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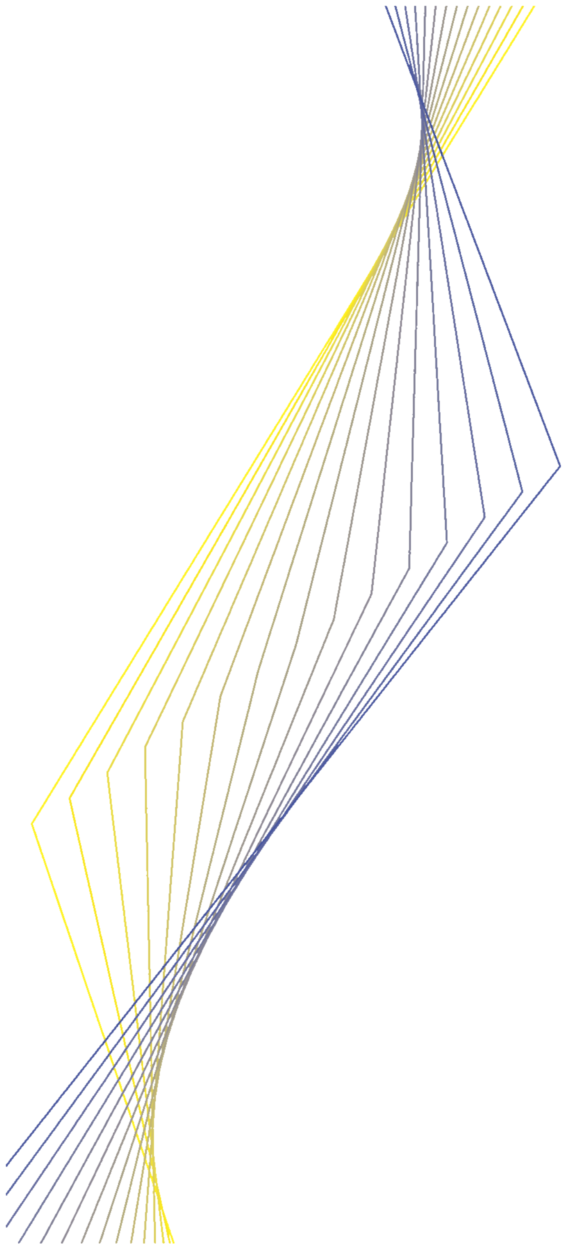

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Contents

Abstract

This paper studies the effects of fiscal policy on GDP, prices and interest rates in 5 OECD countries, using a structural Vector Autoregression approach. Its mains results can be summarized as follows; 1) The effects of fiscal policy on GDP and its components have become substantially weaker in the last 20 years; 2) The tax multipliers tend to be negative but small; 3) Once plausible values of the price elasticity of governments spending are imposed, the negative effects of government spending on prices that have been frequently estimated become positive, although usually small and not always significant; 4) Government spending shocks have significant effects on the real short interest rate, but uncertain signs; 5) Net tax shocks have very small effects on prices; 6) The US is an outlier in many dimensions; US responses to fiscal shocks are often not representative of the average OECD country included in this sample.

JEL: E62, H30

Key words: fiscal policy, government spending, Vector Autoregression, taxation

Non-technical summary

It is an article of faith among many economists that fiscal policy is a dangerous countercyclical tool, because by the time a change is decided, implemented, and takes effect, the cyclical conditions of the economy might change radically. By revealed preferences, most policymakers seem to disagree. Despite the many misgivings, time and again we observe policymakers trying to boost the economy by increasing spending or decreasing taxes.

We know surprisingly little on the effects of these policies. Many more resources have been devoted by economists to the study of monetary policy than fiscal policy. This is doubly unfortunate, because there is probably much more dispersion of beliefs among the profession on the effects of fiscal policy than on the effects of monetary policy. For instance, while most would agree that an exogenous 10 percent increase in money supply will lead to some increase in prices after a while, perfectly reasonable economists can and do disagree even on the *sign* of the response of private consumption or private investment to an exogenous shock to government purchases of goods.

Recent developments both in the theory and in the practice of monetary policy have also emphasized the link between fiscal and monetary policy. At the policy level, many of the institutional provisions of the EMU have been rationalized in terms of constraints on fiscal policy to enable monetary policy to achieve its mandate of price stability. And several policy measures, like the EU Council of Ministers' reprimand against Ireland in February 2001, have been motivated by the alleged affects of specific fiscal policy actions on inflation and interest rates. At the academic level, research on the Taylor rule has inevitably run into the issue of how fiscal policy might interfere with interest rate control.

One important reason why relatively little empirical work has been done on the effects of fiscal policy is probably the difficulty in assembling the necessary data at high enough frequency and over sufficiently long periods. In this paper, I present evidence on the effects of fiscal policy on GDP and its components, the price level, and the short interest rate, for five countries for which I was able to assemble sufficiently detailed quarterly data on the budget of the general government: the US, West Germany, the UK, Canada, and Australia. I do so using an approach originally developed in Blanchard and Perotti [2002]: in essence, the method exploits institutional features of fiscal policymaking and detailed information on the automatic effects of GDP and inflation on tax revenues and governments spending to identify the exogenous fiscal policy shocks in a structural vector autoregression. This is obviously not the first paper to study the effects of fiscal policy: however, almost all the existing time series evidence refers to the United States.

The main conclusions of the analysis can be summarized as follows: 1) The effects of fiscal policy on GDP and its components have become substantially weaker in the last 20 years; 2) The estimated effects of fiscal policy on GDP tend to be small: in the pre-1980 sample, positive government spending multipliers larger than 1 tend to be the exception; in the post-1980 period, significantly negative multipliers of government spending are the norm; the tax multipliers are even smaller; 3) To understand the effects of fiscal policy on prices, the price elasticity of government budget items is crucial, an issue that has not been widely appreciated; 4) Once plausible values of the price elasticity of government spending are imposed, the negative effects of government spending on prices that have been frequently estimated become positive, although usually small and not always significant; 5) Government spending shocks have significant effects on the real short interest rate, but of uncertain signs: after 4 quarters, positive in three countries, negative in two; 6) Net tax shocks have very small effects on prices, typically negative or zero in the second part of the sample; 7) The US is an outlier in many dimensions; responses to fiscal shocks estimated on US data are often not representative of the average OECD country included in this sample.

1 Introduction

It is an article of faith among many economists that fiscal policy is a dangerous countercyclical tool, because by the time a change is decided, implemented, and takes effect, the cyclical conditions of the economy might change radically. By revealed preferences, most policymakers seem to disagree. Despite the many misgivings, time and again we observe policymakers trying to boost the economy by increasing spending or decreasing taxes.

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Recent developments both in the theory and in the practice of monetary policy have also emphasized the link between fiscal and monetary policy. At the policy level, many of the institutional provisions of the EMU have been rationalized in terms of constraints on fiscal policy to enable monetary policy to achieve its mandate of price stability. And several policy measures, like the EU Council of Ministers's reprimand against Ireland in February 2001, have been motivated by the alleged affects of specific fiscal policy actions on inflation and interest rates. At the academic level, research on the Taylor rule has inevitably run into the issue of how fiscal policy might interfere with interest rate control (see Taylor [1996], Taylor [2000], and Woodford [1999]); more generally, the fiscal theory of the price level has emphasized the potential links between fiscal policy and the price level (see, among others, Cochrane [2001], Sims [1994] and [1999], and Woodford [2001]).[1]

[1] The evidence presented in this paper, however, has nothing to say on the fiscal theory of the price level. By its nature, the theory places no testable restriction on the observed relation between fiscal variables and the price level.

One important reason why relatively little empirical work has been done on the effects of fiscal policy is probably the difficulty in assembling the necessary data at high enough frequency and over sufficiently long periods. In this paper, I present evidence on the effects of fiscal policy on GDP and its components, the price level, and the short interest rate, for five countries for which I was able to assemble sufficiently detailed quarterly data on the budget of the general government: the US, West Germany, the UK, Canada, and Australia. I do so using an approach originally developed in Blanchard and Perotti [2002]: in essence, the method exploits institutional features of fiscal policymaking and detailed information on the automatic effects of GDP and inflation on tax revenues and government spending to identify the exogenous fiscal policy shocks in a structural vector autoregression. This is obviously not the first paper to study the effects of fiscal policy: however, almost all the existing time series evidence refers to the United States.[2].

The main conclusions of the analysis can be summarized as follows: 1) The effects of fiscal policy on GDP and its components have become substantially weaker in the last 20 years; 2) The estimated effects of fiscal policy on GDP tend to be small: in the pre-1980 sample, positive government spending multipliers larger than 1 tend to be the exception; in the post-1980 period, significantly negative multipliers of government spending are the norm; the tax multipliers are even smaller; 3) To understand the effects of fiscal policy on prices, the price elasticity of the government budget items is crucial, an issue that has not been widely appreciated; 4) Once plausible values of the price elasticity of government spending are imposed, the negative effects of government spending on prices that have been frequently estimated become positive, although usually small and not always significant; 5) Government spending shocks have significant effects on the real short interest rate, but of uncertain signs: after 4 quarters, positive in three countries, negative in two. 6) Net tax shocks have very small effects on prices, typically negative or zero in the second part of the sample; 7) The US is an outlier in many dimensions; responses to fiscal shocks estimated on US data are often not representative of the average OECD country included in this sample.[3]

The plan of the paper is as follows. Section 2 briefly reviews alternative approaches that have been used to identify fiscal shocks in VARs. Section 3 discusses the methodology I apply. Section 4 describes the data. Section

[2] The exception known to me is Favero [2002]. I discuss this and the other contributions on the issue in the next section.

[3] It is well understood, but still worth repeating, that the results presented here have nothing to say about the effects of systematic fiscal policy as a stabilizing tool, an issue a VAR by its nature is ill equipped to address. See Jones [2001] for an interesting analysis of this issue.

5 briefly discusses a few diagnostic checks on the estimated VARs. The estimated effects of government spending on GDP and the interest rate presented in Section 6. Section 7 discusses the effects of government spending shocks on GDP components. Section 8 discusses the rationale for and consequences of including interest rates in the VAR. Section 9 presents the price responses to government spending shocks. Section 10 displays the results of a tax shock on GDP, interest rate and prices. Section 11 concludes.

2 Four approaches to identifying fiscal policy shocks

A small but growing literature has recently applied to the analysis of fiscal policy VAR methods that have long been common to the analysis of monetary policy. In this section, I briefly review the four different approaches to identification of fiscal policy shocks that have been used.[4]

(i) In a first group, represented by Burnside, Eichenbaum and Fisher [2001], Christiano, Eichenbaum and Eidelberg [1999] , and Ramey and Shapiro [1998], fiscal policy shocks are identified by way of the "narrative approach" of Romer and Romer [1989]. All these papers trace the effects of a dummy variable capturing the "Ramey and Shapiro" fiscal episodes: the Korean war military buildup, the Vietnam war buildup, and the Reagan fiscal expansion.

The advantages and disadvantages of this approach are well known. If these episodes are truly exogenous and unanticipated, and one is only interested in estimating their effects, this is the closest thing to an experiment in macroeconomics. There is no need to impose other potentially controversial identifying assumptions: all is needed is a reduced form regression. But the approach might run into two types of problems. First, these episodes might not be entirely unanticipated. Second, other substantial fiscal shocks, of different type or sign, might have occurred around the same time. For instance, Ramey and Shapiro date the start of the Korean war shock in 1950:3, based on the large observed increase in military spending; but net tax revenues also increased by more than three standard deviations in 1950:2 and 1950:3; and in four quarters between 1948:2 and 1950:3, government spending increased by between two and three standard deviations. It is not obvious how to disentangle the effects of the Korean dummy variable from the delayed effects of these preceding fiscal shocks.

(ii) A second approach consists in identifying fiscal shocks by sign re-

[4] This brief review is based on the papers known to me at the time of writing. I apologize for involuntary omissions of relevant contributions, and welcome any suggestion.

strictions on the impulse responses, rather than by linear restrictions on the contemporaneous relations between reduced form innovations and structural shocks. This approach extends a methodology originally applied by Uhlig [1997] and Faust [1998] to monetary policy analysis;[5] Mountford and Uhlig [2002] apply this methodology to the study of fiscal policy. "Revenue" shocks are identified by the requirement that the tax revenue response increases while the government spending response does not, and by the requirement that all responses such that both tax revenues and GDP increase identify a business cycle shock; "deficit" shocks are identified by the requirement that government spending increases while revenues do not change; and "balanced budget" shocks by the requirement that both government spending and revenues increase.[6]

Notice that here a fiscal shock is not required to take effect at the time of the response by the other endogenous variables: the estimated effect on, say, private consumption at time 0 could be the response to a "revenue shock" that occurs later. Thus, this approach addresses an important potential shortcoming of alternative approaches: the fiscal shocks estimated by the econometrician might have been anticipated, to some degree, by the private sector.

Because each shock is identified by restricting the response of more than one variable, necessarily this approach imposes some a priori view on the response of the economy to fiscal shocks. Still, identification of fiscal shocks is achieved by imposing a minimal set of assumptions: in particular, deficit and balanced budget shocks are identified only on the basis of restrictions on the behavior of the two sides of the government budget, while the response of all the other variables remains unrestricted.

But, like in all identification schemes, *some* a priori views have to be imposed. By identifying revenue shocks via the condition that tax revenues and output do not covary positively in response to the shock, the approach rules out by assumption a whole set of output responses to revenue shocks. While one could regard a positive response of output to higher taxes just as a theoretical curiosum, a recent literature on "non-Keynesian effects" of fiscal policy has highlighted how one could expect precisely this pattern, under specific circumstances.[7] True, the conditions under which one could expect non-Keynesian effects, such as extremely large debt/GDP ratios, are unlikely

[5] While Faust [1998] imposes sign restrictions only at the time of the impact, Uhlig [1997] imposes restrictions on the response of variables also four quarters after the impact.

[6] The selection among the many responses that satisfy these criteria is made on the basis of an appropriate loss function.

[7] For some empirical evidence on non-Keynesian effects of fiscal policy, see Alesina et al. [2002], Giavazzi, Jappelli and Pagano [2000], and Perotti [1999].

to apply to the US data used by Mountford and Uhlig [2002]; yet they might be more relevant for other countries. A second cost of this approach is also related to its benefits: while it can better handle anticipated fiscal policy, it cannot pin down when the fiscal shock occurs.

(iii) A third approach, represented by Fatas and Mihov [2001] and Favero [2002], essentially relies on Choleski ordering to identify fiscal shocks. In the former, government spending is ordered first: other endogenous macro variables, like output and prices, cannot affect government spending contemporaneously. In the latter, fiscal shocks are identified by analogy to monetary shocks, namely by imposing the condition that they cannot affect output and prices contemporaneously; hence, fiscal variables are ordered last. A discussion of this approach will be implicit in the discussion of the next one.

(iv) The fourth approach, developed by Blanchard and Perotti [2002], is akin to a structural VAR. Identification is achieved by exploiting decision lags in fiscal policy, and institutional information about the elasticity of fiscal variables to economic activity. In this paper, I extend this approach to take into account monetary policy and inflation. I describe the methodology in detail in the next section, and defer a discussion of its shortcomings to the concluding section.

3 Methodological issues

3.1 Identifying the fiscal policy shocks

Consider the benchmark specification, a 5-variable VAR that includes the following variables: the log of real government spending on goods and services per capita g_t (government spending for short), the log of real net primary taxes per capita (defined as government revenues less government transfers, both net of property income) t_t[8], the log of real output per capita y_t, the log of the price level p_t, and the 3-month interest rate i_t.[9] Denoting the vector of endogenous variables by X_t and the vector of reduced form residuals by U_t, the reduced form VAR can be written as:

$$X_t = A(L)X_{t-1} + U_t, \tag{1}$$

[8] A precise definition of government spending and net taxes is given in section 3.2.

[9] This 2-way breakdown of the government budget is obviously only one of many possible. Most models would predict that government spending on goods and services has different effects than transfers. Summing algebraically taxes and transfers makes sense if one believes that in the short- and medium run fiscal policy operates mostly via a demand channel. In future work, I am planning to study different disaggregations of the government budgets – in particular, government consumption vs government investment, and taxes vs transfers.

where $X_t \equiv [g_t \quad t_t \quad y_t \quad p_t \quad i_t]'$ and $U_t \equiv [u_t^g \quad u_t^t \quad u_t^y \quad u_t^p \quad u_t^i]'$.

The reduced form residuals of the g_t and t_t equations, u_t^g and u_t^t, can be thought of as linear combinations of three types of shocks. First, the *automatic* response of taxes and government spending to innovations in output, prices and interest rates: in the case of the residual from the net tax equation, it is useful to think of this component as the unanticipated changes in taxes in response to output innovations, given the tax rates and the definition of the tax base. Second, the systematic, *discretionary* response of policymakers to output, price and interest rate innovations; again in the case of the net tax residual, it is useful to think of this component as changes in tax rates in responses to output innovations. Third, random discretionary shocks to fiscal policies; these are the "structural" fiscal shocks, which unlike the reduced form residuals are uncorrelated with each other and with all other structural shocks.[10]

Formally, one can think of the reduced form government spending and net tax residuals as

$$u_t^t = \alpha_{ty}u_t^y + \alpha_{tp}u_t^p + \alpha_{ti}u_t^i + \beta_{tg}e_t^g + e_t^t \tag{2a}$$
$$u_t^g = \alpha_{gy}u_t^y + \alpha_{gp}u_t^p + \alpha_{gi}u_t^i + \beta_{gt}e_t^t + e_t^g \tag{2b}$$

where e_t^g and e_t^t are the structural shocks to government spending and net taxes, part of the vector of mutually uncorrelated structural shocks $F_t \equiv [e_t^g \quad e_t^t \quad e_t^x \quad e_t^p \quad e_t^i]'$. To estimate the effects of unexpected exogenous changes in fiscal policy, one is interested in recovering the series of the shocks e_t^g and e_t^t.

Plainly, an OLS regression of, say, u_t^t on u_t^y, u_t^p, and u_t^i – equivalently, a Choleski decomposition where fiscal policy variables are ordered last – would not provide a consistent estimate of the coefficients α_{jk}'s, since output, inflation and interest rates could all respond to fiscal shocks in the same quarter. Neither would the opposite Choleski orthogonalization, with fiscal policy variables ordered first, provide a correct estimate of the structural fiscal shocks: if the α_{jk}'s are different from 0, this would recover a linear combination of the three types of shocks described above.

The approach followed here is based on two observations. First, it takes longer than three months to decide and implement a discretionary change in fiscal policy in response to observed output or price innovations. As a

[10] As in all definitions, in this one too there is an element of arbitrariness. One could argue that, in a sense, all changes in fiscal policy are discretionary: in theory, policymakers could always undo the effects of changes in output and prices on revenues and spending. While this might be true over the long run, with quarterly data I believe the distinction is meaningful.

consequence, in quarterly data the systematic discretionary component of u_t^t and u_t^g (the second component defined above) is zero: the coefficients $\alpha'_{jk}s$ in (2) reflect only the first component, the automatic response to economic activity.

This would still be of little help if one had to estimate the $\alpha'_{jk}s$, because e_t^g and e_t^t are correlated with the reduced form residuals on the rhs of (2). However, we do have independent information on the $\alpha'_{jk}s$, whose construction is discussed in detail in the next section. With these elasticities, one can define the cyclically adjusted fiscal shocks as:

$$u_t^{t,CA} \equiv u_t^t - (\alpha_{ty}u_t^y + \alpha_{tp}u_t^p + \alpha_{ti}u_t^i) = \beta_{tg}e_t^g + e_t^t \tag{3a}$$

$$u_t^{g,CA} \equiv u_t^g - (\alpha_{gy}u_t^y + \alpha_{gp}u_t^p + \alpha_{gi}u_t^i) = \beta_{gt}e_t^t + e_t^g \tag{3b}$$

This is the first step of the identification procedure. In the second step, the two structural shocks e_t^g and e_t^t must be identified. To do so, one needs to take a stance on the relative ordering of the two cyclically adjusted fiscal policy shocks. One could assume that tax shocks come first; in this case, $\beta_{tg} = 0$ in (3a) and one can estimate β_{gt} in (3b) by a simple OLS regression of the cyclically adjusted government spending residual $u_t^{g,CA}$ on the cyclically adjusted tax residual $u_t^{t,CA}$; a symmetric procedure applies if government spending shocks come first. It is hard to think of plausible reasons for selecting one orthogonalization over the other. Hence, the only option is to check the robustness of the results to the two alternative orderings. As we will see, in all cases the correlation between the two reduced form fiscal shocks is low enough that the ordering of the two shocks is immaterial to the results.

Under either ordering, the outcome of this first step is an estimated series for e_t^g and e_t^t. Both are orthogonal to the other structural shocks of the economy; hence they can be used in the third step as instruments in the remaining equations. In doing so, the ordering of the remaining variables is immaterial if one is only interested in estimating the effects of fiscal policy shocks. For illustrative purposes, suppose output comes first. Then one can estimate the output equation

$$u_t^y = \gamma_{yt}u_t^t + \gamma_{yg}u_t^g + e_t^y \tag{4}$$

using e_t^t and e_t^g as instruments for u_t^t and u_t^g, and similarly for the price equation

$$u_t^p = \gamma_{py}u_t^y + \gamma_{pt}u_t^t + \gamma_{pg}u_t^g + e_t^p \tag{5}$$

Finally, the interest rate equation

$$u_t^i = \alpha_{iy}u_t^y + \alpha_{ip}u_t^p + \beta_{it}e_t^t + \beta_{ig}e_t^g + e_t^i \tag{6}$$

can be estimated using e_t^y, e_t^p, e_t^t and e_t^g as instruments. Notice that the interest rate equation does have a structural interpretation under the maintained hypothesis that movements in the interest rate do not affect output and prices within the same quarter.[11, 12]

3.2 Constructing the output and price elasticities

The two fiscal variables used in the VAR, net taxes and government spending, are defined as follows:

Net taxes = Revenues - Transfers

Revenues = Tax revenues + Non-tax revenues

Tax revenues = Direct taxes on individuals + Direct taxes on corporation + Social security taxes + Indirect taxes

Non-tax revenues = Current transfers received by the general government + Net capital transfers received by the general government

Transfers: = Social security transfers to households + Other transfers to households + Subsidies to firms + Transfers abroad

Government spending on goods and services = Government consumption + Government gross capital formation

Government gross capital formation = Gross fixed capital formation by the government + Net acquisition of non produced non financial assets + Change in inventories

The coefficients α_{jk}'s in equation (2) are weighted averages of the elasticity of each component of net taxes and government spending.

Consider first the output elasticity of net taxes. Current transfers received by the government include items such as fees and penalties and transfers from international cooperation; net capital transfers received by the government include mainly taxes on ownership and betterment of land, death and gift duties, and capital transfers to private and public enterprises to cover operating deficits. Thus, both components of non-tax revenues are inelastic to output within the quarter.

The output elasticity of each component of tax revenues is constructed from a decomposition of actual revenues into a tax rate and a tax base.

[11] See e.g. Bernanke and Blinder [1992], Christiano, Eichenbaum and Evans [1999], and Bernanke and Mihov [1998], among others. Although "standard", this assumption is by no means uncontroversial. For one thing, it is more plausible on monthly data, although it has been used extensively also in work involving quarterly data.

[12] Note that, in contrast to the monetary policy instrument, government spending and net taxes can affect output contemporaneously in this specification.

Consider first direct taxes on individuals, typically the largest component of tax revenues. This can be written as:[13]

$$H_t = S(W_t P_t) W_t(E_t) E_t(Y_t) \tag{7}$$

where H_t denotes total real direct taxes on individuals, S is the tax rate, W_t is the real wage, P_t is the GDP deflator, E_t is employment, and Y_t is output. Thus, $W_t E_t$ is the tax base (ignoring non-labor income). Letting lower-case letters denote logs, and totally differentiating, one obtains:

$$dh_t = \frac{\partial s}{\partial w_t} dw_t + \frac{\partial w_t}{\partial e_t} de_t + \frac{\partial e_t}{\partial y_t} dy_t + \frac{\partial s}{\partial p_t} dp_t \tag{8}$$

$$= \left[\left(\frac{\partial s}{\partial w_t} + 1 \right) \frac{\partial w_t}{\partial e_t} + 1 \right] \frac{\partial e_t}{\partial y_t} dy_t + \frac{\partial s}{\partial p_t} dp_t \tag{9}$$

Thus, the term in brackets is the equivalent of α_{ty} in equation (2a) for this particular tax revenue, and the term $\partial s / \partial p_t$ is the equivalent of α_{tp}.

For most member countries, the OECD computes the elasticity of tax revenues per person to average real earnings, the term $\partial s / \partial w_t + 1$, using information on the tax code of each country and the distribution of tax payers in each bracket, at intervals of a few years.[14] I then estimate the contemporaneous elasticity of the real wage to employment, $\partial w_t / \partial e_t$, as the coefficient on lag 0 from a regression of the log change in real wage on lead 1 and lags 0 to 4 of log employment changes; and I estimate the elasticity of employment to output, $\partial e_t / \partial y_t$, in a similar way.[15] A similar methodology can be used to estimate the elasticity of social security taxes to output.

To estimate the output elasticity of the corporate income tax, I first regress the log difference of the tax base (the operating profits of financial and non financial corporations) on lags -1 to 4 of the log difference of output; the estimated coefficient on lag 0 provides the elasticity of the tax base to output. Because corporate income taxes are always proportional in our sample of countries, the elasticity of corporate income tax revenues to the tax base is assumed to be 1. Finally, the elasticity of indirect taxes to output is assumed to be 1.

[13] This formalizes the approach followed by the OECD to construct annual elasticities: see e.g. Giorno et al. [1995].

[14] Data on $\partial s / \partial w_t + 1$ are obtained from Giorno et al. [1995] until 1992, and from van den Noord [2002] after 1992.

[15] The estimated contemporaneous quarterly employment elasticity of wages is typically negative in Australia and very small, with a t-statistic below .5, in the United Kingdom. The same is true for the output elasticity of employment in Australia. When the estimate of $\partial w / \partial e$ or of $\partial e / \partial y$ is negative or its t-statistic is below 1, as a rule I set them to 0 in constructing the elasticities.

This is not the end of the story, however, because in several countries some taxes are collected with substantial lags with respect to the transaction that generates the tax liability. For instance, corporation taxes in the UK are due several quarters after the end of the corporation's fiscal year; in Australia and West Germany quarterly installments of the corporation income tax are based on the previous year's assessed tax liability; the same is true for income from self-employment in Australia, Canada, United Kingdom, and West Germany. In these cases, the contemporaneous quarterly elasticity of the tax revenue to its tax base is effectively 0, even though the statutory and the yearly elasticities are positive (see Appendix 1 for details).[16] When taxes on self employment income have an effective elasticity of zero, I adjust the elasticity of income taxes on individuals by multiplying the value in brackets in (9) by the ratio of self-employment to total employment, or of self-employment income to total wages and salaries. If possible, I also estimate $\partial w/\partial e$ and $\partial e/\partial y$ by using data on dependent employment only instead of total employment.

Information on the output elasticity of transfers is more limited, but an educated guess suggests it is small. Items like old age, disability and invalidity pensions – the bulk of transfers to households – do not have built-in mechanisms that make them respond automatically to changes in employment or output contemporaneously. Unemployment benefits obviously do, but they typically account for a small part of government spending: in 1994-95, the largest spender on unemployment compensation was Australia, with 1.64 percent of GDP; if all active and passive measures are included, the largest spender was Germany, with 3.03 percent of GDP.[17] In all cases the sum of spending on passive and active measures was less than 10 of total government expenditure. Hence, I assume an output elasticity of transfer of -.2. This is rather generous, and allows for spillover effects in other programs: for instance, some anti-poverty programs like AFDC in the US might display some within-quarter elasticity to output. As we will see, however, reasonable alternative values of the output elasticity of transfers make essentially no difference to the results.

Now consider the price elasticity of net taxes, α_{tp}. For individual income taxes and social security taxes, the elasticity of real revenues to the price level, holding constant employment, output and the real wage, is equal to $\partial s_t/\partial w_t$, which can be obtained by subtracting 1 from the OECD estimate of the elasticity of tax revenues per person to average real earnings. It is

[16] Obviously these lags would not matter if the revenue data were true accrual data. As discussed below, however, they are not.

[17] See OECD [1996]. Data for West Germany are unvailable.

well known that inflation has many and complex effects on corporate income tax revenues, in both directions. Any attempt to quantify these effects in all of the countries studied in this work would deliver extremely unreliable results. Hence I assume a 0 price elasticity of real corporate income taxes.[18] For indirect taxes, that are typically proportional, I also assume a 0 price elasticity.

Many transfer programs are indexed to the CPI; however, indexation typically occurs usually with a substantial lag. A review of indexation clauses in OECD countries in the postwar period did not uncover any government spending program that has been or is indexed to inflation contemporaneously at quarterly frequency. Hence, I set the quarterly price elasticity of real government transfers to -1.

Consider now the output and price elasticities of government spending on goods and services, the coefficients α_{gy} and α_{gp} in equation (2b). It is hard to think of any quantitatively relevant mechanism by which government consumption or investment should respond automatically to output contemporaneously: consequently, I set $\alpha_{gy} = 0$.[19] The elasticity of real government spending to the price level is more complicated. Consider first the wage component of current spending on goods and services (typically, slightly less than half the total spending). While government wages were indexed to the CPI during part of the sample in some countries, in all cases indexation occurred with a considerable lag, well above one quarter. Hence, real government spending on wages is likely to have an elasticity to the GDP deflator of -1.

Consider now the non-wage component of government spending on goods and services. Some of this spending might be fixed in nominal terms within the quarter, implying a price elasticity of real spending equal to -1. Other parts, like spending on drugs in nationalized health services, might be effectively indexed to the price level within the quarter, implying an elasticity of 0. Overall, a price elasticity of real government spending well below 0 seems justified. In my benchmark specifications, I will assume α_{gp} = -.5.

Because I consider the primary budget of the general government, in the benchmark regressions I set the interest rate semi-elasticity of both net taxes and government spending to 0: $\alpha_{gi} = \alpha_{ti} = 0$. This is probably a safe assumption for government spending; it is slightly more uncertain for net

[18] In a detailed study on the effects of inflation on government revenues and expenditure in Sweden, Persson, Persson and Svensson [1998] conclude that it is impossible to quantify credibly the effects of inflation on corporate income taxes. They also assume a zero inflation elasticity of corporate income taxes.

[19] A typically cited counterexample is disaster relief; however, this spending item is minimal, particularly in the countries included in this study.

taxes[20]. Note that, when studying the effects of government spending, the tax elasticity plays no role.

Having constructed the output and price elasticity of each component of net taxes, the elasticities of net taxes are constructed as weighted averages of the elasticities of each components. Note that in general this elasticity varies over time, because so does the real wage elasticity of tax revenues per person computed by the OECD. Table 1 shows the net tax elasticities to output and the GDP deflator in each country over the whole sample and the main subsamples. The output elasticity is very low in Australia, mainly for two reasons: direct taxes on individuals have zero quarterly output elasticity, because the estimated output elasticities of real wages to employment and of employment to output are both zero; and corporate income taxes also have zero contemporaneous elasticity to their tax base, because quarterly installments are paid on the previous year's assessed tax liability. The elasticity is slightly larger in the UK, which has a similar tax system to Australia but a small positive output elasticity of employment; it is still larger in West Germany, with a still higher output elasticity of employment.[21] It is highest in Canada and USA, the only two countries where corporate income taxes have a positive contemporaneous elasticity to profits (see Appendix 1). It is well known that in quarterly data corporate profits are highly elastic to output (in both Canada and the US, the estimated contemporaneous output elasticity of profits is above 4): this accounts for the large contribution of corporate income taxes to the aggregate elasticity of net taxes.

4 Specification, samples and data

4.1 Specification and samples

I estimate the VAR specification described in section 3 on quarterly data from five countries: Australia, Canada, West Germany, United Kingdom, and Unites States.[22] The benchmark VAR includes the logs of real GDP,

[20] One could argue that the individual income tax base includes interest income, which would imply a positive interest rate semi-elasticity of individual income taxes. Yet it also includes dividend income, which might covary negatively with the interest rate. Like for the effects of prices, the effects of interest rates on corporate income tax revenues are too complex to try to quantify.

[21] Note that in all these three countries, the estimated employment elasticity of real wages is either negative (Australia, West Germany) or positive but with a t-statistics below 1 (UK), hence it has been set to 0 according to the rule described above.

[22] In Blanchard and Perotti [2002], we estimated quarter dependent 3-variable VARs, on the basis that there is some quarter dependence in tax collections. However, we also

government spending and net taxes, all in per capita terms; the log of the GDP deflator; and the nominal 3 months interest rate. All variables have been seasonally adjusted by the original sources. All equations include four lags of each endogenous variable and no time trends. The sample typically starts in 1960 or slightly later, and ends in 2000 or 2001; the exception is West Germany, whose sample stops in 1989:4 due to the reunification. The precise samples of the benchmark VARs are: USA: 1961:1 - 2000:4; West Germany: 1961:1 - 1989:4; United Kingdom: 1964:1 - 2001:2; Canada: 1962:1 - 2001:4; Australia: 1964:1 - 2000:4.

4.2 The data

The binding constraint is represented by the availability of quarterly fiscal variables. One reason why fiscal policy VARs have been less popular than their monetary policy counterparts is that fiscal policy data at high enough frequency are more difficult to collect; in most countries they simply do not exist.[23]

All the fiscal data used in this paper originate from only one source per country, ensuring internal consistency;[24] in all cases, the fiscal data are part of the integrated system of national accounts, thus ensuring consistency with other national income account data. The series cover the whole budget of the general government, not just a few items. This is important because most theories postulate that the effects of a budget item also depend on

found that quarter dependence makes little difference for the US. The description of the institutional features of the tax systems in Appendix 1 makes clear that only for corporate income taxes in the United Kingdom is quarter dependence likely to be substantial. Moreover, in the 5-variable VARs that I estimate in this paper, allowing for quarter dependence would quickly exhaust the available degrees of freedom.

[23] Of the other OECD countries, France, Japan and New Zealand seem to have quarterly general government budget figures for long enough periods. However, it appears that parts of the budget data of these countries might be interpolated from annual figures. I am currently investigating the nature of the data for these countries. One or more of these countries might then be added to future versions of this paper.

Other countries have some quarterly or even monthly data on some parts of the budget, and often covering only the central government accounts. Some commerical vendors and international organizations also have quarterly or semi-annual figures on the general government budget of several countries, but, with the exceptions of the countries mentioned above, these are mostly interpolated from annual figures.

[24] The sources for both the fiscal and the national income accounts data are: the NIPA accounts from the Bureau of Economic Analysis for the US; the DIW National Account files for Germany; the United Kingdom National Accounts and the Financial Statistics files, from the Office of National Statistics, for the United Kingdom; the CANSIM database of Statistics Canada for Canada; and the Australian Bureau of Statistics database for Australia.

the concomitant and expected movements in the others. Covering the whole general government is also important because from the point of view of the private sector an increase in income taxes by the local government is likely to have similar effects, to a first approximation, as the same increase by the central government.

In general, all the government budget and national income account data follow the guidelines of the 1993 System of National Accounts. This implies the classification of some budget items is less than ideal for the purposes of the present study.

Direct taxes on individuals usually also include property taxes, taxes on land, and poll taxes, all of which are not elastic to output contemporaneously, and licenses and fees paid by households, which are closer to indirect taxes.[25] Indirect taxes include payroll taxes, which are more akin to social security taxes, and land taxes, which also are inelastic to GDP contemporaneously. Whenever possible, I have reclassified all items that are inelastic to GDP into current or net capital transfers received by the government; I have also reclassified payroll taxes into social security taxes, and licenses and fees paid by households into indirect taxes.

Social security transfers include unfunded pension liabilities contributions by the government; as these items also appear as social security contributions, they wash out when constructing net taxes.

Government consumption (or current spending on goods and services) is net of market sales by the government and of capital consumption allowances, an item which is usually imprecisely measured. Gross capital formation includes the change in inventories, but often quarterly data on acquisition of non produced non-financial assets (a very minor item) are missing. In some countries, like Australia, net capital transfers are also not reported on a quarterly basis.

Property income received and paid by the government – mostly interest, but also rents and dividends from state owned enterprises – is excluded, for two reasons: its coverage tends to be spotty in quarterly data, and there are economic reasons to focus on the primary budget.

Under the guidelines of the new 1993 National Income Account Systems, all budget items should be recorded on an accrual basis. If this were indeed the case, there would be no issue of collection lags: all taxes would be recorded at the time the corresponding liability arises. In reality, even in the new system taxes are at most recorded on a "modified cash" basis, which consists in adjusting for the lag between the time taxes are withheld by the employer or paid by the taxpayer and the time they are recorded by

[25] Licenses and fees paid by businesses are included in indirect taxes.

the agency in charge of collecting them.

Among the other data, the short interest rate is often the binding constraint on the length of the sample. I try to use an interest rate as close as possible to a Central Bank instrument, provided an unbroken series is available from the early 1960s.[26]

5 A first look at the estimates

5.1 Do the fiscal shocks make sense?

Are the estimated fiscal shocks reasonable? This is a rather loose question, but a legitimate one (see Rudebusch [1998]). Since the key facts of US fiscal policy are much better known, I will limit the analysis to the US case. Figure 1 displays the estimated government spending and net tax shocks, e_t^g and e_t^t, from the benchmark 5 variable VAR on the whole sample, multiplied by the average share of government spending and net taxes in GDP, respectively, to express them as shares of GDP. The shaded areas correspond to the three years following and including the onset of the two Ramey and Shapiro episodes in this sample, the Vietnam war buildup that started in 1965:1 and the Carter- Reagan buildup that started in 1980:1.

The estimated shocks capture well the first buildup, much less so the second one. There are several reasons for this: total government spending on goods and services rose at a much faster rate in 1966 and 1967 (10 percent and 7 percent, respectively) than in 1980 , 1981 and 1982 (2, -.1, and 1 percent, respectively). It is not often appreciated that, while defense spending rose at an average rate of about 6% between 1980 and 1981, non defense current spending on goods and services did not move in real terms, and nondefense capital spending *fell* at an average rate of about 4 percent. Note that the estimated fiscal shock captures much better the increase in government spending on goods and services between 1984 and 1987, when the latter rose at an average rate above 4 percent, with non-defense current and capital government spending rising at average rates of 3 and 6 percent, respectively.

[26] In the benchmark specifications, I use the Federal Funds Rate in the USA; the interest rate on three month bills for the United Kingdom (variable 11260CZ, *International Financial Statistics* of the International Monetary Fund); the three month interbank rate in West Germany (series IRS in the OECD Quarterly National Accounts database); the treasury bill rate in Canada (series 15660CZ, *International Financial Statistics* of the International Monetary Fund); and the interest rate on three month Treasury notes (series VNEQ.UN_RTN until decmber 1997 and FIRMMTNIY3 since January 1998, from the Reserve Bank of Australia database).

The structural net tax shock captures well the 1968 tax surcharge and the (much larger) 1975. It is mostly positive between 1980 and 1982; this however is easily explained in view of the large fall in GDP per capita in 1980 (-1.3 percent) and especially in 1982 (-3 percent).

5.2 Subsample stability

Table 2 displays the results from a standard Chow test on each reduced form regression, with a break point in 1980:1 (1975:1 in West Germany). There is substantial evidence of instability: in each country except West Germany at least two of the five Chow tests have a p-value smaller than .05. We will see that the impulse responses to fiscal shocks have very different properties in the two subsamples. [27]

6 The effects of government spending on output

6.1 Effects on aggregate GDP

Table 3 and Figure 2 display the effects of a shock to e_t^g equal to 1 percentage point of GDP[28], from a VAR in 5 variables with g and t ordered first and second, respectively; the benchmark case displayed in this table also assumes an elasticity of real government spending to prices equal to -.5. To allow a comparison of the results across the 5 countries in a compact way, the table displays the responses of GDP on impact and after 4, 12 and 20 quarters, and the maximum and minimum GDP response up to 20 quarters, with the quarter at which it occurs. The maximum GDP response will also be called the "government spending multiplier" in what follows. The two lines on each side of the impulse response give one standard error bands, computed by Monte Carlo simulations based on 500 replications, as in e.g. Stock and Watson [2001].

[27] The Chow test assumes that we know the time of the possible structural break, which we do not. A common alternative would have been to use a test, like the Andrews [1993] sup-Wald test, that does not assume such knowledge. It is well known however that typically this test does not provide a clear picture of the timing of the structural breaks (see e.g. Boivin and Giannoni [2002]).

[28] The impulse response of government spending and taxes are multiplied by their respective average shares in GDP to obtain impulse responses in terms of shares of GDP. The actual response of government spending on impact is usually slightly different from 1, because of the feedback from ouput and price changes to g_t (recall that the shock is on e_t^g).

Over the whole sample, the impact response is positive and significant in all countries. For the US, this is consistent with the positive response estimated by Blanchard and Perotti [2002], Edelberg, Eichenbaum and Fisher [1999], Fatas and Mihov [2001], and Mountford and Uhlig [2002]. The size of the response is similar, between .3 and .4 percentage points (pps) of GDP in all countries except West Germany, where it is 1.30 pps of GDP. The shape of the impulse response is qualitatively similar in all countries (see Figure 2): after the initial rise, GDP starts declining, and after about 4 quarters it rises again; only in Germany and the US, however, is this rise economically and statistically significant. In fact, over the first 3 years, in all countries the largest effect on GDP occurs on impact; in the US, after about 4 years GDP has the absolute peak at about 1 pp of GDP. Thus, in no case is the maximum GDP response much larger than 1, and in three countries it is less than .5.

These results, however, hide a substantial difference between the first and second halves of the sample. When the model is estimated over the two subsamples separately[29], the pattern that emerges is rather clear: in all countries except Australia, the effects of government spending on GDP in the post-1980 period are substantially smaller than in the pre-1980 period. In fact, in the post-1980 sample the response of GDP in the first four countries is never significantly positive (except for Germany on impact), and in all it becomes significantly negative – and sometimes substantially so – within the first 3 years. The minimum response in all these countries is always smaller than -1, and significant. As mentioned, the exception is Australia, where the impact effect is positive and significant in the post-1980 period, and is essentially zero in the pre-1980 period (the difference between the maximum effects is, however, small).[30]

One may wonder whether these results are due to a fundamental difference in the government spending process over the two subsamples: if the government spending response were much less persistent in the post-1980 period, a smaller response of GDP would still be compatible with no change in the effects of government spending on GDP. Table 4 shows clearly that this is not the case. The table displays the cumulative response of government spending as a share of GDP at quarters 4, 12 and 20 (columns 1 to 3), and the

[29] When estimating the model over different subsamples, each time I recompute the average elasticities over the relevant subsample. In doing so, if possible I also reestimate the output elasticity of employment and the employment elasticity of wages over the relevant subsamples.

[30] As shown in the next subsection, this difference is due to the behavior of private investment and net exports; private consumption follows the same pattern as in the other countries.

cumulative multipliers at the same quarters (columns 4 to 6).[31] The cumulative response of government spending is remarkably similar across countries: for instance, at quarter 4 in the whole sample it ranges from 2.89 pp of GDP in Australia to 3.55 in the US. It is also similar across subperiods, with two exceptions: in Germany after 12 and 20 quarters the cumulative response of government spending is 60% and 80% *larger* in the post-1980 period; and in the UK after 20 quarter it is about 90% larger in the pre-1980 period.

Thus, the cumulative multipliers in the last three columns provide an even clearer picture: except for Australia, it is uniformly much higher in the pre-1980 period than in the post-1980 period. In the former period, it is slightly below or above unity in quarter 4 and 12, except in the US where it is about 2 in quarter 12, and in the UK where it ranges between .2 and .3. In the latter period, it is 0 in quarter 4, and substantially negative in quarter 12, except for the US where it is essentially 0. As before, these inequalities are reversed in Australia.

Note that the largest multiplier at four quarters is observed in Germany, at 12 quarters in the US, and at 20 quarters in the US and Canada. Hence, while the results are mildly supportive of the notion that the closest economy of the group tends to have larger multipliers, the ranking is not as clear cut as a standard leakage argument would suggest.

It is interesting to compare the estimated cumulative multipliers from this exercise with the cumulative multipliers typically provided by large scale econometric models. This is done in Table 5. [32] The large scale macroeconometric models tend to predict larger cumulative multipliers than those estimated here, in particular than multipliers estimated from the post-1980 sample.

6.2 The role of monetary policy

One could argue that differences in the government spending multipliers, both over time and across countries, might be caused by differences in the behavior of the monetary authorities.

[31] The cumulative multiplier at quarter x is defined as the ratio of the cumulative response of GDP at quarter x to the cumulative response of government spending at the same quarter.

[32] The multipliers of the macro econometric models are from Sims [1988], who in turn summarizes the results of the Brookings comparison project (see Bryant et al. [1988]). It should be noted that some models have changed since then, in particular more models have incorporated forward - looking behavior.

Also, it is well known that it is very difficult to compare the output of simulations across models, because it is very difficult to hold "everything else" constant. The use of cumulative multipliers is intended to minimize this problem.

Table 6 displays the effects of a unit shock to governments spending on the nominal (first 4 columns) and real (columns 5 to 8) 3-months interest rates, as well as on the cumulative deficit (last 4 columns).[33] Consider the nominal interest rate first. In the US, it falls on impact in all three samples; even after 4 quarters, it declines by -.5 pps in the pre-1980 sample and by 1.4 pps in the post-1980 sample.

This response is puzzling, and indeed it has puzzled other researchers that have found it before, like Mountford and Uhlig [2002] and Edelberg, Eichenbaum and Fisher [1999]; yet, once again, it is not necessarily typical. Outside the US, in the whole sample the nominal interest rate increases in all countries, except West Germany after 12 quarters. In the post-1980 period, the nominal interest rate falls also in the UK; in West Germany (except at 12 quarters), Canada and Australia it increases, although in the former it is rather imprecisely estimated.

The real short term interest rate follows a similar pattern. Over the whole sample, after 4 quarters it falls in the US and, very marginally, in Australia; it increases in the other countries. In all cases, the response is rather precisely estimated. In the post-1980 period, it falls as usual in the US and now in the UK, and it increases in the other three countries out of five (Australia, Canada, and West Germany). [34]

Can the difference in the output response *between the pre- and post-1980 samples* be explained by a stronger interest rate response in the latter? No. Only in Canada does the real interest rate at 4 quarters increase more in the post-1980 sample than in the pre-1980 sample; in all other countries, it increases less, or falls more.

Can the difference in the output response *across countries* be explained by a different behavior of the real interest rate? The answer is unclear. In the post-1980 sample, the real interest rate falls after 4 quarters in the UK, but the cumulative multiplier at the same horizon is also negative. If one excludes the UK, the two countries with the largest real interest rate response at 4 quarters, West Germany and Canada, also have the lowest cumulative multiplier.

Thus, it appears that the response of the interest rate is unlikely to explain

[33]Strictly speaking, this exercise is fully meaningful only under flexible exchange rates.

[34]The real interest rate is defined here as i_t- $(Ep_{t+4}-$ $p_t)$. If the alternative definition $i_t - 4(Ep_{t+1} - p_t)$ had been used, in some cases the real interest rate would have displayed a very large fall in the first few quarters (in the order of 3 or 4 pps), due to the large and irregular behavior of the price response in the very first quarter.

The post-1980 sample in the US includes two possibly very different monetary regimes: the Volcker experiment and the subsequent Volcker-Greenspan regime. The results are robust to the omission of the Volcker experiment, 1979:4 to 1982:3.

the different response of the economy to the government spending shocks. What about the reverse direction of causality, i.e. can the behavior of the real interest rate be explained by the cumulative deficit? Not really. The last 4 columns display the cumulative deficit response to the government spending shock. Consider the post-1980 sample for brevity. The country with the largest increase in the cumulative deficit after 4 quarters, the UK, also has the second largest fall in the real interest rate; conversely, the country with the second smallest increase in the deficit, West Germany, also has the second largest increase in the real interest rate at the same horizon.

One important caveat should be kept in mind in interpreting all these results: the short-term real interest rate might not be the most appropriate interest rate variable for some of these exercises. In particular, to study the response of GDP and its component the long term interest rate might be more appropriate. The study of the role of the long term interest rate is left for future research.

6.3 Other robustness checks

The results presented so far were based on a specific orthogonalization of the two cyclically adjusted fiscal shocks,with government spending ordered first. As discussed in section 3, there is really no basis for choosing one orthogonalization over the other, however. All the impulse responses presented so far were recomputed under the assumption that government spending is ordered second, after net taxes. The differences were minimal: typically the point estimates of the impulse responses at all horizons change by only a few percentage points.

I also checked the robustness of the results to the exclusion of some years between 1973 and 1976 (the exact dates excluded vary with the country, based on the size of the log change in the price level, real output, real net taxes, and real government spending).[35] I also exclude other country specific years, often motivated by standard periodization in monetary policy (for instance, the 1979:4 - 1982:3 Volcker experiment in the post -1980 period in the US, or the 1990:4 - 1992:3 hard-ERM period in the United Kingdom).

Finally, I routinely estimate all impulse responses over the post - Bretton Woods flexible exchange rate period. In the interest of space, I do not present these estimates; in general, however, they appear to be linear combinations of the responses in the two subsamples.

[35] The exact periods I exclude are 1974:1 - 1976:4 in the US, and 1973:1 - 1975:4 in Australia, Canada, UK and West Germany;

7 Effects on GDP components

Table 7 displays the effects of government spending on GDP components. The response of each component is derived from a 6 variable VAR, where each component is added in turn to the benchmark.

The behavior of private consumption largely mimics that of GDP: it typically increases on impact, and more so in the pre-1980 sample, although only in Australia and the United Kingdom is the difference between the impulse responses in the two subsectors substantial. In both subsamples, in most cases the maximum effect occurs on impact, or within the first 3 quarters. In the pre-1980 sample, the maximum effect is larger than 1 in only 2 countries, Australia and the US; in the post-1980 sample, it is never larger than .6. By quarter 12, in the post-1980 quarter the response is insignificantly different from 0 in all countries, except in Canada where it is significantly negative.

Perhaps more informative is the cumulative consumption multiplier (the cumulative change in consumption divided by the cumulative change in output). In the post-1980 sample, by quarter 4 it is no greater than .2 , except in the US where it is .55; by quarter 12 it has fallen further or it has remained essentially at its quarter 4 level.[36]

Note that once again the US appears to be an outlier, particularly over the whole sample: its maximum consumption response is double that of the next highest maximum, and its cumulative consumption responses also are by the highest at all horizons (except for Germany at 10 quarters).

The private investment responses are typically more irregular, hence summarizing their shapes is more difficult. However, once again the responses at all horizons, the maxima and minima, and the cumulative multipliers, are algebraically smaller in the post-1980 period, with very few exceptions (mostly in Australia).

In the pre-1980 period, investment reaches a significantly positive maximum on impact in Canada, United Kingdom, Germany or after 2 years in the USA, all between .6 and 1.0 pps (except in Australia, where it increases by a only .1 pp and then falls immediately). In 3 countries the minima are significantly negative, by between -.4 and -.8 pps of GDP.

In the post-1980 sample, except in Australia the response after 12 quarters is significantly negative in all countries, and remarkably similar – between -.7 and -.1 pp of GDP. The minima are negative in all countries, and large – between -.4 and -2.2 of GDP.

The cumulative multipliers paint a similar picture. They are much smaller

[36]Note that the consumption response is much weaker in the post-1980 period also in Australia, where the GDP response displayed the opposite pattern.

in the second sample, with the exception of Australia at quarters 12 and 20. In all countries, they are negative after 12 quarters; and again with the exception of Australia, they are smaller than -1 at quarter 20.

Notice also the effects of subsample instability: taking for instance the cumulative multipliers at 12 quarters, in three countries out of five the multipliers in the two subsamples are on the same side of the whole sample multiplier.

It is difficult to detect a regular pattern in the response of exports and imports. In general, the responses are surprisingly large, and there is some evidence of a systematic positive response of imports. The US is once again an exception to both statements.

8 How important is monetary policy for fiscal policy? The Sims conjecture

There are two reasons why it might be important to include interest rate and prices in a VAR with fiscal policy. In the Brookings comparison project of Bryant [1988], typically small scale econometric models displayed larger fiscal multipliers than large scale, rational expectation models that included interest rate and prices (see Table 4). Sims [1988] conjectured that these results could be explained by the presence of financial variables, like interest and prices, in the larger scale models; these jump variables embody expectations of future changes in fiscal policy, and absorb some of the estimated effects of fiscal shocks. To test the Sims conjecture, I have estimated a three variable VAR which excludes the interest rate and the GDP deflator.

In order not to clutter the exposition, I do not report the results, but the pattern that emerges is clear. Both the impact effects and the maximum effects are smaller, albeit usually by very small margins, in both the whole sample and the pre-1980 sample. In the post 1980 sample, they tend to be slightly larger, although again by very small amounts, with the exception of the UK which displays a very large maximum multiplier in the smaller VAR.

A second rationale for including interest rates is that in its absence fiscal shocks might pick up the effects of interest rate shocks if there is some systematic contemporaneous relationship between monetary and fiscal policy.[37] The same results mentioned above speak against this interpretation.

Another way to address this issue is to reverse the ordering of the (cyclically adjusted) fiscal policy variables and the interest rate (see also Mountford and Uhlig [2002] for a similar exercise). In all specifications so far, cyclically

[37] Strictly speaking, this argument is relevant in a flexible exchange rate regime only.

adjusted taxes and spending could not respond contemporaneously to interest rates. Suppose instead we assumed the opposite ordering. This is conceptually inconsistent with the assumption that, because of decision lags, fiscal policymakers cannot make discretionary changes to fiscal policy in response to contemporaneous innovations in the other variables. However, this ordering attributes as much as possible of the variation in government spending innovations to interest rate innovations. If the systematic response of monetary policy to fiscal policy is important, one would expect the results to differ substantially now that fiscal shocks are forced to be orthogonal to interest rate innovations. However, the results on the GDP multiplier (not reported to conserve space) are very similar. In this sense, controlling for monetary policy is not important when estimating the effects of fiscal policy on output – a result noted already by Mountford and Uhlig [2002] for the US.

9 The effects of government spending on prices

Just as the output elasticity of taxes is a crucial parameter in estimating the effects of taxes on GDP, so is the price elasticity of government spending crucial in estimating the effects of government spending on prices.[38] To see what is involved, consider a simplified version of the model

$$u^p = \gamma u^g + e^p \tag{10}$$

$$u^g = \alpha u^p + e^g \tag{11}$$

where all inessential variables and superscipts have been omitted. γ is the effect of government spending on prices; α is the elasticity of real government spending to the price level; e^g is the structural shock to government spending, and e^p is the structural shock to prices; as usual, I assume $\text{corr}(e^g, e^p) = 0$. If not all of government spending is indexed, $\alpha < 0$. Suppose the researcher assumes an elasticity $\widehat{\alpha}$ different from α. Hence, the researcher will estimate $\widehat{e}^g = e^p + (\alpha - \widehat{\alpha})u^p$, and

$$cov(\widehat{e}^g, u^p) = cov(e^g, u^p) + (\alpha - \widehat{\alpha})var(u^p) \tag{12}$$

and solving for $var(u^p)$ and $cov(e^g, u^p)$

$$cov(\widehat{e}^g, u^p) = \frac{\gamma}{1-\alpha\gamma}\left[1 + \frac{(\alpha-\widehat{\alpha})\gamma}{1-\alpha\gamma}\right] var(e^g) + \frac{(\alpha-\widehat{\alpha})}{(1-\alpha\gamma)^2} var(e^p) \tag{13}$$

[38] See Blanchard and Watson [1986] for an early application of the methodology used here.

Thus, if $\gamma > 0$ (government spending has a positive effect on prices) but the researcher underestimates (in absolute value) the price elasticity of government spending, typically the researcher will estimate a smaller effect of government spending on prices than the true one. Note also that this bias increases with the variance of the price disturbance.

Indeed, previous VAR investigations on the effects of fiscal policy in the US, like Fatas and Mihov [2001] and Mounford and Uhlig [2002], have typically found a negative effect of government spending on prices or inflation.[39] These results are based on orthogonalizations with governments spending ordered before prices, thus implicitly assuming a zero elasticity of real government spending to the price level.

Table 8 displays the results of a shock to government spending on the price level under two alternative values for this elasticity: 0 (first three lines of each country) and -.5 (last three lines), from the same specification used for Table 2. This table makes three important points.

First, the price elasticity of government spending does matter, especially in the short run: with few exceptions (and quantitatively minimal), the response at all horizons and in all samples is larger when the elasticity is -.5 than when it is 0. In a few countries, moving from a 0 elasticity to -.5 changes the qualitative conclusions from this exercise quite dramatically: in Australia in particular, the impact effect of a shock to government spending in the pre-1980 sample changes from an implausible -1.6 percent to -.34 percent.[40] However, the price elastcity of government spending makes little difference at quarter 12.

Second, for the response of the GDP deflator, even more than for the GDP response, there is evidence of considerable subsample instability. In all countries the response of the GDP deflator over the two subsamples is considerably smaller, in absolute terms, than the response over the whole sample. In the UK, the response of the GDP deflator is explosive over the whole sample, while it appears stable over the two subsamples. Because the effect on output is much more muted, one might expect to see a smaller effect on the GDP deflator in the post-80 period. This is usually the case, except in the UK:[41] even with an elasticity of -.5, no country exhibits a significantly

[39] Edelberg, Eichenbaum and Fisher [1999] find a negative effect after an initial positive effect.

[40] For the reasons discussed above, even -.5 might be an underestimate of the true price elasticity of government spending. Indeed, if we assumed a price elasticity of government spending of -1, all the negative impact effects would become positive (results not reported).

Notice that these results are not a figment of the fact that the GDP deflator appears at the denominator of real government spending. When government spending is deflated by its own deflator rather than the GDP deflator, the results are qualitatively similar.

[41] Also, strictly speaking one would expect the opposite result in Australia, where GDP

positive price response at quarter 4 in the post-1980 sample; after 12 quarters, only two countries exhibit a significantly positive response, the UK (1.13pps) and Australia (.8 pps). In all the others, it is essentially 0. Thus, except possibly in these two countries at a rather long horizon, in the post-1980 period the estimated effect of government spending on prices is not large.

Third, the US is, once again, an exception. It is the only country where the response of the GDP deflator is negative after 4 and 12 quarters; notice, however, that the large negative response over the whole sample estimated here and in other works becomes much smaller in the two separate subsamples.

The effects of a shock to government spending on the CPI deflator, instead of the GDP deflator, are displayed in Table 9. The pattern that emerges is very similar; except in Canada, in the post-1980 sample there is evidence of a slightly stronger response, but the difference is substantial only in Germany.

The responses from a similar exercise, but based on a 6 variable VAR which also includes a commodity price index, are also similar.[42]

10 The effects of taxation

10.1 Effects on output

Table 10 and Figure 3 display the effects of a shock to cyclically adjusted tax revenues equal to 1 percentage point of GDP. For each country, the table displays the impulse responses under the benchmark output elasticity of net taxes (first three lines), and under the same elasticity augmented by one.

Consider first results under the benchmark elasticity. The table makes three points. First, the two countries with the largest output elasticity of net taxes (reported in last column), the US and Canada, are also the only two countries where the impact effect of taxation on output is negative, both in the whole sample and in the two subsamples. This negative impact effect is very small, though, not larger than -.25 pps. In the other countries, the estimated impact effect is always positive, and significant. After a few quarters, the response of GDP is negative in all countries in the pre-1980 period (although insignificant in Australia), between -.19 pps in the UK and

increases more in the post-1980 sample.

[42]Following much of the literature, the commodity price index is ordered first. Results when it is ordered last (see Sims and Zha [1998]) are very similar. It should be noted that the reasons for controlling for a commodity price index when estimating the effects of fiscal policy on prices are much less compelling than when estimating the effects of a monetary policy shock.

-.78 pps in the US; in the post-1980 period it is significantly negative in only two countries, Canada and the UK.

Second, there is again evidence of stronger negative effects of taxation in the pre-1980 period than in the post-1980 one. For instance, after 4 quarters the output response is algebraically smaller in the second subsample in 4 countries out of 5.

Third, the tax multipliers (defined as the minimum output response) are not large: they are usually negative, but larger than one in absolute value only in the US and in West Germany in the pre-1980 sample; in the post-1980 sample, the tax multiplier is between -.6 and -.7 in Canada and West Germany, close to 0 in the other countries.

The positive estimated effects of taxation in Australia, UK and West Germany are suspicious. These are the three countries with the smaller output elasticities of net taxes (in particular, in the first two the benchmark elasticity is close to 0). As discussed, there are two reasons for this the very small (or zero, in the case of Australia and the UK) estimated output elasticity of employment and employment elasticity of wages; and the zero elasticity of corporate income taxes to its base, because corporations can pay quarterly installments on the basis of the previous year's assessed tax liability. This has a large effect on the estimated output elasticity of net taxes, given the large weight of the corporate income tax in the net tax elasticity.

Both conditions are implausible. In particular, it is likely that corporations would choose to pay quarterly installments based on expected profits, if these differ greatly from the previous year's profits. For each country, the second set of rows in Table 10 displays the impulse response of output under an assumed output elasticity of net taxes equal to the benchmark value, augmented by 1. As expected, the response of output falls algebraically at virtually all horizons. But in Australia and in the United Kingdom it often remains positive, or negative but stubbornly small. Reassuringly, note that the size of tax multiplier seems to be largely independent of the net tax elasticity.

Thus, the evidence suggests that the effects of taxation on output are not large; once again, the relatively large estimated effects for the US seem to be towards the high end of the spectrum.

It is interesting to relate the ranking of the tax multipliers with that of the government spending multipliers. In the pre-1980 period, the US and West Germany have by far the two highest tax and spending multipliers; Canada and the UK have similar spending multipliers, and similar tax multipliers; finally, Australia has the smallest spending and tax multipliers. In the post-1980 period, as we have seen in most countries the response of output to a government spending shock is mostly negative; there is indeed a very close match between the rankings of the *minimum* responses to a spending shock and to a net tax shock. is mostly negative West Germany has the largest government spending

One might wonder how government spending responds to tax shocks, and whether this could explain some of the variation in the output response, over time and across countries. This is unlikely. Government spending never increases more than .2 pps of GDP at any horizon and in either subsample. The exception is West Germany, where it increases by .6 pps on impact and by .4 pps after 4 quarters. This might help explain the positive GDP response on impact (although note that GDP turns significantly negative after 4 quarters).

Table 11 reports the cumulative effects of a net tax shock on net taxes (first three columns) and the cumulative tax multiplier (last three columns). In general, net tax shocks have less persistent effects than government spending shocks; there is also some more dispersion over time and across countries. Note however the very similar cumulative response of net taxes at 4 quarters in the post-1980 period.[43]

10.2 Effects on interest rates

Table 12 displays the effects of net tax shocks on nominal and real interest rates, and on the cumulative deficit. In the whole sample, net tax shocks have positive effects on the nominal interest rate in 3 countries (USA, Canada, and Australia), all around .22 pps, and essentially no impact effect in West Germany and the UK. The same pattern can be observed at 4 quarters. The pattern in the post-1980 period is broadly similar: the nominal interest rate increases on impact in the same three countries as before, by between .2 and .4 pps; after 4 quarters, it increases in Australia and the UK.

Note that, with the partial exception of West Germany (where as we have seen government spending increases more), the cumulative deficit falls by very similar amounts in all countries at quarters 1 and 4, and even at quarter 12 (except that in West Germany the deficit actually increases).

The increase in the nominal interest rate in response to a tax shock can be explained in two ways. First, it is part of a joint tightening by fiscal and monetary authorities;[44] second, it is a consequence of reverse causation: when

[43] Note that in some cases the cumulated effect on net taxes is close to zero, generating very large net tax multipliers.

[44] This explanation might be consistent with the fall in the nominal interest rate in response to a positive government spending shock that occurs in two countries in the post-1980 period. However, only in the US does the interest reate increase in response both to a negative government spending shock and to a positive net tax shock.

interest income increases, tax revenues from non-labor income also increase.

10.3 Effects on prices

Table 13 displays the effects of a tax shock on prices. For each country the first three lines display the results under the benchmark price elasticity; the next three lines under the same elasticity, less .5. In the full sample, the impact effect on prices is negative in three countries (UK, Canada, Australia), and 0 in the others. After 4 quarters it is still negative in Australia and Canada, and positive in West Germany.

In the post-1980 sample, the impact effect is again negative in three countries (West Germany, Australia, UK), and remarkably similar at -.2 pp; after 4 quarters it is negative in two countries, US and UK, again at around -.2 pps, and 0 in the others. But after 12 quarters, it is positive small (.14 pps) in the UK, positive and large (.84 pps) in Australia, and significantly negative only in the US.

There is evidence of stronger negative effects on prices in the pre-1980 period; after 4 quarters, the response of the GDP deflator is significantly negative in 3 countries (UK, Canada, and Australia), between -.2 and -.8 pps; after 12 quarters, it is still significantly negative in three countries, and 0 in two. These stronger negative effects of net tax shocks on prices in the pre-1980 period are consistent with the stronger negative effects on GDP and demand.

Thus, it appears that, particularly in the post-1980 period, the effects of tax shocks on prices are negative but small in the short run; after 3 years, there is some evidence of a positive effect in two countries, although only in Australia is this positive effect large.

Isthere a relation between the effects of government spending on taxes and those of net taxes? At quarter 4, we have seen that usually the effects of government spending are insignificant; but at quarter 12, government spending shock and net tax shocks all have effects on prices of the same signs, although not always significant.

11 Conclusions

It is useful to reiterate the main conclusions from this exercise. 1) The effects of fiscal policy on GDP and its components have become substantially weaker in the last 20 years; 2) The estimated effects of fiscal policy on GDP tend to be small: in the pre-1980 sample, positive government spending multipliers larger than 1 tend to be the exception; in the post-1980 period, significantly negative multipliers of government spending are the norm; the tax multipliers are even smaller; 3) To understand the effects of fiscal policy on prices, the price elasticity of the government budget items is crucial, an issue that has not been widely appreciated; 4) Once plausible values of the price elasticity of government spending are imposed, the negative effects of government spending on prices that have been frequently estimated become positive, although usually small and not always significant; 5) Government spending shocks have significant effects on the real short interest rate, but of uncertain signs: after 4 quarters, positive in three countries, negative in two. 6) Net tax shocks have very small effects on prices, typically negative or zero in the second part of the sample; 7) The US is an outlier in many dimensions; responses to fiscal shocks estimated on US data are often not representative of the average OECD country included in this sample.

The difference in the responses to a government spending shocks appears large and robust. What can account for this decline in the efficacy of fiscal policy? A few obvious candidate explanations come to mind, but none is convincing. All the economies in the sample have become more open over time, but the increase in the export / GDP ratio is probably too small to account for the large changes in the government spending multipliers. For more than half of the first period the countries of the sample were on a fixed exchange rate regime: a standard Mundell - Fleming model would predict that fiscal policy is less powerful under flexible exchange rates. Yet, there is no evidence of a systematic crowding out of exports in the second sample. Finally, the behavior of the monetary authorities might have changed in the second part of the sample. Yet, in response to a fiscal shock the real interest rate increases less or falls more in the second period than in the first, except in Canada. Hence, the asymmetry documented in this paper still awaits an explanation.

All these results are of course conditional on the specific methodology used to identify the fiscal shocks. It is therefore important to be aware of its potential shortcomings. While decision lags help in identifying the shocks, the implementation lags of fiscal policy could undermine the unpredictability of the estimated fiscal shocks: precisely because it takes time for fiscal policy changes to be implemented, it is likely that the private sector will factor in these changes before they are actually observed by the econometrician. This is undoubtedly a danger in the methodology used in this paper. Blanchard and Perotti [2002] show how to address this issue, under the maintained assumption that fiscal policymakers cannot respond to output shocks for at least two quarters, instead of one as assumed so far. They show that for the US taking into account anticipated fiscal policy does not change the results substantially. A similar exercise here would carry us far afield. However, it is important to note that anticipated fiscal policy is unlikely to undermine what is perhaps the most interesting result of this paper – the decline in the potency of fiscal policy over the last twenty years. While anticipated fiscal policy might well bias the estimated impulse response downward, it is difficult to see why it should do so more in the second part of the sample.[45]

[45] A possible explanation is that the share of liquidity constrained individuals has decreased as credit markets have become more efficient. It is doubtful, however, that this is enough to explain the large drops in the estimated responses to a government spending shock.

Appendix 1: Tax elasticities and collection lags

This Appendix reports the contemporaneous tax elasticities, collection lags, and quarter dependence for cash tax revenues. For true accrual measures of tax revenues, the tax elasticity would always be the statutory tax elasticity, as measured by the OECD, and the notion of collection lags would not apply.

United States

Individual income tax. (i) Income from employment: withholding system. Contemporaneous elasticity to real earnings per person: OECD elasticity. Collection lags: none. (ii) Income from self-employment and business: quarterly installments of income tax based on expected income. Contemporaneous elasticity to real earnings per person: OECD elasticity. Collection lags: none.

Corporate income tax. Each corporation can have its own fiscal year different from the tax year. Large corporations are required to make quarterly installment payments, of at least .8 of the tax final tax liability. No penalty was applied if the estimated tax liability is based on previous year's tax liability; this exception has been gradually phased out from 1980 on. Contemporaneous elasticity to tax base: 1, although it could be lower at the beginning of the sample until the mid eighties, when a company could base its estimated tax liability on the previous year's tax liability. Collection lags: none.

United Kingdom

Individual income tax. (i) Income from employment and pensions: weekly withholding during entire sample. Contemporaneous elasticity to real earnings per person: OECD elasticity. Collection lags: none. (ii) Income from self-employment: same tax rates as for income from employment (with proportional surcharge). For tax year ending April 1 of year t, two lump sum payments on January 1 and July 1 of year t, based on assessment for fiscal year ending April t-1. Contemporaneous elasticity: 0.

Corporate income tax: For companies started before 1965: If the company's accounting period ends before March 31st of year t, the tax is due January 1 of year t+1. If the company's accounting period ends after March 31st of year t, the tax is due January 1st of year t+2. Hence, the lag in the payment is between 9 and 21 months. For companies started after 1965: the tax is due 9 months after the end of the accounting period. Contemporaneous elasticity: to tax base: 0.

Canada.

Individual income tax. (i) Income from employment: withholding system. Contemporaneous elasticity to real earnings per person: OECD elasticity. Collection lags: none. Quarter dependence: none. (ii) Income from self-employment and business: If an individual has less than 25% of his income from dependent employment, required to pay quarterly installments of income tax on expected income. Expected income is mostly based on previous year's income. Contemporaneous elasticity: 0. .
Corporate income tax. Each corporation has its own fiscal year. The taxation year is jan 1 to Dec 31, and covers corporations whose fiscal year ends within this calendar year. Corporations must pay quarterly installments on expected income. Contemporaneous elasticity to tax base: 1.

West Germany

Individual income tax. (i) Income from employment: withholding system. Contemporaneous elasticity to real earnings per person: OECD elasticity. Collection lags: none. (ii) Income from self-employment and business: quarterly installments of income tax based on previous year's assessed tax liability. Contemporaneous elasticity: 0.
Corporate income tax. Quarterly installments, based on previous year's assessment Contemporaneous elasticity to tax base: 0.

Australia

Individual income tax. (i) Income from employment: withholding system. Contemporaneous elasticity to real earnings per person: OECD elasticity. Collection lags: none. (ii) Income from self-employment and business: installments of income tax based on previous year's assessed tax liability. Contemporaneous elasticity: 0.
Corporate income tax. Quarterly installments, based on previous year's assessment. Contemporaneous elasticity to tax base: 0.

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Table 1: Tax elasticities

		etaxy	etaxp
USA	**all**	1.95	1.23
	to1979	1.94	1.10
	1980on	1.96	1.35
DEU	**all**	0.90	0.98
	to1979	0.90	0.91
	1980on	0.99	1.06
GBR	**all**	0.79	1.17
	to1979	0.65	1.06
	1980on	0.90	1.26
CAN	**all**	1.92	1.09
	to1979	1.67	1.09
	1980on	2.22	1.09
AUS	**all**	0.10	1.00
	to1979	0.08	0.96
	1980on	0.11	1.04

etaxy: average elasticity of real taxes to GDPt
etaxp: average elasticity of real net taxes to GDP deflator

Table 2: Chow tests

		Chow test	Pval
USA	**G**	1.36	0.15
	T	2.58	0.00
	Y	1.57	0.07
	P	2.56	0.00
	i	2.88	0.00
DEU	**G**	1.51	0.10
	T	1.36	0.17
	Y	1.18	0.29
	P	1.42	0.14
	i	1.41	0.14
GBR	**G**	1.76	0.03
	T	2.32	0.00
	Y	1.21	0.26
	P	1.83	0.02
	i	1.19	0.28
CAN	**G**	1.44	0.11
	T	2.41	0.00
	Y	2.03	0.01
	P	1.99	0.01
	i	1.23	0.24
AUS	**G**	1.44	0.12
	T	2.73	0.00
	Y	1.24	0.23
	P	2.41	0.00
	i	0.96	0.52

The table displays the statistics from a Chow test on each reduced form equation, with the associated p-value. The test statistic is distributed according to the F-distribution, with the following degrees of freedom:

USA: F(21,118); West Germany: F(21,74); UK: F(21,110); Canada: F(21,118); Australia: F(21,105)

Breakpoint for tests: 1980:1 (Germany: 1975:1)

Table 3: Effects of G on Y

		1qrt	4qrts	12qrts	20qrts	max	min
USA	**all**	0.43*	0.29	0.97*	0.96*	1.05*(15)	0.29(4)
	to1979	0.73*	0.55	1.30*	-0.62	1.57*(10)	-0.62(20)
	1980on	0.07	0.20	-0.53	-1.26*	0.49(3)	-1.26*(20)
DEU	**all**	1.30*	0.96*	-0.02	0.94*	1.30*(1)	-0.27(10)
	to1979	1.65*	1.24*	0.21	1.06*	1.65*(1)	-0.18(9)
	1980on	0.80*	-0.72*	-0.86	-0.71	0.80*(1)	-1.55*(7)
GBR	**all**	0.30*	-0.04	0.21	0.06	0.30*(1)	-0.04(4)
	to1979	0.46*	-0.20	0.30	0.81*	0.91*(17)	-0.20(4)
	1980on	-0.18*	-0.23	-1.30*	-1.08*	-0.01(3)	-1.52*(15)
CAN	**all**	0.42*	0.06	0.24	0.18	0.46*(2)	0.06(4)
	to1979	0.62*	0.01	0.81*	0.94*	0.94*(17)	0.01(4)
	1980on	0.07	0.17	-2.23*	-2.21*	0.17(3)	-2.36*(16)
AUS	**all**	0.31*	0.01	0.27	0.20	0.31*(1)	-0.08(3)
	to1979	0.01	0.14	0.30	0.33*	0.51*(5)	-0.31(2)
	1980on	0.59*	0.47*	0.75*	0.62*	0.79*(14)	0.32*(3)

The table displays the effects on GDP of a shock to government spending equal to 1 percentage point of GDP. In parentheses beside the max and min response are the quarters at which they occur.

Model with 5 variables: G,T,Y,P,i

Elasticity of government spending to GDP deflator: -0.5.

A “*” indicates that 0 is outside the region between the two one-standard error bands.

Table 4: cumulative effects of G on G; cumulative output multipliers

		g_cum 4 qrts	g_cum 12 qrts	g_cum 20 qrts	y_cum/ g_cum 4 qrts	y_cum/ g_cum 12 qrts	y_cum/ g_cum 20 qrts
USA	**all**	3.55*	8.66*	10.85*	0.47	0.82	1.40
	to1979	3.37*	6.53*	7.63*	0.87	2.08	1.85
	1980on	2.71*	6.62*	7.52*	0.26	0.07	-1.05
DEU	**all**	3.54*	10.92*	15.50*	1.29	0.41	0.59
	to1979	3.00*	7.39*	8.91*	1.95	0.90	1.47
	1980on	3.99*	11.89*	15.95*	0.01	-0.86	-0.94
GBR	**all**	3.40*	7.98*	10.93*	0.20	0.29	0.30
	to1979	3.24*	7.19*	9.64*	0.30	0.20	0.80
	1980on	3.24*	5.67*	5.01*	-0.19	-1.17	-3.52
CAN	**all**	2.94*	7.27*	10.83*	0.40	0.43	0.45
	to1979	2.34*	5.27*	7.53*	0.76	1.23	1.83
	1980on	2.93*	7.70*	9.76*	0.15	-1.43	-3.03
AUS	**all**	2.89*	6.20*	8.10*	0.08	0.31	0.47
	to1979	2.18*	5.08*	5.98*	-0.09	0.30	0.77
	1980on	2.59*	5.15*	6.10*	0.68	1.28	2.03

The table displays the cumulative effects on government spending of a shock to government spending equal to 1 percentage point of GDP (first 3 columns) and the cumulative multipliers from the same exercise (last 3 columns).

Model with 5 variables: G,T,Y,P,i.

Elasticity of government spending to GDP deflator: -0.5

A '*' indicates that 0 is outside the region between the two one-standard error bands.

Table 5: Cumulative government spending multipliers from macroeconometric models and VARs

		1qrt	4qrts	12qrts
DRI		1.53	2.05	1.86
EEC		-	1.18	1.10
EPA		1.14	1.57	1.63
LINK		-	1.24	1.14
LIVERPOOL		-	0.65	0.58
MCM		1.26	1.56	1.61
MINIMOD		1.09	1.11	0.94
MSG		-	0.97	0.85
OECD		-	1.53	1.07
TAYLOR		1.26	1.64	0.93
WHARTON		-	1.78	1.56
USA	**to1979**	0.27	0.87	2.08
	1980on	0.14	0.26	0.07
DEU	**to1979**	0.17	1.95	0.90
	1980on	0.35	0.01	-0.86
GBR	**to1979**	-0.03	0.30	0.20
	1980on	0.26	-0.19	-1.17
CAN	**to1979**	0.01	0.76	1.23
	1980on	-0.03	0.15	-1.43
AUS	**to1979**	0.77	-0.09	0.3
	1980on	-0.17	0.68	1.28

The first panel displays the cumulative multipliers from 11 macroeconometric models, as displayed in Sims [1988]. The second panel displays the cumulative multipliers from a 5 variable VAR, as In Table 4.

Table 6: Effects of G on nominal and real interest rate

		Nominal interest rate				Real interest rate				Cumulative deficit			
		1qrt	**4qrts**	**12qrts**	**20qrts**	**1qrt**	**4qrts**	**12qrts**	**20qrts**	**1qrt**	**4qrts**	**12qrts**	**20qrts**
USA	**all**	-0.69*	-1.31*	-0.86*	-0.23	-0.44	-1.1*	-0.79*	-0.26*	0.87*	3.16*	6.78*	4.90*
	to79	-0.57*	-0.52	1.12*	-0.27	-0.36	-0.38*	0.97*	-0.26*	0.89*	2.19*	-1.38	-0.64
	from80	-0.62*	-1.41*	-0.21	-0.28	-0.44	-1.37*	-0.28*	-0.26*	0.90*	2.77*	6.25*	10.37*
DEU	**all**	0.35*	1.41*	-0.47	-0.18	0.14	1.24*	-0.42*	-0.15*	0.05	-1.10*	4.49*	8.52*
	to79	0.46*	1.86*	-0.76*	0.09	0.19	1.75*	-0.64*	0.08*	-0.29*	-2.63*	1.04	2.00*
	from80	0.80	0.50	-0.65	0.50	0.65	0.63*	-0.55*	0.48*	0.19	1.65*	13.75*	18.71*
GBR	**all**	0.05	0.51*	0.40*	0.40*	-0.17	0.23*	0.12*	0.26*	0.76*	3.31*	8.73*	13.44*
	to79	0.18*	0.95*	-0.29*	0.28*	-0.43	0.81*	0.01	0.10*	1.24*	3.06*	4.54*	6.08*
	from80	-0.40*	-0.57*	-0.08	-1.07*	-0.12	-0.54*	-0.07*	-0.87*	0.88*	5.41*	20.87*	35.59*
CAN	**all**	0.10	0.42*	0.33*	0.38*	0.08	0.36*	0.23*	0.31*	0.95*	2.97*	8.01*	12.94*
	to79	-0.14*	0.08	-0.29*	-0.06	-0.05	0.19*	-0.41*	-0.19*	0.80*	0.25*	-0.26	-1.31*
	from80	0.49*	1.62*	0.08	-0.09	0.47	1.52*	0.10*	-0.02*	1.07*	3.19*	10.92*	19.17*
AUS	**all**	0.02	0.09	0.41*	0.43*	-0.43	-0.06*	0.29*	0.37*	0.82*	2.88*	5.45*	6.17*
	to79	0.09*	0.20	-0.05	0.07	-0.93	0.92*	-0.02	0.08*	0.87*	1.47*	3.38*	3.59*
	from80	0.38*	0.45*	0.25	0.21*	0.20	0.25*	0.17*	0.19*	0.76*	1.84*	1.24*	-1.08

The table displays the effects of a shock to government spending equal to 1 percentage point of GDP on the nominal interest rate, the real interest rate, and the cumulated deficit

Model with 5 variables: G, T, Y, P, i

Elasticity of government spending to GDP deflator: -0.5

A '*' indicates that 0 is outside the region between the two one-standard error bands.

Table 7: effect of G on GDP components

		1qrt	4qrts	12qrts	20qrts	max	min	Cumulative multipliers 4 qrts	12 qrts	20 qrts
PRIVATE CONSUMPTION										
USA	**all**	0.22*	0.69*	1.15*	0.92*	1.15*(10)	0.22*(1)	0.54	1.23	1.73
	to79	0.29*	0.65*	0.94*	0.01	1.39*(7)	-0.04(19)	0.57	1.41	1.27
	from80	0.16*	0.59*	-0.10	-0.81	0.59*(4)	-0.81(20)	0.55	0.53	-0.15
DEU	**all**	0.43*	0.14	0.18	0.60*	0.61*(18)	-0.20(8)	0.28	0.05	0.34
	to79	0.34*	-0.17	0.13	0.29	0.34*(1)	-0.60*(8)	0.02	-0.35	-0.05
	from80	0.21*	-0.15	0.46	0.39	0.63*(16)	-0.16(7)	0.04	0.09	0.31
GBR	**all**	0.33*	0.16	-0.03	-0.03	0.34*(3)	-0.10(9)	0.28	0.09	0.06
	to79	0.74*	0.20	-0.18	0.43*	0.74*(1)	-0.50*(9)	0.58	-0.12	0.26
	from80	-0.09	0.09	-0.41	-0.53*	0.28(3)	-0.59*(17)	0.11	-0.04	-0.92
CAN	**all**	0.16*	0.01	-0.30*	-0.24*	0.16*(1)	-0.31*(14)	0.16	-0.15	-0.35
	to79	0.24*	-0.04	0.30*	0.25*	0.36*(3)	-0.04(4)	0.38	0.48	0.63
	from80	0.15*	0.03	-0.89*	-1.11*	0.15*(1)	-1.13*(19)	0.07	-0.55	-1.36
AUS	**all**	0.57*	0.10	0.12	0.11	0.57*(1)	0.10(4)	0.36	0.38	0.42
	to79	1.28*	-0.11	0.12	0.01	1.28*(1)	-0.11(4)	0.86	1.81	2.23
	from80	0.34*	0.15*	-0.11	-0.05	0.34*(1)	-0.12(13)	0.22	0.14	-0.00
PRIVATE INVESTMENT										
USA	**all**	-0.43*	-0.55*	0.08	-0.10	0.09(13)	-0.73*(2)	-0.67	-0.46	-0.37
	to79	0.01	0.19	0.67*	-0.68*	0.99*(9)	-0.73*(19)	0.12	0.93	0.41
	from80	-0.53*	0.28	-0.70*	-0.78*	0.67*(3)	-0.84*(17)	0.01	-0.57	-1.41
DEU	**all**	-0.07	-0.39	-0.17	-0.06	0.12(2)	-0.74*(7)	-0.14	-0.39	-0.29
	to79	0.15	0.07	0.08	0.01	0.62*(2)	-0.28(6)	0.40	0.09	0.00
	from80	0.20	-1.28*	-0.98*	-0.13	0.20(1)	-2.25*(8)	-0.48	-1.37	-1.07
GBR	**all**	-0.37*	0.14	0.09	-0.15	0.34*(3)	-0.10(9)	-0.16	0.04	-0.00
	to79	-0.61*	0.28*	-0.04	0.12	0.74*(1)	-0.5*(9)	-0.19	-0.23	0.07
	from80	-0.79*	-0.36	-0.99*	-0.86*	0.28(3)	-0.59*(17)	-0.67	-1.28	-3.12
CAN	**all**	0.02	0.06	0.21	0.10	0.34*(2)	0.02(1)	0.20	0.35	0.34
	to79	0.19*	-0.06	0.09	0.44*	0.67*(2)	-0.28(8)	0.42	0.05	0.44
	from80	-0.21*	0.14	-0.94*	-0.70*	0.36(3)	-0.94*(12)	0.15	-0.54	-1.12
AUS	**all**	0.09	-0.08	-0.02	-0.03	0.19*(2)	-0.08(4)	0.10	-0.00	-0.02
	to79	0.13*	-0.36*	0.14	0.05	0.23(14)	-0.36*(4)	-0.11	-0.21	0.02
	from80	0.03	-0.39*	0.37*	0.30*	0.53*(15)	-0.39*(4)	-0.22	-0.15	0.38

		1qrt	4qrts	12qrts	20qrts	max	min	Cumulative effect 4 qrts	12 qrts	20 qrts
EXPORTS										
USA	**all**	-0.03	-0.52*	-0.05	0.35*	0.35*(20)	-0.52*(4)	-0.34	-0.51	-0.21
	to79	-0.07*	-0.52*	-0.01	0.04	0.17*(16)	-0.52*(4)	-0.33	-0.42	-0.23
	from80	-0.05	0.05	0.31*	0.12	0.33*(10)	-0.05(2)	-0.03	0.71	2.02
DEU	**all**	0.87*	0.99*	-0.22	0.64*	1.23*(3)	-0.37*(10)	1.19	0.33	0.33
	to79	0.88*	0.71*	0.01	0.56*	0.94*(3)	-0.27(10)	1.13	0.41	0.60
	from80	0.33*	1.01*	-1.05*	0.01	1.01*(4)	-1.26*(10)	0.66	-0.00	-0.17
GBR	**all**	0.33*	0.49*	0.97*	0.70*	0.99*(11)	0.33*(1)	0.50	1.11	1.45
	to79	0.36*	-0.08	0.45*	0.53*	0.57*(7)	-0.08(4)	0.24	0.68	1.10
	from80	-0.18*	0.19	0.19	0.31	0.59(8)	-0.19(2)	-0.06	0.65	0.94
CAN	**all**	0.11	-0.01	0.41*	0.42*	0.43*(17)	-0.01(4)	0.10	0.42	0.65
	to79	-0.03	-0.28*	0.20*	0.44*	0.46*(18)	-0.28*(4)	-0.06	0.05	0.42
	from80	0.17*	0.42	0.58	1.75*	1.75*(20)	-0.20(2)	0.08	0.74	11.29
AUS	**all**	0.07	-0.05	-0.01	-0.06	0.07(1)	-0.10(2)	-0.05	-0.06	-0.09
	to79	-0.22*	-0.15	-0.03	0.06	0.06(19)	-0.45*(2)	-0.44	-0.29	-0.19
	from80	0.25*	0.23*	0.20*	0.07	0.36*(7)	0.04(3)	0.26	0.61	0.75
IMPORTS										
USA	**all**	0.02	-0.34*	-0.07	0.02	0.02(1)	-0.37*(3)	-0.28	-0.29	-0.24
	to79	0.00	-0.35*	0.04	-0.10	0.07(11)	-0.35*(4)	-0.24	-0.12	-0.12
	from80	0.09*	0.51*	-0.01	-0.42*	0.51*(4)	-0.42*(20)	0.29	0.32	0.03
DEU	**all**	0.83*	1.15*	0.34*	0.58*	1.15*(4)	0.17(10)	1.11	0.66	0.76
	to79	0.70*	0.49*	0.27	0.15	0.70*(1)	-0.39*(8)	0.75	0.18	0.49
	from80	0.67*	1.56*	0.42	0.33	1.60*(5)	0.25(10)	1.07	0.90	0.96
GBR	**all**	0.77*	1.21*	0.72*	0.27*	1.28*(5)	0.27(20)	1.10	1.53	1.49
	to79	0.87*	1.29*	0.11	0.70*	1.33*(5)	0.11(12)	1.22	1.38	1.94
	from80	0.27*	0.11	-0.58*	-0.35	0.54(6)	-0.66*(14)	0.24	0.24	-0.57
CAN	**all**	0.49*	0.25	0.39*	0.29*	0.56*(2)	0.25(4)	0.58	0.73	0.91
	to79	0.44*	0.05	0.14	0.36*	0.68*(2)	-0.16(7)	0.66	0.28	0.52
	from80	0.39*	0.25	-0.61	0.54	0.54(20)	-0.91*(9)	0.32	-0.80	-0.81
AUS	**all**	0.34*	-0.02	0.07	0.02	0.34*(1)	-0.06(6)	0.14	0.10	0.12
	to79	0.69*	0.33*	-0.14	-0.02	0.69*(1)	-0.27*(10)	0.78	0.28	0.28
	from80	0.44*	0.44*	0.33*	0.05	0.52*(5)	0.05(20)	0.62	0.86	0.98

The table displays the effects on the variable listed in each panel of a shock to government spending equal to 1 percentage point of GDP.
Model with 6 variables: G, T, Y, P, i, and the variable listed in each panel. Elasticity of government spending to GDP deflator: -0.5
A '*' indicates that 0 is outside the region between the two one-standard error bands. In parentheses beside the max and min response are the quarters at which they occur.

Table 8: Effects of G on P

		1qrt	4qrts	12qrts	20qrts	egcnp
USA	**all**	-0.12*	-0.80*	-2.08*	-2.30*	0.0
	to1979	-0.00	-0.41*	-0.69*	0.24	0.0
	1980on	-0.23*	-0.59*	-0.26	0.03	0.0
USA	**all**	-0.01	-0.55*	-1.63*	-1.81*	-0.5
	to1979	0.10*	-0.27	-0.63*	0.35	-0.5
	1980on	-0.16	-0.48*	-0.17	0.07	-0.5
DEU	**all**	0.09	0.87*	1.57*	1.22*	0.0
	to1979	0.03	0.88*	1.19*	0.73	0.0
	1980on	0.08	0.35	-0.21	-0.44	0.0
DEU	**all**	0.25*	1.06*	1.72*	1.32*	-0.5
	to1979	0.22*	1.10*	1.39*	0.91	-0.5
	1980on	0.28	0.48	-0.23	-0.38	-0.5
GBR	**all**	-0.48*	-0.12	2.11*	3.98*	0.0
	to1979	-0.92*	-0.48	-0.08	-1.00	0.0
	1980on	-0.15*	0.06	1.20*	0.28	0.0
GBR	**all**	-0.02	0.66*	3.24*	5.03*	-0.5
	to1979	-0.49*	0.27	0.78	-0.29	-0.5
	1980on	0.21*	0.26	1.13*	0.16	-0.5
CAN	**all**	-0.29*	-0.23	0.41	1.26*	0.0
	to1979	-0.21*	-0.25	-0.06	1.17*	0.0
	1980on	-0.48*	-0.18	0.20	-0.15	0.0
CAN	**all**	-0.08	0.17	0.90*	1.61*	-0.5
	to1979	-0.04	0.02	0.08	1.24*	-0.5
	1980on	-0.27*	0.04	0.31	-0.11	-0.5
AUS	**all**	-0.85*	-0.10	1.02*	1.66*	0.0
	to1979	-1.60*	0.17	-0.28	-0.28	0.0
	1980on	-0.36*	-0.38	0.74*	1.20*	0.0
AUS	**all**	-0.16	0.69*	2.09*	2.82*	-0.5
	to1979	-0.34*	1.48*	1.25*	1.08	-0.5
	1980on	-0.21*	-0.24	0.79*	1.21*	-0.5

The table displays the effects on the GDP deflator of a shock to government spending equal to 1 percentage point of GDP.

Model with 5 variables: G,T,Y,P,i.

The elasticity of government spending to the GDP deflator is displayed in the last column. A '*' indicates that 0 is outside the region between the two one-standard error bands.

Table 9: Effects of G on CPI

		1qrt	4qrts	12qrts	20qrts
USA	**all**	0.20*	-0.18	-1.94*	-2.51*
	to1979	0.27*	0.06	-0.11	1.05*
	1980on	0.14	-0.44	0.20	0.39
DEU	**all**	0.24*	0.96*	2.41*	2.68*
	to1979	0.17*	0.83*	2.42*	2.55*
	1980on	0.35	1.22*	1.28*	0.85
GBR	**all**	0.12	1.35*	4.03*	5.25*
	to1979	-0.03	1.77*	2.58*	2.14*
	1980on	0.26*	-0.14	1.17*	0.04
CAN	**all**	0.02	-0.19*	-0.40*	-0.45*
	to1979	0.01*	-0.09*	-0.29*	-0.22*
	1980on	-0.03	-0.29	0.06	-0.48
AUS	**all**	0.23*	0.78*	2.43*	3.25*
	to1979	0.77*	1.85*	2.62*	2.73*
	1980on	-0.17*	0.33	1.21*	1.37*

The table displays the effects on the CPI of a shock to government spending equal to 1 percentage point of GDP.

Model with 5 variables: G,T,Y,P,i.

Elasticity of government spending to CPI: -0.5. A '*' indicates that 0 is outside the region between the two one-standard error bands.

Table 10: Effects of T on Y

		1qrt	4qrts	12qrts	20qrts	max	min	etaxy
USA	**all**	-0.26*	-0.66*	-0.69*	-0.53*	-0.26*(1)	-0.75*(7)	1.95
	to1979	-0.39*	-0.78*	-1.11*	-0.83*	-0.39*(1)	-1.12*(13)	1.94
	1980on	-0.17*	0.37*	0.79*	-0.11	0.91*(9)	-0.17*(1)	1.96
USA	**all**	-0.47*	-0.86*	-0.76*	-0.51*	-0.47*(1)	-0.88*(6)	2.95
	to1979	-0.54*	-0.80*	-0.98*	-0.86*	-0.34*(1)	-1.01*(14)	2.94
	1980on	-0.49*	-0.03	0.62*	-0.08	0.69*(9)	-0.49(20)	2.96
DEU	**all**	0.27*	-0.46*	-0.51*	0.05	0.27*(1)	-0.98*(7)	0.90
	to1979	0.29*	-0.60*	-0.46*	-0.10	0.29*(1)	-1.16*(7)	0.90
	1980on	0.24*	-0.49*	-0.21	-0.32	0.24*(1)	-0.61*(7)	0.99
DEU	**all**	-0.17*	-0.99*	-0.78*	-0.22	-0.17*(1)	-1.40*(7)	1.90
	to1979	-0.08	-1.09*	-0.69*	-0.37*	-0.08(1)	-1.58*(7)	1.90
	1980on	0.01	-0.66*	-0.20	-0.39*	0.01(1)	-0.66*(4)	1.99
GBR	**all**	0.06*	0.05	0.21*	0.24*	0.24*(20)	0.05(4)	0.79
	to1979	0.05*	-0.19*	0.15	-0.13*	0.15(12)	-0.19*(4)	0.65
	1980on	0.18*	0.34*	0.05	-0.14	0.34*(4)	-0.14(20)	0.90
GBR	**all**	-0.04	-0.02	0.20*	0.23*	0.23*(20)	-0.04(1)	1.79
	to1979	-0.08*	-0.26*	0.11	-0.17*	0.11(12)	-0.26*(4)	1.65
	1980on	0.12*	0.29*	0.03	-0.17	0.29*(4)	-0.17(20)	1.90
CAN	**all**	-0.14*	-0.48*	-0.47*	-0.06	-0.06(2)	-0.61*(8)	1.92
	to1979	-0.18*	-0.28*	0.26*	0.28*	0.28*(17)	-0.28*(4)	1.67
	1980on	-0.12*	-0.55*	-0.44*	-0.09	-0.09(20)	-0.67*(7)	2.22
CAN	**all**	-0.27*	-0.57*	-0.49*	-0.10	-0.10(20)	-0.65*(7)	2.92
	to1979	-0.39*	-0.39*	0.19*	0.19*	0.21*(14)	-0.39*(4)	2.67
	1980on	-0.22*	-0.60*	-0.37*	-0.02	-0.02(20)	-0.65*(7)	3.22
AUS	**all**	0.60*	0.44*	0.13	-0.04	0.60*(1)	-0.04(20)	0.10
	to1979	0.54*	-0.09	-0.01	0.05	0.54*(1)	-0.12(3)	0.08
	1980on	0.41*	0.55*	0.20	-0.14	0.56*(7)	-0.14(20)	0.11
AUS	**all**	0.38*	0.31*	0.05	-0.12	0.42*(2)	-0.12(20)	1.10
	to1979	-0.00	-0.36*	-0.17	-0.08	-0.00(1)	-0.36*(4)	1.08
	1980on	0.25*	0.40*	0.12	-0.21	0.46*(7)	-0.21(20)	1.11

The table displays the effects on GDP of a shock to net taxes equal to 1 percentage point of GDP. In parentheses beside the max and min response are the quarters at which they occur.The output elasticities of net taxes are displayed in the last column

Model with 5 variables: G,T,Y,P,i. Elasticity of government spending to GDP deflator: -0.5. A '*' indicates that 0 is outside the region between the two one-standard error bands.

Table 11: Cumulative effects of T on T; cumulative tax multipliers

		t_cum 4 qrts	t_cum 12 qrts	t_cum 20 qrts	y_cum/ t_cum 4 qrts	y_cum/ t_cum 12 qrts	y_cum/ t_cum 20 qrts
USA	**all**	1.79*	1.71*	1.57	-0.88	-4.31	-7.75
	to1979	1.27*	-0.05	-2.69*	-1.75	177.92	6.58
	1980on	2.23*	5.70*	7.81*	0.27	1.24	1.22
DEU	**all**	3.28*	1.80*	1.36	-0.08	-3.62	-5.47
	to1979	3.08*	0.29	-0.32	-0.22	-26.68	27.82
	1980on	2.55*	0.93	0.85	-0.18	-4.04	-5.63
GBR	**all**	2.18*	4.82*	6.31*	0.14	0.37	0.57
	to1979	1.72*	1.68*	1.75*	-0.11	0.04	0.03
	1980on	1.94*	4.22*	4.04*	0.51	0.56	0.44
CAN	**all**	2.51*	4.72*	6.79*	-0.37	-1.14	-1.07
	to1979	1.32*	2.57*	3.99*	-0.44	0.03	0.58
	1980on	2.47*	2.67*	1.51	-0.41	-2.08	-4.93
AUS	**all**	2.25*	4.33*	4.87*	0.9	1.02	0.93
	to1979	0.67*	1.06*	1.16*	0.59	0.99	1.02
	1980on	2.98*	7.15*	8.26*	0.6	0.72	0.59

The table displays the cumulative effects on net taxes of a shock to net taxes equal to 1 percentage point of GDP (first 3 columns) and the cumulative net tax multipliers from the same exercise (last 3 columns).

Model with 5 variables: G,T,Y,P,i.

Elasticity of government spending to GDP deflator: -0.5

A '*' indicates that 0 is outside the region between the two one-standard error bands.

Table 12: Effects of T on nominal and real interest rate

		Nominal interest rate				Real interest rate				Cumulative deficit			
		1qrt	**4qrts**	**12qrts**	**20qrts**	**1qrt**	**4qrts**	**12qrts**	**20qrts**	**1qrt**	**4qrts**	**12qrts**	**20qrts**
USA	**all**	0.23*	0.17	-0.13	-0.21*	0.41*	0.47*	0.18*	0.01	-0.86*	-1.80*	-2.14*	-2.26*
	to79	0.13*	0.17	-0.08	-0.23*	0.10	0.17*	0.06	-0.07	-0.82*	-1.32*	-1.37*	-0.81*
	from80	0.34*	0.02	0.11	0.08	0.70*	0.31	-0.08	-0.05	-0.88*	-2.19*	-4.28*	-4.59*
DEU	**all**	0.01	0.84*	-0.47*	-0.05	-0.23	0.85*	-0.30*	-0.06	-0.50*	-1.64*	2.14*	3.17*
	to79	-0.00	0.75*	-0.56*	0.22*	-0.01	1.09*	-0.36*	0.08	-0.37*	-1.46*	1.67*	0.87*
	from80	-0.21	0.05	-0.35	0.53*	-0.18	0.10	-0.30	0.42*	-0.65*	-1.33*	3.60*	5.77*
GBR	**all**	0.02	0.15*	0.07	0.01	-0.12	0.14	0.04	-0.05	-0.89*	-1.93*	-4.10*	-5.08*
	to79	0.04*	-0.07	-0.00	0.01	0.08	0.23*	-0.10	-0.07	-1.02*	-2.02*	-2.96*	-3.13*
	from80	0.02	0.34*	0.19*	0.04	-0.08	0.16*	0.14*	0.08*	-0.94*	-2.01*	-4.00*	-3.45*
CAN	**all**	0.16*	-0.06	-0.56*	-0.44*	0.45*	0.29*	-0.35*	-0.41*	-0.89*	-2.30*	-4.04*	-6.27*
	to79	0.09*	-0.41*	-0.16*	-0.04	-0.47*	-0.29	-0.52*	-0.24	-0.75*	-0.56*	-1.11*	-1.96*
	from80	0.25*	0.18	0.02	-0.07	0.00	0.01	0.17*	-0.01	-0.94*	-2.59*	-3.51*	-2.71*
AUS	**all**	0.16*	0.32*	0.21*	0.13*	-0.16	-0.02	0.07	0.06	-0.80*	-2.16*	-4.33*	-4.72*
	to79	-0.14*	0.01	-0.01	0.00	-0.81*	0.39*	-0.00	-0.04	-0.74*	-0.52*	-1.03*	-0.99*
	from80	0.40*	0.46*	0.57*	0.22*	-0.07	-0.06	0.44*	0.31*	-0.81*	-2.63*	-6.70*	-8.06*

The table displays the effects of a shock to net taxes equal to 1 percentage point of GDP on the nominal interest rate, the real interest rate, and the cumulated deficit

Model with 5 variables: G, T, Y, P, i

Elasticity of government spending to GDP deflator: -0.5

A '*' indicates that 0 is outside the region between the two one-standard error bands.

Table 13: Effects of T on P

		1qrt	4qrts	12qrts	20qrts	etaxp
USA	**all**	0.00	-0.12	-0.74*	-1.32*	1.23
	to1979	0.02*	0.05	0.01	-0.31*	1.10
	1980on	-0.02	-0.27*	-0.53*	-0.13	1.35
USA	**all**	0.02	-0.08	-0.67*	-1.24*	0.73
	to1979	0.04*	0.07	0.02	-0.30*	0.60
	1980on	-0.00	-0.24*	-0.51*	-0.12	0.85
DEU	**all**	-0.07	0.17*	0.00	-0.25	0.98
	to1979	-0.08*	0.02	-0.68*	-0.83*	0.91
	1980on	-0.19*	-0.16	-0.37	-0.29	1.06
DEU	**all**	-0.01	0.24*	0.05*	-0.21	0.48
	to1979	-0.02	0.08*	-0.63*	-0.79*	0.41
	1980on	-0.16*	-0.15	-0.39*	-0.29	0.56
GBR	**all**	-0.17*	-0.01	0.04	0.10	1.17
	to1979	-0.21*	-0.20*	-0.93*	-0.48*	1.06
	1980on	-0.24*	-0.16*	0.14*	0.19*	1.26
GBR	**all**	-0.13*	0.07	0.15	0.21	0.67
	to1979	-0.16*	-0.12	-0.88*	-0.42	0.56
	1980on	-0.22*	-0.14*	0.14*	0.19*	0.76
CAN	**all**	-0.11*	-0.31*	-0.97*	-1.29*	1.09
	to1979	-0.16*	-0.49*	-0.41*	0.26	1.09
	1980on	-0.08	0.11	0.22	-0.05	1.09
CAN	**all**	-0.07*	-0.24*	-0.89*	-1.25*	0.59
	to1979	-0.11*	-0.41*	-0.37	0.28	0.59
	1980on	-0.05	0.15	0.24	-0.05	0.59
AUS	**all**	-0.55*	-0.45*	0.05	0.29	1.00
	to1979	-1.07*	-0.80*	-0.30	-0.30	0.96
	1980on	-0.19*	0.06	0.84*	0.96*	1.04
AUS	**all**	-0.38*	-0.25*	0.37	0.65	0.50
	to1979	-0.77*	-0.48*	0.20	0.13	0.46
	1980on	-0.13	0.12	0.88*	0.98*	0.54

The table displays the effects on the GDP deflator of a shock to net taxes equal to 1 percentage point of GDP.
Model with 5 variables: G,T,Y,P,i.
The elasticity of net taxes to the GDP deflator is displayed in the last column. A '*' indicates that 0 is outside the region between the two one-standard error bands.

Figure 1 - G and T shocks, USA

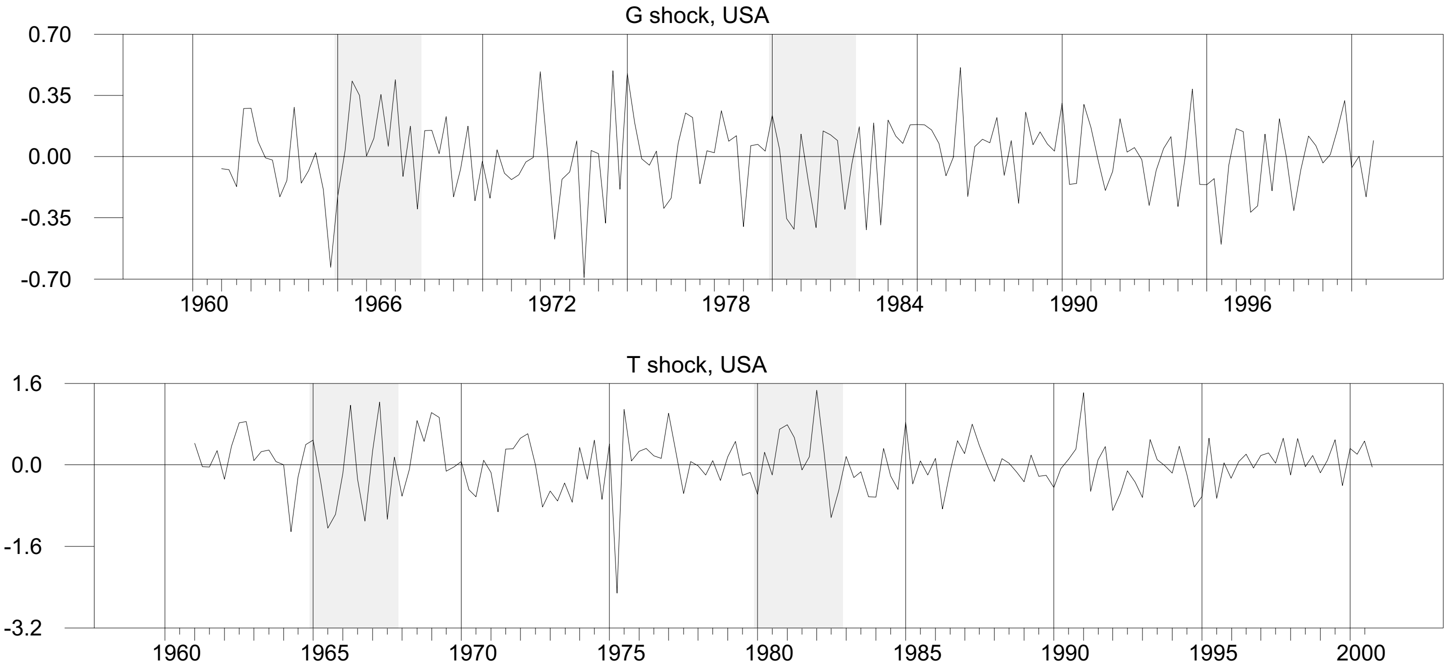


Figure 2 - Response of Y to G

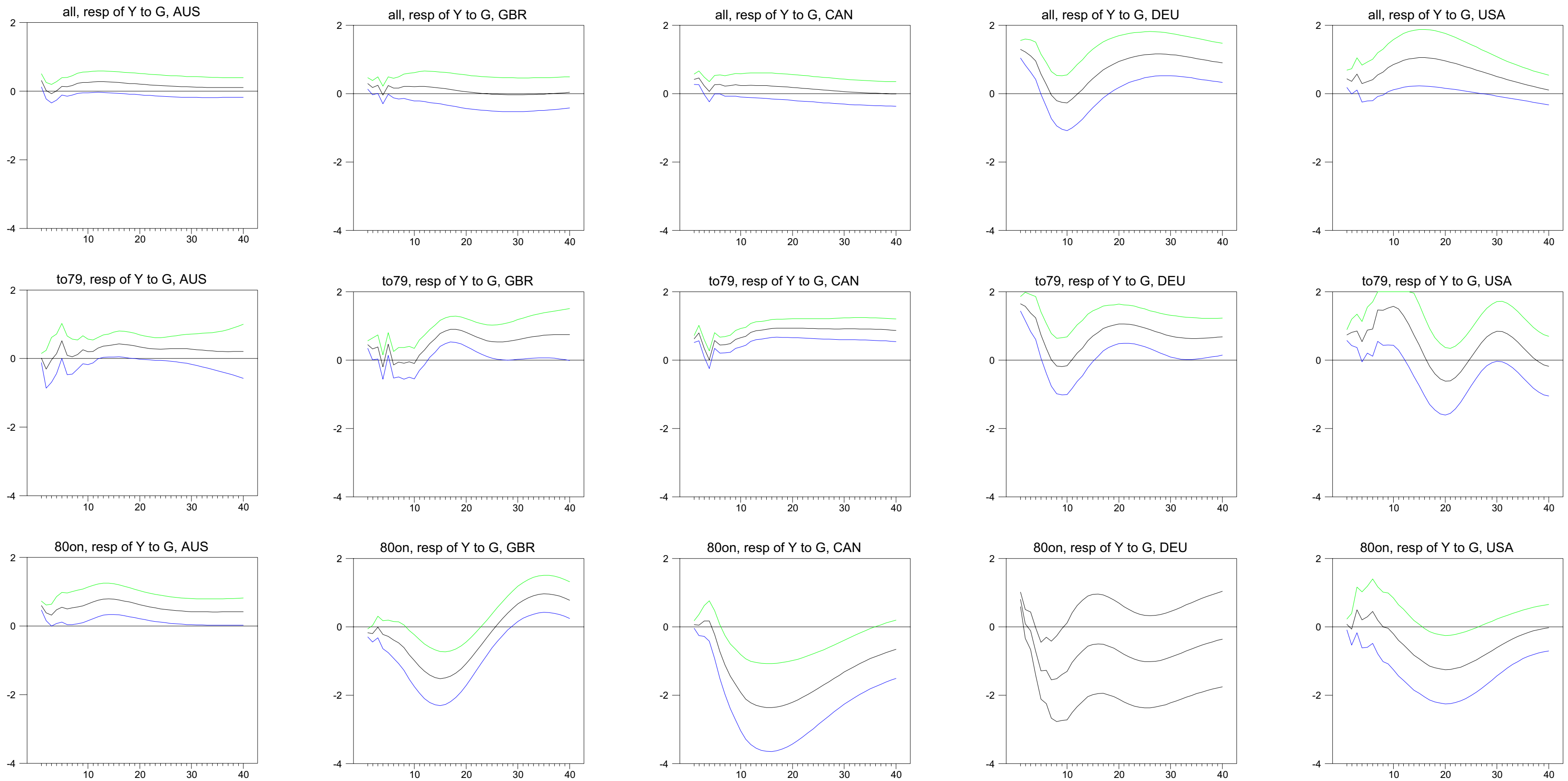
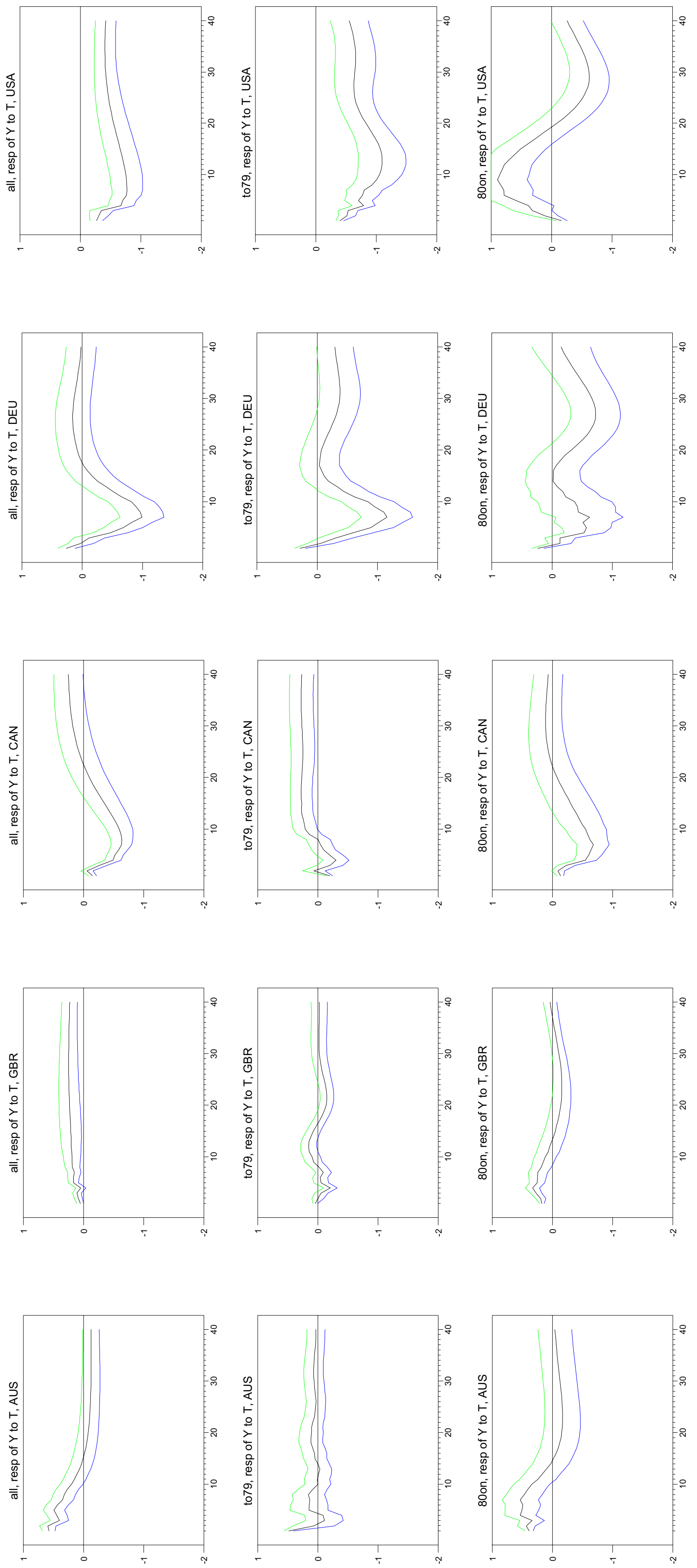


Figure 3 - Response of Y to T



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