

# Do Government Purchases Affect Unemployment?\*

*Steinar Holden*

University of Oslo, NO-0317 Oslo, Norway  
steinar.holden@econ.uio.no

*Victoria Sparrman*

Statistics Norway, NO-0033 Oslo, Norway  
victoria.sparrman@ssb.no

## 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 1 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 it is 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 classification:* 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 soared in many OECD countries. The large changes in fiscal policy and unemployment rates raise the question of how fiscal policy affects unemployment. In this paper, we explore an important part of fiscal policy: the effect of a change in government purchases of goods and services on aggregate unemployment.

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The effect of fiscal policy on the economy has been subject to considerable interest in recent years; see 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 body of literature exploring the effect on unemployment is much smaller. This distinction is important because the effect on unemployment might differ from the effect on GDP. Fiscal actions can lead to an increase in the labour supply and increased unemployment, even if output grows. Alternatively, if cuts in government purchases induce higher private-sector output, and productivity is higher in the private sector, GDP can 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 as a result of increased labour-force participation.

Our study differs from most of the previous studies along several dimensions. First, because our interest is in the effect on unemployment, we draw upon a large body of 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 body of 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 the expansionary effects of fiscal actions.

Second, we use an extensive panel dataset 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; Hall, 2009; Coenen *et al.*, 2012); 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 might 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 (IV), and by controlling for possible additional variables that can affect both fiscal policy and unemployment.

We find that an increase in government purchases, equal to 1 percent 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 the second year, and then decreases gradually, vanishing after eight 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 organized 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. An Online 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), who consider a dynamic model with wage and price setting. They derive a final equation for equilibrium unemployment as a function of labour-market institutions and unmodelled shocks.<sup>1</sup> We replace the shocks by a fiscal variable and an indicator for the export market.

This approach has several advantages. First, an extensive body of literature has shown that aggregate unemployment is, to a large extent, determined by labour-market institutions (e.g., Layard *et al.*, 1991; 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 dataset covering 20 countries and 27 years, there is large variation in a number of other key variables, making it

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<sup>1</sup>A simplified version of Nymoen and Sparrman (2014) is provided in the Online Appendix.

possible to explore how the effect of fiscal policy can 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:

$$u_{it} = \beta_{0i} + \beta_1 u_{it-1} + \beta_2 u_{it-2} + \beta_3 \Delta \mathcal{I}_{it-1} + \beta_4 \mathcal{I}_{it-2} + \beta_5 g_{it} + \beta_6 \Delta XM_{it} + \epsilon_{it}. \quad (1)$$

Here,  $u_{it}$  is the unemployment rate in country  $i$  in period  $t$ ,  $\Delta$  is the first-difference operator,  $\mathcal{I}_{it-1}$  is a vector of institutional labour-market variables to be explained below, and  $XM_{it}$  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 Online Appendix A1 for details and calculations), which, for the sake of simplicity, we refer to as the change in government purchases. We use annual data to better capture the actual fiscal decisions, because the fiscal impulses are likely to follow the annual budgets. The use of annual data can 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 percent, the effect on unemployment must depend on whether public purchases constitute 16 percent of GDP, as in Spain in 1980, or 33 percent 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; 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 can 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 Nymoén 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 Online 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 the first panel of Table 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 (see the second and third panels of Table 1).<sup>2</sup>

Following Nickell *et al.* (2005) and Nymoen and Sparrman (2014), we use the robust within-group (WG) estimator, which allows for heteroscedasticity and autocorrelation (see Stock and Watson, 2008). Allowing for heteroscedasticity and autocorrelation seems reasonable in an equation such as equation (1), where the effects of other variables (e.g., the real interest rate) have been subsumed in the disturbances. Therefore, this is generally a second-order moving average process; see Online Appendix A2 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 Chapter 10 of Wooldridge, 2002).

The WG estimator allows for permanent country-specific differences in unemployment that are not accounted for by the other explanatory variables. A random-effects 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 percent.

Because 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 (see Judson and Owen, 1999). Moreover, other estimation methods that avoid the sample bias also have their difficulties (see Roodman, 2009).

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<sup>2</sup>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.

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

|                             | Homogeneous<br>$H1_a$ | Heterogeneous<br>$H1_b$ |
|-----------------------------|-----------------------|-------------------------|
| $(G_{it} - \bar{G}_{.t})^a$ |                       |                         |
| Lag 1                       | 8.86 (1.00)           | 9.54 (1.00)             |
| Lag 2                       | 9.69 (1.00)           | 8.85 (1.00)             |
| Lag 3                       | 5.71 (1.00)           | 3.66 (1.00)             |
| Number of observations      | 560                   | 560                     |
| $(g_{it} - \bar{g}_{.t})^b$ |                       |                         |
| Lag 1                       | -6.54 (0.00)          | -7.69 (0.00)            |
| Lag 2                       | -2.22 (0.01)          | -4.62 (0.00)            |
| Lag 3                       | -0.25 (0.40)          | -3.09 (0.00)            |
| Number of observations      | 560                   | 560                     |
| $(u_{it} - \bar{u}_{.t})^c$ |                       |                         |
| Lag 1                       | -4.19 (0.00)          | -3.29 (0.00)            |
| Lag 2                       | -2.43 (0.00)          | -2.20 (0.01)            |
| Lag 3                       | -3.37 (0.00)          | -2.12 (0.01)            |
| Number of observations      | 560                   | 560                     |

Notes: The variables for Germany are prolonged with data for West Germany before the unification in 1991 to achieve a balanced panel. Numbers in parentheses are  $p$ -values for the relevant null.

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

<sup>b</sup>Change in government purchases ( $g_{it}$ ) with cross-sectional means ( $\bar{g}_{.t}$ ) subtracted.

<sup>c</sup>Unemployment ( $u_{it}$ ) with cross-sectional means ( $\bar{u}_{.t}$ ) subtracted.

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 can depend on the state of the economy. In the literature, this is typically handled either by focusing 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 (e.g., Blanchard and Perotti, 2002; Beetsma and Giuliodori, 2010; Monacelli *et al.*, 2010). While these methods have clear advantages, they also have important weaknesses. Monacelli *et al.* (2010) emphasize that changes in military spending are often undertaken in periods that also differ for other reasons, which might 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 can 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, lobbying and pressure groups, and media attention. Furthermore, a large part of government purchases might 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 IV estimation, where we treat fiscal policy as endogenous. The instruments are the past values of the change in government purchases and the 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 can affect both fiscal policy and unemployment, which might imply that the error term will be correlated with fiscal policy. By including such variables, the potential bias will be reduced or removed (see the discussion below). Furthermore, because 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 (2008) 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 the United States. The sample data are from 1980–2007, except for Germany, where the data start in 1991. See Online Appendix A1 for detailed documentation of all variables. The seven main variables are as follows.

*The unemployment rate* is the standardized 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 Online Appendix A1). 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. However, there is considerable variation within and across countries (see Table A1.2 in the Online Appendix).

*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 UK, and the US (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 a 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 stabilization purposes, but are solely motivated by a desire to reduce the budget deficit or to 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 Armington *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 we 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 1 percent 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 (see Table A2.1 in Online Appendix A2), 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 Nymoén and Sparrman (2014), but, again, the coefficient of government purchases is hardly affected. For the sake of brevity, and because the effects of the individual labour-market institutions follow the results of Nymoén and Sparrman (2014), the complete results of Model 4 are relegated to the Online Appendix (see Model 1 in Table A2.1). Figures A2.1 and A2.2 in the Online 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, it is difficult to disentangle from the data whether the agents in the economy really viewed the changes as permanent, or whether they believed that the changes would be reversed.

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 (see 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  $\Delta y$  and the lagged debt-to-GDP ratio  $D/Y$  (see Online Appendix A3). We then define unexpected changes in government purchases as the prediction errors from the policy rule (see Online Appendix A3). In Model 5 of Table 2, we include both the actual changes and the unexpected changes in government 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. Thus, we do not pursue this distinction further.

Figure 1 shows the dynamic effect on unemployment of a permanent increase in government purchases equal to 1 percent 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 eight 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 it is found that spending-based deficit cuts equal to 1 percent of GDP raise the unemployment rate by about 0.2 percentage

Table 2. *WG estimation of equation (1)*

|  | Model 1            | Model 2            | Model 3            | Model 4            | Model 5            |
|--|--------------------|--------------------|--------------------|--------------------|--------------------|
| Unemployment, previous period ( $u_{it-1}$ )         | 0.89***<br>(0.01)  | 1.37***<br>(0.04)  | 1.36***<br>(0.04)  | 1.31***<br>(0.06)  | 1.29***<br>(0.06)  |
| Unemployment, two years ago ( $u_{it-2}$ )           |                    | -0.52***<br>(0.05) | -0.51***<br>(0.05) | -0.48***<br>(0.06) | -0.47***<br>(0.07) |
| Change in government purchases ( $g_{it}$ )          | -0.47***<br>(0.11) | -0.34***<br>(0.08) | -0.35***<br>(0.08) | -0.32***<br>(0.08) | -0.49***<br>(0.21) |
| Export market, first difference ( $\Delta XM_{it}$ ) |                    |                    | -0.50***<br>(0.14) | -0.46***<br>(0.14) | -0.46***<br>(0.14) |
| Unexpected changes in government purchases           |                    |                    |                    |                    | 0.21<br>(0.23)     |
| Time dummies   | Yes                | Yes                | Yes                | Yes                | Yes                |
| Labour-market institutions                           | 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               |

Notes: Standard errors are given in parentheses. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . The dependent variable is the rate of unemployment. The estimation method is the within-country estimate with heteroscedastic and within-country autocorrelated robust standard errors (see Stock and Watson, 2008).

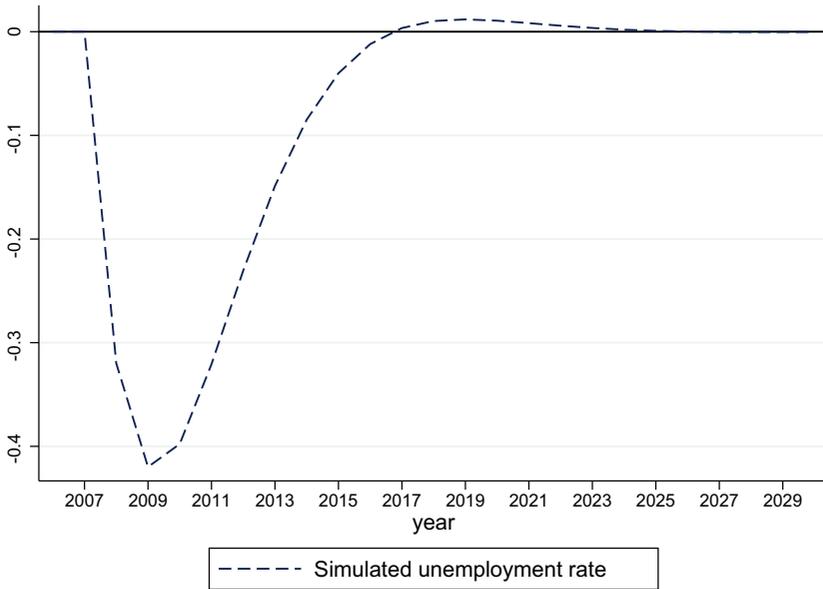


Fig. 1. Effect of a permanent increase in government purchases equal to 1 percent of GDP, from 2008, based on simulation of equation (1) with estimated coefficients from the WG Model 4 in Table 2 [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

points. Using US data, Monacelli *et al.* (2010) find that an increase in government spending equal to 1 percent of GDP leads to a fall of 0.6 percentage points in the rate of unemployment after 10 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 percent of GDP. In contrast, using an analysis of 10 OECD countries with SVARs, Brückner and Pappa (2012) find that a typical estimate from the impulse responses implies that a 10 percent increase in government expenditure increases the unemployment rate at peak (which varies from 3 to 16 quarters) by around 0.2–0.5 percent.

Using Okun's law, which says that an increase in unemployment of one percentage point is associated with a 2 percent 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 0.7–1.0 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

Table 3. *First-stage estimation*

|   | Model 1            | Model 2            |
|---|--------------------|--------------------|
| Unemployment, previous period ( $u_{it-1}$ )  | -0.11***<br>(0.04) | -0.08**<br>(0.04)  |
| Unemployment, two years ago ( $u_{it-2}$ )  | 0.10**<br>(0.04)   | 0.10**<br>(0.04)   |
| Export market, first difference ( $\Delta XM_{it}$ )                                      | -0.13<br>(0.12)    | -0.16<br>(0.14)    |
| <b>Instruments</b>  |                    |                    |
| Change in government purchases,<br>first difference previous period ( $\Delta g_{it-1}$ ) | 0.13**<br>(0.06)   |                    |
| Debt previous period  | -0.01***<br>(0.00) | -0.01***<br>(0.00) |
| Fiscal consolidation <sup>a</sup>   |                    | -0.26***<br>(0.07) |
| Time dummies  | Yes                | Yes                |
| Labour-market institutions.   | Yes                | Yes                |
| Observations  | 455                | 402                |

Notes: Standard errors are given in parentheses. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . First-stage IV regression of dependent variable: change in government spending.  $F$ -test of excluded instruments:  $F_{\text{Mod1}}(2) = 18.50(0.000)$  and  $F_{\text{Mod2}}(3) = 15.58(0.000)$ .

<sup>a</sup>Fiscal consolidation is the series on spending reductions from Devries *et al.* (2011).

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. The second instrument, the debt-to-GDP ratio, can also affect unemployment through other channels, such as the effect on expected future taxes.

Therefore, we 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.<sup>3</sup>

Model 1 in Table 4 shows the results of the IV estimation with the first difference of the lagged change in government spending and lagged debt as instruments. The effect is significant at the 1 percent level, and the point estimate says that an increase in government purchases equal to 1 percent of GDP reduces unemployment by 0.49 percentage points (i.e., somewhat higher than the WG estimate). This might indicate that the WG estimate is biased towards zero, but the difference is not significant. The 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 percent 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 Models 1 and 2 is a result of 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 consolidation 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 1 percent 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

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<sup>3</sup>We have also tried using the election year as an instrument, but this did not affect the result. Furthermore, the election year is potentially endogenous in countries where the government can choose the time of elections.

Table 4. Equation (1): IV and WG estimator

|  | IV <sup>a</sup>    | IV <sup>b</sup>    | Model 3 <sup>c</sup> | Model 4 <sup>c</sup> | IV <sup>d</sup>    |
|--|--------------------|--------------------|----------------------|----------------------|--------------------|
| Change in government purchases ( $g_{it}$ )  | -0.49***<br>(0.17) | -0.78***<br>(0.16) |                      | -0.28***<br>(0.07)   |                    |
| Unemployment, previous period ( $u_{it-1}$ )   | 1.30***<br>(0.05)  | 1.24***<br>(0.06)  | 1.33***<br>(0.07)    | 1.15***<br>(0.08)    | 1.44***<br>(0.08)  |
| Unemployment, two years ago ( $u_{it-2}$ )   | -0.48***<br>(0.05) | -0.43***<br>(0.06) | -0.49***<br>(0.07)   | -0.33***<br>(0.08)   | -0.66***<br>(0.09) |
| Export market, first difference ( $\Delta X_{it}$ )  | -0.44***<br>(0.13) | -0.52***<br>(0.15) | -0.43***<br>(0.14)   | -0.40***<br>(0.16)   | -0.61***<br>(0.19) |
| Fiscal consolidation via spending reduction ( $Spend_{it}^c$ )                             |                    |                    | 0.21***<br>(0.05)    |                      |                    |
| Fiscal consolidation via tax increase <sup>e</sup>   |                    |                    | 0.12<br>(0.08)       |                      |                    |
| <b>Controls</b>  |                    |                    |                      |                      |                    |
| Log GDP first difference previous period   |                    |                    |                      | -21.05***<br>(6.48)  |                    |
| Output gap first difference previous period  |                    |                    |                      | 0.09<br>(0.08)       |                    |
| Predicted direct and indirect taxes divided by trend GDP, first difference                 |                    |                    |                      | -0.06*<br>(0.03)     |                    |
| Predicted direct and indirect taxes divided by trend GDP, first difference previous period |                    |                    |                      | 0.00<br>(0.02)       |                    |
| Change in government net lending, percent of GDP   |                    |                    |                      |                      | 0.42***<br>(0.12)  |

Table 4. *Continued*

|   | IV <sup>a</sup> | IV <sup>b</sup> | Model 3 <sup>c</sup> | Model 4 <sup>c</sup> | IV <sup>d</sup> |
|---|-----------------|-----------------|----------------------|----------------------|-----------------|
| Time dummies  | Yes             | Yes             | Yes                  | Yes                  | Yes             |
| Labour-market institutions (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 <i>J</i> overidentification test ( <i>p</i> -values) | 0.69<br>(0.41)  | 2.30<br>(0.13)  |                      |                      |                 |

*Notes:* Standard errors are given in parentheses. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . The dependent variable is the rate of unemployment.

<sup>a</sup>Change in government purchases ( $g_{it}$ ) is treated as endogenous; instruments are  $\Delta g_{it-1}$  and  $debt_{it-1}$ .

<sup>b</sup>Change in government purchases ( $g_{it}$ ) is treated as endogenous; instruments are  $Spend_{it}$  and  $debt_{it-1}$ .

<sup>c</sup>Estimation method: within-country estimate with heteroscedastic and within-country autocorrelated robust standard errors (see Stock and Watson, 2008).

<sup>d</sup>Change in government purchases ( $g_{it}$ ) is used as an instrument for change in government net lending.

<sup>e</sup>Fiscal consolidations are the series from Devries *et al.* (2011).

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 can 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 called 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, the expectations that prevail when the budget is decided are those 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.<sup>4</sup> 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 stabilize 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 Online Appendix A4, 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

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<sup>4</sup>Note that the standard error of predicted taxes might be biased downwards because predicted taxes are a generated regressor (see Murphy and Topel, 1885).

unemployment, even if the coefficient value is somewhat lower as a result of 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 Column 4 of Table 2, namely  $0.32/0.77 = 0.42$ .

## V. Labour-Market Institutions, Cyclical Situation, and Monetary Regime

We 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, 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, Furlanetto (2011) has shown 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 Models 3 and 4 of Table 2, 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, Model 1, in the Online Appendix 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

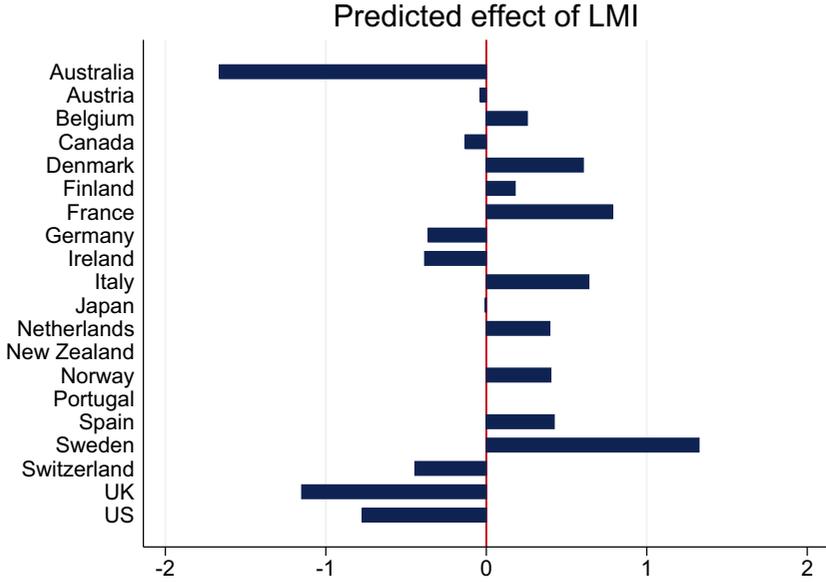


Fig. 2. Predicted effect of labour-market institutions, based on simulations of equation (1) in 2007 with estimated coefficients from the WG Model 4 in Table 2 [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

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 Column 1 of Table 5 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 1 percent 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

Table 5. Effect of labour-market institutions, cyclical situation, and monetary regime

|  | Model 1 <sup>a</sup> | Model 2 <sup>a</sup> | Model 3 <sup>a</sup> | Model 4 <sup>a</sup> | IV 5 <sup>b</sup>  | Model 6 <sup>a</sup> |
|--|----------------------|----------------------|----------------------|----------------------|--------------------|----------------------|
| Unemployment, previous period ( $u_{it-1}$ )               | 1.30***<br>(0.06)    | 1.15***<br>(0.07)    | 1.15***<br>(0.07)    | 1.28***<br>(0.06)    | 1.31***<br>(0.05)  | 1.12***<br>(0.07)    |
| Unemployment, two years ago ( $u_{it-2}$ )                 | -0.47***<br>(0.06)   | -0.36***<br>(0.05)   | -0.37***<br>(0.05)   | -0.46***<br>(0.06)   | -0.53***<br>(0.05) | -0.35***<br>(0.06)   |
| Export market, first difference ( $\Delta XM_{it}$ )       | -0.47***<br>(0.14)   | -0.42***<br>(0.13)   | -0.41***<br>(0.13)   | -0.44***<br>(0.14)   | -0.37***<br>(0.12) | -0.38***<br>(0.12)   |
| <b>Government purchases and labour-market institutions</b> |                      |                      |                      |                      |                    |                      |
| Change in government purchases, ( $g_{it}$ )               | -0.39***<br>(0.07)   | -0.21***<br>(0.07)   | -0.28***<br>(0.07)   | -0.29***<br>(0.09)   | -0.46***<br>(0.14) | -0.23***<br>(0.09)   |
| Interaction $g_{it}$ and the predicted $LM_{it}$           | -0.37***<br>(0.10)   |                      | -0.30***<br>(0.07)   |                      |                    | 0.03*<br>(0.02)      |
| Interaction $g_{it}$ and $\tilde{Y}_{it}$                  |                      | 0.04***<br>(0.01)    | 0.03***<br>(0.01)    |                      |                    | -0.15***<br>(0.02)   |
| Output gap from OECD ( $\tilde{Y}_{it}$ )                  |                      | -0.15***<br>(0.03)   | -0.14***<br>(0.03)   |                      |                    | -0.15***<br>(0.02)   |
| <b>Government purchases and monetary regime</b>            |                      |                      |                      |                      |                    |                      |
| $g_{it}$ - EMU   |                      |                      |                      | -0.36**<br>(0.13)    | -0.47***<br>(0.17) | -0.45**<br>(0.16)    |
| $g_{it}$ - fixed   |                      |                      |                      | -0.48***<br>(0.12)   | -0.11<br>(0.24)    | -0.29**<br>(0.12)    |
| $g_{it}$ - float   |                      |                      |                      | -0.25**<br>(0.10)    | -0.31<br>(0.21)    | -0.12<br>(0.11)      |
| Dummy for EMU  |                      |                      |                      | -0.15<br>(0.18)      | -0.19<br>(0.19)    | -0.16<br>(0.23)      |
| Dummy for fixed  |                      |                      |                      | 0.32<br>(0.21)       | 0.04<br>(0.26)     | 0.08<br>(0.25)       |

Table 5. Continued

|  | Model 1 <sup>a</sup> | Model 2 <sup>a</sup> | Model 3 <sup>a</sup> | Model 4 <sup>a</sup> | IV 5 <sup>b</sup> | Model 6 <sup>a</sup> |
|--|----------------------|----------------------|----------------------|----------------------|-------------------|----------------------|
| Time dummies   | Yes                  | Yes                  | Yes                  | Yes                  | Yes               | Yes                  |
| Labour-market institutions                                 | 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 <i>J</i> overidentification test ( <i>p</i> -value) |                      |                      |                      |                      | 16.61 (0.01)      |                      |

Notes: Standard errors are given in parentheses. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . The dependent variable is the rate of unemployment.

<sup>a</sup> Estimation method: within-country estimate with heteroscedastic and within-country autocorrelated robust standard errors (see Stock and Watson, 2008).

<sup>b</sup> Changes in government purchases ( $g_{it}$ , fixed), and ( $g_{it}$ , float) are treated as endogenous. Instruments, separately for each regime, are ( $\Delta g_{it-1}$ ), ( $g_{it-2}$ ), 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).

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 percent 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 the output gap in the equation to avoid any spurious effects resulting from 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, have found 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 US, but they do find 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.

In Model 3 of Table 5, 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 emphasized 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 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 as instruments the lagged debt level, the first difference of changes in government purchases in the previous period, and changes in government purchases two periods ago. 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 (see 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 Online Appendix, we show results for the effects of a number of other variables that can 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 10 percent 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. 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 might 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 stabilize 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 reparametrize 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 1 percent 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 upper panel shows the effect in a floating regime, and the lower panel shows 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.

## 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

Table 6. Effect of labour-market institutions and inflation targeting regime on dynamics

|   | Model 1         | Model 2         | Model 3         |
|---|-----------------|-----------------|-----------------|
| Change unemployment, first difference previous period ( $\Delta u_{it-1}$ ) | 1.28*** (0.05)  | 1.36*** (0.07)  | 1.33*** (0.07)  |
| Unemployment two years ago ( $u_{it-2}$ )                                   | 0.83*** (0.02)  | 0.84*** (0.02)  | 0.84*** (0.02)  |
| Interaction $\Delta u_{it-1}$ and predicted $LM_{it}$                       | 0.13*** (0.02)  |                 | 0.09** (0.03)   |
| Interaction $u_{it-2}$ and predicted $LM_{it}$                              | -0.00 (0.02)    |                 | -0.02 (0.01)    |
| Export market, first difference ( $\Delta XM_{it}$ )                        | -0.47*** (0.15) | -0.42*** (0.13) | -0.44*** (0.13) |
| Change in government purchases ( $g_{it}$ )                                 | -0.39*** (0.06) |                 |                 |
| Interaction $g_{it}$ and predicted $LM_{it}$                                | -0.32*** (0.09) | -0.33*** (0.08) | -0.30*** (0.08) |
| Interaction $\Delta u_{it-1}$ and float                                     |                 | -0.22*** (0.07) | -0.17** (0.07)  |
| Interaction $u_{it-2}$ and float  |                 | -0.06 (0.04)    | -0.08** (0.03)  |
| $g_{it}$ - fixed  |                 | -0.39*** (0.08) | -0.40*** (0.07) |
| $g_{it}$ - float  |                 | -0.34*** (0.10) | -0.34*** (0.10) |
| Dummy for fixed   |                 | -0.40 (0.35)    | -0.49 (0.32)    |
| Time dummy  | Yes             | Yes             | Yes             |
| Labour-market institutions  | Yes             | Yes             | Yes             |
| Obs. = country*average groups   | 502             | 502             | 502             |
| Standard deviation of residuals   | 0.59            | 0.59            | 0.59            |

Notes: Standard errors are given in parentheses. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . The dependent variable is the rate of unemployment. Estimation method: within-country estimate with heteroscedastic and within-country autocorrelated robust standard errors (see Stock and Watson, 2008).

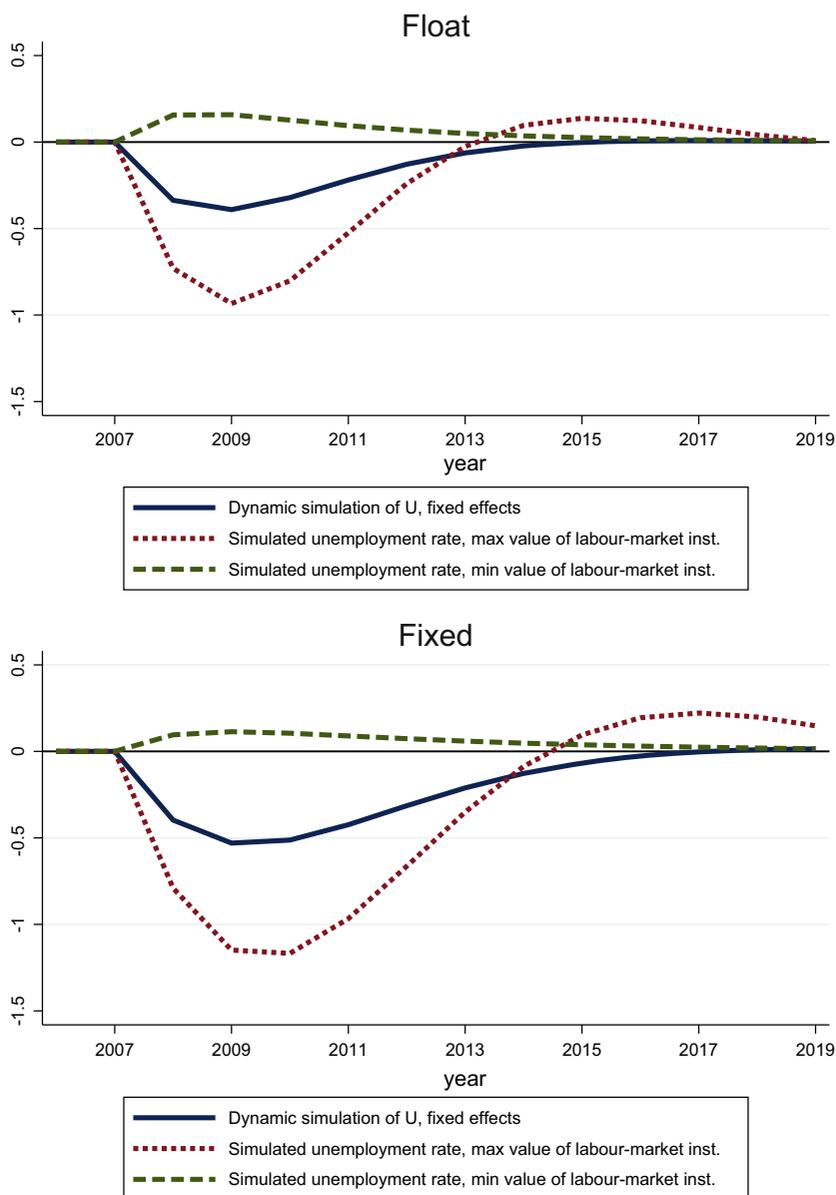


Fig. 3. Effect on the rate of unemployment of a permanent increase in government purchases, equal to 1 percent of GDP, from 2008, based on a simulation of equation (1) with estimated coefficients from Model 3 in Table 6 for three different levels of labour-market institutions, for floating exchange rate (upper panel) and fixed exchange rate (lower panel) [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

consumption, which is essentially expenditure on public employment (i.e., employees in the public sector,  $dCGW$ ), constitutes 54 percent of total government purchases, government non-wage consumption ( $dCGNW$ ) 29 percent, and government investments ( $dIG$ ) 17 percent (unweighted average across countries, from the period 1960–2007). The variables are in the same form as before, that is, the change in each of these categories, in real terms, and measured as share of trend GDP; see Online Appendix A1 for a detailed explanation.

Model 1 in Table 7 shows that increased government wage consumption (i.e., 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.

Model 2 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 it is highly significant. The larger point estimate under IV might 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  $-0.45 + (-3) \cdot 0.15 = -0.90$ , implying that an increase in government wage

Table 7. Effect of different types of government purchases

|  | Model 1 <sup>a</sup> | IV 2 <sup>b</sup> | Model 3 <sup>a</sup> | Model 4 <sup>a</sup> |
|--|----------------------|-------------------|----------------------|----------------------|
| Unemployment, previous period ( $u_{it-1}$ )                               | 1.24*** (0.08)       | 1.23*** (0.07)    | 1.22*** (0.07)       | 1.02*** (0.08)       |
| Unemployment, two years ago ( $u_{it-2}$ )                                 | -0.44*** (0.08)      | -0.47*** (0.06)   | -0.44*** (0.08)      | -0.27*** (0.07)      |
| Export market, first difference ( $\Delta XM_{it}$ )                       | -0.46*** (0.15)      | -0.39*** (0.15)   | -0.49*** (0.15)      | -0.43*** (0.13)      |
| <b>Government purchases</b>  |                      |                   |                      |                      |
| Change in government investments ( $g_{it}$ )                              | -0.20 (0.13)         | -1.02*** (0.37)   | -0.44*** (0.12)      | -0.09 (0.12)         |
| Change in government non-wage consumption ( $cgnw_{it}$ )                  | -0.03 (0.02)         | -0.09 (0.20)      | -0.02 (0.03)         | -0.03 (0.02)         |
| Change in government wage consumption ( $cgw_{it}$ )                       | -0.63*** (0.20)      | -0.49 (0.48)      | -0.48** (0.19)       | -0.45*** (0.13)      |
| Interaction ( $g_{it} - \bar{g}_{it}$ ) and predicted $LM_{it}$            |                      |                   | -0.61*** (0.10)      |                      |
| Interaction ( $cgnw_{it} - \overline{cgnw}_{it}$ ) and predicted $LM_{it}$ |                      |                   | -0.01 (0.13)         |                      |
| Interaction ( $cgw_{it} - \overline{cgw}_{it}$ ) and predicted $LM_{it}$   |                      |                   | -0.57** (0.27)       |                      |
| Interaction ( $g_{it} - \bar{g}_{it}$ ) and $\tilde{Y}_{it}$               |                      |                   |                      | -0.02 (0.04)         |
| Interaction ( $cgnw_{it} - \overline{cgnw}_{it}$ ) and $\tilde{Y}_{it}$    |                      |                   |                      | 0.02** (0.01)        |
| Interaction ( $cgw_{it} - \overline{cgw}_{it}$ ) and $\tilde{Y}_{it}$      |                      |                   |                      | 0.15*** (0.05)       |
| Output gap from OECD ( $\tilde{Y}_{it}$ )                                  |                      |                   |                      | -0.16*** (0.02)      |
| Time dummies   | Yes                  | Yes               | Yes                  | Yes                  |
| Labour-market institutions   | 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)       |                      |                      |

Notes: Standard errors are given in parentheses. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .  $F$ -test of additional instruments from first-stage regression results:  $g_{it}(8) = 5.03$  (0.000),  $cgnw_{it}(8) = 1.87$  (0.000), and  $cgw_{it}(8) = 3.13$  (0.000).

<sup>a</sup>Estimation method: within-country estimate with heteroscedastic and within-country autocorrelated robust standard errors (see Stock and Watson, 2008).  
<sup>b</sup>Changes in government purchases ( $g_{it}$ ), ( $cgnw_{it}$ ), and ( $cgw_{it}$ ) are treated as endogenous.

Instruments are  $\Delta \tilde{g}_{it-1}$ ,  $\tilde{g}_{it-2}$ ,  $\Delta cgnw_{it-1}$ ,  $cgnw_{it-2}$ ,  $\Delta cgw_{it-1}$ ,  $cgw_{it-2}$ ,  $\Delta debt_{it-1}$ , and  $debt_{it-1}$ .

consumption equal to 1 percent 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.

### **VIII. 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 (see Model 1 of Table 8). 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 downturn than during a boom.

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.

### **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.*

Table 8. *Effect on the employment rate*

|  | Model 1 <sup>a</sup> | Model 2 <sup>a</sup> | Model 3 <sup>a</sup> | Model 4 <sup>a</sup> |
|--|----------------------|----------------------|----------------------|----------------------|
| Employment, previous period ( $e_{it-1}$ )                               | 1.46*** (0.06)       | 1.41*** (0.05)       | 1.19*** (0.09)       | 1.19*** (0.11)       |
| Employment, two years ago ( $e_{it-2}$ )                                 | -0.54*** (0.05)      | -0.52*** (0.05)      | -0.32*** (0.07)      | -0.34*** (0.07)      |
| Export market, first difference ( $\Delta XM_{it}$ )                     | 0.40** (0.15)        | 0.38** (0.15)        | 0.37*** (0.12)       | 0.41*** (0.12)       |
| <b>Government purchases and labour market</b>                            |                      |                      |                      |                      |
| Change in government purchases, ( $g_{it}$ )                             | 0.24*** (0.06)       |                      |                      |                      |
| Interaction $g_{it}$ and predicted $LMI$                                 |                      | 0.20** (0.08)        | 0.09 (0.09)          |                      |
| <b>Government purchases and monetary regime</b>                          |                      |                      |                      |                      |
| $g_{it}$ - EMU   |                      | 0.29 (0.17)          | 0.59** (0.22)        |                      |
| $g_{it}$ - fixed   |                      | 0.34*** (0.10)       | 0.16 (0.14)          |                      |
| $g_{it}$ - float   |                      | 0.22*** (0.07)       | 0.08 (0.07)          |                      |
| Dummy for EMU  |                      | 0.51** (0.21)        | 0.62** (0.23)        |                      |
| Dummy for fixed  |                      | -0.12 (0.23)         | 0.28 (0.33)          |                      |
| Interaction ( $g_{it} - \bar{g}_{i,t}$ ) and output gap $\hat{Y}_{it}$ , |                      |                      |                      |                      |
| Monetary union (EMU)   |                      |                      | -0.17* (0.09)        |                      |
| Interaction ( $g_{it} - \bar{g}_{i,t}$ ) and output gap $\hat{Y}_{it}$ , |                      |                      |                      |                      |
| Fixed exchange rate  |                      |                      | -0.04 (0.03)         |                      |
| Interaction ( $g_{it} - \bar{g}_{i,t}$ ) and output gap $\hat{Y}_{it}$ , |                      |                      |                      |                      |
| Floating exchange rate   |                      |                      | 0.02 (0.04)          |                      |
| Output gap from OECD ( $\hat{Y}_{it}$ )                                  |                      |                      | 0.17*** (0.04)       | 0.16*** (0.04)       |

Table 8. Continued

|  | Model 1 <sup>a</sup> | Model 2 <sup>a</sup> | Model 3 <sup>a</sup> | Model 4 <sup>a</sup> |
|--|----------------------|----------------------|----------------------|----------------------|
| <b>Government purchases</b>                                |                      |                      |                      |                      |
| Change in government investments, ( $g_{it}$ )             |                      |                      |                      | 0.04 (0.06)          |
| Interaction ( $g_{it} - \bar{g}_t$ ) and $\bar{Y}_t$       |                      |                      |                      | 0.04 (0.04)          |
| Change in government non-wage consumption ( $cgnw_{it}$ )  |                      |                      |                      | 0.01 (0.02)          |
| Interaction ( $cgnw_{it} - \bar{cgnw}_t$ ) and $\bar{Y}_t$ |                      |                      |                      | -0.01 (0.01)         |
| Change in government wage consumption, ( $cgw_{it}$ )      |                      |                      |                      | 0.35*** (0.12)       |
| Interaction ( $cgw_{it} - \bar{cgw}_t$ ) and $\bar{Y}_t$   |                      |                      |                      | -0.16*** (0.02)      |
| Time dummies   | Yes                  | Yes                  | Yes                  | Yes                  |
| Labour-market institutions                                 | Yes                  | Yes                  | Yes                  | Yes                  |
| Obs. = country*average groups                              | 499                  | 499                  | 499                  | 391                  |
| Standard deviation of residuals                            | 0.62                 | 0.61                 | 0.56                 | 0.53                 |

Notes: Standard errors are given in parentheses. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . The dependent variable is the employment to population rate.  
<sup>a</sup>Estimation method: within-country estimate with heteroscedastic and within-country autocorrelated robust standard errors (see Stock and Watson, 2008).

(2005) and Nickell *et al.* (2005). The results show that a permanent increase in government purchases equal to 1 percent 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 the finding of Furlanetto (2011) 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 1 percent 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 it is also stronger in countries with a fixed exchange rate.

## Supporting Information

The following supporting information can be found in the online version of this article at the publisher's web site.

### Online Appendix A1: Data definitions and sources

**Online Appendix A2:** The empirical specification

**Online Appendix A3:** Fiscal policy rule

**Online Appendix A4:** Additional results

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