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The Effects of Legislated Tax Changes in Germany*

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Abstract This paper studies the short run macroeconomic effects of legislated tax changes in Germany using a vector autoregression (VAR) approach. The identification of the tax shock follows the narrative approach recently proposed by Romer and Romer (2010). Results indicate a moderate, but statistically significant reduction in output as well as a strong offsetting monetary policy reaction following the announcement of the tax policy shock. In response to a one percent increase in the tax to GDP ratio, the peak output reduction is 0.67%. Distinguishing between anticipation and implementation effects suggests that tax changes affect GDP prior to actual implementation, while effects around implementation are insignificant. Our results ascribe this to an offsetting monetary policy reaction prior to actual implementation. This offers an explanation for the apparent failure of traditional VAR studies to reach coherent conclusions on tax policy effects in Germany. Moreover, these studies typically ignore anticipation effects and monetary policy reactions and hence give a misleading account of the transmission of tax policy shocks.

Keywords Legislated Tax Change · Narrative Approach · Fiscal Policy · Tax Policy

JEL Classification E62 · H30 · K34

1 Introduction

In the recent decade, macroeconomic effects of fiscal policy have obtained increasing attention in the economic literature. A very influential modeling strategy is the structural vector autoregression (SVAR) approach pioneered by Blanchard and Perotti (2002). The key idea is to model the relationship amongst reduced form and structural innovations by applying institutional information. This allows studying the short run macroeconomic consequences of structural policy shocks. Using quarterly US data from 1960 to 1997 the authors find the standard result: an increase in government expenditures has a statistically significant positive effect on output, whereas an increase in taxes has a significant negative effect. Somewhat different in spirit are the event study and narrative approach by Ramey and Shapiro (1998) and Ramey (2011) respectively Romer and Romer (2010). Here, structural policy shocks are not identified from the reduced form errors, but rather by applying narrative information from outside the econometric model. Romer and Romer (2010) identify discretionary tax policy shocks based on an account of US postwar tax changes. They collect all important US tax legislations in the period 1945 to 2007 and use official government sources to classify these as either exogenous or endogenous with regard to current fluctuations in output. Revenue forecasts are used to measure the size of the shocks. This identification strategy delivers a series of exogenous tax shocks, which can be included as regressors in econometric models. Using an autoregressive distributed lag model of output growth with their tax shock series as independent variable, Romer and Romer (2010) find significant impacts of tax changes of considerable magnitude - an exogenous tax increase worth one percent of GDP lowers GDP by nearly three percent in the medium term. However, using the Romer and Romer (2010) exogenous tax shock series in a VAR framework, Favero and Giavazzi (2009) find much smaller effects of tax changes. Ramey and Shapiro (1998) and Ramey (2011) identify exogenous increases in defense spending to deduce the effects of fiscal policy on the expenditure side.

Although studies using the aforementioned approaches show remarkable differences with regard to the effects of fiscal policy shocks on consumption, wages *et cetera* (see, e.g., Fontana (2009) for a discussion), they overwhelmingly share the story that governments can boost the economy by either increasing spending or lowering taxes. However, *a priori*, results derived from US data need not carry over to other countries. Examples for applications of the Blanchard and Perotti (2002) SVAR modeling approach to countries outside the US are Perotti (2004), Marcellino (2006) and Afonso and Sousa (2009). These studies focus on multiple countries and hence allow cross country comparisons. The general picture drawn from such efforts suggests remarkable differences in the effects of fiscal policy across countries. Hence, fiscal policy transmission mechanisms might be country specific.

With regard to Germany, there are quite a few studies using the SVAR modeling approach. Perotti (2004), Marcellino (2006) and Afonso and Sousa (2009) study Germany alongside other countries. This research does not provide convincing evidence for the effectiveness of fiscal policy and in some specifications, Perotti (2004) and Afonso and Sousa (2009) report tax multipliers having the wrong sign. Heppke-Falk et. al. (2006) find statistically insignificant effects of shocks to aggregate taxes. Similarly, Baum and Koester (2011), using a threshold VAR approach, conclude that revenue policies "have a generally […] limited impact". Höppner (2001) as well as Bode et. al. (2009) find tax multipliers significantly different from zero, albeit those are smaller than one in absolute terms. Up to now, and to the best of the authors' knowledge, Breuer and Buettner (2010) offer the only application of the Romer and Romer (2010) narrative approach to Germany. They find a short run multiplier for tax changes of close to one in absolute terms. Taken together, the literature has not yet reached a consensus on sign or statistical significance of tax policy effects in Germany.

This paper adds to the literature an analysis of the effects of legislated tax changes in Germany using the narrative approach following Romer and Romer (2010). We identify all important tax changes in Germany between 1974:1 and 2010:2 based on various issues of the *Finanzbericht*, an annual publication of the Federal Ministry of Finance. Only exogenous tax shocks are used to derive the short run macroeconomic impacts of legislated tax changes in a five variable VAR containing output, government spending and revenue, inflation and a short term interest rate. The chosen model is close to Favero and Giavazzi (2009). However, in contrast, we time the tax shock at the quarter of announcement rather than implementation and include lagged values of the tax shock variable. This allows tax shocks to have effects before and after actual implementation, respectively. We label the first class of effects anticipation, the second implementation effects. This approach has the advantage of accounting for effects working through expectations on future fiscal stances. Especially, it allows for an endogenous monetary policy reaction before implementation. In an extended model, we explicitly disentangle anticipation and implementation effects by taking an approach similar to one chosen by Mertens and Ravn (2011) for the US. The basic idea is to include anticipated future tax shocks as exogenous variables in the VAR.

Breuer and Buettner (2010) also apply the Romer and Romer (2010) strategy to identify German tax policy shocks. However, the methodological approach taken by these authors is considerably different to the one taken here. First, we control for inflation and short term interest rates. As the results will show, controlling for the monetary policy side of the economy is crucial. Also, rather than studying the dynamic effects of tax changes by shocking the exogenous tax shocks series directly, Breuer and Buettner (2010) use the estimated coefficients on the tax shock variable to identify a structural system of equations modeling the relationships among the residuals. While this allows studying the effects of changes in government spending, it is unnecessary as long as one wants to estimate the effects of tax changes only. And, as soon as the prior theoretical assumptions used to identify the system are wrong, this procedure could give misleading results. Finally, Breuer and Buettner (2010) do not discuss the timing of their tax shocks in detail. The approach taken here has the advantage of allowing for and differentiating between both anticipation and implementation effects.

Our results indicate a statistically significant, albeit quantitatively small reduction in output following the announcement of a tax change. In response to a one percent increase in the tax to GDP ratio, the peak output reduction is 0.67%. The output effect becomes statistically insignificant in the fourth quarter after announcement and then quickly turns towards zero. Impulse response functions further suggest an offsetting monetary policy reaction. Monetary conditions as measured by a short term interest rate significantly loosen after the tax increase, hence compensating the fiscal impulse. Distinguishing anticipation and implementation effects, we find evidence only for the former. Tax shocks show a significant impact on GDP in the time following announcement of the law change, but are insignificant at the quarter of implementation. This might be explained by an offsetting monetary policy reaction before actual implementation. Taken together, our results offer only weak evidence in support of important output effects of legislated tax changes. Effects are much smaller than derived for the US and quickly become insignificant. An offsetting monetary policy reaction could be the leading explanatory factor behind this finding.

Our results offer valuable contributions to the current level of knowledge on the fiscal policy transmission mechanism in Germany. We allow for monetary policy effects and both anticipation and implementation effects. Indeed, doing so offers an explanation for the mixed and generally

inconclusive picture drawn by the Germany based VAR literature on fiscal policy effects. Traditional SVAR analysis is based on innovations in the VAR, and hence, is concerned with fiscal policy shocks around their implementation. An offsetting monetary policy reaction at that time offers a potential explanation for the apparent failure of these studies to reach coherent conclusions. Methodologically, ignoring anticipation effects and choosing concise specifications without a monetary side might be inappropriate to model Germany's fiscal policy transmission mechanism.

The plan of this paper is the following. Section 2 discusses methodology and data. Results are shown in section 3. Section 4 addresses the robustness of the results, while section 5 concludes. Supplementary tables and figures can be found in the appendix.

2 Methodology and Data

2.1 Benchmark Model Specification

In order to study the effects of legislated tax changes in Germany, we employ VAR modeling as pioneered by Sims (1980). In the benchmark case, we estimate the five variable VAR in Eq. 1.

$$\text{Eq. 1} \quad \mathbf{y}_t = \mathbf{c}_t + \sum_{i=1}^{k} \delta_i \mathbf{y}_{t-i} + \sum_{i=0}^{m} \beta_i \mathbf{x}_{t-i} + \mathbf{u}_t$$

$\mathbf{y}_t$ is a 5x1 vector of endogenous variables containing log real GDP, government expenditures and revenues as percentage of GDP, the rate of inflation as well as a short term interest rate. For details on variable definitions and data sources see table 2 in the appendix. Figure 4 in the appendix provides time series plots of each individual series. $\mathbf{c}_t$ is a vector of exogenous variables, containing a constant, a dummy for reunified Germany and a dummy for participation in European Monetary Union (EMU). $\mathbf{x}_{t-i}$, i = 0,…,m are current and lagged values of our exogenous tax shock series based on the narrative approach by Romer and Romer (2010). In the benchmark model, we time the tax shock at the quarter of announcement.

Impulse response functions are computed by shocking the exogenous tax shock variable in Eq. 1. The size of the shock is set to one percent of GDP. Error bands are constructed by a parametric bootstrap procedure. To be precise, they are constructed by drawing 10000 repetitions from a multivariate normal distribution with expected value equal to the estimated parameter vector of the VAR and covariance matrix equal to the estimated covariance matrix of the parameter vector. The error bands show one standard error deviations of the resulting impulse responses. Similar error bands are used in Romer and Romer (2010), Favero and Giavazzi (2009) or Mertens and Ravn (2011).

The lag length on the endogenous variable has been set to four, which is the quasi standard in the related VAR literature. Four lags are used in Blanchard and Perotti (2002), Perotti (2004), Höppner (2010) and others. The constant and the dummies do not enter in lagged terms, while we include eight lags of the tax shock variable. In the benchmark case, we study the effects of legislated tax changes dating the tax shock at the quarter of announcement. The average lag between announcement and implementation is two quarters. Hence, by including eight lags, we typically cover both anticipation and implementation effects. The sample period considered is 1974:1 to 2010:2. At the time of constructing the dataset, 2010:2 was the last quarter for which tax changes were covered in our sources. The choice of the first date is motivated by Perotti (2004), who identifies a structural break around 1974. Heppke-Falk et al. (2006) and Baum and Koester (2011) also use a similar sample.

Table 1 Outcome of KPSS Unit Root Tests

Variable	LM-Statistic Level	LM-Statistic First Difference
Output	1.41**	0.19
Government Expenditures	1.12**	0.04
Taxes	0.94**	0.03
Rate of Interest	0.68*	0.05
Rate of Inflation	1.09**	0.05

Kwiatkowski-Phillips-Schmidt-Shin test for null hypothesis: variable is stationary. With constant, */** significant at 1%/5%.

We investigate on the order of integration of the involved time series by applying the Kwiatkowski et. al. (1992) unit root test. Table 1 shows the resulting LM statistics. Based on the KPSS test all variables are I(1). It is common to estimate the VAR in levels in this situation, see e.g. Bank (2011) or Höppner (2001).

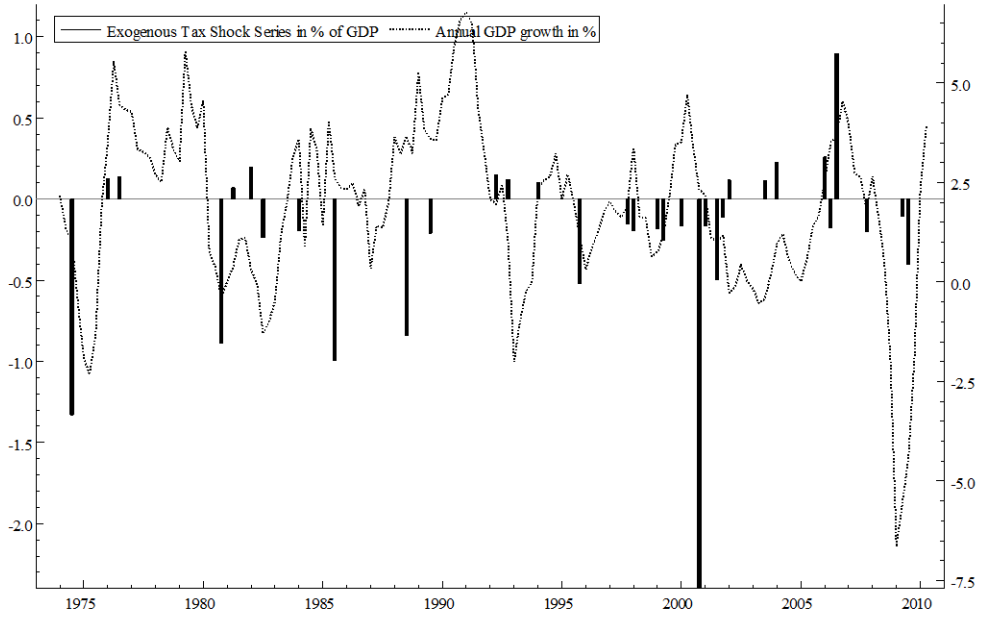
2.2 An Exogenous Tax Shock Series for Germany

The tax shock series proposed in this paper is based on a total of 51 important legislated tax changes and spans the time horizon from 1974 to 2010. The size of the tax change is measured by the prospected revenue effect within the first twelve months of the law change. All tax shocks are expressed in percent of GDP. Revenue forecasts and identification of important tax laws are based on the *Finanzbericht*, an annual publication of the Federal Ministry of Finance. Out of all laws mentioned in this publication, tax laws with a prospected impact on tax liabilities larger than 0.10% of GDP are chosen. The core idea of the methodological approach developed by Romer and Romer (2010) is that the motivation behind any such measure can be inferred from official government sources, which allows classifying a tax change as either exogenous or endogenous. This procedure delivers an exogenous tax shock series orthogonal to current innovations in $\mathbf{u}_t$. Impulse response functions derived from the exogenous tax shock series then give consistent estimates of their short run macroeconomic effects. Table 3 in the Appendix gives details on the characterization of all identified important tax measures. In total, our tax shock series is based on 35 exogenous tax legislations.

The motivation behind tax measures is inferred from official government sources. By rules of parliamentary procedure, motivation and intention needs to be explained in the draft of any bill. In case a bill changes throughout the legislative procedure, the report of the leading parliamentary committee, which usually is the *Finanzausschuss*, contains an explanation of the motivation behind this change. Furthermore, protocols from parliamentary discussion in *Bundestag* and *Bundesrat* are informative. The *Finanzbericht* contains explanation and sometimes classifications of motivation behind law changes. Building on the work of Romer and Romer (2010), tax changes can be assigned to one of the following categories.

Tax policies might be taken for **countercyclical** reasons. Here, the tax change is designed to offset current or past shocks to GDP growth. These policy measures are clearly endogenous. Tax changes might occur to finance an increase in **government spending**. The increase in government spending might be treated as a structural innovation in the spending equation. Similarly, tax policies sometimes react to important policy events such as unification, the completion of the European common market or the introduction of the euro. Here, the effect of the **policy event** and the tax

Figure 1 Exogenous Tax Changes and the Business Cycle



Left scale show exogenous tax shock series in % of GDP, right scale annual GDP growth in %. Exogenous tax shock are timed at the quarter of announcement. Growth rates are based on former FRG till 1991:4, and on unified Germany thereafter.

change cannot credibly be disentangled; as a consequence, this class of tax changes is treated as endogenous. The latter class of tax shocks is not considered in Romer and Romer (2010), but seems of considerable importance in Germany given the large aforementioned shocks.

Finally, Romer and Romer (2010) consider two classes of exogenous tax changes. First, tax changes in order to **consolidate** the budget. These laws are related only to past spending and tax decisions and hence are exogenous with regard to contemporaneous macroeconomic shocks. Second, tax changes in order to promote **long term growth**. Policy makers might lower taxes in order to promote investment or consumption with the objective of raising long term growth. Other measures in this category are undertaken to offset regional disparities or to promote equity. Moreover, tax changes are sometimes made to increase the efficiency of the tax system. In all these cases, the tax change is unrelated to contemporaneous macroeconomic shocks.

Figure 1 presents our series of exogenous tax shocks contrasted against annual real GDP growth in %. There is no systematic relationship between the two series. Both series have a correlation coefficient of 0.054, which is remarkably low. To systematically investigate on the exogeneity of our tax shock series, we test whether the tax shock series can be predicted by the residuals taken from the model in Eq. 1. First, we run a linear regression with the tax shock series as dependent and the residuals from Eq. 1 as independent variables. Secondly, we construct an ordinal series of tax shocks, taking the value -1 in case the quarter saw a tax decrease, 0 if taxes have remained unchanged and 1 if the quarter saw a tax increase. Then we test whether this series can by predicted by the residuals from Eq. 1 in an ordered logistic regression.[1] As it turns out, our exogenous tax shock serious cannot be predicted either linearly or in an ordinal framework. Results are available on request.

[1] Mertens and Ravn (2011) use a similar approach. However, rather than using residuals as independent variables, the authors test whether past values of the endogenous variables in the VAR can predict tax changes.

2.3 Distinguishing Anticipation and Implementation Effects

Dating the tax shock at the quarter of announcement as in section 2.1 allows studying the macroeconomic effects of a tax law after announcement and hence has inherent value. However, this timing mixes effects stemming from the anticipation of the tax shock as well as those deriving from actual changes in tax liabilities after implementation. To differentiate among those two effects, we run the regression in Eq. 2 which is close to the approach taken in Mertens and Ravn (2011).[2]

$$\text{Eq. 2} \quad \mathbf{y}_t = c + \sum_{i=1}^{k} \delta_i \mathbf{y}_{t-i} + \sum_{i=0}^{k} \beta_i \mathbf{x}_{t-i} + \sum_{i=1}^{k} \gamma x_{t,t+i} + \mathbf{u}_t$$

The tax shock variable $\mathbf{x}_t$ is now timed at the quarter of implementation. In contrast, $x_{t,t+i}$, i = 1,2,..4 is a tax shock known at time t to be implemented at time t+i. This variable allows measuring anticipation effects. To study the effect of an preannounced tax shock we combine the impulse responses to $\mathbf{x}_{t-i,t}$, i = 1,2,…,4 and the tax shock series $\mathbf{x}_t$ to derive the impulse response functions of a tax shock decided on in t-4 or before and implemented at time t. Up to step t, impulse response functions are solely based on the $x_{t,t+i}$ and hence measure pure announcement effects. Beginning with step t, the tax change has been implemented. We therefore label the effects seen afterwards implementation effects.

Except for the exogenous tax shock series all variables are identical to those in Eq. 1. To keep the number of parameters the same as in Eq. 1 and since the tax shock is now dated substantially later than before, we think reducing the lag length k to four is appropriate. To make results comparable, we again start estimation in 1976:1. Note however that four quarters of information are lost at the end of the sample as legislated tax shocks post 2010:2 and hence the $\mathbf{x}_{t,t+i}$ are not covered.

3 Results

3.1 The Benchmark: Effects of Legislated Tax Changes

Figure 2 shows the resulting impulse response functions for a tax increase corresponding to one percent of GDP timed at the quarter of announcement. In case of the rate of inflation, the cumulative impulse response function is shown. This represents changes in the price level, which are easier to interpret than changes in the quarter to quarter rate of inflation. Tax revenues significantly increase after the positive tax shock, with the peak effect appearing six quarters after the announcement. Then, tax revenue slowly declines. This suggests that policy makers might endogenously retract from the tax increase after roughly two years. Also note that government expenditures do not seem to react towards the tax shock in the first years after announcement. However, from figure 2, the response function of government expenditures seems to accelerate three years after announcement. And indeed, when prolonging the time horizon, government expenditures increase significantly for a total of nine quarters in the time span three to five years after announcement. The peak increase in government expenditures is 0.16% of GDP. Together with the decrease in tax revenues this suggests that tax increases have only temporary effects on the budget balance. Results are available on request.

Following the tax shock, output is statistically significantly reduced. The output effect is significant during the first, second and third quarter and peaks at -0.67% in the third quarter. The implicit

[2] Except for notational differences, the main difference is that we do not distinguish anticipated and unanticipated tax shocks. Rather, **all** tax shocks enter Eq. 2 via the x_{t-i}´s and $x_{t,t+i}$´s. This is because we are interested in differentiating anticipation from implementation effects and, hence, approach a slightly different question than Mertens and Ravn (2011).

multiplier is smaller than one and much smaller than derived for the US in Romer and Romer (2010) and Favero and Giavazinni (2009). Note that output is significantly affected prior to tax revenues. The impact on tax revenues reaches its peak effect in the sixth quarter after the tax shock, while output is affected immediately after the shock. Hence, there are important dynamics in the model before the actual peak in tax revenues occurs. This in itself could be interpreted as evidence in favor of a prevalence of anticipation over implementation effects. After the tax shock, the short term interest rate declines significantly. This indicates a softening of monetary and financial conditions, offsetting the fiscal shock. At the peak level, the short term interest rate is reduced by 0.71%. At the same time, the price level effect is relatively modest; indicating that monetary policy might have been successful in stabilizing prices.

Our results suggest that tax policy changes have only weak output effects, which are of a small magnitude and quickly become insignificant. This is broadly in line with the evidence drawn by traditional SVAR studies on tax policy effects in Germany. Given the timing of the effects, anticipation effects might matter as we observe output and interest rate effects prior to the peak in tax revenues. Of course, tax shocks are anticipated prior their actual implementation due to their coverage in cabinet, parliament and media. Especially professional agents such as the *Bundesbank* are likely to anticipate fiscal policy shocks in advance. Monetary policy might thus have changed prior to actual implementation of the tax change, and indeed, this view is broadly consistent with the timing of the effects found in our data. For further investigations on the latter point, we will disentangle pure announcement from implementation effects in the next section.

However, what is most appealing about our results is the strong interest rate reaction. In response to a tax increase of one percent of GDP, the short term interest rate is reduced as much as 0.71%. The short term interest rate has been included in order to allow for an endogenous monetary policy reaction. It is unlikely that fiscal policy has direct effects on day to day interest rates in money markets. Hence, we are confident that this change indeed measures an adjustment in the monetary policy stance. The strong interest rate reaction indicates that monetary policy has compensated for the fiscal impulse and, thereby, has depressed output effects of tax shocks. Of course, for this argument to be consistent with our econometric model of the economy, a decrease in the interest rate should improve output. A simple way to check this is deriving impulse response functions from a Cholesky decomposition with the interest rate ordered last. Results indicate that an increase in the interest rate depresses output. Hence, the offsetting interest rate reaction is capable of explaining weak output effects of tax shocks. Policy conflicts between *Bundesbank* and the federal government are occasionally discussed in the literature. Berger (1997) and Berger and de Haan (1999) provide anecdotic evidence for an offsetting reaction towards fiscal policy actions. Melitz (2000), in a cross section including Germany, concludes that fiscal and monetary policies move in opposite directions. Hence, our results are broadly consistent with views expressed in the literature.

One caveat remains. In deriving the empirical results, we were forced to use only *exogenous* tax shocks. As they are unrelated to current economic disturbances, they might very well have been regarded as such by monetary policy makers. An offsetting reaction is perfectly reasonable in this case, but might not occur in case of *endogenous* tax shocks. We hence do not read our results as indicating that fiscal policy is useless in steering the economy. Rather, our results offer a methodological critique on traditional SVAR modeling: without a monetary side, we cannot adequately describe the fiscal policy transmission mechanism in Germany.

Figure 2 Impulse Response Functions for Legislated Tax Changes

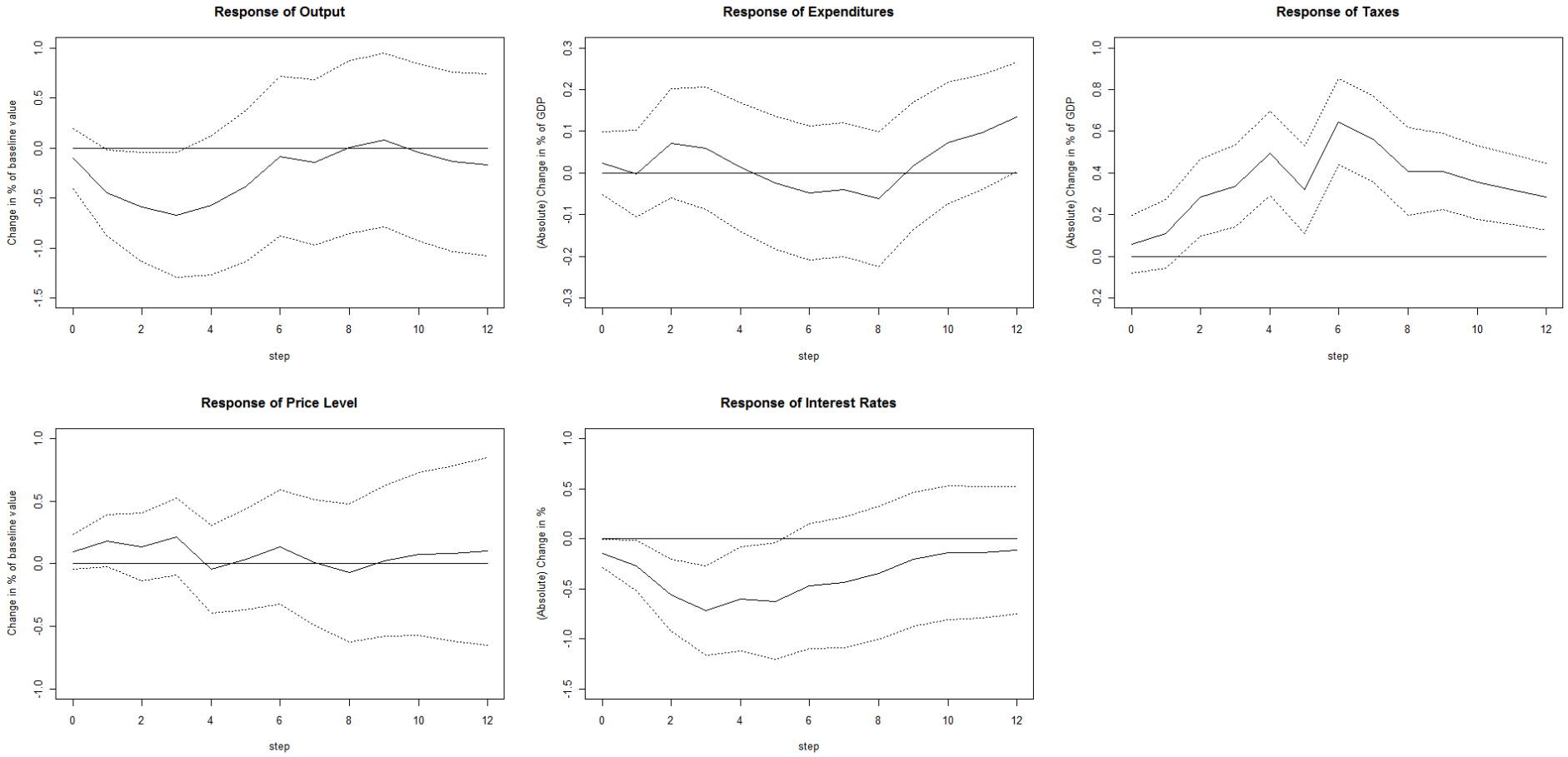


Figure shows impulse response functions for a one percent increase in the tax to GDP ratio, with the shock timed at the quarter of announcement. Error bands are one standard error deviations constructed from a parametric bootstrap.

3.2 Distinguishing Anticipation and Implementation Effects

The methodology presented in the last section does not allow distinguishing anticipation and implementation effects of tax changes. On average, the lag between the announcement of the tax change and its implementation is two quarters, while fiscal policy seems to affect output in the first, second and third quarter after announcement. This finding is consistent both with important announcement as well as implementation effects. By applying the extended model from Eq. 2, we seek to disentangle these effects. The resulting impulse response functions for a tax shock decided on in -4 or earlier and expected to come into effect at time 0 are shown in figure 3. Up to step 0, impulse response functions measure pure anticipation effects. Beginning with step 0, the tax change has been implemented. Effects seen afterwards are labeled implementation effects.

Taxes build up around the quarter of implementation and the implicit multiplier reaches one shortly after implementation. One year after implementation tax revenues start declining, similar as in the results presented in the last section. Impulse response functions indicate a significant reaction of government expenditures three quarters prior to implementation. In anticipation of raising revenues, policy makers may be inclined to increase spending. Output decreases in anticipation of the tax increase, with the effect being statistically significant four quarters prior to the actual implementation and then slowly leveling off. Hence, output is statistically significantly affected prior to implementation, yet not afterwards. Quantitatively, the effect is always small. Four quarters prior implementation, the effect is -0.64%. After implementation, the peak effect is -0.47%. Results do not indicate important price levels effects, potentially because monetary policy is active in promoting stability: interest rates are lowered significantly in the fourth and third quarter before implementation of the tax shock. Monetary policy thus reacts to the tax change prior to its implementation. Interest rates are cut by 0.53% in the third quarter before implementation and stay at that level for three additional quarters. In the second quarter after implementation, the interest rate effect reaches -0.75% and then slowly returns towards zero.

The findings of the above exercise largely confirm the results from the last section. Legislated tax changes have output effects before actual implementation. Also, there is an offsetting monetary policy reaction before the tax shock is actually implemented. This suggests that monetary policy makers anticipate future tax changes before they occur and react in a way as to curb their effects. Allowing for implementation lags of monetary policy, the interest rate reaction pattern is well suited to explain insignificance of output effects around implementation. The substantial offsetting monetary policy reaction might also explain the small size of the tax effects.

These findings have important bearings for studying the fiscal policy transmission mechanism in Germany. Traditional SVAR studies identify structural policy shocks from reduced form innovations in the VAR model. Hence, by definition, these studies focus on tax policy effects around implementation. Our results, on the contrary, suggest the importance of allowing for anticipation effects. We find significant output effects before implementation, which, however, are small. More importantly, we find an offsetting monetary policy reaction before actual implementation. This monetary policy reaction might cut off any influence of fiscal policy, hence depressing size and statistical significance of fiscal policy effects. Taken together, our result suggest that monetary policy and anticipation effects matter for the tax policy transmission mechanism in Germany, and that monetary policy is a leading explanatory factor for the incoherent findings of the German VAR literature on the effects of tax policy shocks.

Figure 3 Distinguishing Anticipation and Implementation Effects

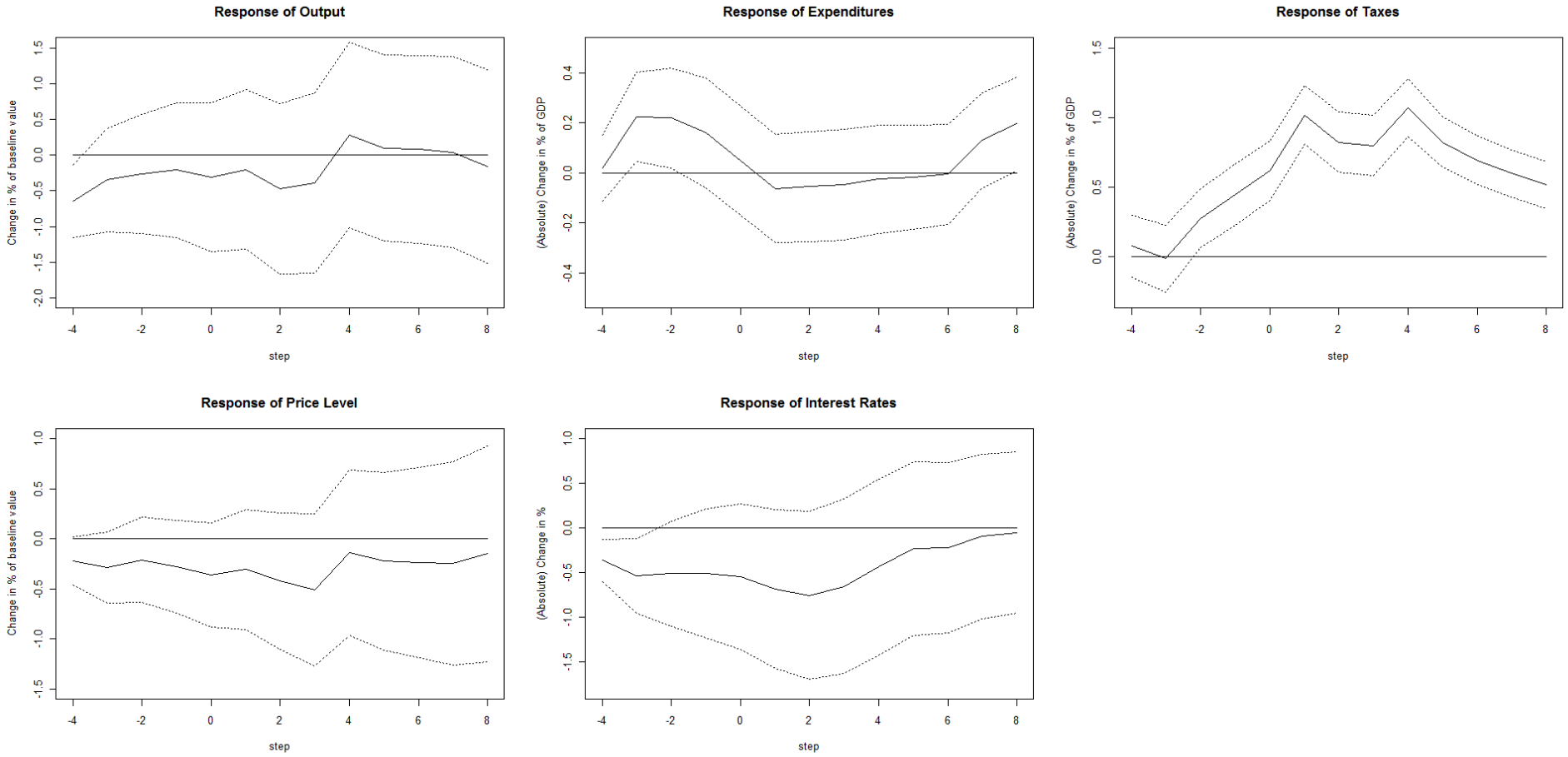


Figure shows impulse response functions for a tax increase decided on in -4 or earlier and expected to come into effect at time 0. The size of the shock is one percent of GDP. Error bands are one standard error deviations constructed from a parametric bootstrap.

4 Robustness

Our results suggest that monetary policy takes an important role in Germany's fiscal policy transmission mechanism. Given that, the introduction of the Euro might cause a structural break. Studying the effects of tax policy shocks in pre and post EMU samples would therefore be of special interest. Estimation in the 1974:1 to 1998:4 sample is technically feasible; even so it suffers from limited degrees of freedom. In comparison to the longer sample, we find weaker output and stronger interest rate effects after announcement of the tax change. In the case where the tax shock is timed at the quarter of announcement, the output effect becomes insignificant, while the magnitude of the interest rate effect increases. In the peak, interest rates are reduced by as much as 1.44% in response to a one percent increase in the tax to GDP ratio. Distinguishing anticipation and implementation effects suggest that output is significantly reduced four quarters before implementation. Post implementation, the output effect becomes insignificant. Again, monetary policy reacts by reducing interest rates prior to implementation. The results found in the pre EMU sample hence strengthen our main conclusions. Evidence for output effects of legislated tax changes is weak - because the *Bundesbank* has offset the fiscal stimulus.

The results are robust towards variations in the measure of monetary policy. In the benchmark cases, the interest rate for day to day money was chosen because of the theoretical prior that this measure is closest to policy instruments by the central bank and, hence, best reflects monetary policy actions. Still, other definitions of the short term interest rate are feasible. As a robustness test, we apply interest rates for both one month money and ninety days' money. Data source is the *Bundesbank*. The outcomes of these exercises are qualitatively similar to those presented previously, with the caveat that the output effect is slightly weakened.

In principle, our results could be driven by specific properties of the examined tax laws. Our exogenous tax shock series consists of two classes of tax laws, namely, those implemented for consolidation purposes and those addressing long term growth. We have identified four laws designed to consolidate the budget. When excluding those, the results remain qualitatively unchanged. Further, the analysis presented here is on the aggregate level and ignores the detailed composition of the tax stimulus. In reality, however, tax changes consist of changes in various tax types. When using only changes in income based taxes, i.e. changes in the *Einkommensteuer*, *Körperschaftssteuer* and in the *Solidaritätszuschlag*, results remain qualitatively unchanged. Changes in other tax types occur frequently, but do not offer enough information for individual estimation.

As evident from figure 1, there is one large outliner at the beginning of the 2000s. The *Steuersenkungsgesetz* was expected to lower tax revenues by a total of 2.40% of GDP. This revenue effect was primarily driven by large permanent tax cuts to be implemented in 2005 and by forwarding to 2001 tax cuts originally designed to be implemented in 2002. When removing the latter component, the tax shock amounts to 1.71% of GDP. This size is in line with other tax shocks included in the model. Removing the large one time effect has little impact on the results.

Our results are robust to further modifications. By use of dummy variables, we control for the creation and (factual) abolishment of EMS, and the recent final crisis. Also, we reduce the lag length in Eq. 1 to 6. None of these variations had substantial effects on the results. Impulse response functions for any of the specifications proposed in this section are available on request.

5 Conclusion

This paper studies short run macroeconomic effects of legislated tax changes in Germany. We apply a five variable VAR consisting of output, taxes, government expenditures, inflation and the short term interest rate. Identification of the tax policy shock is achieved by constructing an exogenous tax shock series as in Romer and Romer (2010). Results indicate a small, yet significant reduction in output following the announcement of a tax change. In response to a one percent increase in the tax to GDP ratio, the peak output reduction is 0.67%. The output effect becomes statistically insignificant in the fourth quarter after announcement and then quickly turns towards zero. Impulse response functions further suggest an offsetting monetary policy reaction. Monetary conditions as measured by a short term interest rate significantly loosen after the tax increase, hence compensating the fiscal impulse. Distinguishing anticipation and implementation effects, we find evidence only for the former. Tax shocks show a significant impact on GDP in the time following announcement of the law change, but are insignificant at the quarter of implementation. This might be explained by an offsetting monetary policy reaction before actual implementation.

Our results offer an explanation for the mixed and generally inconclusive picture drawn by the Germany based VAR literature on fiscal policy effects. Tax multipliers estimated with German data are of small magnitude, often insignificant and occasionally have the wrong sign. Traditional SVAR analyses are based on innovations in the VAR, and hence, are concerned with fiscal policy shocks around their implementation. An offsetting monetary policy reaction at that time offers a potential explanation for the apparent failure of these studies to reach coherent conclusions. Methodologically, ignoring anticipation effects and choosing concise specifications without a monetary side might be inappropriate to model Germany's fiscal policy transmission mechanism.

Studying fiscal policy effects still provides opportunities for further research. Any empirical investigation on the effects of fiscal policy needs to be based on *past* economic data. But with the introduction of the Euro - and given the importance of the monetary policy reaction found in this paper - there are good reasons to suspect the *current* fiscal policy transmission mechanism to be different. As more data gets available, studying the post 1999 episode might provide interesting insights. Until then, our narrative account of Germany's tax legislative history could be used to study the interaction between monetary policy and fiscal policy more closely. Looking on changes appearing with the introduction of the Euro might even allow for projections on Germany's fiscal policy transmission mechanism in European Monetary Union – potentially with stronger support for tax policy effects than found in our data.

References

Afonso, António and Ricardo M. Sousa (2009), The Macroeconomic Effects of Fiscal Policy, ECB Working Paper Series No 991.

Baum, Anja and Gerrit B. Koester (2011), The Impact of Fiscal Policy on Economic Activity over the Business Cycle – Evidence from a Threshold VAR Analysis, Deutsche Bundesbank Discussion Paper No 03/2011.

Bank, Alexander (2011), Effects of Discretionary Fiscal Policy: New Empirical Evidence for Germany, Leibniz University of Hannover, Discussion Paper No 470.

Berger, Helge (1997), The Bundesbank's Path to Independence: Evidence from the 1950s, Public Choice 93(3-4), 427-53.

Berger, Helge and Jakob de Haan (1999), A State Within the State? An Event Study on the Bundesbank (1948–1973), Scottish Journal of Political Economy 46(1), 17-39.

Blanchard, Oliver and Roberto Perotti (2002), An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output, The Quarterly Journal of Economics 117(4), 1329-1368.

Bode, Oliver, Rafael Gerke and Hannes Schellhorn (2009), Die Wirkung fiskalischer Schocks auf das Bruttoinlandsprodukt, Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung, Arbeitspapier 01/2006.

Breuer, Christian, and Thiess Büttner (2010), Fiscal Policy in a Structural VAR model for Germany, mimeo.

Favero, Carlo and Francesco Giavazzi (2009), How large are the Effects of Tax Changes?, NBER Working Paper No 15303.

Finanzbericht, Bundesministerium der Finanzen, various issues.

Fontana, Giuseppe (2009), The Transmission Mechanism of Fiscal Policy: a Critical Assessment of Current Theories and Empirical Methodologies, Journal of Post Keynesian Economic 31(4), 587-604.

Heppke-Falk, Kirsten H., Jörn Tenhofen, and Guntram B. Wolff (2006), The Macroeconomic Effects of Exogenous Fiscal Policy Shocks in Germany: A Disaggregated SVAR Analysis, Deutsche Bundesbank Discussion Paper No 41/2006.

Höppner, Florian (2001), A VAR Analysis of Fiscal Policy in Germany, mimeo.

Kwiatkowski, Denis, Peter C.B. Phillips, Peter Schmidt and Yongcheol Shin (1992), Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root, Journal of Econometrics 54, 159-178.

Marcellino, Massimiliano (2006), Some Stylized Facts on Non-Systematic Fiscal Policy in the Euro Area, Journal of Macroeconomics, 28(3), 461–479.

Melitz, Jacques (2000), Some Cross-Country Evidence about Fiscal Policy Behaviour and Consequences for EMU, European Economy Reports and Studies 2, 3–21.

Mertens, Karel and Morten O. Ravn (2011), Empirical Evidence on the Aggregate Effects of Anticipated and Unanticipated U.S. Tax Policy Shocks, American Economic Journal: Economic Policy, forthcoming.

Perotti, Roberto (2004): Estimating the Effects of Fiscal Policy in OECD Countries, mimeo.

Ramey, Valerie A. and Matthew Shapiro (1998), Costly Capital Reallocation and the Effects of Government Spending, Carnegie Rochester Conference on Public Policy.

Ramey, Valerie A. (2011), Identifying Government Spending Shocks: It´s All in the Timing, The Quarterly Journal of Economics 126(1), 1-50.

Romer, Christina D., and David H. Romer (2010), The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks, American Economic Review 100(3), 763–801.

Sims, Christopher A. (1980), Macroeconomics and Reality, Econometrica 48(1), 1-48.

Appendix

Table 2 List of Variables

Variable	Definition	Source
y	Log of real and seasonally adjusted (Census X-12 ARIMA) GDP measured as quantity index, base year 1991	Federal Statistical Office
g	Sum of government final consumption expenditure and gross government fixed capital formation as percentage of nominal GDP, seasonally adjusted with Census X-12 ARIMA	OECD Economic Outlook 89
t	Tax revenues of administrative units, total, expressed as percentage of nominal GDP, seasonally adjusted with Census X-12 ARIMA	Monthly Bulletin, Bundesbank
i	Money market rates at Frankfurt, day to day money, geometric averages	Bundesbank
infl	Log difference of implicit GDP Deflator derived from seasonally adjusted real and nominal GDP	OECD.Stat

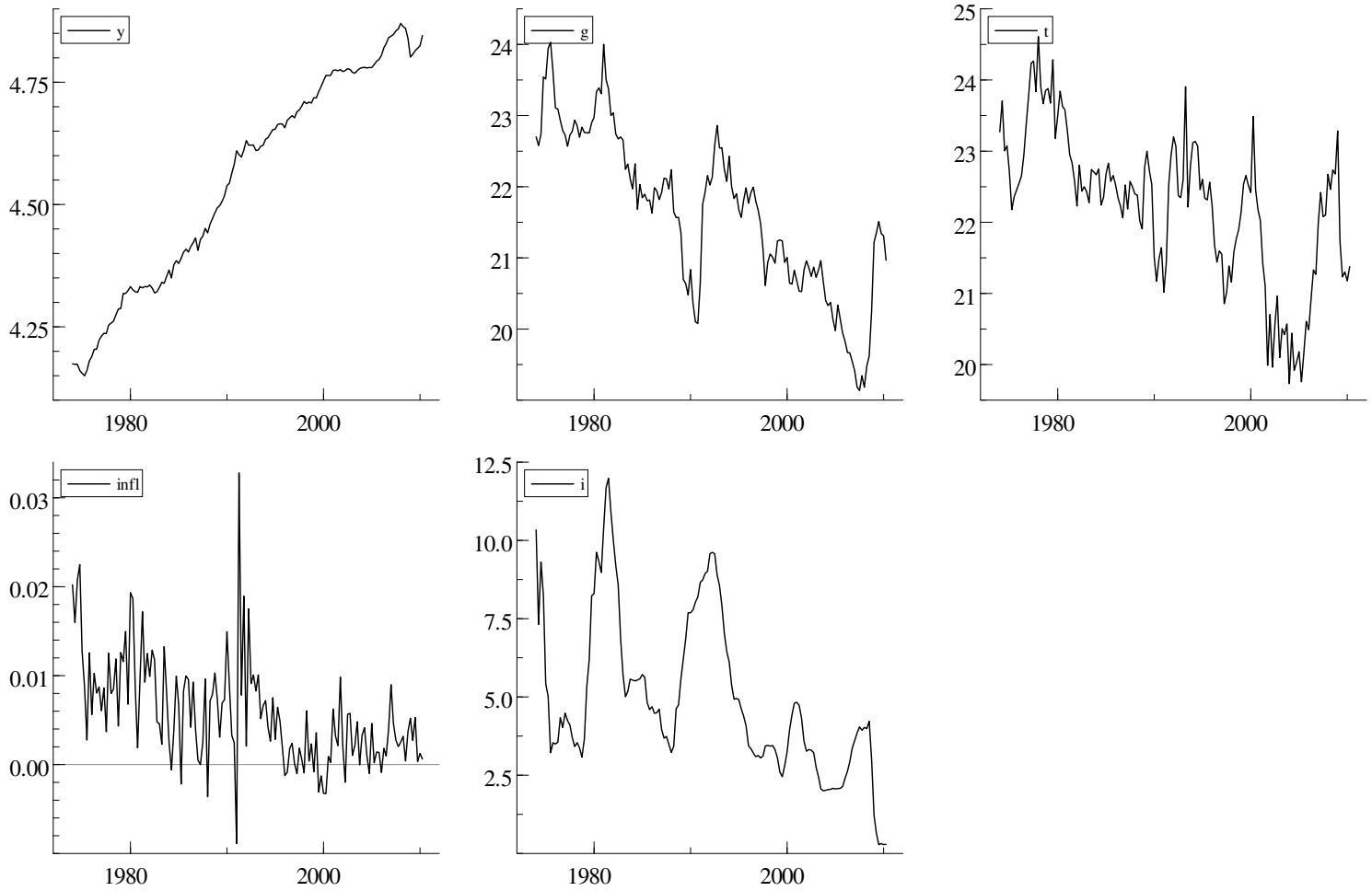
Table 3 List of Quantitatively Important Tax Laws

	Law	Motivation	Revenue (% of GDP)
1	Gesetz zur Beschleunigung des Wirtschaftswachstums (Wachstumsbeschleunigungsgesetz) vom 22.12.2009	endogenous	-0.35%
2	Gesetz zur Umsetzung steuerrechtlicher Regelungen des Maßnahmenpakets "Beschäftigungssicherung durch Wachstumsstärkung" vom 21.12.2008	endogenous	-0.17%
3	Gesetz zur Sicherung von Beschäftigung und Stabilität in Deutschland vom 2.3.2009	endogenous	-0.31%
4	Gesetz zur Fortführung der Gesetzeslage 2006 bei der Entfernungspauschale vom 20.4.2009	exogenous	-0.11%
5	Gesetz zur verbesserten steuerlichen Berücksichtigung von Vorsorgeaufwendungen (Bürgerentlastungsgesetz Krankenversicherung) vom 16.7.2009	exogenous/ endogenous	-0.44%
6	Unternehmensteuerreformgesetz 2008 vom 14.8.2007	exogenous	-0.20%
7	Gesetz zur steuerlichen Förderung von Wachstum und Beschäftigung vom 26.4.2006	exogenous	-0.18%
8	Haushaltsbegleitgesetz 2006 (HBeglG 2006) vom 29.6.2006	exogenous/ endogenous	1.03%
9	Steueränderungsgesetz 2007 vom 19.7.2006	exogenous	0.19%
10	Gesetz zur Abschaffung der Eigenheimzulage vom 22.12.2005	exogenous	0.26%
11	Gesetz zur Förderung der Steuerehrlichkeit vom 23.12.2003	exogenous	0.23%
12	Gesetz zur Änderung des Tabaksteuergesetzes und anderer Verbrauchsteuergesetze vom 23.12.2003	endogenous	0.11%
13	Gesetz zum Abbau von Steuervergünstigungen und Ausnahmeregelungen (Steuervergünstigungsabbaugesetz - StVergAbG) vom 16.5.2003	exogenous	0.11%
14	Zweites Gesetz zur Familienförderung vom 16.8.2001	exogenous	-0.11%
15	Gesetz zur Bekämpfung von Steuerverkürzungen bei der Umsatzsteuer und zur Änderung anderer Steuergesetze (Steuerverkürzungsbekämpfungsgesetz - StVBG) vom 19.12.2001	exogenous	0.12%
16	Gesetz zur Reform der gesetzlichen Rentenversicherung und zur Förderung eines kapitalgedeckten Altersvorsorgevermögens (Altersvermögensgesetz - AVmG) vom 26.6.2001	exogenous	-0.50%
17	Gesetz zur Fortführung der ökologischen Steuerreform vom 16.12.1999	endogenous	0.13%
18	Gesetz zur Familienförderung vom 22.12.1999	exogenous	-0.16%
19	Gesetz zur Senkung der Steuersätze und zur Reform der Unternehmensbesteuerung (Steuersenkungsgesetz - StSenkG) vom 23.10.2000	exogenous	-2.40%
20	Gesetz zur Ergänzung des Steuersenkungsgesetzes (Steuersenkungsergänzungsgesetz – StSenkErgG) vom 19.12.2000	exogenous	-0.17%
21	Steuerentlastungsgesetz 1999 vom 19.12.1998	exogenous	-0.18%
22	Steuerentlastungsgesetz 1999/2000/2002 vom 24.3.1999	exogenous	-0.25%
23	Gesetz zum Einstieg in die ökologische Steuerreform vom 24.3.1999	endogenous	0.31%
24	Gesetz zur Senkung des Solidaritätszuschlags vom 21.11.1997	exogenous	-0.19%

25	Gesetz zur Finanzierung eines zusätzlichen Bundeszuschusses zur gesetzlichen Rentenversicherung vom 19.12.1997	exogenous/ endogenous	0.29%
26	Gesetz zur Fortsetzung der wirtschaftlichen Förderung in den neuen Ländern vom 18.8.1997	exogenous	-0.15%
27	Jahressteuergesetz 1996 vom 11.10.1995	exogenous	-0.52%
28	Gesetz zur Bekämpfung des Mißbrauchs und zur Bereinigung des Steuerrechts (Mißbrauchsbekämpfungs- und Steuerbereinigungsgesetz - StMBG) vom 21.12.1993	exogenous	0.10%
29	Erstes Gesetz zur Umsetzung des Spar-, Konsolidierungs- und Wachstumsprogramms (1. SKWPG) vom 21.12.1993	endogenous	0.25%
30	Gesetz zur Neuregelung der Zinsbesteuerung (Zinsabschlaggesetz) vom 9.11.92	exogenous	0.12%
31	Gesetz über Maßnahmen zur Bewältigung der finanziellen Erblasten im Zusammenhang mit der Herstellung der Einheit Deutschlands, zur langfristigen Sicherung des Aufbaus in den neuen Ländern, zur Neuordnung des bundesstaatlichen Finanzausgleichs und zur Entlastung der öffentlichen Haushalte (Gesetz zur Umsetzung des Föderalen Konsolidierungsprogramms - FKPG) vom 23.6.1993	endogenous	1.03%
32	Gesetz zur Entlastung der Familien und zur Verbesserung der Rahmenbedingungen für Investitionen und Arbeitsplätze (Steueränderungsgesetz 1992 - StÄndG 1992) vom 25.2.1992	exogenous	0.15%
33	Gesetz zur Förderung von Investitionen und Schaffung von Arbeitsplätzen im Beitrittsgebiet sowie zur Änderung steuerrechtlicher und anderer Vorschriften (Steueränderungsgesetz 1991 - StÄndG 1991) vom 24.6.1991	endogenous	0.12%
34	Gesetz zur Einführung eines befristeten Solidaritätszuschlags und zur Änderung von Verbrauchsteuer- und anderen Gesetzen (Solidaritätsgesetz) vom 24.6.1991	endogenous	0.96%
35	Gesetz zur Änderung des Steuerreformgesetzes 1990 sowie zur Förderung des Mietwohnungsbaus und von Arbeitsplätzen in Privathaushalten vom 30.6.1989	exogenous	-0.21%
36	Gesetz zur Änderung von Verbrauchsteuergesetzen (Verbrauchsteueränderungsgesetz 1988 - VerbrStÄndG 1988) vom 20.12.1988	endogenous	0.35%
37	Steuerreformgesetz 1990 vom 25.7.1988	exogenous	-0.84%
38	Gesetz zur Änderung des Einkommensteuergesetzes (Steuersenkungs-Erweiterungsgesetz 1988 - StSenkErwG 1988) vom 14.7.1987	endogenous	-0.26%
39	Gesetz zur leistungsfördernden Steuersenkung und zur Entlastung der Familie (Steuersenkungsgesetz 1986/1988 - StSenkG 1986/1988) vom 26.6.1985	exogenous	-1.00%
40	Gesetz zur Stärkung der Wettbewerbsfähigkeit der Wirtschaft und zur Einschränkung von steuerlichen Vorteilen (Steuerentlastungsgesetz 1984 - StEntlG 1984) vom 22.12.1983	exogenous	-0.19%
41	Gesetz zur Wiederbelebung der Wirtschaft und Beschäftigung und zur Entlastung des Bundeshaushalts (Haushaltsbegleitgesetz 1983) vom 20.12.1982	endogenous	0.47%
42	Gesetz zur Änderung von Verbrauchsteuergesetzen (Verbrauchsteueränderungsgesetz 1982 - VStÄndG 1982) vom 22.12.1981	exogenous	0.20%
43	Gesetz über steuerliche und sonstige Maßnahmen für Arbeitsplätze, Wachstum und Stabilität (Beschäftigungsförderungsgesetz - BeschäftFG) vom 3.6.1982	exogenous	-0.24%
44	Mineralöl- und Branntweinsteuer-Änderungsgesetz 1981 - MinöBranntwStÄndG 1981 - vom 20.3.1981	exogenous/ endogenous	0.24%
45	Gesetz zur Steuerentlastung und Familienförderung (Steuerentlastungsgesetz 1981) vom 16.8.1980	exogenous	-0.89%
46	Gesetz zur Änderung des Einkommensteuergesetzes, des Gewerbesteuergesetzes, des Umsatzsteuergesetzes und anderer Gesetze (Steueränderungsgesetz 1979 - StÄndG 1979) vom 30.11.1978	endogenous	-0.72%
47	Gesetz zur Steuerentlastung und Investitionsförderung vom 4.11.1977	endogenous	-0.85%
48	Gesetz zur Verbesserung der Haushaltsstruktur (Haushaltsstrukturgesetz - HStrukG) vom 18.12.1975	exogenous	0.12%
49	Gesetz zur Änderung des Tabaksteuergesetzes und des Gesetzes über das Branntweinmonopol vom 5.7.1976	exogenous	0.14%
50	Gesetz zur Förderung von Investitionen und Beschäftigung vom 23.12.1974	endogenous	-0.64%
51	Gesetz zur Reform der Einkommensteuer, des Familienlastenausgleichs und der Sparförderung (Einkommensteuerreformgesetz - EStRG) vom 5.8.1974	exogenous	-1.33%

Revenue impact is total prospected revenue impact in percentage of GDP at the quarter of announcement.

Figure 4 Data Plots



y: log of real GDP (as measured by a quantity index), g: government expenditures as % of GDP, t: tax revenue as % of GDP, infl: log difference of implicit GDP deflator, i: rate of interest for day to day money.