The macroeconomic effects of exogenous fiscal policy shocks in Germany: a disaggregated SVAR analysis

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Abstract:
We investigate the short-term effects of fiscal policy shocks on the German economy following the SVAR approach by Blanchard and Perotti (2002). We find that direct government expenditure shocks increase output and private consumption on impact with low statistical significance, while they decrease private investment, though insignificantly. For the sub-category government investment – in contrast to government consumption – a positive output effect is found, which is statistically significant until 12 quarters ahead. Allowing for anticipation effects of fiscal policy does not change the sign of the positive consumption response. Anticipated expenditure shocks have significant effects on output when the shock is realized, but not in the period of anticipation. In sum, effects of expenditure shocks are only short-lived. Government net revenue shocks do not affect output with statistical significance. However, when splitting up this aggregate, direct taxes lower output significantly, while small indirect tax revenue shocks have little effects. Compensation of public employees is equally not effective in stimulating the economy.

Keywords: Fiscal policy, government spending, net revenue, policy anticipation, structural vector autoregression.
JEL-Classification: E62, H30.

Non-technical summary

In this paper, we investigate the effects of fiscal policy shocks on the German economy. Most studies investigate fiscal policy in the US. For Europe, the number of papers appears to be limited. As for Germany, few studies exist (e.g., Höppner (2003) and Perotti (2005)).

We start by contrasting the predictions of different models. Both neoclassical and (New) Keynesian theory predict that government expenditure financed by lump-sum taxes should result in an increase of output. However, while private consumption falls in the neoclassical world, it increases in a Keynesian setting. Productive government investment should have positive output effects according to both theories. Moreover, distortionary taxes are detrimental to output in both frameworks.

The empirical approach is a structural vector autoregressive (SVAR) analysis based on the seminal contribution of Blanchard and Perotti (2002). (S)VAR models enable us to examine the effects of shocks to certain variables (here direct expenditure and net revenue) on the respective variables of interest. However, it is difficult to draw conclusions on the effects of large structural changes of tax rates in this context. We go beyond existing studies by providing a disaggregated analysis and employing a comparatively long sample (1974:1 – 2004:4). We find that in the short run direct government expenditure shocks increase output and private consumption with low statistical significance, while they decrease private investment, though insignificantly. These effects disappear after a few quarters, thereby indicating the vanishing character of effects on GDP stemming from one-off government expenditure increases. The possible long-term effects on government debt are discounted in this model. According to our estimation results government investment as sub-component of direct government expenditure – in contrast to government consumption – has positive effects on output, being reflected in statistical significance lasting until 12 quarters ahead. Allowing for the possibility of one period ahead anticipation of fiscal policy in the framework of this estimation approach does not change the sign of the positive consumption response. In our model, we find that anticipated expenditure shocks have significant effects on output when the shock is realized, but not in the period of anticipation.

Small shocks to government net revenue do not affect output with statistical significance. However, when splitting up this aggregate, direct tax shocks lower output significantly, while small shocks to indirect tax revenues have little statistical effects. Compensation of public employees is equally not effective in stimulating the economy. The evidence on revenues and personnel expenditure is thus supportive of neoclassical models and Ricardian equivalence. In sum, effects from one-off government expenditure and revenue changes on the German economy are rather short-lived; hence, such measures cannot be used for long-lasting purposes.

Nicht-technische Zusammenfassung

Im vorliegenden Diskussionspapier untersuchen wir die Auswirkungen von finanzpolitischen Schocks auf die deutsche Wirtschaft. Die meisten Studien auf diesem Gebiet untersuchen die Finanzpolitik in den Vereinigten Staaten, während die Zahl der wissenschaftlichen Veröffentlichungen über Europa begrenzt scheint. Zu Deutschland gibt es nur einige wenige Studien (z. B. von Höppner (2003) und Perotti (2005)).

Zunächst stellen wir die Vorhersagen verschiedener Modelle einander gegenüber. Sowohl die neoklassische als auch die (neu)keynesianische Theorie sagen vorher, dass über Kopfsteuern finanzierte Staatsausgaben einen Zuwachs der gesamtwirtschaftlichen Produktion bewirken. Doch während der private Verbrauch in der neoklassischen Theorie zurückgeht, nimmt er in keynesianischen Modellen zu. Produktive öffentliche Investitionsausgaben sollten sich nach beiden Theorien positiv auf die Wertschöpfung auswirken. Zudem sind verzerrende Steuern in beiden Modellen der Produktion abträglich.

Der empirische Ansatz basiert auf einer strukturellen vektorautoregressiven (SVAR) Analyse, die auf dem Forschungsbeitrag von Blanchard und Perotti (2002) beruht. (S)VAR-Modelle ermöglichen es, die Wirkungen von Schocks bestimmter Variablen (in diesem Fall direkte Staatsausgaben und Netto-Einnahmen) auf die jeweiligen Variablen von Interesse zu untersuchen. Schlussfolgerungen hinsichtlich der Wirkungen großer struktureller Veränderungen von Steuersätzen sind in diesem Rahmen allerdings schwierig zu ziehen. Wir gehen über bereits vorliegende Studien hinaus, da wir eine disaggregierte Analyse vornehmen und einen vergleichsweise langen Beobachtungszeitraum (1974:1 – 2004:4) zugrunde legen. Wir kommen zu dem Ergebnis, dass direkte Staatsausgabenschocks die Produktion und den privaten Verbrauch kurzfristig mit niedriger statistischer Signifikanz erhöhen, während sie die privaten Investitionen schmälern, wenn auch ohne Signifikanz. Diese Effekte verschwinden allerdings nach einigen Quartalen, was darauf hinweist,

dass sich die Auswirkungen einmaliger Staatsausgabenerhöhungen auf das Sozialprodukt rasch wieder auflösen. Dagegen bleiben mögliche Effekte auf die Staatsverschuldung in diesem Modell unberücksichtigt. Unsere Schätzergebnisse zeigen für investive Staatsausgaben – im Gegensatz zu den Konsumausgaben des Staats –, dass sie einen positiven Effekt auf die gesamtwirtschaftliche Produktion ausüben, welcher bis zu 12 Quartalen nach dem Schock noch statistisch signifikant ist. In einer Modellvariante, die eine Vorwegnahme der Finanzpolitik eine Periode im Voraus zulässt, bleibt die Reaktion des Konsums positiv. Antizipierte Ausgabenschocks haben bei Eintritt des Schocks eine signifikante Wirkung auf die gesamtwirtschaftliche Produktion, nicht aber bei Ankündigung. Schocks, die die staatlichen Nettoeinnahmen betreffen, wirken sich nicht signifikant auf die Produktion aus. Betrachtet man allerdings die einzelnen Komponenten des Aggregats, so zeigt sich, dass direkte Steuerschocks die Produktion verringern, während kleine Schocks auf indirekte Steuereinnahmen kaum durchschlagen. Ebenso haben die Arbeitnehmerentgelte im öffentlichen Dienst keine stimulierende Wirkung auf die Wirtschaft. Diese Ergebnisse stützen demnach neoklassiche Modelle und die Ricardianische Äquivalenz. Insgesamt sind die Effekte von einmaligen Änderungen der Staatsausgaben und -einnahmen auf die deutsche Volkswirtschaft eher kurzfristiger Natur, so dass solche Maßnahmen nicht für langfristige Ziele eingesetzt werden können.

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The macroeconomic effects of exogenous fiscal policy shocks in Germany: a disaggregated SVAR analysis[1]

1 Introduction

The effects of fiscal policy on the macroeconomy are of ongoing interest to economic policy makers. For example, the German government announced a 25 billion fiscal package at the beginning of 2006, thereby intending to stimulate the economy. Furthermore, in the European Economic and Monetary Union national fiscal policy might have to play a greater role in stabilizing national business cycles as monetary policy focuses on the euro area as a whole. However, the effects of fiscal policy on the macroeconomy are still object of empirical research, and stylized facts have not been established yet – in contrast to analyses on monetary policy effects. Most studies investigate fiscal policy in the US (Blanchard and Perotti (2002), Fatás and Mihov (2001), Mountford and Uhlig (2005), Ramey and Shapiro (1997) among others). For Europe, the number of papers appears to be limited (see de Castro Fernández and Hernández de Cos (2006) for Spain, Biau and Girard (2005) for France and Giordano, Momigliano, Neri, and Perotti (2005) for Italy). As for Germany, few studies exist (e.g., Höppner (2003) and Perotti (2005)). They have been restricted by relatively short time series and highly aggregated fiscal data. We contribute to the existing analyses on the largest economy in the EMU by providing a more detailed analysis of the effects of fiscal policy actions in Germany. The present study is based on a long sample period (1974:1 – 2004:4) using quarterly data and disaggregated budgetary items. We apply the structural vector autoregressive approach first proposed by Blanchard and Perotti (2002).

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While economic policy in Germany unanimously starts out from the idea that a rise in government expenditure or a decrease in revenue supports – at least in the short run – private economic activity,[2] there are different outcomes in theory. In the *neoclassical world*, captured in standard Real Business Cycle models, households behave in a Ricardian manner, and goods, labor and capital markets work without any frictions. Baxter and King (1993) show that an increase in government spending financed via non-distortionary, i.e. lump-sum, taxes generates a loss in wealth for the representative private household. She responds by decreasing consumption and increasing labor supply. As a result, output rises, and marginal labor productivity and real wages decline in the short run. Depending on the persistence of the fiscal impulse, marginal productivity of capital may rise, thereby initiating an increase of private investment. Finally, a new steady state is reached where real wages have returned to their initial level and private consumption is lower than before. If an increase in government spending is financed by distortionary taxes, the results change due to intratemporal and intertemporal substitution effects of labor supply. Provided that tax rates are raised in a hump shaped manner, Burnside, Eichenbaum, and Fisher (2000) show an increase in labor supply initially after the government expenditure shock, followed by a reversion. In the new steady state private consumption, investment and output have fallen.

In the *New Keynesian world* a positive response of private consumption to a rise in government expenditure is achieved by introducing price rigidities and non-Ricardian consumers. Galí, López-Salido, and Vallés (2006) implement "rule-of-thumb" consumers, whose consumption equals labor income.[3] Despite labor expansion after a rise in government spending financed by lump-sum taxes, real wages increase due to a decreasing price markup. The rise in labor income triggers an increase in consumption of rule-of-thumb households implying a rise in aggregate demand, leading to further expansion in output and employment. In the case of distortionary taxes, intratemporal substitution effects of labor supply lead to a decrease in private consumption after its

[2]Analogously, restrictive fiscal policy leads to opposite effects. To support a recovery of sluggish private consumption for instance, the German government's "growth package" of around 25 bn, adopted at the beginning of 2006, provides tax reliefs – among others – for households. Additionally, a restrictive expenditure strategy has been announced, and the VAT rate will increase in 2007 from 16 to 19 %, which was decided in mid-2006.

[3]Instead of rule-of-thumb consumers, Basu and Kimball (2000) integrate a utility function exhibiting complementarity between consumption and labor; Linnemann (2005) implements a binding cash-in-advance constraint to capture non-Ricardian behavior.

initial rise (see Bilbiie and Straub (2004)).

A range of empirical studies and different methods to identify fiscal shocks deliver mixed outcomes. In their *event study*, Ramey and Shapiro (1997) set dummies for identified military buildups in the US to capture government spending unrelated to the state of the US economy.[4] The estimation results of their univariate autoregressive model are consistent with the neoclassical framework. They are confirmed by Edelberg, Eichenbaum, and Fisher (1999) who adopt an extended version of the Ramey-Shapiro approach in terms of a vector autoregressive (VAR) specification. Mountford and Uhlig (2005) introduce shock identification by *sign restrictions* on the impulse responses in a VAR with fiscal data. They find a weak stimulation of private consumption and output along with a fall in residential and non-residential investment after a spending shock for US data. Fatás and Mihov (2001) apply a VAR approach and identify fiscal shocks by *Choleski ordering* of the variables. They assume that government spending categories are contemporaneously unaffected by GDP and its components and find persistent increases in private consumption and insignificant reactions of private investment in response to a spending shock. Their outcomes thus correspond to (New) Keynesian predictions. Blanchard and Perotti (2002), who develop a *structural* VAR (SVAR) approach with US data, find rising private consumption after a spending shock. Furthermore, output increases (decreases) in response to a positive expenditure (tax) shock, which is in line with both neoclassical and New Keynesian models. However, spending and tax shocks trigger a fall in private investment.[5] For West Germany (1975:1 – 1989:4), Perotti (2005) finds a significant positive cumulative response of GDP to a government spending shock at 4 quarters which reverses into negative at 12 quarters. For the same sample period, private consumption and private investment show insignificant responses at 4 quarters and a significant decline at 12 quarters. However, results are sensitive to the chosen sample period. For 1960:1 – 1974:4 the cumulative private consumption response at 4 quarters proves to be significantly negative.

[4]This procedure refers to the *narrative approach* applied by Romer and Romer (1989) to monetary policy analysis.

[5]According to Perotti (2005) expansionary effects of government spending in the US are sensitive to the sample period. The author finds less expansionary Keynesian effects for the US after 1980. Bilbiie, Meier, and Müller (2006) find reasons for this phenomenon in an increased asset market participation, a less persistent but more deficit-financed government spending and a more active monetary policy.

Our main findings are that a government expenditure shock triggers an output increase, while a government revenue shock does not affect output significantly. Private consumption reacts positively to a spending shock, whereas private investment does not react significantly. Our results further suggest that government investment has stronger effects on macroeconomic activity than government personnel expenditure. Moreover, indirect tax shocks seem to have weaker effects than direct tax shocks. Generally, we find typical response patterns of the inflation rate and the interest rate.

The remainder is organized as follows: Section 2 presents the empirical approach. Section 3 includes a detailed description of the data in use. The effects of fiscal policy on disaggregated macroeconomic variables are discussed in section 4. In section 5, the results of shocks to disaggregated government budgetary items are presented. Section 6 concludes.

2 The empirical approach

Since the work of Sims (1980), the use of VARs has become very popular in macroeconomics. However, while there is abundant literature on the effects of monetary policy in such a setting, only few researchers have investigated fiscal policy in a VAR context. Our empirical approach relies on a structural VAR analysis. In particular, identification of fiscal policy shocks is based on the methodology originally proposed by Blanchard and Perotti (2002), which is the seminal paper for fiscal policy SVAR approaches. The main idea is to exploit fiscal policy decision lags to compute discretionary fiscal policy shocks, which are unaffected by the macroeconomic variables in the VAR model. In particular, Blanchard and Perotti (2002) argue that governments cannot react within the same quarter to changes of the macroeconomic environment, since fiscal policy decision-making is a rather long process, involving many agents in parliament, government and civil society. Therefore, reactions of fiscal policy to current developments only result from so called "automatic" responses, which are defined by existing laws and regulations. All fiscal policy developments in a given quarter, which do not reflect automatic responses, are basically seen as structural fiscal policy shocks, which are exogenous to the macroeconomy.

In general, the reduced-form VAR has the following form:

$$Y_t = C(L)Y_{t-1} + U_t, \qquad t = 1, \ldots, T, \tag{1}$$

where Y_t is a $N \times 1$ vector of endogenous variables, $C(L)$ is a $N \times N$ matrix lag polynomial, and U_t is a $N \times 1$ vector of reduced-form innovations, which are independent and identically distributed with variance-covariance matrix $\Sigma_U = E(U_t U_t')$.[6] The so-called AB-model of Amisano and Giannini (1997) suggests the following relation between the reduced-form innovations U_t and the objects of ultimate interest, the structural shocks V_t:

$$AU_t = BV_t, \tag{2}$$

where the $N \times N$ matrices A and B describe the instantaneous relation between the variables and the linear relationship between the structural shocks and the reduced form residuals, respectively. The structural shocks are assumed to be orthogonal in order to investigate the impact of an isolated shock.

Consequently, the structural form of the VAR can be obtained by pre-multiplying (1) by A:

$$AY_t = AC(L)Y_{t-1} + AU_t = AC(L)Y_{t-1} + BV_t. \tag{3}$$

Solving the latter equation for Y_t yields the structural moving-average representation, whose coefficients are the structural impulse response functions, which are the primary analytical tool in this analysis:

$$Y_t = [I - C(L)L]^{-1} A^{-1} B V_t. \tag{4}$$

More specifically, in our benchmark specification Y_t consists of the following five variables for Germany: real GDP (y_t), the rate of inflation as measured by the GDP-deflator (π_t), the nominal short-term interest rate (i_t), real government direct expenditure (e_t), and real government net revenue (r_t), i.e. $Y_t = [y_t \quad \pi_t \quad i_t \quad e_t \quad r_t]'$.[7] The frequency of the time series used is crucial for the identification approach. In order to exclude the possibility of discretionary fiscal policy actions within one time period, quarterly data are used. The VAR is estimated in levels and a constant, a time trend, and a shift dummy to account for the effects of German re-unification are included as

[6] For an overview of VARs, see for example Hamilton (1994).

[7] A more detailed description of the variables used in this investigation can be found in Section 3.

deterministic terms. The number of lags for the VAR is chosen to be two as suggested by the Akaike information criterion (AIC).[8]

The estimation proceeds in four steps following Giordano, Momigliano, Neri, and Perotti (2005). In the first step, the reduced form VAR is estimated, yielding the reduced form residuals $U_t = [u_t^y \quad u_t^\pi \quad u_t^i \quad u_t^e \quad u_t^r]'$. As mentioned by Perotti (2005) the innovations in the fiscal variables u_t^e and u_t^r can be thought of as a linear combination of three types of shocks: i) the *automatic* response of government expenditure and revenue to real output, inflation, and interest rate innovations; ii) the *systematic, discretionary* response of fiscal policy to shocks to the macro variables; and iii) the *random, discretionary* fiscal policy shocks, which are the underlying structural shocks to be identified. This leads to the following formal representation of the reduced form residuals:

$$u_t^e = \alpha_y^e u_t^y + \alpha_\pi^e u_t^\pi + \alpha_i^e u_t^i + \beta_r^e v_t^r + v_t^e \tag{5}$$

$$u_t^r = \alpha_y^r u_t^y + \alpha_\pi^r u_t^\pi + \alpha_i^r u_t^i + \beta_e^r v_t^e + v_t^r, \tag{6}$$

where v_t^e and v_t^r are the structural shocks to government direct expenditure and government net revenue, respectively. Here, the observation of Blanchard and Perotti (2002), that the fiscal authorities need more than one quarter to react to macroeconomic shocks, becomes relevant. Basically this means that the second type of shock mentioned above is irrelevant and the α_i^j's only reflect the first channel, i.e. the automatic response of the fiscal variables to macroeconomic developments. Since the reduced form residuals are correlated with the v_t's, it is not possible to simply estimate the α_i^j's by OLS, but rather exogenous elasticities are used to compute cyclically adjusted reduced-form fiscal policy shocks:

$$u_t^{e,CA} = u_t^e - \alpha_y^e u_t^y - \alpha_\pi^e u_t^\pi - \alpha_i^e u_t^i = \beta_r^e v_t^r + v_t^e \tag{7}$$

$$u_t^{r,CA} = u_t^r - \alpha_y^r u_t^y - \alpha_\pi^r u_t^\pi - \alpha_i^r u_t^i = \beta_e^r v_t^e + v_t^r. \tag{8}$$

This is the second step of the estimation procedure. In the third step, in order to identify the structural shocks to the fiscal variables, it is necessary to make a decision with respect to the relative ordering of the fiscal variables.

[8]The other information criteria we looked at (FPE, HQ, SC) also suggest at most two lags. In addition, investigating the (auto)correlation properties of the residuals suggest specifying two lags as well. For an extensive survey of model selection criteria, see Lütkepohl (1991).

Setting $\beta_e^r = 0$ means that tax decisions come first, whereas setting $\beta_r^e = 0$ postulates the priority of spending decisions. In the baseline specification the latter assumption is used, a reverse ordering does not affect the results. Consequently, in this third step it is possible to estimate β_e^r by OLS and retrieve the structural shocks to the fiscal variables, v_t^e and v_t^r, as illustrated by the following two equations:

$$u_t^{e,CA} = v_t^e \tag{9}$$
$$u_t^{r,CA} = \beta_e^r v_t^e + v_t^r. \tag{10}$$

In the final step, the remaining coefficients of the equations for the macroeconomic variables are estimated:

$$u_t^y = \alpha_e^y u_t^e + \alpha_r^y u_t^r + v_t^y \tag{11}$$
$$u_t^\pi = \alpha_e^\pi u_t^e + \alpha_r^\pi u_t^r + \alpha_y^\pi u_t^y + v_t^\pi \tag{12}$$
$$u_t^i = \alpha_e^i u_t^e + \alpha_r^i u_t^r + \alpha_y^i u_t^y + \alpha_\pi^i u_t^\pi + v_t^i. \tag{13}$$

This is done recursively by means of instrumental variables regressions, in order to account for the correlation of the respective regressors and error terms.[9] Since the structural shocks v_t are orthogonal, they can be used as instruments.

These four steps yield all necessary elements to construct the A and B matrices:

$$\begin{bmatrix} 1 & 0 & 0 & -\alpha_e^y & -\alpha_r^y \\ -\alpha_y^\pi & 1 & 0 & -\alpha_e^\pi & -\alpha_r^\pi \\ -\alpha_y^i & -\alpha_\pi^i & 1 & -\alpha_e^i & -\alpha_r^i \\ -\alpha_y^e & -\alpha_\pi^e & -\alpha_i^e & 1 & 0 \\ -\alpha_y^r & -\alpha_\pi^r & -\alpha_i^r & 0 & 1 \end{bmatrix} \begin{bmatrix} u_t^y \\ u_t^\pi \\ u_t^i \\ u_t^e \\ u_t^r \end{bmatrix} =$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & \beta_e^r & 1 \end{bmatrix} \begin{bmatrix} v_t^y \\ v_t^\pi \\ v_t^i \\ v_t^e \\ v_t^r \end{bmatrix}.$$

[9] Note, that if the interest rests only on the identification of the structural fiscal policy shocks, the ordering of the remaining variables is irrelevant.

Computing the structural impulse response functions is based on these estimated matrices as illustrated above. In this investigation the point estimate as well as 90 % bootstrap confidence intervals based on 5000 replications are shown.[10] We rely on a bootstrap procedure in order to take account of the full estimation uncertainty of the four-step estimation approach. This is a very cautious approach. Furthermore, we plot 90 % confidence intervals, compared to for example one-standard deviation bands (68 % under normality) in Blanchard and Perotti (2002), which explains relatively wide confidence bands. In addition, the impulse response functions are plotted for the first 12 quarters, only. Since we estimate the VAR in levels there are unit roots or near unit roots in the system. For these cases Phillips (1998) shows that estimated long period ahead impulse responses are inconsistent, i.e., they tend to random variables and not to the true impulse responses. Thus, in such a setting confidence in impulse responses for longer periods ahead does not seem to be advisable.

3 Data

3.1 Data sources and description

We use quarterly data ranging from 1974:1 – 2004:4. The macroeconomic variables in terms of GDP, private consumption and investment, 3-month money market rate to capture monetary policy, GDP deflator, consumer price index and government consumption deflator stem from the Statistisches Bundesamt (Federal Statistical Office Germany – destatis). Graphs of these data are presented in the appendix. The macroeconomic variables are adjusted for the German re-unification jump in 1991 by prolonging the series backwards with West-German growth rates. Overlapping time series for West-Germany with data of unified Germany enables this procedure.

Sources of the fiscal variables are the Federal Statistical Office Germany and the Deutsche Bundesbank. Fiscal variables are cash data. In contrast to data based on ESA 1995, they are available at a higher than annual frequency and reflect actual cash payments. A shift dummy in the estimation approach captures the German re-unification jump in the fiscal data as overlapping time series are missing. All variables except for the inflation and interest rate are

[10] An introduction into bootstrapping impulse responses can be found in Lütkepohl and Krätzig (2004, p. 177-179).

in logs and expressed in real terms, deflated by the GDP deflator[11]. Where required, the data are seasonally adjusted by applying US Census Bureau's X12-ARIMA procedure.

To reflect the actual withdrawal of resources from the private sector we define – following Blanchard and Perotti (2002) – net revenue as total revenue of central, state and local government less transfers to social security funds, current grants paid to the private sector and public enterprises[12] and interest payments.[13] The social security sector is disregarded in this approach as social security contributions are assumed to be redistributed to the private sector and do not constitute a withdrawal of resources from the private sector as a whole. Accordingly, on the expenditure side the focus is on an aggregate labelled government "direct" expenditure. It consists of three categories: personnel expenditure, other operating expenditure and capital formation. Figure 1 plots

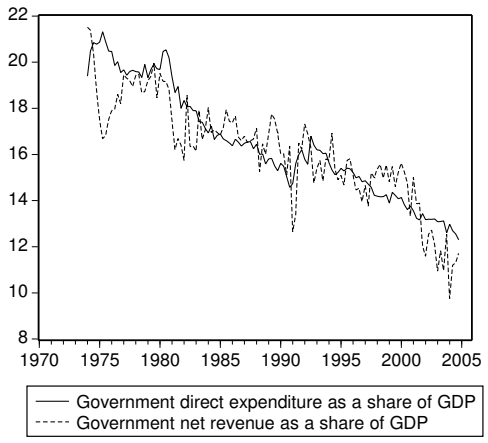

Figure 1: Government direct expenditure and net revenue in percent of GDP, seasonally adjusted.

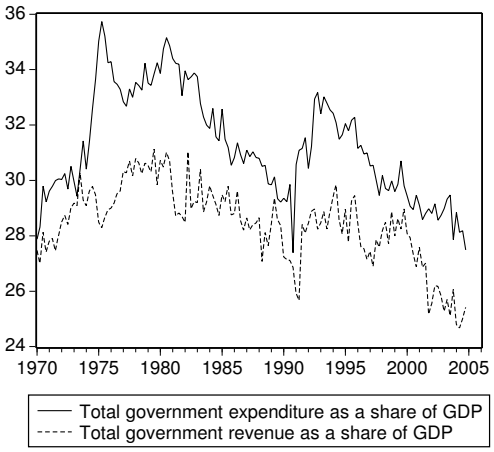

Figure 2: Total government expenditure and revenue in percent of GDP, seasonally adjusted.

the evolution of the measures of revenue and expenditure used in our base-

[11]The index is set at 100 in 1995.

[12]These current grants are derived as a residuum by substracting the following expenditure categories from total expenditure of central, state and local government: personnel and other operating expenditure, fixed asset (capital) formation, financial aid, interest payments, and transfers to social security funds. Current grants plus transfers to social security funds, labelled total transfers paid, are depicted in Figure 18 in the appendix.

[13]EU transfers are still included as they are not passed on to the domestic private sector directly. As regards financial aid, it does not diminish the revenue variable as it rather reflects "indirect" expenditure in terms of expenditure on investment grants, loans and acquisition of participating interests.

line specification – here in percent of GDP. We observe a clear and common downward trend of both net revenue and direct expenditure in the period under consideration. Due to their construction, the slope is steeper than of the shares of total government revenue and expenditure (see Figure 2 for comparison). Furthermore, the net revenue to GDP ratio partly exceeds the direct expenditure ratio, which is in contrast to total aggregates. The reason for this finding is that direct expenditure do not include transfers.

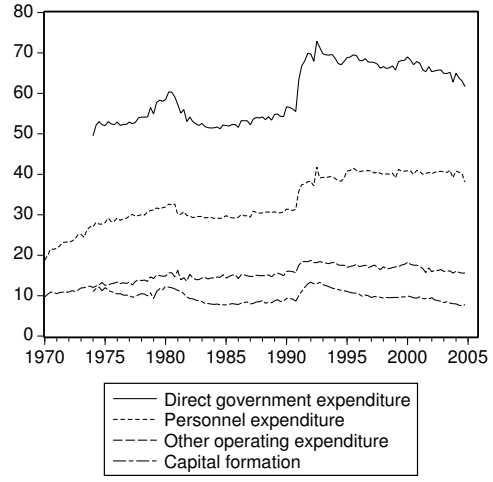

Figure 3: Real government direct expenditure and sub-categories in billion euros, seasonally adjusted.

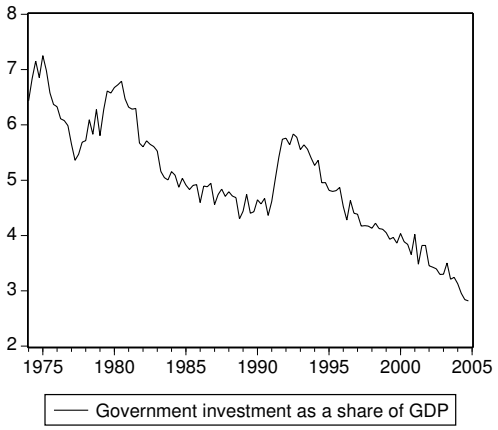

Figure 4: Government investment in Germany in percent of GDP, seasonally adjusted.

On the expenditure side, Figure 3 illustrates that personnel expenditure far exceed other operating expenditure. The jump in 1991 reflects German re-unification. Capital formation is small and in absolute real terms almost unchanged in the investigated period, leading to a declining share in GDP over the last thirty years. This downward trend is noteworthy. As is depicted in Figure 4, the share decreases from over 7 to below 3 percent. Only in the late 1970s and after re-unification, public investment somewhat increases.

On the revenue side, we can distinguish three tax sub-components: indirect taxes, wage taxes and profit related taxes (Figure 5). The upward shift at the beginning of the 1990s of indirect taxes, which comprises taxes on special excises and VAT, and of income taxes are due to German re-unification. Profit related taxes are subject to a sharp decrease after 2000. This phenomenon can be explained partly by changes in tax legislation and the development of entrepreneurial and investment income, and also by the exceptional high tax level reached in 2000 (see Deutsche Bundesbank (2006)).

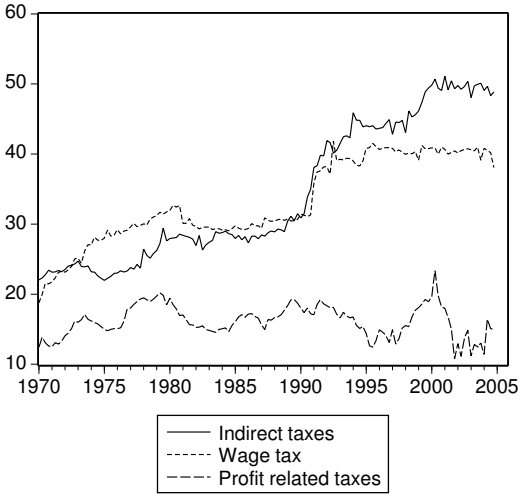

Figure 5: Real taxes in billion euros, seasonally adjusted.

3.2 Unit root and cointegration tests

We investigate the time series properties of our series. In a first step, we test for the existence of unit roots. Standard augmented Dickey-Fuller (Dickey and Fuller 1979) tests indicate that there is a unit root in the level of real GDP, inflation and the short term interest rate in this sample. The null hypothesis of a unit root can, however, be rejected for the series in first differences (Table 1). For the fiscal variables, which exhibit a shift due to German re-unification, we

Table 1: Unit root test

	level	1st difference
real GDP	-2.42	-4.03**
inflation (GDP deflator)	-2.41	-9.71**
short-term interest rate	-2.13	-6.54**
government direct expenditure[a]	-2.62	-3.88**
government net revenue[a]	-2.04	-3.35*

Notes: ADF test statistics; optimal endogenous lags from AIC;
* significant at 5%-level, ** significant at 1%-level;
[a] UR with structural break: Saikkonen and Lütkepohl (2002)

perform the augmented Dickey-Fuller test with Saikkonen and Lütkepohl's (2002) adoption to address the shift. Again, the results indicate that both fiscal series are $I(1)$.

Thus, all five variables of our VAR have a unit root. In a next step, we therefore test for co-integration using the Johansen trace test (Johansen 1995).

The results are presented in Table 2. We find a maximum of four co-integrating

Table 2: Cointegration test

r_0	LR	p-value
0	183.19	0.0000
1	118.12	0.0000
2	64.75	0.0000
3	31.36	0.0016
4	5.11	0.6189

Notes: Johansen trace test

relationships. Consequently, we could specify a vector error correction model (VECM) and thereby take account of the cointegration relations. This approach has been taken by Krusec (2003) for a 3- and 5-variable framework. However, especially when estimating models with many disaggregated time series it is difficult to find economically interpretable cointegration vectors. Therefore, the SVAR-specifications in this analysis are estimated in levels.

3.3 Exogenous elasticities

To identify the contemporaneous effects of budgetary items on the macroeconomic variables we need to adjust fiscal variables for the contemporaneous effects of the macroeconomy to address endogeneity issues. To do so, exogenous elasticities are required. To obtain the elasticity of a fiscal category with respect to GDP, the elasticity of the budgetary item to its macroeconomic base is multiplied with the elasticity of this base with respect to GDP. These sub-elasticities are derived from exogenous information (e.g., on the sensitivity of taxes on labor income to the compensation per employee in the public sector and on the sensitivity of this compensation to GDP). The calculations are based on Mohr (2001) and Kremer, Braz, Brosens, Langenus, Momigliano, and Spolander (2006). The GDP deflator elasticity is simply the real GDP elasticity of the nominal fiscal variable less 1.

Table 3 provides an overview of the quarterly elasticities in use. The elasticities of the fiscal variables with respect to real private consumption and investment are not shown here. They are equal to the elasticities with respect to real GDP, weighted by the shares of each GDP component in the sum of both (private consumption (investment) amounts to 74 % (26 %)).

The elasticities of the aggregated fiscal variables are derived by weighting

Table 3: Exogenous elasticities

	real GDP	nominal interest rate	GDP deflator
direct expenditure	0	0	-1
net revenue	0.95	0	-0.05
public personnel expenditure	0	0	-1
other operating expenditure	0	0	-1
capital formation	0	0	-1
wage tax	1.58	0	0.58
indirect taxes	0.92	0	-0.08
direct taxes	1.62	0	0.62
profit taxes	0	0	-1
non-profit taxes	1.19	0	0.19

Notes: Authors' calculations based on Mohr (2001) and Kremer, Braz, Brosens, Langenus, Momigliano, and Spolander (2006).

the elasticities of their sub-components with their relative amounts. Government net revenue, for instance, responds to real GDP by 0.95. This number contains output elasticities of direct taxes on households (1.58), indirect taxes (0.92), direct taxes on operating surplus and mixed income (0 as – in accordance with tax legislation – the payment of corporate income tax does not react to an increase in operating surplus instantaneously), other revenue, interest payments and unemployment aid (all equal to 0), and remaining transfers to private households, private and public enterprises and social security funds (0.95 altogether). The close-to-one GDP-elasticity of transfers to social security funds is driven by transfers to the pension scheme. Reason for their high sensitivity to real GDP is the fact that such transfers are widely predetermined to amount to a fixed proportion of the pension scheme contributions and that the macroeconomic base of the latter responds to changes in GDP by nearly 1 on average. As the output elasticity of government revenue differs across SVAR-studies, some robustness checks were carried out. They are described in Subsection 4.3.

We assume that government direct expenditure do not respond to real GDP within a quarter as expenditure are predetermined in a budgetary plan and therefore rather inflexible in the short run. Furthermore, no fiscal variable is sensitive to the nominal interest rate.

4 Fiscal policy effects on macroeconomic variables

4.1 Benchmark results

Figure 6 depicts the results of our 5-variable benchmark regressions.[14] We present the responses of GDP, inflation, and the short-term interest rate to a shock either to government direct expenditure (upper row) or to government net revenue (lower row). We find that on impact government expenditure raises real GDP, the impact multiplier is significant on an 11 percent level. Table 4 provides the cumulative response of output in euros to an expenditure shock amounting to 1 euro.[15] The impact multiplier is smaller than 1, as 1 euro generates only 62 cent of GDP. The point estimate of the output response increases to 1.27 euros after 6 quarters, but it is insignificant. In terms of the point estimate, the stimulating effect of government expenditure almost completely disappears after 12 quarters. Regarding the effects of revenue shocks, our impulse responses illustrate that output does not react to a net revenue shock. The point estimate is very small and insignificant for the entire 12 quarters shown. Inflation responds with a significant upward jump to an increase in expenditure, while its response to a revenue shock is insignificant. The response of the short-term interest rate to government expenditure and revenue is insignificant.

4.2 Effects on private consumption and investment

To obtain a more detailed picture, we look at the response of GDP components in terms of private consumption and investment. Neoclassical theory broadly predicts that consumption should fall in response to a (temporary) spending shock, while (New) Keynesian models predict that consumption increases. In Figure 7 the responses of consumption and investment to a spending and

[14] Following Blanchard and Perotti (2002) and for comparison purposes we also carried out regressions with only three variables in terms of real GDP, government direct expenditure, and net revenue. Table 4 contains the resulting impulse responses.

[15] Please note, that we estimate a VAR in *levels* and cumulate the obtained impulse response functions of that system. This *cumulative* response enables us to present the *entire* increase in GDP over the considered horizon after a shock to the respective fiscal variable, compared to a situation where there has been no shock. It basically corresponds to the *area* between the standard impulse response function and the zero line, the latter representing the scenario without a shock.

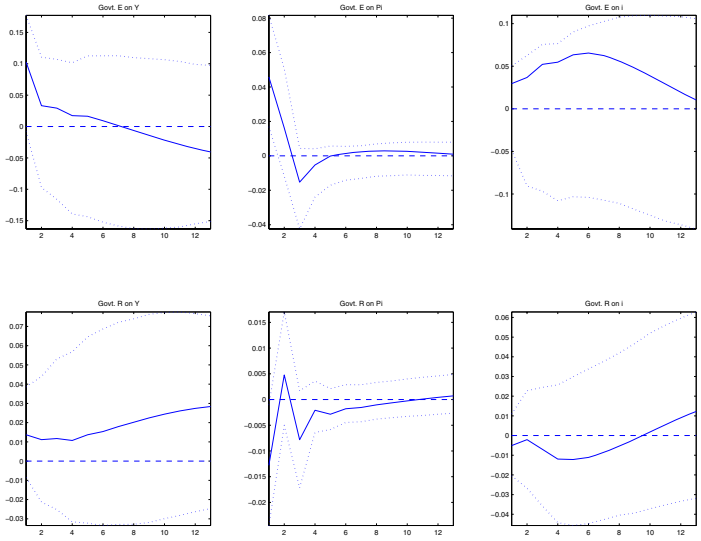

Figure 6: Basic 5-variable specification.

revenue shock in a 6-variable VAR is given. Real GDP is dropped in this specification and replaced by real consumption – ordered first – and real investment.

The impulse responses show a significant positive response of private consumption on impact to a spending shock, while investment reacts negatively but insignificantly. These positive consumption and negative investment responses are in line with previous evidence from VAR analyses, e.g. Blanchard and Perotti (2002). The effects of government revenue are again insignificant. Interestingly, the point estimate for the investment response, although insignificant, is positive, which is not in line with Blanchard and Perotti (2002). This investment response, however, is in accordance with simple Keynesian theory, which predicts that the response of investment to a revenue shock should be opposite to the response to a spending shock.[16] The response of inflation and the short-term interest rate is very similar to the previous specification.

4.3 Anticipated fiscal policy

Our results so far do not consider the effects of anticipated fiscal policy. However, under the rational expectations assumption, economic agents will adjust

[16]Keynesian theory is mute on the sign of the investment response. The interest rate increase after a spending shock should dampen investment, while the accelerator effect should have positive effects on investment.

Table 4: Cumulative GDP responses

quarter	0	1	2	3	4	5	6
Govt. E (3)	0.98*	1.64	2.31	2.94	3.56	4.16	4.77
Govt. R (3)	0.12	0.31	0.53	0.78	1.04	1.32	1.61
Govt. E	0.62	0.83	1.00	1.11	1.21	1.26	1.27
Govt. R	0.08	0.15	0.23	0.29	0.38	0.47	0.58
quarter	7	8	9	10	11	12	
Govt. E (3)	5.37	5.96	6.56	7.16	7.76	8.35	
Govt. R (3)	1.90	2.20	2.49	2.80	3.10	3.40	
Govt. E	1.23	1.15	1.02	0.84	0.63	0.38	
Govt. R	0.71	0.85	1.00	1.16	1.33	1.51	

Notes: Entries are real cumulative GDP responses in euros to a 1-euro increase in the respective fiscal variable. * indicates 10 percent significance level. (3) denotes regressions with only 3 variables in terms of real GDP, government direct expenditure, and net revenue.

their consumption, saving, and labor supply decisions as soon as they anticipate changes in fiscal policy. Ramey (2006) argues that fiscal policy actions are anticipated well before cash actually flows. She demonstrates that US war dummies, which are set to one when a war becomes announced in the newspapers, Granger-cause fiscal policy shocks identified by a VAR, but not the other way around. Thus, shocks identified with our procedure might reflect only the time period, when cash is flowing, but not the time period, when economic agents anticipate these flows.

Blanchard and Perotti (2002) try to address this criticism by including future fiscal policy variables in their estimation procedure. In particular, they argue that because of *implementation lags* agents perfectly know fiscal policy one period ahead. Accordingly, GDP should respond to tomorrow's spending shock that is anticipated today. Formally, one can write the 2-variable VAR with expenditure and output as:

$$e_t = \alpha_y^e y_t + C_{11}(L)e_{t-1} + C_{12}(L)y_{t-1} + v_t^e \quad (14)$$

$$y_t = \gamma_1 E_t e_{t+1} + \alpha_e^y e_t + C_{21}(L)e_{t-1} + C_{22}(L)y_{t-1} + v_t^y. \quad (15)$$

The first equation is as before, the second equation allows output to depend in addition on expected future spending. Equation (15) can be rewritten as:

$$y_t = \gamma_1 e_{t+1} + \alpha_e^y e_t + C_{21}(L)e_{t-1} + C_{22}(L)y_{t-1} + v_t^{y'} \quad (16)$$

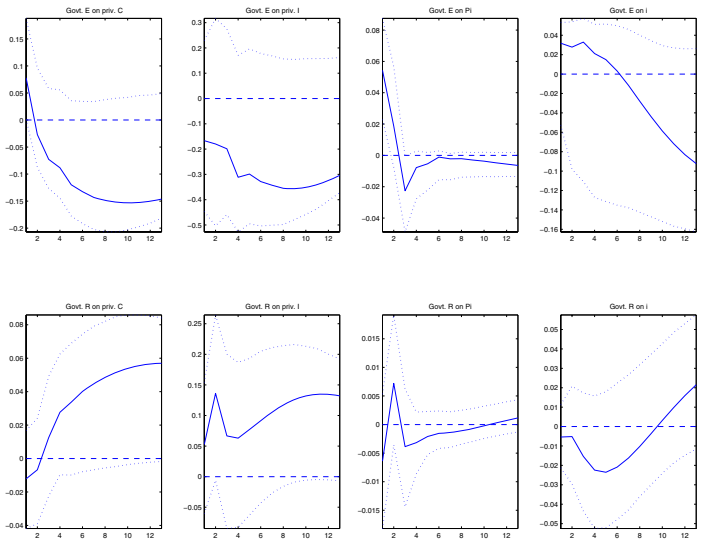

Figure 7: Separating private consumption and investment, 6-variable specification.

where $v_t^{y'} = v_t^y - \gamma_1(e_{t+1} - E_t e_{t+1})$. Blanchard and Perotti (2002) assume that v_{t+1}^e is perfectly known at time t. Therefore this error term is uncorrelated with the expectation error in $v_t^{y'}$. It is also uncorrelated with v_t^y. Consequently, we can use v_{t+1}^e and v_t^e as instruments for e_{t+1} and e_t to estimate γ_1 and α_e^y, i.e. the effect of future spending and today's spending on output.

To retrieve the structural shocks v_t^e to expenditure, we must be willing to extend our previous identifying assumptions since one additional parameter needs to be identified. Identification is now achieved by assuming that there is no discretionary response of fiscal policy to output in the same quarter (assumption as above) and in the previous quarter:

$$e_t = \alpha_{y1}^e y_t + \alpha_{y2}^e y_{t-1} + C_{11}(L)e_{t-1} + \tilde{C}_{12}(L)y_{t-2} + v_t^e. \tag{17}$$

As before, we then have to construct the exogenous elasticities of the automatic stabilizers and assume that $\alpha_{y1}^e = 0$. In addition, we argue, as Blanchard and Perotti (2002) do, that there is no automatic response of direct government expenditure to output in the previous quarter, i.e. $\alpha_{y2}^e = 0$. Under these assumptions it is relatively easy to estimate a new 2-variable SVAR with real direct government expenditure and real GDP, including the effects of perfectly anticipated fiscal policy one quarter ahead. We restrict the SVAR to the 2-variable case to get analytical solutions of the impulse responses. This restriction does not appear to drive the results as the 2-variable case without

addressing anticipation issues looks very similar to the results of the benchmark 5-variable case.

Figure 8 depicts the response of output to a perfectly anticipated direct expenditure shock one period ahead. Period 1 denotes the announcement date preceding the shock in period 2. As in our benchmark results, we find that output reacts positively to the fiscal shock. In the moment of announcement, the anticipated shock does not increase output significantly. The output response in period 2, when the shock is realized, is however strongly significant and the point estimate is larger than before. Not addressing anticipation in this

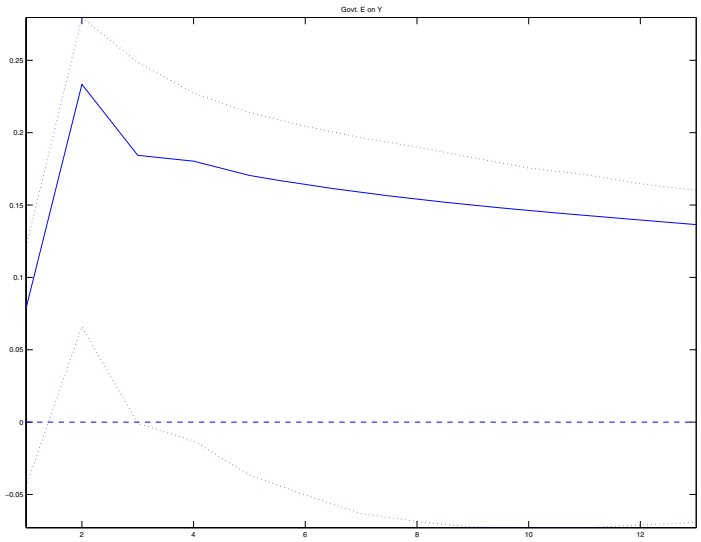

Figure 8: The effects of an anticipated direct government expenditure shock on output. 2-variable SVAR.

SVAR framework thus leads to qualitatively the same result. Quantitatively, however, the effect is underestimated. This is an interesting finding: Ramey (2006) shows in a very simple neoclassical model where next period's spending is changed that the strongest response of output occurs in the period the future spending shock becomes known. We find the strongest response when cash is flowing and the shock is realized. Our result stands thus in contrast to the neoclassical model. The difference of the output response compared to the non-anticipated estimation approach in the moment of the shock is, however, only quantitative, the sign of the response is the same.

Baxter and King (1993) furthermore show the response of private consumption to an unproductive and temporary expenditure shock. On impact,

consumption falls strongly and subsequently converges to its old steady state. They do not model, however, the effects of anticipated expenditure increases. Intuitively, it makes sense to argue that the largest drop of consumption should occur at the moment of anticipation as labor supply and consumption adjust instantaneously to the negative wealth effect, i.e., before the expenditure rise occurs. Ramey (2006) models the effect of a perfectly known increase of government expenditure in the next period. On announcement, consumption falls strongly, but then increases back to its old steady state. She argues that missing the anticipation in the identification strategy of the VAR could thus lead to an impact multiplier with a wrong sign as one measures the effect at a point in time when consumption increases again, even though it is below the old steady state level.

We therefore estimate a 2-variable SVAR with government direct expenditure and private consumption following the above described identification strategy with the expenditure shock perfectly anticipated one period ahead. The results are depicted in Figure 9. The response of consumption to this

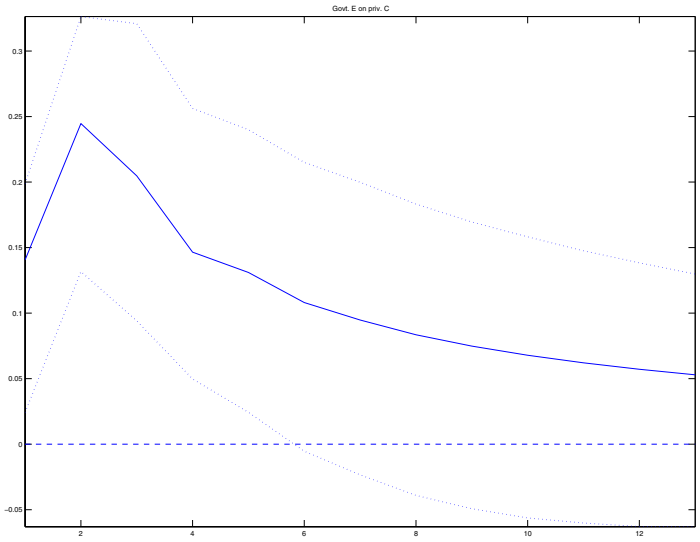

Figure 9: The effects of an anticipated fiscal policy shock. 2-variable SVAR with consumption and direct government expenditure.

anticipated shock is very similar to the response of output. Contrary to the predictions of the neoclassical model, we cannot observe a switch in the sign of the consumption response. In sum, addressing one period ahead anticipation effects in this VAR estimation approach does not change our main results. We

therefore would argue that, in the short run, government direct expenditure has effects consistent with Keynesian theory.

The investigation of the effects of anticipated fiscal policy, however, has clearly received little attention. Possible future research could investigate, whether the opposite responses of consumption in "war dummy" studies might result from the size of the identified shock. While in a standard rational expectations framework, the size should not matter for the sign of the response, under more realistic assumptions concerning the cost of information gathering and re-optimization it might very well play a role. On the one hand, recent micro-econometric evidence by Shapiro and Slemrod (1995), Souleles (1999, 2002) and Johnson, Parker, and Souleles (2005) appears to be more in line with our VAR results, as they show a very strong response of household consumption to tax cuts.[17] These studies are based on relatively small tax rebates. The macroeconomic effects are found to be quite strong (Johnson, Parker, and Souleles 2005). Fuchs-Schündeln (2006) on the other hand argues based on a large income shock (German re-unification) that households behave in line with precautionary saving theories. This suggests that after large shocks, such as announced wars, households might re-optimize their behavior, thereby leading to a fall in private consumption. Hsieh (2003) provides further evidence in that direction. In his study, spending of Alaskan families does not appear to react to large and predictable annual payments while it does react to small and predicted income tax refunds. This difference is explained by the fact that computational costs of re-optimization are significant. Exploiting the size of the shock therefore appears to be a worthwhile area of future research on the effects of fiscal policy. As for now, our VAR results are based on small scale fluctuations and show evidence in line with traditional (New) Keynesian stories.

4.4 Further robustness checks

We performed a variety of robustness checks to our 5-variable benchmark specification. First of all it is worth mentioning that responses of output and inflation to a short-term interest rate shock are in line with standard monetary (S)VAR findings. Output decreases and inflation only declines after an initial

[17] In a follow-up study, Shapiro and Slemrod (2003) find a substantial weakening of their results of 1995. Nevertheless a fair amount of consumers still behaved in a way consistent with Keynesian theory.

upward hike, the usual price puzzle (Bernanke and Blinder 1992). Instead of using a short-term interest rate we looked at a 10 year interest rate to see whether the results change when long-run financing conditions are taken into account. The results do not change.

We also employed different deflators. Besides the GDP deflator to deflate our variables and create the inflation measure, we employed the CPI with no change in results. In a next step, we deflated government expenditure with the government consumption deflator without any significant change in results.

We performed robustness checks regarding the definition of the fiscal variables. Disregarding interest payments or transfer payments when constructing our revenue measure does not change our results.

To address issues of sub-sample stability, we performed the estimation procedure for the sample ranging to German re-unification and 1991-2004. The empirical results are stable for the sub-samples. We also performed CUSUM tests, which do not show signs of coefficient instability. Our estimation results thus do not depend on the exact choice of the period and are not driven by re-unification related shocks.

Central to the identification strategy are the elasticities, which are taken from exogenous sources. Even though we are confident that our presented elasticities accurately capture the working of automatic stabilizers, we performed robustness checks by varying these values. The central elasticity is the elasticity of net revenue with respect to GDP, α_y^r. Here we have calculated a value of 0.95 from different income tax statisitics. We re-estimated the SVAR assuming that this elasticity amounts to only 0.5, without any substantive change of results. Increasing the elasticity beyond the original value to 1.5, however, does affect our results. In particular, the effect of net revenue on GDP becomes significantly negative. The responses of the other variables are unaffected. This result is in line with Perotti (2005, p. 25), who presents additionally the response of GDP assuming a higher value of this elasticity. If the elasticity is higher, a tax cut results in significantly higher output in the sample period 1975 – 89. Also, Blanchard and Perotti (2002) assume a very high value for this elasticity, equalling 2. Driving force of this high value for the USA is the very strong reaction of corporate tax income to corporate profits on a quarterly basis. Checking the German tax codes,[18] we are confident,

[18]I.e. EStG §37(3) (Einkommenssteuergesetz) , KStG §31(1) (Körperschaftssteuergesetz), and GwStG §19(2) (Gewerbesteuergesetz).

that corporate tax payments do not react to changes in profits on a quarterly basis. Reason for this is that corporations do not have to make statements about their profits within the quarter to the fiscal authorities. Rather, their tax payments are based on average profit patterns in the previous year. We have therefore set this sub-elasticity to 0, which is in line with Perotti's (2005) assumption. Nevertheless, increasing the sub-elasticity of corporate tax income to the annual value of 1.69, leads to an overall elasticity of $\alpha_y^r = 1.25$. At this value, net revenue has a slight negative impact on GDP. Regarding the other components of α_y^r, we do not have any indication for assuming a higher elasticity so that we are confident, that $\alpha_y^r = 0.95$ is a correct value.

5 Disaggregating fiscal variables

In this section we investigate the effects of different components of fiscal policy on output, inflation, and interest rates. To do so, we augment our basic 5-variable specification by splitting up either expenditure or revenue. Accordingly, we estimate VARs with six variables, and in two additional cases seven variables by splitting up fiscal variables and additionally GDP into private consumption and investment.

5.1 Expenditure components

In a first disaggregated specification, we include – in addition to net revenue – personnel and operating expenditure as fiscal variables in the VAR. These two expenditure components add up to our previous government direct expenditure variable, which is dropped. For the sub-components of government expenditure we assumed a zero exogenous elasticity. Figure 10 presents the responses to these three variables. The effects of government net revenue are, as before, small and insignificant. Government personnel expenditure (PE) has equally no significant effect. Government operating expenditure (OE), consisting of capital formation and other operating expenditure, has a clear and persistent positive effect on output. Table 5 provides the cumulative response of GDP in euros to a 1-euro shock to operating expenditure. On impact, output increases by more than 1 euro. This value subsequently increases substantially. Part of this increase is due to a further endogenous increase of government operating

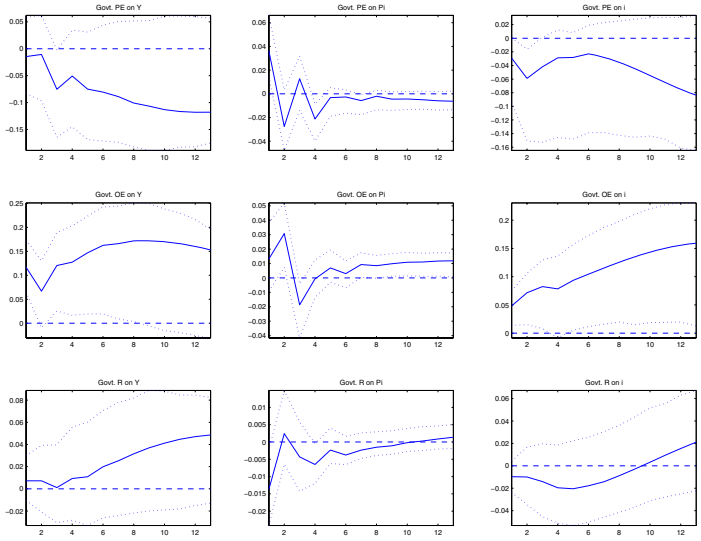

Figure 10: Separating personnel and operating expenditure, 6-variable specification.

expenditure.[19]

Our results on the effects of expenditure components contrast with the findings of Fatás and Mihov (2001), who report that compensation of public employees is a highly effective way of boosting consumption and output, while public investment expenditure has little effects. Our results confirm the outcomes for Italy by Giordano, Momigliano, Neri, and Perotti (2005).

In a next step we combine personnel expenditure and other operating expenditure to obtain government consumption (C). In addition, we include government investment (I), consisting of capital formation and financial aid to investment. The impulse responses are depicted in Figure 11. We find a weak and insignificant response of output to a shock to government consumption. The effect of government investment is, however, strong, significant, and persistent. The positive effect of operating expenditure found above thus seems to result from the effect of public capital formation. Table 5 shows, that the response of output to the public investment shock is substantially persistent

[19]By this endogenous increase we mean the interaction of the whole system, i.e., the VAR. The 1 euro increase in operating expenditure triggers a whole chain of reactions of the system due to its lagged structure which leads to further increases in operating expenditure and thus in GDP after the original shock period. This partly explains the large magnitude of the response after a couple of quarters. Another important reason why we obtain such huge numbers is that we cumulate impulse responses of a VAR estimated in *levels* as indicated in footnote 15.

Table 5: Cumulative GDP responses

quarter	0	1	2	3	4	5	6
OE	1.65*	2.59*	4.29*	6.09*	8.17*	10.46*	12.81*
Govt. I	1.45*	2.13*	3.65*	5.25*	7.28*	9.57*	12.06*
Dir. T	-0.79*	-1.46*	-1.95*	-2.31	-2.54	-2.60	-2.50
quarter	7	8	9	10	11	12	
OE	15.24*	17.67*	20.07*	22.42*	24.68*	26.84*	
Govt. I	14.72*	17.50*	20.37*	23.28*	26.21*	29.14*	
Dir. T	-2.22	-1.77	-1.15	-0.37	0.57	1.63	

Notes: Entries are real cumulative GDP responses in euros to a 1-euro increase in the respective fiscal variable. * indicates 10 percent significance level.

and increasing.

This finding is in line with theoretical predictions by Baxter and King (1993), who found very large positive output multipliers for government investment depending on the productivity parameter of public capital. Empirically, large effects have also been found by e.g. Aschauer (1989). These empirical results indicate that weak German growth in the last decade might partly result from persistently weak and declining public investment (see Figure 4).

In a further step (Figure 12), we investigate the response of the GDP components private investment and consumption to public consumption and investment shocks, respectively. While the neoclassical model by Baxter and King (1993) predicts very strong positive output effects of public investment, especially in the long run, private consumption is expected to fall on impact. This effect is driven by the direct resource absorption that an increase in investment constitutes. Only after some years, consumption can be above its initial level when output has increased sufficiently due to the increase in production factors. In contrast to the predictions of the neoclassical model, we find that government investment shocks increase private consumption on impact, the effect is however quite small and insignificant. Government investment has stronger effects on private investment with an impact elasticity of 0.14, which is also insignificant. The further evolution of the responses is of interest: Both private consumption and investment further increase after the positive investment shock. This suggests that public investment generates resources that lead to higher consumption and investment in the longer run. This confirms our result for the output response. In contrast, private consumption initially increases after a government consumption shock, but it

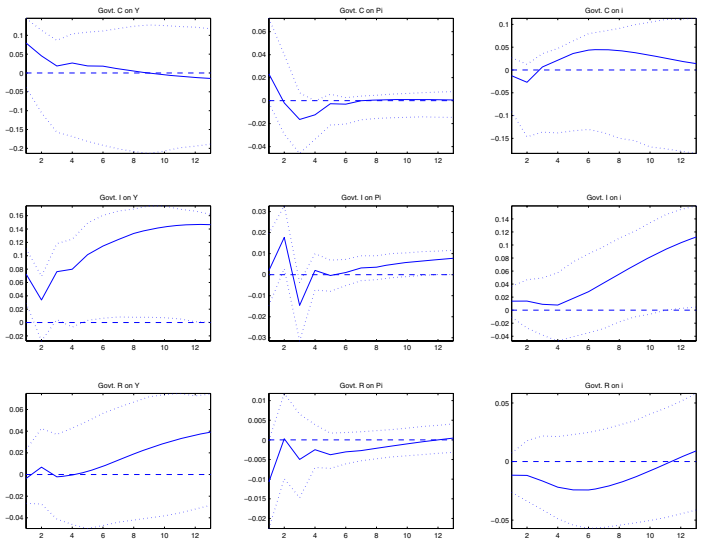

Figure 11: Separating government consumption and investment, 6-variable specification.

falls subsequently to levels below the initial one. Again, this result can be reconciled with medium-term arguments of resource constraints. In the short run (on impact), however, private consumption and investment respond in line with (New) Keynesian predictions.

5.2 Revenue components

In this section we investigate the effects of different sub-components of net revenue on real GDP. In a first specification, we include indirect and direct (wage and profit related) taxes. Figure 13 shows that government expenditure has similar effects as before. Indirect taxes are found to affect output very little and insignificantly. The point estimate becomes larger in absolute terms with time, however. Regarding the effects of direct taxes, our results show a clear and significant negative effect on output (see also Table 5). This evidence thus indicates that only some components of taxes have negative effects on output. The difference might result from stronger distortions of direct taxes – via shifts in relative prices across labor and capital, for instance – as compared to indirect taxes.

In a next step, we choose a different disaggregated split-up of revenue by looking at profit taxes (profit related taxes) and non-profit taxes (indirect taxes and wage taxes). We expect that while profit taxes should reduce investment

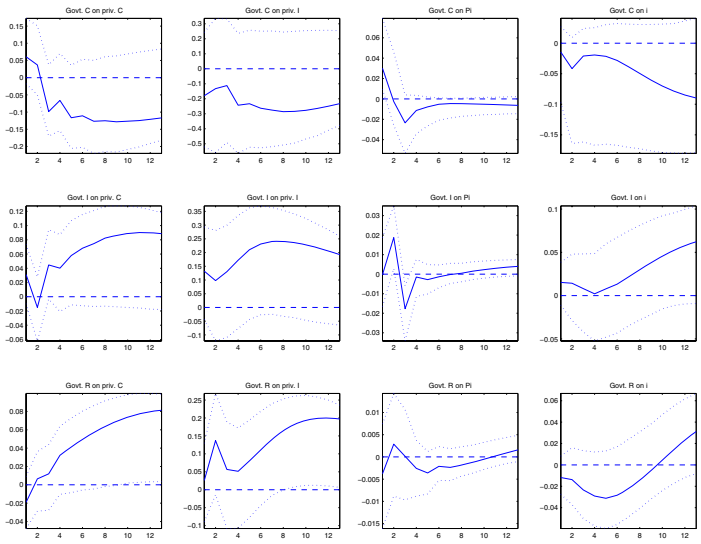

Figure 12: Separating government consumption and investment and private consumption and investment, 7-variable specification.

significantly, non-profit taxes should have detrimental effects on private consumption. We therefore estimate a 7-variable VAR, including consumption, investment, inflation, short-run interest rate, government direct expenditure, and non-profit and profit taxes. We find only some of our expectations met (Figure 14). Private consumption reacts negatively to a shock to non-profit taxes, while the impact response of private consumption and investment is insignificant to a shock to profit taxes. Furthermore, the responses to the profit shock have an unexpected sign. This might result from some sort of reverse causality stemming from identification difficulties due to problems with exogenous elasticities. As discussed above, the determination of the elasticity of profit taxes to GDP is quite cumbersome as tax payments are only loosely connected to their macroeconomic base. Overall, this sub-section has shown, that only some components of taxes affect output negatively in the short run. In particular direct taxes reduce output significantly on impact. In general, the effect of tax shocks is rather weak, which might be explained by Ricardian behavior of consumers.

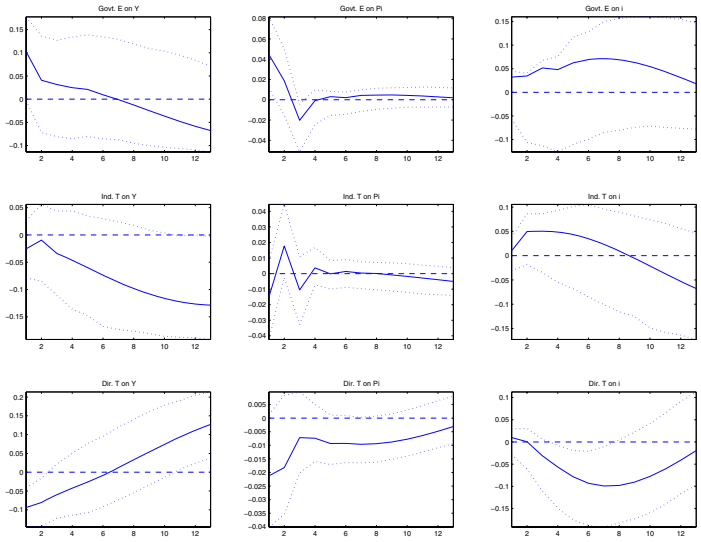

Figure 13: Separating indirect and direct taxes, 6-variable specification.

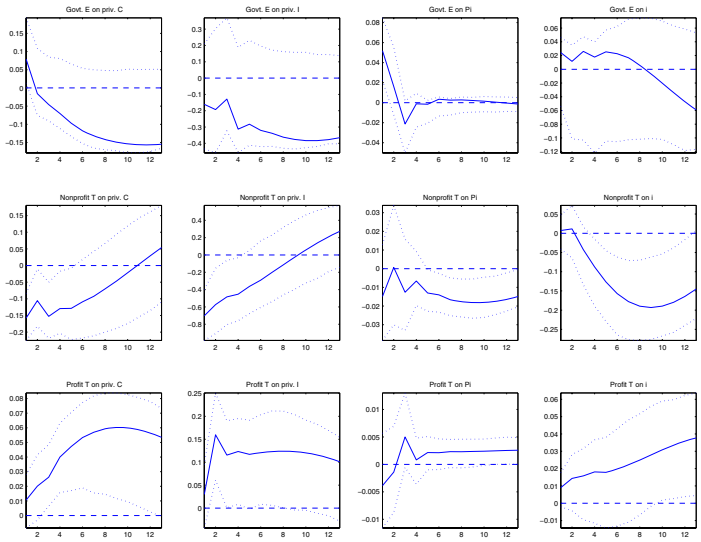

Figure 14: Separating non-profit and profit taxes, 7-variable specification.

6 Conclusion

We investigate the short-term effects of fiscal policy shocks on the German economy in the framework of Blanchard and Perotti (2002). Direct government expenditure shocks are found to increase output and private consumption on impact and with low statistical significance, while they lower private investment, though insignificantly. One period ahead anticipated fiscal policy does not change the sign of the positive consumption response. When anticipation effects are allowed for, expenditure shocks have larger effects on output, in particular in the moment of shock realization.

Looking at sub-components of government direct expenditure confirms this result: Operating expenditure in terms of capital formation plus other operating expenditure increase output statistically significant until 8 quarters ahead. This is driven by government investment, which has positive effects on output with statistical significance lasting until 12 quarters after the shock. According to our results, government consumption – here defined as personnel expenditure plus other operating expenditure – has only negligible effects on the economy. While Baxter and King (1993) show strong positive effects of government investment in their model, they still find a negative response of private consumption on impact due to the resource absorption of the investment shock. Our results differ from this view as private consumption also reacts positively on impact, though statistically insignificant. In contrast, we find that a rise in public personnel expenditure, which might reflect a change in both employment and compensation per employee, has no positive effect on output. This finding might suggest Ricardian behavior.

Small shocks to net revenue are found to matter little for GDP. Looking at sub-components of taxes provides a more detailed picture. Shocks to direct taxes lower output significantly, while small shocks to indirect taxes have no statistically significant effect. By interpreting this finding as a distortionary feature of direct taxes, this result supports Baxter and King (1993), who show that the response of GDP to distortionary taxes is negative.

Overall our results show that government fiscal policy shocks have weak impact multipliers. Long-lasting effects on the German economy via one-off changes in government expenditure and revenue cannot be derived from our framework. Future research appears worthwhile to further uncover the anticipation effects of fiscal policy and the relevance of the size of shocks in greater

detail.

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A Appendix

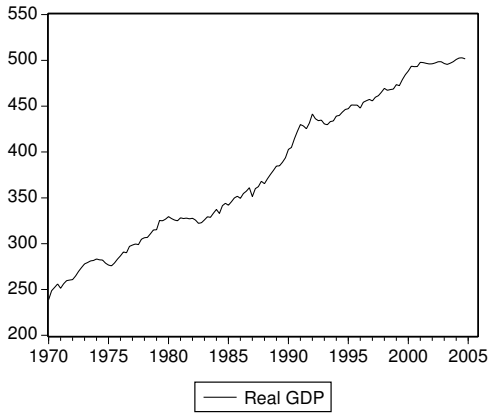

Figure 15: Real GDP in billion euros, seasonally adjusted.

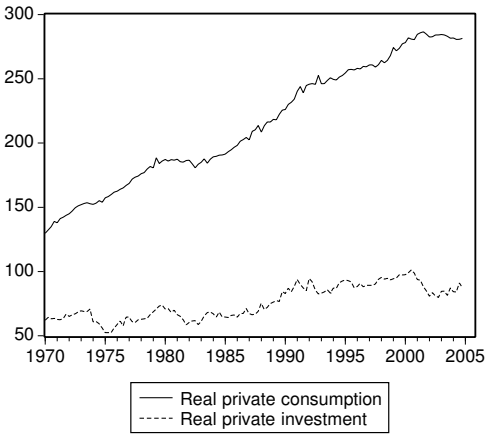

Figure 16: Real private consumption and investment in billion euros, seasonally adjusted.

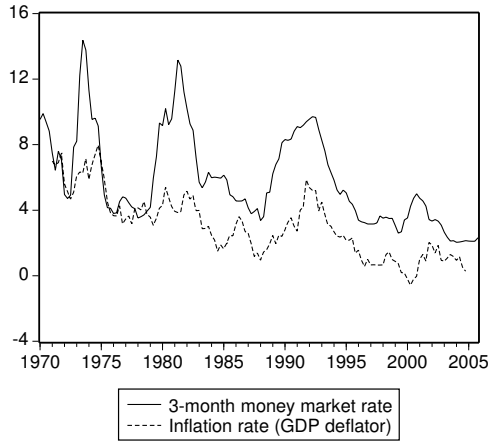

Figure 17: Short-term interest rate and rate of inflation.

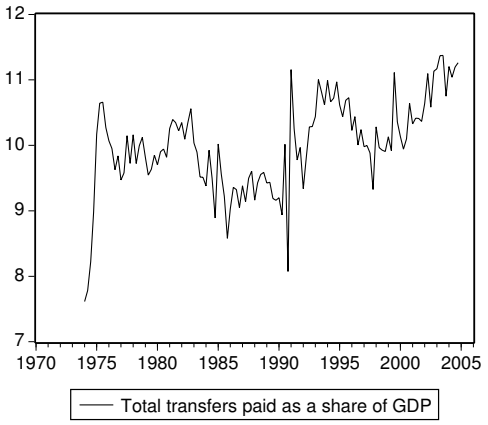

Figure 18: Total transfers paid in percent of GDP.

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