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Abstract

I estimate the short-run dynamic effect of fiscal shocks on real wages for a panel of euro area countries. The main findings are in line with the Neo-Keynesian predictions that real wages increase in response to spending shocks. However, the scale of the wage response depends on the type of government spending.

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Keywords: government spending shocks; real wages; panel VAR; European Monetary Union.

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1 Introduction

This paper studies the dynamic effects of positive shocks to different measures of government spending on real wages using a panel of euro area members.

The literature studying the short-run dynamic effect of government spending shocks shows that the response of real wages varies across theoretical paradigms and empirical approaches. Neoclassical models predict that shocks to government spending reduce real wages through negative wealth effects that induce agents to increase their labour supply. By contrast, Neo-Keynesian models allowing for price rigidities or other reasons for counter cyclical markups show that real wages increase in response to these shocks (Linnemann and Schabert 2003; Galí et al. 2007; Monacelli and Perotti 2007; Rotemberg and Woodford 1992; Ravn et al. 2007).

Using a wide range of parametrisations, Pappa (2005) compares the dynamic effects of fiscal shocks between these two theoretical frameworks. She finds that shocks to government consumption and investment produce dissimilar effects. Real wage falls in Neoclassical models but increase in Neo-Keynesian models.

Accordingly, the response of the real wage is a key differentiating factor between these theoretical paradigms.

Empirically, the effects of government expenditure shocks are studied with vector autoregressions that use different identification techniques. For the United States, applications of the 'narrative' approach developed by Romer and Romer (1989) show that real wages fall in response to military spending shocks (Ramey and Shapiro 1998; Edelberg et al. 1999; Burnside et al. 2004). However, Perotti (2007) shows that after removing the two implicit restrictions of this identification method (that all Ramey-Shapiro episodes have the same dynamics and that fiscal policy explains all the deviation from 'normal' of all endogenous variables), real wages increase.

Results coming from the structural identification approach are typically in line with the implications of Neo-Keynesian models. Fatás and Mihov (2001), Blanchard and Perotti (2002) and Perotti (2004, 2007) show that government spending shocks increase real wages. However, when these models are estimated using quarterly data, fiscal shocks may not be fully unanticipated. When this is the case and the econometric model does not account for it, the estimated responses may miss the initial (maybe negative) change in wages that is produced by the expectation of a future increase in government spending.[1]

Most of the empirical literature studying the dynamic response of real wages focus on four countries with reliable non-interpolated quarterly data (United States, Australia, Canada and the United Kingdom).

This paper departs from this literature along two dimensions: (1) it estimates the dynamic

[1] In order to test if the positive wage responses produced by VARs with quarterly data are the result of anticipation effects not being considered, Ramey (2008) estimates a structural VAR for the United States with long run annual data extended back to 1889. She finds that responses to government spending shocks are consistent with Neoclassical models. However, Perotti (2007) estimates a structural VAR using official BEA data and finds that the responses of private consumption and real wages become positive. He claims that the qualitative differences in the wage responses are the result of government spending being interpolated linearly over long intervals prior to 1929.

response of real wages using a panel of euro area countries and annual data; (2) it compares the dynamic effect of shocks to different measures of government spending.

In line with the empirical evidence for other advanced countries, I find that positive innovations in most measures of government spending increase real wages. Shocks producing these effects are: government investment, government consumption, these two types taken together (government absorption) and non-wage government consumption.

I also analyze the effects of shocks to government absorption and consumption in a panel formed by the four countries earlier mentioned and find that real wage responses depend on its price deflator. By contrast, shocks to government investment have no effect on real wages in these countries.

The reminder of the paper is organized as follows: Section 2 presents the strategy to identify exogenous spending shocks. In Section 3, I describe the data and study the responses to shocks in different types of government spending. In Section 4, I check the robustness of these results. Section 5 studies the effect of shocks in government spending in a panel formed by the four countries used in the studies of Perotti. In Section 6, I analyze the role of alternative price deflators for government spending variables, as well as for wages. Finally, in Section 7, I conclude.

2 Identification Approach

Following Beetsma et al. (2008) and Bénétrix and Lane (2009), I identify fiscal shocks using a Choleski ordering. To this end, it is convenient to present the three-variable structural model in companion form.

$$A_0 Z_{i,t} = A(L) Z_{i,t-1} + C X_{i,t} + \varepsilon_{i,t} \tag{1}$$

$Z_{i,t}$ is a vector of endogenous variables containing: the government spending variable ($\mathrm{g}_{i,t}$), the real GDP ($\mathrm{y}_{i,t}$) and real wages ($\mathrm{w}_{i,t}$). $X_{i,t}$ is a vector with the country-specific intercepts (c_i), country-specific linear trends ($\mathrm{t}_{i,t}$) and year dummies (d_t). Subscripts i and t denote the country and the year. Matrix A_0 captures the contemporaneous relations between the endogenous variables. Matrix $A(L)$, is the matrix polynomial in the lag operator L that captures the relation between the endogenous variables and their lags. Matrix C contains the coefficients of the country fixed effects, the country-specific linear trends and the time fixed effects. The vector $\varepsilon_{i,t}$, contains the orthogonal structural shocks to each equation of the VAR and $\mathrm{var}(\varepsilon_{i,t}) = \Omega$. Thus,

$$Z_{i,t} = \begin{bmatrix} \mathrm{g}_{i,t} \\ \mathrm{y}_{i,t} \\ \mathrm{w}_{i,t} \end{bmatrix} \quad A_0 = \begin{pmatrix} 1 & -\alpha_{\mathrm{yg}} & -\alpha_{\mathrm{wg}} \\ -\alpha_{\mathrm{gy}} & 1 & -\alpha_{\mathrm{wy}} \\ -\alpha_{\mathrm{gw}} & -\alpha_{\mathrm{yw}} & 1 \end{pmatrix} \quad X_{i,t} = \begin{bmatrix} \mathrm{c}_i \\ \mathrm{t}_{i,t} \\ \mathrm{d}_t \end{bmatrix} \quad \varepsilon_{i,t} = \begin{bmatrix} \varepsilon^{\mathrm{g}}_{i,t} \\ \varepsilon^{\mathrm{y}}_{i,t} \\ \varepsilon^{\mathrm{w}}_{i,t} \end{bmatrix}.$$

Premultiplying (1) by A_0^{-1}, I obtain the model in reduced-form,

$$Z_{i,t} = B(L)Z_{i,t-1} + DX_{i,t} + u_{i,t}; \tag{2}$$

where $B(L) = A_0^{-1}A(L)$, $D = A_0^{-1}C$, $u_{i,t} = A_0^{-1}\varepsilon_{i,t}$, $u_{i,t} = \begin{bmatrix} u_{i,t}^{\mathrm{g}} & u_{i,t}^{\mathrm{y}} & u_{i,t}^{\mathrm{w}} \end{bmatrix}'$ and $\mathrm{var}(u_{i,t}) = \Sigma$. Then, to recover $\varepsilon_{i,t}$ and Ω from the reduced-form, I set $\alpha_{\mathrm{yg}} = \alpha_{\mathrm{wg}} = \alpha_{\mathrm{wy}} = 0$ in matrix A_0.

Imposing these restrictions is equivalent to assume that fiscal spending does not react contemporaneously to shocks in the real GDP or in real wages and that the real GDP does not react contemporaneously to shocks in real wages. Therefore, the Choleski ordering to identify shocks is: government spending, GDP and real wages. This ordering is motivated by the fact that government spending is planned before the period starts. Moreover, Beetsma et al. (2006) estimate a panel VAR in public spending (g) and output (y) for seven EU countries with non-interpolated quarterly fiscal data assuming that g does not react to y within a quarter. From these results they construct an estimate of the response of public spending to output at annual frequency finding that it is not significantly different from zero.

3 Baseline Empirical Model

3.1 Data

The literature studying the effects of fiscal shocks has considered a wide range of government spending measures. For instance, Blanchard and Perotti (2002) study the effects of shocks to government consumption on GDP, while Monacelli and Perotti (2006) assess the effect of these on trade balance, real exchange rate, GDP and private consumption. Monacelli and Perotti (2008) take shocks to non-wage government consumption and study the dynamic response of the terms of trade and relative price of nontradables. Cavallo (2005, 2007) distinguishes between government spending on goods and wages to assess the effects of fiscal shocks on U.S. private consumption and current account. Similarly, Giordano et al. (2007) analyze the effects of these on Italian GDP. Furthermore, shocks to government investment are studied in Pappa (2005), Perotti (2007b) and Beetsma et al. (2006, 2008).

Papers examining the dynamic effects of government spending typically take one or two of these measures. Here, as in Bénétrix and Lane (2009), I take a general approach and study five types of government spending. These are: government absorption (GEXP), defined as the sum of government fixed investment (GINV) and total government consumption (GC); these two measures taken individually and the wage (WGC) and non-wage (NWGC) components of government consumption.[2]

The source of these variables is the OECD Economic Outlook No 82, with the exception of government fixed investment for Greece. For the latter, I use national sources.[3] All govern-

[2]Government spending is composed of government consumption, government investment and transfers (welfare payments and pensions). Since transfers just redistribute payments across citizens, it should not have short run impact on macroeconomic variables. Therefore, I exclude this component from the analysis that follows.

[3]I would like to thank George Tavlas for providing these data.

ment variables are in real terms (log levels) and deflated with their own deflators. These are available at the OECD Economic Outlook No 82. The exception is non-wage government consumption. For this variable I use total government consumption prices. I take these deflators for the baseline estimations because I am primarily interested on the effect of changes in the quantities purchased by the government. However, I later use GDP prices to deflate government spending variables and compare the effect of shocks in quantities to the effect of shocks that combine changes in quantities and relative prices.

The time span of the data is 1970 to 2006. Although data coverage is good, I do not include wage government consumption for Belgium between 1970 and 1975, Germany in 1970 and Portugal between 1970 and 1977. This last country also lacks data for total government consumption and government fixed investment for the same period, while Germany lacks total government consumption for 1970.[4] The second variable used in the baseline model is gross domestic product in constant local currency units. The source of this variable is also the OECD Economic Outlook.

The goal of this paper is to study the effect of shocks to different measures of government spending on real wages. Following Lane and Perotti (2003), I define real wages as real compensation per employee. Since I analyze the economy as a whole without distinguishing between sectors, I use real consumption wages (i.e. CPI-deflated real wages). I take this variable, instead of real product wage, because it is relevant for labour supply and real labour income. The source of real consumption wages is the Annual Macroeconomic Database of the European Commission (AMECO).

3.2 Estimation Approach

To assess the effects of government spending shocks on real wages, I estimate a panel VAR for each measure of government spending taking annual data for the period 1970 to 2006 and eleven euro area countries. I exclude Luxembourg since most of the used spending data are not available for this country.

In order to deal with country-specific heterogeneity, each panel VAR includes country fixed effects and country-specific linear trends. Furthermore, to eliminate cross-country contemporaneous residual correlation, I include time fixed effects. The lag length in each model is set to two according to the Akaike Information Criterion, Schwarz Bayesian Information Criterion and the absence of first-order autocorrelation, tested with the Durbin-Watson statistic.

Nickell (1981) and Arellano (2003) show that the introduction of lagged regressors in panels with fixed effects induce serial correlation between the residuals and future values of the regressors. When the time dimension of the panel is fixed and the cross-section dimension tends to infinity, this correlation produces a bias in the coefficient of the lagged dependent variable. The panel has eleven countries and annual data for the period 1970 to 2006. This means that, if present, biases in the coefficients may be small.

[4] Data from West Germany and Germany is combined by splicing growth rates in 1991.

Figure 1 shows the impulse-response functions to a 1 percent of GDP shock in each definition of government spending. To scale the responses, I take the cross-country mean shares of each of these five measures of government spending in GDP. In this panel, GEXP, GINV, GC, WCG and NWGC represent 22, 3.2, 18.8, 11.2 and 7.6 percent of GDP in the period between 1970 and 2006, respectively.

In order to derive the 16th and 84th percentiles of the impulse-response distribution in the figures, I perform Monte Carlo simulations and assume that the parameter distribution is normal. Therefore, the mean of the impulse response minus/plus one standard deviation corresponds to the 16th and 84th percentiles of its distribution, respectively. With this information, I construct t-tests that show the statistical significance of the mean responses.

3.3 Impulse-Response Analysis

3.3.1 Government Absorption

As in most of the literature studying the dynamic effects of government spending on wages, the effects of a shock to government absorption are in line with the Neo-Keynesian predictions.

A shock of 1 percent of GDP produces positive impact and delayed responses in real wages and GDP. The impact wage response equals to 0.95 percent and it is statistically significant at a level of 1 percent. As shown in the first column of Table 1, the point estimate of the mean wage response is statistically significant until year nine. Between year zero and year six, it is significant at a level of 1 percent. The peak wage response is located in year two with a value of 1.18 percent.

A shock to this spending variable is also expansionary. Table 2 shows that the impact and peak GDP responses are equivalent to 0.91 and 1.28 percent, respectively. The latter is located in year one. The point estimate of the mean GDP response is statistically significant at 1 percent levels between years zero and three. This estimate is statistically significant at 5 and 10 percent in years four and five, respectively.

3.3.2 Government Investment and Government Consumption

Government investment shocks also increase wages. A 1 percent of GDP shock to this variable generates the largest response. Its impact equals to 1.37 percent while its peak, located in year two, equals to 1.66 percent. The point estimate of the mean wage response to a shock in government investment is statistically significant along the whole impulse-response horizon. Between years zero and four it is significant at 1 percent.

A shock of the same magnitude to government consumption also increases wages. The impact response equals to 1.04 percent and the maximum, located in year two, is equivalent to 1.4 percent. In relation to the wage response produced by a shock to government absorption, government consumption produces a larger increase on impact and in the following five years.

In contrast to the evidence reported by Perotti (2007) for the four-country sample, government investment is more effective than government consumption in boosting the GDP of these

euro area countries. The response of the latter to a shock in government investment is greater, not only for the impact but also for the whole impulse-response horizon. GDP responses are statistically significant up to year seven and three for shocks to investment or consumption, respectively.

3.3.3 Government Consumption: Wage and Non-Wage Elements

The last two shocks produce different effects on real wages. First, an increase in government wage consumption leads to a reduction in real wages of the whole economy. Although the point estimate of the impact is insignificant, the location of the 16th and 84th percentiles suggest that wages respond negatively in the first six years. The minimum response to a shock in government wages is located in year two and it is equivalent to -1.35 percent. This point estimate is statistically significant at 5 percent. As I discuss next, the reason for this negative response is that wage government consumption is negatively correlated with the sum of other spending variables.

A 1 percent of GDP shock to the non-wage component of government consumption produces an insignificant negative impact response. In contrast to a shock in wage government consumption, real wages present a positive peak in years five and six equivalent to 0.83 percent and significant at a level of 5 percent.

The effects of these shocks on GDP are also different. Shocks to government wage consumption produce statistically insignificant and negative GDP responses, while shocks to non-wage government consumption produce significant and positive responses.

3.4 Variance Decomposition

To study the contribution of structural innovations to the h-step ahead forecast error variance, I present the variance decomposition of each estimated panel VAR. This is a complementary exercise to the impulse-response analysis because it shows the relative power of each structural shock in explaining the forecast error variance of each equation in the system.

Figure 2 presents the proportion of the forecast error variance attributable to a shock in two of the three endogenous variables in each panel VAR. That is, for the GDP equation, I show the share of the variance attributable to a shock in government spending and real wages.[5] Since the interest in on the effect of government spending shocks in wages, I focus on this equation.

The forecast error variance attributable to a shock to government absorption is the largest across all types of spending shocks and ranges between 6.2 and 22 percent. This is in line with the fact that wage responses to a shock in this variable are significant for a longer period and for higher levels of confidence. This proportion grows as the forecast horizon becomes larger.

[5]The proportion of forecast error variance attributable to a shock in the lagged dependent variable is the share which is not explained by shocks in the other two endogenous variables. For instance, if the proportion of forecast error variance in the wage equation attributable to shocks in government consumption and GDP are 15 and 35 percent respectively, the proportion attributable to a shock in wages would be 50 percent.

A shock of 1 percent of GDP to government investment explains on average 6.3 percent of the whole forecast error variance in the wage equation. This proportion grows at a lower rate as the forecast horizon becomes larger. The proportion of forecast error variance in the wage equation attributable to shocks in this variable ranges between 4.3 and 7.9 percent.

When the shock is to government consumption, the proportion attributable to it grows as the forecast horizon becomes larger. The minimum is 3.4 while the maximum 20.6 percent.

In contrast, wage government consumption shocks explain a smaller proportion. After year five it stabilizes around 4.4 percent. Finally, non-wage government consumption explains the smallest proportion of forecast error variance in the wage equation. The average proportion attributable to this shock is 1.4 percent.

3.5 Summary

Shocks of the same magnitude to different measures of government spending produce dissimilar responses in real wages and GDP. These depend on how they affect labor productivity and aggregate demand. For instance, government investment shocks are more likely to increase labor productivity leading to a rise in real wages. This paper shows that the increase in real wages is largest when spending shocks are in this variable. Government spending innovations can have demand side effects. For this panel of countries, shocks to government absorption and consumption increase real wages. Moreover, non-wage government consumption does too but with some delay. By contrast, shocks to wage government consumption produce negative wage responses in the baseline model. However, as I will show next, this qualitative response is not robust to changes in the VAR specification.

GDP responses vary across spending measures. The larger is produced by shocks to government investment. Shocks to government absorption, consumption and non-wage government consumption are also expansionary while shocks to wage government consumption are not.

4 Robustness Checks

4.1 Four-Variable Panel VAR

The first robustness check is to estimate each panel VAR including a new expenditure variable. This is defined as the difference between government absorption and the fiscal variable being considered. I call this the 'fiscal complement'. The aim of this check is to ensure that the spending shock being studied is not a shock to a different government spending measure that is contemporaneously correlated with the former.

To identify shocks I use two Choleski orderings. I place the fiscal complement in the first position and the shocked spending variable in the second position, with GDP and wages in the third and fourth positions respectively. Doing this, I allow the studied government spending variable to react contemporaneously to shocks in the fiscal complement. I report these responses in Figure 3. Then, I revert the order of the fiscal variables.

The wage and GDP responses obtained with these two alternative orderings are reported in columns '4-vbles VAR 2nd' and '4-vbles VAR 1st' of Tables 1 and 2. Columns '4-vbles VAR 2nd' show the responses for the case in which the shocked spending variable is ordered in the second position.

Most of the baseline results are robust to this change in the model specification. However, when the shock is to wage government consumption, the inclusion of the fiscal complement generates qualitative changes in the GDP and wage responses. When wage government consumption is placed in the second position, GDP changes to positive and the wage response becomes statistically zero. This qualitative change is the result of wage government consumption being negatively correlated to the fiscal complement. This could be the result of governments reducing the expenditure in consumption and investment in order to increase the number of public employees. By contrast, when the identification order of the fiscal variables is reverted (the shocked spending variables is ordered first), GDP and wage responses are similar to the baseline.

4.2 Different Time Period

The next robustness check is motivated by the evidence of Perotti (2004) and Romer and Romer (2007) that the variance of fiscal policy shocks and GDP has decreased after approximately the year 1980. Taking this into account, I estimate the baseline model using data for the period 1980 to 2006.

Tables 1 and 2 show the responses of wage and GDP for each shock. Baseline responses are qualitatively robust to this change in the data span. A shock to government absorption produces smaller wage and GDP responses and less significant wage responses. A similar result is observed for shocks to government consumption.

In the same way, shocks to government investment produce smaller mean wage responses with statistical significance falling drastically. GDP responses are also smaller and less significant. Shocks to wage government consumption produce less negative and less significant wage responses as well as less persistent GDP contraction. Finally, the responses of wages to shocks in non-wage government consumption are greater and more significant from year three onwards. Mean GDP responses, however, become smaller and statistically insignificant.

Another robustness check aims at capturing the European Monetary Union (EMU) effect. Tables 1 and 2 show the responses of all endogenous variables for the period between 1970 and 1998.

Shocks to government absorption produce impact and year-one wage responses that are greater but less persistent. The significance of the wage response falls for pre-EMU data. Similarly, impact and year-one GDP responses are greater. A shock to government investment generates larger impact wage responses and a reduction in the degree of persistence and statistical significance. The response of GDP is also greater on impact and year-one and less persistent than the baseline.

Government consumption leads to larger wage responses in the first years but less per-

sistence and significant. The same pattern is found on the GDP response. Wage government consumption produces less negative wage responses with no change in the significance while non-wage government consumption produces larger wage responses for the impact and subsequent five years. For a shock in the latter, the GDP response is greater in the first years and it is less persistent.

These two experiments give mutually consistent results. For the period preceding the creation of the EMU, wage and GDP responses tend to be stronger and more significant than in the period going from 1980 to 2006. These is consistent with the findings of Perotti (2004) and Romer and Romer (2007). Accordingly, the baseline model produces responses which are, in most of the cases, between these two.

4.3 Debt Feedback

Following Beetsma et al. (2008), I check if the baseline results are robust to the inclusion of the general government consolidated gross debt as a ratio of GDP. To this end, I include the logarithm of the first two lags of this variable. The source of these data is the AMECO database.

As shown in Table 1, the debt feedback produces no significant changes in the response of real wages to a shock in government absorption, either in its level or in its significance. For the GDP, however, Table 2 shows that responses are slightly greater in this specification.

A shock to government investment produces slightly larger wage and GDP responses. Shocks to government consumption produce larger wage and GDP responses in the first years. Finally shocks to wage government consumption produce less negative wage responses, while shocks to non-wage government consumption give smaller wage responses. For the latter, the GDP response is slightly smaller for latter years and less statistically significant.

4.4 Summary

This section shows that most of the baseline results survive all robustness checks. The exception is wage government consumption. Shocks to this variable produce negative wage responses in the baseline that disappear when the model specification is changed to account for correlations with the fiscal complement.

5 The Perotti Sample

Most of the papers studying the dynamic effects of government spending on wages take a small set of countries or, as in many cases, focus on the United States economy.

Pappa (2005) studies the effects of shocks to government consumption, investment and employment on the real wages of the United States using annual data. She define real wages as the average wage per job deflated with the aggregate price deflator. Using sign constraints which are robust to Neoclassical and Neo-Keynesian theoretical predictions to identify fiscal shocks she finds positive real wage and employment responses.

Taking Canada, United Kingdom and United States, Perotti (2007) finds that shocks to government expenditure in goods and services, increase real product wage (nominal wage deflated with GDP prices) in the whole economy and, more importantly, in the manufacturing sector. In that study, government expenditure includes purchases of military equipment and excludes fixed capital formation. Data is in quarterly frequency and fiscal shocks are identified following Blanchard and Perotti (2002) and Perotti (2004).

As in Monacelli and Perotti (2006) and Perotti (2007), this paper takes the set of countries for which reliable non-interpolated quarterly fiscal data are available (Australia, Canada, United Kingdom and United States). I call this set 'the Perotti sample'. By contrast, rather than studying different VARs for each country separately using quarterly data and identifying shocks with their method, I estimate a panel VAR with annual and identify shocks as in Section 2. Similarly to the EMU panel, I take the real consumption wage (nominal wage deflated with consumption prices).

Figure 4 shows the real wage responses to shocks in government absorption, government investment and government consumption. The wage and non-wage components of the latter are not studied since these data are not available for Australia at the OECD Economic Outlook.

This figure shows that all these shocks are expansionary. However, the point estimates of the real wage are statistically insignificant. The inspection of the confidence bands shows that wage tends to respond negatively after year two and four to shocks in government absorption and government consumption, respectively. This result is in sharp contrast to the results for the EMU countries.

Moreover, while a shock in government investment produces the largest real wage response in the euro countries, the same shock have no effect in the Perotti sample. These contrasting results are in line with the findings of Bénétrix and Lane (2009) that real exchange rate responses are the opposite for the EMU and this panel. Moreover, the fall in real consumption wages seems to be in contrast to the findings of Perotti (2007) that real product wage increase in response to government consumption shocks. However, as I will show next, the price deflator used to construct real wages plays a crucial role.

6 Alternative Price Deflators

6.1 Government Spending Deflated with GDP Prices

The preceding part of the paper was concentrated on the effects of shocks in the quantities purchased by governments. That is, real spending variables were constructed using each specific government price deflator. This approach is also implemented by Corsetti and Müller (2006) and Beetsma et al. (2008). A different strategy is to deflate fiscal variables with GDP prices (Lane and Perotti 2003, Pappa 2005, Perotti 2004, 2007 or Monacelli and Perotti 2006).

This section make a step in this direction. More precisely, I estimate the baseline model using GDP deflated government spending data. Doing this, fiscal shocks combine changes in government quantities and relative prices.

Tables 3 and 4 show the wage and GDP responses to these shocks. As in the baseline, I check their robustness using the same tests of Section 4.

An inspection of these shows that the wage responses to fiscal shocks that include changes in quantities and relative prices are larger than the baseline and qualitative the same for many measures of government spending (government absorption, consumption and non-wage government consumption). By contrast, the effect of shocks to government investment's relative prices and quantities is smaller and less significant than the effect of shocks to investment quantities alone.

The main change produced by adopting the GDP deflator is on the wage response to shocks in wage government consumption. A 1 percent of GDP shock to wage government consumption produces the largest wage response across all types of government spending. This shock increases real wages by 3.42 percent on impact with a peak of 3.95 percent in year one. However, a caveat against the use of the GDP deflator in this case is the fact that, if government nominal wages are endogenous to private-sector nominal wages, shocks in the former would not be completely exogenous. Therefore, the use of the GDP deflator may be problematic.

I also estimate the real wage responses for the Perotti sample using GDP-deflated government spending variables. For these countries, there are not large qualitative differences in the shape of the wage responses to shocks in government absorption or government consumption. By contrast, government investment produces negative real wage responses. Quantitatively, GDP-deflated government absorption and consumption produce larger positive impact responses that change to negative after year two. As in the previous case, the point estimates of the mean real wage responses are statistically insignificant.

6.2 CPI- versus GDP-Deflated Real Wages

This section compares the dynamic effects of government spending shocks on real consumption and real product wages. The difference between these is that the former can be thought as real wages perceived by private agents, since it is defined as nominal compensation per employee deflated with private consumption prices. By contrast, the latter is nominal compensation per employee deflated with GDP prices. Hence it is a measure of firm costs (real wages paid to the employees).

Table 1 shows the point estimates of the mean responses of real product wage to shocks in the government spending variables for the EMU sample.[6] A 1 percent of GDP shock in government absorption produces responses in real consumption wage which are larger than those of the real product wage for the impact as well as for year one and two. Similarly, shocks to government investment produce larger consumption wage responses in the first years. This difference is greater than the one produced by government absorption.

Government consumption shocks produce larger increases in the real product wage. In contrast to the previous cases, this difference persists for the whole impulse-response horizon. As

[6]For completeness, Tables 2, 3 and 4 report the real wage and GDP responses for the case in which real product wage is used.

in the government consumption case, responses to shocks in wage and non-wage government consumption are smaller for real consumption wages.

In contrast to the case of the EMU, the responses of the real product and real consumption wages differ in the Perotti sample. This is the case of shocks to government absorption or government consumption. However, responses to shocks in government investment are qualitatively the same (shocks to this variable do not affect real wages).

Since the point estimates of these responses are statistically insignificant, I analyze the qualitative differences by plotting the confidence bands. Figure 5, shows that shocks to government absorption produce positive real product wage and negative real consumption wage responses. This same pattern is observed in shocks to government consumption.

7 Conclusions

Although the literature is not conclusive on the theoretical effects of government spending shocks in wages, most empirical studies find evidence supporting the Neo-Keynesian predictions. That is, spending shocks produce a GDP expansion and an increase in real wages.

However, this same literature has been mostly concentrated on countries with reliable non-interpolated quarterly fiscal data, leaving unexplored the effects of these policies in other countries. An exception is the work of Lane and Perotti (2003). This article takes a panel of OECD countries and finds that shocks to wage government spending increase the real product wage in the short run. The authors also find that this effect is stronger under a flexible exchange rate regime.

Here I studied the dynamic effects of positive shocks to different measures of government spending taking eleven euro area members. More precisely, I estimated a panel VAR using annual data and conducted impulse-response analysis identifying shocks with a Choleski decomposition.

The main finding of the paper is that shocks to government absorption, government fixed investment, government consumption or non-wage government consumption increase real wages (either CPI- or GDP-deflated wages). These results, that survive all robustness checks, are also observed for the case of government spending shocks that combine changes in quantities and relative prices, i.e. government spending variables deflated with GDP prices.

Finally, the impact of shocks to wage government consumption depends on the deflator employed. In particular, it seems that shocks to the quantity of public employees do not affect real wages. By contrast, if shocks are to the level of public wage pay, this is associated with an increase in real wages. However, if government nominal wages are endogenous to private-sector nominal wages, shocks in the former would not be completely exogenous.

I also analyzed the effects of some of these shocks in a panel formed by the countries used in the studies of Perotti. As in Perotti (2007), I find that shocks in government absorption and consumption increase real GDP-deflated wages. However, these shocks reduce CPI-deflated wages. This result highlights the need of further research on the sources of this difference.

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Table 1: Real wage responses to fiscal spending shock equivalent to 1% of GDP.

shock		Baseline		4-vbles VAR 2nd		4-vbles VAR 1st		post 1980		pre-EMU		DEBT		GDP-deflated W	
	0	0.95	***					0.57	***	1.10	***	0.97	***	0.89	***
	1	1.13	***					0.69	**	1.22	***	1.17	***	1.07	***
	2	1.18	***					0.78	**	1.03	***	1.22	***	1.14	***
	3	1.17	***					0.82	**	0.80	**	1.20	***	1.17	***
	4	1.10	***					0.81	**	0.59	*	1.12	***	1.16	***
GEXP	5	0.99	***					0.74	**	0.41		0.99	***	1.10	***
	6	0.85	***					0.64	*	0.26		0.83	***	1.01	***
	7	0.70	**					0.51	*	0.14		0.67	**	0.89	***
	8	0.55	**					0.38		0.05		0.52	*	0.75	***
	9	0.42	*					0.26		-0.01		0.39	*	0.62	**
	10	0.30						0.16		-0.04		0.27		0.50	**
	0	1.37	***	1.20	***	1.42	***	0.78	**	1.44	***	1.42	***	1.04	***
	1	1.60	***	1.37	***	1.65	***	0.74		1.51	***	1.70	***	1.16	***
	2	1.66	***	1.38	***	1.69	***	0.78		0.94	*	1.78	***	1.32	***
	3	1.65	***	1.35	**	1.67	***	0.85		0.37		1.75	***	1.49	***
	4	1.57	***	1.30	**	1.59	***	0.88		0.02		1.65	***	1.58	***
GINV	5	1.44	**	1.22	**	1.47	**	0.85		-0.11		1.49	**	1.58	***
	6	1.27	**	1.11	*	1.32	**	0.75		-0.12		1.31	**	1.50	***
	7	1.09	**	0.99	*	1.16	**	0.62		-0.07		1.12	**	1.37	***
	8	0.92	**	0.87	*	0.99	**	0.48		-0.01		0.94	*	1.21	***
	9	0.76	*	0.75	*	0.83	*	0.34		0.03		0.78	*	1.04	***
	10	0.62	*	0.64	*	0.69	*	0.22		0.05		0.64	*	0.88	**
	0	1.04	***	0.86	***	1.09	***	0.78	***	1.26	***	1.09	***	1.10	***
	1	1.31	***	1.09	***	1.35	***	1.09	**	1.51	***	1.39	***	1.41	***
	2	1.40	***	1.15	***	1.41	***	1.23	**	1.41	***	1.46	***	1.46	***
	3	1.35	***	1.10	**	1.37	***	1.25	**	1.19	***	1.39	***	1.43	***
	4	1.22	***	0.98	**	1.25	***	1.16	**	0.93	**	1.22	***	1.34	***
GC	5	1.05	**	0.82	**	1.07	**	1.01	**	0.68	*	1.01	**	1.21	***
	6	0.85	**	0.64	*	0.87	**	0.83	*	0.45		0.79	*	1.06	***
	7	0.67	*	0.47		0.68	*	0.64		0.28		0.58		0.90	**
	8	0.50	*	0.31		0.49	*	0.47		0.14		0.39		0.74	**
	9	0.35		0.18		0.34		0.32		0.05		0.23		0.59	**
	10	0.23		0.07		0.21		0.20		0.00		0.10		0.45	*
	0	-0.50		0.59		-0.68	*	-0.13		-0.57		-0.45		-0.44	
	1	-1.22	*	0.38		-1.46	**	-0.84		-1.18	*	-1.13	*	-0.83	
	2	-1.35	**	0.13		-1.59	**	-1.02		-1.26	**	-1.28	*	-0.89	
	3	-1.21	*	0.00		-1.35	**	-0.93		-1.07	*	-1.18	*	-0.82	
	4	-0.99	*	-0.06		-1.04	*	-0.75		-0.84		-1.00	*	-0.72	
WGC	5	-0.79		-0.09		-0.78		-0.55		-0.67		-0.83		-0.62	
	6	-0.62		-0.13		-0.60		-0.37		-0.57		-0.69		-0.54	
	7	-0.51		-0.17		-0.49		-0.22		-0.52		-0.59		-0.47	
	8	-0.42		-0.20		-0.42		-0.09		-0.50		-0.51		-0.42	
	9	-0.36		-0.24		-0.38		0.00		-0.48		-0.46		-0.38	
	10	-0.32		-0.27		-0.36		0.06		-0.45		-0.43		-0.34	
	0	-0.31		-0.32		-0.30		-0.80	***	-0.14		-0.33		-0.03	
	1	-0.19		-0.19		-0.17		-0.53		0.22		-0.21		0.01	
	2	0.19		0.21		0.24		0.11		0.69		0.17		0.29	
	3	0.53		0.60		0.62		0.67		0.98	**	0.51		0.58	
	4	0.75	*	0.83	**	0.85	**	1.00	**	1.04	**	0.73	*	0.78	**
NWGC	5	0.83	**	0.89	**	0.91	**	1.11	**	0.94	**	0.81	*	0.87	**
	6	0.83	**	0.85	**	0.87	**	1.07	**	0.76	**	0.80	**	0.88	**
	7	0.76	**	0.74	**	0.76	**	0.95	**	0.56	**	0.74	**	0.83	**
	8	0.67	**	0.62	**	0.63	**	0.78	**	0.39	*	0.64	**	0.75	**
	9	0.57	**	0.50	**	0.51	**	0.61	**	0.26		0.54	*	0.66	**
	10	0.48	**	0.39	*	0.40	*	0.46	*	0.17		0.44	*	0.57	**

Note: Point estimates of the Impulse-Response mean. *, ** and ***, denote statistical significance at 10, 5 and 1 percent, respectively.

Table 2: Real GDP responses to fiscal spending shock equivalent to 1% of GDP.

shock		Baseline		4-vbles VAR 2nd		4-vbles VAR 1st		post 1980		pre-EMU		DEBT		GDP-deflated W	
	0	0.91	***					0.47	***	1.11	***	0.97	***	0.90	***
	1	1.28	***					0.76	***	1.42	***	1.42	***	1.25	***
	2	1.23	***					0.81	***	1.19	***	1.36	***	1.19	***
	3	1.01	***					0.71	**	0.81	***	1.11	***	0.97	***
	4	0.75	**					0.55	*	0.47	*	0.82	**	0.70	**
GEXP	5	0.51	*					0.37		0.21		0.55		0.45	
	6	0.30						0.21		0.04		0.32		0.23	
	7	0.13						0.07		-0.06		0.12		0.05	
	8	0.01						-0.04		-0.11		-0.03		-0.09	
	9	-0.09						-0.11		-0.12		-0.15		-0.20	
	10	-0.15						-0.15		-0.11		-0.24		-0.27	
	0	1.73	***	1.61	***	1.72	***	1.21	***	1.94	***	1.79	***	1.71	***
	1	2.27	***	2.08	***	2.27	***	1.83	***	2.43	***	2.43	***	2.21	***
	2	2.24	***	2.13	***	2.29	***	1.86	***	2.02	***	2.40	***	2.17	***
	3	2.00	***	1.98	***	2.07	***	1.61	**	1.42	**	2.13	***	1.94	***
	4	1.71	***	1.75	***	1.77	***	1.25	*	0.94	*	1.81	***	1.65	***
GINV	5	1.43	**	1.51	**	1.46	**	0.89		0.62		1.51	**	1.35	**
	6	1.17	**	1.27	**	1.18	*	0.58		0.43		1.24	*	1.06	*
	7	0.94	*	1.05	*	0.92		0.32		0.33		1.00		0.80	
	8	0.75		0.86		0.70		0.13		0.26		0.81		0.57	
	9	0.59		0.69		0.52		0.00		0.22		0.65		0.38	
	10	0.46		0.54		0.37		-0.09		0.18		0.52		0.22	
	0	0.74	***	0.41	**	0.72	***	0.33	*	1.01	***	0.79	***	0.72	***
	1	1.10	***	0.66	**	1.07	***	0.55	*	1.30	***	1.19	***	1.07	***
	2	0.97	**	0.53	*	0.96	**	0.58		1.04	**	1.02	**	0.93	**
	3	0.70	*	0.29		0.69	*	0.51		0.68	*	0.69	*	0.64	*
	4	0.42		0.05		0.40		0.38		0.36		0.35		0.35	
GC	5	0.17		-0.16		0.15		0.23		0.12		0.05		0.09	
	6	-0.02		-0.32		-0.07		0.09		-0.03		-0.20		-0.12	
	7	-0.18		-0.44		-0.23		-0.03		-0.12		-0.40		-0.29	
	8	-0.28		-0.51		-0.34		-0.12		-0.16		-0.55		-0.40	
	9	-0.35		-0.55		-0.41		-0.18		-0.17		-0.65		-0.48	
	10	-0.39		-0.56		-0.45		-0.20		-0.16		-0.71		-0.52	
	0	-0.22		0.66	*	-0.47		-0.02		-0.04		-0.16		-0.24	
	1	-0.44		1.02	*	-0.75		-0.59		0.03		-0.35		-0.53	
	2	-0.55		0.81		-0.83		-0.74		-0.17		-0.50		-0.68	
	3	-0.56		0.50		-0.68		-0.60		-0.33		-0.56		-0.74	
	4	-0.54		0.25		-0.50		-0.35		-0.43		-0.58		-0.75	
WGC	5	-0.50		0.03		-0.40		-0.10		-0.49		-0.58		-0.74	
	6	-0.48		-0.15		-0.38		0.09		-0.54		-0.58		-0.72	
	7	-0.46		-0.31		-0.40		0.23		-0.55		-0.57		-0.70	
	8	-0.44		-0.42		-0.44		0.30		-0.55		-0.57		-0.66	
	9	-0.43		-0.51		-0.48		0.32		-0.53		-0.56		-0.63	
	10	-0.41		-0.56		-0.51		0.32		-0.49		-0.55		-0.59	
	0	0.51	**	0.45	**	0.48	**	-0.08		0.71	**	0.49	**	0.44	**
	1	0.87	**	0.79	**	0.82	**	0.08		1.03	**	0.88	**	0.75	**
	2	1.02	**	0.97	**	1.00	**	0.34		1.06	**	1.02	**	0.91	**
	3	1.06	**	0.98	**	1.01	**	0.56		0.94	**	1.05	**	0.95	**
	4	1.01	**	0.89	**	0.92	**	0.67		0.74	*	1.00	**	0.91	**
NWGC	5	0.92	**	0.76	*	0.79	*	0.67		0.53		0.90	*	0.81	**
	6	0.80	*	0.63	*	0.64	*	0.58		0.33		0.77	*	0.69	*
	7	0.67	*	0.50		0.51		0.44		0.18		0.64		0.55	
	8	0.55		0.39		0.39		0.29		0.07		0.52		0.42	
	9	0.44		0.30		0.30		0.16		0.00		0.41		0.30	
	10	0.35		0.23		0.23		0.05		-0.03		0.31		0.20	

Note: Point estimates of the Impulse-Response mean. *, ** and ***, denote statistical significance at 10, 5 and 1 percent, respectively.

Table 3: Real wage responses to fiscal spending (GDP-deflated) shock equivalent to 1% of GDP.

shock		Baseline		4-vbles VAR 2nd		4-vbles VAR 1st		post 1980		pre-EMU		DEBT		GDP-deflated W	
	0	1.17	***					0.95	***	1.32	***	1.23	***	1.30	***
	1	1.34	***					0.94	***	1.38	***	1.41	***	1.38	***
	2	1.31	***					0.90	***	1.11	***	1.37	***	1.27	***
	3	1.22	***					0.89	***	0.82	***	1.26	***	1.16	***
	4	1.10	***					0.86	***	0.58	**	1.12	***	1.06	***
GEXP	5	0.95	***					0.78	***	0.38	*	0.95	***	0.95	***
	6	0.79	***					0.66	**	0.23		0.78	***	0.83	***
	7	0.63	**					0.54	**	0.11		0.62	**	0.70	***
	8	0.49	**					0.41	**	0.03		0.48	**	0.58	***
	9	0.37	**					0.29	*	-0.02		0.36	*	0.46	**
	10	0.27	*					0.20		-0.04		0.27		0.36	**
	0	1.17	***	0.15		1.12	***	0.53		1.28	***	1.23	***	1.16	***
	1	1.24	***	-0.08		1.11	**	0.22		1.26	**	1.37	***	1.07	**
	2	1.20	**	-0.35		0.87	*	0.12		0.66		1.35	**	1.02	**
	3	1.15	**	-0.36		0.76		0.18		0.16		1.29	**	1.06	**
	4	1.08	*	-0.15		0.77		0.26		-0.07		1.20	**	1.10	**
GINV	5	0.99	*	0.14		0.84	*	0.31		-0.08		1.10	*	1.10	**
	6	0.89	*	0.41		0.90	*	0.31		0.02		0.99	*	1.05	**
	7	0.79	*	0.60		0.93	**	0.28		0.12		0.87	*	0.97	**
	8	0.69	*	0.72	*	0.91	**	0.23		0.19		0.76		0.87	**
	9	0.59	*	0.77	**	0.86	**	0.17		0.22		0.66		0.76	**
	10	0.50		0.77	**	0.79	**	0.11		0.21		0.57		0.65	*
	0	1.55	***	1.66	***	1.68	***	1.30	***	1.75	***	1.61	***	1.72	***
	1	1.85	***	2.06	***	2.03	***	1.40	***	1.86	***	1.92	***	1.91	***
	2	1.87	***	2.11	***	2.04	***	1.50	***	1.59	***	1.93	***	1.81	***
	3	1.74	***	1.93	***	1.86	***	1.54	***	1.23	***	1.77	***	1.64	***
	4	1.51	***	1.60	***	1.57	***	1.47	***	0.85	***	1.52	***	1.43	***
GC	5	1.24	***	1.22	***	1.25	***	1.29	***	0.53	**	1.24	***	1.22	***
	6	0.97	***	0.87	***	0.95	***	1.05	***	0.28		0.96	***	1.01	***
	7	0.73	**	0.58	**	0.69	***	0.81	***	0.11		0.72	**	0.81	***
	8	0.53	**	0.35	*	0.49	**	0.58	**	0.01		0.51	*	0.63	**
	9	0.37	*	0.18		0.33	*	0.39	*	-0.04		0.35		0.48	**
	10	0.25		0.05		0.20		0.23		-0.07		0.22		0.34	*
	0	3.42	***	3.50	***	3.51	***	3.53	***	3.57	***	3.54	***	3.47	***
	1	3.93	***	4.03	***	4.03	***	3.64	***	3.57	***	4.08	***	3.98	***
	2	3.50	***	3.50	***	3.62	***	3.05	***	2.55	***	3.62	***	3.53	***
	3	2.81	***	2.67	***	2.94	***	2.40	***	1.51	***	2.88	***	2.88	***
	4	2.13	***	1.88	***	2.26	***	1.83	***	0.74		2.14	***	2.25	***
WGC	5	1.54	***	1.23	**	1.65	***	1.34	**	0.23		1.49	***	1.72	***
	6	1.07	**	0.74		1.15	**	0.93	*	-0.07		0.96	*	1.28	**
	7	0.70		0.38		0.76	*	0.60		-0.23		0.55		0.92	**
	8	0.42		0.14		0.47		0.35		-0.29		0.24		0.63	*
	9	0.21		-0.04		0.24		0.17		-0.29		0.02		0.41	
	10	0.06		-0.16		0.08		0.04		-0.27		-0.15		0.23	
	0	0.50	**	-0.03		0.50	**	-0.06		0.73	**	0.52	**	0.80	***
	1	0.72	**	0.13		0.72	*	0.15		1.01	**	0.75	**	0.86	**
	2	1.01	**	0.51		1.03	**	0.76	*	1.24	***	1.03	**	1.03	***
	3	1.21	***	0.85	**	1.29	***	1.29	***	1.29	***	1.22	***	1.17	***
	4	1.26	***	1.02	**	1.37	***	1.53	***	1.17	***	1.26	***	1.21	***
NWGC	5	1.21	***	1.02	***	1.31	***	1.53	***	0.95	***	1.20	***	1.18	***
	6	1.08	***	0.92	***	1.15	***	1.36	***	0.71	**	1.07	***	1.08	***
	7	0.93	***	0.77	**	0.95	***	1.12	***	0.50	*	0.91	**	0.95	***
	8	0.77	**	0.62	**	0.75	**	0.87	***	0.34	*	0.75	**	0.82	***
	9	0.63	**	0.48	*	0.58	**	0.64	**	0.22		0.60	**	0.69	***
	10	0.51	**	0.37	*	0.45	*	0.45	*	0.14		0.48	**	0.57	**

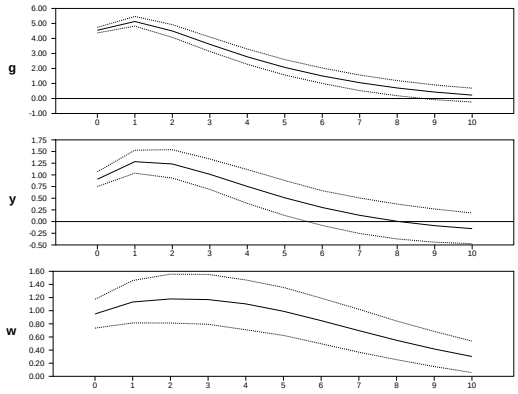
Note: Point estimates of the Impulse-Response mean. *, ** and ***, denote statistical significance at 10, 5 and 1 percent, respectively.

Table 4: Real GDP responses to fiscal spending (GDP-deflated) shock equivalent to 1% of GDP.

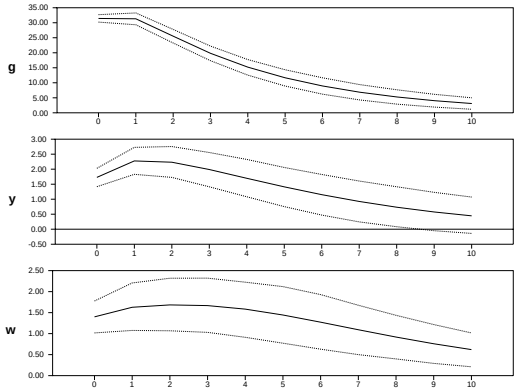
shock		Baseline		4-vbles VAR 2nd		4-vbles VAR 1st		post 1980		pre-EMU		DEBT		GDP-deflated W	
	0	0.73	***					0.44	***	0.86	***	0.79	***	0.71	***
	1	0.97	***					0.50	**	1.06	***	1.07	***	0.91	***
	2	0.92	***					0.45	*	0.84	***	1.01	***	0.84	***
	3	0.76	***					0.38		0.53	**	0.82	***	0.65	***
	4	0.57	**					0.30		0.26		0.61	**	0.46	**
GEXP	5	0.40						0.21		0.07		0.42		0.28	
	6	0.24						0.13		-0.04		0.25		0.12	
	7	0.12						0.05		-0.10		0.12		0.00	
	8	0.03						-0.01		-0.12		0.02		-0.10	
	9	-0.04						-0.05		-0.11		-0.06		-0.17	
	10	-0.08						-0.08		-0.10		-0.12		-0.22	
	0	1.94	***	1.80	***	1.90	***	1.38	***	2.27	***	2.03	***	1.91	***
	1	2.51	***	2.29	***	2.46	***	1.84	***	2.78	***	2.71	***	2.41	***
	2	2.43	***	2.20	***	2.36	***	1.78	***	2.34	***	2.62	***	2.29	***
	3	2.16	***	2.01	***	2.09	***	1.52	**	1.72	***	2.32	***	2.00	***
	4	1.85	***	1.85	***	1.82	***	1.19	*	1.22	**	1.99	***	1.68	***
GINV	5	1.57	***	1.71	***	1.58	**	0.89		0.88		1.70	**	1.38	**
	6	1.32	**	1.59	**	1.37	**	0.62		0.68		1.44	**	1.10	*
	7	1.11	*	1.45	**	1.18	**	0.41		0.54		1.22	*	0.87	
	8	0.93	*	1.30	**	1.00	*	0.24		0.44		1.03		0.66	
	9	0.77		1.14	**	0.83		0.12		0.36		0.88		0.49	
	10	0.64		0.99	*	0.69		0.03		0.28		0.75		0.35	
	0	0.56	***	0.20		0.54	***	0.28	**	0.68	***	0.60	***	0.52	***
	1	0.78	***	0.34		0.77	***	0.22		0.84	***	0.83	***	0.71	***
	2	0.73	***	0.31		0.73	**	0.21		0.63	**	0.75	***	0.62	**
	3	0.57	**	0.17		0.56	*	0.23		0.33		0.55	*	0.44	*
	4	0.38		-0.01		0.34		0.22		0.09		0.33		0.23	
GC	5	0.20		-0.19		0.14		0.17		-0.08		0.13		0.05	
	6	0.04		-0.33		-0.03		0.10		-0.16		-0.04		-0.10	
	7	-0.07		-0.43		-0.15		0.01		-0.19		-0.17		-0.22	
	8	-0.15		-0.48	*	-0.23		-0.06		-0.19		-0.27		-0.30	
	9	-0.21		-0.50	*	-0.28		-0.12		-0.16		-0.33		-0.35	
	10	-0.24		-0.50	*	-0.30		-0.15		-0.13		-0.37		-0.38	
	0	0.76	***	0.28		0.75	***	0.76	***	0.80	**	0.86	***	0.75	***
	1	0.90	**	0.23		0.89	**	0.62	*	0.82	**	0.99	**	0.87	**
	2	0.61		-0.12		0.59		0.26		0.32		0.65		0.53	
	3	0.19		-0.53		0.16		-0.07		-0.21		0.17		0.05	
	4	-0.19		-0.87	*	-0.23		-0.31		-0.57		-0.29		-0.39	
WGC	5	-0.49		-1.10	**	-0.53		-0.45		-0.73		-0.65		-0.72	
	6	-0.69		-1.23	**	-0.74		-0.53		-0.75		-0.91		-0.95	*
	7	-0.82		-1.27	**	-0.87	*	-0.54		-0.69		-1.07	*	-1.08	*
	8	-0.88	*	-1.26	**	-0.93	*	-0.52		-0.57		-1.16	*	-1.14	**
	9	-0.89	*	-1.21	**	-0.94	*	-0.47		-0.45		-1.19	*	-1.15	**
	10	-0.87	*	-1.13	**	-0.92	*	-0.41		-0.33		-1.18	*	-1.11	**
	0	0.54	**	0.23		0.54	**	0.00		0.77	**	0.58	***	0.50	**
	1	0.88	***	0.49	*	0.89	***	0.04		1.06	***	0.94	***	0.79	**
	2	1.03	***	0.71	**	1.06	***	0.27		1.01	**	1.07	***	0.92	**
	3	1.04	***	0.80	**	1.06	***	0.52		0.83	**	1.06	***	0.93	**
	4	0.97	**	0.78	**	0.95	**	0.66	*	0.60		0.97	**	0.86	**
NWGC	5	0.84	**	0.69	*	0.79	**	0.66		0.39		0.84	**	0.73	*
	6	0.70	*	0.58	*	0.62	*	0.56		0.21		0.69	*	0.58	
	7	0.56		0.46		0.46		0.41		0.09		0.55		0.43	
	8	0.44		0.36		0.33		0.25		0.01		0.42		0.29	
	9	0.33		0.28		0.23		0.10		-0.03		0.31		0.17	
	10	0.24		0.22		0.15		-0.01		-0.04		0.22		0.08	

Note: Point estimates of the Impulse-Response mean. *, ** and ***, denote statistical significance at 10, 5 and 1 percent, respectively.

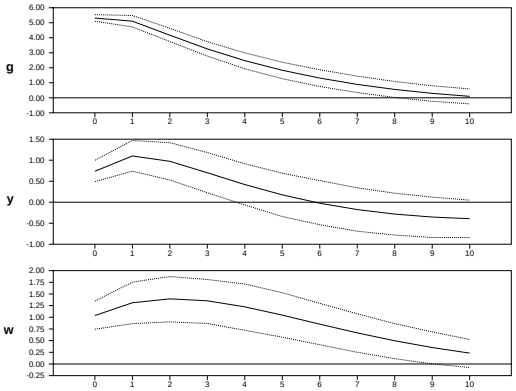
Figure 1: Baseline. Responses to a government spending shock (1% of GDP).



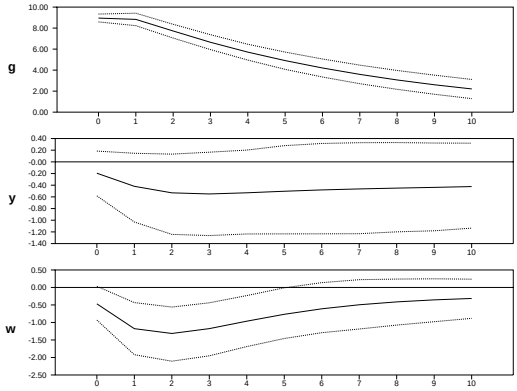
shock in GEXP



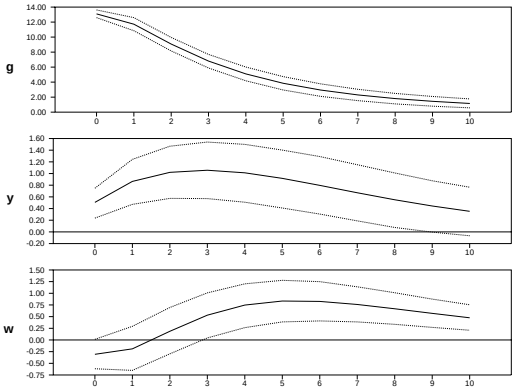
shock in GINV



shock in GC



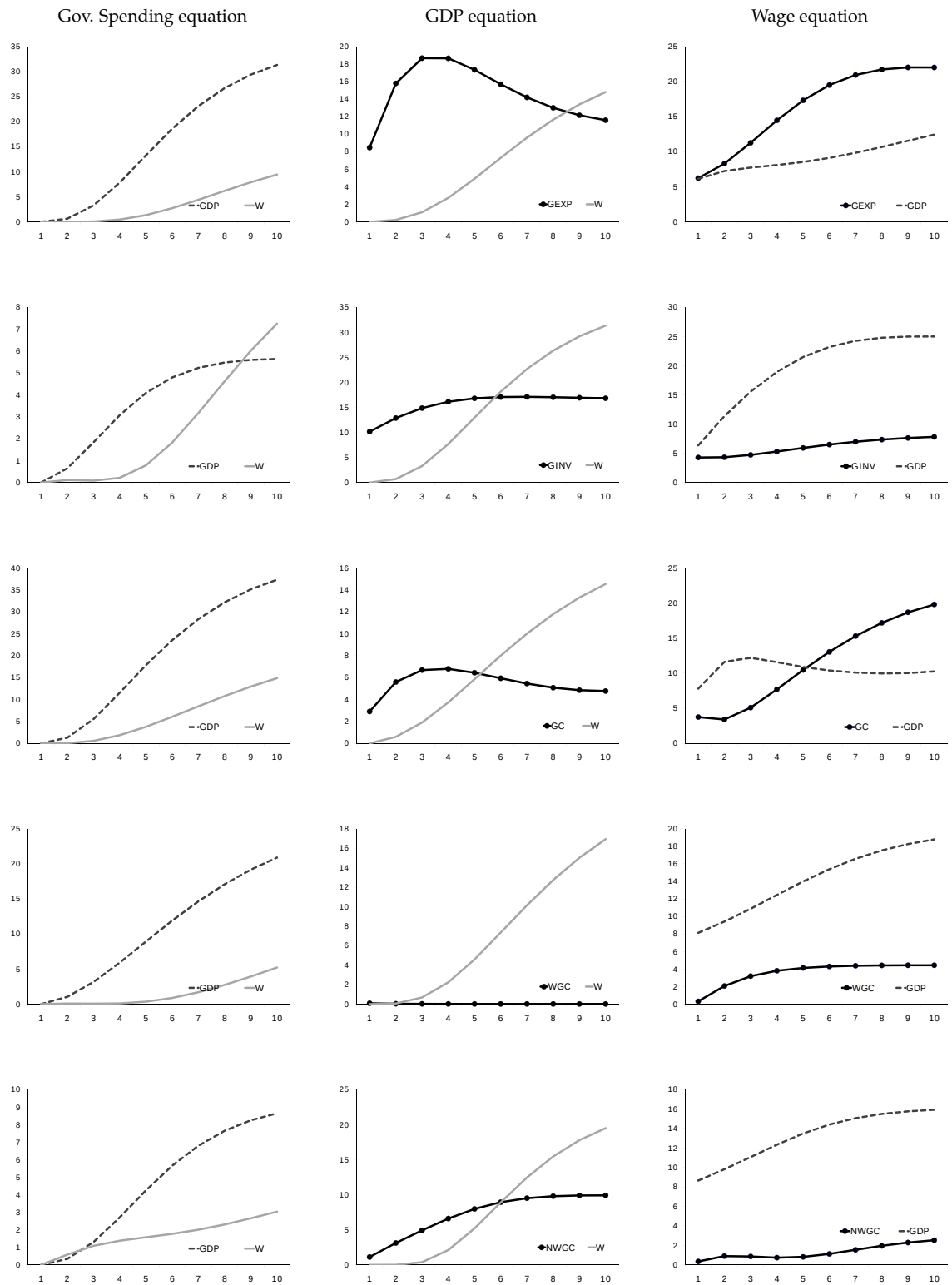
shock in WGC



shock in NWGC

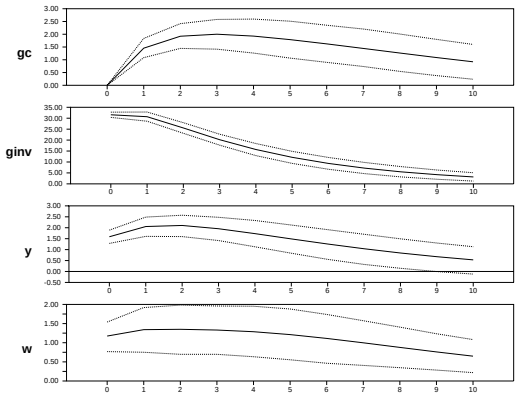
Note: Solid lines are the point estimates of the Impulse-Response mean. Dotted lines are the 16th and 84th percentiles from Monte Carlo simulations based on 1000 replications. Vertical axis indicates the percentage change in government spending (g), GDP (y) and CPI-deflated real wages (w).

Figure 2: Variance decomposition.

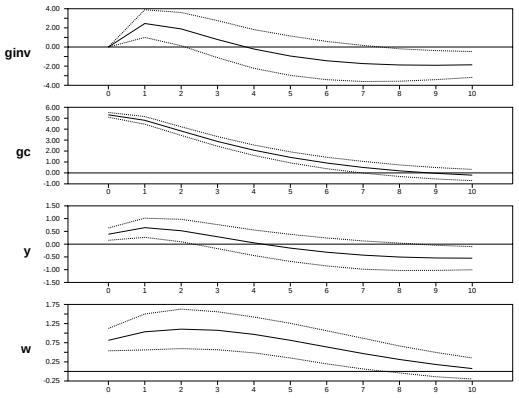


Note: Each row represents a VAR model for each definition of government spending. Vertical axis measures the percentage of forecast error variance attributable to a shock in the plotted endogenous variable.

Figure 3: Robustness check. VAR including the 'complement government spending'.



shock in GINV



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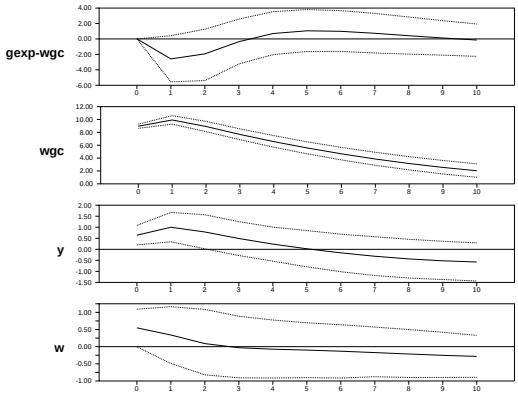
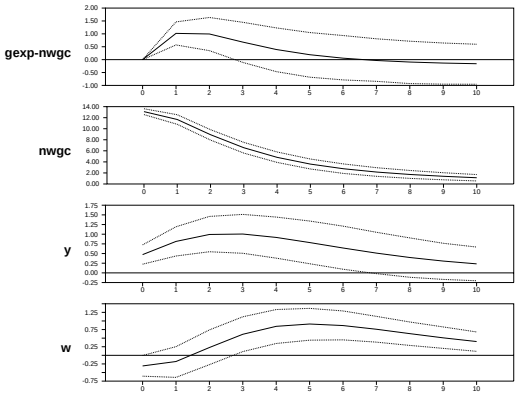


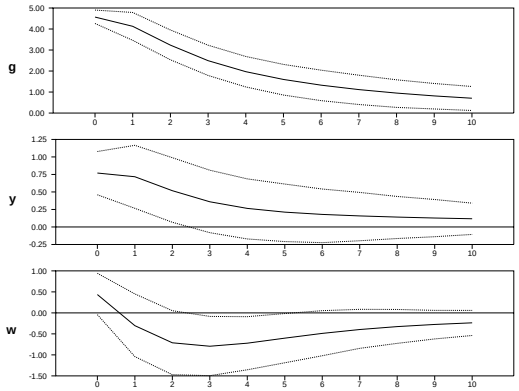
shock in WGC



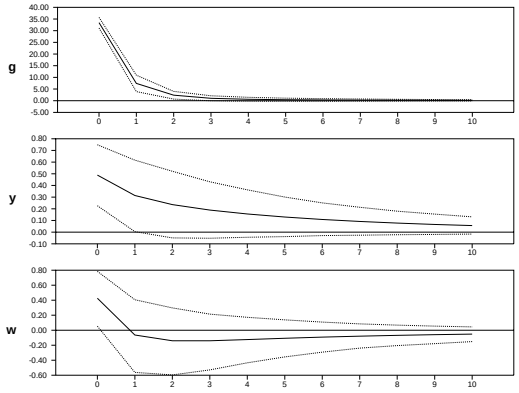
shock NWGC

Note: Solid lines are the point estimates of the Impulse-Response mean. Dotted lines are the 16th and 84th percentiles from Monte Carlo simulations based on 1000 replications. Vertical axis indicates the percentage change in government spending (g), GDP (y) and CPI-deflated real wages (w).

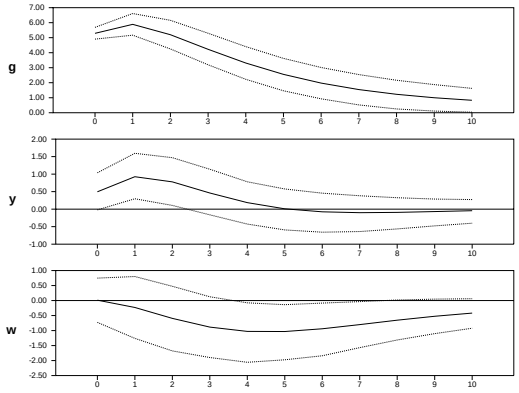
Figure 4: Responses to a spending shock equivalent to 1% of GDP using the Perotti sample: Australia, Canada, United Kingdom and United States.



shock in GEXP



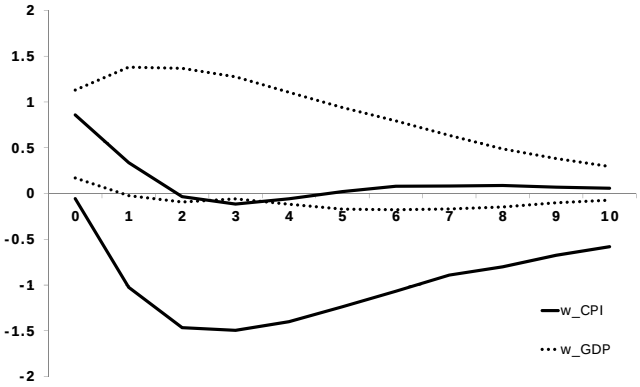
shock in GINV



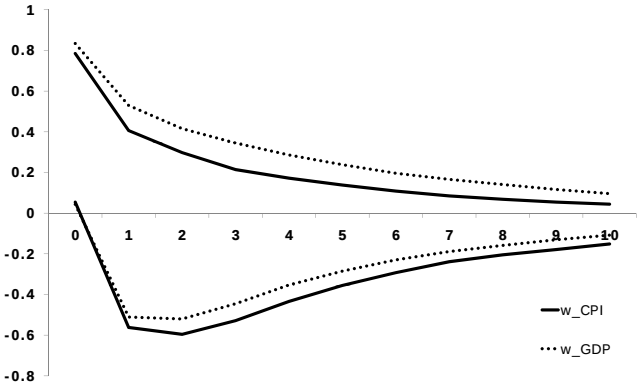
shock in GC

Note: Solid lines are the point estimates of the Impulse-Response mean. Dotted lines are the 16th and 84th percentiles from Monte Carlo simulations based on 1000 replications. Vertical axis indicates the percentage change in government spending (g), GDP (y) and CPI-deflated real wages (w).

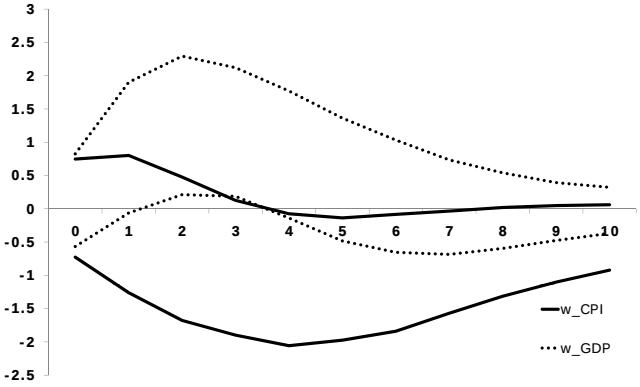
Figure 5: Comparison between CPI- and GDP- deflated wage responses to a spending shock equivalent to 1% of GDP using the Perotti sample.



shock in GEXP



shock in GINV



shock in GC

Note: 16th and 84th percentiles from Monte Carlo simulations based on 1000 replications. Vertical axis indicates the percentage change in CPI-deflated and GDP-deflated real wages.

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