Do government purchases affect unemployment?*

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May 30, 2016

Abstract

We estimate the effect of government purchases on unemployment in 20 OECD countries, for the period 1980-2007. An increase in government purchases equal to one percent of GDP is found to reduce unemployment by about 0.3 percentage points in the same year. The effect is greater and more persistent under less "employment-friendly" labour market institutions, and greater and more persistent under a fixed exchange rate regime than under a floating regime. The effect is also greater in downturns than in booms. The effect on unemployment reflects a corresponding positive effect of increased government purchases on the employment to population rate.

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

I 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 have led to substantial fiscal tightening in many countries. At the same time, unemployment has soared in many OECD countries. The large changes in fiscal policy and unemployment rates raise the question of how fiscal policy affects unemployment. This paper explores an important part of fiscal policy: the effect of a change in government purchases of goods and services on aggregate unemployment.

The effect of fiscal policy on the economy has been subject to considerable interest in recent years, cf. surveys in Auerbach et al. (2010), Beetsma and Giuliodori (2010), and Ramey (2011). 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 smaller. This distinction is important because the effect on unemployment may differ from the effect on GDP. Fiscal actions can lead to an increase in the labour supply and increased unemployment

*We are grateful to Roel Beetsma, Erik Biørn, Ådne Cappelen, Francesco Furlanetto, Nils Gottfries, Tarjei Havnes, Ragnar Nymoen, Hashem Pesaran, Asbjørn Rødseth, Thomas Von Brasch, Fredrik Wulfsberg and two anonymous referees, as well as numerous seminar participants, for very useful comments. The paper is part of the research activities at Statistics Norway and ESOP at the University of Oslo. ESOP and Statistics Norway are supported by the Research Council of Norway.

even if output grows. Alternatively, if cuts in government purchases induce higher private sector output, and productivity is higher in the private sector, GDP may grow even if unemployment increases. This ambiguity is reflected in recent research: While Monacelli et al. (2010), IMF (2010), Auerbach and Gorodnichenko (2012b) and Ramey (2012) conclude that an increase in government purchases leads to lower unemployment, Brückner and Pappa (2012) find that increased government purchases lead to higher unemployment due to increased labour force participation.

Our study differs from most of the previous studies along several dimensions. First, since our interest is in the effect on unemployment, we draw upon a large literature, associated with, among others, Layard et al. (1991), Blanchard and Wolfers (2000) and Nickell et al. (2005), which has documented the importance of labour market institutions to the evolution of the rate of unemployment. Our analysis builds on this literature, as we add the change in government purchases to a regression framework designed to explore the effect of institutional and other determinants of unemployment. This also allows us to explore whether the effect of fiscal policy depends on labour market institutions. Furlanetto (2011) explores theoretically the link between fiscal stimulus and wage rigidity, and shows that, if labour markets are segmented, wage stickiness is essential to obtain expansionary effects of fiscal actions.

Second, we use an extensive panel data set for 20 OECD countries for the period 1980-2007, which makes it possible to explore whether the effect of fiscal policy depends on a host of other factors, such as the cyclical situation 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. Eggertson and Woodford (2003), Coenen et al. (2012) and Hall (2009)); we explore this idea by considering how the effect differs across monetary regimes.

An important methodological problem is that fiscal policy is likely to be endogenous, as it may depend on the state of the economy. Restricting attention to government purchases mitigates this problem, because, unlike taxes and transfers, there are no automatic links between the state of the economy and government purchases. We handle possible endogeneity by using instrumental variables, and by controlling for possible additional variables that may affect both fiscal policy and unemployment.

We find that an increase in government purchases equal to one per cent of GDP leads to a first-year reduction in the rate of unemployment of about 0.3 percentage points, with a somewhat larger effect when we use an IV estimator. The effect increases somewhat in year 2, and then decreases gradually, vanishing after 8 years. The size of the effect is highly dependent on other factors in the economy. We find a greater effect on unemployment in countries with labour market institutions that are less conducive to employment. Consistent with the recent research mentioned above, we find a strong effect of fiscal policy on unemployment in countries with a fixed exchange rate, and a weaker effect under a floating exchange rate. There is also evidence suggesting that the change in unemployment due to a rise in government purchases is greater when the economy is in a downturn, which is consistent with recent findings by Auerbach and Gorodnichenko (2012a,b) and Nakamura and Steinsson (2014). We find a positive effect of increased government purchases on the employment to population rate, which corresponds to the negative effect on unemployment.

The rest of the paper is organised as follows. In section II, we present our empirical approach, the data are presented in section III, while the empirical results are laid out in sections IV - VIII. Section IX concludes. A web appendix contains further descriptions of the data, the underlying theoretical model and additional results.

II Empirical model and estimation methods

We consider the effect of a change in government purchases on unemployment and employment, building on a panel data estimation framework derived by Nymoen and Sparrman (2014). Nymoen and Sparrman (2014) consider a dynamic model with wage and price setting, and derive a final equation for equilibrium unemployment as a function of labour market institutions and unmodelled shocks (a simplified version of Nymoen and Sparrman (2014) is provided in the web appendix). We replace the shocks by a fiscal variable and an indicator for the export market.

This approach has several advantages. First, extensive literature has shown that aggregate unemployment is to a large extent determined by labour market institutions, see e.g. Layard et al. (1991) and Nickell et al. (2005). Thus, it seems appropriate to control for labour market institutions and to also investigate whether the effect of fiscal policy depends on these institutions. Second, with a data set covering 20 countries and 27 years, there is large variation in a number of other key variables, making it possible to explore how the effect of fiscal policy may vary depending on, for instance, the monetary regime, the cyclical state of the economy or the size of the public debt.

In our main estimations, we estimate an equation of the following form.

$$\begin{aligned} u_{it} =& \beta_{0i} + \beta_1 u_{it-1} + \beta_2 u_{it-2} + \boldsymbol{\beta_3} \Delta \mathcal{I}_{it-1} + \beta_4 \mathcal{I}_{it-2} \\ &+ \beta_5 g_{it} + \beta_6 \Delta XM_{it} + \epsilon_{it}, \end{aligned} \tag{1}$$

where u_{it} is the unemployment rate in country i in period t, Δ is the first-difference operator and $\mathcal{I}_{it-1}$ is a vector of institutional labour market variables to be explained below. XM_{it} is the export market indicator, which captures the cyclical state of the economy of the trading partners, including country-specific effects of shocks to the world business cycle. g_{it} is the real percentage change in government purchases multiplied by the ratio of government purchases to trend GDP (see web appendix A.1 for details and calculations), which, for the sake of simplicity, we will refer to as the change in government purchases. We use annual data to better capture the actual fiscal decisions, since the fiscal impulses are likely to follow the annual budgets. Using annual data may also mitigate possible anticipation effects; see the discussion in Beetsma and Giuliodori (2010).

Our specification of the fiscal variable differs from most previous studies, where it is usually the percentage change in the fiscal variable itself that is considered. The motivation for our choice lies in the large variation in the size of the public sector in our sample. Clearly, if government purchases increase by 5 per cent, the effect on unemployment must depend on whether public purchases constitute 16 per cent of GDP, as in Spain in 1980, or 33 per cent of GDP, as in Sweden in 1982. Thus, it seems reasonable to scale the real change in government purchases to government purchases as a share of trend GDP. An alternative would be to consider the change in government purchases as a share of GDP, as has been done in some studies (e.g. Alesina and Ardagna (2009) and Duell et al. (2009)). However, this specification is also sensitive to changes in the denominator, implying that a reduction in GDP caused by a negative external shock may increase the ratio of government purchases to GDP, even if government purchases are 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, 10-year moving average of real GDP to calculate trend GDP.

The dynamic structure follows from the theoretical labour market framework of Nymoen and Sparrman (2014). The theoretical motivation is that the institutional variables in year t-2 affect wage and price setting in year t-1, which then influence unemployment in year t (see further discussion in the web appendix).

The specification in equation (1), with the level of unemployment explained by the change in government purchases, reflects how we would expect these two variables to behave in growing economies: Government purchases increase over time, while unemployment and the change in government purchases are essentially stationary variables. This presumption is consistent with results from stationarity tests. In Table 1, column 1, we report results from Dickey-Fuller tests for a unit root in the level of government purchases, considering both homogeneous and heterogeneous autoregressive parameters across countries, and with several different specifications concerning lags and subtraction of cross-sectional means prior to undertaking the tests, see Mátyás and Sevestre (2008). Non-stationarity is not rejected in any of the tests. Corresponding tests reject non-stationarity of the level of unemployment and the change in government purchases (except for the homogeneous alternative with three lags), indicating that these variables are stationary, cf. Table 1, columns 2 and 3.[1]

Table 1: Unit root test for government purchases (G), the change in government purchases (g) and the rate of unemployment (u)

	$(G_{it} - \overline{G}_{.t})^a$		$(g_{it} - \overline{g}_{.t})^b$		$(u_{it} - \overline{u}_{.t})^c$	
	Homogeneous	Heterogenous	Homogeneous	Heterogenous	Homogeneous	Heterogenous
	$H1_a$	$H1_b$	$H1_a$	$H1_b$	$H1_a$	$H1_b$
lag 1^d	8.86 (1.00)	9.54 (1.00)	-6.54 (0.00)	-7.69 (0.00)	-4.19 (0.00)	-3.29 (0.00)
lag 2^d	9.69 (1.00)	8.85 (1.00)	-2.22 (0.01)	-4.62 (0.00)	-2.43 (0.00)	-2.20 (0.01)
lag 3^d	5.71 (1.00)	3.66 (1.00)	-0.25 (0.40)	-3.09 (0.00)	-3.37 (0.00)	-2.12 (0.01)
Obs	560	560	560	560	560	560

The variables for Germany are prolonged with data for West-Germany before the unification in 1991 to achieve a balanced panel.

a) Govt. purchases (G_{it}) with cross-sectional means ($\overline{G}_{.t}$) subtracted. Trend and country specific constant terms are included in all the tests.

b) Change in govt. purchases (g_{it}) with cross-sectional means ($\overline{g}_{.t}$) subtracted.

c) Unemployment (u_{it}) with cross-sectional means ($\overline{u}_{.t}$) subtracted.

d) Numbers in parentheses are p-values for the relevant null.

Following Nickell et al. (2005) and Nymoen and Sparrman (2014), we use the robust within-group estimator (WG), which allows for heteroscedasticity and autocorrelation, see Stock and Watson (2008). Allowing for heteroscedasticity and autocorrelation seems reasonable in an equation like (1), where the effects of other variables, e.g. the real interest rate, have been subsumed in the disturbances, which is therefore generally a second order moving average process; see web appendix A.2 for further details. The robust WG estimator will lead to consistent and efficient estimates of explanatory variables when the errors are heteroscedastic and autocorrelated, see (Wooldridge, 2002, Chapter 10).

The WG estimator allows for permanent country-specific differences in unemployment that are not accounted for by the other explanatory variables. A random effect model would require there to be no correlation between the country-specific-effects and the explanatory variables in the model. However, this assumption is rejected in a Hausman test with a p-value of 1 per cent.

[1] For the growth in government purchases, the test of unit root with lag 3 is not significant. However, as the third lag of the growth in government purchases is not significant, this test is less important.

Since equation 1 also includes lagged levels of unemployment, the robust WG estimator is biased, see Nickell (1981). However, with a long time dimension of 27 years, this bias is small, cf. Judson and Owen (1999). Moreover, other estimation methods that avoid the sample bias also have their difficulties, cf. Roodman (2009).

Importantly, the robust WG estimator requires that all explanatory variables are strictly exogenous, conditional on the unobserved country-specific effect. A key problem is that fiscal policy is likely to be endogenous, as it may depend on the state of the economy. In the literature, this is typically handled by either focussing on the effect of specific events that can be thought to be exogenous, such as changes in military spending in response to political changes (e.g. Ramey and Shapiro (1998)), or by using 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), Beetsma and Giuliodori (2010) and Monacelli et al. (2010). While these methods have clear advantages, they also have important weaknesses. Monacelli et al. (2010) emphasise that changes in military spending are often undertaken in periods that also differ for other reasons, which may affect the results. Auerbach et al. (2010) point out that an SVAR can only measure the multiplier of policies that deviate from the standard policy response to economic conditions within the sample period. In addition, it can be questioned to what extent the policy response identified in an SVAR over a period of 20 or 30 years corresponds to the fiscal policy response as perceived by agents in real time. Changes in the policy response, and uncertainty about it, will lead to noise, possibly systematic, and may contaminate the results.

We consider the effect of the change in government purchases, not taking into account whether the change is part of a systematic policy rule. This approach is more transparent, as it considers the effect of all real changes in government purchases. As a robustness check, we also present a specification where we include the unexpected change in the fiscal policy, defined as the prediction error of a simple estimated policy rule.

Our focus on government purchases mitigates the endogeneity problem considerably, as this choice excludes budget items that are determined by rules, such as tax revenues and expenditures on transfers. This also excludes all "passive" unemployment expenditure such as unemployment benefits, and the large majority of active unemployment-related expenditure, which is classified as transfers, not government purchases. In contrast, changes in government purchases typically do not follow automatically from changes in the economy. Clearly, the state of the economy also affects purchase decisions, but other factors also come into play, such as 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 implementation, implying that there is no clear cut or simple relationship between the state of the economy and government purchases.

Even though we believe that the endogeneity problem is less important for purchases than for taxes or transfers, we nevertheless undertake two different analyses to handle it. First, we use instrumental variable estimation, where we treat fiscal policy as endogenous. The instruments are the past values of the change in government purchases and past values of government debt. As an additional instrument, we also use the data for fiscal consolidation episodes developed by Devries et al. (2011). These instruments are motivated below.

Second, we control for possible additional variables that may affect both fiscal policy and unemployment, which may imply that the error term will be correlated with fiscal policy. By including such variables, the potential bias will be reduced or removed, cf. the

discussion below. Furthermore, since we include export markets, labour market institutions and the monetary regime, we include variables that would be omitted in most other analyses of the effect of government purchases on unemployment.

III Data

The model is estimated based on annual data from OECD Economic Outlook (2008B) for 20 OECD countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, the United Kingdom and United States. The sample data are from 1980 to 2007, except for Germany, where the data start in 1991. See the web appendix A.1 for detailed documentation of all variables. The main variables are:

The unemployment rate is the standardised unemployment rate.

The change in government purchases, g_{it}, is the real percentage change in government purchases, multiplied by the ratio of government purchases to trend GDP, see web appendix A.1. Government purchases are the sum of government consumption and investment, which includes expenditure on public employment, but does not include transfers and subsidies. The growth in government purchases has generally been positive in real terms in the sample period, with unweighted decade averages from 0.52 to 0.56. There is considerable variation within and across countries, however; see web appendix, Table A1.2.

Labour market institutions are measured by indicators constructed by the OECD for employment protection (EPL), the benefit replacement ratio (BRR), benefit duration (BD), union density $(UDNET)$, the tax wedge (TW) and the degree of coordination in wage setting (CO). We also include several interaction terms between three pairs of institutional variables: benefit duration and the benefit replacement ratio; coordination in wage setting and union density; and coordination and the tax wedge, measured as the deviations from country-specific means. See the further description in Sparrman (2011).

Monetary regime is a dummy for the monetary regime over the sample period. We use three dummies, for a floating exchange rate, a fixed exchange rate, and membership in the European Monetary Union (EMU). The dummy for a floating exchange rate is used for Australia, Canada, Japan, New Zealand, Switzerland, the United States and United Kingdom (except for 1990 and 1991, associated with the brief period of UK membership of the ERM). Germany is also defined as having a floating regime until 1999, in light of Germany's dominant position in the European Exchange Rate Mechanism ERM, and the independent status of the Bundesbank. In addition, Sweden adopted a floating exchange rate in 1992, and Norway in 1999 (the year with de facto change of regime). The dummy for EMU membership covers Austria, Belgium, Finland, France, Germany, Ireland, Italy, Portugal and Spain since 1999. The dummy for a fixed exchange rate is used for the remainder of the sample.

The export market 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 a Hodrick Prescott-trend, divided by the trend, and where the weights reflect the share of the exports from country i that goes to each of its trading partners j.

Fiscal consolidation episodes are two series of spending reductions and tax increases, identified as fiscal actions that are not undertaken for stabilisation purposes, but are solely motivated by a desire to reduce the budget deficit or cut public debt. The series are constructed by investigating the relevant policy documents, including budgets and central

bank reports, see Devries et al. (2011). The data cover 17 OECD countries during the period 1978-2009 (New Zealand, Norway and Switzerland are not included).

Gross Public Debt is measured at the end of the year, and taken from Armingeon et al. (2010). The original data source is several versions of OECD Economic Outlook.

IV Basic results

In this section, we present the basic results. To shed light on the fundamental relationships, we start out with a simplified version of equation 1, and gradually add the relevant variables. Table 2, model 1, shows the result of regressing unemployment on lagged unemployment and the change in government purchases. Both variables are highly significant. The point estimate of government purchases is almost 0.5, and the coefficient of lagged unemployment about 0.9.

In model 2, we add an additional lag of unemployment, which is also highly significant, yielding a significant reduction in the standard deviation of the residuals. The point estimate of government purchases is reduced to 0.34, implying that an increase in government purchases equal to one per cent of trend GDP reduces unemployment by 0.34 percentage points at impact.

In model 3, we add the first difference of the export market indicator, which has a highly significant negative coefficient. Thus, growth in the export market leads to a sizeable reduction in unemployment. However, the coefficient of government purchases is not affected, suggesting that there is no systematic link between changes in the export market and government purchases. Note that we have also tried richer dynamic specifications for the change in government purchases as well as for the export market indicator, cf. web appendix A.2, Table A2.1, but these could easily be reduced to the chosen specification.

In model 4, we also add a number of labour market institutions, following the specifications of Nymoen and Sparrman (2014), but, again, the coefficient of government purchases is hardly affected. For brevity sake, and because the effects of the individual labour market institutions follow the results of Nymoen and Sparrman (2014), the complete results of model 4 are relegated to the web appendix, cf. model 1 in Table A2.1. Figures A2.1 and A2.2 in the web appendix show the estimated residuals. They show little indication of autocorrelation, even though there is some variation across countries.

The theoretical literature suggests that the effect of fiscal changes will depend on whether the changes are viewed as permanent or transitory. Permanent changes usually have a smaller effect, because they involve a larger increase in expected future taxes, which dampens private consumption. As will become apparent below, the effect we find is mainly from higher public employment, which is typically fairly permanent in most countries. However, whether the agents in the economy really viewed the changes as permanent, or whether they believed that the changes would be reversed, is difficult to disentangle from the data.

Based on theory, the effect of changes in fiscal policy might also depend on whether the policy is expected. Typically, the effect is stronger when policy changes are unexpected, cf. Ramey (2011). To explore this distinction, we postulate a simple policy rule, whereby the change in government purchases depends on the lagged change in government purchases, as well as the lagged growth rate of GDP (Δy) and the lagged debt to GDP ratio ($\frac{D}{Y}$); see web appendix A.3. We then define unexpected changes in government purchases as the prediction errors from the policy rule, see web appendix A.3. In Table 2, column 5, we include both the actual and the unexpected change in government

Table 2: Estimation of equation (1) - Within group

	Model 1	Model 2	Model 3	Model 4	Model 5
Unemployment previous period (u_{it-1})	0.89***	1.37***	1.36***	1.31***	1.29***
	(0.01)	(0.04)	(0.04)	(0.06)	(0.06)
Unemployment two years ago (u_{it-2})		-0.52***	-0.51***	-0.48***	-0.47***
		(0.05)	(0.05)	(0.06)	(0.07)
Change govt. purchases (g_{it})	-0.47***	-0.34***	-0.35***	-0.32***	-0.49**
	(0.11)	(0.08)	(0.08)	(0.08)	(0.21)
Export market, 1st diff. (ΔXM_{it})			-0.50***	-0.46***	-0.46***
			(0.14)	(0.14)	(0.14)
Unexpected changes in govt. purchases					0.21
					(0.23)
Time dummies	Yes	Yes	Yes	Yes	Yes
Lab. market inst.	No	No	No	Yes	Yes
Obs = Country*Average groups	502	502	502	502	450
Standard deviation of residuals	0.76	0.64	0.62	0.62	0.59

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: The rate of unemployment. Estimation method: Within country estimate with heteroscedastic and within country autocorrelated robust standard errors, see Stock and Watson (2008).

purchases. The coefficient of unexpected changes in government purchases is positive and statistically insignificant, providing no support for the idea that unexpected changes in government purchases have a stronger effect on unemployment than expected changes. We will therefore not pursue this distinction further.

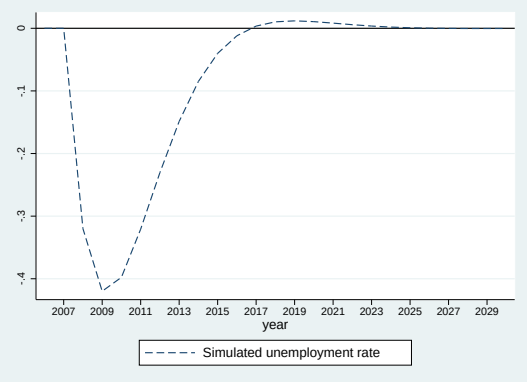

Figure 1: The effect of a permanent increase in government purchases equal to one per cent of GDP, from 2008, based on simulation of equation (1) with estimated coefficients from the WG model 4 in Table 2

Figure 1 shows the dynamic effect on unemployment of a permanent increase in government purchases equal to one per cent of trend GDP. The maximum impact of about -0.4 percentage points is reached in the second year, after which the effect gradually weakens to become almost negligible after 8 years. This result is comparable to other results in the literature. IMF (2010) studies fiscal consolidations in 15 OECD countries over the last 30 years, and finds that spending-based deficit cuts equal to one per cent of GDP raise the unemployment rate by about 0.2 percentage points. Using US data, Monacelli et al. (2010) find that an increase in government spending equal to one per cent of GDP

leads to a fall of 0.6 percentage points in the rate of unemployment after ten quarters. The DSGE model of Cantore et al. (2014) predicts a fall in the unemployment rate of 0.35 percentage points following a government spending expansion of 1 per cent of GDP. In contrast, Brückner and Pappa (2012) find, in an analysis of 10 OECD countries using structural VARs, that a typical estimate from the impulse responses implies that a 10 per cent increase in government expenditure increases the unemployment rate at peak (which varies from $3-16$ quarters) by around $0.2-0.5$ per cent.

Using Okun's law, which says that an increase in unemployment of one percentage point is associated with a two per cent reduction in GDP, our estimate of a maximum impact of -0.4 corresponds to a GDP multiplier of 0.8. This is within the range of the GDP-multiplier of 0.7 to 1.0 suggested by Hall (2009).

Endogeneity and financing

As noted above, the estimated coefficient of the change in 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, implying that g_{it} is correlated with the error term in equation (1). We deal with this problem in two ways: by using instrumental variables, and by controlling for possible additional variables that might be correlated with both unemployment and the change in government purchases.

Valid instruments must be correlated with the change in government purchases and uncorrelated with the error term. We use the lagged first difference of the change in government purchases, as well as the lagged ratio of public debt to GDP. As shown in Table 3, model 1, there is a fairly strong and significant correlation between the change in government purchases and the instrumental variables. The F-test statistic for additional instruments is equal to 18.50, with a p-value of 0.00.

If the instruments are correlated with the error term, the IV estimates will be biased. This could happen if, for example, decisions on government purchases in year t are affected by expectations of the rate of unemployment in year t+1, and the error term is correlated with these expectations. Or the second instrument, the debt to GDP ratio, may affect unemployment through other channels, such as the effect on expected future taxes.

We therefore also try a third instrument, which is the fiscal consolidation episodes developed by Devries et al. (2011) and used by Guajardo et al. (2014). As shown in Table 3, model 2, the fiscal consolidation episodes are highly significant in the first stage regression, and the F-test statistic for additional instruments is equal to 15.58, with a p-value of 0.00. For our purposes, this variable has the limitation that it only includes the consolidation episodes, implying that it is zero in years where government purchases are increased. Furthermore, the validity of this variable as an instrument hinges on the assumption that the consolidation episodes are solely motivated by budget concerns, and are not affected by the cyclical situation of the economy.[2]

Model 1 in Table 4 shows the results of the instrumental variable estimation with the first difference of the lagged change in government spending and lagged debt as instruments. The effect is significant at the 1 per cent level, and the point estimate says that an increase in government purchases equal to one per cent of GDP reduces unemployment by 0.49 percentage points, i.e. somewhat higher than the WG estimate. This may indicate that the WG estimate is biased towards zero, but the difference is not significant. The

[2]We have also tried using election year as an instrument, but it did not affect the result. Furthermore, election year is potentially endogenous in countries where the government can choose the time of elections.

Table 3: First stage estimation

	Model 1	Model 2
Unemployment previous period (u_{it-1})	-0.11***	-0.08**
	(0.04)	(0.04)
Unemployment two years ago (u_{it-2})	0.10**	0.10**
	(0.04)	(0.04)
Export market, 1st diff. (ΔXM_{it})	-0.13	-0.16
	(0.12)	(0.14)
Instruments:		
Change govt. purchases, 1st diff. prev. period (Δg_{it-1})	0.13**	
	(0.06)	
Debt previous period	-0.01***	-0.01***
	(0.00)	(0.00)
Fiscal consolidations[a]		-0.26***
		(0.07)
Time dummies	Yes	Yes
Lab. market inst.	Yes	Yes
Observations	455	402

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

First stage IV-regression of dependent variable: Change in govt. spending.

F-test of excluded instruments: $F_{Mod1}(2) = 18.50(0.000)$ and $F_{Mod2}(3) = 15.58(0.000)$

a) Fiscal consolidations is Devries et al's series on spending reductions

Hausman test statistic is equal to 5.88 which does not refute that the residuals are uncorrelated with the error term. The Hansen J overidentification test has a p-value of 0.41, giving no indication of invalid instruments. However, these tests have limited power, and the Hansen J-test assumes that at least one instrument is valid.

In model 2 in Table 4, we use the fiscal consolidation episodes as the instrument instead of the lagged first difference of the change in government purchases. The effect is still significant at the 1 per cent level, and the point estimate is larger in terms of absolute value, -0.78, giving further indication that the WG estimate is biased towards zero. Some of the difference between the point estimates in columns 1 and 2 is due to the different number of observations. The Hansen J overidentification test has a p-value of 0.13, which borders on indicating invalid instruments.

In model 3, we explore the effect of fiscal consolidations rather than the change in government purchases, including both spending reductions and tax increases. Spending cuts have a highly significant impact on unemployment, but the point estimate is somewhat smaller than for the change in government purchases: a spending cut equal to one per cent of GDP increases unemployment by 0.22 percentage points. The effect of a tax-based consolidation is not statistically significant. One should be aware that these results are not fully comparable with the other results in Table 4, as these episodes only cover the changes in government purchases that are part of budget consolidation. The stronger effect of changes in spending rather than taxes is consistent with the findings of Coenen et al. (2012).

In model 4, we include additional variables that may affect both the unemployment rate and government purchases. For example, fiscal policy might be pro-cyclical if higher tax revenues in a boom cause politicians to spend more money; this effect is termed the voracity effect by Tornell and Lane (1999). If, in addition, the increase in tax revenues during the boom is correlated with a fall in unemployment, the change in government

purchases would be correlated with the error term. In this case, including tax revenues as a regressor in the unemployment equation would yield government purchases uncorrelated with the error term, removing the bias in the coefficient. As government purchases are typically decided in the budget process in the autumn of the year prior to the budget year, it would be the expectations that prevail when the budget is decided that might affect the budget. We use predicted tax revenues as a proxy for expected tax revenues, where the prediction is based on a regression with two lags of tax revenues, and two lags of the change in real GDP as well as the output gap, as explanatory variables.[3] Specifically, we include the predicted change in tax revenues as a share of trend GDP in the regression.

Alternatively, fiscal policy might be countercyclical if the government attempts to use fiscal policy to stabilise the economy. In this case, one would expect an increase in government purchases during downturns, when GDP growth is low, or when 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 4, model 4.

We observe that the estimated effect of government purchases is marginally smaller when we include the additional explanatory variables in model 4 in Table 4, but it is still statistically significant. 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. In web appendix A.4, we control for the possible endogeneity of government purchases by also including consensus forecasts for GDP growth, unemployment and the output gap. Again, one might conjecture that government purchases would respond to such forecasts, and that the correlation we find between government purchases and unemployment is due to both variables being correlated with the forecasts. However, controlling for forecasts does not affect the negative impact on unemployment, even if the coefficient value is somewhat lower due to a more limited sample.

So far, we have not discussed the financing side of the public budget. Unless Ricardian equivalence holds, the effect of an increase in government purchases depends on whether it is financed by increased taxes or by a larger budget deficit. However, controlling for the actual change in taxes is problematic, as this variable is clearly highly endogenous. Instead, we include the change in the budget balance (net lending) as the explanatory variable, treating it as endogenous, with the change in government purchases as the instrument. The estimated coefficient for the change in government purchases in the first-stage regression provides information about the share of the changes in government purchases that is deficit financed, in the sense that a change in purchases leads to the same change, with the opposite sign, in net lending. This coefficient is -0.77, implying that about three-quarters of the changes in government purchases are debt financed. The last column in Table 4 shows that the estimated coefficient for the change in government net lending is 0.42, but this value is merely a reflection of the coefficients for the change in government purchases in the first-stage regression as well as in the WG regression in Table 2, column 4, namely $0.32/0.77 = 0.42$.

[3]Note that the standard error of predicted taxes might be biased downwards because predicted taxes are a generated regressor, cf. Murphy and Topel (1885).

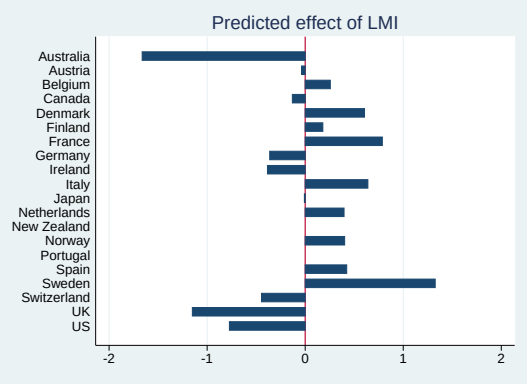

Figure 2: The predicted effect of labour market institutions, based on simulations of equation (1) in 2007 with estimated coefficients from the WG model 4 in Table 2

V Labour market institutions, cyclical situation and monetary regime

We then turn to the effects of 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. More recently, Furlanetto (2011) shows, in a theoretical dynamic stochastic general equilibrium model where a fraction of households have no access to financial markets and the labour market is segmented, that sticky wages are essential to obtain expansionary effects of an increase in government purchases.

First, we consider the effect of controlling for labour market institutions. As shown in Table 2, models 3 and 4, 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. Second, we explore whether the effect of fiscal policy depends on labour market institutions. To this end, we construct a summary index of the predicted effect of the labour market institutions. The index is country-year specific, equal to the product of the estimated coefficients from Table A2.1 in the web appendix, model 1, and the country-year specific values of the institutional variables. We compute the deviation of the index from its sample mean to obtain an index with a zero mean. Figure 2 shows the value of the index for each country in the sample in 2007. In some countries, in particular Australia, the UK and the US, labour market institutions are 'employment-friendly', with an estimated reduction in unemployment of $0.8 - 1.5$ percentage points. In contrast, labour market institutions are less conducive to employment in Sweden, France and Denmark. We then interact the change in government purchases with the index of the predicted effect of labour market institutions.

The results in Table 5, column 1, show that an increase in government purchases has a stronger negative impact on unemployment in country-years with less 'employment-friendly' labour market institutions. The effect is highly statistically significant and numerically rather strong: In Australia, labour market institutions are employment-friendly with a mean index value of -1.5, and the estimated effect on unemployment of an increase in government purchases equal to one per cent of GDP is equal to $-0.39+(-1.5)*(-0.37) = 0.17$. In contrast, in Sweden, institutions are less conducive to employment with a mean index of 1.2, implying that the overall coefficient for an increase in government purchases is $-0.39 + 1.2 * (-0.37) = -0.83$. The stronger impact in countries with

less 'employment-friendly' labour market institutions is in line with Furlanetto (2011) and Auerbach and Gorodnichenko (2012b); the latter find that, as the rigidity in the labour market rises, the output response in recessions increases.

An important question from a policy perspective is whether the effect of government purchases varies over the business cycle. In the second column in Table 5, we extend equation (1) by including the interaction between the output gap as calculated by the OECD and the change in government purchases, the latter measured as the deviation from the country-specific mean, to ensure that the variable has a mean of zero. The interaction term is statistically significant at the 1 per cent level, with a positive sign, implying that an increase in government purchases leads to a larger reduction in unemployment during bad times when the output gap is negative than during good times. In fact, the point estimates indicate that the effect of a change in government purchases is twice as large during a large downturn, with an output gap equal to -3 percentage points, than during a strong boom, with an output gap of 3 percentage points. The numerical value is not large, however. Note that we control for output gap in the equation to avoid any spurious effects due to the fact that both unemployment and the output gap are cyclical variables.

The stronger effect during a downturn is consistent with the findings of Auerbach and Gorodnichenko (2012b), who, using data for a large number of OECD countries, find that, during recessions, an increase in government purchases increases GDP and employment, and reduces unemployment, while there is no significant effect during expansions. Other studies also report similar results: Auerbach and Gorodnichenko (2012a) find a larger fiscal multiplier during recessions than during expansions, using a regime-switching model on US aggregate data; Nakamura and Steinsson (2014) find the same result exploiting differences across US regions, while Batini et al. (2012) and Baum et al. (2012) report consistent evidence for some G7 countries. Using historical data, Owyang et al. (2013) find no evidence that multipliers are higher during periods of high unemployment in the USA, but some such evidence for Canada. For a theoretical motivation for cyclical variation in the effects of fiscal policy, see the discussion of Michaillat (2014) in Section VII below.

In Table 5, model 3, equation 1 is extended to include both the effect of labour market institutions and the output gap, with essentially the same results as when the variables are included separately.

In the final three columns, we explore whether the effect of government purchases depends on the monetary regime, as emphasised in recent literature, e.g. Coenen et al. (2012). We use three dummies to capture the different monetary regimes within the sample period: fixed exchange rate regimes, floating exchange rate regimes (in recent years including inflation targeting), and membership of the European Monetary Union (EMU). Note that we include the interaction with labour market institutions to avoid spurious correlations due to the fact that labour market institutions are generally more rigid in continental Europe.

Model 4 in Table 5 shows that an increase in government purchases leads to lower unemployment across monetary regimes, although with somewhat larger effects for the fixed exchange rate regimes (-0.36 in the EMU and -0.48 in other fixed exchange rate regimes) than in floating exchange rate regimes (-0.25).

In model 5, we treat the change in government purchases as endogenous in the three regimes, using lagged debt level, the first difference of changes in government purchases in the previous period, and changes in government purchases two periods ago as instruments. The coefficient in the EMU is statistically significant and negative, while the other coefficients are fairly small and not statistically significant. However, the low values of

the F-test of additional instruments indicate that the instruments are weak, cf. Table 5.

In model 6, we also add the interaction with the output gap. Now, the change in government purchases is only significant in the two fixed exchange rate regimes, and not under a floating exchange rate.

The difference across monetary regimes is consistent with standard textbook macro models such as the Mundell-Fleming model: Under a flexible exchange rate, an expansionary effect of increased government purchases will typically lead to a rise in the interest rate, partly offsetting the effect on unemployment. In contrast, if the nominal interest rate is unaffected, as it will be with a credible, fixed exchange rate and for a small country in a monetary union, and inflation and inflation expectations increase so that the real interest falls, the government multiplier might be considerably above unity. Ilzetzki et al. (2013) 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.

In the web appendix, we show results for the effect of a number of other variables that may affect the potency of fiscal actions. We find no evidence that the effect of a change in government purchases depends on the level of public debt, as argued by Giavazzi and Pagano (1990). Nor do we find any evidence that the effect depends on the size of the level of development of the financial market, the shadow economy or the degree of corruption (see discussion in Pappa et al. (2015)). However, we find some weak evidence, significant at the ten per cent level, that the effect of a change in government purchases is smaller in more open economies, in line with previous findings by Beetsma and Giuliodori (2010) and Ilzetzki et al. (2013).

VI The effect of labour market institutions and monetary regime on dynamics

In this section, we explore whether the labour market institutions and the monetary regime affect how the effect of government purchases evolves over time. Based on theory, we would expect the effect to be more persistent under rigid labour market institutions, as employment protection legislation and unions may reduce firms' scope for changing employment levels. Likewise, we would expect the effect to be more persistent in fixed exchange rate regimes, where there is no active central bank to stabilise fluctuations in the economy. We interact the index for the predicted effect of the labour market institutions and a dummy for the monetary regime with the lagged unemployment variables. To save degrees of freedom, we constrain the effect to be the same for the EMU and other fixed exchange rate regimes, thus only using a dummy for a floating regime. To facilitate the interpretation of the effects, we re-parameterize the lagged unemployment variables, using the lagged first difference as well as the level for year $t-2$.

Table 6 shows the results. In models 1 and 2, the interaction terms for labour market institutions and monetary regime are added separately, while model 3 shows the results when both interactions are included. The results are consistent across all specifications, with statistically significant interaction terms for both the predicted effect of labour market institutions and for the monetary regime. As expected, the effect on unemployment is more persistent in countries with less 'employment-friendly' labour market institutions and also more persistent in countries with a fixed exchange rate.

Figure 3 shows the effect on the rate of unemployment of a permanent increase in government purchases equal to one per cent of GDP, from 2008, based on a simulation

of equation (1) with estimated coefficients from model 3 in Table 6 for three different levels of labour market institutions: the minimum, the maximum and the average. The left-hand panel shows the effect in a floating regime, and the right-hand panel the effect with a fixed exchange rate. We observe that the effect is much stronger in countries where labour market institutions are less conducive to employment. In countries with the most 'employment-friendly' institutions, the effect is essentially zero. We also see that the effect is larger and more persistent under a fixed exchange rate.

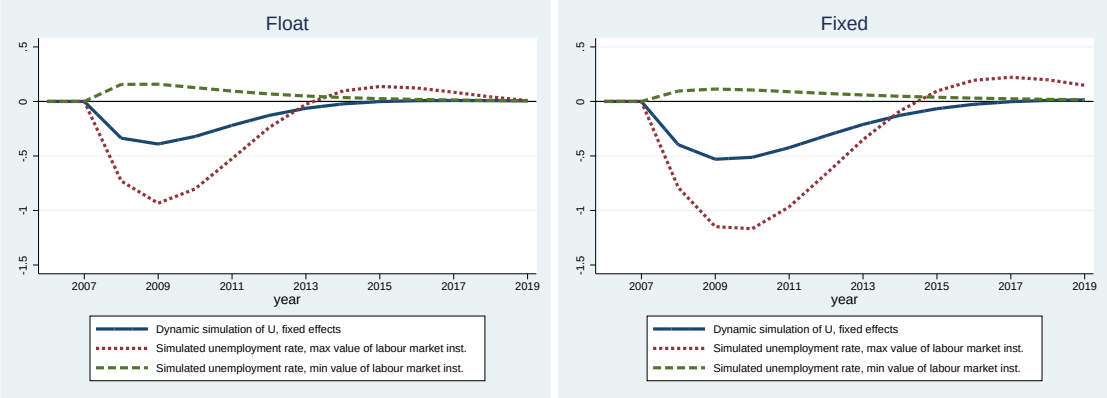

Figure 3: The effect on the rate of unemployment of a permanent increase in government purchases, equal to one per cent of GDP, from 2008, based on a simulation of equation (1) with estimated coefficients from model 3 in Table 6 for three different levels of labour market institutions, for floating exchange rate (left panel) and fixed exchange rate (right panel).

Table 4: Equation (1): IV and within group estimator

	IV[a]	IV[b]	Model 3[c]	Model 4[c]	IV[d]
Change govt. purchases (g_{it})	-0.49***	-0.78***		-0.28***	
	(0.17)	(0.16)		(0.07)	
Unemployment previous period (u_{it-1})	1.30***	1.24***	1.33***	1.15***	1.44***
	(0.05)	(0.06)	(0.07)	(0.08)	(0.08)
Unemployment two years ago (u_{it-2})	-0.48***	-0.43***	-0.49***	-0.33***	-0.66***
	(0.05)	(0.06)	(0.07)	(0.08)	(0.09)
Export market, 1st diff. (ΔXM_{it})	-0.44***	-0.52***	-0.43***	-0.40**	-0.61***
	(0.13)	(0.15)	(0.14)	(0.16)	(0.19)
Fiscal consolidation via spending reduction ($Spend^e_{it}$)			0.21***		
			(0.05)		
Fiscal consolidation via tax increase [e]			0.12		
			(0.08)		
Controls:					
Log GDP 1st diff. prev. period				-21.05***	
				(6.48)	
Outputgap 1st diff. prev. period				0.09	
				(0.08)	
Predicted direct and indirect taxes divided by trend GDP, 1st diff.				-0.06*	
				(0.03)	
Predicted direct and indirect taxes divided by trend GDP, 1st diff. prev. period				0.00	
				(0.02)	
Change govt. net lending, per cent of GDP					0.42***
					(0.12)
Time dummies	Yes	Yes	Yes	Yes	Yes
Lab. market inst (LMI).	Yes	Yes	Yes	Yes	Yes
Obs = Country*Average groups	455.0	402.0	428.0	479.0	488.0
Standard deviation of residuals	0.56	0.59	0.64	0.59	0.93
Hansen J Overidentification test (p-values)	0.69	2.30			
	(0.41)	(0.13)			

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: The rate of unemployment

a) Change govt. purchases (g_{it}) is treated as endogenous. Instruments are: Δg_{it-1} and $debt_{it-1}$.

b) Change govt. purchases (g_{it}) is treated as endogenous. Instruments are: $Spend_{it}$ and $debt_{it-1}$.

c) Estimation method: Within country estimate with heteroscedastic
and within country autocorrelated robust standard errors (Stock and Watson (2008)).

d) Change govt. purchases (g_{it}) is used as an instrument for change in govt. net lending.

e) Fiscal consolidations are the series from Devries et al (2011).

Table 5: The effect of labour market institutions, cyclical situation and monetary regime

	Model 1[a]	Model 2[a]	Model 3[a]	Model 4[a]	IV 5[b]	Model 6[a]
Unemployment previous period (u_{it-1})	1.30***	1.15***	1.15***	1.28***	1.31***	1.12***
	(0.06)	(0.07)	(0.07)	(0.06)	(0.05)	(0.07)
Unemployment two years ago (u_{it-2})	-0.47***	-0.36***	-0.37***	-0.46***	-0.53***	-0.35***
	(0.06)	(0.05)	(0.05)	(0.06)	(0.05)	(0.06)
Export market, 1st diff. (ΔXM_{it})	-0.47***	-0.42***	-0.41***	-0.44***	-0.37***	-0.38***
	(0.14)	(0.13)	(0.13)	(0.14)	(0.12)	(0.12)
Govt. purchases and lab. market inst. (LMI):						
Change govt. purchases, (g_{it})	-0.39***	-0.21***	-0.28***			
	(0.07)	(0.07)	(0.07)			
Interaction g_{it} and the predicted LMI_{it}	-0.37***		-0.30***	-0.29***	-0.46***	-0.23**
	(0.10)		(0.07)	(0.09)	(0.14)	(0.09)
Interaction g_{it} and $\widetilde{Y}_{it}$		0.04***	0.03**			0.03*
		(0.01)	(0.01)			(0.02)
Outputgap from OECD ($\widetilde{Y}_{it}$)		-0.15***	-0.14***			-0.15***
		(0.03)	(0.03)			(0.02)
Govt. purchases and monetary regime:						
g_{it} - EMU				-0.36**	-0.47***	-0.45**
				(0.13)	(0.17)	(0.16)
g_{it} - Fixed				-0.48***	-0.11	-0.29**
				(0.12)	(0.24)	(0.12)
g_{it} - Float				-0.25**	-0.31	-0.12
				(0.10)	(0.21)	(0.11)
Dummy for EMU				-0.15	-0.19	-0.16
				(0.18)	(0.19)	(0.23)
Dummy for Fixed				0.32	0.04	0.08
				(0.21)	(0.26)	(0.25)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Lab. market inst (LMI).	Yes	Yes	Yes	Yes	Yes	Yes
Obs = Country*Average groups	502	502	502	502	440	502
Standard deviation of residuals	0.60	0.57	0.56	0.59	0.51	0.56
Hansen J overidentification test (p-value)					16.61	
					(0.01)	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: The rate of unemployment.

a) Estimation method: Within country estimate with heteroscedastic and within country autocorrelated robust standard errors (Stock and Watson (2008)).

b) Change govt. purchases (g_{it} - EMU), (g_{it} - Fixed) and (g_{it} - Float) are treated as endogenous. Instruments, separately for each regime, are:
(Δg_{it-1}), (g_{it-2}) and ($debt_{it-1}$). F-test of additional instruments from first stage regression results:
EMU(9) = 4.65 (0.000), Fixed(9) = 4.14 (0.000) and Float(9) = 6.30 (0.000)

Table 6: The effect of labour market institutions and inflation targeting regime on dynamics

	Model 1	Model 2	Model 3
Change unemployment, 1st diff. prev. period (Δu_{it-1})	1.28***	1.36***	1.33***
	(0.05)	(0.07)	(0.07)
Unemployment two years ago (u_{it-2})	0.83***	0.84***	0.84***
	(0.02)	(0.02)	(0.02)
Interaction Δu_{it-1} and predicted LMI_{it}	0.13***		0.09**
	(0.02)		(0.03)
Interaction u_{it-2} and predicted LMI_{it}	-0.00		-0.02
	(0.02)		(0.01)
Export market, 1st diff. (ΔXM_{it})	-0.47***	-0.42***	-0.44***
	(0.15)	(0.13)	(0.13)
Change govt. purchases, (g_{it})	-0.39***		
	(0.06)		
Interaction g_{it} and predicted LMI_{it}	-0.32***	-0.33***	-0.30***
	(0.09)	(0.08)	(0.08)
Interaction Δu_{it-1} and float		-0.22***	-0.17**
		(0.07)	(0.07)
Interaction u_{it-2} and float		-0.06	-0.08**
		(0.04)	(0.03)
g_{it} - Fixed		-0.39***	-0.40***
		(0.08)	(0.07)
g_{it} - Float		-0.34***	-0.34***
		(0.10)	(0.10)
Dummy for Fixed		-0.40	-0.49
		(0.35)	(0.32)
Time dummy	Yes	Yes	Yes
Lab. market inst (LMI).	Yes	Yes	Yes
Obs = Country*Average groups	502	502	502
Standard deviation of residuals	0.59	0.59	0.59

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: The rate of unemployment. Estimation method: Within country estimate with heteroscedastic and within country autocorrelated robust standard errors (Stock and Watson (2008)).

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

In this section, we explore whether the effect on unemployment depends on the type of government purchases. In our sample, government wage consumption, which is essentially expenditure on public employment, i.e. employees in the public sector ($dCGW$), constitutes 54 per cent of total government purchases, government non-wage consumption ($dCGNW$) 29 per cent, and government investments (dIG) 17 per cent (unweighted average across countries, from 1960-2007). The variables are in the same form as before, i.e. the change in each of these categories, in real terms, and measured as share of trend-GDP; see web appendix A.1 for a detailed explanation.

Model 1 in Table 7 shows that increased government wage consumption (increased public employment) has a significant negative impact on the unemployment rate, while the estimated effect of government investment is negative but not statistically significant, and the effect of government non-wage consumption is essentially zero.

Ramey (2012) also finds a stronger effect on unemployment of government wage consumption - hiring workers - than of other parts of government purchases, while Ilzetzki et al. (2013) find fairly similar effects on GDP of shocks in government consumption and investment for advanced countries, with GDP multiplier estimates of 0.4 at impact and 0.7 in the long run. Ilzetzki et al. (2013) do not distinguish between wage and non-wage consumption. Bénétrix and Lanea (2013) consider the effect of fiscal policy on the extent of real appreciation, and find a stronger real appreciation of government investment and government wage consumption, than of government non-wage consumption.

The second model in Table 7 presents the result of model 1 using IV; we find that the effect of government investment is much stronger, with a point estimate of -1.02, and highly significant. The larger point estimate under IV may suggest that the WG estimate in column 1 is biased towards zero, which would be the case if public investments tend to increase during downturns. However, the low values of the F-test of additional instruments indicate weak instruments.

In table 7, model 3, we add interaction terms for the predicted effect of labour market institutions. Now, the effect is negative and statistically significant for both investment and wage consumption, with point estimates of -0.44 and -0.48. Here, the interaction terms are also significant, implying as before that the effect is stronger under less 'employment-friendly' labour market institutions.

In model 4, we explore a possible interaction with the output gap, replacing the interaction with labour market institutions. We find a strong positive and statistically significant interaction term for government wage consumption, implying that increased public employment has a stronger dampening effect on unemployment when the output gap is negative, which is consistent with our prior results. The effect is large: with an output gap of minus 3, the coefficient is $-0.45 + (-3) * 0.15 = -0.90$, implying that an increase in government wage consumption equal to one per cent of GDP reduces unemployment by almost one percentage point at impact. This finding is consistent with the predictions from the dynamic stochastic general equilibrium search model of Michaillat (2014). In this model, increased public employment has a much stronger effect on total employment during recessions, because there is much less crowding out of private employment. When unemployment is high, there is no shortage of unemployed workers, implying that higher public employment has little impact on the hiring of private firms.

Table 7: The effect of different types of government purchases

	Model 1[a]	IV 2[b]	Model 3[a]	Model 4[a]
Unemployment previous period (u_{it-1})	1.24***	1.23***	1.22***	1.02***
	(0.08)	(0.07)	(0.07)	(0.08)
Unemployment two years ago (u_{it-2})	-0.44***	-0.47***	-0.44***	-0.27***
	(0.08)	(0.06)	(0.08)	(0.07)
Export market, 1st diff. (ΔXM_{it})	-0.46***	-0.39***	-0.49***	-0.43***
	(0.15)	(0.15)	(0.15)	(0.13)
Govt. purchases:				
Change govt. investments, (gi_{it})	-0.20	-1.02***	-0.44***	-0.09
	(0.13)	(0.37)	(0.12)	(0.12)
Change govt. non-wage consumption, ($cgnw_{it}$)	-0.03	-0.09	-0.02	-0.03
	(0.02)	(0.20)	(0.03)	(0.02)
Change govt. wage consumption, (cgw_{it})	-0.63***	-0.49	-0.48**	-0.45***
	(0.20)	(0.48)	(0.19)	(0.13)
Interaction ($gi_{it} - \overline{gi}_{i.}$) and predicted LMI_{it}			-0.61***	
			(0.10)	
Interaction ($cgnw_{it} - \overline{cgnw}_{i.}$) and predicted LMI_{it}			-0.01	
			(0.13)	
Interaction ($cgw_{it} - \overline{cgw}_{i.}$) and predicted LMI_{it}			-0.57**	
			(0.27)	
Interaction ($gi_{it} - \overline{gi}_{i.}$) and $\widetilde{Y}_{it}$				-0.02
				(0.04)
Interaction ($cgnw_{it} - \overline{cgnw}_{i.}$) and $\widetilde{Y}_{it}$				0.02**
				(0.01)
Interaction ($cgw_{it} - \overline{cgw}_{i.}$) and $\widetilde{Y}_{it}$				0.15***
				(0.05)
Outputgap from OECD ($\widetilde{Y}_{it}$)				-0.16***
				(0.02)
Time dummies	Yes	Yes	Yes	Yes
Lab. market inst (LMI).	Yes	Yes	Yes	Yes
Obs = Country*Average groups	391	357	391	391
Standard deviation of residuals	0.58	0.57	0.55	0.52
Hansen J Overidentification test (p-value)		4.50		
		(0.48)		

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

a) Estimation method: Within country estimate with heteroscedastic
and within country autocorrelated robust standard errors, see Stock and Watson (2008).

b) Change govt. purchases (gi_{it}), ($cgnw_{it}$) and (cgw_{it}) are treated as endogenous.
Instruments are: Δgi_{it-1}, gi_{it-2}, $\Delta cgnw_{it-1}$, $cgnw_{it-2}$, Δcgw_{it-1}, cgw_{it-2}, $\Delta debt_{it-1}$ and $debt_{it-1}$.
F-test of additional instruments from first stage regression results:
$gi(8)$ = 5.03 (0.000), $cgnw(8)$ = 1.87 (0.000) and $cgw(8)$ = 3.13 (0.000)

VIII The effect on the employment rate

In this section, we explore whether our findings of a clear effect on the unemployment rate is reflected in a corresponding effect on the employment to population rate. Generally, the effects are very similar to those reported above, with coefficients with the opposite sign. For example, in equation (1) with the employment rate as the dependent variable, the estimated coefficient for the change in government purchases is 0.24 and significant, cf. Table 8, model 1. The correspondence between the effects on employment and unemployment indicates that variation in government purchases usually has limited effect on labour supply.

In model 2, we find that the effect of government purchases on employment is stronger in countries with institutions that are less conducive to employment. In models 2 and 3, we also explore the effect of the monetary regime. The difference across regimes is somewhat smaller than before, and the effect of each regime is statistically significant in only one of the specifications. However, in both specifications, the point estimates are lower under a floating exchange rate, in line with the results for the effect on unemployment. Furthermore, in EMU countries, the interaction term for the output gap is statistically significant, suggesting that, within the EMU, the effect of an increase in government purchases on employment is considerably stronger during a boom than during a downturn.

Column 4 shows that it is essentially government wage consumption that has a positive effect on employment, and the effect is much stronger in recessions (when the output gap is negative), which is consistent with our findings for unemployment.

Table 8: The effect on the employment rate

	Model 1[a]	Model 2 [a]	Model 3[a]	Model 4[a]
Employment previous period (e_{it-1})	1.46***	1.41***	1.19***	1.19***
	(0.06)	(0.05)	(0.09)	(0.11)
Employment two years ago (e_{it-2})	-0.54***	-0.52***	-0.32***	-0.34***
	(0.05)	(0.05)	(0.07)	(0.07)
Export market, 1st diff. (ΔXM_{it})	0.40**	0.38**	0.37***	0.41***
	(0.15)	(0.15)	(0.12)	(0.12)
Govt. purchases and labour market:				
Change govt. purchases, (g_{it})	0.24***			
	(0.06)			
Interaction g_{it} and predicted LMI		0.20**	0.09	
		(0.08)	(0.09)	
Govt. purchases and monetary regime:				
g_{it} - EMU		0.29	0.59**	
		(0.17)	(0.22)	
g_{it} - Fixed		0.34***	0.16	
		(0.10)	(0.14)	
g_{it} - Float		0.22***	0.08	
		(0.07)	(0.07)	
Dummy for EMU		0.51**	0.62**	
		(0.21)	(0.23)	
Dummy for Fixed		-0.12	0.28	
		(0.23)	(0.33)	
Interaction ($g_{it} - \overline{g}_{i.}$) and output gap $\widetilde{Y}_{it}$,				
Monetary union (EMU)			-0.17*	
			(0.09)	
Interaction ($g_{it} - \overline{g}_{i.}$) and output gap $\widetilde{Y}_{it}$,				
Fixed exchange rate			-0.04	
			(0.03)	
Interaction ($g_{it} - \overline{g}_{i.}$) and output gap $\widetilde{Y}_{it}$,				
Floating exchange rate			0.02	
			(0.04)	
Outputgap from OECD ($\widetilde{Y}_{it}$)			0.17***	0.16***
			(0.04)	(0.04)
Govt. purchases:				
Change govt. investments, (gi_{it})				0.04
				(0.06)
Interaction ($gi_{it} - \overline{gi}_{i.}$) and $\widetilde{Y}_{it}$				0.04
				(0.04)
Change govt. non-wage consumption, ($cgnw_{it}$)				0.01
				(0.02)
Interaction ($cgnw_{it} - \overline{cgnw}_{i.}$) and $\widetilde{Y}_{it}$				-0.01
				(0.01)
Change govt. wage consumption, (cgw_{it})				0.35***
				(0.12)
Interaction ($cgw_{it} - \overline{cgw}_{i.}$) and $\widetilde{Y}_t$				-0.16***
				(0.02)
Time dummies	Yes	Yes	Yes	Yes
Lab. market inst (LMI).	Yes	Yes	Yes	Yes
Obs = Country*Average groups	499	499	499	391
Standard deviation of residuals	0.62	0.61	0.56	0.53

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: Employment to population rate.

a) Estimation method: Within country estimate with heteroscedastic

and within country autocorrelated robust standard errors, see Stock and Watson (2008).

IX Concluding remarks

We investigate the effect of changes in government purchases on unemployment and employment by using panel data estimation for 20 OECD countries, building on an empirical equation where long-run unemployment is a function of labour market institutions, along the lines of Layard et al. (2005) and Nickell et al. (2005). The results show that a permanent increase in government purchases equal to one per cent of GDP on average leads to a reduction in unemployment of 0.3 percentage points using a within-group estimator, and a somewhat larger effect using IV estimation.

There is considerable variation in the effect of government purchases depending on the specific circumstances. In countries with the most 'employment-friendly' labour market institutions, the effect of a change in government purchases is essentially zero, while the effect is fairly strong in countries with institutions that are less conducive to employment. This is consistent with Furlanetto (2011)'s finding that wage stickiness might be crucial to the existence of an expansionary effect of a fiscal stimulus.

In line with recent studies such as Auerbach and Gorodnichenko (2012a,b), Nakamura and Steinsson (2014), Baum et al. (2012) and Batini et al. (2012), we find that the effect is larger when the economy is in a weak cyclical situation. This is also consistent with the countercyclical effect of fiscal policy in the general equilibrium search model of Michaillat (2014).

The monetary regime is important for the effect. In line with the Mundell Fleming model, the effect of government purchases on unemployment is stronger and more persistent for countries in a monetary union or with a fixed exchange rate regime, than for countries with a floating exchange rate. This finding is also consistent with the argument of, among others, Coenen et al. (2012), that fiscal policy has a strong impact on the economy when 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), while the IV estimates suggest that government investment has a strong dampening effect on unemployment. The effect of government wage consumption is strongly countercyclical, consistent with the search model of Michaillat (2014).

Finally, we explore the effect of a change in government purchases on the employment rate. For the most part, the results correspond well with the unemployment results. Increased government purchases equal to one per cent of GDP are estimated to increase the employment rate by 0.24 percentage points. The effect essentially comes from government wage consumption (i.e. public employment), it is stronger during a downturn, and also stronger in countries with a fixed exchange rate.

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A Supporting information

Additional supporting information may be found in the online version of this article:

A.1 Appendix: Data definitions and sources

A.2 Appendix: The empirical specification

A.3 Appendix: Fiscal policy rule

A.4 Appendix: Additional results