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Conference Paper

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Beiträge zur Jahrestagung des Vereins für Socialpolitik 2010: Ökonomie der Familie - Session:
Empirical Analyses of Fiscal Policy, No. B9-V1

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Breuer, Christian; Buettner, Thiess (2010) : Fiscal Policy in a Structural VAR Model for Germany, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2010: Ökonomie der Familie - Session: Empirical Analyses of Fiscal Policy, No. B9-V1, Verein für Socialpolitik, Frankfurt a. M.

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Fiscal Policy in a Structural VAR Model for Germany

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February, 2010

Abstract:

This paper examines the effects of fiscal policy measures on GDP and the government budget balance in a structural VAR model. In order to identify expenditure shocks we follow Blachard/Perotti (2002) and assume that government expenditure is partly predetermined in the budget. For the identification of tax policy shocks we exploit changes in tax law in Germany between 1967 and 2008. Our results support significant short term effects of fiscal expansionary policies. In the medium term, however, the model predicts substantial increases in government debt. Applying the model to the recent stimulus programmes in Germany, we find that the stimulus programme had substantial effect on output in the short run.

Keywords: Fiscal policy, tax policy, government spending, structural VAR

JEL codes: E02, E62, H30, H68

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[‡]We thank Irene Gasser, Karol Kempa and Axel von Schwerin for valuable research assistance.

1 Introduction

After a protracted period of high public deficits the last years have witnessed a brightening of the fiscal outlook of the German Economy. The total public sector deficit declined from a figure of -3.1% of GDP in 2003 to a surplus of 0.4 % in 2007 and 0.0 for 2008. Relatively high growth rates further contributed to a slight reduction of the debt-GDP ratio which came down to a figure of about 65.1% in 2007. Also the medium term perspective improved as is indicated by a decline of the structural deficit. According to EU Commission estimates the structural deficit decreased from -3.0% in 2003 to - 0.8% in 2007, and, consequently, in June 2007 EU Council abrogated the excessive deficit procedure against Germany. While demographic change continues to overshadow the long-term fiscal perspective labor market reforms and reform of the pension system contributed to an improvement of long-term fiscal sustainability, according to the *2nd Sustainability Report* issued in June 2008.

The global financial crisis that entered an acute phase in autumn of 2008 has stopped this trend towards consolidation. First, the federal government needed to issue guarantees to banks. The first programm issued in October 2008 allowed to government to issue guarantees and to provide equity capital in the amount of 480 Billion Euros. Additional funds of roughly 100 Billion Euros were mobilized to save specific financial institutions including several state owned banks (Sinn, 2009). Relative to GDP in 2008 the funds amount to a figure of 23%. While it is currently not possible to come up with a reliable estimate of the extent to which these funds will result in an increase in public debt. But given the sheer magnitude fears that these funds will exert a strong negative impact on the net-fiscal asset position seem justified.

A second fiscal consequence of the global financial crisis which is more traditionally associated with a rise in deficits is related to the sharp economic downturn. Especially the German economy with its large exports was severely hit by the worldwide recession and GDP declined by about 5% in 2009. At the same time the deficit was increasing to 3.3% and is expected to grow to a figure of 5.1% in 2010 (Carstensen *et al.*, 2009). Some major part of this deterioration is due to the automatic response of the tax- transfer systems. Due to the recession tax revenues decline and transfers to households increase. Even if important social

security institutions in Germany make this kind of response particularly strong in the German case, the fiscal consequences are less problematic as a future upswing corrects the resulting deficits and would contribute to the intertemporal balance of public finances.

A fiscal development that is discussed more controversially is a set of discretionary fiscal policy measures initiated by the federal government in a first spending program issued in November 2008 with a volume of 4.2 Bill Euro in 2009 and 7.6 Bill. Euro in 2010 and a second larger programme in 2009 with amount of 19.5 and 27.5 Bill. Euro for 2009 and 2010, respectively. Together with some other policy changes, the fiscal impulse through discretionary measures amounts to no less than 32.1 Bill. Euro in 2009 and 48.4 Bill. Euro in 2010. Compared to the levels in 2008 this impulse amounts to almost 1.3% in 2009 and about 2.0% in the year 2010, relative to GDP.

While the federal government is taking measures that further increase public spending and further decrease public revenue the fiscal consequences depend on the macroeconomic effects of this discretionary fiscal policy. Yet there is much controversy about these consequences and the empirical evidence is rather weak. This results from the general difficulties to provide a meaningful empirical analysis based on a few macroeconomic aggregates that reflect the decisions of innumerable agents. In contrast to the discussion in macroeconomic textbooks, public expenditures and revenues are not just determined by a single government but rather the outcome of the decisions of multiple governments, the decisions of individual agents, and a complex set of institutions that administer the various government policies. This makes it rather difficult to discern the impact of discretionary government policies on fiscal and macroeconomic aggregates.

The approach usually taken in the empirical literature pioneered by Sims is to formulate a statistical model that captures all possible relations of the aggregates of interest in time and to trace the impact of stochastic shocks to some of the aggregates as for instance public expenditures in order to analyze the consequences of policy changes. The problem with this strategy is that stochastic shocks to each of the aggregates tend to be correlated. In order to come up with a model that traces the consequences of actual policies it is therefore necessary to relate the correlated shocks to isolated changes of single aggregates that would reflect

a policy decision. This is a difficult matter and empirical research in macroeconomics has developed few approaches that could possibly be used to obtain such “structural” empirical models.

The existing evidence for the US case points at modest output effects of expansionary fiscal policies, which, however, tend to be temporary as effects vanish over the medium- or the long-run effects. It is questionable, whether these results can be applied to the German case. As is often noted, the German economy is rather closely connected with other European countries and consequently is dependent on the development in other countries. Moreover, the large share of funds appropriated by the Laender governments and the importance of revenue sharing could result in a situation where federal fiscal policy exerts important repercussions at the subnational level. Yet only very few studies are concerned with the case of Germany.

This paper provides an empirical analysis of the macroeconomic effects of fiscal policy for Germany. It basically follows the seminal approach by Blanchard and Perotti (2002) to investigate the impact of public spending and revenue shocks. However, in order to identify revenue shocks we rely on estimates of the revenue effects of tax law changes, an approach that was recently employed by Romer and Romer (2007). Technically, we estimate a structural vector autoregressive model using quarterly data from the 1960 until 2008. The advantage of this approach is that the analysis is directly concerned with the aggregates for public spending and public revenue, their interrelationship, and their relationship with the gross domestic product. We then use this model in order to provide estimates of the fiscal consequences of the discretionary fiscal policy measures of 2009 and 2010.

Our results point at significant effects of expansionary fiscal policies on output – in the short term. However, these effects quickly peter out and in the medium term expansionary fiscal policies contribute to an increase in government debt. Applied to the recent fiscal expansion that took place in the wake of the global financial crisis the model suggests considerable effects on GDP for the years 2009 and 2010. However, the model predicts that following the stimulus programme, governments will tend to restore primary balance. As a consequence, the level of government debt will reach a new steady-state level of about 4 percentage points in terms of GDP above the initial level.

2 A Structural VAR Model

The empirical model is concerned with three macroeconomic aggregates, GDP (Y_t) and public revenue and spending (R_t and G_t). Public spending comprises government consumption as well as investment. Public revenue is defined as tax revenues and social security contributions net of transfers to individuals.

The reduced form of the basic VAR model is a system

$$\begin{aligned} R_t &= a_0^1 + \sum_{k=1}^p a_{1,k}^1 R_{t-k} + \sum_{k=1}^p a_{2,k}^1 G_{t-k} + \sum_{k=1}^p a_{3,k}^1 Y_{t-k} + u_t^R \\ G_t &= a_0^2 + \sum_{k=1}^p a_{1,k}^2 R_{t-k} + \sum_{k=1}^p a_{2,k}^2 G_{t-k} + \sum_{k=1}^p a_{3,k}^2 Y_{t-k} + u_t^G \\ Y_t &= a_0^3 + \sum_{k=1}^p a_{1,k}^3 R_{t-k} + \sum_{k=1}^p a_{2,k}^3 G_{t-k} + \sum_{k=1}^p a_{3,k}^3 Y_{t-k} + u_t^Y. \end{aligned}$$

where u_t^R , u_t^G and u_t^Y are the forecast errors. Following Blanchard and Perotti (2002), these forecasts are linked through the following structural equations of the model

$$\begin{aligned} u_t^R &= \alpha_1 u_t^Y + \alpha_3 u_t^G + \alpha_2 \epsilon_t^G + \epsilon_t^R \\ u_t^G &= \beta_1 u_t^Y + \beta_3 u_t^R + \beta_2 \epsilon_t^R + \epsilon_t^G \\ u_t^Y &= \gamma_1 u_t^R + \gamma_2 u_t^G + \epsilon_t^Y, \end{aligned}$$

where ϵ_t^R , ϵ_t^G and ϵ_t^Y represent structural shocks. α_2 and β_2 capture possible linkages between structural shocks to revenues or expenditures which arise if the government immediately responds to revenue changes with spending adjustments or *vice versa*.

In order to determine the parameters that relate the forecast errors Blanchard and Perotti (2002) consider the institutional setting of fiscal policy. To start with, α_1 is the (short-term) tax revenue elasticity with regard to GDP, the size of which is shaped by the tax system. Since most taxes (such as value added tax or income taxes) are closely associated with GDP, this is a key parameter for revenue forecasting and for computing structural deficits. However, revenue forecasters usually do not utilize information about current government spending.

This suggests to set α_3 to zero. With quarterly data, it is also hard to expect an immediate impact of revenue and output realizations on government spending. Usually, government expenditures are determined for annual or even biannual budget periods. Short-term effects within a quarter are usually rather unlikely. This suggests to restrict β_1 and β_3 to zero. With these limitations the structural equations become

$$\begin{aligned} u_t^R &= \alpha_1 u_t^Y + \alpha_2 \epsilon_t^G + \epsilon_t^R \\ u_t^G &= \beta_2 \epsilon_t^R + \epsilon_t^G \\ u_t^Y &= \gamma_1 u_t^R + \gamma_2 u_t^G + \epsilon_t^Y. \end{aligned}$$

Blanchard and Perotti (2002) discuss different options to estimate the set of structural parameters needed to make predictions about how fiscal policy shocks ϵ_t^G , ϵ_t^R affect the time path of the output and the fiscal variables. The identification of fiscal policy shocks out of the aggregate spending and revenue variables, however, seems problematic as the aggregate time series are not always clearly associated with current fiscal policies. In particular with revenues it seems difficult to interpret an innovation as a policy change since tax revenues very much result from taxpayer responses to taxation rather than just reflecting government decisions. For this reason, we utilize revenue estimates for tax reforms to identify revenue shocks in our VAR model.

More specifically, we add an exogenous variable x_t^R capturing the predicted change in revenues due to tax reforms implemented in the current period. With this information we decompose the total forecast error in two parts. Formally we define forecast errors unrelated to tax reforms \tilde{u}_t^R , \tilde{u}_t^G and \tilde{u}_t^Y such that

$$\begin{aligned} \tilde{u}_t^R &\equiv \alpha_1 \tilde{u}_t^Y + \alpha_2 \epsilon_t^G + \epsilon_t^R \\ \tilde{u}_t^G &\equiv \beta_2 \epsilon_t^R + \epsilon_t^G \\ \tilde{u}_t^Y &\equiv \gamma_1 \tilde{u}_t^R + \gamma_2 \tilde{u}_t^G + \epsilon_t^Y. \end{aligned}$$

With these definitions we can see that

$$\begin{aligned} u_t^R &= \tilde{u}_t^R + \alpha_1 (u_t^Y - \tilde{u}_t^Y) + x_t^R \\ u_t^G &= \tilde{u}_t^G \\ u_t^Y &= \tilde{u}_t^Y + \gamma_1 (u_t^R - \tilde{u}_t^R). \end{aligned}$$

Rearranging yields

$$\begin{aligned} u_t^R &= \tilde{u}_t^R + \frac{1}{1-\alpha_1\gamma_1} x_t^R \\ u_t^G &= \tilde{u}_t^G \\ u_t^Y &= \tilde{u}_t^Y + \frac{\gamma_1}{1-\alpha_1\gamma_1} x_t^R \end{aligned}$$

and we can rewrite the system to obtain

$$\begin{aligned} R_t &= a_0^1 + \sum_{k=1}^p a_{1,k}^1 R_{t-k} + \sum_{k=1}^p a_{2,k}^1 G_{t-k} + \sum_{k=1}^p a_{3,k}^1 Y_{t-k} + a_4^1 x_t^R + \tilde{u}_t^R \\ G_t &= a_0^2 + \sum_{k=1}^p a_{1,k}^2 R_{t-k} + \sum_{k=1}^p a_{2,k}^2 G_{t-k} + \sum_{k=1}^p a_{3,k}^2 Y_{t-k} + a_4^2 x_t^R + \tilde{u}_t^G \\ Y_t &= a_0^3 + \sum_{k=1}^p a_{1,k}^3 R_{t-k} + \sum_{k=1}^p a_{2,k}^3 G_{t-k} + \sum_{k=1}^p a_{3,k}^3 Y_{t-k} + a_4^3 x_t^R + \tilde{u}_t^Y, \end{aligned}$$

where the parameters associated with the predicted change in revenues obey

$$\begin{aligned} a_4^1 &= \frac{1}{1-\alpha_1\gamma_1} \\ a_4^2 &= 0 \\ a_4^3 &= \frac{\gamma_1}{1-\alpha_1\gamma_1}. \end{aligned}$$

The empirical estimation, thus, directly determines the fiscal impact of a revenue shock with

$$\hat{\gamma}_1 = \frac{\hat{a}_4^3}{\hat{a}_4^1}.$$

Using the estimate for γ_1 we can transform the forecast errors for GDP to obtain

$$\hat{u}_t^Y = u_t^Y - \hat{\gamma}_1 u_t^R.$$

This enables us to determine the expenditure elasticity of the output γ_2 from a regression

$$\hat{u}_t^Y = d_0 + du_t^g + \epsilon_{i,t}.$$

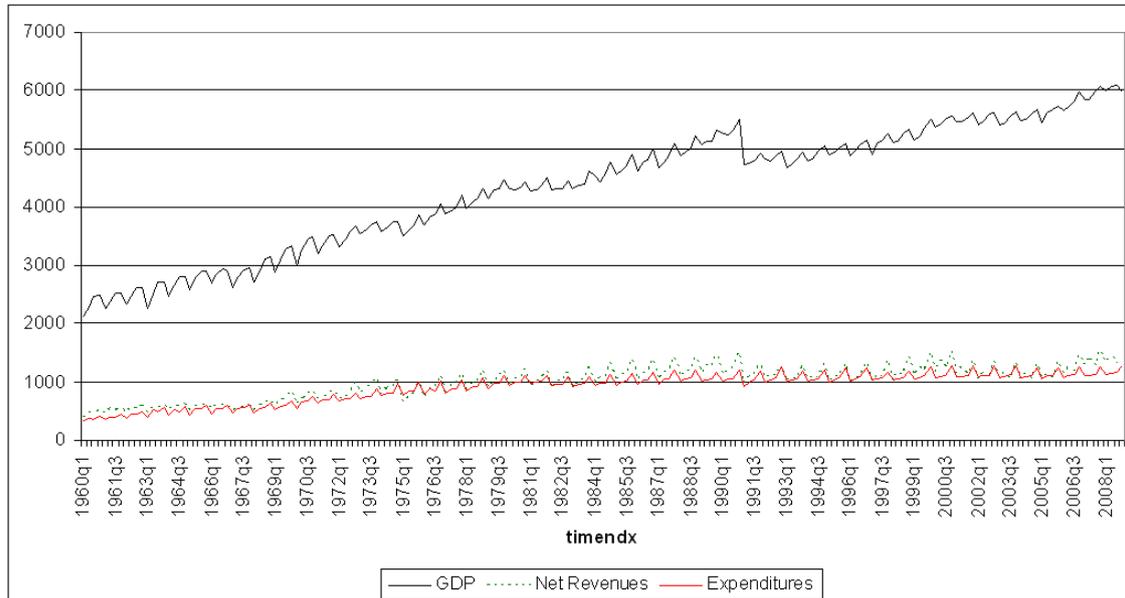
where the coefficient d serves as an estimate for the elasticity γ_2 ($\hat{\gamma}_2 = \hat{d}$). With these parameters, the remaining coefficients of the structural form α_2 and β_2 can be determined from the empirical covariance matrix of the forecast errors $\tilde{u}_t^Y, \tilde{u}_t^R$ and \tilde{u}_t^G .

3 Data

The empirical analysis is based on quarterly national accounts data for Germany in the period from 1960 - 2008. The data for 1970 - 2008 is obtained from the Federal Statistical Office (Destatis) respectively Eurostat. For the sixties we resort to the national accounts of the German Institute of Economic Research (DIW). Since quarterly data is not available from the Federal Statistical Office before 1998, also the revenue data employed is obtained from the German Institute of Economic Research (DIW) until 1998. The combination of these different sources improves our database relative to other studies which either study shorter periods of time (Bode *et al.*, 2006) or resort to cash data (Heppke-Falk *et al.*, 2006). Due to substantial lags in tax collection, however, cash data are not well synchronized with national accounts data.

The fiscal series are generated analogue to the approach of Blanchard and Perotti (2002). Government expenditures consist of expenditures and gross investments of the general government including expenditures of the national social insurance system but excluding transfers to the private sector and subsidies. Net revenues include all taxes to the general government and contributions to the social insurance system net of transfers like unemployment compensation and pensions. Unlike Blanchard and Perotti (2002) we do not consider interest revenues and expenditures of the general government as net taxes. This is consistent with other studies for Germany where the capital market is closely integrated with other European countries. The resulting series are deflated using the GDP price index and expressed in per-capita terms. This is helpful also for limiting the structural breaks that relate to German unification. Figure

Figure 1: GDP, Revenues and Expenditures (real and per capita in prices of 1991)



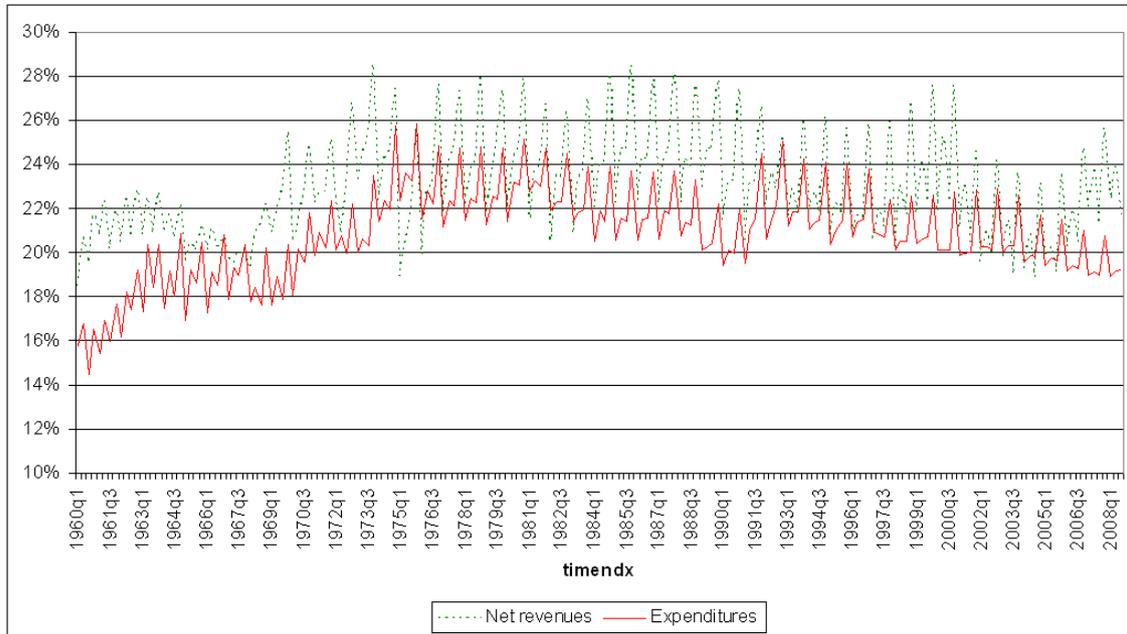
Source: Destatis, DIW and own calculations.

1 depicts the basic series. Figure 2 provides a visual impression of the close relationship and the degree of seasonal variation of the fiscal variables.

In order to identify the effects of revenue shocks we use estimates of the revenue effects of tax reforms by the Federal Ministry of Finance. Starting in the sixties those estimates have been provided as input to the legislative process. The revenue effects of implemented tax reforms is summarized for every year in the yearly report of the Federal Ministry of Finance. We consider the revenue effects of 892 changes of the tax law in the last 43 years. Expressed in terms of first differences we obtain a series of exogenous shocks on tax revenues in every year as shown in Figure 3.

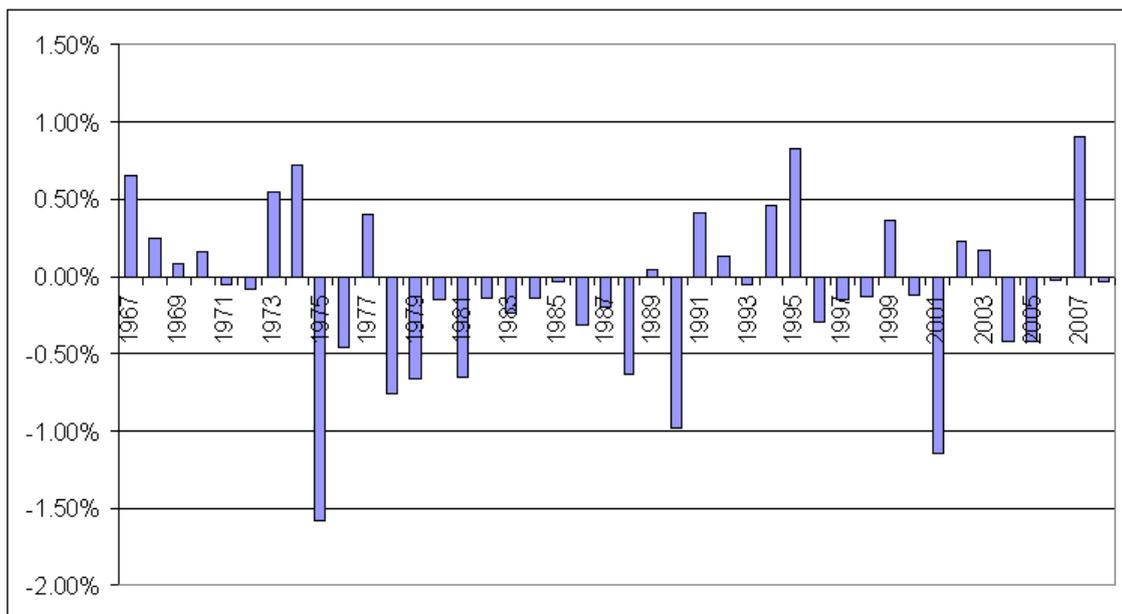
With regard to identifying public expenditure shocks, one might consider to use a similar approach. For instance, fiscal expansions associated with wars have often been used to identify expenditure shocks (Edelberg *et al.*, 1998 and Kamps and Kaldara, 2006). However, in the case of the Federal Republic of Germany it is difficult to come up with corresponding events. In order to identify expenditure shocks, we, therefore, rely on the structural identification

Figure 2: Revenues and Expenditures as percentage of GDP



Source: Destatis, DIW and own calculations.

Figure 3: Revenue Effects of Tax Law Changes as percentage of GDP



Source: Federal Ministry of Finance, own calculations.

approach of Blanchard and Perotti (2002). Given the emphasis on budget planning in the German context this approach seems quite useful in the German context.

4 Revenue Elasticities

A crucial issue for macroeconomic VAR analysis is to identify the contemporaneous relationship between the variables (Dungey and Fry, 2009). As we have discussed above in Section 2 we rely on Blanchard and Perotti (2002)'s seminal approach which makes use of the fact that governments' expenditures are usually predetermined in an annual or sometimes bi-annual budget. As a consequence, forecast errors associated with revenues or output exert no contemporaneous effect on quarterly government spending. At the same time, however, current revenues are sensitive to output fluctuations because the latter induce fluctuations also in the tax base.

Following Blanchard and Perotti (2002) we utilize institutional information on all major taxes in order to obtain a precise indicator of the output elasticity of tax revenues (in the above model this elasticity is denoted α_1). To this end we disaggregate net taxes and consider the impact of GDP to the different types of taxes and their tax bases. In order not to overestimate the contemporaneous elasticity of net taxes the elasticity in this model is defined as a contemporaneous relationship in the same quarter and is determined using distributed lag processes in a disaggregated approach. Since we use data from the national accounts, collection lags are not important for most taxes. Only for some assessed taxes which are basically collected in a tedious process of tax assessment a substantial lag arises, which, however, is longer than one quarter. Accordingly, the contemporaneous elasticity of assessed taxes within the German tax system is zero, even though the tax base is strongly elastic to a shock in the GDP (Bode *et al.*, 2006). Thus, we estimate direct contemporaneous effects of a GDP shock to the wage tax, the value added tax (VAT), petroleum tax, the social security contributions, other taxes, unemployment benefits and their particular tax bases under usage of distributed lag models. In addition, we consider direct effects of changes in GDP on welfare expenditures, which are treated as tax expenditures. The automatic flexibility of

Table 1: Revenue Elasticities

tax	dt/dgdp	weight	weighted elasticity
Wage tax + solidarity tax	0.797	27.34 %	21.79 %
Social contributions	0.538	72.26 %	38.88 %
Assessed taxes	0	20.28 %	0 %
Other taxes	1.000	49.47 %	49.47 %
Unemployment benefits	-1.341	-3.83 %	5.14 %
Other monetary transfers	0	-65.52 %	0 %
Net revenue		100.00 %	115.27 %

Source: own computations.

unemployment benefits influences the elasticity of the net taxes but other social expenditures like pensions are unaffected by GDP variations in the short run. Table 1 provides an overview of the point estimates of tax elasticities. Based on the detailed revenue elasticities and using the above weights we obtain a short-run elasticity of net taxes to GDP of 1.1527.

5 Basic Estimates and Impulse-Response Functions

The reduced form VAR is estimated using quarterly data for the years 1960 - 2008. The variables are expressed in per-capita terms and deflated with the GDP price index. The estimation employs quarterly dummies to capture seasonal effects. In addition the model employs a deterministic quadratic trend to each of the series. The basic model employs four lags but in order to check the robustness we have also estimated the model using eight lags. Since the data from 1991 to 2008 include eastern Germany, we allow for different levels, seasonal effects, and time trends before and after the German reunification.

With respect to the estimated contemporaneous elasticities the structural form is estimated by augmenting the model with an indicator of tax revenue shocks as suggested in Section 2. This estimation, however, relies on the time period from 1966, since the revenue estimates of tax law changes are not observed before 1967. The estimation yields a strong and significant effect of tax reforms on tax revenues and the effect of tax changes on output is strictly negative. Consistent with our identification approach we also find that the tax revenue changes do not

Table 2: Short-Run Elasticities

Coefficient	Elasticity
α_1	-1.1527
γ_1	0.2891
γ_2	-0.4169

Source: own estimates.

possess any predictive value for the forecast errors of government spending. Following the procedure outlined above, we obtain a point estimate of the output elasticity of revenues (γ_1) of 0.2891.

Given the above assumptions, the remaining parameter γ_2 is directly estimated using the transformed forecast errors from the reduced-form VAR model.¹ The point estimate for the elasticity of GDP to a shock in government expenditures in the same quarter is -0.4169 .

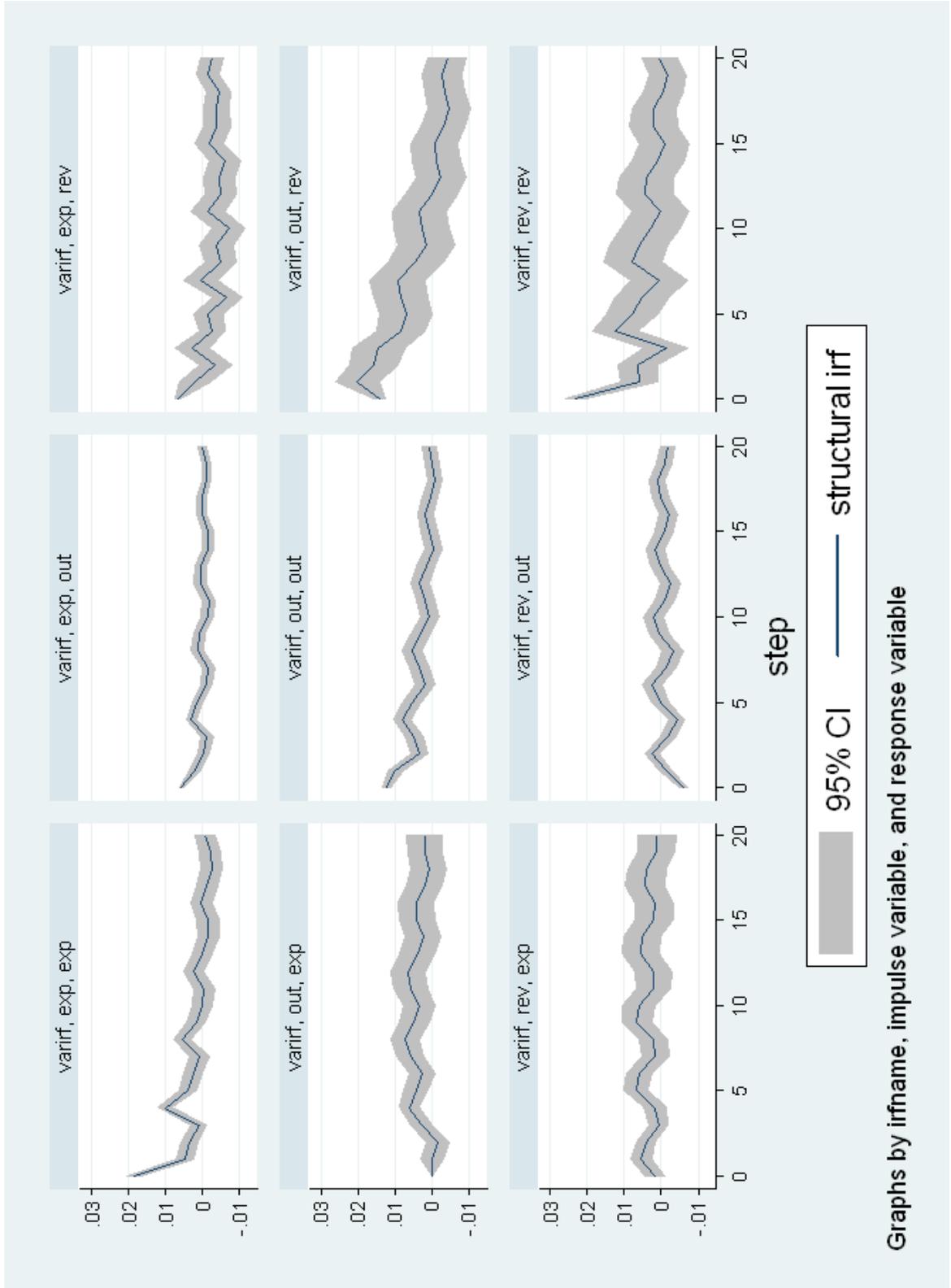
The contemporaneous elasticities as provided in Table 2 show a strong response of taxes to shocks in taxes. Furthermore, the response of production to an exogenous tax shock is negative. The covariance of the forecast errors provides us with further degrees of freedom which enable us to take account of a possible dependence between revenue and expenditure policies. More specifically, as in Blanchard and Perotti (2002) we are able to take account of spend and tax (α_2) or, alternatively, tax and spend sequences (β_2). However, the estimated coefficients are rather small and the choice between these alternatives has no important effect on the results.

The short-run elasticities indicate that additional government expenditures exert positive output effects, while increases in net taxes exert a negative effect on production. However, the elasticities are much smaller as compared to studies for the US (Blanchard/Perotti, 2002 and Romer/Romer, 2007). This may reflect the openness of the German economy which implies that an important part of demand is from abroad and also domestic fiscal policies may lead to substantial spill-overs on other countries output.

The impulse-response-functions (IRFs) depict the dynamic effects of fiscal shocks. We provide

¹This transformation utilizes the parameter estimate for the output elasticity of revenues γ_1 , see page 6.

Figure 4: Impulse-Response Functions, 1960-2008



Graphs by irfname, impulse variable, and response variable

the detailed IRFs in Figure 4. While the effect of government expenditure shocks decreases, the accumulated effect of a shock to taxes remains almost constant after some time. The results show that GDP responds positively to a one-unit increase in government spending and negatively to a one-unit tax reduction. Expressed in currency-units, the short-run multiplier of government spending is 1.5 while the short run multiplier of a tax reduction is close to one. After a period of 20 quarters both, the effect of government spending as well as the effect of taxes falls to the amount of 0.5.

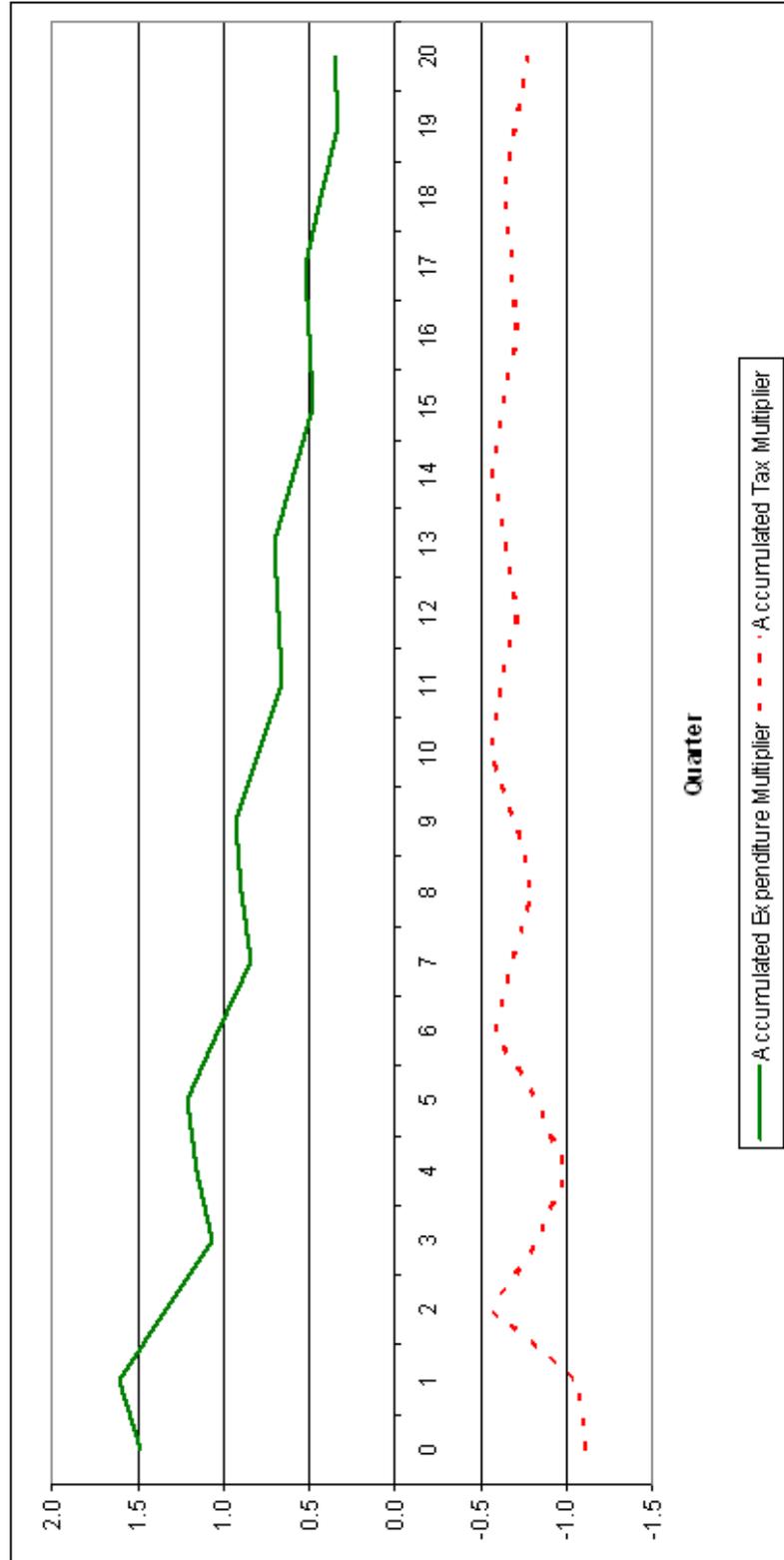
Compared to other estimations for Germany, the short-run, as well as the dynamic responses of GDP to both fiscal shocks are large. Other estimations obtain a spending-multiplier between 0.4 and 0.6 for Germany (Perotti, 2005 or Heppke-Falk, 2006). The tax multiplier in estimations for Germany is mostly regarded as low or even positive (Perotti, 2005 or EEAG report 2010). However, none of these studies has employed our measure of revenue changes associated with tax reforms, which is, as we believe crucial, for identifying tax policy effects. In addition, previous studies employing the Blanchard and Perotti (2002) methodology often rely on simulated rather than estimated revenue elasticities and utilize annual data (for a detailed analysis of revenue elasticities see Buettner *et al.*, 2006).

Figure 5 reports the accumulated effect on GDP. While the effect of government expenditure shock decreases, the accumulated effect of a shock to taxes remains almost constant after some time. The results show that GDP responds positively to a one-unit increase in government spending and negatively to a one-unit tax reduction. Expressed in currency-units, the short-run multiplier of government spending is 1.5 while the short run multiplier of a tax reduction is close to one. After a period of 20 quarters both, the effect of government spending as well as the effect of a tax falls to the amount of 0.5.

6 Robustness

Since we rely on different data sources before and after 1970, since existing literature employs data starting in 1970 (Perotti, 2004, and Heppke-Falk *et al.*, 2006) and since a residual plot shows some potential outliers in the period before 1971 we conduct a separate analysis for

Figure 5: Accumulated Response of GDP to an Initial One-unit-shock



the period 1970-2008.

In this sub-sample the effect of tax changes on GDP decreases visibly, compared to the estimation in the base scenario, to 0.123. The coefficient for the elasticity of GDP to expenditures increases slightly (0.442). The coefficient for the effect of tax changes to government expenditures remains at zero and shows no significance at all.

The resulting IRFs are provided in the appendix (see Figure 11). We see that the effect of a tax shock to GDP is lower than in the previous sample. The tax-multiplier decreases to roughly 0.4 and its time pattern is more flat. However, the effect of a shock to government expenditures are slightly stronger compared to the base scenario in the short run as well as in the medium term. As above, the results are almost identical if we replace the assumption of tax and spend sequences (β_2) with an assumption of spend and tax (α_2) sequences.

We run another robustness test with respect to the lag length of the VAR-regression. While most of the comparable studies consider 4 lags (Blanchard/Perotti, 2002, Kamps/Kaldara, 2006 and Hoepfner 2001), the lag order criteria for our VAR indicate an optimal lag length of more than 4 lags, especially with respect to the information criteria. If we take into account 8 lags in order to consider the information of the pre-previous year, however, our results remain almost unchanged, compared to the base scenario. The short-run elasticities of GDP will increase to 0.361 with respect to the tax shock, respectively to -0.454 in response to a shock to government expenditures. The IRFs of this scenario are also provided in the appendix (see Figure 12).

Taken together, the robustness checks indicate that the results are quite robust against a higher lag order. But, the identification of the structural parameters tends to yield different results if the sample is reduced. In particular, the tax revenue shock yields weaker effects in the shorter subsample indicating that the nature of tax policy shocks is changing over time. Thus, the estimated effects of tax shocks should be interpreted with some caution.

7 German Stimulus Programmes 2009 and 2010

In the face of the recent financial and economic crisis the German federal government enacted several fiscal policy measures starting in winter 2008/2009 with the aim to stabilize the economy in the global and national downturn (see also Roos, 2009). Besides the two explicit fiscal programmes in 2008 and 2009, additional tax cuts have been enacted in the *Buergerentlastungsgesetz* and the *Wachstumsbeschleunigungsgesetz*. This section aims at an analysis of this recent programmes using the above fiscal VAR model. More specifically we use the model to predict output, revenue and expenditure effects of these stimulus programmes.

We base the simulation on the assessment of the size and timing of revenue and expenditure impulses by the German joint economic forecast group (Gemeinschaftsdiagnose, 2009). We divide the enacted measures into two parts - tax cuts and expenditure increases. The parts of the programmes that deal with social expenditures – like for instance the compensation of workers in the short-time work schemes (*Kurzarbeitergeld*) are considered as net taxes, in analogy to the definitions used in Section 3.

A problem with the analysis of the stimulus programmes is that these programmes are not just effective in one quarter but that they include a host of measures that are distributed over eight quarters. To discuss the programmes as being a sequence of eight separate shocks seems problematic, however. Not only are the programmes and their impulses in later quarters known in advance. Each quarters's revenue or expenditure impulse would also trigger certain revenue and expenditure repercussion, and, as a consequence, the later shocks would be amplified or depressed as the status-quo is changed in later quarters. We, therefore, decided to treat the expenditure and revenue patterns as fully determined by the stimulus programmes in the first eight quarters, *i.e.* until 2010.

Table 3 depicts the size and time pattern of the stimulus programmes revenue and expenditure impulses. Relative to the revenues in 2008, the programmes entail tax cuts of about 0.9% and 1.5% of GDP in 2009 and 2010. Spending measures relative to 2008 are about 0.4 and 0.5% of GDP in the years 2009 and 2010.²

²Net taxes measures include the effects of tax arrangements in the two fiscal packages, the effect of the

Table 3: Fiscal policy measures in % of GDP in 2009 and 2010

quarter	net revenues	expenditures	gross fiscal stimulus
2009Q1	-1.20%	0.03 %	1.23%
2009Q2	-0.74%	0.22 %	0.96%
2009Q3	-0.90%	0.78 %	1.68%
2009Q4	-0.90%	0.55 %	1.44%
2010Q1	-1.51%	0.37 %	1.88%
2010Q2	-1.51%	0.63 %	2.13%
2010Q3	-1.44%	0.60 %	2.05%
2010Q4	-1.44%	0.52 %	1.96%

The accumulated responses to the shocks on additional government spending measures are presented in Figure 6. The simulation is based on the assumption that government expenditures are predetermined in the first eight quarters, *i.e.* during the stimulus programmes. However, revenues and GDP are allowed to respond. Accordingly, after the initial period where spending is predetermined by the stimulus programmes, the effect on GDP decreases strongly and reaches the zero line. After 2012, the stimulus is gone.

Figure 7 shows the accumulated responses to the tax shocks. This simulation is now based on the assumption that government revenues are predetermined in the first eight quarters, *i.e.* during the stimulus programmes, but expenditures are allowed to respond. Accordingly, the effects of a tax shock on GDP will be less strong, but the effect on government expenditures will be significantly negative. Given the importance of state and local government finance in federal Germany, this could well reflect the subnational governments' strive for fiscal balance.

The effect of both shocks simultaneously is depicted in Figure 8 which shows the responses to the shocks in government expenditures and taxes. In this simulation both expenditures and revenues are combined as a sum of the responses to the stimulus programmes as they are shown in figure 6 and 7. The induced net effect of the fiscal measures on public deficits is

extension of the "short time work scheme", further children bonuses, the decrease of contributions to the public health insurance, the extension of the commuter lump-sum deduction, the consideration of contributions for health insurance for income tax purposes, the enhancement of active labor policy, the additional children bonuses in the year 2010 as well as the reduced VAT rate for hotel- and catering services and other measures with respect to the tax and social insurance system. Expenditures include first of all the infrastructure investments programmes of both fiscal packages as well as the car-scrap scheme.

Figure 6: Response to the Expenditure Measures

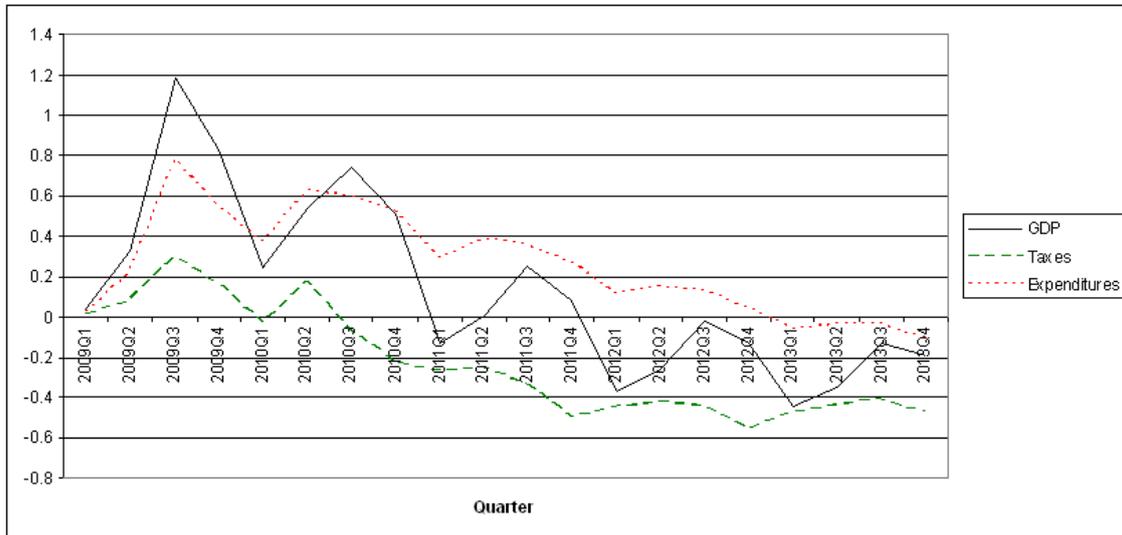
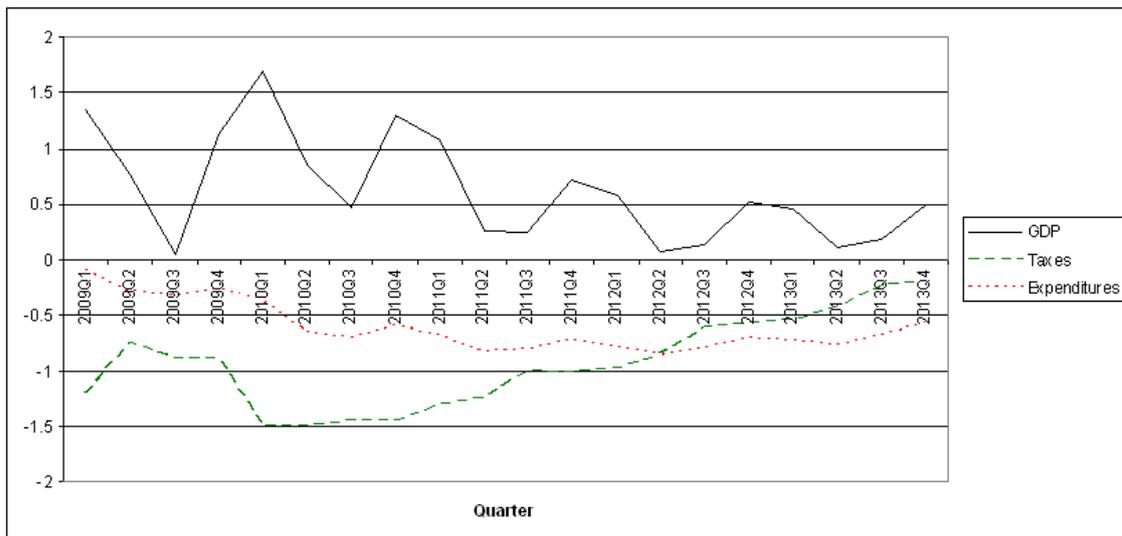


Figure 7: Response to the Tax Measures



about 1.5% in the year 2010. After an expansionary period of five years the primary balance is restored since expenditures match revenues. In this year the effect of the measures on GDP will be zero as well. Both, net taxes as well as government expenditures will decrease by about 0.6% of GDP. However, this process implies that the government starts the process of consolidation in 2011 and reduce expenditures while increasing taxes significantly.

Figures 9 and 10 depict the implications for the primary balance and the level of public debt in Germany. Accordingly, at the end of the stimulus programme, the primary balance has deteriorated by about 1.6 percentage of GDP, before being restored in 2013. Nevertheless, total government public debt is increasing. Ignoring interest rate effects the total stock of government debt increases by 2.5 percentage points in 2011. After all adjustments, the new level of public debt is increased by about 4 percentage points.

8 Summary

This study examines the macroeconomic impact of fiscal policy in Germany using a structural VAR-Model. Following Banhard and Perotti (2002), the identification of expenditure shocks is based on the institutionally determined short-term revenue elasticities and on the assumption that quarterly government expenditures are predetermined by annual budgets. In order to identify revenue shocks, we utilize estimates about revenue effects of tax law changes.

Our analysis show significant effects of expansionary fiscal policies on output in the short term. The result points at a multiplier for government expenditures of 1.5 and below 1 for tax cuts. However, these effects quickly peter out and after four to five years GDP is back at initial levels. As a consequence, expansionary fiscal policies contribute to an increase in government debt.

Applied to the recent fiscal expansion that took place in the wake of the global financial crisis the model suggests considerable effects on GDP for the years 2009 and 2010. However, the model predicts that following the stimulus programme, governments will tend to restore primary balance. As a consequence, the level of government debt will reach a new steady-state

Figure 8: Sum of Responses to the Tax and Expenditure Measures

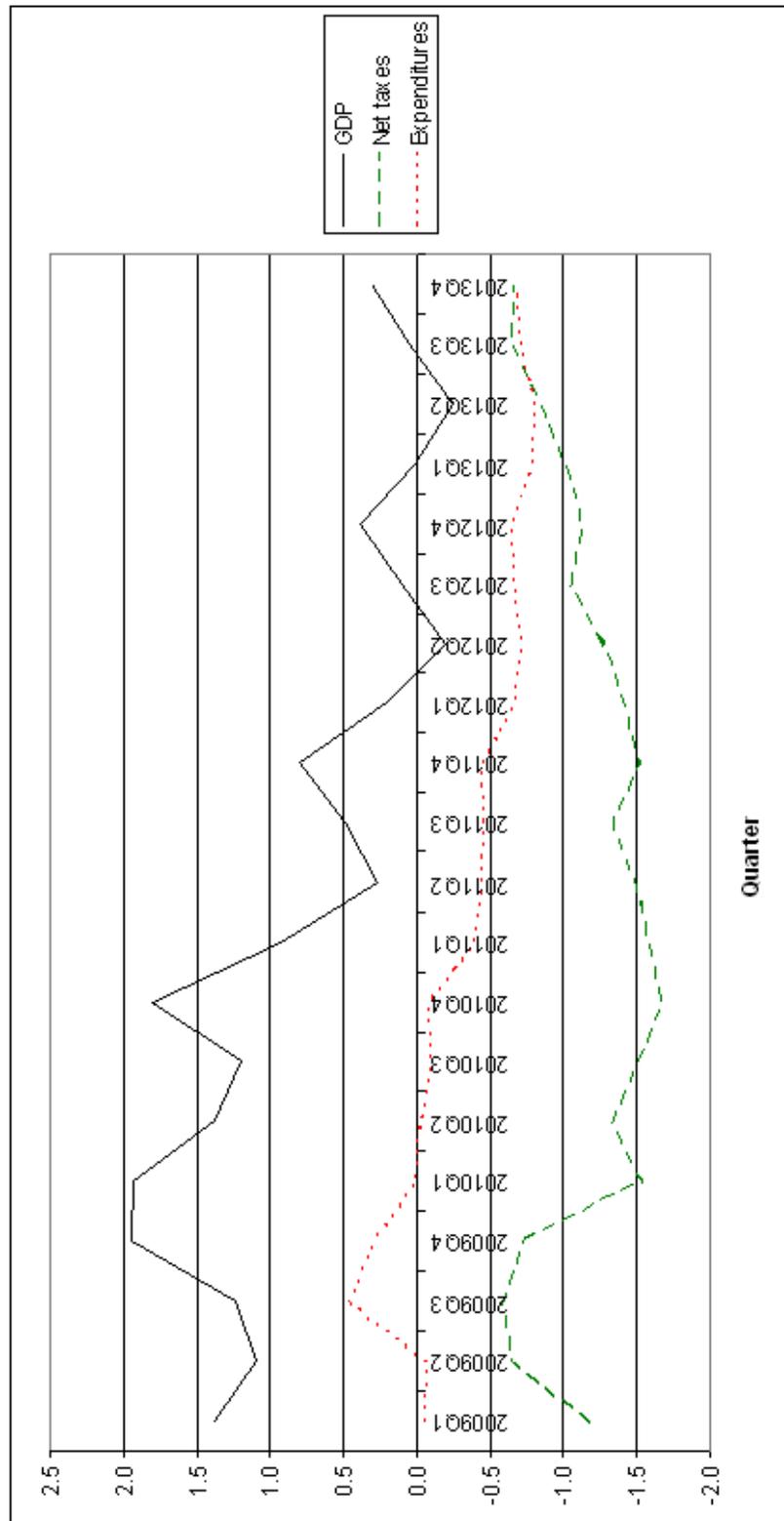


Figure 9: Effect of Fiscal Policy on Primary Balance

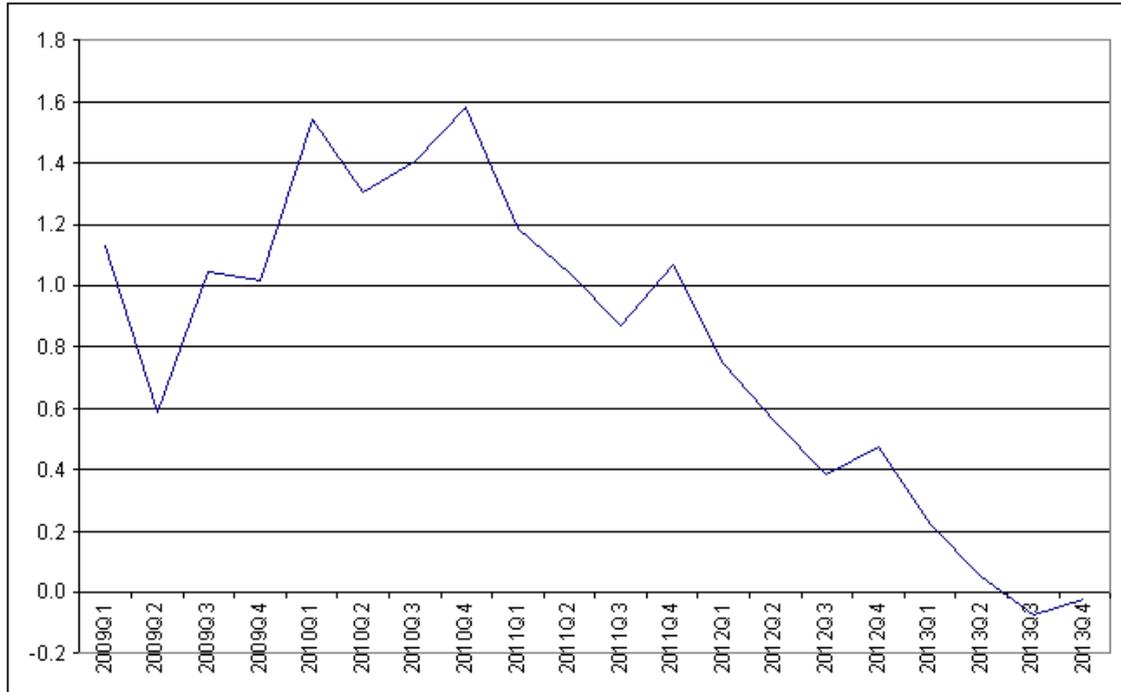
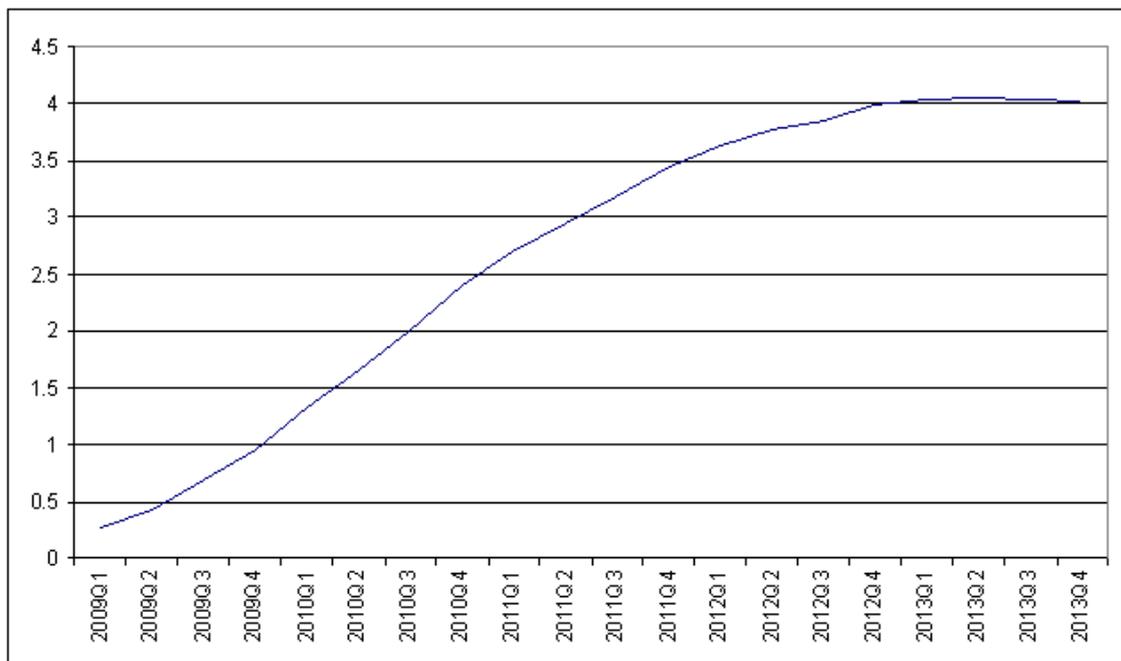


Figure 10: Effect of Fiscal Policy on Stock of Government Debt

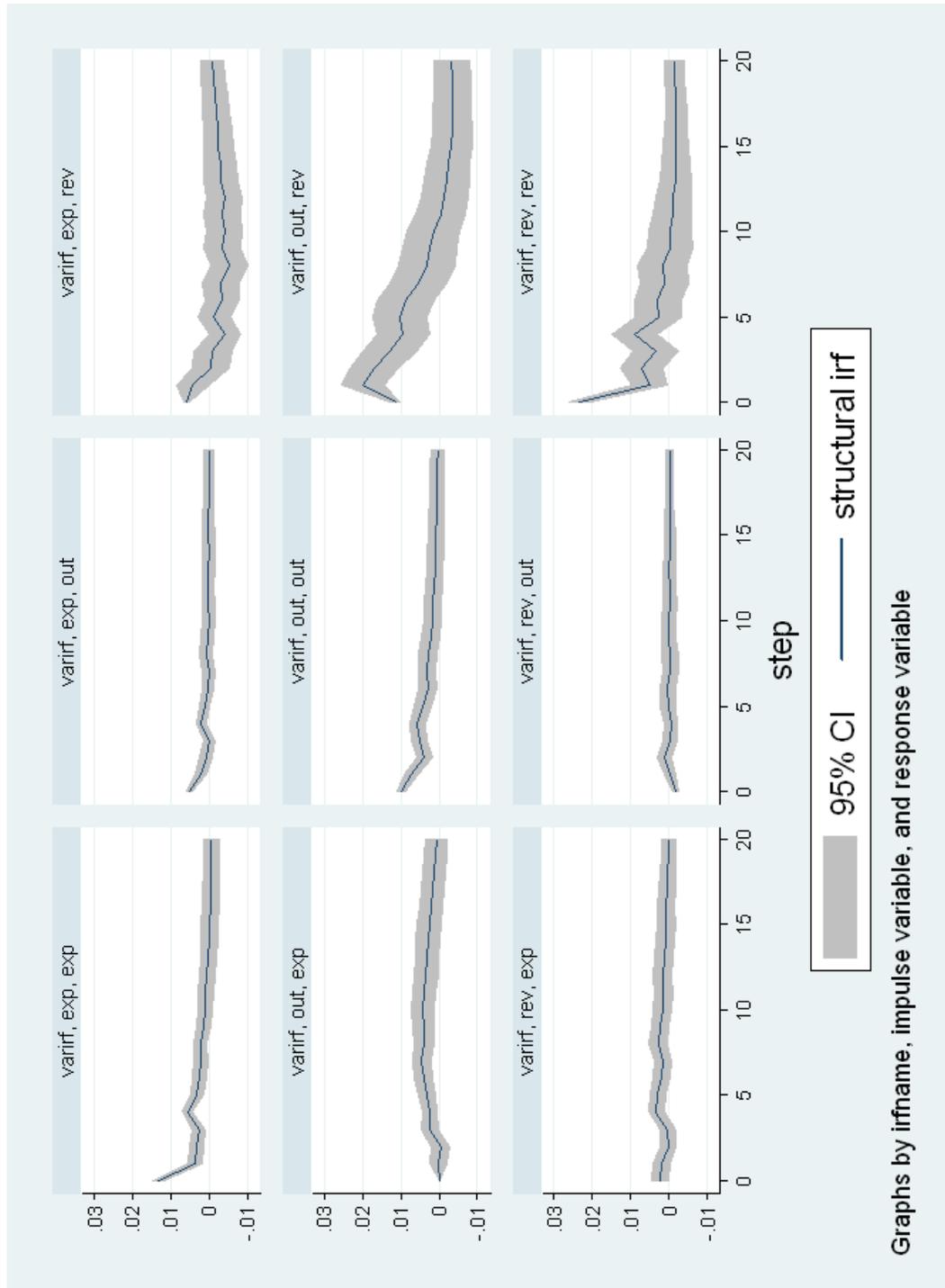


level of about 4 percentage points in terms of GDP above the initial level.

Regarding the effect of tax shocks to GDP the results are sensitive to the definition of the sample indicating that the macroeconomic effects of tax policies differ across time. However, the effect of expenditure shocks to GDP prove rather robust.

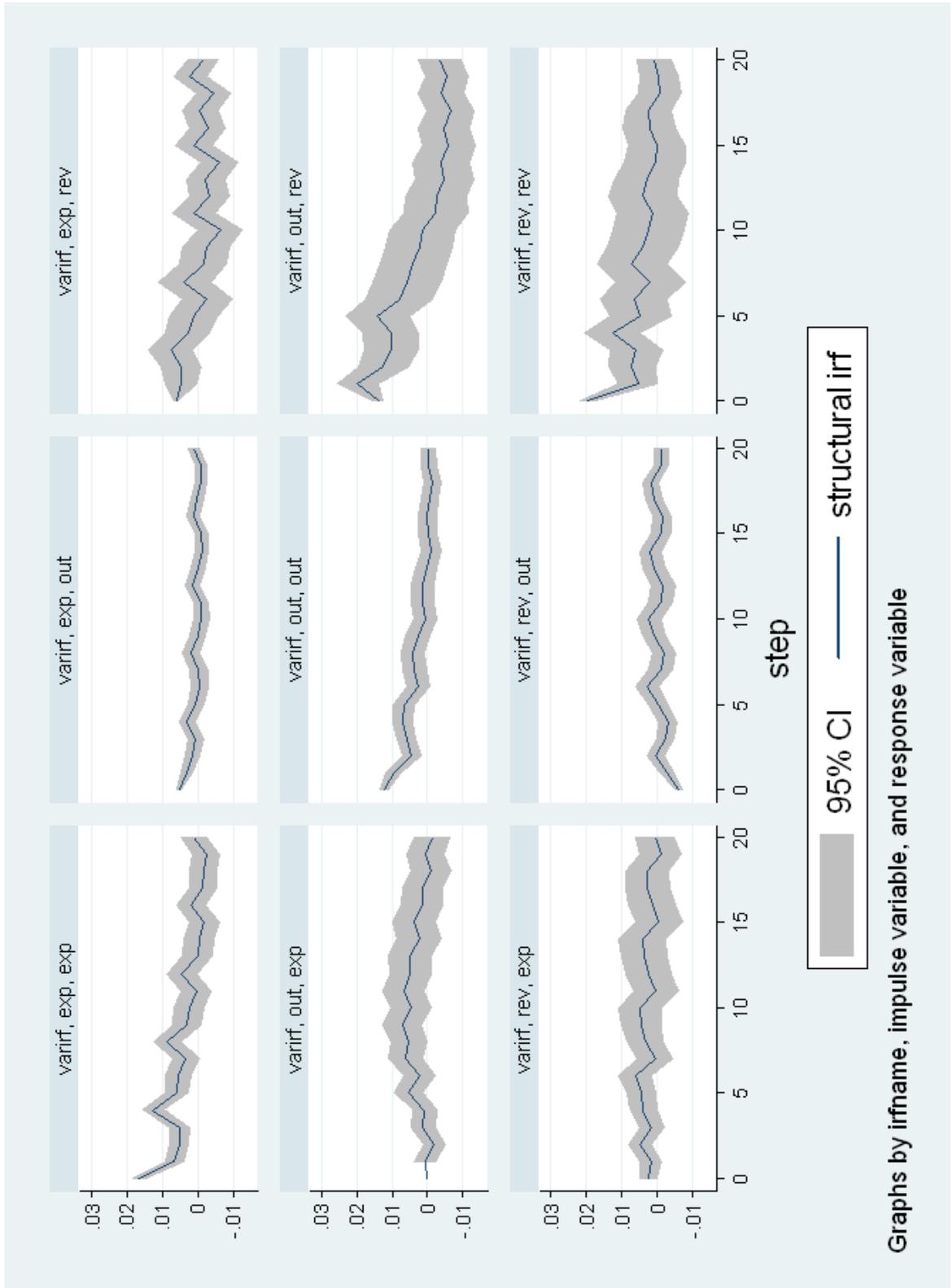
Our results point at smaller macroeconomic effects of fiscal policies as compared to the case of the US (Blanchard/Perotti,2002 and Romer/Bernstein, 2009). This is consistent with the view that fiscal policies in Germany as a highly open economy are less effective. However, relying on simpler approaches to identify the structural impulse response functions, existing studies for Germany tend to be more pessimistic than ours (Perotti, 2005 and Heppke-Falk et al, 2006).

Figure 11: Impulse-response Functions, 1970-2008, 4 lags



Graphs by irframe, impulse variable, and response variable

Figure 12: Impulse-response Functions, 1960-2008, 8 lags



Graphs by irfname, impulse variable, and response variable

References

- Blanchard, O., Perotti (2002), "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output", *Quarterly Journal of Economics*, Vol 117, no. 4 (Nov., 2002), pp. 1329-1368).
- Bode, O., Gerke, R., Schellhorn, H. (2006), "Die Wirkung fiskalpolitischer Schocks auf das Bruttoinlandsprodukt", SVR Arbeitspapier 01/2006.
- Buettner, T., Dehne, A., Flaig, G., Huelsewig, O., Winker, P. (2006), "Berechnung der BIP-Elastizitaeten oeffentlicher Ausgaben und Einnahmen zu Prognosezwecken und Diskussion ihrer Volatilitaet", ifo Forschungsberichte 28.
- Carstensen, K., Nierhaus, W., Huelsewig, O., Abberger, K., Buchen, T., Breuer, C., Elstner, S., Hristov, N., Kleemann, M., Mayr, J., Meister, W., Paula, G., Stangl, A., Wohlrabe, K., Wollmershauser, T. (2009), "ifo Konjunkturprognose 2010: Deutsche Wirtschaft ohne Dynamik", ifo Schnelldienst 24/2009, 17-64.
- Dungey, M., Fry, R. (2009), "The identification of fiscal and monetary policy in a structural VAR", *Economic Modelling* 26 (2009), 1147 - 1160.
- Edelberg, W., Eichenbaum, M., Fisher, J. (1998), "Understanding the Effects of a Shock to Government Purchases", *Review of Economic Dynamics*, Vol. 2, Issue 1 (1999), 166-206.
- EEAG Report (2010).
- Gemeinschaftsdiagnose (2009), "Zoegerliche Belebung - steigende Staatsschulden", Projektgruppe Gemeinschaftsdiagnose, 13. Oktober 2009.
- Hepke-Falk, K. H., Tenhofen, J., Wolff, G. B. (2006), "The macroeconomic effect of exogenous fiscal policy shocks in Germany: a disaggregated SVAR analysis, Deutsche Bundesbank Discussion Paper No 41/2006.
- Hoepfner, F. (2001), "A VAR Analysis of the Effects of Fiscal Policy in Germany", University of Bonn, November 2001.

- Kamps, C., Caldara, D. (2006), "What do we know about Fiscal Policy Shocks Effects? A Comparative Analysis",
- Perotti, R. (2004), "Estimating the effect of fiscal policy in OECD countries", IGIER working paper n. 276.
- Romer, C. and Bernstein, J. (2009), "The job impact of the american recovery and reinvestment plan".
- Romer, C. and Romer, D. H. (2007), "The macroeconomic effects of tax changes: Estimates Based on a new measure of fiscal shocks", University of California, Berkeley.
- Roos, M. W. M. (2007), "Die makroökonomischen Wirkungen diskretionärer Fiskalpolitik in Deutschland - Was wissen wir empirisch?", Perspektiven der Wirtschaftspolitik 2007 8(4): 293-308.
- Roos, M. W. M. (2009), "Die deutsche Fiskalpolitik während der Wirtschaftskrise 2008/2009", Perspektiven der Wirtschaftspolitik 2009 10(4): 389-412.
- Sinn, H.-W. (2009), "Kasino Kapitalismus - Wie es zur Finanzkrise kam, und was jetzt zu tun ist", Econ Verlag.