Fiscal Policy and Automatic Stabilisers: A SVAR Perspective

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Abstract

This paper analyses the interpretation of the impulse response analysis in a standard fiscal policy SVAR and proposes a way to disentangle the effects of a 'pure' fiscal policy shock from the working of automatic stabilisers. Building on a procedure recently proposed by Cochrane identifying the response of a variable included in a SVAR to an anticipated policy impulse, the output impulse response to a 'pure' policy shock and the working of automatic stabilisers can be identified. The analysis indicates that the discretionary policy effect is significantly smaller than the response including the endogenous working of automatic stabilisers. The result thereby supports the widely held notion that automatic stabilisers have a significant role in the overall effect of fiscal policy in the business cycle.

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1 Introduction

This paper analyses the interpretation of the impulse response analysis of a standard fiscal SVAR and proposes a way to disentangle the effects of a 'pure' fiscal policy shock from the working of automatic stabilisers. A typical SVAR analysis proceeds by identifying exogenous and unexpected policy shocks from the estimated reduced form of the model and simulates the dynamic reaction of key macroeconomic variables to these policy shocks by means of impulse response analysis. The structural shocks of a specific equation in the VAR thereby represent the 'news' in the respective variable that can not be explained by the systematic interaction of the other variables included in the system. Although the identification of uncorrelated structural policy shocks is of great use for the generation of stylised facts of the working of the economy, with respect to a comprehensive policy analysis this focus on exogenous policy shocks constitutes a severe limitation. It is for instance a standard finding of the money SVAR literature that policy shocks do not play a significant role in generating output changes over the business cycle, yet this does not imply that monetary policy more general is without real effects, see e.g. the discussion in McCallum (2001). Although theoretically a much debated issue, there is evidence that systematic rule based monetary policy exerts significant real effects on the economy. The standard SVAR analysis that is deliberately based on policy shocks certainly has not very much to say on this aspect. Likewise with regard to the analysis of fiscal policy, it is widely accepted that the built-in automatic stabilisers of the welfare and tax system play an important role in the real effects of overall fiscal policy. It is a plausible assumption that discretionary fiscal policy does not react at all to the cyclical situation of the economy in addition to the working of automatic stabilisers. Again the analysis of the systematic rule based component is an aspect that is very much neglected in the standard SVAR analysis of fiscal policy.

This paper tries to demonstrate a way to analyse the business cycle effects of both discretionary fiscal policy and automatic fiscal stabilisers in a coherent SVAR framework. The central idea of the analysis is the distinction between anticipated and unanticipated policy actions, where the systematic and hence anticipated component of fiscal policy is assumed to be restricted to the working of automatic stabilisers. In an important contribution to the SVAR literature Cochrane (1998) proposes a way to distinguish the two policy components within a standard SVAR analysis by imposing one further identifying assumption. Note that an explicit structural identification of the effects of anticipated policy is of course only possible with a fully specified model of the economy. Within the SVAR framework nevertheless the analysis of Cochrane (1998) elegantly clarifies the role of systematic policy in the overall interpretation of the impulse response analysis. The present paper builds on this work and discusses a way to identify both the effects of discretionary fiscal policy and the working of automatic stabilisers in a standard SVAR set-up. The analysis indicates that the pure discretionary policy effect is significantly smaller than the response including the endogenous working of automatic stabilisers. The result thereby supports the widely held notion that automatic stabilisers have a significant role in the overall effect of fiscal policy in the business cycle.

The paper is structured as follows. The following section starts by briefly discussing the identification of fiscal policy in empirical models and then presents a VAR set-up and the results of this analysis applied to Germany, while details of the SVAR specification and the data used can be found in the appendix. Section 3 introduces the explicit analysis of automatic stabilisers in the SVAR framework. After discussing some restrictions of the standard impulse response analysis, the Cochrane methodology is presented and applied to the VAR analysis of fiscal policy in Germany. The last section concludes.

2 The Effects of Discretionary Fiscal Policy

2.1 Identifying Discretionary Fiscal Policy

One key problem for an empirical analysis of fiscal policy is identifying discretionary policy actions from the aggregate data available. The main methodological problem thereby is that budget variables move in reaction to discretionary policy but also due to automatic stabilisers built into the tax and welfare system of the economy. There is no commonly accepted method to disentangle these two effects to get the 'pure' policy effect out of fiscal data.

Past research on the effects of fiscal policy has usually focused either on estimating dynamic multipliers from large macroeconometric models or on reduced form studies that concentrate on summary indicators like the structural deficit or aggregates like expenditure and revenue variables.[1] More recently it has been tried to identify discretionary fiscal policy as exogenous policy shocks using both the 'narrative' and the SVAR approach. These approaches identify discretionary policy changes as unexpected policy shocks and thereby disentangle the discretionary policy component from any systematic and predictable policy move as well as from the working of automatic stabilisers. Once identified, the dynamic effects of these policy shocks on the economy can be simulated with the help of dynamic econometric techniques.[2] Ramey and Shapiro (1998) use the 'narrative' approach formerly used for monetary policy to identify episodes in the American history that led to three large military build-ups. Based on these episodes they construct military build-up dates which can be interpreted as an indicator of unanticipated shifts in fiscal policy. An extension of this approach is presented

[1] A very good comparison of estimates from different large scale macroeconometric models is presented in Bryant et al. (1988). For a discussion of fiscal indicators see Blanchard (1993), reduced form studies on the effects of fiscal policy include Barro (1981), Aschauer (1985) and Graham (1993), see also the survey in Elmendorf and Mankiw (1999).

[2] In this respect policy analysis in a SVAR model is close to the concept of policy analysis in the rational expectations literature, see e.g. Breitung (2001) for an appealing illustration.

in Edelberg et al. (1999).

In contrast to the 'narrative' approach, a number of studies try to identify fiscal policy shocks as the residuals of a SVAR model, a method so far mainly used for the identification of monetary policy shocks. As a first VAR-type application to the analysis of fiscal policy, Rotemberg and Woodford (1992) identify the reduced form residuals of a regression of defence purchases on a number of macroeconomic variables as policy shocks. These residuals are then used in a VAR to simulate the dynamic response of the economy to these shocks. Blanchard and Perotti (1999) are the first to construct a structural VAR model for the US economy to recover shocks related to unexpected government expenditure and tax revenues within the system.[3] Standard impulse response techniques are then used to identify the dynamic response of the economy to the identified shocks.

Note that the impulse responses can be thought of as the result of a particular 'policy experiment' implemented within the SVAR system. Take for instance the response of the system to a tax shock: this policy experiment assumes that for one period tax rates are unexpectedly increased. The impulse responses then indicate the dynamic and joint endogenous response of the variables included in the system to this one-off exogenous policy shock. Although this scenario may not be very 'realistic' in the sense that fiscal policy is actually implemented in this way, it is nevertheless a very useful analytical exercise, as due to the orthogonality assumption it isolates the response of the macroeconomic system to this particular exogenous policy shock. To generate stylised facts of the response of a macroeconomic system to specific policy shocks, a SVAR analysis thus seems to be a good starting point.

[3]Other recent SVAR studies of fiscal policy include Bruneau and de Bandt (1999), Fatás and Mihov (2001), Mountford and Uhlig (2000), Dalsgaard and de Serres (1999) and Höppner (2001).

2.2 The VAR

The empirical analysis of fiscal policy in this paper is based on the following basic reduced form formulation of a VAR:

$$Y_t = A_0 + A_1 Y_{t-1} + ... + A_p Y_{t-p} + U_t, \tag{1}$$

where Y_t is a three dimensional variable vector containing tax revenues, government expenditures and GDP, the A_i are the coefficient matrices and U_t is a vector containing the reduced form residuals which are assumed to be normally distributed white noise with a constant variance-covariance matrix $E(U_t U_t') = \Sigma_U$.[4] For more details on the data and the specification of the reduced form see appendix A.

In order to obtain orthogonal innovations for each variable included in the VAR, one has to factorise the variance-covariance matrix obtained by the estimation of the reduced form. $A \cdot U_t = B \cdot E_t$ defines the vector of structural innovations E_t as linear combinations of the reduced form residuals U_t. It is assumed that the elements of E_t, e_t, are normally distributed with unit variance, i.e. $E(E_t E_t') = \Sigma_E = I$. To fully identify the structural innovations, one has to impose additional restrictions on the system, where this paper follows the idea of Blanchard and Perotti (1999). Consider the following version of the relationship $A \cdot U_t = B \cdot E_t$,

$$\begin{aligned} u_r &= \alpha_1 u_y + e_r \\ u_e &= \beta_1 u_y + e_e \\ u_y &= \gamma_1 u_r + \gamma_2 u_e + e_y. \end{aligned} \tag{2}$$

In the preceding equations, u_r, u_e and u_y represent the reduced form residuals for

[4] A general exposition of the VAR model is given in Lütkepohl (2001). The underlying VAR used here is very similar to the model spelled out in Höppner (2001), where the present paper uses income tax revenues instead of total tax revenues to focus explicitly on the working of automatic stabilisers.

government expenditure, tax revenues and GDP, whereas e_r, e_e and e_y are the structural shocks to be recovered. The key argument of Blanchard and Perotti is that using time series at the quarterly frequency ensures that there is no *discretionary* response of fiscal policy to unexpected movements in GDP within the same period. Due to the use of quarterly data as a consequence the response of income tax revenues to business cycle movements within the same quarter can be solely attributed to the working of automatic stabilisers. To illustrate this point, take for instance the first equation of system (2),

$$u_r = \underbrace{\alpha_1 u_y}_{autom.stab.} + \underbrace{e_r}_{policy}. \tag{3}$$

If there is no response of discretionary tax policy to unexpected movements in output within the same period, the coefficient α_1 solely captures the working of the automatic stabilisers in the economy, the same is true for the coefficient β_1. The whole system given in (2) therefore defines a recursive structure on the contemporaneous interaction between the endogenous variables.

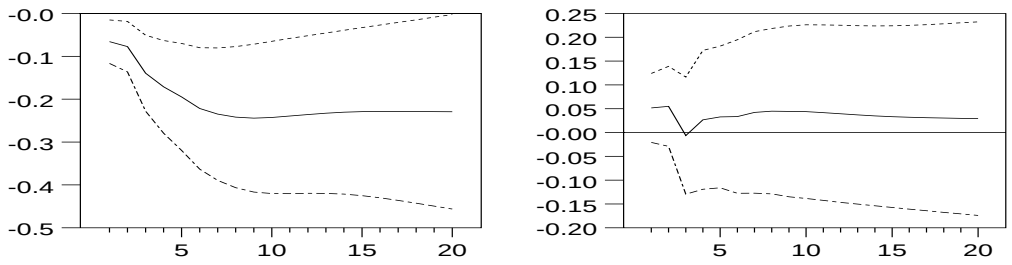
To fully identify the model, some additional assumptions on the coefficients are necessary. Note that the expenditure variable is defined as government consumption and investment excluding current transfers. As automatic stabilisers on the expenditure side work mainly through social transfers like benefits paid out by the unemployment insurance, one can assume that there is no automatic feedback from movements in output to government expenditures, setting $\beta_1 = 0$. The value of the elasticity α_1 is certainly nonzero but can not be properly estimated within the model due to the potential endogeneity of output. Therefore, following Blanchard and Perotti (1999) identification of the SVAR is achieved by using additional information about the output elasticity of tax revenues. Weighting OECD estimates of the cyclical elasticity of income taxes paid by the household and the corporate sector by their relative share in total income tax revenues, one

arrives at an average income tax elasticity for Germany of 1.3, which in turn is the value that is imposed on the data.[5] The contemporaneous reaction of output to unexpected movements in tax revenues is captured by γ_1, the contemporaneous reaction of output to movements in expenditure by γ_2, both coefficients are unrestricted and can be estimated in the model.

2.3 The Response of the Economy to Fiscal Policy Shocks

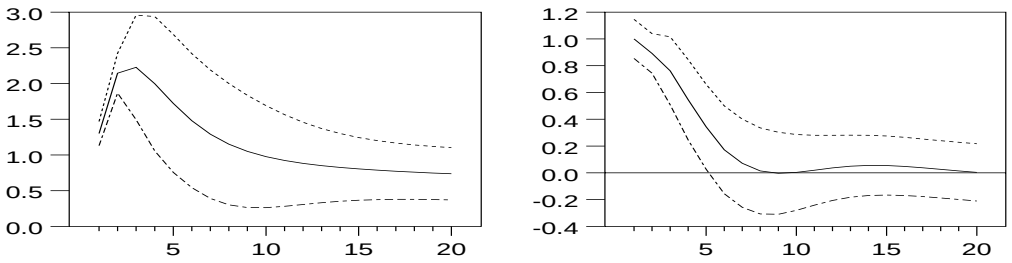
Figure 1 presents the impulse responses generated from the SVAR model presented in the preceding section. All impulse responses presented in this paper indicate the deviation of the shocked variable in percent from some baseline value in response to a one percent shock measured at this baseline value. The dashed lines are 5 percent asymptotic error bands. The responses of output to tax and expenditure shocks are given in the first two panels of figure 1. An unexpected increase in tax revenues leads to a decrease in output, see figure 1(a), whereas there is an increase in output after a shock to government expenditure, see figure 1(b). In response to the tax shock, GDP converges relatively smooth to its new long run level at which GDP is about 0.35 percent lower. The expenditure shock induces an impact increase of GDP of about 0.07 percent, which afterwards decreases and then increases again. In contrast to the reaction of output to a tax shock, the response of output to a shock to government expenditures is only significant on impact. While tax policy has a considerable and significant output effect, the result points towards a very small if not negligible effect of unexpected fiscal expansions on the economy.

[5]The OECD estimates of the elasticities for direct taxes paid by the corporate sector and direct taxes paid by the household sector are 2.5 and 0.9, respectively, see e.g. Leibfritz (1999). Alternatively using individual tax elasticity estimates of the German ifo-institute, namely 1.0 and 1.6, respectively, one arrives at an average income tax elasticity of 1.45, which is slightly higher than the OECD average. Nevertheless, the imposed value for the output elasticity should be regarded as tentative as the estimation of this elasticity itself is connected to huge methodological problems, note that it moreover may not be time-invariant.



(a) Response of GDP to TAX

(b) Response of GDP to GEX



(c) Response of TAX to GDP

(d) Response of TAX to TAX

Figure 1: **Impulse Responses, 3 Variable SVAR**

Moreover, a first approach to the analysis of automatic stabilisers in a fiscal VAR model can be given by examining figures 1(c) and (d). Figure 1(c) presents the response of tax revenues to an unanticipated shock to output and therefore indicates the degree of the cyclical sensitivity of total tax revenues in the German economy. It has been argued in the previous section that the use of data at the quarterly frequency rules out a contemporaneous discretionary response of tax policy to business cycle movements. Moreover it seems to be a reasonable assumption that in contrast to monetary policy *discretionary* fiscal policy does not react at all systematically to output changes over the cycle. Rule-based, and therefore anticipated systematic fiscal policy then works predominantly through automatic stabilisers, at least on the tax side of the budget. It follows that the response of tax revenues to an output shock captured in 1(c) is predominantly due to the automatic response of tax revenues to output changes. It will be important in the argumentation of the following section that this response reflects

the average systematic response of tax revenues to the business cycle, where this systematic component of fiscal policy can be on average anticipated by the public. Finally figure 1(d) presents the response of total tax revenues to a tax shock. It indicates that after a one percent tax shock, tax revenues remain positive, while gradually declining back to the baseline value. Due to the assumption that there is no systematic reaction of fiscal policy to the business cycle, this again reflects the working of automatic stabilisers in the economy. It is the negative output response to the initial tax shock that leads to the decline in tax revenues. In the next step of the analysis the role of the automatic stabilisers in the VAR analysis of fiscal policy is looked at a bit closer.

3 Automatic Stabilisers in the VAR Analysis of Fiscal Policy

The analysis of the effects of fiscal policy on output so far has focused on the effects of discretionary fiscal policy shocks. In this section of the paper the foregoing analysis is extended by examining the role of automatic stabilisers in the effects of the policy shocks on output presented in figures 1 (a) and (b).

3.1 Limitations of the Standard Impulse Response Analysis

Bringing the output reaction to fiscal policy shocks and the working of automatic stabilisers together, one can easily identify an important and sometimes overlooked aspect in the interpretation of impulse responses generated in a VAR. The key point, emphasised by Cochrane (1998), is that the interpretation of the output effect caused by a policy shock usually focuses on the output impulse response function alone, while the further policy stance depicted in the impulse response function for the policy instrument itself is ignored.

Applying this viewpoint to the results reported for the fiscal policy model, figure 1(a) indicates that the output response to an unexpected tax shock is about 0.8 percent of GDP, showing no tendency to return to its baseline value. The central argument now is that this output response is not necessarily exclusively due to the initial tax shock, but may be in addition be attributed to the output effects of the further response of the policy instrument, namely the path of tax revenues given in figure Figure 1(c). Hence it is important for the interpretation of the impulse response of output to the policy shock that it is *conditional* on the average historical reaction of the policy instrument itself to the policy shock.

Figure 1(d) indicates that after a one percent tax shock, tax revenues remain positive for some years while gradually declining back to the baseline value. Note that figure 1(d) presents the average historical response of tax revenues to a tax shock. Therefore, this response of tax revenues is in contrast to the initial shock anticipated once the shock has occurred. In other words, the agents in the economy can, on average, expect this response of tax revenues once an unexpected shock has hit the economy. Cochrane (1998) argues that this information should not be neglected in the interpretation of the output impulse response function. If the anticipated policy reaction indeed has real effects on the economy, the total output response given in figure 1(a) is due both to the initial policy shock and the effects of the endogenous reaction of the policy variable. The remainder of the paper discusses the implications of this argument for the analysis of fiscal policy in standard SVAR models.

The following point is worth mentioning. Cochrane (1998) illustrates his reasoning using a standard money SVAR model. He argues that the average path of the interest rate and output following a monetary policy shock provides at best an incomplete answer regarding the output effects of monetary policy actions more generally. This is due to the fact that monetary policy certainly not always reacts

in the way the impulse response analysis indicates. This problem regarding the interpretation of the impulse response is certainly less severe in the case of fiscal policy, as the reaction of the policy instrument to the policy shock is attributed to the working of automatic stabilisers. Disregarding changes in the underlying tax structure of the economy, automatic stabilisers constitute a rule based and therefore stable component of 'policy' that at least in the short run is clearly disconnected from policy initiatives and changes. The impulse response of tax revenues to the business cycle shock hence may indeed reflect the typical reaction of the economy to this specific policy shock.

3.2 Identifying Automatic Stabilisers

To obtain a more complete answer regarding the real effects of policy actions, Cochrane argues that one further theoretical identification assumption is necessary. To gain full identification of the model that distinguishes between a discretionary and a rule based policy component he proposes to specify the effectiveness of an anticipated policy impulse relative to the effectiveness of an unanticipated policy shock of similar size. Conditional on this identifying assumption it is then possible to calculate from the estimated impulse responses the output effects of anticipated fiscal policy. To put it more into the context of the present paper, the algorithm disentangles explicitly the 'pure' discretionary policy effect and the working of automatic stabilisers.

The intuition behind the algorithm is straightforward. In section 3.1 it has been argued that if one assumes that anticipated fiscal policy has no effect, the output response in figure 1(a) is indeed exclusively due to the fiscal policy shock. If on the other hand anticipated policy has an effect, the output response is due both to the initial policy shock and the further endogenous reaction of the policy variable. Taking the impulse responses given by figure 1(a) and 1(c), with the

additional identifying assumption of the relative effectiveness of both types of policy, impulse responses for the output effects of a policy shock and anticipated policy can be generated. In effect, the Cochrane procedure quantifies the real effects of the endogenous policy response given in figure 1(d), or, which is the same, it quantifies the real effects of automatic stabilisers. For full identification thus the relative effectiveness of an anticipated policy impulse and an unanticipated policy shock of similar size has to be specified. The aim of the present analysis is hence not to estimate the relative effectiveness from the data, but rather to demonstrate the consequences of different parameter choices for the identification of automatic stabilisers and thereby for the interpretation of the impulse responses generated in the standard SVAR model.

Consider the following version of an IS curve,

$$y_t = a^*(L)[\lambda g_t + (1-\lambda)(g_t - E_{t-1}g_t)] + b^*(L)\delta_t, \tag{4}$$

where $a^*(L)$ and $b^*(L)$ are structural lag polynomials, g_t and $(g_t - E_{t-1}g_t)$ denote overall and surprise fiscal policy actions, respectively, and δ_t captures additional output disturbances that are orthogonal to fiscal policy. For $\lambda \to 0$ equation (5) converges towards the extreme case that only unanticipated policy has an effect, while $\lambda \to 1$ indicates that both policy components have the same relative effectiveness. Specifying a value for λ hence is the additional assumption needed to disentangle discretionary fiscal policy and automatic stabilisers in the VAR framework discussed above. The recursive algorithm proposed in Cochrane (1998) can then be used to identify the polynomial $a^*(L)$, see appendix B for a brief outline of the procedure.

The available theoretical literature on the effects of fiscal policy is unfortunately not very helpful concerning the choice of a specific value for λ. The working of automatic stabilisers is typically motivated in a Keynesian framework, where automatic tax changes over the business cycle affect disposable income of the

private households and hence exert their stabilising power via a countercyclical effect on private demand. It follows for the standard Keynesian model that there is no difference between the effectiveness of discretionary policy and automatic stabilisers which is reflected in a value for λ of one. Note that the other extreme case, in which there is no distinction between the effects of discretionary policy and automatic stabilisers, is a purely Ricardian world. Here, a change in taxes will be offset by a future adjustment in taxes in the opposite direction, irrespective of whether the initial tax change is anticipated or not. Private agents, by internalising the government budget constraint perfectly anticipate future policy changes and therefore react by a change in savings and not by adjusting their expenditures. Tax changes, assuming constant government expenditures, in this model are generally without effect, see e.g. the discussion in Christiano (1984). The result of a significant effect of a tax shock on output presented in section 2.3 nevertheless directly contradict this proposition.

Christiano (1984) argues that the neoclassical policy ineffectiveness proposition, which proposes that only unanticipated monetary policy may have a real effect, does not carry over to the case of income taxes. Certainly the validity of the ineffectiveness proposition would have given rise to a value of λ smaller than one and in the extreme even of zero. A branch of the theoretical literature that takes expectations on fiscal policy directly into account is the recent literature on 'non-Keynesian' effects of fiscal policy.[6] Bertola and Drazen (1993) propose a model, in which under certain circumstances anticipated fiscal policy in the form of government expenditures has no effect on private consumption. Blanchard (1990) presents a model, in which the effect of tax changes on private consumption to some extent depends on the degree this tax policy has been anticipated. Both models yet analyse sizeable discretionary measures implemented by the government to stabilise public finances from some unsustainable level. It is not possible

[6]See e.g. the overview given in Giavazzi and Pagano (1996)

to directly map this theoretical concept into the present empirical framework, as due to the identification approach chosen in the present paper anticipated fiscal policy is connected to the working of automatic stabilisers and not the irregular occurance of distinct stabilisation programs of the government. It follows from this brief discussion that there is not much theoretical foundation for a choice of λ greatly different from one. For illustrative purposes however the results in the following section will be presented for different choices of λ.

3.3 Consequences for the Fiscal Policy Impulse Responses

The result of applying the foregoing argumentation to the fiscal policy effects identified in the SVAR are presented in figures 2 and 3. Figure 2 presents the response of output to a tax shock for four different choices of the parameter λ, reflecting different views about the relative effectiveness of discretionary fiscal policy and the working of automatic stabilisers as discussed in the last section. The solid line in figure 2 for $\lambda = 0$ repeats the response of output to a tax shock already presented in figure 1(a). As has been argued above, figure 1(a) is subject to the endogenous working of the automatic stabilisers as shown in figures 1(c) and (d). If now automatic stabilisers have no effect on the economy, which is reflected in $\lambda = 0$, both responses must be equal. In other words, figure 1(a) only reflects the pure effect of the fiscal policy shock on output when automatic stabilisers are itself without real effects. Three additional simulations for λ equal to 0.2, 0.5 and 1 respectively are plotted in 2. It is very clear from the figure that the higher λ is set, the weaker is the pure policy shock effect excluding the endogenous working of the automatic stabilisers. In the extreme case of equal effectiveness reflected in $\lambda = 1$, the case that is assumed to be the most realistic, the pure shock effect on output is less than one fourth of the initial response. This in turn indicates that the working of automatic stabilisers has a consider-

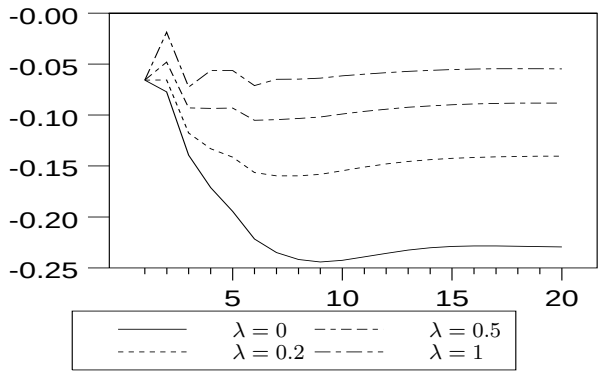


Figure 2: The Adjusted Response of GDP to a Policy Shock

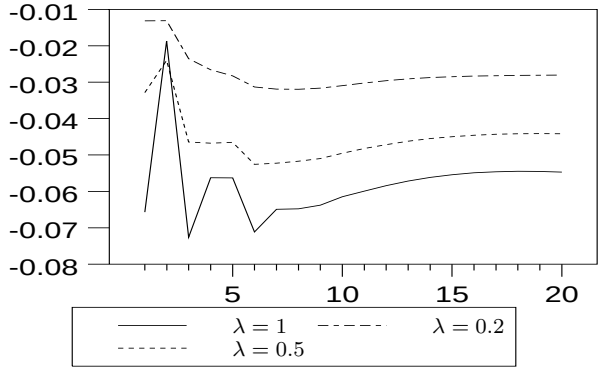


Figure 3: The Effectiveness of Automatic Stabilisers

able share in the total effect of a tax shock on output and hence supports the widely held notion that automatic stabilisers have a significant role in the overall effect of fiscal policy in the business cycle.

In addition figure 3 plots the response of output to a tax impulse that is due to the working of automatic stabilisers. Note that the response for $\lambda = 1$ is necessarily the same in figures 3 and 2, as these response are simulated for the assumption of equal effectiveness. Figure 3 in addition depicts the effectiveness of automatic stabilisers for λ equal to 0.5 and 0.2. The lower λ is set, the weaker the response, certainly there is no output response at all due to the automatic stabilisers for the case $\lambda = 0$.

The foregoing discussion has demonstrated a way to disentangle the effects of discretionary fiscal policy and automatic stabilisers in a standard SVAR framework. However it is not argued that the adjusted response presented in figures

2 and 3 reflect an exact 'structural' identification of automatic stabilisers, a task that can only be performed in a fully specified dynamic macroeconomic model. The aim is rather to make a methodological point, discussing in more detail as typically made the implications of the SVAR impulse response analysis.

4 Conclusion

The aim of this paper is to demonstrate a way to analyse the business cycle effects of both discretionary fiscal policy and automatic fiscal stabilisers in a coherent SVAR framework. To achieve this aim it applies a recursive algorithm proposed by Cochrane (1998) to disentangle the effects of purely exogenous and therefore unexpected policy shocks from the endogenous, rule based component of policy identified in a SVAR model. Cochrane made the forceful point that not taking this distinction into account may lead to a misleading interpretation of a standard SVAR impulse response analysis.

The present paper applies this methodology to a fiscal policy SVAR for the German economy. It argues that due to the structural identification scheme used the endogenous, rule based component of fiscal policy can be interpreted as the working of automatic stabilisers in the economy. Applying the Cochrane methodology to the case of a fiscal SVAR therefore gives an impulse response of output to a fiscal policy shock that is the 'pure' policy effect, adjusted for the working of automatic stabilisers.

The main conclusion of the paper is that when analysing the effects of fiscal policy in a SVAR framework, not explicitly taking the effects of automatic stabilisers into account gives a hugely misleading picture of the effects of fiscal policy *shocks* on the economy. The analysis indicates that the pure discretionary policy effect is significantly smaller than the response including the endogenous working of automatic stabilisers. The result thereby supports the widely held notion that

automatic stabilisers have a significant role in the overall effect of fiscal policy in the business cycle.

The paper however does not argue that the presented methodology provides a proper way to structurally identify the effect of anticipated, rule based policy elements, a task that can only be performed in a fully specified dynamic macroeconomic model. The key point of the foregoing analysis rather is to reveal the consequences of explicitly taking into account the potential effectiveness of automatic stabilisers for the interpretation of the impulse response analysis within the standard SVAR framework. Knowledge of this may help improving the usefulness of a SVAR impulse response analysis in applied economic research and also getting a clearer picture of its limitations.

References

Aschauer, David A. (**1985**): Fiscal Policy and Aggregate Demand, *American Economic Review*, vol. 75(1): pp. 117–127.

Barro, Robert J. (**1981**): Output Effects of Government Purchases, *Journal of Political Economy*, vol. 89(6): pp. 1086–1121.

Bertola, Guiseppe and Drazen, Allen (**1993**): Trigger Points and Budget Cuts: Explaining the Effects of Fiscal Austerity, *American Economic Review*, vol. 83(1): pp. 1170–1188.

Blanchard, Olivier J. (**1990**): Comment on Giavazzi and Pagano (1990): "Can Severe Fiscal Contractions Be Expansionary?", *Macroeconomics Annual*, pp. 111–116.

— (**1993**): Suggestions for a New Set of Fiscal Indicators, in: Harrie A. Verbon and Frans Van Winden (eds.), *The Political Economy of Government Debt*, pp. 307–325, North-Holland.

Blanchard, Olivier J. and Perotti, Roberto (**1999**): An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output, NBER Working Paper No. 7269.

Breitung, Jörg (**2001**): Recent Developments in the Structural Analysis of Time Series, Mimeo, institut für statistik und ökonometrie, humboldt-universität zu berlin.

Bruneau, Catherine and de Bandt, Olivier (**1999**): Fiscal Policy in the Transition to Monetary Union: A Structural VAR Model, Discussion Paper, Banque de France, No. 60.

Bryant, Ralph C., Henderson, Dale W., Holtham, Gerald, Hooper, Peter and Symansky, Steven A. (eds.) (**1988**): *Empirical Macroeconomics for Interdependent Economies*, The Brookings Institution.

Christiano, Lawrence J. (**1984**): A Reexamination of the Theory of Automatic Stabilizers, *Carnegie-Rochester Conference Series on Public Policy*, vol. 20: pp. 147–206.

Cochrane, John H. (**1998**): What Do the VARs Mean? Measuring the Output Effects of Monetary Policy, *Journal of Monetary Economics*, vol. 41(2): pp. 277–300.

Dalsgaard, Thomas and de Serres, Alain (**1999**): Estimating Prudent Budgetary Margins for 11 EU Countries: A Simulated SVAR Model Approach, OECD Economics Department Working Papers No. 216.

Edelberg, Wendy, Eichenbaum, Martin and Fisher, Jonas D.M. (**1999**): Understanding the Effects of a Shock to Government Purchases, *Review of Economic Dynamics*, vol. 2: pp. 166–206.

Elmendorf, Douglas W. and Mankiw, N. Gregory (**1999**): Government Debt, in: John B. Taylor and Michael Woodford (eds.), *Handbook of Macroeconomics, Volume 1C*, pp. 1615–1669, Elsevier.

Fatás, Antonio and Mihov, Ilian (**2001**): The Effects of Fiscal Policy on Consumption and Employment: Theory and Evidence, CEPR Discussion Paper No. 2760.

Giavazzi, Francesco and Pagano, Marco (**1996**): Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience, *Swedish Economic Policy Review*, vol. 3(1): pp. 67–103.

Graham, Fred C. (**1993**): Fiscal Policy and Aggregate Demand: Comment, *American Economic Review*, vol. 83(3): pp. 659–666.

Höppner, Florian (**2001**): A VAR Analysis of Fiscal Policy in Germany, unpublished mimeo, Institute for International Economics, University of Bonn.

Lütkepohl, Helmut (**2001**): Vector Autoregressions, in: Badi H. Baltagi (ed.), *A Companion To Theoretical Econometrics*, pp. 678–699, Blackwell.

McCallum, Bennett T. (**2001**): Analysis of the Monetary Transmission Mechanism: Methodological Issues, in: Deutsche Bundesbank (ed.), *The Monetary Transmission Process: Recent Developments and Lessons for Europe*, pp. 11–43, Palgrave.

Mountford, Andrew and Uhlig, Harald (**2000**): What are the Effects of Fiscal Policy Shocks?, unpublished mimeo.

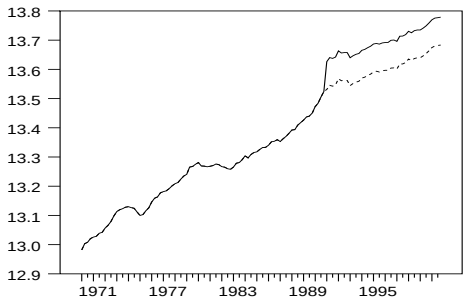
Ramey, Valerie A. and Shapiro, Matthew D. (**1998**): Costly Capital Reallocation and the Effects of Government Spending, *Carnegie-Rochester Conference Series on Public Policy*, vol. 48: pp. 145–194.

Rotemberg, Julio J. and Woodford, Michael (**1992**): Oligopolistic Pricing and the Effects of Aggregate Demand on Economic Activity, *Journal of Political Economy*, vol. 100(6): pp. 1153–1207.

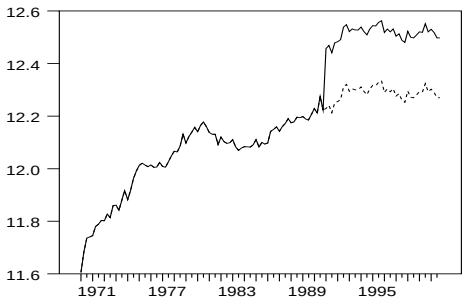
A Data Description and Model Specification

In the basic VAR analysis of the present paper the vector Y contains income tax revenues, government expenditures and GDP. The two fiscal series are taken from the Bundesbank Monthly Bulletin covering the general government, including the central government budget, the 'Lnder' and 'Gemeinden' budgets, but excluding social security funds. All variables are on a cash basis and at the quarterly frequency, the time series run from 1970:1 to 2000:4. Expenditures are defined as total government expenditures, including government consumption, investment and public transfers like subsidies. Tax revenues are total revenues from direct and indirect taxes. Output is real GDP based on the quarterly national accounts of the German Institute of Economic Research (DIW). All series are seasonally adjusted. GDP is deflated by the GDP deflator, the fiscal series by the CPI index. In addition, the time series are adjusted for the level shift due to German unification by regressing the series in first differences on a dummy that has a unit entry at the date the shift occurs. The level of the data then is adjusted by removing the effect captured by the dummy. In the following plot of the data, the adjusted series is given as the dashed lines.

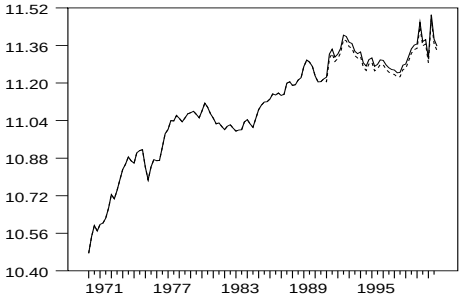
Figure 4: **Plot of Time Series (in Logarithms)**



(a) GDP



(b) Expenditures



(c) Income Taxes

A unit root analysis of the time series over the full sample shows that all variables are clearly $I(1)$, i.e. they can be modelled as being driven by a stochastic trend. Applying the Johansen trace-test for cointegration to the system significantly indicates the existence of one cointegrating vector among all three endogenous variables. Therefore for the final VAR specification of the reduced form given by equation (1) the variables are included in levels, the model is then estimated using 4 lags.
Two specification checks are in addition made. First, the VAR is estimated in first differences, which is the right specification if no cointegration is existent among the variables. Second, as an alternative to specifying the model in levels, cointegration is imposed explicitly and the final VAR is estimated in VECM form, see Lütkepohl (2001). Both sensitivity checks give results that are qualitatively very much in line with the results presented in this paper, although magnitudes sometimes differ.

B The Cochrane Procedure

Cochrane (1998) has demonstrated a way to identify the polynomial $a^*(L)$ of the following IS-curve from the estimation output of a standard SVAR,

$$y_t = a^*(L)[\lambda g_t + (1-\lambda)(g_t - E_{t-1}g_t)] + b^*(L)\delta_t, \tag{5}$$

where the parameter λ is a choice parameter as discussed in section 3.2 of the paper that has to be imposed as an identifying assumption. The starting point of the procedure to identify $a^*(L)$ is the estimated SVAR model. Consider the moving average representation of output and the policy instrument,

$$\begin{bmatrix} g_t \\ y_t \end{bmatrix} = \begin{bmatrix} c_{gg} & c_{gy} \\ c_{yg} & y_{yy} \end{bmatrix} \begin{bmatrix} e_{g,t} \\ e_{y,t} \end{bmatrix}, \tag{6}$$

where $e_{g,t}$ and $e_{y,t}$ are the structural residuals from the SVAR. The $c(L)$ are the structural polynomials of the moving average representation of the SVAR, i.e. the impulse response functions. In order to identify $a^*(L)$, the moving average representations of equation (6) are substituted into the IS curve (5). The elements of $a^*(L)$ are then given by

$$a_0^* = \frac{c_{ym,0}}{c_{mm,0}} \tag{7}$$

and

$$a_j^* = \frac{c_{ym,j} - \lambda \Sigma_{k=0}^{j-1} a_k^* c_{mm,j-k}}{c_{mm,0}}. \tag{8}$$