynesian view. On the one hand, the neoclassical view states that discretionary fiscal policy has no effect on output (pure form of the theory) or that it increases output due to supply-side changes (New classical extension). In both forms, however, private expenditure is crowded-out. On the other hand, Keynesian theory predicts an increase in output and consumption after lowering taxes or increasing government expenditure.

Regarding the methodological approach, identification of the SVAR model follows the seminal contribution of Blanchard and Perotti (2002) by using institutional information about the German economy. The data sample contains the time period from 1991 to 2009.

Our results are as follows. For the basic specification including GDP, government direct expenditure and net revenue, we get a significant contemporaneous response of output to expenditure by 0.21 percent. The contemporaneous effect of taxes, however, is small and insignificant. Regarding the dynamic effects, GDP significantly increases on impact by 0.20 percent after an expenditure shock, but then the point estimate falls quickly and becomes insignificant up from quarter 2. A tax shock has small and insignificant dynamic effects. Controlling for inflation leads to insignificant contemporaneous effects of the fiscal variables on GDP. Moreover, the point estimate for the influence of government expenditure falls sharply. The dynamic effects are also insignificant once inflation is taken into account. By controlling for the interest rate, the results of the basic specification are not changed substantially. The results of all specifications are highly robust to variations in the assumptions. Overall, the response of GDP to lowering taxes tends towards the neoclassical view. The response of GDP to increasing government expenditure is inconclusive for the basic specification. Once controlling for inflation, however, it leans to the neoclassical view as well.

In conclusion, our analysis has found no compelling empirical evidence for the effectiveness of discretionary fiscal policy for Germany. This reasoning casts doubt whether the political actors should implement an active stabilisation policy. Caution is in particular warranted as this policy tends to lead to higher government debt in the medium and long term, thereby restricting the freedom of action for public finances in the future.

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Appendix

All series are seasonally adjusted by X12-ARIMA. Furthermore, except for inflation and the interest rate, they are converted into real terms by the GDP deflator.

Figure A1: GDP

(in billion Euro)

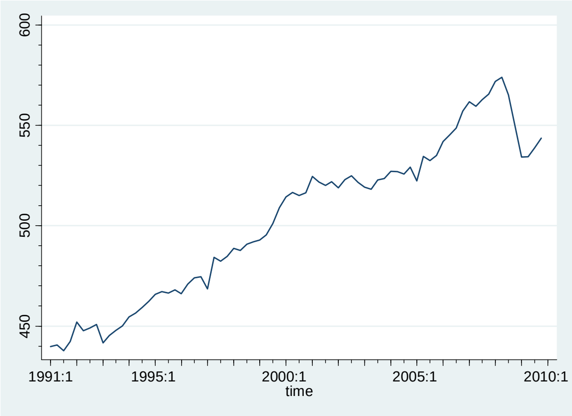

Figure A2: Government direct expenditure

(in billion Euro)

Figure A3: Net revenue

(in billion Euro)

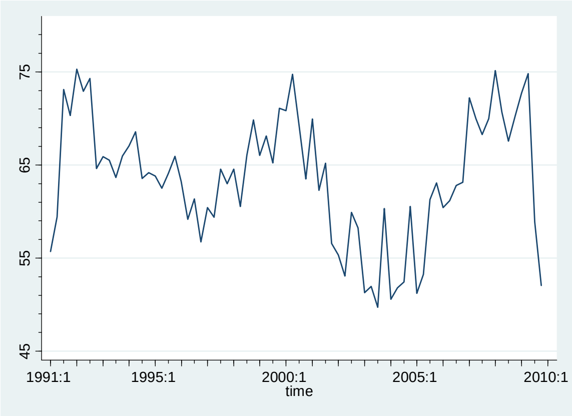

Figure A4: Inflation (GDP deflator)

(in %)

Figure A5: Nominal short-term interest rate

(in %)

Table A1: Variable descriptions

Variable	
Y	Gross domestic product (GDP) (in billion Euro). Seasonally adjusted by author using X12-ARIMA. Converted into real terms by the GDP deflator and transformed into logarithms. *Source: Deutsche Bundesbank*: *VGR-D-Ges, Gesamtwirtschaftliche Übersicht, nominal, Bruttoinlandsprodukt.*
G	Government direct expenditure = personnel expenditure + other operating expenditure + capital formation (in billion Euro). Cash data including the central, state and local government. Components seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. Transformed into logarithms. *Source: Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte*.
T	Net revenue = total revenue - transfers to social security funds - interest payments - current grants to the private sector and public enterprises (in billion Euro). Cash data including the central, state and local government. Components seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. Transformed into logarithms. *Source: Deutsche Bundesbank*; *Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte.*
π	GDP deflator as a measure of inflation calculated as ratio of nominal to real GDP. Nominal and real GDP seasonally adjusted by author using X12-ARIMA. *Source: Statistisches Bundesamt*.
i	Nominal short-term interest rate = 3-month FIBOR (1991 – 1998) / 3-month EURIBOR (1999 – 2009) (in %). Seasonally adjusted by author using X12-ARIMA. *Source: Deutsche Bundesbank: Geldmarktsätze / FIBOR Dreimonatsgeld / Monatsdurchschnitt* (1991 – 1998) and *Geldmarktsätze / EURIBOR Dreimonatsgeld / Monatsdurchschnitt* (1999 – 2009).
Components of fiscal variables	
Capital formation	Cash data including the central, state and local government (in billion Euro). Seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. *Source: Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte: Sachinvestitionen*.
Current grants to the private sector and public enterprises	Total expenditure - personnel expenditure - other operating expenditure - capital formation - financial aid - interest payments - transfers to social security funds. Cash data including the central, state and local government (in billion Euro). Seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. *Source: Deutsche Bundesbank; Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte.*
Financial aid	In billion Euro. Seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. *Source: Deutsche Bundesbank: Gebietskörperschaften – Ausgaben Finanzierungshilfen*.
Interest payments	Cash data including the central, state and local government (in billion Euro). Seasonally adjusted by author using X12-ARIMA and converted into real terms

	by the GDP deflator. *Source: Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte: Zinsausgaben - Zinseinnahmen*.
Other operating expenditure	Cash data including the central, state and local government (in billion Euro). Seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. *Source: Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte: Laufender Sachaufwand*.
Personnel expenditure	Cash data including the central, state and local government (in billion Euro). Seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. *Source: Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte*: *Personalausgaben*.
Total expenditure	Cash data including the central, state and local government (in billion Euro). Seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. *Source: Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte: Bereinigte Ausgaben*.
Total revenue	Cash data including the central, state and local government (in billion Euro). Seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. *Source: Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte: Bereinigte Einnahmen*.
Transfers to social security funds	Cash data including the central, state and local government (in billion Euro). Seasonally adjusted by author using X12-ARIMA and converted into real terms by the GDP deflator. *Source: Statistisches Bundesamt: Vierteljährliche Kassenergebnisse der öffentlichen Haushalte: Sonstige lfd. Zuweisungen und Zuschüsse an Sozialversicherungsträger*.

Notes: In the third quarter of the year 2000, the central government received a large one-time revenue from auctioning UMTS licenses. This outlier effect is taken into account by subtracting it from total revenue. Furthermore, for the year 2009, local government data for the fiscal variables suffers from methodological problems due to the introduction of new accounting techniques.

Figure A6: Dynamic responses basic specification (per quarter in %)

(Shaded areas represent 95 % asymptotic confidence intervals)

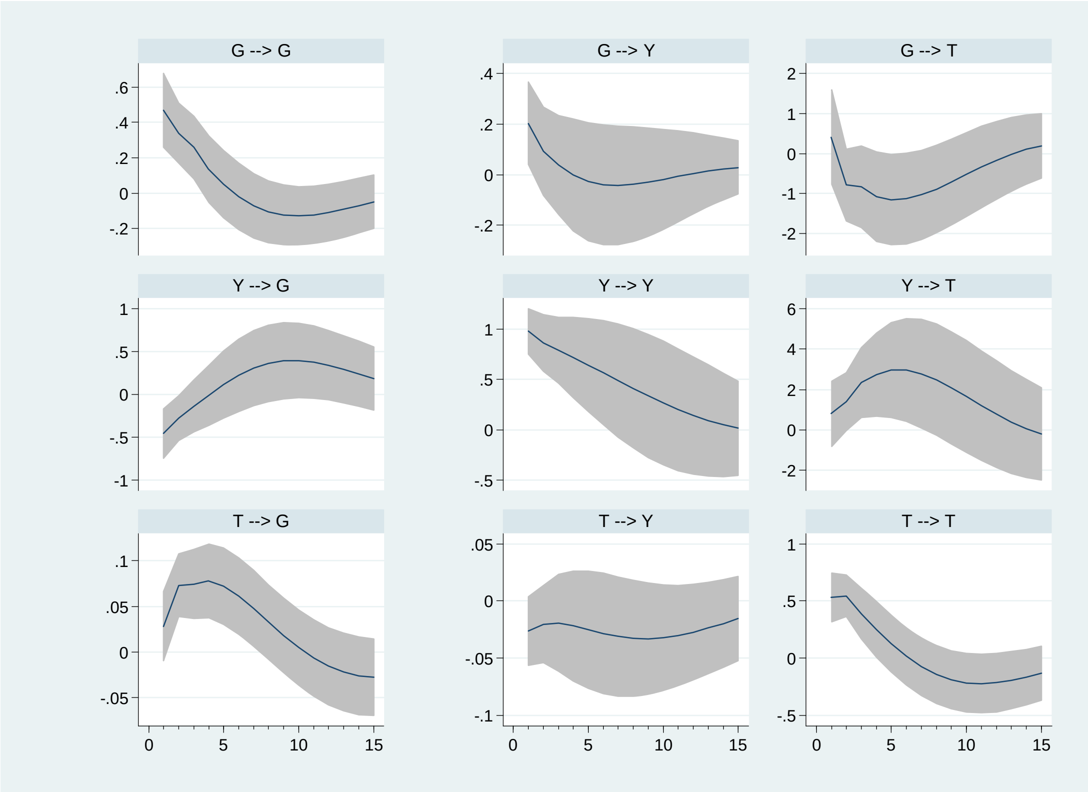

Figure A7: Dynamic responses extended specification 1 (per quarter in %)

(Shaded areas represent 95 % asymptotic confidence intervals)

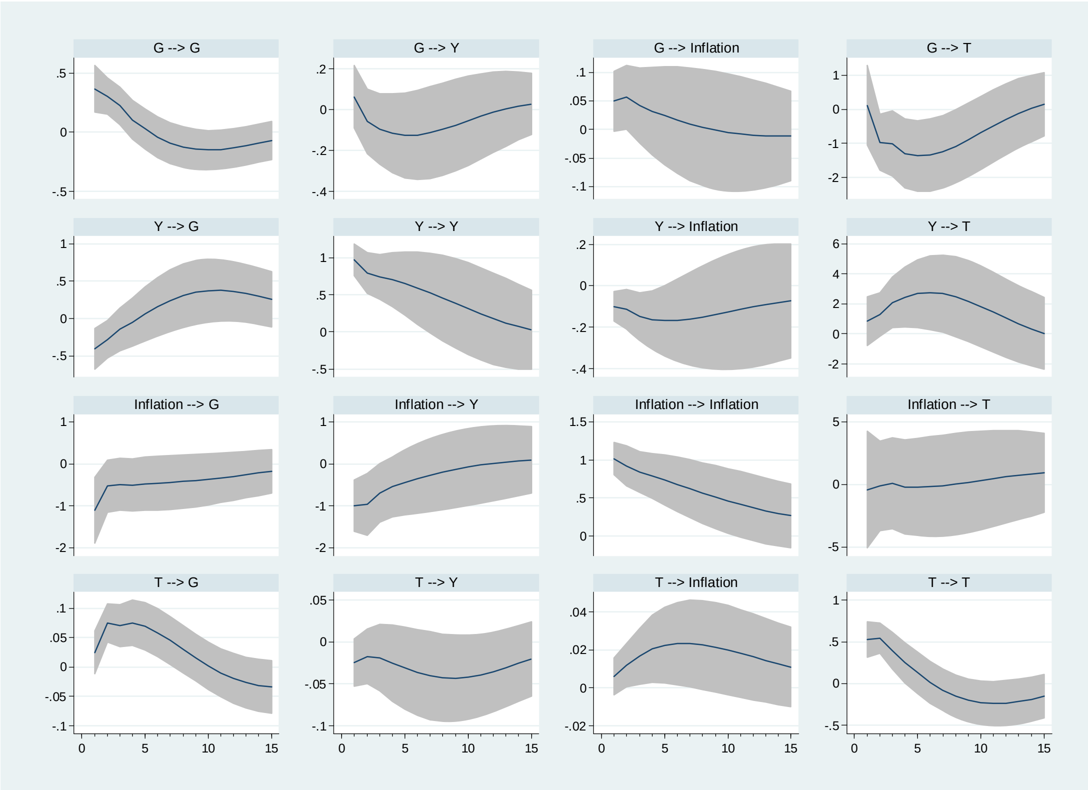

Figure A8: Dynamic responses extended specification 2 (per quarter in %)

(Shaded areas represent 95 % asymptotic confidence intervals)

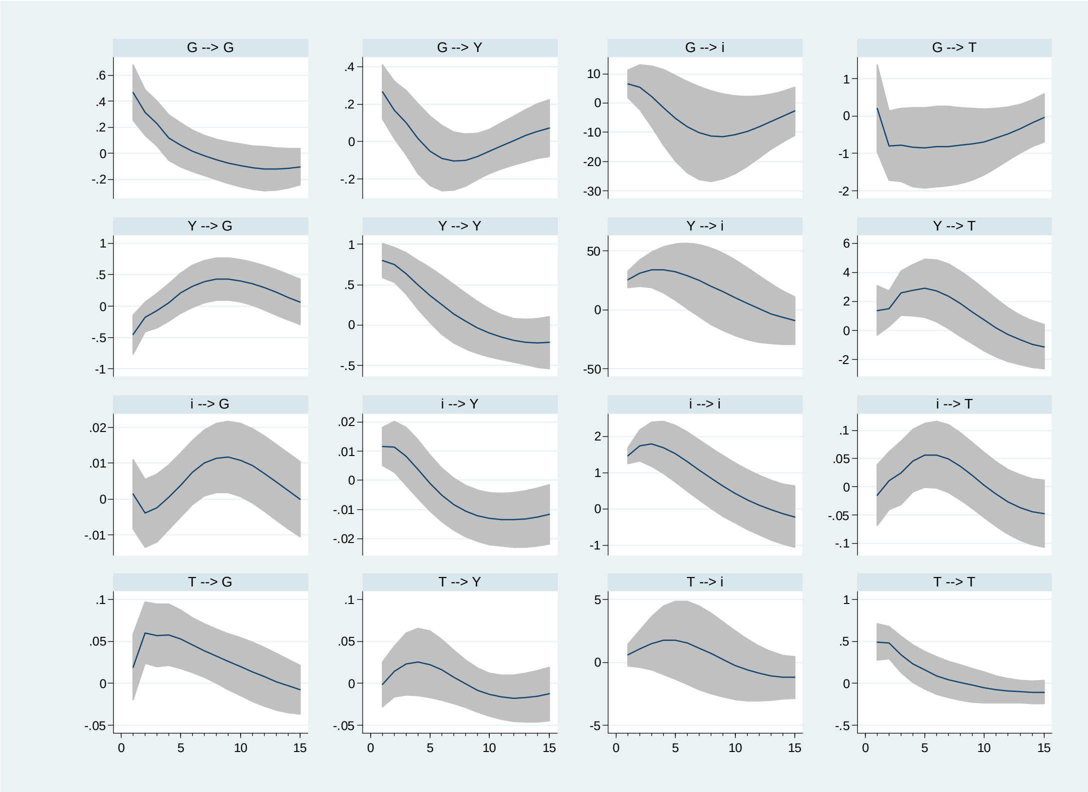

Figure A9: Dynamic responses extended specification 3 (per quarter in %)

(Shaded areas represent 95 % asymptotic confidence intervals)