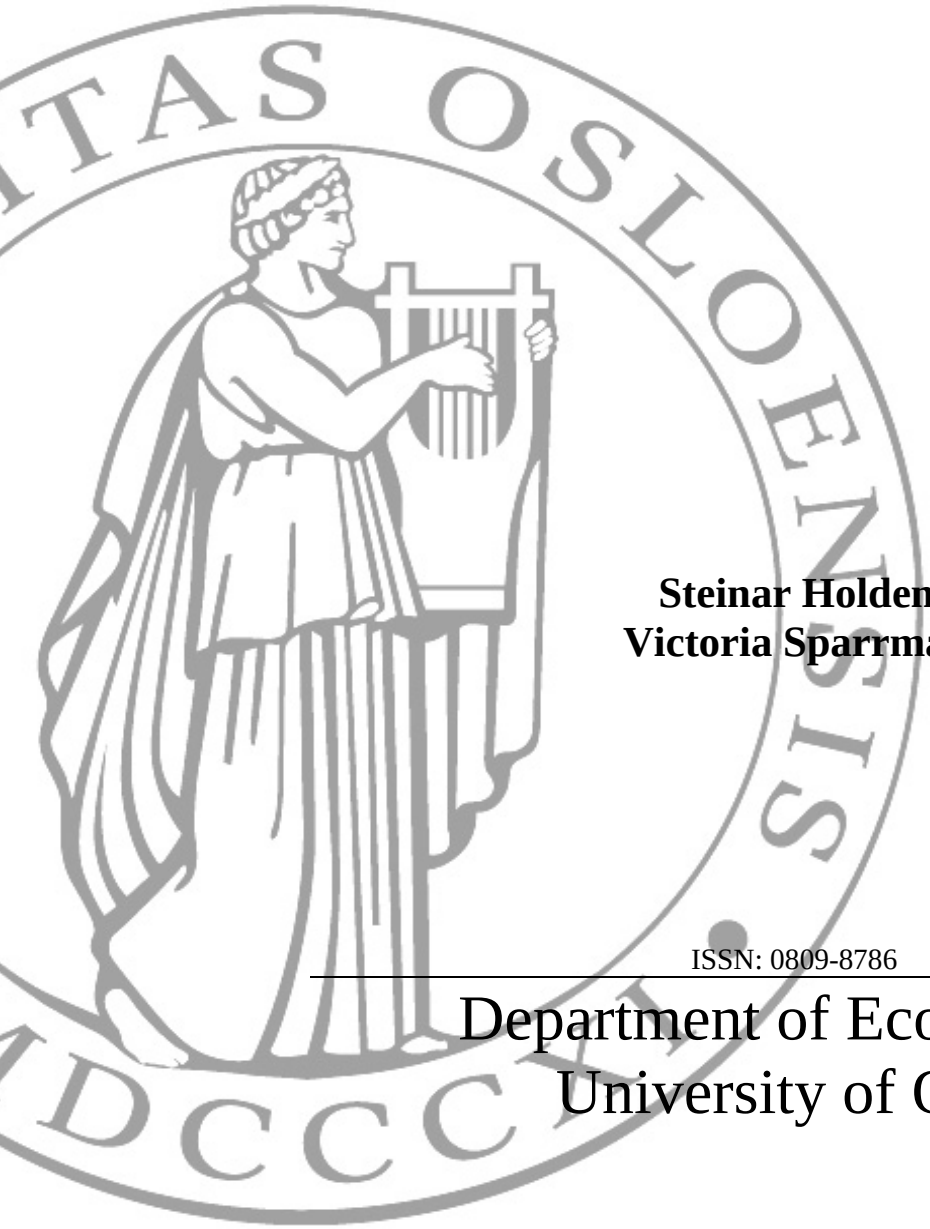
MEMORANDUM

No 17/2011

Do Government Purchases Affect Unemployment?



Steinar Holden
Victoria Sparrman

ISSN: 0809-8786

Department of Economics
University of Oslo

This series is published by the
University of Oslo
Department of Economics

P. O.Box 1095 Blindern
N-0317 OSLO Norway
Telephone: + 47 22855127
Fax: + 47 22855035
Internet: http://www.sv.uio.no/econ
e-mail: econdep@econ.uio.no

In co-operation with
The Frisch Centre for Economic Research

Gaustadalleén 21
N-0371 OSLO Norway
Telephone: +47 22 95 88 20
Fax: +47 22 95 88 25
Internet: http://www.frisch.uio.no
e-mail: frisch@frisch.uio.no

Last 10 Memoranda

No 16/11	Ola Lotherington Vestad *Who pays for occupational pensions?*
No 15/11	Mads Greaker, Michael Hoel *Incentives for environmental R&D*
No 14/11	Halvor Mehlum , Karl Moene , Ragnar Torvik *Mineral Rents and Social Development in Norway*
No 13/11	André K. Anundsen, Eilev S. Jansen *Self-reinforcing effects between housing prices and credit: Evidence from Norway*
No 12/11	Nils Chr. Framstad *Portfolio Separation with α-symmetric and Psuedo-isotropic Distributions*
No 11/11	Jørgen Modalsli *Inequality and growth in the very long run: inferring inequality from data on social groups*
No 10/11	Eilev S. Jansen, Tord S. H. Krogh *Credit conditions indices: Controlling for regime shifts in the Norwegian credit market*
No 09/11	Karin Jacobsen , Kari H. Eika, Leif Helland, Jo Thori Lind, Karine Nyborg *Are nurses more altruistic than real estate brokers?*
No 08/11	Michael Hoel *The supply side of CO_2 with country heterogeneity*
No 07/11	Anne Line Bretteville-Jensen, Erik Biørn, Randi Selmer *Quitting Behaviour of Cigarette Smokers* *Are there direct effects of a screening program?*

Previous issues of the memo-series are available in a PDF® format at:
http://www.sv.uio.no/econ/forskning/publikasjoner/memorandum

Do government purchases affect unemployment?

Steinar Holden and Victoria Sparrman*
University of Oslo, Department of Economics

.

May 23, 2011

Abstract

We investigate empirically the effect of government purchases on unemployment in 20 OECD countries, for the period 1960-2007. Compared to earlier studies we use a data set with more variation in unemployment, and which allows for controlling for a host of factors that influence the effect of government purchases. We find that increased government purchases lead to lower unemployment; an increase equal to one percent of GDP reduces unemployment by 0.2 percentage point in the same year. The effect is greater in downturns than in booms, and also greater under a fixed exchange rate regime than under a floating regime.

Keywords: Fiscal policy, unemployment
JEL codes: E62, H3

*We are grateful to Roel Beetsma, Francesco Furlanetto, Ragnar Nymoen and Fredrik Wulfsberg for comments and discussions. The numerical results in this paper were obtained by use of *OxMetrics 6/PcGive 13* and *Stata 9*. This paper is part of the project *Demand, unemployment and inflation* financed by the The Research Council of Norway. While carrying out this research, Steinar Holden has been associated with the ESOP centre at the Department of Economics, University of Oslo. ESOP is supported by The Research Council of Norway. Corresponding author: steinar.holden@econ.uio.no

1 Introduction

During the financial crisis, most OECD countries used fiscal measures extensively to stimulate the economy. More recently, increasing public debt and rising default premia on sovereign debt lead to substantial fiscal tightening in many countries. At the same time, unemployment has soared in many OECD countries. The large changes in policy and unemployment rates raise the question of how fiscal policy affects unemployment, irrespective of what the motivation for the policy is. This paper explores the effect of a change in government purchases on goods and services on aggregate unemployment.

The effect of fiscal policy on the economy has been subject to considerable interest in the recent years, cf. surveys in Auerbach et al. (2010), Perotti (2007), Beetsma and Giuliodori (2010), and Hall (2009). The bulk of this literature has dealt with the effect of fiscal policy on GDP, while the literature exploring the effect on unemployment is much more limited. Most studies conclude that an increase in government purchases leads to lower unemployment (e.g. Monacelli et al. (2010) and IMF (2010)), but there are also studies like Brückner and Pappa (2010) which find that increased government purchases lead to higher unemployment.

Our study differs from most of the previous studies along several dimensions. First, we use an extensive panel data set for 20 OECD countries for the period 1960-2007, which makes it possible to explore whether the effect of fiscal policy depends on a host of other factors, like the cyclical situation of the economy, the openness of the economy, the type of fiscal impulse, etc. A number of recent papers argue that the effect of fiscal policy depends crucially on the possible monetary response (e.g.Coenen et al. (2010) and Hall (2009)); we explore this idea by considering how the effect differs across monetary regimes. Second, we draw upon a large literature, associated with among others Layard et al. (1991) and Nickell et al. (2005), which has documented the importance of labour market institutions for the evolution of the rate of unemployment. Our analysis builds on this literature, investigating the effect of fiscal policy in a regression framework, controlling for other explanatory variables, including institutions in the labour market. This also allows us to explore whether the effect of fiscal policy depends on labour market institutions (which we find that it does).

We find that an increase in government purchases leads to an economically and statistically significant reduction in unemployment. The point estimate in our fixed effects equation implies that a permanent increase in government purchases equal to one percent of GDP leads to a reduction in unemployment of 0.25 percentage points after one year. The IV estimate is considerably larger, with a reduction in unemployment of about 0.60 percentage points after one year. In either case the effect decreases gradually, and only about 1/5 remains after ten years. The size of the effect is highly dependent on other factors in the economy. For example, we find that the reduction in unemployment due to a rise in government purchases is greater when the economy is in a weak cyclical situation. Furthermore, in line with the Mundell-Fleming model, we find a strong effect of fiscal policy on unemployment in countries with a fixed exchange rate, but no effect for countries with a floating exchange rate. This is consistent with recent research mentioned above, arguing that fiscal policy may have a strong impact on the economy in situations when the monetary policy is constrained (see e.g. Coenen et al. (2010)).

The rest of the paper is organized as follow. Section 2 provides a brief review

of the theoretical and empirical literature on the effect of fiscal policy on GDP and unemployment. In section 3, we present our empirical approach, while the empirical results are laid out in section 4. Section 5 concludes. The appendices describe data and additional results.

2 The effect of fiscal policy on unemployment - a comparison with the literature

Most of the the literature on the effect of fiscal policy focuses on the effect on GDP, see surveys referred to above. While there is large variation in the findings, most studies find that increased government spending has a positive impact on GDP, even if the size of the effect may vary considerably depending on the specific circumstances. The effect on unemployment is clearly linked to the effect on GDP, as one would expect an increase in output to be associated with higher employment. However, as fiscal policy is also likely to affect labour supply, there is an additional channel for the effect. In this brief review we will concentrate on the effect on unemployment to save space; however, in the discussion of the empirical results below, we will also compare with related studies focussing on the effect on GDP.

An early study is Holmlund and Linden (1993), who explore the effects of public employment in a calibrated search model. They find ambiguous effects on unemployment, as increased wage pressure may counteract the direct unemployment-reducing effect of increased public employment. More recently, Monacelli et al. (2010) explore the effect of government consumption in a neoclassical model augmented with search and matching frictions. They show that while higher government consumption increases the hiring rate due to the negative wealth effect inducing higher labour supply, this effect is dampened by the rise in the real interest rate. Overall, the effect of an increase in government spending equal to one percent of GDP leads to a reduction in the rate of unemployment of 0.2 percentage points, i.e. a fairly small reduction in unemployment. However, in their empirical study, which is a structural VAR analysis on US data, they find a larger effect of 0.6 percentage points. Pappa (2009) and Linnemann (2009) also find that increased public employment leads to increased total employment. In contrast, Brückner and Pappa (2010), in an analysis of 10 OECD countries using structural VARs, find that higher government expenditures increases the unemployment rate. However, Brückner and Pappa (2010) also find that increased government spending leads to higher GDP and higher employment, so that the increase in unemployment is caused by higher participation rates due to increased labour supply. Gomes (2010) finds mixed effects of fiscal shocks on unemployment in a DSGE model with search and matching frictions.

An important methodological problem in an analysis of the effects of fiscal policy is that the policy potentially is endogenous, in the sense that the key indicators of fiscal policy clearly depend on the state of the economy. In the literature, this is typically handled either by focussing on the effect of specific events that can be thought to be exogenous, such as changes in military spending in a response to political changes (e.g. Ramey and Shapiro (1999) and Eichenbaum and Fisher (2005)), or by use of a structural vector autoregression (SVAR) model, where the model explains several macroeconomic variables by their lags and exogenous shocks to the variables in the model, see e.g. Blanchard and Perotti (2002), Fatás and Mihov (2001), Benetrix and Lane (2010), Beetsma and Giuliodori (2010) and Monacelli

et al. (2010). Both these methods have clear advantages when it comes to dealing with endogenity. However, the methods also have their weaknesses, see Monacelli et al. (2010) and Auerbach et al. (2010). For the specific events approach, it may be asked whether these events also affect the economy directly, implying that one does not detect the true effect of the policy. For the SVAR approach, there are concerns whether the fiscal shocks identified in the analysis might be anticipated by the private sector in advance, which would cause problems in the interpretation. Furthermore, within the SVAR approach it is also difficult to explore whether the effect depends on the cyclical situation of the economy, as would be expected from traditional keynesian arguments. More recently, a number of studies analyze the effect of fiscal policy within structural models used for macro policymaking, typically of the Dynamic Stochastic General Equilibrium (DSGE) type, see e.g. Coenen et al. (2010); however, the findings in these studies hinge on whether the model is appropriate, which is a matter that is still open for discussion, cf. e.g. Chari et al. (2009) and Caballero (2010). This is a clear argument for also trying other approaches.

We consider the effect of a change in government purchases on unemployment, building on a panel data estimation framework derived by Nymoen and Sparrman (2010). More specifically, we add the real change in government purchases, measured as a share of trend-GDP, to an empirical equation for aggregate unemployment as a function of a number of labour market institutions. This approach has several advantages. First, an extensive literature has shown that aggregate unemployment to a large extent is determined by labour market institutions, see e.g. Layard et al. (1991) and Nickell et al. (2005). Thus, it seems appropriate to control for the effect of labour market variables when analysing the effect of fiscal policy. Second, with a data set covering 20 countries and 47 years, there is large variation in a number of key variables, making it possible to explore how the effect of fiscal policy may vary depending on for instance the monetary regime, the openness of the economy, or the size of the public debt.

We restrict attention to the effect of government purchases, that is, government consumption and investment, which includes public employment but excludes transfers, which makes the endogeneity problems less compelling than if we had analysed the effect of changes in taxes and transfers. Tax revenues and expenditures on transfers are clearly endogenous, following changes in the economy according to rules and legislation. For example, all "passive" unemployment expenditure like benefits, and the large majority of active unemployment related expenditure, are classified as transfers, not government purchases, and thus not included in our analysis. In contrast, government purchases are not directly linked to the state of the economy. Clearly, the state of the economy also affects purchase decisions, but also other factors come into play, like electoral cycles, party politics, lobbyism and pressure groups, media attention, etc. Furthermore, a large part of government purchases may be subject to a lengthy bureaucratic process involving both the decision making and the implementation, implying that there is no clear cut or simple relationship between the state of the economy and government purchases. Yet there is of course a potential endogeneity problem: When we include the change in government purchases as a regressor in the estimated equation, any correlation between our fiscal variable and the error term in the equation may bias our estimate.

We address this problem in two ways. First, we use instrumental variable esti-

mation, where we treat the measure of fiscal policy as endogenous. The instruments we use, which are past values of the change in government purchases and past values of government debt, seem to pass the most basic tests.

Second, we use an omitted variables approach. The idea here is that fiscal policy might be correlated with the error term because it is affected by other explanatory variables that also affect unemployment. By including the omitted variable, the potential bias will be reduced or removed, cf. discussion below.

From a theoretical perspective, one would expect the effect of an increase in government spending to depend on whether it is deficit-financed or debt-financed. However, to distinguish between these two alternatives one must be able to differentiate between tax changes induced by changes in the economy and tax changes linked to the financing of public expenditure. Given the identification problems that are involved, we have chosen not to do this at this stage. Thus, our results must be interpreted as an average effect, where the weights depend on the average method of financing over the sample period. As government debt has increased in most countries over the sample period, the increase in government spending is partly debt-financed and partly deficit-financed.

3 Empirical Approach

We measure government purchases by the real change in the government purchases of goods and services, measured as a share of trend GDP. This variable, denoted dG, is calculated as the real growth rate of government purchases, multiplied by government purchases as a share of trend of GDP, in nominal prices, see appendix 6 for details and calculations. The motivation for using this specification is to ensure that our measure of government purchases is not directly affected by a change in GDP. Some studies (e.g. Alesina and Ardagna (2009), Duell et al. (2009)) consider the effect of a change in the ratio of government spending to GDP. This choice involves the risk that a reduction in GDP caused by, say, an external shock leads to an increase in the ratio of government purchases to GDP, even if government purchases is kept constant. Thus, one might erroneously conclude that government purchases have a negative effect on GDP. For this reason we also use a backward-looking measure of trend GDP, where the trend real growth is measured as the moving average of the growth rate over the past ten years. With a two-sided measure of trend-growth, there would be a risk that the future evolution of GDP affects the estimated trend-GDP, implying a possibility that the future evolution of GDP affects the measure of contemporaneous fiscal policy.

To improve the precision of our estimates, we want to control for other variables that may affect unemployment. First, we include an indicator for the export markets, in the form of the cyclical state of the economy of the trading partners. The indicator is calculated as a weighted average of the GDP-gap of the trading partners, where the GDP-gap is the deviation of GDP from Hodrick Prescott-trend, divided by the trend, and the weights reflect the share of the exports from country i that goes to each of the trading partners j. Second, as argued above, we include labour market institutions. More specifically, we include the change in government purchases and the export market in the unemployment equation derived in Nymoen and Sparrman (2010), which in accordance with Layard et al. (1991) and Nickell et al. (2005), is

a function of labour market institutions and shocks. Thus, in our main estimations, we estimate an equation of the following form

$$\begin{aligned} u_{it} =& \beta_{0i} + \beta_1 u_{it-1} + \beta_2 u_{it-2} + \beta_3 u_{it-3} + \beta_4 \Delta \mathcal{I}_{it-1} + \beta_5 \mathcal{I}_{it-2} \\ &+ \beta_6 \Delta dG_t + \beta_7 dG_{t-1} + \beta_8 \Delta dG_{t-1} + \beta_9 \Delta XM_t + \beta_{10} XM_{t-1} + \beta_{11} \Delta XM_{t-1} + \epsilon_{it} \end{aligned} \tag{1}$$

where u_{it} is unemployment in country i in period t and $\mathcal{I}_{it-1}$ is a vector of institutional labour market variables like unemployment benefits, employment protection legislation, measures of coordination and centralization of wage setting, etc, see table B1 in appendix 7. The dynamic structure follows from the theoretical labour market framework of Nymoen and Sparrman (2010).

In most of the analysis, we use a Fixed Effects (FE) estimator, allowing for permanent country-specific differences in unemployment that are not accounted for by the other explanatory variables. A random effect model would require that there is no correlation between the country fixed effects and the explanatory variables in the model. However, this assumption is rejected in a Hausman test, with a p-value of 1 percent. In principle, the FE estimator is biased when the regression includes a lagged endogenous variable. However, with a long time dimension of more than 40 years, this bias is small, cf. Judson and Owen (1999). In addition, other estimations methods which avoid the sample bias also have their difficulties, cf. Roodman (2009).

The model is estimated on annual frequency, using data from OECD Economic Outlook, see data appendix. Annual data has the advantage of a allowing a much longer time span, as very few countries have quarterly data for the fiscal policy from the 1960s and 70s. Furthermore, annual data may capture the actual fiscal decisions better, as the fiscal impulses are likely to follow annual budgets, as well as mitigating possible anticipation effects, see discussion in Beetsma and Giuliodori (2010).

Government purchases have generally increased in real terms, and the unweighted average in our sample is 0.74 percent, as a share of trend-GDP. The increase was higher in the 1960s and 70s, when the unweighted average was 1.25 and 1.00 percent, respectively, while in the latter decades it has varied from $0.52 - 0.56$. There is however considerable variation within and across countries, with overall standard deviation of 0.7, see table A1 in the appendix.

The evolution of the change in government purchases and the rate of unemployment are illustrated in figure 1 and 2. There may seem to be a negative comovement between these two variables in some countries like Belgium, Canada, Denmark and New Zealand, but not in others.

4 Empirical results

Estimation of equation (1) resulted in essentially the same coefficient value for the first difference and the lagged change in government purchases, while the lagged first difference was not statistically significant, cf. model 1 in table B1 in appendix 7. Thus, the two former variables were put together in the regression, and the result is shown in the first column of table 1. To focus on the novel variables, the coefficients

Figure 1: The change in government purchases, subtracted country specific mean, and the unemployment rate during the period 1960 to 2007

Figure 2: The change in government purchases, subtracted country specific mean, and the unemployment rate during the period 1960 to 2007

Table 1: Estimation of equation (1) - Fixed Effects and Instrumental Variables

	FE[a]			IV[b]		
	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.28	0.04	0.00	1.27	0.05	0.00
Unemployment two years ago	-0.39	0.05	0.00	-0.43	0.07	0.00
Unemployment three years ago	-0.01	0.03	0.82	0.01	0.04	0.81
Demand components:						
Export market, 1st diff. (ΔXM_t)	-0.53	0.06	0.00	-0.51	0.07	0.00
Export market, prev. period (XM_{t-1})	0.17	0.07	0.01	0.22	0.08	0.01
Export market, 1st diff. prev. period (ΔXM_{t-1})	-0.30	0.07	0.00	-0.28	0.08	0.00
Change govt. purchases (dG_t)	-0.19	0.04	0.00	-0.50	0.18	0.01
Obs = Country*Average groups	801	20	40.0	626	20	31.3
Standard deviation of residuals	0.65			0.92		
χ^2 of all the exogenous variables.[c]	287.57	(0.00)		210.14	(0.00)	
χ^2 of dummy, fiscal policy and exports.[c]	195.35	(0.00)		128.26	(0.00)	

In all equations it is also controlled for labour market institutions.

a) Estimation method: Fixed effect coefficients estimates, standard errors from GLS (xtgls without options).

b) Change govt. purchases (dG_t) is treated as endogenous. Instruments are: ΔdG_{t-1}, dG_{t-2} and $\Delta debt_{t-1}$.

c) Numbers in parenthesis are p-values for the relevant null.

for the labour market institutions are omitted; the complete results are found in table B1 in appendix 7.

We observe that the change in government purchases has a highly significant negative impact on unemployment, the point estimate implying that an increase in government purchases equal to one percent of GDP reduces unemployment by 0.2 percentage points. The export market variables also have a significant negative effect on unemployment. The effect of government purchases is unaffected by including year dummies, cf. model 3i in table B1 in appendix 7. In contrast, the effect of the export market variables is much smaller with year dummies, suggesting that these dummies capture common shocks that affect most or all OECD countries. Figure x in the appendix shows the estimated residuals of model 1 in table 1, and there is little indication of autocorrelation, even if there is some variation across countries.

Figure 3 shows the effect on unemployment over time from a permanent increase in government purchases equal to one percent of trend GDP. The maximum impact of -0.25 percentage points is reached in the second year, then the effect weakens gradually to be almost negligible after 10 years. This effect is very close to the findings in IMF (2010), based on a study of fiscal consolidations in 15 OECD countries over the last 30 years. They find that spending-based deficit cuts equal to one percent of GDP raise the unemployment rate of about 0.2 percentage points. Monacelli et al. (2010) find a larger effect on US data; an increase in government spending equal to one percent of GDP leads to a fall in the rate of unemployment of 0.6 percentage points after ten quarters. In contrast, Brückner and Pappa (2010) find in an analysis of 10 OECD countries using structural VARs, that a typical estimate from the impulse responses implies that a 10 percent increase in government expenditures increases the unemployment rate at peak (which varies from $3-16$ quarters) of around $0.2-0.5$ percent.

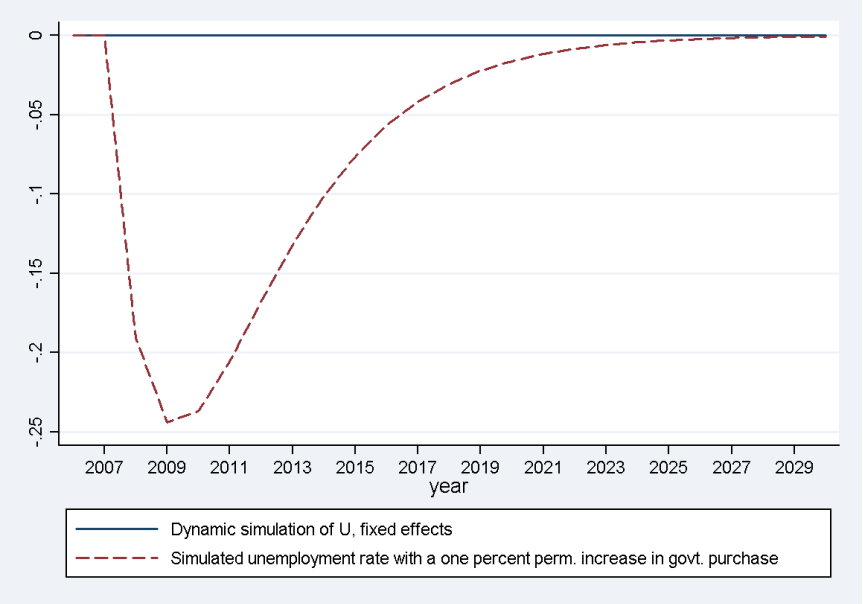


Figure 3: The effect of a permanent increase in government purchases, equal to one percent of GDP, from 2008, based on simulation of equation (1) with estimated coefficients from the FE model in table 1

Table 2: Correlation of government purchases with other variables

	Change govt. purchases (dG_t)		
	Correlation	p-value	Observations
Change govt. purchases, 1st diff. prev. period (ΔdG_{t-1})	0.13	0.00	880.00
Change govt. purchases, two periods ago (dG_{t-2})	0.32	0.00	880.00
Debt, 1st diff. prev. period ($\Delta debt_{t-1}$)	-0.26	0.00	677.00
N	1020		

4.1 Instrument variable approach

As noted above, the estimated coefficient of government purchases will be biased if government purchases also react to changes in the state of the economy that are correlated with the rate of unemployment. One way to deal with this problem is to find instruments that are uncorrelated with the error term and highly correlated with the change in government purchases. We use lags for the change in government purchases, both lagged first difference and two years lag, as well as the lagged change in public debt as a ratio to GDP. As shown in Table 2, there is a fairly strong and significant correlation between the change in government purchases and the instrumental variables. Note that while our results imply that the lagged change in government purchases is correlated with lagged unemployment, the fact that lagged unemployment is also included in the equation implies that lagged government purchases may well be a valid instrument. We have also tried election year, based on the idea that governments may pursue an expansionary fiscal policy in connection with elections to increase the probability of reelection; see evidence in Shi and Svensson (2006). However, including election year did not affect the result, and as election year is potentially endogenous in countries where the government can choose the time of the election, we decided to leave it out in the presented specification.

Column 2 in Table 1 shows the results of the instrumental variable estimation. The point estimate indicates that an increase in government purchases equal to one percent of GDP reduces unemployment by half a percentage point, i.e. more than twice the effect from the FE estimates. The effect is also highly statistically significant. This may suggest that government purchases is endogenous, leading to a downward bias in the coefficient in the FE result. Note however that a Hausman test does not indicate that government purchases is endogenous, as the t-value of the residual variation in this variable is only 0.28. The F-test of the instrument variables is equal to 9.2, which is at the borderline to a sign of weak instruments. Because of the difficulty of obtaining satisfying instruments, we undertake both FE and IV estimations below, except for some of the interactions where it is difficult to find suitable instruments. However, it suggests some caution in the interpretation of the results.

4.2 Controlling for omitted variables

The possible weakness of the instruments suggests that we also address the potential endogeneity of government purchases by other means. The idea behind controlling for omitted variables is that fiscal policy might be correlated with the error term because it is affected by other explanatory variables that also are correlated with unemployment. For example, fiscal policy might be pro-cyclical, because in a boom, tax revenues increase making it possible for politicians to spend more money; this effect is termed the voracity effect by Tornell and Lane (1999). At the same time, the increase in tax revenues during the boom might be correlated with a fall in unemployment. However, in this case including tax revenues as a regressor in the unemployment equation would lend fiscal policy uncorrelated with the error term, removing the bias in the coefficient. As the government purchases are typically decided in the budget process in the fall the year prior to the budget year, it would be tax revenues for the year when the budget is decided that might affect the budget. Thus, in table 3 we include the lagged change in tax revenues as a share of trend GDP to capture that higher revenues might lead to increased government purchases. In contrast, if the government attempts to use fiscal policy to stabilize the economy, one would expect an increase in government purchases in downturns, when GDP growth is low, or the output gap is negative. To control for this, we also include GDP growth and the change in the output gap, both lagged, in table 3.

We observe that the effect of government purchases is not affected by including the additional explanatory variables in model 2 in table 3. [1] This lends considerable support to the robustness of this effect, as both the lagged GDP growth and the output gap are variables that are strongly correlated with unemployment. Note however that some of the export market variables are no longer significant. This emphasizes that including lagged GDP growth and lagged output gap entail a strong test of the explanatory power of the variables.

In model 3 and 4 in table 3, we control for the possible endogeneity of government purchases in a somewhat different way, by also including consensus forecast for GDP growth, unemployment and the output gap. Again, one might conjecture that government purchases would respond to such forecasts, and that the correlation

[1] The sample size is reduced somewhat because of data availability, and the isolated effect of this - i.e. model 1 on the reduced sample size - is a coefficient for government purchases of 0.27. Thus, the isolated effect of the additional variables is a small reduction in the value of the coefficient.

we find between government purchases and unemployment is due to both variables being correlated with the forecasts. However, we see that the change in government purchases has a significant negative impact on unemployment even when controlling for forecasts. The coefficient value is slightly smaller, but a comparison with model 5 shows that this difference is due to the much smaller sample size in the regressions with forecasts.

Table 3: Equation (1) with control for omitted variables

	Model 1			Model 2			Model 3			Model 4			Model 5		
	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.28	0.04	0.00	1.13	0.05	0.00	1.06	0.07	0.00	1.19	0.07	0.00	1.05	0.07	0.00
Unemployment two years ago	-0.39	0.05	0.00	-0.30	0.07	0.00	-0.34	0.09	0.00	-0.53	0.09	0.00	-0.40	0.09	0.00
Unemployment three years ago	-0.01	0.03	0.82	0.01	0.04	0.83	0.08	0.05	0.13	0.12	0.06	0.03	0.13	0.05	0.01
Demand components:															
Export market, 1st diff. (ΔXM_t)	-0.53	0.06	0.00	-0.55	0.07	0.00	-0.39	0.08	0.00	-0.42	0.09	0.00	-0.40	0.08	0.00
Export market, prev. period (XM_{t-1})	0.17	0.07	0.01	0.09	0.07	0.23	0.01	0.13	0.93	-0.08	0.14	0.56	-0.05	0.12	0.69
Export market, 1st diff. prev. period (ΔXM_{t-1})	-0.30	0.07	0.00	-0.08	0.08	0.29	0.06	0.13	0.64	0.02	0.13	0.86	0.11	0.11	0.33
Change govt. purchases, (dG_t)	-0.19	0.04	0.00	-0.21	0.05	0.00	-0.17	0.06	0.00	-0.16	0.06	0.01	-0.16	0.06	0.00
Controls:															
Log GDP 1st diff. prev. period				-20.20	4.46	0.00	-22.96	10.42	0.03				-17.58	9.08	0.05
Outputgap 1st diff. prev. period				0.06	0.05	0.22	0.04	0.10	0.68				0.01	0.09	0.95
Direct and indirect taxes divided by trend GDP, 1st diff. prev. period				1.37	3.55	0.70	-1.83	3.16	0.56				-1.47	3.19	0.64
Direct and indirect taxes divided by trend GDP, 1st diff. two periods ago				0.12	3.35	0.97	-6.76	3.14	0.03				-5.83	3.11	0.06
Year_{t-1} forecast of GDP growth year t							-0.00	0.06	0.98	-0.06	0.06	0.31			
Year_{t-1} forecast of output gap year t							-0.05	0.10	0.61	-0.15	0.10	0.12			
Year_{t-1} forecast of unemployment year t							-0.15	0.09	0.08	-0.14	0.09	0.15			
Year_{t-1} forecast of GDP growth year $t+1$							-0.02	0.08	0.85	0.00	0.09	0.98			
Year_{t-1} forecast of output gap year $t+1$							0.11	0.09	0.23	0.13	0.10	0.17			
Year_{t-1} forecast of unemployment year $t+1$							0.15	0.09	0.10	0.15	0.10	0.14			
Obs = Country*Average groups	801	20	40.0	616	20	30.8	207	20	10.4	207	20	10.4	207	20	10.4
Standard deviation of residuals	0.65			0.61			0.34			0.36			0.34		
χ^2 of all the exogenous variables.[a]	287.57	(0.00)		235.53	(0.00)		95.47	(0.00)		78.58	(0.00)		92.72	(0.00)	
χ^2 of policy and exports.[a]	195.35	(0.00)		139.26	(0.00)		45.20	(0.00)		41.60	(0.00)		44.72	(0.00)	
1st order autocorrelation[a]	0.65	(0.52)		1.97	(0.05)		-3.02	(0.00)		-3.00	(0.00)		-0.26	(0.79)	
2nd order autocorrelation[a]	0.15	(0.88)		-0.65	(0.52)		0.66	(0.51)		0.18	(0.86)		-1.59	(0.11)	

Estimation method: Fixed effect coefficients estimates, standard errors from GLS (xtgls without options).

In all equations it is also controlled for labour market institutions.

b) Numbers in parenthesis are p-values for the relevant null.

4.3 Does the effect of government purchases vary over the cycle?

An important question from a policy perspective is whether the effect of government purchases varies over the business cycle. We measure the cyclical situation of the economy by use of the output gap as measured by the OECD, and defined as real GDP minus trend GDP, divided by trend GDP, and multiplied by 100.

In the first column in table 4, we extend equation (1) by including the interaction between the output gap and the change in government purchases. The interaction term is strongly significant, with positive sign, implying that an increase in government purchases leads to a larger reduction in unemployment in bad times when the output gap is negative than in good times. The effect of the interaction term is quite large, with estimated coefficient equal to 0.07. This means that if the output gap is negative and equal to -2 percentage point, an increase in government purchases equal to one percent of GDP will decrease unemployment by $0.21 + 0.14 = 0.35$ percentage points at impact. The result is consistent with Auerbach and Gorodnichenko (2010), who also find a larger fiscal multiplier in recessions than in expansions, using a regime-switching model on U.S. aggregate data.

The systematic link between the output gap and the effect of government purchases has potentially vast policy interest, in particular for countries where fiscal tightening is required. The results in table 4 show that it matters when the fiscal tightening takes place, as the same fiscal tightening has a stronger effect on unemployment in a downturn of the economy. Ceteris paribus, this suggests that fiscal tightening should be postponed until the economy is in better shape. Taken at face value, the result suggests that countercyclical fiscal policy may reduce the average unemployment rate over time, see further discussion below.

Table 4: Equation (1) with interaction with output gap, debt and openness in the economy

	Model 1			Model 2			Model 3			Model 4		
	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.31	0.04	0.00	1.31	0.04	0.00	1.27	0.03	0.00	1.27	0.03	0.00
Unemployment two years ago	-0.48	0.06	0.00	-0.45	0.06	0.00	-0.39	0.05	0.00	-0.39	0.05	0.00
Unemployment three years ago	0.04	0.03	0.29	0.01	0.04	0.71	-0.00	0.03	0.97	-0.00	0.03	0.98
Demand components:												
Export market, 1st diff. (ΔXM_t)	-0.51	0.07	0.00	-0.53	0.07	0.00	-0.54	0.06	0.00	-0.54	0.06	0.00
Export market, prev. period (XM_{t-1})	0.14	0.07	0.05	0.20	0.07	0.00	0.18	0.07	0.01	0.17	0.07	0.01
Export market, 1st diff. prev. period (ΔXM_{t-1})	-0.27	0.07	0.00	-0.30	0.08	0.00	-0.30	0.07	0.00	-0.30	0.07	0.00
Change govt. purchases (dG_t)	-0.21	0.04	0.00	-0.28	0.05	0.00	-0.19	0.04	0.00	-0.18	0.04	0.00
Interaction change govt. purchases (dG_t) and output gap $\bar{Y}_t$	0.07	0.01	0.00									
Interaction change govt. purchases and debt ratio prev. period (deviation from global mean), ($dG_t * (debt_{t-1} - \overline{debt})$)				-0.27	0.15	0.07						
Govt. debt prev. period ($debt_{it-1}$)				-0.19	0.19	0.30						
Interaction govt. purchases and openness deviation from sample mean prev. period ($dG_t * (open_{it-1} - \overline{open})$)							-0.20	0.09	0.03			
Openness prev. period ($open_{it-1}$)							-0.29	0.24	0.23	-0.34	0.23	0.14
Interaction govt. purchases and openness deviation from year mean prev. period ($dG_t * (open_{it-1} - \overline{open}_t)$)										-0.25	0.10	0.02
Obs = Country*Average groups	698	20	34.9	643	20	32.1	801	20	40.0	801	20	40.0
Standard deviation of residuals	0.63			0.63			0.64			0.64		
χ^2 of all the exogenous variables.[a]	272.76	(0.00)		262.69	(0.00)		300.12	(0.00)		301.61	(0.00)	
χ^2 of policy and exports.[a]	189.17	(0.00)		186.59	(0.00)		206.83	(0.00)		208.20	(0.00)	
1st order autocorrelation[a]	0.83	(0.40)		1.41	(0.16)		0.95	(0.34)		0.95	(0.34)	
2nd order autocorrelation[a]	-0.92	(0.36)		0.14	(0.89)		-0.03	(0.97)		-0.03	(0.97)	

Estimation method: Fixed effect coeffcients estimate, standard errors from GLS (xtgls without options).

a) Numbers in parenthesis are p-values for the relevant null.

4.4 Government purchases, debt and openness

A key issue in part of the literature on the effect of fiscal policy is that the effect is likely to depend on private sector expectations on future fiscal policy. For example, Giavazzi and Pagano (1990) argue that a severe fiscal contraction might be expansionary in situations with concern for the risks of high public debt. This suggests that the effect of government purchases may depend on the level of public debt. In a recent study using structural VARs on quarterly data for 44 countries, both advanced and developing countries, Ilzetzki et al. (2010) find that the fiscal multiplier depends on the level of government debt, and that the fiscal multiplier is zero in high debt countries. To explore the possible importance of public debt, we interact the change in government purchases with lagged public debt as a ratio to GDP (measured as deviation from sample mean, which is equal to 0.6). We also include debt as a separate explanatory variable, as the levels of debt might well be correlated with the level of unemployment, cf. Bertola (2010).

The results are shown in model 2 in table 4. Surprisingly, the interaction term has the opposite sign of the expected, although only marginally significant, with a p-value of 7 percent. However, the results reported below suggests that this finding is due to spurious correlation with time effects.

In table 4, we also explore whether the effect of government purchases depends on the openness of the country. According to traditional Keynesian analysis, the government expenditure multiplier is smaller in an open economy. In line with this, Beetsma and Giuliodori (2010) find in an analysis of 14 *EU* countries a clear positive effect of a rise in government purchases on GDP in "closed economies" (defined as countries where the ratio of export plus import to GDP is above sample average), and no significant effect in the remaining "open economies". Ilzetzki et al. (2010) also find a stronger expansionary effect in closed economies than in open. To analyse the effect of openness, we interact the change in government purchases with an indicator of openness, based on the ratio of export plus import to GDP. As the degree of openness has increased over time, we consider two different specifications of this indicator. In model 3, the indicator measures the deviation of the export plus import ratio from the sample mean, implying that the indicator also captures the increase in openness over time. In model 4, the indicator is measured as deviation from year mean, thus omitting the change in openness over time. However, the result is essentially the same in both specifications, with a stronger effect in more open economies, i.e. the opposite of the expected effect. Yet as we shall see below, this effect does not hold up when we control for monetary regime.

4.5 Does the effect of government purchases vary over time?

In this subsection we investigate whether the effect of government purchases on unemployment varies over time, by allowing for a different effect for each decade. This exercise entails the added benefit that it facilitates comparison of our results with other studies on shorter sample periods. Model 2 in table 5 shows a striking difference. In the 1960s and 70s, we find essentially no effect of government purchases on unemployment. In contrast, in the 1980s, 90s, and 2000s, the effect is much stronger than in the total sample, with coefficient estimates varying from -0.27 in the 2000s to -0.45 in the 1990s.

One might speculate that the absence of any effect in the 1960s reflects that unemployment in almost all countries was very stable and low, not giving much room for an effect of government purchases. In contrast, in the 1970s, unemployment rose quite sharply in most countries, and some countries tried to counteract this rise by use of expansionary fiscal policy. Thus, there could be a downward bias in the estimate reflecting that the rise in unemployment induced increased government spending, suggesting the use of IV. However, the IV results in the third model in table 5 are rather consistent with the FE results; no effect of government purchases in the 1960s and 70s, and a negative effect for the last three decades, although with only a p-value of 15 percent in the 1980s. For the 2000s, the IV point estimate is almost three times as large as the FE estimate.

In model 4, we include government debt in the FE regression, to explore whether the unexpected sign for the debt-government purchases interaction in table 4 is related to the fact that the level of debt has varied over time, cf. table A2 in appendix 6. It turns out that the debt-government purchases interaction loses its explanatory power, with a coefficient value close to zero with a p-value of 0.74.This suggests that the significant debt-government purchases interaction in table 4 is spurious, implying that we do not find any effect of the debt level on the impact of government purchases on unemployment.

Table 5: Equation (1) for each decade in the sample

	Model 1			Model 2			IV 3[a]			Model 4		
	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.28	0.04	0.00	1.24	0.03	0.00	1.28	0.05	0.00	1.27	0.04	0.00
Unemployment two years ago	-0.39	0.05	0.00	-0.38	0.05	0.00	-0.46	0.07	0.00	-0.44	0.06	0.00
Unemployment three years ago	-0.01	0.03	0.82	-0.02	0.03	0.57	-0.01	0.04	0.75	0.00	0.04	0.94
Demand components:												
Export market, 1st diff. (ΔXM_t)	-0.53	0.06	0.00	-0.48	0.06	0.00	-0.46	0.07	0.00	-0.50	0.07	0.00
Export market, prev. period (XM_{t-1})	0.17	0.07	0.01	0.16	0.07	0.03	0.17	0.08	0.04	0.16	0.07	0.03
Export market, 1st diff. prev. period (ΔXM_{t-1})	-0.30	0.07	0.00	-0.28	0.07	0.00	-0.17	0.09	0.05	-0.24	0.08	0.00
Change govt. purchases (dG_t)	-0.19	0.04	0.00									
Change govt. purchases (dG_t), 1960s				0.04	0.11	0.69	0.12	0.27	0.67	0.04	0.18	0.83
Change govt. purchases (dG_t), 1970s				0.04	0.06	0.50	0.28	0.38	0.46	0.04	0.09	0.63
Change govt. purchases (dG_t), 1980s				-0.33	0.08	0.00	-0.42	0.29	0.15	-0.48	0.10	0.00
Change govt. purchases (dG_t), 1990s				-0.45	0.09	0.00	-0.38	0.22	0.08	-0.44	0.09	0.00
Change govt. purchases (dG_t), 2000s				-0.28	0.09	0.00	-0.81	0.29	0.01	-0.32	0.09	0.00
Dummy for 1970s				0.25	0.18	0.17	0.23	0.46	0.62	0.32	0.26	0.23
Dummy for 1980s				0.77	0.19	0.00	1.13	0.38	0.00	0.97	0.27	0.00
Dummy for 1990s				0.89	0.20	0.00	1.22	0.37	0.00	1.09	0.27	0.00
Dummy for 2000s				0.65	0.20	0.00	1.25	0.40	0.00	0.84	0.28	0.00
Interaction change govt. purchases and debt ratio (deviation from global mean) prev. period, ($dG_t * (debt_{t-1} - \overline{debt})$)										-0.06	0.16	0.74
Lagged levels of govt. debt										-0.31	0.20	0.12
Obs = Country*Average groups	801	20	40.0	801	20	40.0	626	20	31.3	643	20	32.1
Standard deviation of residuals	0.65			0.63			0.98			0.61		
χ^2 of all the exogenous variables.[b]	287.57	(0.00)		275.60	(0.00)		186.28	(0.00)		263.00	(0.00)	
χ^2 of policy and exports.[b]	195.35	(0.00)		198.66	(0.00)		106.02	(0.00)		184.38	(0.00)	
1st order autocorrelation[b]	0.65	(0.52)		0.98	(0.33)					1.26	(0.21)	
2nd order autocorrelation[b]	0.15	(0.88)		0.26	(0.79)					0.56	(0.58)	

Estimation method: Fixed effect coeffcients estimate, standard errors from GLS (xtgls without options) in all the regressions, except for model 3 where IV approach is used.

In all equations it is also controlled for labour market institutions.

a) Change govt. purchases (dG_t) is treated as endogenous. Instruments are: (ΔdG_{t-1}), (dG_{t-2}) and ($\Delta debt_{t-1}$).

b) Numbers in parenthesis are p-values for the relevant null.

4.6 Distinguishing between types of government purchases: investment, wage consumption and non-wage consumption

Both from a theoretical and policy perspective it is of considerable interest to explore whether the effect of a change in government purchases differs depending of the type of purchase. In statistical sources, one typically distinguishes between three categories, which we also use in our analysis: government wage consumption, which is essentially public employment ($dCGW$), government non-wage consumption ($dCGNW$) and government real investments (dIG). In our sample, government wage consumption constitutes 54 percent of total government purchases, government non-wage consumption 29 percent, and government investments 17 percent (unweighted average across countries). We consider the same form of the left hand side variable as before, i.e. the change in each of this categories (indicated by the d in the variable name), in real terms, and measured as share of trend-GDP, see appendix 6 for a detailed explanation.

The results are presented in table 6. Model 1 shows that government investments and government wage consumption both have a significant negative impact on the unemployment rate (although government investment only with a p-value of 0.08), while the estimated effect of government non-wage consumption is close to zero and not statistically significant.

In model 2 in table 6, we explore whether the effect of the different types of government purchase depends on the cyclical state of the economy. The interaction terms for both government investment and government wage consumption are positive and statistically significant, implying that both increased government investment and increased government wage consumption have a stronger dampening effect on unemployment when the output gap is negative, consistent with our prior results.

The third model in table 6 presents the result of model 1 using IV; we find that the effect of government investment is much stronger, with a point estimate of -0.59, and a p-value of 0.05, while the other coefficients are not statistically significant.

Ilzetzki et al. (2010) also explore possible differences between the effect of government consumption and government investment, and they find about the same point estimates for both consumption and investment for advanced countries, with multiplier estimates (the effect of government purchases on GDP) of 0.4 at impact and 0.8 in the long run.

Table 6: Equation (1) with different types of government purchases and interaction with the output gap

	Model 1			Model 2			IV 3[a]		
	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.31	0.04	0.00	1.30	0.04	0.00	1.25	0.06	0.00
Unemployment two years ago	-0.39	0.06	0.00	-0.43	0.07	0.00	-0.37	0.07	0.00
Unemployment three years ago	-0.01	0.04	0.83	0.03	0.04	0.41	-0.04	0.04	0.32
Demand components:									
Export market, 1st diff. (ΔXM_t)	-0.52	0.07	0.00	-0.48	0.07	0.00	-0.51	0.08	0.00
Export market, prev. period (XM_{t-1})	0.26	0.08	0.00	0.24	0.08	0.00	0.19	0.09	0.04
Export market, 1st diff. prev. period (ΔXM_{t-1})	-0.33	0.08	0.00	-0.32	0.09	0.00	-0.29	0.10	0.00
Change govt. investments, (dIG_t)	-0.11	0.06	0.08	-0.13	0.07	0.06	-0.59	0.30	0.05
Change govt. non-wage consumption, ($dCGNW_t$)	0.01	0.01	0.73	0.00	0.02	0.78	-0.01	0.07	0.87
Change govt. wage consumption, ($dCGW_t$)	-0.29	0.09	0.00	-0.27	0.09	0.00	-0.25	0.33	0.45
Interaction dGI_t and $\bar{Y}_t$				0.08	0.03	0.02			
Interaction $dCGNW_t$ and $\bar{Y}_t$				0.01	0.01	0.37			
Interaction $dCGW_t$ and $\bar{Y}_t$				0.14	0.03	0.00			
Obs = Country*Average groups	595	16	37.2	537	16	33.6	501	16	31.3
Standard deviation of residuals	0.66			0.64			0.84		
χ^2 of all the exogenous variables.[b]	237.52	(0.00)		244.56	(0.00)		185.35	(0.00)	
χ^2 of policy and exports.[b]	167.66	(0.00)		181.62	(0.00)		101.43	(0.00)	
1st order autocorrelation[b]	1.30	(0.19)		1.39	(0.16)				
2nd order autocorrelation[b]	0.47	(0.64)		0.12	(0.91)				

Estimation method: Fixed effect coeffcients estimate, standard errors from GLS (xtgls without options)

is used in all the regressions except for in model 3 which IV approach is used.

In all equations it is also controlled for labour market institutions.

a) Change govt. purchases (dG_t) is treated as endogenous. Instruments are: (ΔdG_{t-1}), (dG_{t-2}) and ($\Delta debt_{t-1}$).

b) Numbers in parenthesis are p-values for the relevant null.

4.7 Government purchases and monetary regime

In this subsection we explore whether the effect of government purchases depends on the monetary regime, as implied by standard text book macro like the Mundell Fleming model, and also emphasized in much of the recent literature, e.g. Coenen et al. (2010). Under an inflation target, an expansionary effect of increased government purchases will be counteracted by a rise in the interest rate, partly offsetting the effect on unemployment. Also with other types of floating exchange rates, one would expect an expansionary effect from fiscal policy be counteracted by changes in the exchange rate and the interest rate. In contrast, if the nominal interest rate is unaffected, as it will be with a fixed exchange rate and for a small country in a monetary union, and inflation increases so that the real interest falls, the government multiplier might be considerably above unity. Note however that this effect depends on private sector expectations. As pointed out by Nakamura and Steinsson (2011), if one imposes purchasing power parity in the long run, a short run increase in inflation will be compensated by lower inflation in later periods, offsetting the effect on the long run real interest rate. Yet to what extent private agents in fact take such effects into account remains an open empirical question.

We use four dummies to capture the different monetary regimes within the sample period; the Bretton Woods agreement (all currencies were tied to US dollars until 1972), fixed exchange rate regimes, floating exchange rate regimes (in recent years including inflation targeting), and membership in the European Monetary Union (EMU). Countries that took part in the European Exchange Rate Mechanism ERM are defined as having a fixed exchange rate regime, except for Germany, which we define as floating in light of Germany's dominating position and the independent status of the Bundesbank. We also tried to distinguish between credible and non-credible fixed exchange rate regimes depending on the interest rate differential relative to the anchor country (in most cases Germany), defining the regime as non-credible if the interest rate differential exceed 1 percentage point in annual terms. The idea here is that if the fixed exchange rate lacks credibility, a fiscal expansion could have a negative effect on the economy by impairing credibility, for example raising devaluation expectations and thus also push up interest rates. However, the point estimates were essentially the same for credible and non-credible fixed exchange rate regimes, so we decided to drop this distinction in the results we report.

Table 7: Equation (1) with different types of monetary regime

	Model 1			IV[a]			Model 3			Model 4			Model 5		
	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.24	0.03	0.00	1.31	0.05	0.00	1.23	0.03	0.00	1.23	0.03	0.00	1.28	0.04	0.00
Unemployment two years ago	-0.37	0.05	0.00	-0.46	0.07	0.00	-0.37	0.05	0.00	-0.37	0.05	0.00	-0.47	0.06	0.00
Unemployment three years ago	-0.01	0.03	0.77	0.01	0.04	0.84	-0.00	0.03	0.96	-0.00	0.03	0.96	0.04	0.03	0.21
Demand components:															
Export market, 1st diff. (ΔXM_t)	-0.51	0.06	0.00	-0.51	0.07	0.00	-0.53	0.06	0.00	-0.52	0.06	0.00	-0.49	0.06	0.00
Export market, prev. period (XM_{t-1})	0.15	0.07	0.03	0.13	0.08	0.11	0.11	0.07	0.13	0.10	0.07	0.13	0.14	0.07	0.04
Export market, 1st diff. prev. period (ΔXM_{t-1})	-0.29	0.07	0.00	-0.23	0.08	0.00	-0.26	0.07	0.00	-0.26	0.07	0.00	-0.27	0.07	0.00
Change govt. purchases (dG_t), Bretton woods	0.01	0.08	0.87	-0.11	0.27	0.69	0.02	0.08	0.77	0.02	0.08	0.79	-0.03	0.11	0.76
Change govt. purchases (dG_t) Monetary union (EMU)	-0.35	0.11	0.00	-0.17	0.21	0.42	-0.27	0.16	0.08	-0.30	0.14	0.04	-0.50	0.15	0.00
Change govt. purchases (dG_t), Fixed exchange rate	-0.45	0.07	0.00	-0.36	0.19	0.06	-0.47	0.07	0.00	-0.48	0.07	0.00	-0.45	0.07	0.00
Change govt. purchases (dG_t), Floating exchange rate	-0.03	0.06	0.66	0.26	0.49	0.60	-0.03	0.06	0.56	-0.03	0.06	0.67	0.02	0.06	0.79
Dummy for Bretton woods	-0.27	0.14	0.06	0.02	0.48	0.97	-0.40	0.15	0.01	-0.40	0.15	0.01	-0.08	0.19	0.65
Dummy for EMU	0.14	0.15	0.36	0.13	0.28	0.64	0.35	0.17	0.04	0.37	0.17	0.03	0.21	0.16	0.20
Dummy for Fixed exchange rate	0.46	0.12	0.00	0.59	0.31	0.05	0.53	0.12	0.00	0.54	0.12	0.00	0.48	0.14	0.00
Interaction change govt. purchases and openness deviation from sample mean prev. period ($dG_t * (open_{t-1} - \overline{open})$)							0.05	0.13	0.73						
Openness prev. period ($open_{it-1}$)							-1.07	0.28	0.00	-1.08	0.28	0.00			
Interaction change govt. purchases and openness, deviation from year mean prev. period ($dG_t * (open_{t-1} - \overline{open}_t)$)										0.10	0.13	0.48			
Interaction change govt. purchases (dG_t) and output gap $\bar{Y}$, Bretton woods													-0.03	0.05	0.54
Interaction change govt. purchases (dG_t) and output gap $\bar{Y}$, Monetary union (EMU)													0.12	0.07	0.06
Interaction change govt. purchases (dG_t) and output gap $\bar{Y}$, Fixed exchange rate, credible													0.05	0.02	0.01
Interaction change govt. purchases (dG_t) and output gap $\bar{Y}$, Floating exchange rate													0.09	0.03	0.00
Obs = Country*Average groups	801	20	40.0	626	20	31.3	801	20	40.0	801	20	40.0	698	20	34.9
Standard deviation of residuals	0.63			0.87			0.63			0.63			0.61		
χ^2 of all the exogenous variables.[b]	305.94	(0.00)		218.24	(0.00)		304.28	(0.00)		304.82	(0.00)		314.45	(0.00)	
χ^2 of policy and exports.[b]	218.94	(0.00)		123.29	(0.00)		210.36	(0.00)		210.85	(0.00)		219.76	(0.00)	
1st order autocorrelation[b]	-0.29	(0.77)					0.51	(0.61)		0.34	(0.74)		0.92	(0.36)	
2nd order autocorrelation[b]	0.21	(0.83)					0.19	(0.85)		0.19	(0.85)		-1.35	(0.18)	

In all equations it is also controlled for labour market institutions.

a) The change in govt. purchases (dG_t) is treated as endogenous. Instruments, which are interacted with dummy for monetary regime, are: ΔdG_{t-1}, dG_{t-2} and $\Delta debt_{t-1}$.

b) Numbers in parenthesis are p-values for the relevant null.

Model 1 in table 7 shows that the effect of government purchases differs sharply across monetary regimes. The point estimate is -0.35 in the EMU and -0.45 with a fixed exchange rate regime, and highly statistically significant. In contrast, during the Bretton Woods regimes, and with a floating exchange rate, the point estimate is essentially zero. The difference across regimes is statistically significant (results available on request) and in line with our theoretical expectations, where fiscal policy is effective under a fixed exchange rate regime, but not under float. The exception is of course the Bretton Woods period; however, this finding only reflects the prior finding of no effect of fiscal policy during the 1960s and 70s. The difference across exchange rate regimes is consistent with those of Ilzetzki et al. (2010); they find a significant positive effect of increased government consumption on GDP for fixed exchange rate regimes, while the effect is significant and negative at impact for floating regimes. Model 2 displays the IV results: the effect of fiscal policy is significant under a fixed exchange rate, while the other interaction terms are imprecisely determined.

In model 5, we explore whether the importance of the cyclical situation depends on the monetary regime. We do this by including an interaction term between the output gap, a dummy for monetary regime and the change in government purchases. The interaction term is significant for three regimes, EMU, fixed and floating, which implies that fiscal policy has a stronger negative effect on unemployment during a downturn in all three regimes. The reason why the effect of fiscal policy is not offset by monetary policy under floating, could be that in a downturn, the monetary policy is in any case on the expansionary side, so that it reacts less to variation in fiscal policy.

In model 3 and 4, we review our prior findings on the link between fiscal policy and the openness of the economy. We find that the interaction between openness and the change in government purchases is no longer significant. Indeed, for both specifications the point estimate is close to zero, suggesting that our prior findings on openness are spurious and caused by a correlation between openness and monetary regime.

4.8 The effect of labour market institutions

As noted above, there is a large literature documenting the importance of labour market institutions for unemployment rates. Thus, we want to control for such institutions. First, as noted we include institutions in all the regressions. This turns out to be of limited importance, as the effect of fiscal policy is only slightly larger in a regression without the labour market institutions (results available on request). Second, we want to see whether the effect of fiscal policy depends on the labour market institutions. The theoretical results are mixed: Ardagna (2007) finds that an increase in government purchases leads to increased unemployment in a monopoly union model, while Furlanetto (2011) shows that real wage rigidity may play an important role to preserve the traditional effect of fiscal policy in New Keynesian Models, i.e. that increased purchases leads to higher employment.

To explore the effect of labour market institutions, we first construct a summary index on the basis of our regression result. Specifically, we detect the estimated effect of the labour market institutions in column 1 in table 1 by calculating the index as the product of the estimated coefficients and the actual values of the labour market institutions. We compute the deviation of the index from its sample mean to obtain

an index with zero mean. We then interact our measure of fiscal policy with the index of labour market institutions. The results in Table 9, column 1, shows that an increase in government purchases has a stronger negative impact on unemployment in country-years with labour market institutions that induce higher unemployment. The effect is highly significant statistically, and numerically rather strong: In Australia, labour market institutions are "employment-friendly" with mean index value -0.77, and the effect on unemployment of an increase in government purchases equal to one percent of GDP is equal to $-0.24 + 0.77 * 0.41 = 0.08$, In contrast, in Sweden, institutions are more conducive to unemployment with mean index of 0.38, implying that the overall coefficient for an increase in government purchases is $-0.24 - 0.38 * 0.41 = -0.40$. Thus, fiscal policy seems to have a stronger impact on unemployment in countries with adverse labour market institutions. One possible concern with these results is that may be caused by spurious correlation, as labour market institutions are generally more rigid in Continental Europe, where we also find most of the EMU countries. Thus, in column two, we also include the interaction of fiscal policy and monetary regime, and we find that the results still hold - fiscal policy has a larger effect with adverse labour market institutions - even if the point estimate of -0.28 is smaller in numerical value.

Table 8: Equation (1) with interaction with labour market institutions.

	Model 1			IV[a]		
	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.26	0.03	0.00	1.24	0.03	0.00
Unemployment two years ago	-0.38	0.05	0.00	-0.37	0.05	0.00
Unemployment three years ago	-0.02	0.03	0.59	-0.02	0.03	0.63
Demand components:						
Export market, 1st diff. (ΔXM_t)	-0.51	0.06	0.00	-0.51	0.06	0.00
Export market, prev. period (XM_{t-1})	0.20	0.07	0.00	0.16	0.07	0.02
Export market, 1st diff. prev. period (ΔXM_{t-1})	-0.33	0.07	0.00	-0.31	0.07	0.00
Change govt. purchases, (dG_t)	-0.24	0.04	0.00			
Interaction change govt. purchases and the predicted effect of labour market institutions	-0.41	0.08	0.00	-0.28	0.09	0.00
Change govt. purchases (dG_t), Bretton woods				-0.04	0.08	0.65
Change govt. purchases (dG_t) Monetary union (EMU)				-0.38	0.11	0.00
Change govt. purchases (dG_t), Fixed exchange rate				-0.39	0.07	0.00
Change govt. purchases (dG_t), Floating exchange rate				-0.11	0.06	0.08
Dummy for Bretton woods				-0.29	0.14	0.04
Dummy for EMU				0.10	0.15	0.49
Dummy for Fixed exchange rate				0.34	0.12	0.01
Obs = Country*Average groups	801	20	40.0	801	20	40.0
Standard deviation of residuals	0.64			0.63		
χ^2 of all the exogenous variables.[a]	325.66	(0.00)		319.48	(0.00)	
χ^2 of policy and exports.[a]	230.21	(0.00)		231.42	(0.00)	

In all equations it is also controlled for labour market institutions.

a) Numbers in parenthesis are p-values for the relevant null.

Table 9: Equation (1) with different types of monetary regime

	Model 1			IV[a]		
	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.26	0.03	0.00	1.24	0.03	0.00
Unemployment two years ago	-0.38	0.05	0.00	-0.37	0.05	0.00
Unemployment three years ago	-0.02	0.03	0.59	-0.02	0.03	0.63
Demand components:						
Export market, 1st diff. (ΔXM_t)	-0.51	0.06	0.00	-0.51	0.06	0.00
Export market, prev. period (XM_{t-1})	0.20	0.07	0.00	0.16	0.07	0.02
Export market, 1st diff. prev. period (ΔXM_{t-1})	-0.33	0.07	0.00	-0.31	0.07	0.00
Change govt. purchases, (dG_t)	-0.24	0.04	0.00			
Interaction change govt. purchases and the predicted effect of labour market institutions	-0.41	0.08	0.00	-0.28	0.09	0.00
Change govt. purchases (dG_t), Bretton woods				-0.04	0.08	0.65
Change govt. purchases (dG_t) Monetary union (EMU)				-0.38	0.11	0.00
Change govt. purchases (dG_t), Fixed exchange rate				-0.39	0.07	0.00
Change govt. purchases (dG_t), Floating exchange rate				-0.11	0.06	0.08
Dummy for Bretton woods				-0.29	0.14	0.04
Dummy for EMU				0.10	0.15	0.49
Dummy for Fixed exchange rate				0.34	0.12	0.01
Obs = Country*Average groups	801	20	40.0	801	20	40.0
Standard deviation of residuals	0.64			0.63		
χ^2 of all the exogenous variables.[a]	325.66	(0.00)		319.48	(0.00)	
χ^2 of policy and exports.[a]	230.21	(0.00)		231.42	(0.00)	

In all equations it is also controlled for labour market institutions.

a) Numbers in parenthesis are p-values for the relevant null.

4.9 Heterogenous effects of government purchases across countries

The large difference in the effect of government purchases depending on the monetary regimes raises the question of whether there are systematic differences across countries. This is explored in table 10, where model 1 presents the base specification allowing for country-specific effects of government purchases. We observe that there is considerable variation, yet the sign is negative for 17 of 20 countries, and the effect is statistically significant at the 10 percent level for 8 of 20 countries. There is a striking link to monetary regime: the seven countries for which the coefficient for government purchases is essentially zero (Australia, Canada, Japan, New Zealand, Switzerland, the UK, and the US), all have had a floating exchange rate for most or all the time since the Bretton Woods. In contrast, for all the countries with a fixed exchange rate regime, the coefficient is negative and larger in absolute value.

Model 2 shows that IV estimation for most countries yields the same sign as the Fixed Effects estimate, even if the coefficient usually is larger in absolute value and the standard error is also larger, rendering the coefficient insignificant. However, there are a few exceptions where the IV estimates are large and positive, but also here imprecisely determined and insignificantly different from zero. Presumably, the results reflect the problem of weak instruments, which is clearly more important when we allow for country-specific coefficients for the effect of government purchases.

In model 3 we address the endogeneity by including possible omitted variables, and include the lagged growth rate of GDP, the lagged output gap (first difference), and indirect and direct taxes as a share of trend GDP (lagged and first differences). By and large, the results correspond well with the FE results in model 1.

Table 10: Equation (1) with country-specific effect of government purchases

	Model 1			IV 2[a]			Model 3			Model 1i		
	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.25	0.03	0.00	1.25	0.07	0.00	1.07	0.05	0.00	1.23	0.03	0.00
Unemployment two years ago	-0.38	0.05	0.00	-0.35	0.12	0.00	-0.24	0.07	0.00	-0.37	0.05	0.00
Unemployment three years ago	-0.00	0.03	0.90	-0.05	0.07	0.49	0.01	0.04	0.86	-0.00	0.03	0.96
Export market indicator:												
Export market, 1st diff. (ΔXM_t)	-0.52	0.06	0.00	-0.44	0.10	0.00	-0.54	0.06	0.00	-0.24	0.10	0.02
Export market, prev. period (XM_{t-1})	0.17	0.07	0.01	0.26	0.14	0.06	0.07	0.07	0.33	0.09	0.10	0.39
Export market, 1st diff. prev. period (ΔXM_{t-1})	-0.31	0.07	0.00	-0.29	0.13	0.02	-0.10	0.08	0.18	-0.29	0.10	0.00
Change govt. purchases (dG_t):												
dG_t (Australia)	-0.00	0.21	1.00	-1.15	2.26	0.61	0.10	0.21	0.64	-0.01	0.20	0.97
dG_t (Austria)	-0.19	0.28	0.51	-0.73	0.84	0.39	-0.12	0.28	0.67	-0.30	0.27	0.26
dG_t (Belgium)	-0.34	0.16	0.03	-0.53	0.44	0.23	-0.23	0.19	0.21	-0.24	0.15	0.11
dG_t (Canada)	0.10	0.16	0.54	0.18	0.36	0.61	0.33	0.17	0.05	0.19	0.15	0.20
dG_t (Denmark)	-0.35	0.20	0.08	2.51	1.66	0.13	-0.24	0.19	0.19	-0.34	0.19	0.07
dG_t (Finland)	-0.55	0.13	0.00	-1.02	0.55	0.07	-1.27	0.19	0.00	-0.59	0.13	0.00
dG_t (France)	-0.35	0.28	0.21	-1.92	1.05	0.07	-0.23	0.28	0.42	-0.42	0.26	0.10
dG_t (Germany)	-0.34	0.18	0.06	-0.65	0.51	0.20	-1.07	0.71	0.13	-0.34	0.17	0.05
dG_t (Ireland)	-0.32	0.09	0.00	-0.37	0.23	0.11	-0.25	0.10	0.01	-0.32	0.09	0.00
dG_t (Italy)	-0.76	0.29	0.01	-1.12	0.72	0.12	-0.72	0.30	0.02	-0.69	0.27	0.01
dG_t (Japan)	-0.04	0.10	0.66	-0.52	0.52	0.32	-0.05	0.11	0.63	-0.07	0.09	0.44
dG_t (Netherlands)	-0.29	0.18	0.11	-0.33	0.49	0.50	-0.38	0.19	0.05	-0.32	0.17	0.07
dG_t (Norway)	-0.37	0.17	0.03	-1.11	0.96	0.25	-0.39	0.20	0.05	-0.31	0.16	0.06
dG_t (New Zealand)	-0.04	0.10	0.71	-0.30	0.58	0.60	-0.17	0.15	0.27	-0.06	0.10	0.54
dG_t (Portugal)	-0.23	0.19	0.22	-0.94	1.00	0.35	-0.26	0.20	0.20	-0.35	0.18	0.05
dG_t (Spain)	-0.92	0.29	0.00	-0.48	0.62	0.44	-1.01	0.27	0.00	-0.98	0.27	0.00
dG_t (Sweden)	-0.15	0.16	0.35	-0.18	1.15	0.88	-0.65	0.21	0.00	-0.16	0.15	0.27
dG_t (Switzerland)	0.11	0.38	0.77	24.53	23.37	0.29	-0.21	1.06	0.84	-0.03	0.36	0.92
dG_t (United Kingdom)	0.04	0.16	0.79	-0.20	1.30	0.88	0.07	0.17	0.70	0.10	0.16	0.52
dG_t (United States)	-0.02	0.17	0.90	0.03	0.33	0.94	0.21	0.23	0.36	0.02	0.16	0.90
Controls:												
Log GDP 1st diff. prev. period							-23.29	4.52	0.00			
Outputgap 1st diff. prev. period							0.09	0.05	0.05			
Direct and indirect taxes divided by trend GDP, 1st diff. prev. period							1.24	3.43	0.72			
Direct and indirect taxes divided by trend GDP, 1st diff. two periods ago							3.01	3.26	0.36			
Obs = Country*Average groups	801	20	40.0	626	20	31.3	616	20	30.8	801	20	40.0

Estimation method: Fixed effect coefficients estimates in all models except for in the second column where IV is used, standard errors from GLS (xtgls without options).

In all equations it is also controlled for labour market institutions.

a) Change govt. purchases (dG_t) is treated as endogenous. Instruments are: ΔdG_{t-1}, dG_{t-2} and $\Delta debt_{t-1}$.

5 Concluding remarks

The great interest of fiscal policy issues has led to a fast increasing body of research. Most of the studies are based on structural VARs, or analyze the effects within structural macro models. As these approaches have their strengths and weaknesses, it is of value also to try other methods. We investigate the effect of changes in government purchases on unemployment by use of panel data estimation, building on an empirical equation where long run unemployment is a function of a number of labour market variables, along the lines of Layard et al. (2005) and Nickell et al. (2005). Compared to most of the existing studies, our analysis has two key advantages. First, our data set is fairly large, covering 20 countries and 47 years. More importantly, our analysis allows us to explore how the effect differ according to the circumstances, like monetary regime, cyclical situation of the economy, and whether the labour market institutions are "employment-friendly". It turns out that the effect differs strongly with these circumstances, underscoring the importance of exploring the differences.

We find that an increase in government purchases has an economically and statistically significant dampening effect on unemployment. According to our base specification, a permanent increase in government purchases equal to one percent of GDP on average leads to a reduction in unemployment of 0.2 percentage point, increasing to 0.25 percentage points after one year, for then to gradually vanish over the following decade. Instrumental variable estimation suggests that this estimate is downward biased, and the IV point estimate is a reduction in unemployment of 0.5 percentage point. There is considerable variation in the effect of government purchases, across time periods and depending on other specific circumstances. We find no effect in the 1960s and 70s, and a correspondingly stronger effect in the 1980s, 90s and 2000s. We also find that the effect is considerably larger in a weak cyclical situation; when the output gap is equal to minus three percent, the effect on unemployment is about double of the average effect.

The systematic link between the output gap and the effect of government purchases has potentially vast policy interest. In many countries, the increasing public debt implies that fiscal policy has to be tightened before long, so there is little scope for using fiscal policy to reduce unemployment. However, taken at face value the results in table 4 suggest that even a fiscally neutral countercyclical policy may reduce the average unemployment rate over time. According to these results, if the increase in government purchases in downturns were matched by a decrease of the same magnitude in booms, the net effect would be a decrease in unemployment. Admittedly, such an effect would be inconsistent with standard theories of equilibrium unemployment. On the other hand, the strong downturn that many OECD countries experience at present suggests that unemployment may remain above long run equilibrium levels for a long time, implying that one should not rule out a role for policy on theoretical grounds.

The monetary regime is important for the effect. In line with the Mundell Fleming model, we find a strong effect of government purchases on unemployment for countries within a monetary union or with a fixed exchange rate regime (excluding the Bretton-Woods), and no significant effect of government purchases for countries with a floating exchange rate. This finding is consistent with the argument of among others Coenen et al. (2010), that fiscal policy has a strong impact on the economy when the monetary policy does not respond. Considering different types

of government purchases, we only find a strong significant effect of government wage consumption (i.e. public employment), and to some extent also government investment (with p-value of 5 percent), but not of government non-wage consumption. We also find that the fiscal policy has a stronger effect in countries with labour market institutions that are conducive to high unemployment.

6 The Data: Definitions and sources

The data are from OECD (2008b) unless otherwise noted. The sample period is from 1960 to 2007, with the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States. The labour market data is also based on the OECD (2008b), but the more detailed description is given in Sparrman (2010).

6.A Government purchases

The change in government purchases (dG) is measured as the growth rate in real terms of government purchases, multiplied with government purchases as a share of trend GDP. . The formula of dG is:

$$dG_{it} = \frac{(CGV_{it} + IGV_{it}) - (CGV_{it-1} - IGV_{it-1})}{(CGV_{it-1} + IGV_{it})} * \frac{CG_{it} + IG_{it} - CFKG_{it}}{YCT_{it}} * 100 \tag{A1}$$

where CG is government consumption, IG government investments, $CFKG$ is consumption of fixed capital, and YCT is trend-GDP. The variables are in nominal prices, except those where the last letter V indicates real terms. Note that government purchases do not include transfers like social security expenditures etc. Note also that we subtract consumption of fixed capital ($CFKG$) from government consumption to obtain the actual expenditure, as the consumption of fiscal capital is an imputed measure. $CFKG$ is not subtracted in the real growth rate for reasons of data availability, but this is unimportant as there presumably is little variation over time in the imputed consumption of fixed capital. Investment data is missing for some countries (Spain, Italy, Switzerland) and for these countries we use government consumption. Trend-GDP is equal to the backward looking 10 year moving average of real GDP (YQ) multiplied with the two year moving average of the price deflator ($PGDP$) to a variable in nominal terms. Real GDP is prolonged backwards (1950-1960) with the growth rate in GDP in The Conference Board (2010). We have used the GDPGK series expressed in 1990 U.S. dollars. Germany is prolonged backwards with the sum of West Germany and East Germany before 1989, and the data for East Germany is linearly interpolated when observations are missing. The variable IGV is calculated as $IGV = IG/PIG$, where PIG is the associated price deflator. The change for the categories of government purchases; $dCGW$ government purchases for wage-consumption, $dCGNW$ non-wage-consumption and dIG investments in fixed capital, are calculated by use of the formula above. The variables in real terms are when necessary (i.e. because they are not supplied by the OECD) calculated as above; real government wage consumption ($CGW/PCGW$), real government non-wage consumption ($CGNW/PCGNW$) and real gross government investments (IG/PIG), where $PCGW$, $PCGNW$, *and* PIG are the associated price deflators. There was no data available for $PCGNW$, which was then calculated from the identity $CG = CGW + CGNW$, which should also hold in real terms, $CG/PCG = CGW/PCGW + CGNW/PCGNW$, or $PCGNW = CGNW/(CG/PCG - CGW/PCGW)$. Some clearly implausible values for the growth rate of $CGNW$ were dropped (287 for Spain in 1983, 140 and 34 in United Kingdom in 1967 and 1970, a fall in the same variable in United Kingdom in 1968 and 1969 of 24 and 27, and finally a fall equal to 20 in Ireland in 1971). Investment

data is missing for some countries (Spain, Italy, Switzerland) and for these countries the missing observations are set to zero.

6.B Unemployment rate

The standardized unemployment rate (UNR) in Economic Outlook OECD (2008a) is used as a primary data source for the unemployment rate in the OECD countries, and missing observations are replaced by the growth rate in a corresponding time series in an earlier data base OECD (2002).[2] Australia, Denmark, Germany, Spain and Switzerland are prolonged by the formula in equation (A2):

$$Y_{it} = Y_{it+1} * \frac{X_{it}}{X_{it+1}} \tag{A2}$$

where Y_it denotes (UNR) in OECD (2008a) and X_{it} denotes the (UNR) in the earlier data base OECD (2002) for country i in time period t. Australia and Denmark are prolonged five years backwards, Germany from 1991, Spain from 1976 and Switzerland from 1969.

6.C Output gap

The output gap is defined as the actual GDP less potential GDP, as a share of potential GDP. It is measured in percentage points and collected from OECD (2008b).

6.D Monetary regime

We have constructed 4 dummies to account for changes in the monetary regime over the sample period; the Bretton Woods agreement (until 1972), a floating exchange rate, a fixed exchange rate, and membership in the European Monetary Union (EMU). The dummy $D_{bretton} = 1$ indicates the Bretton Woods agreement covering all countries in the sample in the period 1960 to 1972. In the Bretton Woods agreement, all currencies were tied to US dollars. The dummy D_{float} indicates that a number of countries adopted a floating exchange rate from 1973: Australia, Canada, Germany, Japan, New Zealand, Switzerland, United States and United Kingdom (except 1990 and 1991 [3]). Germany is defined to have a floating regime in light of Germany's dominating position European Exchange Rate Mechanism ERM, and the independent status of the Bundesbank. Later also Sweden (since 1992) and Norway (since 1999) adopted a floating exchange rate, with inflation targeting. The dummy D_{fixed} indicates a fixed exchange rate, and this includes the countries that took part in the ERM, except Germany. We also tried to distinguish between credible and non-credible fixed exchange rate regimes is based on the interest rate differential relative to the anchor country (in most cases Germany), where the regime is defined as non-credible if the interest rate differential exceed 1 percentage point in annual terms, or if the regime is non-credible in subsequent years before entry into the monetary union. In other words, a fixed exchange rate

[2]Data are collected and organized by the author. This implies that neither OECD nor any other source is responsible for the analysis or the interpretation of the data in this paper.

[3]The UK was a member of the European exchange rate mechanism (ERM) from October 1990 to September 1992

regime is only defined as credible if the interest rate differential is less than one percent in all the following years. D_{EMU} indicates EMU membership, covering Austria, Belgium, Finland, France, Germany, Ireland, Italy, Portugal and Spain since 1999.

6.E Export market indicator

The export market (XM) indicator is calculated as a weighted average of the GDP-gap of the trading partners, where the GDP-gap is the deviation of GDP from Hodrick Prescott-trend (with smoothing parameter 100), and the weights reflect the share of the exports from country i that goes to each of the trading partners j. The formulae is

$$XM_{it} = \Sigma_j w_{ijt} * GAP_{jt} \tag{A3}$$

where $w_{ijt} = x_{ijt}/\Sigma_j x_{ijt}$. x_{ijt} is export from country i to county j in year t. GAP_{jt} is the GDP-gap in country j in year t. The trading partners to one country in the sample are all the other countries in the sample and the rest of 'the world'. 'The world' is one country's total export subtracted the sum of exports to all countries in the sample. The The exports data is from SITC Revision 2 OECD (2010), and are used to calculate the export shares for each country in the sample. The exports from Germany includes Eastern Germany since 1991 and as a partner country Eastern Germany is included the whole sample period. The time series are prolonged backwards with the exports to the world when observations are missing. For instance if Australia has exported to Canada, but exports are only reported in the years 2003 and onwards, the exports from Australia to Canada is prolonged backwards with the change in Australia's world export growth rate and is equal to the total export for Australia. The same method is used for extracting the time series forward. For Belgium the exports data is only reported from 1993. Before 1993 the data is constructed by prolonging the export data for Belgium by use of the change in exports for the Belgium-Luxembourg Economic Union. The GDP-gap for the XM indicator is calculated as the deviation of GDP from trend GDP, divided by trend GDP. Trend GDP derived by use of Hodrick and Prescott (1997) filter, (the HP filter hereafter). The value of the smoothing parameter has been discussed in several papers in range of 6.25 up to 400, see Backus and Kehoe (1992), Correia et al. (1992) and Baxter and King (1999). We would like to remove the difference in growth rates from 1960 to 2007, but not remove cycles, irrespective of whether they are caused by business cycle movements or structural changes in the economy. Therefore we use a rather high value of the smoothing parameter equal to 100, this is also in line with Backus and Kehoe (1992). The GDP-gap for each of the twenty OECD countries is calculated using data from OECD (2008b). The world GDP-gap is constructed using data for the real GDP in The Conference Board (2010). We have used the $GDPGK$-series with are GDP expressed in 1990 U.S. dollars, and covers 123 countries in the database. The world GDP is the sum of the 123 countries subtracted the value of GDP in each of the twenty countries in the sample. Note, that East Germany is linearly interpolated when observations are missing, and Germany is prolonged backwards with the sum of West Germany and East Germany before 1989. The aggregate of former Union of Soviet Socialist Republics, Yugoslav federation and Czechoslovakia is used in the world GDP due to missing observations for each of the countries separately.

6.F Election year

The election year variable 'elect' is collected from Armingeon et al. (2010), and the original data source is European Journal of Political Research (Political Data Yearbook, various issues); Mackie and Rose (1991); Keesing's Archive; Parline database. The variable describes date of election of national parliament (lower house). The variable covers the years in the period 1960 to 2008.

6.G Debt

The gross government debt variable, as a percent of GDP, 'debt', is collected from Armingeon et al. (2010), and the original data source is several versions of Oecd Economic outlook. See details regarding versions and the mission observations in Codebook by Armingeon et al. (2010). To facilitate the interpretation of the coefficients, the variable is rescaled to be the share of GDP. Gross government debt as a percentage of GDP is shown in table A2.

6.H Openness

The openness variable is total trade (export and imports) in percentage of GDP. The variable is collected from Armingeon et al. (2010). See details regarding versions and the mission observations in Codebook by Armingeon et al. (2010). To facilitate the interpretation of the coefficients, the variable is rescaled to be the share of GDP. Gross government debt as a percentage of GDP is shown in table A2.

Table A1: Growth in government purchases - country specific mean and standard deviation

Country stats	**1960-69**	**1970-79**	**1980-89**	**1990-99**	**2000-07**	**1960-07**
Australia mean	1.38	0.87	0.87	0.64	0.80	0.90
sd	0.75	0.60	0.57	0.26	0.21	0.55
Austria mean	0.93	0.89	0.23	0.48	0.13	0.53
sd	0.48	0.35	0.24	0.29	0.30	0.46
Belgium mean	1.55	1.36	0.17	0.35	0.43	0.75
sd	0.52	0.40	0.53	0.37	0.29	0.70
Canada mean	1.56	1.16	0.72	0.25	0.82	0.88
sd	0.59	0.70	0.36	0.52	0.20	0.66
Denmark mean	.	0.89	0.16	0.54	0.52	0.51
sd	.	0.69	0.52	0.45	0.31	0.55
Finland mean	1.31	1.19	0.79	0.20	0.37	0.77
sd	1.07	0.72	0.32	0.85	0.35	0.81
France mean	1.13	0.89	0.80	0.44	0.49	0.72
sd	0.21	0.35	0.24	0.41	0.20	0.38
Germany mean	1.47	1.22	0.19	0.45	0.13	0.68
sd	0.94	0.58	0.51	0.48	0.21	0.78
Ireland mean	1.06	1.59	-0.04	1.11	1.45	1.02
sd	0.57	0.81	1.41	0.50	1.37	1.13
Italy mean	0.88	0.70	0.59	0.04	0.40	0.51
sd	0.15	0.19	0.24	0.37	0.17	0.37
Japan mean	2.17	1.79	0.53	0.73	-0.08	1.03
sd	0.85	1.44	0.47	0.62	0.21	1.14
Netherlands mean	1.12	0.78	0.67	0.65	0.93	0.81
sd	0.37	0.76	0.32	0.24	0.76	0.54
New Zealand mean	0.73	0.97	0.28	0.54	0.93	0.68
sd	1.07	1.49	0.94	1.01	1.14	1.13
Norway mean	1.64	1.56	0.87	1.18	0.90	1.22
sd	0.58	0.45	0.53	0.61	0.53	0.61
Portugal mean	.	1.80	0.93	0.94	0.21	0.80
sd	.	0.83	0.66	0.61	0.61	0.74
Spain mean	0.49	0.99	0.96	0.79	1.18	0.91
sd	0.18	0.27	0.50	0.46	0.18	0.40
Sweden mean	1.86	1.10	0.50	0.41	0.24	0.80
sd	0.49	0.70	0.31	0.56	0.45	0.76
Switzerland mean	0.37	0.22	0.36	0.10	0.07	0.21
sd	0.13	0.32	0.27	0.24	0.15	0.27
United Kingdom mean	0.70	0.53	0.20	0.30	0.74	0.46
sd	0.75	0.62	0.32	0.39	0.82	0.60
United States mean	1.20	0.12	0.67	0.26	0.44	0.51
sd	0.82	0.43	0.42	0.28	0.23	0.58
Total mean	1.25	1.00	0.52	0.52	0.56	0.74
sd	0.77	0.80	0.61	0.58	0.65	0.73

Table A2: Public debt for the countries in the panel over the sample period.

Country stats	**1960-69**	**1970-79**	**1980-89**	**1990-99**	**2000-07**	**1960-07**
Australia mean	.	.	0.24	0.33	0.19	0.26
sd	.	.	0.01	0.07	0.03	0.09
Austria mean	.	0.23	0.48	0.65	0.70	0.50
sd	.	0.07	0.09	0.06	0.04	0.19
Belgium mean	.	0.60	1.08	1.31	1.01	1.00
sd	.	0.04	0.17	0.07	0.09	0.28
Canada mean	0.61	0.48	0.62	0.93	0.75	0.68
sd	0.06	0.04	0.10	0.08	0.06	0.17
Denmark mean	.	.	0.66	0.73	0.48	0.63
sd	.	.	0.10	0.07	0.09	0.14
Finland mean	.	0.11	0.17	0.52	0.49	0.34
sd	.	0.03	0.02	0.18	0.04	0.20
France mean	.	0.33	0.35	0.57	0.70	0.48
sd	.	0.04	0.04	0.12	0.04	0.17
Germany mean	.	0.22	0.38	0.51	0.65	0.43
sd	.	0.05	0.04	0.10	0.04	0.17
Ireland mean	.	0.61	0.94	0.80	0.34	0.70
sd	.	0.05	0.15	0.16	0.04	0.26
Italy mean	0.37	0.75	0.91	1.18	1.18	0.91
sd	0.03	0.13	0.06	0.13	0.03	0.29
Japan mean	.	0.24	0.65	0.87	1.59	0.80
sd	.	0.12	0.10	0.22	0.14	0.50
Netherlands mean	0.72	0.56	0.79	0.86	0.59	0.71
sd	0.03	0.05	0.11	0.07	0.04	0.13
New Zealand mean	.	.	.	0.49	0.31	0.39
sd	.	.	.	0.09	0.04	0.11
Norway mean	.	0.43	0.34	0.34	0.47	0.39
sd	.	0.05	0.04	0.05	0.10	0.08
Portugal mean	.	.	.	0.66	0.69	0.68
sd	.	.	.	0.03	0.04	0.04
Spain mean	.	.	0.47	0.64	0.55	0.58
sd	.	.	0.02	0.11	0.08	0.11
Sweden mean	.	0.30	0.62	0.74	0.59	0.56
sd	.	0.03	0.09	0.13	0.06	0.19
Switzerland mean	.	.	.	0.45	0.54	0.49
sd	.	.	.	0.08	0.04	0.08
United Kingdom mean	0.95	0.58	0.47	0.45	0.44	0.53
sd	0.05	0.08	0.05	0.08	0.03	0.16
United States mean	0.56	0.44	0.52	0.68	0.59	0.56
sd	0.05	0.02	0.08	0.04	0.03	0.09
Total mean	0.62	0.43	0.59	0.69	0.64	0.60
sd	0.16	0.19	0.26	0.27	0.31	0.28

7 Extra

Table B1 presents the complete results of the models in table B1, including the estimates for the labour market variables. Thus, model 1 is reestimation of the unrestricted unemployment equation of Nymoen and Sparrman (2010), including dummies for large outliers. Model 2 includes government purchases and the indicator for the export market, and in model 3, the dummies for large outliers are omitted, as including them is likely to involve a downward bias in the effect of the fiscal policy. For comparison, table B1 also includes two models more, 2i and 3i. Comparing models 2 and 2i shows the effect of omitting the large outliers, which is a fairly large increase in the coefficient values of government purchases and the export market. Model 3i extends model 3 by including year dummies. We observe that the coefficients for the export market become much smaller, reflecting considerable co-movement of the export markets for all countries. In contrast, the coefficient for the change in government purchases is not affected, presumably because any comovement in government purchases across countries is not linked to comovement in unemployment.

Table B1: Equation (1), total results including labour market institutions.

	Model 1			Model 2			Model 2 i			Model 3			Model 3 i [a]		
	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value	Coef.	Std	p-value
Unemployment previous period	1.38	0.03	0.00	1.29	0.03	0.00	1.28	0.04	0.00	1.28	0.04	0.00	1.26	0.04	0.00
Unemployment two years ago	-0.52	0.05	0.00	-0.41	0.05	0.00	-0.40	0.05	0.00	-0.39	0.05	0.00	-0.40	0.05	0.00
Unemployment three years ago	0.06	0.03	0.04	0.01	0.03	0.70	-0.01	0.03	0.86	-0.01	0.03	0.82	-0.00	0.03	0.96
Institutions:															
Employment protection (EPL), 1st diff. previous period	0.12	0.24	0.61	0.09	0.22	0.69	0.04	0.27	0.87	0.04	0.27	0.87	-0.25	0.25	0.32
EPL, two years ago	0.14	0.07	0.05	0.14	0.07	0.03	0.16	0.08	0.05	0.15	0.08	0.05	0.04	0.08	0.60
Benefit replacement ratio (BRR), 1st diff. previous period	-0.89	0.81	0.27	-0.19	0.78	0.81	1.16	0.94	0.22	0.98	0.93	0.29	0.29	0.88	0.74
BRR, two periods ago	0.63	0.24	0.01	0.61	0.25	0.01	0.97	0.29	0.00	0.92	0.29	0.00	0.70	0.27	0.01
Benefit duration (BD), 1st diff. previous period	-0.51	0.54	0.35	-0.53	0.53	0.31	-0.77	0.63	0.22	-0.88	0.62	0.16	-0.58	0.59	0.33
BD, two periods ago	0.00	0.17	1.00	-0.00	0.17	0.98	-0.13	0.20	0.51	-0.14	0.20	0.47	-0.16	0.19	0.41
Interaction - BRR and BD 1st diff. previous period	-2.59	2.03	0.20	0.02	1.99	0.99	4.10	2.37	0.08	3.74	2.31	0.11	3.05	2.16	0.16
Interaction - BRR and BD two periods ago	1.17	0.63	0.06	1.12	0.67	0.09	1.96	0.80	0.01	1.99	0.80	0.01	2.04	0.76	0.01
Interaction - CO and UDNET 1st diff. previous period	-4.16	2.15	0.05	-4.61	2.03	0.02	-2.88	2.44	0.24	-2.91	2.42	0.23	-2.03	2.28	0.37
Interaction - CO and UDNET two periods ago	-0.77	0.46	0.10	-0.67	0.44	0.13	-1.07	0.53	0.04	-1.09	0.52	0.04	-0.90	0.48	0.06
Interaction - CO and TAX 1st diff. previous period	-8.02	2.48	0.00	-7.73	2.35	0.00	-11.99	2.81	0.00	-11.71	2.80	0.00	-8.43	2.67	0.00
Interaction - CO and TAX two periods ago	-0.18	0.81	0.82	-0.84	0.78	0.29	-1.03	0.94	0.27	-0.82	0.93	0.38	-0.26	0.87	0.77
Union density (UDNET), 1st diff. previous period	0.43	2.02	0.83	-0.91	1.95	0.64	-1.21	2.35	0.61	-0.67	2.30	0.77	1.36	2.23	0.54
UDNET, two periods ago	0.26	0.28	0.35	0.02	0.29	0.96	0.42	0.34	0.22	0.53	0.34	0.11	0.34	0.37	0.36
Coordination (CO), 1st diff. previous period	0.12	0.17	0.46	0.19	0.16	0.23	-0.34	0.19	0.07	-0.36	0.19	0.05	-0.32	0.18	0.08
CO, two periods ago	-0.01	0.04	0.79	-0.01	0.04	0.84	-0.07	0.05	0.15	-0.08	0.05	0.10	-0.06	0.04	0.15
Tax level (TAX), 1st diff. previous period	-0.29	1.52	0.85	1.32	1.46	0.36	2.04	1.75	0.24	1.95	1.74	0.26	2.96	1.67	0.08
TAX, two periods ago	0.48	0.53	0.37	0.57	0.53	0.28	1.41	0.64	0.03	1.48	0.63	0.02	1.19	0.68	0.08
Large outlier[b]	0.94	0.05	0.00	0.82	0.04	0.00									
Export market, 1st diff. (ΔXM_t)				-0.39	0.05	0.00	-0.53	0.06	0.00	-0.53	0.06	0.00	-0.21	0.10	0.04
Export market, prev. period (XM_{t-1})				0.12	0.06	0.03	0.17	0.07	0.01	0.17	0.07	0.01	0.13	0.10	0.19
Export market, 1st diff. prev. period (ΔXM_{t-1})				-0.23	0.06	0.00	-0.31	0.07	0.00	-0.30	0.07	0.00	-0.31	0.10	0.00
Demand components:															
Change govt. purchases, 1st diff. (ΔdG_t)				-0.14	0.03	0.00	-0.20	0.04	0.00						
Change govt. purchases, prev. period (dG_{t-1})				-0.21	0.05	0.00	-0.22	0.06	0.00						
Change govt. purchases, 1st diff. prev. period (ΔdG_{t-1})				0.03	0.03	0.31	0.02	0.04	0.60						
Change govt. purchases, (dG_t)										-0.19	0.04	0.00	-0.20	0.04	0.00
Obs = Country*Average groups	837	20	41.9	794	20	39.7	794	20	39.7	801	20	40.0	801	20	40.0
Standard deviation of residuals	0.58			0.54			0.65			0.65			0.60		
χ^2 of all the exogenous variables.[c]	531.93	(0.00)		766.19	(0.00)		286.23	(0.00)		287.57	(0.00)		103.97	(0.00)	
χ^2 of dummy, fiscal policy and exports.[c]				635.76	(0.00)										
χ^2 of policy and exports.[c]				150.38	(0.00)		195.92	(0.00)		195.35	(0.00)		52.92	(0.00)	
1st order autocorrelation[c]	0.37	(0.71)		0.29	(0.77)		0.83	(0.41)		0.65	(0.52)		1.20	(0.23)	
2nd order autocorrelation[c]	-1.71	(0.09)		-2.00	(0.04)		0.28	(0.78)		0.15	(0.88)		0.79	(0.43)	

Estimation method: Fixed effect coeffcients estimate, standard errors from GLS (xtgls without options) is used in all the regressions.

a) With time dummies.

b) Break by large outlier approach.

c) Numbers in parenthesis are p-values for the relevant null.

Figure B1: Estimated residuals of model 1 in table 1

References

Alesina, A. F. and S. Ardagna (2009, October). Large Changes in Fiscal Policy: Taxes Versus Spending. Technical Report 15438, National Bureau of Economic Research.

Ardagna, S. (2007). Fiscal policy in unionized labor markets. *Journal of Economic Dynamics and Control 31*, 1498–1534.

Armingeon, K., S. Engler, P. Potolidis, M. Gerber, and P. Leimgruber (2010). Codebook: Coparative political data set I 1960-2008.

Auerbach, A., W. Gale, and B. Harris (2010). Activist fiscal policy. *Journal of Economic Perspectives 24*(4), 141–164.

Auerbach, A. J. and Y. Gorodnichenko (2010, August). Measuring the output responses to fiscal policy. Technical Report 16311, National Bureau of Economic Research.

Backus, D. K. and P. J. Kehoe (1992, September). International Evidence of the Historical Properties of Business Cycles. *American Economic Review 82*(4), 864–88.

Baxter, M. and R. G. King (1999). Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series. *The Review of Economics and Statistics 81*(4), 575–593.

Beetsma, R. and M. Giuliodori (2010). Discretionary Fiscal Policy: Review and Estimates for the EU. *Economic Journal 121*(1), F4–F32.

Benetrix, A. and P. Lane (2010). Fiscal shocks and the sectoral composition of output. *Open Economies Review 21*(3), 335–350.

Bertola, G. (2010). Fiscal Policy and Labor Markets at Times of Public Debt. *Nordic Economic Policy Review 1*, 111–148+.

Blanchard, O. and R. Perotti (2002, November). An Empirical Characterization Of The Dynamic Effects Of Changes In Government Spending And Taxes On Output. *The Quarterly Journal of Economics 117*(4), 1329–1368.

Brückner, M. and E. Pappa (2010, March). Fiscal expansions affect unemployment, but they may increase it. Technical Report 7766, C.E.P.R. Discussion Papers.

Caballero, R. (2010). Macroeconomics after the crisis: Time to deal with the pretense-of-knowledge syndrome. *Journal of Economic Perspectives Forthcoming*.

Chari, V. V., P. J. Kehoe, and E. R. McGrattan (2009, January). New Keynesian Models: Not Yet Useful for Policy Analysis. *American Economic Journal: Macroeconomics 1*(1), 242–66.

Coenen, G., C. Erceg, C. Freedman, D. Furceri, M. Kumhof, R. Lalonde, D. Laxton, J. Lindé, A. Mourougane, D. Muir, S. Mursula, C. D. Resende, J. Roberts, W. Roeger, S. Snudden, M. Trabandt, and J. Veld (2010). Effect of Fiscal Stimulus in Structural Models. Technical report.

Correia, I. H., J. L. Neves, and S. Rebelo (1992, April). Business cycles from 1850 to 1950 : New facts about old data. *European Economic Review 36*(2-3), 459–467.

Duell, N., S. Singh, and P. Tergeist (2009, February). Activation policies in norway. Technical report, http://www.olis.oecd.org/olis/2009doc.nsf/linkto/delsa-elsa-wd-sem(2009)4.

Eichenbaum, M. and J. D. M. Fisher (2005, February). Fiscal Policy in the Aftermath of 9/11. *Journal of Money, Credit and Banking 37*(1), 1–22.

Fatás, A. and I. Mihov (2001, April). The Effects of Fiscal Policy on Consumption and Employment: Theory and Evidence. CEPR Discussion Papers 2760, C.E.P.R. Discussion Papers.

Furlanetto, F. (2011). Fiscal stimulus and the role of wage rigidity. *Journal of Economic Dynamics and Control 35*, 512–527.

Giavazzi, F. and M. Pagano (1990, May). Can Severe Fiscal Contractions be Expansionary? Tales of Two Small European Countries. NBER Working Papers 3372, National Bureau of Economic Research, Inc.

Gomes, P. (2010). Fiscal policy and the labour market: The effects of public sector employment and wages. Technical report, IZA Discussion Paper No 5321.

Hall, R. E. (2009, November). By How Much Does GDP Rise if the Government Buys More Output? Technical Report 15496, National Bureau of Economic Research.

Hodrick, R. J. and E. C. Prescott (1997, February). Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking 29*(1), 1–16.

Holmlund, B. and J. Linden (1993, July). Job matching, temporary public employment, and equilibrium unemployment. *Journal of Public Economics 51*(3), 329–343.

Ilzetzki, E., E. G. Mendoza, and C. A. Végh (2010, October). How Big (Small?) are Fiscal Multipliers? NBER Working Papers 16479, National Bureau of Economic Research, Inc.

IMF (2010, October). Will it hurt? Macroeconomic effects of fiscal consolidation. *World Economic Outlook*.

Judson, R. A. and A. L. Owen (1999). Estimating dynamic panel data models: a guide for macroeconomists. *Economics Letters 65*(1).

Layard, R., S. Nickell, and R. Jackman (1991). *Unemployment*. Oxford: Oxford University Press.

Layard, R., S. Nickell, and R. Jackman (2005). *Unemployment* (2 ed.). Oxford: Oxford University Press. First published 1991.

Linnemann, L. (2009). Macroeconomic effects of shocks to public employment. *Journal of Macroeconomics 31*, 252–267.

Monacelli, T., R. Perotti, and A. Trigari (2010, April). Unemployment Fiscal Multipliers. Technical Report 15931, National Bureau of Economic Research.

Nakamura, E. and J. Steinsson (2011). Fiscal stimulus in a monetary union: Evidence from U.S. regions. Technical report, Columbia University.

Nickell, S., L. Nunziata, and W. Ochel (2005). Unemployment in the OECD Since the 1960s. What Do We Know? *Economic Journal 115*(500), 1–27.

Nymoen, R. and V. Sparrman (2010). The role of institutions in unemployment dynamics and equilibrium.

OECD (2002). Economic Outlook No. 71. *Economic Outlook: Annual Projections for the OECD Countries (database)*.

OECD (2008a). Economic Outlook No. 84. *Economic Outlook: Annual Projections for the OECD Countries (database)*.

OECD (2008b). OECD Economic Outlook No. 83. *OECD Economic Outlook: Annual Projections for the OECD Countries (database)*.

OECD (2010). SITC Revision 2 (Standard International Trade Classification Revision 2, 1976) - data from 1961 onwards.

Pappa, E. (2009). The effects of fiscal shocks on employment and the real wage. *International Economic Review 50*(1), 217–244.

Perotti, R. (2007, June). In Search of the Transmission Mechanism of Fiscal Policy. Technical Report 13143, National Bureau of Economic Research.

Ramey, V. A. and M. D. Shapiro (1999, April). Costly Capital Reallocation and the Effects of Government Spending. Technical Report 6283, National Bureau of Economic Research, Inc.

Roodman, D. (2009). A Note on the Theme of Too Many Instruments. *Oxford Bulletin of Economics and Statistics 71*(1), 135–158.

Shi, M. and J. Svensson (2006, September). Political budget cycles: Do they differ across countries and why? *Journal of Public Economics 90*(8-9), 1367–1389.

The Conference Board (2010). The Conference Board Total Economy Database, January 2010. Technical report.

Tornell, A. and P. R. Lane (1999, March). The Voracity Effect. *American Economic Review 89*(1), 22–46.