

# Government spending multipliers: An international comparison\*

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## Abstract

We compare the transmission of three types of government spending shocks in Canada, Japan, the UK and the US and in the Euro area. Fiscal shocks are identified in a SVAR via theoretical robust sign restrictions: disturbances to government consumption, government investment and government employment increase output and deficits contemporaneously. All spending shocks increase private consumption and employment, while the responses of private investment and the real wage are mixed. Government employment multipliers are the highest for all countries and all samples. The transmission of fiscal shocks has changed features over time.

JEL classification: C11, E12, E32, E62, H30.

Key Words: fiscal policy shocks, SVARs, sign restrictions, stability.

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# 1 Introduction

How does the economy react to fiscal shocks? This question became central in academic and policy circles over the last two years. The answer typically depends on the methodology used to extract fiscal shocks and on the identification restrictions employed. The "Dummy Variable" approach, which considers fiscal shocks as episodes of significant exogenous and unforeseen increases in government spending for national defense (see, e.g., Rotemberg and Woodford (1992), Ramey and Shapiro (1998), Edelberg et al. (1999), and Burnside et. el. (2004) among others) find that a positive shock to spending for national defense makes private consumption and the real wage fall while employment and nonresidential investments increase. The Structural Vector Autoregression (SVAR) methodology, which identifies fiscal shocks by assuming that fiscal variables do not contemporaneously react to changes in economic conditions (see, e.g., Blanchard and Perotti (2002), Fatas and Mihov (2001) and Perotti (2004)) concludes that private consumption, output, employment and the real wage positively comove with the spending shock. The evidence that the Dummy Variable approach delivers is consistent with basic neoclassical Real Business Cycle (RBC) models which predict that increases in government consumption should crowd out the private sector and reduce the real wage. The evidence of the SVAR approach, on the other hand, is consistent with traditional Keynesian models, which typically predict that an increase in government expenditure should be accompanied by an increase in labor demand, generating an increase in the real wage, in output and consumption.

Perotti (2007) has shown that the different conclusions the two approaches yield are in part due to the strong restrictions that the Dummy variable approach imposes. When these restrictions are relaxed, he finds that the dynamics in response to exogenous government expenditure increases are similar to those of the SVAR literature. Caldara and Kamps (2008), on the other hand, show that part of the differences among approaches is due to important differences in the specification of the empirical model: once these differences are removed, responses to government expenditure shocks look similar in the two approaches.

The Dummy and the standard SVAR approaches are not the only method used to identify fiscal shocks in the empirical literature. For example, Canova and Pappa (2006) and (2007), Pappa (2009) and Mountford and Uhlig (2009) have used sign restrictions to identify fiscal shocks. Sign restrictions are preferable to those of the standard SVAR

approach because they are valid with data at any frequency; because they are shared by models with different microfoundations, and because they circumvent problems connected with the endogeneity and the predictability of movements in fiscal variables. The evidence that this literature produces is somewhat mixed, but, in general, shocks to government expenditure tend to increase employment and real wages.

With the exclusion of Perotti (2004) and Canova and Pappa (2007), the focus of the analysis has been on the US, primarily because it is difficult to find comparable international data and because fiscal variables measure different aggregates in different countries. Data availability also restricts our exercise to five countries. We use quarterly data for Canada, Japan, UK and US from 1970 until 2008 and for the Euro area since 1991. In order to account for potential structural breaks (See, Kim and Nelson (1999), McConell and Perez-Quiros (2000), and Stock and Watson (2003)), we also split the sample at the beginning of the 1980s.

Although theoretically economists have tried to investigate the effects of different types of fiscal stimuli (See, e.g., Finn (1998) for an early contribution, and Gomes (2009) and Faia et al. (2010) for more recent contributions), with the exception of Pappa (2009), empirical exercises on the effects of different types of government spending shocks are scarce in the literature. The aim of this paper is to cover this gap.

Using a structural VAR for the log of real per capita GDP, the log of real per capita government expenditure in either (a) goods purchases, (b) capital outlays, or (c) government employment and the log of real per-capita net tax revenues, the log of average real production wage per job, the log of total employment, the log of real per capita private consumption and investment, a measure of a short term interest rate and oil prices we identify fiscal shocks using sign restrictions. The identification scheme is based on the idea that shocks to government spending raise output and the deficit contemporaneously. The impact responses of output and the deficit to government consumption, government investment and government employment disturbances satisfy these restrictions in both a prototypical RBC and a New-Keynesian model and that these restrictions do not typically hold for other disturbances, such as technology, or monetary policy shocks (see Pappa (2009)). Since tax cuts might also increase output and deficits, we require a zero or small positive correlation between the identified shock and tax revenues, so as to exclude the possibility that the identified shocks are combinations of government spending and tax cut shocks. Once shocks

are identified, we examine the dynamics of the other macroeconomic variables in response to the fiscal shocks.

Our findings can be summarized as follows. All spending shocks typically increase private consumption contemporaneously and employment with some delay. The responses of private investment and real wages are mixed. However, at least in response to government employment shocks, the real wage increases on impact in all the countries. Hence, our results appear to reinforce those of the standard SVAR literature and, notwithstanding the criticism of Chari et. al. (2005), they appear to be broadly in line with the predictions of Keynesian models.

In all the countries, government employment shocks have the largest output multiplier, regardless of the horizon we consider. Interestingly, government consumption shocks have small output multiplier in all countries, but the US and Canada where, in fact, medium run output multipliers are larger than one. Government investment shocks generate medium run output multipliers larger than one only in Japan, while for government employment shocks multipliers are larger than one for all countries and all horizons. When we split the sample, to take into account potential time heterogeneity problems, we find that the transmission of fiscal policy shocks has changed over time. In particular, we find that the effects of government investment shocks on output and its components have significantly declined over time, while the effects of government employment shocks have been strengthened in the post 1980 period and that the transmission of fiscal shocks to the labor markets display a significant change since the early 1980s.

We believe the facts we uncover are useful to policymakers in at least two ways. First, they highlight that unexpected expansions in government employment are the most effective tool for stimulating output in all the five economies we consider. Contrary to the common wisdom, increases in government investments do not generate stronger output effects at the horizons of interest. However, since they are likely to increase labor productivity and private investment more than government consumption shocks, they enjoy longer run implications that the other type of shocks do not have. Second, the facts we uncover stress that the expansionary effects of government investment shocks have been significantly reduced during the last two decades, while the opposite is true for government employment shocks. This change provides additional support for using unexpected government employment expansions to stimulate economies during recessions.

The rest of the paper is organized as follows: The next section describes briefly the methodology for extracting fiscal shocks. Section 3 presents the econometric framework. Results appear in section 4 and section 5, and Section 6 concludes.

## **2 Identifying fiscal shocks: The methodology**

We adopt the methodology used in Pappa (2009) to extract fiscal shocks in the data. The methodology consists of four steps. In the first step it is established that shocks to government expenditures for consumption, investment and employment increase output and the deficit contemporaneously both in a prototypical flexible price RBC and in a New-Keynesian sticky price setup for a wide range of parameterizations. In the second step it is established that the restrictions used to identify fiscal shocks cannot be produced by other shocks and in the third step fiscal shocks are identified in the data by imposing the model-based restrictions. The final step studies the effects of the identified fiscal shocks on key macroeconomic variables.

### **2.1 Theoretical restrictions**

Pappa (2009) shows that the responses of output and the deficit to shocks in government consumption, government investment and government employment are qualitatively similar in both standard RBC and New Keynesian models. In particular, she shows that for all three shocks in both models output and deficits react positively to the fiscal disturbance in the impact period of the shock. Adopting her results, we will use sign restrictions on the contemporaneous effect of spending shocks on output and deficits to identify the disturbances of interest. Pappa (2009) shows that such restrictions are not a feature of productivity, labor supply, or monetary shocks. For all shocks and in both models the responses of the deficit are key for distinguishing fiscal disturbances from other shocks: fiscal shocks increase deficits; the other shocks decrease them at least on impact.

A negative shock to the tax rate could also increase both output and deficits. Hence, one may wonder whether the disturbances we identify as shocks that move government spending, output and deficits in the same direction could potentially be a combination of positive government spending and negative tax shocks. To avoid this possibility, in the exercises we have conducted we require a zero or (small) positive correlation between the

identified shock and tax revenues. Positive correlation may arise since government spending shocks increase output and therefore tax revenues. On the other hand, tax cuts on the left side of the Laffer curve will decrease tax revenues. Tax cuts that occur on the right side of the Laffer curve may increase tax revenues, but given a level of expenditure, deficits must decrease. In this situation, deficits can increase only if the increase in government spending is larger than the increase in tax revenues. Hence, by requiring that government spending and tax revenues are not highly positively correlated such event can be excluded. We think this assumption is reasonable since tax cuts accompanied by contemporaneous increases in expenditures are events rare in our sample (with the exception of the Reagan tax cut).

Once the disturbances are obtained, we trace out their effect on interesting macroeconomic variables and calculate output multipliers.

### **3 The Econometric framework**

#### **3.1 The reduced form model**

The reduced form model contains nine variables and a constant: The log of real per capita GDP, the log of real per capita government expenditure in either (a) goods purchases, defined as government expenditures minus government wage expenditures, minus transfers and minus debt interest payments (b) capital outlays, given by real government fixed investment (c) government employment, given by government wage expenditure; the log of real per-capita net tax revenues, the log of average real production wage per job, the log of total employment, the log of real per capita private consumption and investment, a measure of a short term interest rate and oil prices. We treat the latter as exogenous, and the remaining eight variables as endogenous<sup>1</sup>.

As mentioned, we use quarterly real, seasonally adjusted data for Canada, Japan, the US and the UK from 1970 to 2008 and data for the Euro area from the first quarter of 1991 to 2008. The series come from the OECD Economic Outlook, the IMF International Financial Statistics and the NIPA tables. Output is measured by real gross domestic product, consumption by real total private consumption and investment by real private fixed investment, which excludes changes in inventories. Total employment series were constructed by multiplying the employment rate with the labor force, while for the real wage we have

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<sup>1</sup>In order to control for anticipation effects, we have also included changes of the international oil price in the VAR as an endogenous variable, results are robust to this change.

used four alternative definitions: (a) wages and salaries of employees divided by the GDP deflator, (b) wages and salaries of employees divided by the CPI index, (c) gross wages received by the employee divided by the GDP deflator and (d) gross wages received by the employee divided by the CPI index. Since conclusions are similar, we present results using option (a) as a measure of the real wage.

Since all data sets are short, we limit the lag length of the VAR to four. We have examined several variants of the model (e.g. a VAR with revenues and expenditures in percentage of GDP, a model where we include the log of debt to GDP ratio as an endogenous variable, a model in which we control for net exports as a percentage of GDP, or for the exchange rate and a model where variables are expressed in growth rates (but not per-capita terms)). The results we present are unaffected by all of these changes.

### 3.2 Identifying the shocks

To identify the shocks in the data we employ the theoretical sign restrictions in the impact period of the shock.

Let  $\Sigma$  be the covariance matrix of the VAR shocks and let  $PP' = \Sigma$  an orthogonal decomposition of  $\Sigma$ . Then, structural shocks  $\varepsilon_t$  are constructed as  $\varepsilon_t = P^{-1}u_t$ , where  $u_t$  are reduced form shocks and, for each element of  $\varepsilon_t$ , we check if the required restrictions are satisfied. If no structural shock produces the required comovements in the variables, the orthogonal decomposition is rotated by an orthonormal matrix  $H(\lambda)$ , with  $H(\lambda)H(\lambda)' = I$ , where  $\lambda$  measures the angle of rotation, and the comovements in response to the new set of shocks is examined (see Canova (2007)). This search process continues, randomly varying  $\lambda$  in the range  $(0, \pi)$ , and randomly rotating the columns of  $H(\lambda)$ . Since many  $H(\lambda)$ 's can in principle produce the required pattern, the error bands we report reflect not only the uncertainty in  $\Sigma$  and the reduced form parameter estimates but also how responses vary with different  $\lambda$ 's and  $H$ 's.

Besides making the link between the model and the data tighter, the use of robust sign restrictions avoids, in principle, typical problems associated with the identification of economically meaningful fiscal shocks. In particular, problems concerning the endogeneity of fiscal variables, the delays between planning, approval and implementation of fiscal policies, which may give rise to predictability problems and the scarceness of reasonable zero-identifying restrictions are to a large extent solved. In fact, all relevant variables are

endogenous here and since we control for the state of the business cycle, there is no need to produce cyclically adjusted estimates of fiscal variables. Furthermore, since theory defines the features of the fiscal disturbances we are looking for and the timing of the responses of the endogenous variables is largely unrestricted, the other two problems are also considerably eased. Sign restrictions resolve to some extent the problem of predictability of fiscal shocks since identification does not rely on delay restrictions. Finally, since monetary policy and fiscal shocks move deficits in opposite directions the question of fiscal and monetary policy interaction does not arise when identifying fiscal shocks.

## 4 The Full Sample Evidence

We present the responses of output, private consumption and investment, real wages and employment to a 1% increase in government spending on consumption, investment and government employment in Figures 1, 2 and 3. Each box presents median estimates (solid line) and pointwise 68-percent probability bands (dotted lines).

### 4.1 A shock to government consumption

The responses in Figure 1 are quantitatively and qualitatively different across countries: A government consumption shock generates sizeable responses in the US, while the effects in the rest of the countries are, at best, moderate. In these economies, the responses of almost all variables are comparable in terms of size, except for investment.

The sign of the impact responses of private consumption and real wages is similar across countries and both variables increase. Total employment increases on impact in all units but the UK and the US, where employment responses are negligible on impact and become significant about six quarters after the shock. The responses of private investments are mixed. Government consumption shocks crowd private investment out in the Euro area, in Japan and the UK, while they crowd in private investment in Canada (significantly) and the US. The output responses to this shock are larger in these two countries, probably as a consequence of this effect.

Hence, government consumption shocks significantly increase output, private consumption, employment and the real wage in most units. The responses of private investment are, however, heterogeneous and outside the North American continent these shocks tend

to crowd private investment out.

## **4.2 A shock to government investment**

The responses of macroeconomic variables to surprise increases in government investment are comparable in size and, surprisingly, no more persistent than those produced by increases in government consumption.

The responses of output and private consumption are similar across countries. Both variables contemporaneously increase after the fiscal shock, the increase is significant and the magnitude of the response comparable in the five countries. Responses in Canada, Japan and the Euro area display a hump shaped pattern; in the UK and the US the impact response is the largest and the effect lasts approximately one year. Comparatively speaking, and except for the US, shocks to government investment and government consumption induce similar quantitative effects.

The responses of private investment are mixed. Shocks to government investment have negligible impact effects on private investment in the UK and the US, while in the other three countries the effect is positive (on impact in Canada and the Euro area, and with some delay in Japan).

Shocks to government investment significantly increase employment and the real wage in Canada, UK and the Euro area, but generate no significant effects in the US. In the UK employment responses are insignificant at all horizons, while the response of the real wage is significantly negative only on impact. Quantitatively speaking the labor market effects of these shocks are smaller than those induced by government consumption shocks.

As for the case of government consumption shocks, US responses to government investment shocks are different than in the other four countries. Hence, it seems very important to have a cross country perspective when evaluating the effects of fiscal shocks and the relevance of various theories of the business cycle.

## **4.3 A shock to government employment**

The shape of the responses to government employment shocks is heterogeneous across countries. Nevertheless, government employment shocks have sizeable effects in both the goods and the labor markets of all countries. The effects of the shock are stronger in the Euro area, Japan and the UK, while they are more moderate in Canada and the US. Interestingly,

government employment shocks generate sizeable and persistent deficit responses, especially in the former three economies. Hence, in terms of present value balance calculations, these appear to be the shocks needing the largest adjustments in other parts of the government budget.

Output increases substantially and significantly in all units for several quarters. Consumption tracks output responses and it increases significantly in all units, but the US. Private investment responses are, once again, heterogeneous: they are positive and significant in Canada, the Euro area and the UK, positive and insignificant in the US and negative but hardly significant in Japan.

Government employment shocks positively affect the real wage in all the countries. However, the timing at which the responses become significant varies across countries. For example, in the US responses are significant only on impact; in the Euro area and Japan they are significant on impact and several quarters after the shock; in Canada it takes some quarters before the response of real wages becomes significant; in the UK real wage responses become significant one quarter after the shock.

The responses of employment are relatively similar: they are all positive (except for a negative delayed effect in the Euro area), significant and persistent and reach their peak at different time horizons in the different countries. In the Euro area and in the US the peak is three quarters after the shock; in Canada, Japan and the UK it is six quarters after the shock. Relative to the other two shocks, the real wage and employment responses are quantitatively much stronger in all countries.

#### **4.4 Summary and discussion**

To summarize, shocks to different government expenditure components expand economic activity across countries but they also generate heterogeneous responses of certain macrovariables across countries. Surprise increases in any component of government spending are expansionary in Canada and the US. In the Euro area they are expansionary: but only temporarily so (the positive impact on private consumption, investment and employment is reversed in subsequent periods). In Japan deficit financed fiscal expansions expand output, private consumption and employment but generally crowd out private investment. In the UK fiscal expansions increase output and private consumption, but employment and private investment expand only after employment shocks.

Can the different economic and institutional characteristics of the five economies explain the cross country differences in the responses? The degree of openness, the monetary regime, or the relative size of the government do not seem to matter for the patterns of impulse responses. For example, in small open economies, like Canada and the UK, government consumption and investment shocks induce output dynamics which are comparable to those of the US or the Euro area. On the other hand, the size of the government is relatively smaller in Japan and the US than in the rest of the countries, but there is no pattern in the responses that can be associated with such a variable. Similarly, the responses of the macrovariables to fiscal shocks appear to be largely independent of the monetary policy regime a country follows.

#### **4.5 Output multipliers**

The previous section has revealed that the composition of fiscal expansions matters for the effects of government spending in the macroeconomy. To compare the effect of the various types of fiscal shocks, we present in Table 1 the annualized cumulative output multipliers on impact, one and three years after the shock. Multipliers are computed by multiplying the response of output with the sample mean of the share of each fiscal component in GDP, dividing by four and then cumulating up to the required horizon.

Regardless of the horizon we consider, shocks to government employment have the largest output multipliers. Fiscal stimulus packages that rely mostly on measures to support government employment are more effective than those based on public investment. Actually, except for Japan, government investment shocks are the least effective in stimulating the real economy and output multipliers are never larger than one. Fatas and Mihov (2001) find that shocks in government consumption induce a higher multiplier than shocks to government investment in the US. Our analysis shows that their result holds for other economies as well, except for Japan.

Finally, for almost all the shocks and all the countries, the three years ahead multipliers are larger than the impact multipliers implying that fiscal shocks typically take time to exercise their full effects on real variables.

## 5 Subsample analysis

There are several reasons to believe that the sample of data we consider is not homogeneous in any of the countries we consider. For example, it is well known that the volatility and the persistence of US real and nominal variables has fallen after 1980 (see e.g. Stock and Watson (2003) and Canova et al.(2007) have shown that such a pattern is shared by the UK and, to a smaller extent, the Euro area. To take into account sample heterogeneity, we split the sample into two from the starting date up to 1979:4 and from 1982:1 to the end of the sample. In Table 2 we present annualized cumulative output multipliers on impact, one and three years after the shock for each of the two subperiods<sup>2</sup>. We also present the difference in the multipliers between the two subperiods with the statistical significance of the difference.

The structural change that occurred in the early part of the 1980s has not changed significantly the transmission of government consumption shocks in all four countries. However, the effects of government investment shocks have weakened substantially in all the countries except for the UK, where the effects of government investment shocks have remained small. Surprisingly, the effects of government employment shocks have substantially increased in the second subsample for all countries and almost all horizons considered.

To further investigate the variations induced by the structural change occurred in the 80s on the dynamics of fiscal shocks, we present in Table 3 the annualized cumulative responses of private consumption, investment and total employment and the real wage to a fiscal shock equal to 1% of GDP<sup>3</sup> in the period before the break of the 80s ("pre80") and the difference in the cumulative responses of the pre 80s versus the post 80s sample ("dif"). The numbers give the percentage annual change of each variable to a one-percent shock to each of the government spending components considered. Statistically significant differences in the two subperiods are marked by asterisks.

Although the sign of the impact responses for output and its components to any spending shock hardly changes across subsamples, the magnitude of the responses is substantially affected. The responses of private consumption and investment after a government consumption shock in Canada and Japan after 1982 are considerably increased, and the responses of

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<sup>2</sup>We use a Bayesian approach for the identification of the shocks in the subsample analysis.

<sup>3</sup>Cumulative responses for these variables are calculated by dividing the impulse responses of these variables with the ratio of the respective variable with the shocked fiscal variable evaluated at the sample mean.

private investment and consumption to public investment shocks is significantly weakened in the post 1980s period for Canada, Japan and the US. Also, the responses of private consumption to a government employment shock are significantly higher in the second subsample for all the countries except for Japan and the responses of private investment are higher for the UK and the US, while they are significantly lower for Canada and Japan one and three years after the shock.

Changes are noticeable also in the labor market variables. Employment and the real wage cumulative responses after a shock to government consumption and government employment change significantly for all units in the post 1980 period. The response of employment to a government investment shock does not display significant changes except for Canada, while the response of the real wage to this shock changes significantly in Canada and the US.

The structural break of the 1980s does not only affect the magnitude but also the direction of the responses of labor markets variables. In fact, the sign of the responses of the real wage is reversed in some countries (from negative to positive in Canada and the US and from positive to negative in Japan after government consumption shocks; from negative to positive in the US after government investment shocks; and from negative to positive in Canada and the US after government employment shocks).

The change in the responses of the macrovariables to shocks in government employment is consistent with a major shift in the structure of the economies from say a more keynesian type to a more neoclassical type in the second subsample. Such an interpretation, however, needs to be verified against other potential ones such as a change in the productivity of public inputs.

Overall, the analysis reveals that the responses of labor market variables to fiscal shocks were most affected by the structural break. Shocks to government investment have weaker expansionary effects on output and its components. Perotti (2004) documents also a decline in the effects of government consumption shocks in this period that standard explanations fail to justify, a decline we do not find. However, we document significant changes in the transmission of government employment shocks. We conjecture that the literature studying the causes of Great Moderation (see e.g. Gambetti et al. (2008)) can provide useful insights about the reasons for the structural changes we document here.

## 6 Conclusions

This paper analyzes the dynamics of transmission of different types of government expenditure shocks financed through deficit increases in five different countries. We restrict attention to expenditure shocks for two reasons. First, while the effects of expenditure shocks in the literature is controversial, there is somewhat more agreement on the dynamic effects induced by tax shocks. Second, although not often appreciated in the empirical literature, the qualitative features of the dynamics in response to government shocks crucially depend on the way expenditure is financed (see, e.g., Baxter and King (1993)). Since the implications produced by deficit financed expenditure increases are relatively robust across model specifications and across different components of expenditures, while this is not the case for tax financed expenditure increases and since robustness gives credibility to our identification methodology, we consider only deficit financed expenditure shocks in our exercises. A cross country perspective can help us to understand whether the controversy present in the literature is solely a US phenomena, or if instead is shared in a number of developed economies. The countries we have chosen differ in size, degree of openness, size of the government sector, monetary policy regime and degree of flexibility of the labor market relative to the US but we fail to explain differences in the responses to fiscal shocks across countries using these features.

To identify deficit financed expenditure shocks we use constraints on the sign of output and deficit responses. In particular, the identification scheme we employ requires that government spending shocks raise output and the deficit contemporaneously. The identification restrictions we use are relatively uncontroversial since they hold in both Keynesian and RBC frameworks. Once the shocks are identified, we examine the dynamics of consumption, investment, employment and real wages, which are left unrestricted in the identification process.

Almost all spending shocks increase private consumption contemporaneously and employment with some delay. The responses of private investment and real wages are mixed. However, at least in response to government employment shocks, the real wage increases on impact. Hence, our results appear to reinforce those of the standard SVAR literature and they appear to be broadly in line with the predictions of Keynesian models. We find that in all the countries government employment shocks have the largest output multiplier. Inter-

estingly, government investment shocks have the smallest output multiplier in all countries, but Japan where, in fact, output multipliers are larger than one three years after the shock. Government consumption shocks generate output multipliers larger than one in Canada and in the US in the medium run while for government employment shocks multipliers larger than one are the rule for all countries and all horizons.

There are substantial differences in the transmission of fiscal shocks pre and after the beginning of the 80s. First, shocks to government investment have significantly weaker effects in the last two decades. Second, the opposite is true for government employment shocks. Third, the response of the real wage to fiscal policy shocks changes in the two subsamples. Determining whether these facts have a common underlying explanation is a challenging task. We plan to study this issue in future work on the subject.

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## Tables and Figures

	Canada			EU			Japan			UK			US		
	1	4	12	1	4	12	1	4	12	1	4	12	1	4	12
$C^g$	0.18	0.63	<b>1.02</b>	0.16	0.38	0.33	0.13	0.26	0.38	0.13	0.39	0.07	0.74	<b>1.46</b>	<b>2.52</b>
$I^g$	0.05	0.36	0.61	0.06	0.22	0.07	0.16	0.83	<b>1.93</b>	0.03	0.08	0.09	0.07	0.17	0.23
$N^g$	0.73	<b>3.69</b>	<b>9.34</b>	<b>2.03</b>	<b>4.62</b>	-0.61	<b>1.64</b>	<b>3.19</b>	<b>2.93</b>	<b>1.30</b>	<b>6.60</b>	<b>13.7</b>	0.89	<b>2.93</b>	<b>4.30</b>

		Canada			Japan			UK			US		
horizon		1	4	12	1	4	12	1	4	12	1	4	12
	pre80	0.11	0.28	0.60	0.20	0.30	0.58	0.17	0.63	1.57	0.22	0.37	-0.48
$C^g$	post80	0.13	0.58	0.07	0.34	0.42	1.04	0.09	0.76	2.33	0.20	0.38	1.02
	dif	-0.02	-0.30	0.53	0.14	-0.12	-0.46	0.08	-0.13	-0.76	0.02	-0.01	-1.50
	pre80	0.19	0.54	1.09	0.27	0.91	1.71	0.03	0.05	-0.15	0.07	0.16	-0.17
$I^g$	post80	0.02	0.07	-0.96	0.05	0.10	-0.30	0.01	0.01	0.05	0.12	0.28	-0.35
	dif	0.17*	0.47*	2.05*	0.22	0.81*	2.01*	0.02	0.04	-0.20	-0.05	-0.12	0.18*
	pre80	0.82	2.02	4.21	0.21	2.98	2.15	0.87	1.43	3.47	0.78	-4.14	-9.60
$N^g$	post80	1.28	5.77	9.17	0.30	1.32	4.08	2.38	5.66	15.7	2.03	1.12	-2.50
	dif	-0.46*	-3.75*	-4.96*	-0.09	1.66*	-1.93*	-1.51*	-4.23*	-12.3*	-1.25*	-5.26*	-7.1*

**Table 3: Annualized Cumulative responses, subsample analysis**

countries	Canada			Japan			UK			US			
horizon	1	4	12	1	4	12	1	4	12	1	4	12	
private consumption													
$C^g$	pre80	0.14	0.34	0.55	0.01	0.34	1.16	0.03	0.52	1.04	0.17	-0.11	-2.43
	dif	-0.36	-1.58*	-2.84*	-1.16*	-2.53*	-4.42	0.03	0.50*	0.61*	-0.07	-0.65	-3.62*
$I^g$	pre80	0.46	1.66	3.04	0.05	0.14	0.19	0.03	-0.08	-0.48	0.06	0.01	-0.56
	dif	0.43*	1.54*	3.81*	0.04	0.07*	0.14*	0.03	-0.13	-0.74	-0.16	-0.08	0.26*
$N^g$	pre80	-0.04	0.14	0.52	0.46	6.76	15.4	-0.74	0.64	3.89	0.63	-8.52	-14.6
	dif	-0.17*	-0.46*	-1.08	0.07	5.54*	10.2*	0.42	-3.08*	-6.51*	1.88*	-3.92*	-11.3*
private investment													
$C^g$	pre80	0.11	0.36	0.87	0.10	0.13	-0.23	0.31	1.93	3.18	0.50	1.76	0.42
	dif	-1.22*	-2.44*	-2.12*	-0.42	-0.47	0.18	-0.63*	0.56	-0.19	0.09	1.37*	0.66*
$I^g$	pre80	0.32	0.94	1.36	-0.06	0.12	0.72	-0.02	-0.03	-0.38	0.16	0.36	-0.36
	dif	0.25*	0.78*	3.06*	0.18*	0.59*	2.87*	0.02	0.02	-0.53	0.08	0.40*	2.24*
$N^g$	pre80	0.27	7.41	12.1	-0.18	3.86	10.6	0.12	0.37	0.97	-0.19	-20.1	-37.7
	dif	0.35	6.76*	14.4*	-0.78*	1.72*	4.36*	0.47*	-12.4*	-8.5*	-0.15	-16.2*	-35.2*
total employment													
$C^g$	pre80	0.02	0.15	0.47	-0.02	-0.05	-0.22	0.00	0.02	0.08	0.05	0.18	-0.33
	dif	0.04	-0.08	-0.39	0.01	0.15	0.88	0.00	0.01	-0.34	0.07	0.22*	-0.66*
$I^g$	pre80	-0.03	0.00	0.23	0.04	0.04	0.14	0.01	0.03	-0.09	0.01	0.02	-0.16
	dif	-0.05	0.06	0.38*	0.04	-0.02	0.04	0.01	0.03	-0.19	0.00	-0.06	-0.08
$N^g$	pre80	-0.11	0.45	1.63	-0.05	0.20	0.86	0.03	0.01	0.10	0.09	-1.26	-9.86
	dif	-0.57*	-1.80*	-4.9*	-0.09	0.07	0.15	0.82*	2.51*	-1.90*	-0.08	-0.98*	-5.0*
real wage													
$C^g$	pre80	0.00	-0.02	-0.02	0.01	0.01	-0.68	0.02	0.17	0.51	-0.08	-1.19	-4.31
	dif	0.07	-0.15	0.08	0.02	-0.12	-0.36	-0.26*	-0.43*	-0.60	-0.25*	-1.28*	-5.66*
$I^g$	pre80	0.01	0.04	0.17	0.06	0.08	-0.38	0.01	0.02	-0.04	0.00	-0.10	-0.56
	dif	0.01	0.04	0.32*	0.05	0.06	-0.22	0.01	0.01	-0.05	-0.06	-0.30*	-0.86*
$N^g$	pre80	-0.06	0.00	0.22	-0.54	-1.32	4.92	0.04	0.30	1.04	-0.27	-9.45	-16.2
	dif	-0.39*	-0.80*	0.10	-0.43*	-1.2*	3.96	0.39*	0.17	-4.94*	-0.56*	-9.00*	-16.6*

# Figures

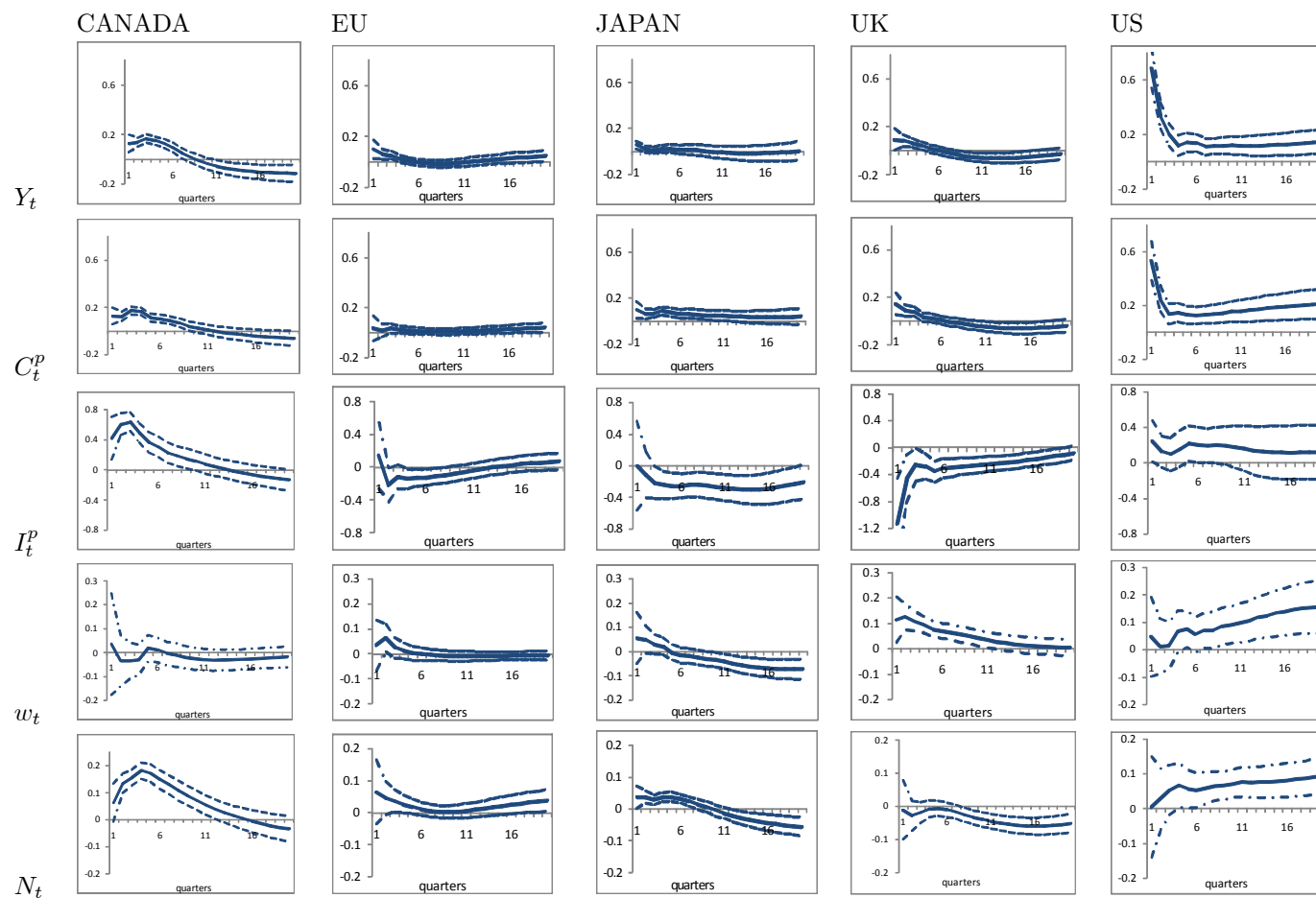


Figure 1: Responses to a government consumption shock

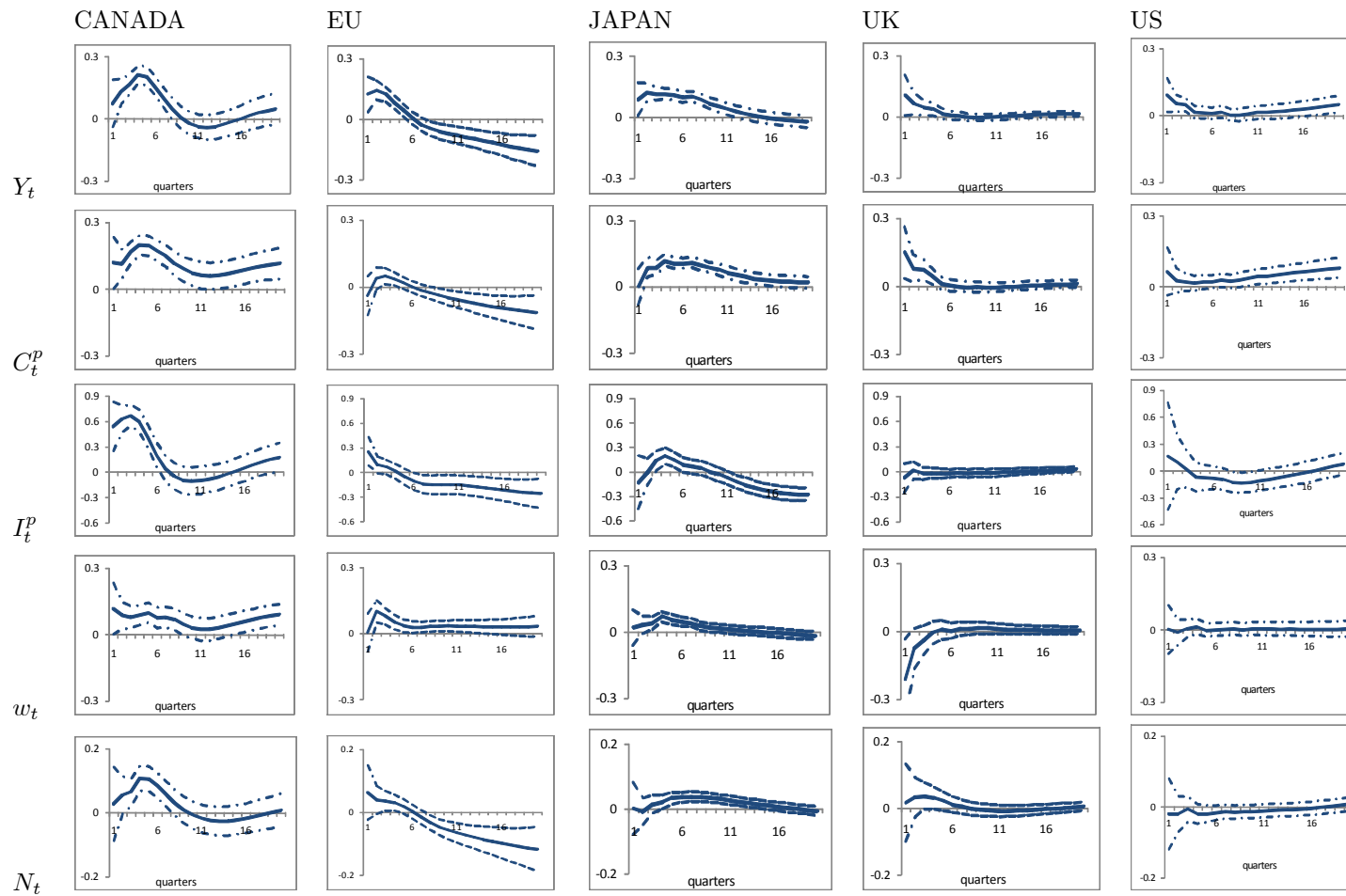


Figure 2: Responses to a government investment shock

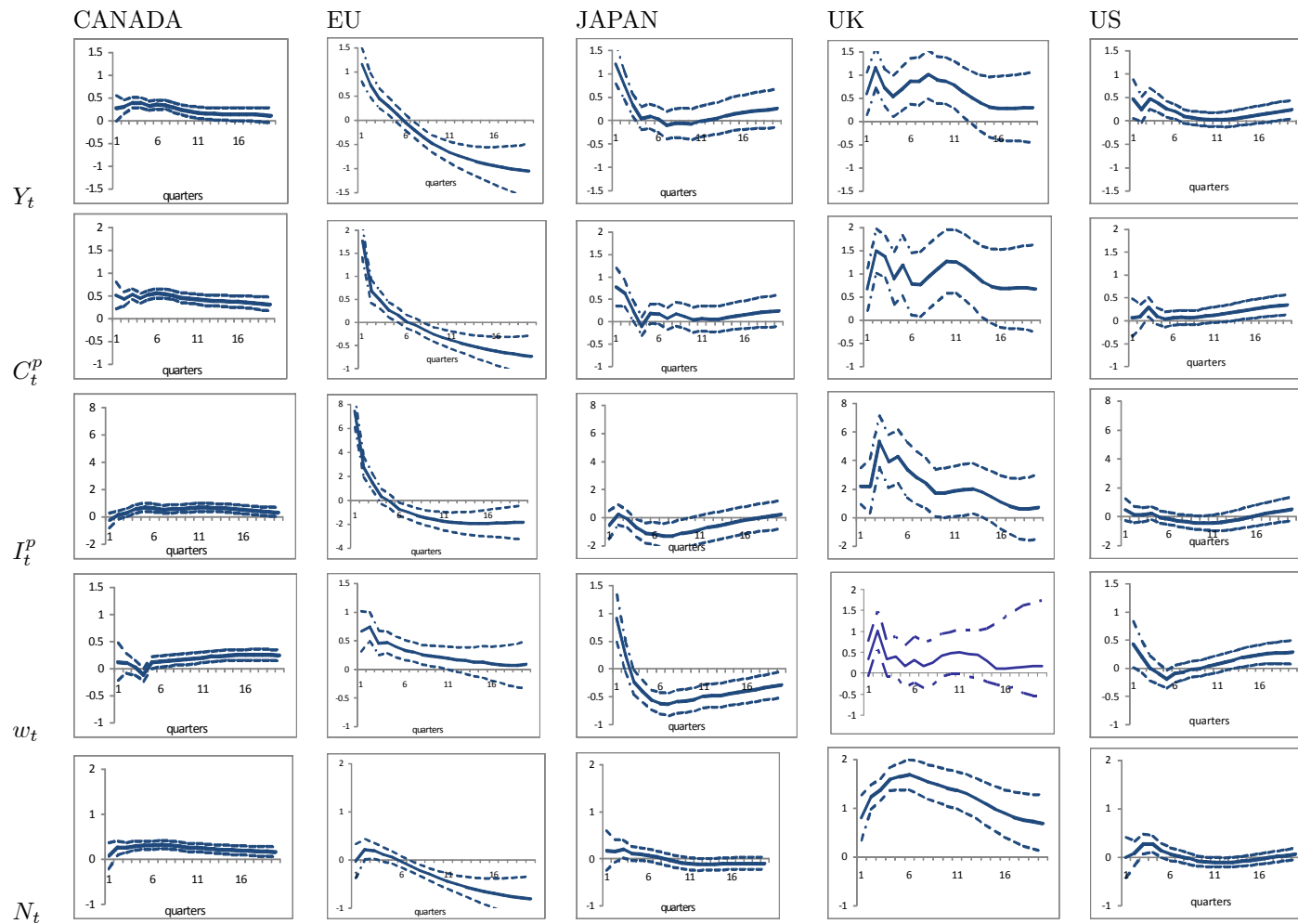


Figure 3: Responses to a government employment shock