

Hayo, Bernd; Uhl, Matthias

Working Paper

The effects of legislated tax changes in Germany

MAGKS Joint Discussion Paper Series in Economics, No. 42-2011

Provided in Cooperation with:

Faculty of Business Administration and Economics, University of Marburg

Suggested Citation: Hayo, Bernd; Uhl, Matthias (2011) : The effects of legislated tax changes in Germany, MAGKS Joint Discussion Paper Series in Economics, No. 42-2011, Philipps-University Marburg, Faculty of Business Administration and Economics, Marburg

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<https://hdl.handle.net/10419/56545>

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MAGKS



**Joint Discussion Paper
Series in Economics**

by the Universities of
**Aachen · Gießen · Göttingen
Kassel · Marburg · Siegen**

ISSN 1867-3678

No. 42-2011

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This paper can be downloaded from
http://www.uni-marburg.de/fb02/makro/forschung/magkspapers/index_html%28magks%29

Coordination: Bernd Hayo • Philipps-University Marburg
Faculty of Business Administration and Economics • Universitätsstraße 24, D-35032 Marburg
Tel: +49-6421-2823091, Fax: +49-6421-2823088, e-mail: hayo@wiwi.uni-marburg.de

The Effects of Legislated Tax Changes in Germany*

Bernd Hayo and Matthias Uhl

7 October 2011

Philipps-University Marburg

Corresponding author:

Bernd Hayo

Faculty of Business Administration and Economics

Philipps-University Marburg

D-35032 Marburg

Germany

Phone: +49-6421-2823091

Email: hayo@wiwi.uni-marburg.de

* We thank seminar participants at the MAGKS Doctoral Meeting in Marburg and Kerstin Friebe, Laura Marlene Große, Edith Neuenkirch, Matthias Neuenkirch, Florian Neumeier, and Britta Niehof for their helpful comments. All remaining shortcomings are ours.

The Effects of Legislated Tax Changes in Germany

Abstract This paper studies the short-run macroeconomic effects of legislated tax changes in Germany using a vector autoregression (VAR) approach. 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 announcement of the tax policy. In response to a 1 percent increase in the tax-to-GDP ratio, the peak output reduction is about 0.7 percent. Distinguishing between anticipation and implementation effects suggests that tax changes affect GDP prior to actual implementation, whereas effects around the implementation period are insignificant, which is arguably due to the offsetting, forward-looking monetary policy reaction.

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

JEL Classification E62 · H30 · K34

1. Introduction

In response to questions raised by the recent financial and economic crisis, the macroeconomic effects of fiscal policy are receiving increased attention in the economic literature. A very influential modelling strategy in this regard is the structural vector autoregression (SVAR) approach pioneered by Blanchard and Perotti (2002). The key idea of the strategy is to model the relationships among reduced form and structural innovations by employing 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 what is considered a stylised fact: an increase in government expenditures has a statistically significant positive effect on output, whereas an increase in taxes has a significantly negative effect.

Somewhat different in spirit are the event study and narrative approaches taken by Ramey and Shapiro (1998), Ramey (2011a), and Romer and Romer (2010). Here, structural policy shocks are not identified through the reduced form errors, but by employing narrative information from outside the econometric model. Romer and Romer (2010) identify discretionary tax policy shocks based on the history of US postwar tax changes. They collect all important US tax legislation enacted during 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 that can be included as regressors in econometric models. Using an autoregressive distributed lag model of output growth with their tax shock series as the independent variable, Romer and Romer (2010) find that tax changes can have a significant impact—an exogenous tax increase worth 1 percent of GDP lowers GDP by nearly 3 percent in the medium term. However, using the Romer and Romer (2010) exogenous tax shock series in a VAR framework, Favero and Giavazzi (2011) and Perotti (2011) find smaller effects. In an application of the narrative approach to the United Kingdom, Cloyne (2011) finds results very similar to the original work for the United States—increasing taxes by 1 percent of GDP depresses GDP by 2.5 percent over three years. In a different, but conceptionally related, approach to overcoming the identification problem, Ramey and Shapiro (1998) and Ramey (2011a) employ exogenous increases in defence spending to investigate how fiscal policy affects output.¹

Although studies using the aforementioned approaches show remarkable differences in the effects of fiscal policy shocks on important macroeconomic variables, such as consumption or wages (for a discussion, see, e.g., Fontana, 2009), they all generally find that governments can boost the economy by either increasing spending or lowering taxes. However, results derived from US data do not necessarily hold true for other countries. Examples for applications of the Blanchard and Perotti (2002) SVAR modelling approach to countries outside the United States include Perotti (2004), Marcellino (2006), and Afonso and Sousa (2009). These studies focus on multiple countries and hence permit cross-country

¹ For a more detailed discussion on the macroeconomic effects of changes in government spending, see Ramey (2011b).

comparisons. The empirical results suggest remarkable differences in the effects of fiscal policy across countries. Hence, fiscal policy transmission mechanisms might be country specific.

Several multi-country studies on tax change that also include Germany use the SVAR modelling approach (Perotti, 2004; Marcellino, 2006; Afonso and Sousa, 2009). 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 characterised by unexpected signs. 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 they are smaller than one in absolute terms. To the best of our knowledge, Breuer and Buettner (2010) provide the only application of the Romer and Romer (2010) narrative approach to Germany. They find a short-run multiplier for tax changes close to one in absolute terms. Taken together, the literature has not yet reached a consensus on the statistical significance, or even the direction, 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 of Romer and Romer (2010). Using the *Finanzbericht*, an annual publication of the Federal Ministry of Finance, we identify all important tax changes in Germany between 1974:1 and 2010:2. 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. Our study differs in at least two important ways from conventional VAR studies on fiscal policy effects. First, we set the tax shock to the quarter of announcement rather than to the time of implementation and include lagged values of the tax shock variable. This allows tax shocks to have effects before and after implementation. We label the first class of effects ‘anticipation’ effects; the second ‘implementation’ effects. This approach has the advantage of accounting for effects that are due to forward-looking expectations of fiscal policy. Also, in an extension of our model, we explicitly disentangle anticipation and implementation effects by taking an approach similar to one employed by Mertens and Ravn (2011) for the United States, in that we include anticipated future tax shocks as exogenous variables in the VAR.

Germany’s monetary policy regime is particularly focussed on stability. The Bundesbank, as an independent central bank with the overriding objective of keeping prices stable, was a strong influence on the design of the European Central Bank. Given the large role this strong monetary policy actor plays in the German situation, we believe that it is important to take monetary policy into account when studying fiscal policy shocks. Thus our second important difference from standard VAR approaches is to allow for an endogenous monetary policy reaction before implementation of tax changes and thus for interactions between fiscal shocks and monetary policy.

Breuer and Buettner (2010) also apply the Romer and Romer (2010) strategy to identify German tax policy shocks, but their methodological approach is considerably different from ours. Rather than studying the dynamic effects of tax changes by shocking the exogenous tax series directly, Breuer and Buettner (2010) use the estimated coefficients on the tax shock variable to identify a structural system of equations modelling the relationships among the residuals. This does allow studying the effects of exogenous changes in government spending, but the problem is that potentially invalid theoretical identification assumptions can produce misleading empirical results. Since we concentrate on the effects of exogenous tax changes, we do not make additional identification assumptions. Finally, Breuer and Buettner (2010) neither study the timing of the tax shocks nor take monetary policy into account. Our approach has the advantage of allowing for and differentiating between both anticipation and implementation effects and possible interactions between fiscal and monetary policy.

Our results indicate a statistically significant, albeit quantitatively small, reduction in output following announcement of a tax change. In response to an increase in the tax-to-GDP ratio of 1 percentage point, the peak output reduction is 0.67 percent. The output effect becomes statistically insignificant in the fourth quarter after announcement and then quickly turns toward zero. Moreover, our estimated impulse response functions suggest an offsetting monetary policy reaction. Monetary policy, as measured by a short-term interest rate, becomes significantly more expansionary after the tax increase in an attempt to bring output back to its steady state and thereby avoid an increase in inflationary pressures. As a result, monetary policy almost completely compensates the fiscal impulse. Distinguishing between anticipation and implementation effects, we find evidence only for the former. Tax shocks have a significant impact on GDP after announcement of a change in the law, but are insignificant in the quarter of implementation. This could be explained by an offsetting monetary policy reaction that starts affecting GDP before actual implementation. Taken together, our results offer only weak evidence in support of important output effects of legislated tax changes under the condition of a stability-oriented monetary policy regime. Effects in Germany are smaller than those estimated for the United States and the United Kingdom and show lower persistence. This difference is consistent with our hypothesis that an endogenous monetary policy reaction offsets the fiscal impulse in Germany, as the Fed and the Bank of England were less stability-oriented during our sample period than the Bundesbank. These results are a valuable contribution to the current level of knowledge on the fiscal policy transmission mechanism in Germany. Our explanation for the mixed and generally inconclusive picture of Germany drawn by VAR literature on fiscal policy effects is that this literature omits anticipation effects and endogenous monetary policy responses

The paper is organised as follows. Section 2 discusses methodology and data. Results are given in Section 3. Section 4 addresses the robustness of the results; Section 5 concludes. Supplementary tables and figures can be found in the Appendix.

2. Methodology and Data

2.1 Benchmark Model Specification

To study the effects of legislated tax changes in Germany, we employ VAR modelling as pioneered by Sims (1980). In the benchmark case, we estimate the five-variable VAR in Equation (1).

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

\mathbf{y}_t is a 5x1 vector of endogenous variables containing log real GDP, government expenditures and revenues as percentage of GDP, and the rate of inflation, as well as a short-term interest rate. For details on variable definitions and data sources, see Table A1 in the Appendix. Figure A1 in the Appendix provides time-series plots of each individual series. \mathbf{c}_t is a vector of exogenous variables, containing a constant, a step dummy for reunified Germany, and a step dummy for participation in the European Monetary Union (EMU). \mathbf{x}_{t-i} , $i = 0, \dots, m$ are current and lagged values of our exogenous tax shock series. Unit root testing shows that the time series are integrated of order 1.² Nevertheless, based on theoretical results put forward by Sims and Uhlig (1991) and reflecting the practice in the applied VAR literature (e.g., Bank, 2011; Höppner, 2001), we estimate the VAR in levels.

Impulse response functions are computed by changing the exogenous tax shock variable in Equation (1). The size of the shock is set to 1 percent of GDP. Error bands are constructed by a parametric bootstrap procedure. They are based on 10,000 draws of the coefficient vector 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. Following the literature (Romer and Romer, 2010; Favero and Giavazzi, 2011; Mertens and Ravn, 2011), the error bands show one standard error deviations of the resulting impulse responses.

The lag length on the endogenous variable is set to four, which is standard in the VAR literature (e.g., Blanchard and Perotti, 2002; Perotti, 2004; Höppner, 2010), 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 is 1974:1 to 2010:2. At the time the dataset was constructed, 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) use a similar sample period.

2.2 An Exogenous Tax Shock Series for Germany

The tax shock series employed in this paper is based on 51 important legislated tax changes that occurred between 1974 and 2010. The size of the tax change is measured by the

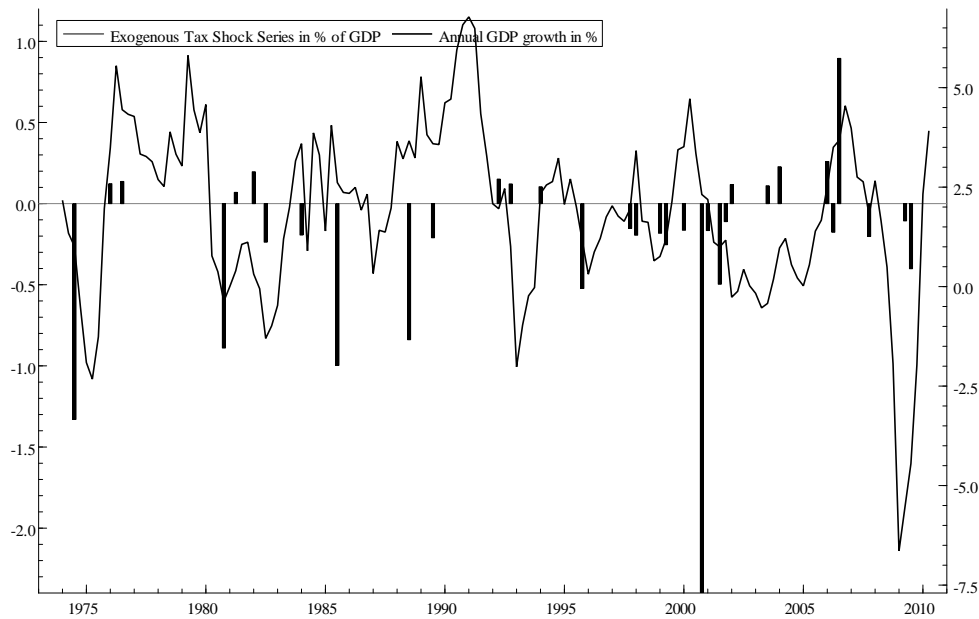
² Test results are available on request.

forecasted revenue effect within the first 12 months after full implementation of the new law and is expressed in percent of GDP. Revenue forecasts and identification of important tax laws are from the *Finanzbericht*. Only tax laws with an estimated impact on tax liabilities greater than 0.10 percent of GDP are used. The main idea of Romer and Romer's (2010) methodological approach is that the motivation for a tax change can be inferred from official government sources, which allows classification of the shocks as either exogenous or endogenous. Assuming that this identification assumption holds, this procedure delivers an exogenous tax shock series orthogonal to current innovations in u_t . Impulse response functions derived from the exogenous tax shock series then give consistent estimates of their short-run macroeconomic effects. Table A2 in the Appendix provides details on all tax changes we identify as important.

The motivation behind tax measures is inferred from official government sources. By rules of parliamentary procedure, motivation and intent must be explained in the draft of any bill. In the event a bill is changed during the legislative process, the report of the leading parliamentary committee, which is usually the *Finanzausschuss*, contains an explanation of the motivation behind the change. Furthermore, protocols from discussions in the two parliamentary chambers in Germany, *Bundestag* and *Bundesrat*, are also helpful. The *Finanzbericht* contains explanations and, sometimes, classifications of the motivations behind law changes. Extending the work of Romer and Romer (2010), tax changes can be assigned to one of the following categories.

Tax policies introduced for **countercyclical** reasons, with the aim of offsetting current deviations of actual from potential output, are obviously endogenous. Tax changes might be enacted to finance an increase in **government spending**. The increase in government spending can be interpreted as a structural innovation in the spending equation; hence, this tax change is endogenous to important contemporaneous macroeconomic shocks. Similarly, tax policies sometimes react to important policy events; for example, German Reunification, completion of the European common market, or introduction of the euro. Here, the effect of the **event** triggering the policy move and the tax change itself 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 by Romer and Romer (2010) in their study of the United States, but, given the size of the aforementioned shocks, this class is of considerable importance in the case of Germany.

Figure 1: Exogenous Tax Changes and the Business Cycle



Notes: Left scale shows exogenous tax shock series in percent of GDP; right scale shows annual GDP growth in percent. Exogenous tax shocks are timed at the quarter of announcement. Growth rates are based on the Federal Republic of Germany until 1991:4, and on a unified Germany thereafter.

Finally, Romer and Romer (2010) consider two classes of exogenous tax changes. First, tax changes made 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, policymakers might lower taxes in an effort to stimulate investment or consumption with the objective of increasing **long-term growth**. Other measures in this category are undertaken to offset regional disparities or to promote social 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 with annual real GDP growth in percent. The correlation coefficient of 0.05 illustrates that there is no notable systematic relationship between the two series. To systematically investigate the exogeneity of our tax shock series, we test whether the tax shock series can be predicted by the residual vector u_t from the model in Equation (1). As a first test, we run a linear regression with the tax shock series as dependent and the residuals as independent variables. In a second test, we construct an ordinal series of tax shocks, coding a tax decrease in a quarter as -1, no change as 0, and a tax increase as 1. In an ordered logistic regression, we check whether this series can be predicted by the residuals from Equation (1). As our exogenous tax shock series cannot be predicted either linearly or in an ordinal framework, we conclude that it is indeed exogenous. Results are available on request.

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. However, using this dating system mixes effects arising from anticipation of the tax shock with those occurring due to actual changes in tax liabilities after implementation. To differentiate between these two effects, we run the regression in Equation (2), which is similar to the approach taken by Mertens and Ravn (2011).³

$$(2) \quad \mathbf{y}_t = \mathbf{c}_t + \sum_{i=1}^k \delta_i \mathbf{y}_{t-i} + \sum_{i=0}^k \beta_i \mathbf{x}_{t-i} + \sum_{i=1}^k \gamma_i \mathbf{x}_{t,t+i} + \mathbf{u}_t$$

The tax shock variable \mathbf{x}_t now measures the implementation effect and, consequently, is set to the quarter of implementation. In contrast, $\mathbf{x}_{t,t+i}$ ($i = 1, 2, \dots, 4$) is a tax shock known at time t to be implemented at time $t+i$ and thus captures the anticipation effect. To study the full effect of a preannounced tax shock, we combine the impulse responses to $\mathbf{x}_{t-i,t}$ ($i = 1, 2, \dots, 4$) and \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 period t , impulse response functions are solely based on $\mathbf{x}_{t,t+i}$ and hence measure pure announcement effects. From t onward, the tax change has been implemented. We label any effects observed afterward as ‘implementation’ effects, although they may also encompass reactions to the announcement. Since the tax shock is now dated substantially later than previously, we reduce the lag length to four. To make results comparable, we estimate the same number of parameters and 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 are not covered.

3. Results

3.1 The Benchmark: Effects of Legislated Tax Changes

Figure 2 shows the resulting impulse response functions for a positive tax shock corresponding to 1 percent of GDP timed at the quarter of announcement. In case of the inflation rate, 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 inflation rate. Tax revenues significantly increase after the positive tax shock, peaking six quarters after the announcement and then slowly declining. Government expenditures do not react to the tax shock in the first couple of years after announcement; however, the response function of government expenditures accelerates about three years after announcement. Extending the time horizon of the impulse response functions shows that government expenditures increase significantly for a total of nine quarters in the time span of three to five years after announcement. The peak increase in government expenditures is 0.16

³ The main difference between our approach and that of Mertens and Ravn (2011) is that we do not distinguish *a priori* between anticipated and unanticipated tax shocks; rather, **all** tax shocks enter Equation (2) through \mathbf{x}_{t-i} s and $\mathbf{x}_{t,t+i}$ s. This is because we are interested in differentiating anticipation from implementation effects and therefore pursue a slightly different question.

percent of GDP. This suggests that policymakers start increasing expenditures after a period of budget surplus and that tax increases only temporarily lead to a positive fiscal balance. This finding is in line with a key result reported in the literature on fiscal consolidations (von Hagen and Strauch, 2001), which is that budget adjustment programmes focussing on expenditure reductions rather than on tax increases have a higher probability of success. Detailed estimation results are available on request.

Following the tax shock, output is reduced in a statistically significant way. The output effect is significant during the first, second, and third quarters and peaks at -0.67 percent in the third quarter. The implicit multiplier is smaller than unity and therefore much smaller than the multiplier derived for the United States by Romer and Romer (2010), Favero and Giavazzi (2011), and Perotti (2011), and for the United Kingdom by Cloyne (2011). Note that output is significantly affected prior to a significant movement in tax revenues. The impact on tax revenues reaches its peak effect in the sixth quarter after the tax shock, whereas output is affected immediately after the shock. Hence, there are important dynamics in the model before the actual peak in tax revenues occurs. This can be interpreted as indirect evidence that anticipation effects dominate implementation effects. After the tax shock, the short-term interest rate declines significantly. At the peak level, the short-term interest rate is reduced by 0.71 percentage points. The price level effect is quantitatively modest and always statistically insignificant.

Our results suggest that tax policy changes have only weak output effects: they are of a small magnitude and quickly become insignificant. This is broadly in line with the conclusion drawn by traditional SVAR studies on tax policy effects in Germany. However, a unique result of our study is the strong interest rate reaction after the tax shock. In response to a tax increase of 1 percent of GDP, the short-term interest rate is reduced by as much as 0.71 percentage points. Following the VAR literature starting with Sims (1980), we interpret the short-term interest rate as the main monetary policy instrument. The short end of the term structure of interest rates is rather tightly controlled by the central bank and its monetary policy and fiscal policy has no direct effects on day-to-day interest rates in money markets. Thus, the observed strong interest rate reaction suggests that endogenous monetary policy reactions compensate the fiscal impulse and, thereby, affect the size of output effects resulting from tax shocks.

The Bundesbank is well known for its strong emphasis on price stability. Facing policy shocks that threaten to move the economy out of its steady-state position, the bank might be inclined to take countervailing measures so as to prevent spillover effects from fiscal policy on prices via output effects. This view is consistent with a New Keynesian Phillips curve relating inflation to the output gap.⁴ Indeed, empirically estimated reaction functions of the Bundesbank typically indicate that monetary policy has reacted to the output gap (see, e.g., Clarida et al., 1998; Hayo and Hofmann, 2006).

⁴ For instance, Blanchard and Galí (2007) show how to derive a New Keynesian Phillips curve from a standard New Keynesian macroeconomic model.

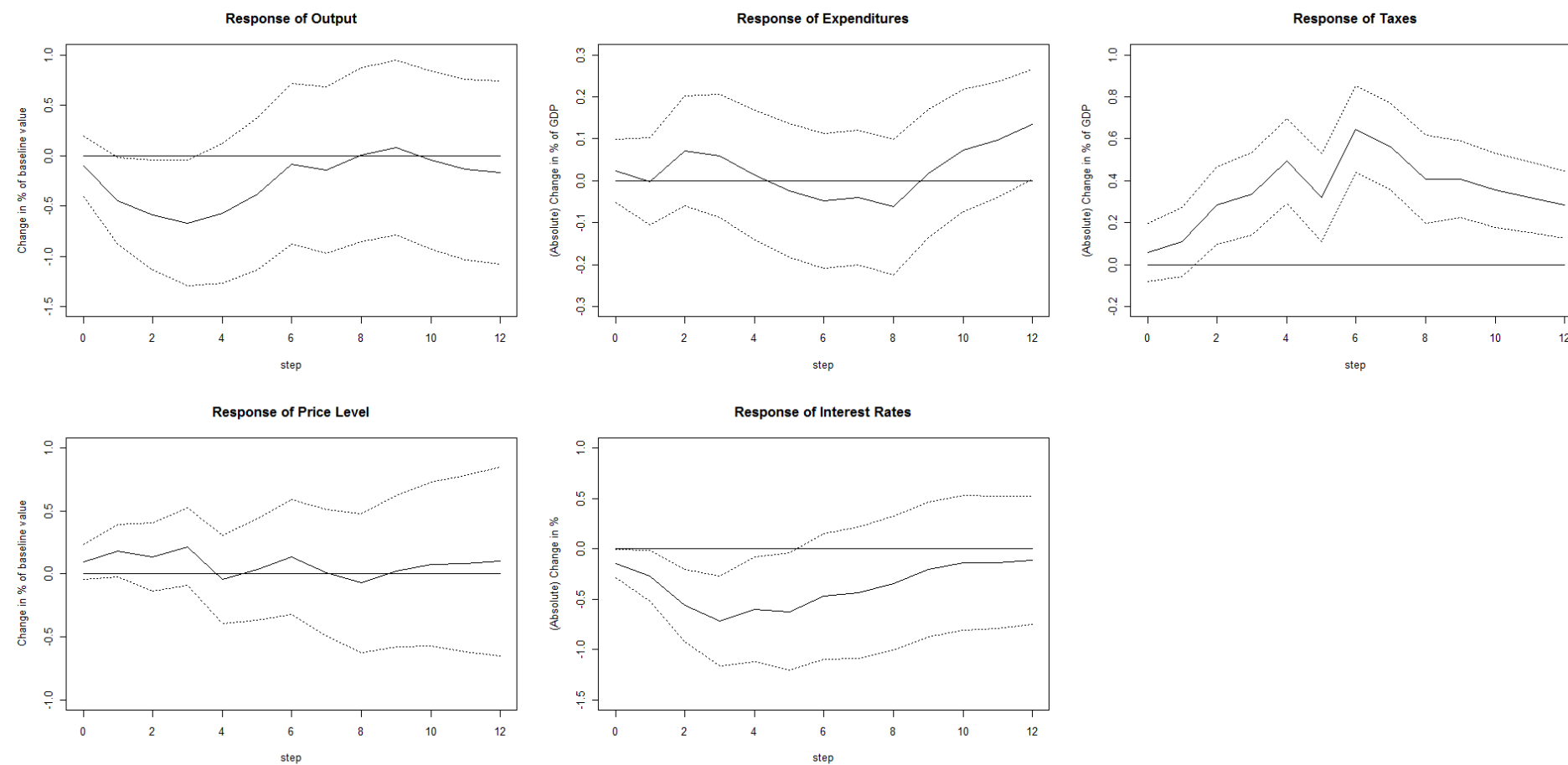
Moreover, policy conflicts between Bundesbank and the federal government are discussed in the literature. For instance, Berger (1997) and Berger and de Haan (1999) provide anecdotic evidence of such an offsetting reaction after fiscal policy actions. Melitz (2000), in a cross-section including Germany, concludes that fiscal and monetary policies move in opposite directions. Hence, our results are consistent with views expressed in other areas of the monetary economics literature.

For the argument of an endogenous monetary policy response to be consistent with our econometric model of the economy, a monetary policy shock must significantly influence output. To check the validity of this assumption, we derive impulse response functions from a Cholesky decomposition with the interest rate ordered last. Our results indicate that an innovation in interest rates significantly depresses output. Hence, the endogenous offsetting interest rate reaction can explain why we observe only weak output effects of tax shocks.

However, there is an important caveat to these findings. Given that our tax shock series is exogenous, shocks occur both during recessions as well as during normal times.⁵ As an extension, we study whether tax laws announced during recessions have different effects on the economy than those announced during normal times. This exercise is motivated by the fact that a stability-oriented central bank might want to offset shocks in normal times, but welcomes tax decreases during a recession. Indeed, when using only tax laws announced during recessions, we find that interest rates move in the direction of the tax shock, while otherwise monetary policy offsets the fiscal stimulus. Correspondingly, the output effects of tax shocks are much larger during recessions, with the peak effect being a 2 percent reduction in output following an increase in the tax-to-GDP ratio of 1 percentage point. Hence, we do not interpret our results as demonstrating that fiscal policy is useless for stabilising the business cycle. Rather, our analysis offers a methodological critique of the SVARs specification typically employed in studying tax effects: without accounting for monetary policy, we cannot adequately describe the fiscal policy transmission mechanism in Germany.

⁵ We define a recession as a period during which the output gap, as computed by the OECD in its Economic Outlook No. 89, is smaller than -1 percent.

Figure 2: Impulse Response Functions for Legislated Tax Changes



Notes: The figure shows impulse response functions for a tax increase. The size of the shock is 1 percent of GDP. Error bands are one standard error deviations constructed from a parametric bootstrap.

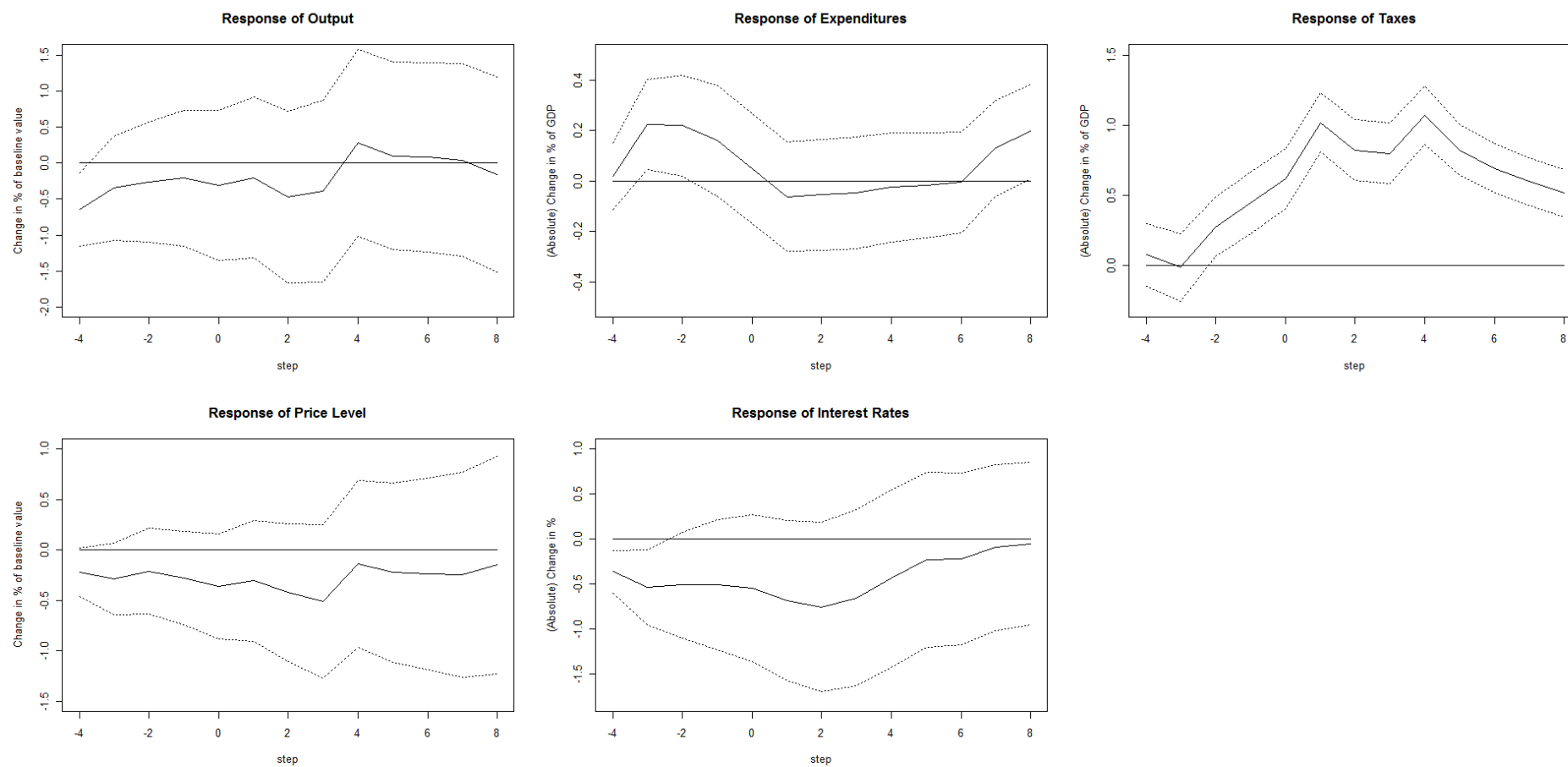
3.2 Distinguishing Anticipation and Implementation Effects

The methodology presented in the last section does not allow distinguishing between anticipation and implementation effects of tax changes. However, 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 to their actual implementation due to their coverage in cabinet, parliament, and media. Professional economic actors, particularly the central bank, are likely to engage in forward-looking behaviour and thus anticipate fiscal policy shocks. By means of the extended model from Equation (2), we seek to disentangle anticipation and implementation effects. The resulting impulse response functions for a tax shock decided on in -4 or earlier and expected to become effective at time 0 are shown in Figure 3. Up to period 0, impulse response functions measure pure anticipation effects. Beginning with period 0, the tax change has been implemented and we call those effects observed afterward ‘implementation’ effects.

Shortly after implementation, the implicit multiplier effect on tax revenues reaches a value of one. One year after implementation, tax revenues start declining, similar to 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 rising government revenues, policymakers appear to increase spending. Output decreases in anticipation of the tax increase, with the effect being statistically significant four quarters prior to actual implementation, but not afterward. Quantitatively, the influence of tax shocks on output is small. Four quarters before implementation, output decreases by 0.64 percent. After implementation, the peak effect is -0.47 percent. Results do not indicate notable price level effects. As argued above, this is due to monetary policy actively promoting stability: interest rates are cut by 0.53 percentage points 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 percentage points and then slowly returns to zero. Interest rates are lowered statistically significantly in the fourth and third quarter before implementation of a tax shock.

Thus, these findings confirm the results from the last section. Legislated tax changes have output effects before actual implementation and there is an offsetting monetary policy reaction before the tax shock is actually implemented. This suggests that monetary policymakers anticipate tax changes and react in an appropriate way taking into account transmission lags. Given the typical lags involved in monetary policy transmission in Germany (Clausen and Hayo, 2006), the interest rate reaction pattern well explains the insignificance of output effects around the time of implementation. Put differently, the offsetting monetary policy reaction helps explain the small tax multipliers found here as well as in other studies on Germany.

Figure 3: Distinguishing Anticipation and Implementation Effects



Notes: The figure shows impulse response functions for a tax increase decided on in -4 or earlier and expected to become effective at time 0. The size of the shock is 1 percent of GDP. Error bands are one standard error deviations constructed from a parametric bootstrap.

4. Robustness

Our results suggest that monetary policy plays an important role in Germany's fiscal policy transmission mechanism. The change in monetary regime due to introduction of the euro could have affected the transmission of fiscal policy shocks. Therefore, we study the effects of tax policy shocks in a pre-EMU subsample. Although estimation of the VAR model for the pre-EMU period of 1974:1–1998:4 is feasible, precision is less than optimal due to limited degrees of freedom. Compared to the full sample, we find weaker output and stronger interest rate effects after announcement of the tax change. When the tax shock is set to the quarter of announcement, the output effect becomes insignificant, while the magnitude of the interest rate effect increases. Interest rates are reduced by as much as 1.44 percentage points in response to a 1 percentage point increase in the tax-to-GDP ratio. Distinguishing anticipation and implementation effects suggests 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 post-EMU sample is too short for estimating the model, but comparing the pre-EMU results with those from the full sample suggests that the Bundesbank reacts more strongly than the ECB to exogenous tax shocks in Germany. Given that the ECB supposedly takes into account developments in the whole euro area, this is a plausible result.

Our results are also robust with respect to variations in the monetary policy indicator. 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 the central bank's actual policy instrument. As a robustness test, we employ interest rates for both one-month money and 90-day money. The outcomes of these exercises are similar to those presented previously, except that the output effect is weaker.

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: those implemented for consolidation purposes and those addressing long-term growth. We identified four laws designed for budget consolidation. When excluding those, the results remain qualitatively unchanged. Further, the analysis presented here is on the aggregate level and ignores the composition of the tax stimulus. In reality, however, tax changes involve changes to various types of taxes. When using only changes in income-based taxes, i.e., changes in the *Einkommensteuer*, *Körperschaftsteuer*, and *Solidaritätszuschlag*, results remain qualitatively unchanged. Changes to other types of taxes occur regularly, but not often enough to allow estimation of their individual effects.

As evident from Figure 1, there is one large outlier in the tax series at the beginning of the 2000s. The *Steuersenkungsgesetz* was expected to lower tax revenues by a total of 2.40 percent 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 percent of GDP. This size is in line with other tax shocks included in the model and removing the large one-time effect has little impact on the results.

Our results are robust to other modifications, too. Using dummy variables, we control for the creation and (factual) breakdown of the European Monetary System as well as the recent financial crisis. We also reduce the lag length in Equation (1) from 8 to 6. None of these variations affects the outcome of our analysis. Impulse response functions for all these modifications are available on request.

5. Conclusion

This paper studies short-run macroeconomic effects of legislated tax changes in Germany in the framework of a five-variable VAR consisting of output, taxes, government expenditures, inflation, and the short-term interest rate. Following Romer and Romer (2010), identification of the tax policy shock is achieved by constructing an exogenous tax shock series based on a legislative history of Germany's tax policy. Our results indicate a small, yet significant, reduction in output following announcement of a tax change. In response to a 1 percentage point increase in the tax-to-GDP ratio, we observe a maximum output reduction of 0.67 percent. The output effect becomes statistically insignificant in the fourth quarter after announcement and then quickly turns toward zero. Moreover, the impulse response functions suggest an offsetting endogenous monetary policy reaction. Monetary policy, as measured by a short-term interest rate, loosens significantly after the tax increase, thereby compensating the fiscal impulse. After distinguishing between anticipation and implementation effects, we find evidence for only the former: tax shocks have a significant impact on GDP in the period following announcement of the change, but are insignificant at the quarter of implementation. In our view, the weak impact of exogenous fiscal policy shocks can be explained by monetary policy actions initiated by a forward-looking, stability-oriented central bank, the Bundesbank. Our results indicate that monetary policy reacts immediately after the announcement of tax changes, so that, after taking into account the transmission lags, monetary policy almost fully absorbs the impact of fiscal policy on output and prices at the time of implementation. Moreover, we find evidence that the central bank does not offset exogenous tax changes announced during recessions, which implies that such shocks have much larger output effects. We find values of up to 2 percent in the aftermath of an increase in the tax-to-GDP ratio of 1 percentage point, which are similar to multipliers found in studies on other countries.

Our results offer an explanation for the mixed and generally inconclusive picture of fiscal policy effects in Germany as drawn by the extant VAR literature. Tax multipliers estimated with German data are of a small magnitude, often insignificant, and occasionally show expansionary effects. Traditional SVAR analyses are based on innovations in the VAR and, hence, are concerned with fiscal policy shocks around the date of implementation. A forward-looking, offsetting monetary policy reaction offers an explanation for the apparent

failure of these studies to reach coherent conclusions. Methodologically, ignoring anticipation effects and choosing specifications without a monetary side appear to be inappropriate oversights in modelling Germany's fiscal policy transmission mechanism.

Our study of fiscal policy effects leaves ample opportunity for further research. Any empirical investigation on the effects of fiscal policy must be based on *past* economic data. However, with the introduction of the euro—and given the importance of the offsetting monetary policy reaction found in this paper—there are good reasons to suspect that the *current* fiscal policy transmission mechanism is different. As more data become available, studying the post-1999 era might provide interesting insights. Until then, our narrative account of Germany's tax history could be used to more closely study the interaction between monetary policy and fiscal policy. Looking at changes brought about by the introduction of the euro might allow generating projections for Germany's fiscal policy transmission mechanism in the European Monetary Union. Given that the ECB focuses less attention on one country than does a national central bank, we would expect to see stronger tax policy effects today than found in our data.

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Appendix

Table A1: 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 A2: List of Quantitatively Important Tax Laws

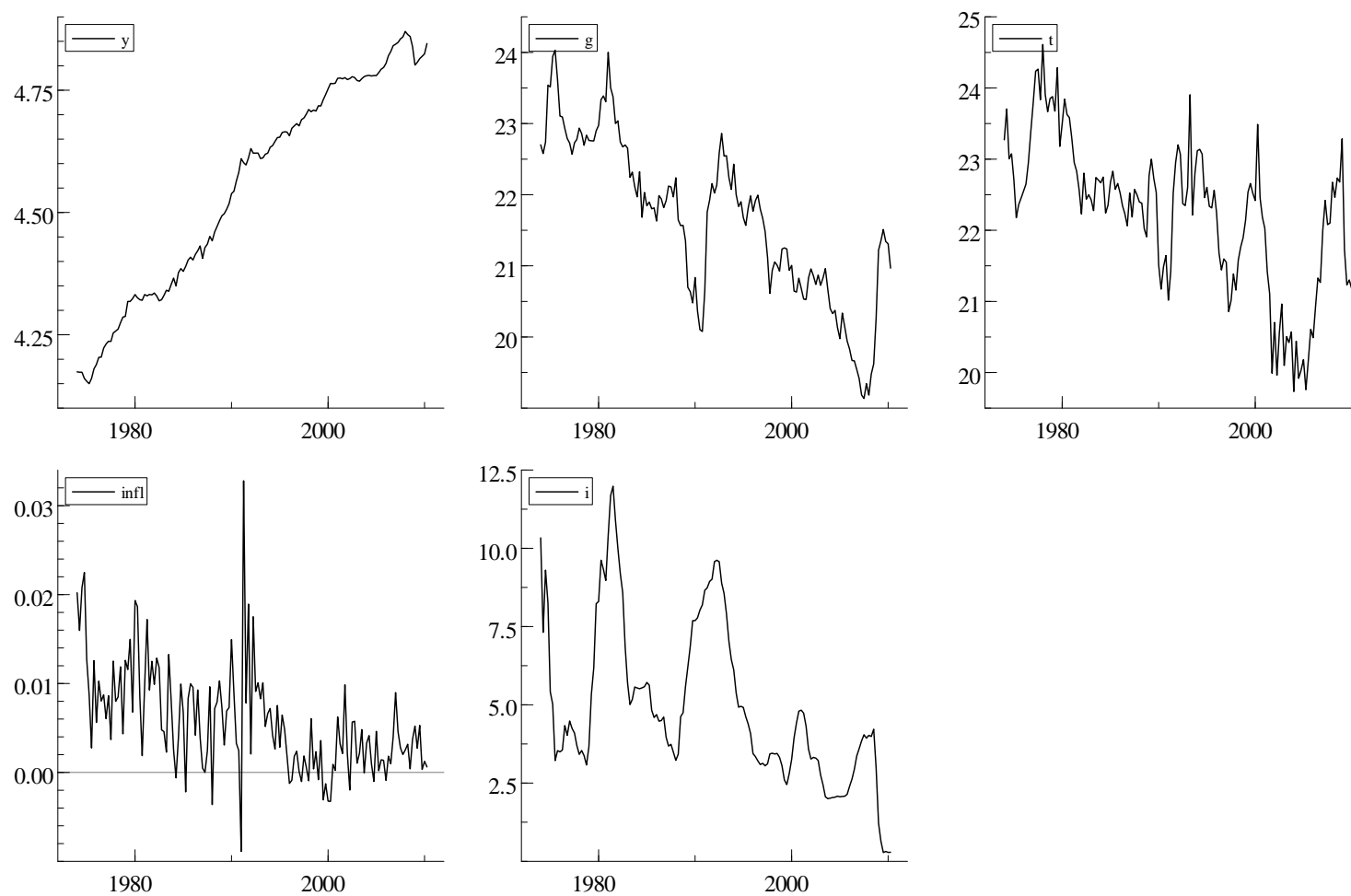
	Law	Announcement	Motivation	Revenue (% of GDP)
1	Gesetz zur Beschleunigung des Wirtschaftswachstums (Wachstumsbeschleunigungsgesetz)	30/12/2009	endogenous	-0.35%
2	Gesetz zur Umsetzung steuerrechtlicher Regelungen des Maßnahmenpakets "Beschäftigungssicherung durch Wachstumsstärkung"	29/12/2008	endogenous	-0.17%
3	Gesetz zur Sicherung von Beschäftigung und Stabilität in Deutschland	05/03/2009	endogenous	-0.31%
4	Gesetz zur Fortführung der Gesetzeslage 2006 bei der Entfernungspauschale	23/04/2009	Exogenous	-0.11%
5	Gesetz zur verbesserten steuerlichen Berücksichtigung von Vorsorgeaufwendungen (Bürgerentlastungsgesetz Krankenversicherung)	22/07/2009	exogenous/ endogenous	-0.44%
6	Unternehmensteuerreformgesetz 2008	17/08/2007	Exogenous	-0.20%
7	Gesetz zur steuerlichen Förderung von Wachstum und Beschäftigung	05/05/2006	Exogenous	-0.18%
8	Haushaltsbegleitgesetz 2006 (HBegLG 2006)	30/06/2006	exogenous/ endogenous	1.03%
9	Steueränderungsgesetz 2007	24/07/2006	exogenous	0.19%
10	Gesetz zur Abschaffung der Eigenheimzulage	30/12/2005	exogenous	0.26%
11	Gesetz zur Förderung der Steuerehrlichkeit	29/12/2003	exogenous	0.23%
12	Gesetz zur Änderung des Tabaksteuergesetzes und anderer Verbrauchsteuergesetze	29/12/2003	endogenous	0.11%
13	Gesetz zum Abbau von Steuervergünstigungen und Ausnahmeregelungen (Steuervergünstigungsabbaugesetz - StVergAbG)	20/05/2003	exogenous	0.11%
14	Zweites Gesetz zur Familienförderung	21/08/2001	exogenous	-0.11%
15	Gesetz zur Bekämpfung von Steuerverkürzungen bei der Umsatzsteuer und zur Änderung anderer Steuergesetze (Steuerverkürzungsbekämpfungsgesetz - StVBG)	27/12/2001	exogenous	0.12%
16	Gesetz zur Reform der gesetzlichen Rentenversicherung und zur Förderung eines kapitalgedeckten Altersvorsorgevermögens (Altersvermögensgesetz - AVmG)	29/06/2001	exogenous	-0.50%
17	Gesetz zur Fortführung der ökologischen Steuerreform	22/12/1999	endogenous	0.13%
18	Gesetz zur Familienförderung	28/12/1999	exogenous	-0.16%
19	Gesetz zur Senkung der Steuersätze und zur Reform der Unternehmensbesteuerung (Steuersenkungsgesetz - StSenkG)	26/10/2000	exogenous	-2.40%
20	Gesetz zur Ergänzung des Steuersenkungsgesetzes (Steuersenkungsergänzungsgesetz – StSenkErgG)	23/12/2000	exogenous	-0.17%
21	Steuerentlastungsgesetz 1999	23/12/1998	exogenous	-0.18%
22	Steuerentlastungsgesetz 1999/2000/2002	31/03/1999	exogenous	-0.25%
23	Gesetz zum Einstieg in die ökologische Steuerreform	29/03/1999	endogenous	0.31%

24	Gesetz zur Senkung des Solidaritätszuschlags	28/11/1997	exogenous	-0.19%
25	Gesetz zur Finanzierung eines zusätzlichen Bundeszuschusses zur gesetzlichen Rentenversicherung	23/12/1997	exogenous/ endogenous	0.29%
26	Gesetz zur Fortsetzung der wirtschaftlichen Förderung in den neuen Ländern	25/08/1997	exogenous	-0.15%
27	Jahressteuergesetz 1996	20/10/1995	exogenous	-0.52%
28	Gesetz zur Bekämpfung des Mißbrauchs und zur Bereinigung des Steuerrechts (Mißbrauchsbekämpfungs- und Steuerbereinigungsgesetz - StMBG)	29/12/1993	exogenous	0.10%
29	Erstes Gesetz zur Umsetzung des Spar-, Konsolidierungs- und Wachstumsprogramms (1. SKWPG)	29/12/1993	endogenous	0.25%
30	Gesetz zur Neuregelung der Zinsbesteuerung (Zinsabschlaggesetz)	12/11/1992	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)	26/06/1993	endogenous	1.03%
32	Gesetz zur Entlastung der Familien und zur Verbesserung der Rahmenbedingungen für Investitionen und Arbeitsplätze (Steueränderungsgesetz 1992 - StÄndG 1992)	28/02/1992	exogenous	0.15%
33	Gesetz zur Förderung von Investitionen und Schaffung von Arbeitsplätzen im Beitrittsgebiet sowie zur Änderung steuerrechtlicher und anderer Vorschriften (Steueränderungsgesetz 2001 - StÄndG 2001)	27/06/1991	endogenous	0.12%
34	Gesetz zur Einführung eines befristeten Solidaritätszuschlags und zur Änderung von Verbrauchsteuer- und anderen Gesetzen (Solidaritätsgesetz)	27/06/1991	endogenous	0.96%
35	Gesetz zur Änderung des Steuerreformgesetzes 1990 sowie zur Förderung des Mietwohnungsbaus und von Arbeitsplätzen in Privathaushalten	30/06/1989	exogenous	-0.21%
36	Gesetz zur Änderung von Verbrauchsteuergesetzen (Verbrauchsteueränderungsgesetz 1988 - VerbrStÄndG 1988)	22/12/1988	endogenous	0.35%
37	Steuerreformgesetz 1990 vom 25.7.1988	02/08/1988	exogenous	-0.84%
38	Gesetz zur Änderung des Einkommensteuergesetzes (Steuersenkungs-Erweiterungsgesetz 1988 - StSenkErwG 1988)	22/07/1987	endogenous	-0.26%
39	Gesetz zur leistungsfördernden Steuersenkung und zur Entlastung der Familie (Steuersenkungsgesetz 1986/1988 - StSenkG 1986/1988)	28/06/1985	exogenous	-1.00%
40	Gesetz zur Stärkung der Wettbewerbsfähigkeit der Wirtschaft und zur Einschränkung von steuerlichen Vorteilen (Steuerentlastungsgesetz 1984 - StEntlG 1984)	28/12/1983	exogenous	-0.19%
41	Gesetz zur Wiederbelebung der Wirtschaft und Beschäftigung und zur Entlastung des Bundeshaushalts (Haushaltsbegleitgesetz 1983)	23/12/1982	endogenous	0.47%
42	Gesetz zur Änderung von Verbrauchsteuergesetzen (Verbrauchsteueränderungsgesetz 1982 - VStÄndG 1982)	30/12/1981	exogenous	0.20%
43	Gesetz über steuerliche und sonstige Maßnahmen für Arbeitsplätze, Wachstum und Stabilität (Beschäftigungsförderungsgesetz - BeschäftFG)	08/06/1982	exogenous	-0.24%
44	Mineralöl- und Branntweinsteuer-Änderungsgesetz 1981 - MinöBranntwStÄndG 1981 -	25/03/1981	exogenous/ endogenous	0.24%
45	Gesetz zur Steuerentlastung und Familienförderung (Steuerentlastungsgesetz 1981)	21/08/1980	exogenous	-0.89%
46	Gesetz zur Änderung des Einkommensteuergesetzes, des Gewerbesteuer- und des Umsatzsteuergesetzes und anderer Gesetze (Steueränderungsgesetz 1979 - StÄndG 1979)	02/12/1978	endogenous	-0.72%
47	Gesetz zur Steuerentlastung und Investitionsförderung	08/11/1977	endogenous	-0.85%
48	Gesetz zur Verbesserung der Haushaltsstruktur (Haushaltsstrukturgesetz - HStrukG)	20/12/1975	exogenous	0.12%
49	Gesetz zur Änderung des Tabaksteuergesetzes und des Gesetzes über das Branntweinmonopol	08/07/1976	exogenous	0.14%

50	Gesetz zur Förderung von Investitionen und Beschäftigung	24/12/1974	endogenous	-0.64%
51	Gesetz zur Reform der Einkommensteuer, des Familienlastenausgleichs und der Sparförderung (Einkommensteuerreformgesetz - EStRG)	10/08/1974	exogenous	-1.33%

Notes: Revenue is the projected impact on annual tax revenue after full implementation of the law change, expressed in percent of GDP.

Figure A1: Data Plots



Notes: 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.