Do government purchases affect unemployment?

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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 point in the same year. The extensive data set allows us to explore how the effect of fiscal policy depends on the specific circumstances. The effect is greater in downturns than in booms, greater under a fixed exchange rate regime than under a floating regime, and also greater under less ”employment-friendly” labour market institutions. 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

1 Introduction

During the financial crisis, most OECD countries used fiscal measures extensively to stimulate the economy. More recently, increasing public debt and rising default premia on sovereign debt 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. The distinction between effects on GDP and unemployment is not unimportant: While more output in general requires higher employment and thus may lower unemployment, there are other effects that make the link between GDP and unemployment less clear. Fiscal actions that lead to increased labour supply may increase unemployment even if output grows. Alternatively, if cuts in government purchases induce higher private sector output, and productivity is higher in the private sector, unemployment may increase even if GDP grows. This ambiguity is reflected in recent research: While Monacelli et al. (2010),

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IMF (2010)), Auerbach and Gorodnichenko (2012a) and Ramey (2012) conclude that an increase in government purchases lead 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, as 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 for the evolution of the rate of unemployment. Our analysis builds on this literature, as we add fiscal policy 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 labor markets are segmented, wage stickiness is essential to obtain expansionary effects.

Second, we use an extensive panel data set for 20 OECD countries for the period 1980-2007 (some of the analysis also includes 1960-1979), which makes it possible to explore whether the effect of fiscal policy depends on a host of other factors, like the cyclical situation of the economy, the 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. (2010) and Hall (2009)); we explore this idea by considering how the effect differs across monetary regimes. Furthermore, as our framework uses different identification assumptions compared to the studies using structural VARs, our findings are valuable for evaluating the robustness of the results from previous studies.

We find that an increase in government purchases equal to one percent of GDP leads to a first year reduction in the rate of unemployment of about 0.3 percentage points, irrespective of whether we use fixed effects or IV estimation. The effect increases somewhat in year 2, and then decreases gradually and vanishes after 8 years. The size of the effect is highly dependent on other factors in the economy. We find that the change in unemployment due to a rise in government purchases is countercyclical, being greater when the economy is in a downturn; this is consistent with the recent findings of Auerbach and Gorodnichenko (2012a,b), and Nakamura and Steinsson (2012). There is no indication that the effect depends on the size of public debt, in contrast to the suggestions in the literature on expansionary fiscal contractions. Furthermore, we find a strong effect of fiscal policy on unemployment in countries with a fixed exchange rate, but less or no effect for countries with a floating exchange rate. This is consistent with recent research mentioned above, arguing that fiscal policy may have a strong impact on the economy in situations when the monetary policy is constrained (see e.g. Coenen et al. (2010), Christiano and Rebelo (2011) and Woodford (2011)). We also find a positive effect of increased government purchases on the employment to population rate, which corresponds to the negative effect on unemployment. The effect on employment is stronger when the economy is in a recession than in a boom.

The rest of the paper is organized as follows. In section 2, we present our empirical approach, while the empirical results are laid out in sections 3 and 4. Section 5 concludes. The data is described in the data appendix.

2 Empirical approach

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 an equation for equilibrium unemployment as a function of labour market
institutions and unmodelled shocks. We replace the shocks by a fiscal variable (the real change in government purchases, scaled by the share of trend-GDP) and an indicator for the export market. This approach has several advantages. First, an extensive literature has shown that aggregate unemployment to a large extent is determined by labour market institutions, see e.g. Layard et al. (1991) and Nickell et al. (2005). Thus, it seems appropriate to control for the effect of labour market institutions when analysing the effect of fiscal policy and investigate if the effect of the fiscal policy depends on the prevailing labour market 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

\[ u_{it} = \beta_0 + \beta_1 u_{it-1} + \beta_2 u_{it-2} + \beta_3 u_{it-3} + \beta_4 \Delta I_{it-1} + \beta_5 I_{it-2} + \beta_6 g_{it} + \beta_7 \Delta X M_{it} + \beta_8 X M_{it-1} + \beta_9 \Delta X M_{it-1} + \epsilon_{it} \]  

(1)

where \( u_{it} \) is the unemployment rate in country \( i \) in period \( t \), \( \Delta \) is the first difference operator, \( I_{it-1} \) is a vector of institutional labour market variables which includes unemployment benefits, employment protection legislation, measures of coordination and centralization of wage setting, and \( g_{it} \) is the real percentage change in government purchases, multiplied by the ratio of government purchases to trend GDP (see appendix A for details and calculations), which we for simplicity will refer to as the change in government purchases. Government purchases is the sum of government consumption and investment, which includes expenditure on public employment, but does not include transfers and subsidies. \( X M_{it} \) is the export market indicator, which captures the cyclical state of the economy of the trading partners.\(^1\)

Our specification of the fiscal variable differs from most previous studies, where one usually considers the percentage change in the fiscal variable itself. 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 with government purchases as a share of trend of GDP. An alternative would be to consider the change in government purchases as a share of GDP, as is done in some studies (e.g. Alesina and Ardagna (2009), Duell et al. (2009)). Yet this specification is also sensitive to changes in the denominator, implying a risk that a reduction in GDP caused by a negative external shock, increases the ratio of government purchases to GDP, even if government purchases is kept constant. Thus, one might erroneously conclude that government purchases have a negative effect on GDP.

The dynamic structure follows from the theoretical labour market framework of Nyomoen and Sparrrman (2014), where the institutional variables affect the wage and price setting, which subsequently shape the evolution of unemployment. Note that we have also tried a richer dynamic specification for the change in government purchases, including a lag, cf. appendix B, but it could easily be reduced down to the chosen specification.

The specification in equation (1), with the level of unemployment and 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

\(^1\)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 Hodrick Prescott-trend, divided by the trend, and the weights reflect the share of the exports from country \( i \) that goes to each of the trading partners \( j \). This variable will to a large extent capture the effect of common shocks related to the world business cycle.
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 Mátýás 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 3.²

In most of the analysis, we use a Fixed Effects (FE) estimator, allowing for permanent country-specific differences in unemployment that are not accounted for by the other explanatory variables. A random effect model would require that there is no correlation between the country fixed effects and the explanatory variables in the model. However, this assumption is rejected in a Hausman test with a p-value of 1 percent. In principle, the FE estimator is biased when the regression includes a lagged endogenous variable, see Nickell (1981). However, with a long time dimension of 27 years, this bias is small, cf. Judson and Owen (1999). In addition, other estimations methods which avoid the sample bias also have their difficulties, cf. Roodman (2009).

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

The growth in government purchases has generally been positive in real terms in the sample period, and the unweighted decade averages in our sample vary in the interval 0.52 – 0.74. There is however considerable variation within and across countries, see appendix table A1.

An important methodological 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 either by focussing on the effect of specific events that can be thought to be exogenous, such as changes in military spending in a response to political changes (e.g. Ramey and Shapiro (1999)), or by use of a structural vector autoregression (SVAR) model, where the

²For 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.

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### Table 1: Unit root test for government purchases, the change in government purchases and the rate of unemployment

<table>
<thead>
<tr>
<th></th>
<th>Homogeneous</th>
<th>Heterogenous</th>
<th>Homogeneous</th>
<th>Heterogenous</th>
<th>Homogeneous</th>
<th>Heterogenous</th>
</tr>
</thead>
<tbody>
<tr>
<td>$(G_t - \bar{G}_t)$</td>
<td>H1a</td>
<td>H1b</td>
<td>H1a</td>
<td>H1b</td>
<td>H1a</td>
<td>H1b</td>
</tr>
<tr>
<td>lag 1st</td>
<td>8.86 (1.00)</td>
<td>9.54 (1.00)</td>
<td>-6.54 (0.00)</td>
<td>-7.69 (0.00)</td>
<td>-4.19 (0.00)</td>
<td>-3.29 (0.00)</td>
</tr>
<tr>
<td>lag 2nd</td>
<td>9.69 (1.00)</td>
<td>8.85 (1.00)</td>
<td>-2.22 (0.01)</td>
<td>-4.62 (0.00)</td>
<td>-2.43 (0.00)</td>
<td>-2.20 (0.01)</td>
</tr>
<tr>
<td>lag 3rd</td>
<td>5.71 (1.00)</td>
<td>3.66 (1.00)</td>
<td>-0.25 (0.40)</td>
<td>-3.09 (0.00)</td>
<td>-3.37 (0.00)</td>
<td>-2.12 (0.01)</td>
</tr>
</tbody>
</table>

In these tests, the variables for Germany are prolonged with data for West-Germany before the unionization in 1991 to achieve a balanced panel.

a) Govt. purchases ($G_t$) subtracted cross-sectional means ($\bar{G}_t$). Trend and country specific constant terms are included in all the tests.

b) Change in govt. purchases ($g_t$) subtracted cross-sectional means ($\bar{g}_t$).

c) Unemployment ($U_t$) subtracted cross-sectional means ($\bar{U}_t$).

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

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In most of the analysis, we use a Fixed Effects (FE) estimator, allowing for permanent country-specific differences in unemployment that are not accounted for by the other explanatory variables. A random effect model would require that there is no correlation between the country fixed effects and the explanatory variables in the model. However, this assumption is rejected in a Hausman test with a p-value of 1 percent. In principle, the FE estimator is biased when the regression includes a lagged endogenous variable, see Nickell (1981). However, with a long time dimension of 27 years, this bias is small, cf. Judson and Owen (1999). In addition, other estimations methods which avoid the sample bias also have their difficulties, cf. Roodman (2009).

The growth in government purchases has generally been positive in real terms in the sample period, and the unweighted decade averages in our sample vary in the interval 0.52 – 0.74. There is however considerable variation within and across countries, see appendix table A1.

An important methodological 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 either by focussing on the effect of specific events that can be thought to be exogenous, such as changes in military spending in a response to political changes (e.g. Ramey and Shapiro (1999)), or by use of a structural vector autoregression (SVAR) model, where the
model explains several macroeconomic variables by their lags and exogenous shocks to the variables in the model, see e.g. Blanchard and Perotti (2002), Beetsma and Giuliodori (2010) and Monacelli et al. (2010). While these methods have clear advantages, they also have important weaknesses, cf Monacelli et al. (2010) and Auerbach et al. (2010). Monacelli et al. (2010) emphasise that changes in military spending are often undertaken in periods which differ also 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, one can question 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 and uncertainty about the policy response will lead to noise, possibly systematic, and may contaminate the results. These weaknesses provide a strong motivation for also trying other methods, with different advantages and problems. If different methods lead to similar results, it would be a strong indication of robust results.

Our focus on government purchases mitigates the endogeneity problem considerably, as this choice excludes budget items which are determined by rules and thus obviously endogenous, like tax revenues and expenditures on transfers, as well as all “passive” unemployment expenditure like unemployment benefits, and the large majority of active unemployment related expenditure, which are classified as transfers, not government purchases. In contrast, decisions on government purchases are in general not directly linked to the state of the economy. Clearly, the state of the economy also affects purchase decisions, but also other factors come into play, like electoral cycles, party politics, lobbyism and pressure groups, media attention, etc. Furthermore, a large part of government purchases may be subject to a lengthy bureaucratic process involving both the decision making and the implementation, implying that there is no clear cut or simple relationship between the state of the economy and government purchases.

Even if 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, and instrument with past values of the change in government purchases and past values of government debt. Second, we use an omitted variables approach. The idea here is that fiscal policy might be correlated with the error term because it is affected by other explanatory variables that also affect unemployment. By including the omitted variables, the potential bias will be reduced or removed, cf. discussion below. Furthermore, as 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.

3 Empirical results

We find that a change in government purchases has a highly significant negative impact on unemployment, the point estimate implying that an increase in government purchases equal to one percent of GDP reduces unemployment by 0.27 percentage points, cf table 2. The result is also robust to including time dummies. (For clarity, the complete results are relegated to the appendix, model 2 in table B1). The export market variables also have a significant negative effect on unemployment. In contrast to government purchases, the effect of the export market variables is smaller with year dummies, and the level effect becomes insignificant, suggesting that the export market variables without time dummies also capture the effect of common shocks that affect most or all OECD countries. Note that even if the level effect of the export market variable is positive, this variable is based on GDP-gaps and thus by construction only positive in a limited number of years in a row. Simulation exercises show that the overall effect of the export market is dominated by the
### Table 2: Estimation of equation (1) - Fixed Effects

<table>
<thead>
<tr>
<th></th>
<th>FE Coef.</th>
<th>FE Std</th>
<th>p-value</th>
<th>FE with time dummies Coef.</th>
<th>FE Std</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment previous period</td>
<td>1.34</td>
<td>0.08</td>
<td>0.00</td>
<td>1.37</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Unemployment two years ago</td>
<td>-0.57</td>
<td>0.10</td>
<td>0.00</td>
<td>-0.61</td>
<td>0.10</td>
<td>0.00</td>
</tr>
<tr>
<td>Unemployment three years ago</td>
<td>0.04</td>
<td>0.05</td>
<td>0.43</td>
<td>0.07</td>
<td>0.05</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Demand components:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export market, 1st diff. ($\Delta X_{Mt}$)</td>
<td>-0.48</td>
<td>0.10</td>
<td>0.00</td>
<td>-0.39</td>
<td>0.14</td>
<td>0.01</td>
</tr>
<tr>
<td>Export market, prev. period ($X_{Mt-1}$)</td>
<td>0.17</td>
<td>0.08</td>
<td>0.04</td>
<td>0.05</td>
<td>0.13</td>
<td>0.69</td>
</tr>
<tr>
<td>Export market, 1st diff. prev. period ($\Delta X_{Mt-1}$)</td>
<td>-0.18</td>
<td>0.08</td>
<td>0.03</td>
<td>-0.07</td>
<td>0.12</td>
<td>0.56</td>
</tr>
<tr>
<td>Change govt. purchases ($g_t$)</td>
<td>-0.27</td>
<td>0.08</td>
<td>0.00</td>
<td>-0.28</td>
<td>0.08</td>
<td>0.00</td>
</tr>
<tr>
<td>Obs = Country*Average groups</td>
<td>483</td>
<td>20</td>
<td>24.1</td>
<td>483</td>
<td>20</td>
<td>24.1</td>
</tr>
<tr>
<td>Standard deviation of residuals</td>
<td>0.63</td>
<td>0.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\chi^2$ of policy and exports[^a]</td>
<td>107.61</td>
<td>(0.00)</td>
<td>68.73</td>
<td>(0.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st order autocorrelation[^a]</td>
<td>1.50</td>
<td>(0.13)</td>
<td>1.34</td>
<td>(0.18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd order autocorrelation[^a]</td>
<td>-1.74</td>
<td>(0.08)</td>
<td>-1.74</td>
<td>(0.08)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dependent variable: The unemployment rate.

Estimation method: Fixed effect coefficients estimate with huber-robust standard error (Stata command `xtreg` with cluster(code) is used in all the regressions. We also control for labour market institutions.

\[^a\] Numbers in parentheses are p-values for the relevant null.

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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. One way to deal with this problem is to find instruments that are uncorrelated with the error term and correlated with the change in government purchases. We use the lagged first difference of the change in government purchases, as well as the lagged ratio of public debt to GDP.

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3.1 Endogeneity

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. One way to deal with this problem is to find instruments that are uncorrelated with the error term and correlated with the change in government purchases. We use the lagged first difference of the change in government purchases, as well as the lagged ratio of public debt to GDP.

\[^3\] Guajardo et al. (2011) estimate effects of fiscal consolidations in the interval from 0.25 to 0.53, but for the effect on unemployment, they do not distinguish between spending-based and tax-based consolidations.
Figure 1: The effect of a permanent increase in government purchases, equal to one percent of GDP, from 2008, based on simulation of equation (1) with estimated coefficients from the FE model in table 2

As shown in Table 3, 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 24, with a p-value of 0.00. Note that while our results in Table 2 imply that the lagged change in government purchases is correlated with lagged unemployment, the fact that lagged unemployment is also included in the equation implies that lagged government purchases may well be a valid instrument. We have also tried election year as instrument, based on the idea that fiscal policy may be used to increase the probability of reelection; see evidence in Shi and Svensson (2006). However, this did not affect the result, and as election year is potentially endogenous in countries where the government can choose the time of the election, we decided to leave it out in the presented specification.

Column 1 in Table 4 shows the results of the instrumental variable estimation. The point estimate indicates that an increase in government purchases equal to one percent of GDP reduces unemployment by 0.31 percentage points, i.e. close to the effect from the FE estimates. The effect is also highly statistically significant. Thus, there is no indication that government purchases is endogenous. The Hausman test statistics is equal to 5.88 which does not reject that the residuals are uncorrelated with the error term. The Hansen J overidentification test has a p-value of 0.31, giving no indication of invalid instruments. Yet these tests have limited power, and the Hansen J-test assumes that at least one instrument is valid. Thus, we choose to present both FE and IV estimations below.

For robustness, we also control for omitted variables. The idea is that fiscal policy might be correlated with the error term because it is affected by other explanatory variables that are excluded from the regression and that also are correlated with unemployment. This would be the case if fiscal policy is either pro- or counter-cyclical. 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). At the same time, the increase in tax revenues during the boom might be correlated with a fall in unemployment.
Table 3: First stage estimation

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>Std</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment previous period</td>
<td>-0.11</td>
<td>0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>Unemployment two years ago</td>
<td>0.10</td>
<td>0.07</td>
<td>0.12</td>
</tr>
<tr>
<td>Unemployment three years ago</td>
<td>0.02</td>
<td>0.04</td>
<td>0.51</td>
</tr>
<tr>
<td><strong>Demand components:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export market, 1st diff. ($\Delta X_{M_{t}}$)</td>
<td>-0.04</td>
<td>0.10</td>
<td>0.67</td>
</tr>
<tr>
<td>Export market, prev. period ($X_{M_{t-1}}$)</td>
<td>0.18</td>
<td>0.07</td>
<td>0.01</td>
</tr>
<tr>
<td>Export market, 1st diff. prev. period ($\Delta X_{M_{t-1}}$)</td>
<td>-0.08</td>
<td>0.10</td>
<td>0.42</td>
</tr>
<tr>
<td><strong>Instruments:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change govt. purchases, 1st diff. prev. period ($\Delta g_{t-1}$)</td>
<td>0.13</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Debt previous period</td>
<td>-0.01</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Observations: 440
F-test of additional instruments, p-value in parenthesis: 24 (0.00)

Dependent variable: The change in government purchases. We also control for labour market institutions.
First stage IV-regression of change in govt. purchases (Stata command xtivreg2, see Baum et al. (2002))

In this case, including tax revenues as a regressor in the unemployment equation would lend government purchases uncorrelated with the error term, removing the bias in the coefficient. As the government purchases are typically decided in the budget process in the fall the year prior to the budget year, it would be 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, two lags of the change in real GDP as well as the output gap, as explanatory variables. Thus, in table 4 we include the predicted change in tax revenues as a share of trend GDP to capture that higher revenues might lead to increased government purchases. 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 in downturns, when GDP growth is low, or the output gap is negative. To control for this, we also include GDP growth and the change in the output gap, both lagged, in table 4.

We observe that the estimated effect of government purchases is somewhat smaller when we include the additional explanatory variables in model 2 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. Note however that some of the export market variables are no longer significant. This emphasizes that including lagged GDP growth and lagged output gap entails a strong test of the explanatory power of the variables.

In model 3 in table 4, we control for the possible endogeneity of government purchases by also including consensus forecast for GDP growth, unemployment and the output gap. Again, one might conjecture that government purchases would respond to such forecasts, and that the correlation we find between government purchases and unemployment is due to both variables being correlated with the forecasts. However, the significant negative impact on unemployment remains, even controlling for forecasts.
Table 4: Equation (1): IV and FE with control for omitted variables

<table>
<thead>
<tr>
<th></th>
<th>IV</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>Std</td>
<td>p-value</td>
</tr>
<tr>
<td>Change govt. purchases, ((g_t))</td>
<td>-0.32</td>
<td>0.15</td>
<td>0.04</td>
</tr>
<tr>
<td>Unemployment previous period</td>
<td>1.37</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Unemployment two years ago</td>
<td>-0.62</td>
<td>0.09</td>
<td>0.00</td>
</tr>
<tr>
<td>Unemployment three years ago</td>
<td>0.06</td>
<td>0.04</td>
<td>0.15</td>
</tr>
<tr>
<td>Export market:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export market, 1st diff. (\Delta X M_t)</td>
<td>-0.45</td>
<td>0.08</td>
<td>0.00</td>
</tr>
<tr>
<td>Export market, prev. period (X M_{t-1})</td>
<td>0.22</td>
<td>0.09</td>
<td>0.01</td>
</tr>
<tr>
<td>Export market, 1st diff. prev. period (\Delta X M_{t-1})</td>
<td>-0.20</td>
<td>0.10</td>
<td>0.04</td>
</tr>
<tr>
<td>Controls:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log GDP 1st diff. prev. period</td>
<td>-25.75</td>
<td>6.74</td>
<td>0.00</td>
</tr>
<tr>
<td>Output gap 1st diff. prev. period</td>
<td>0.13</td>
<td>0.09</td>
<td>0.17</td>
</tr>
<tr>
<td>Predicted Direct and indirect taxes divided by trend GDP, 1st diff.</td>
<td>0.01</td>
<td>0.03</td>
<td>0.79</td>
</tr>
<tr>
<td>Predicted Direct and indirect taxes divided by trend GDP, 1st diff. prev. period</td>
<td>-0.02</td>
<td>0.07</td>
<td>0.81</td>
</tr>
<tr>
<td>Year_{t-1} forecast of GDP growth year (t)</td>
<td>0.01</td>
<td>0.08</td>
<td>0.88</td>
</tr>
<tr>
<td>Year_{t-1} forecast of output gap year (t)</td>
<td>-0.04</td>
<td>0.10</td>
<td>0.67</td>
</tr>
<tr>
<td>Year_{t-1} forecast of unemployment year (t)</td>
<td>-0.14</td>
<td>0.07</td>
<td>0.04</td>
</tr>
<tr>
<td>Year_{t-1} forecast of GDP growth year (t+1)</td>
<td>0.00</td>
<td>0.10</td>
<td>0.98</td>
</tr>
<tr>
<td>Year_{t-1} forecast of output gap year (t+1)</td>
<td>0.10</td>
<td>0.12</td>
<td>0.40</td>
</tr>
<tr>
<td>Year_{t-1} forecast of unemployment year (t+1)</td>
<td>0.14</td>
<td>0.07</td>
<td>0.04</td>
</tr>
</tbody>
</table>

|                                      |          |              |              |          |              |              |          |              |              |
| Obs = Country*Average groups         | 440      | 20           | 22.0         | 464      | 20           | 23.2         | 207      | 20           | 10.4         |
| Standard deviation of residuals      | 0.58     |              |              | 0.60     |              |              | 0.39     |              |              |
| F-test of additional instruments.    | 24 (0.00)|              |              |          |              |              |          |              |              |
| \(\chi^2\) of policy and exports.\(^c\) | 69.45 (0.00) | 25.74 (0.00) |          |          |              |              |          |              |              |
| 1st order autocorrelation\(^c\)      | 2.13 (0.03) | -2.93 (0.00) |          |          |              |              |          |              |              |
| 2nd order autocorrelation\(^c\)      | -1.47 (0.14) | 1.31 (0.19)  |          |          |              |              |          |              |              |
| Hansen J Overidentification test\(^c\) | 1.02 (0.31) |              |              |          |              |              |          |              |              |

Dependent variable: The unemployment rate. We also control for labour market institutions.

a) Stata command xtabsreg2, see Baum et al. (2002). Change govt. purchases \((g_t)\) is treated as endogenous. Instruments are: \(\Delta g_{t-1}\) and debt_{t-1}.

b) Fixed effect coefficients estimate. Huber-robust standard error (Stata command xtab with cluster(code)).

c) Numbers in parenthesis are p-values for the relevant null.
3.2 Cyclical effects and variation over time

An important question from a policy perspective is whether the effect of government purchases varies over the business cycle. We measure the cyclical situation of the economy by use of the output gap as calculated by the OECD.

In the first column in table 5, we extend equation (1) by including the interaction between the output gap and the change in government purchases, the latter measured as deviation from the country-specific mean, to ensure that the variable has a mean of zero. The interaction term is strongly significant, with positive sign, implying that an increase in government purchases leads to a larger reduction in unemployment in bad times when the output gap is negative than in good times. The estimated coefficient is equal to 0.05, which implies that if the output gap is negative and equal to $-3$ percentage point, an increase in government purchases equal to one percent of GDP will decrease unemployment by $-0.17 + (-3) \times 0.05 = -0.32$ percentage points at impact. 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 in a downturn is consistent with the findings of Auerbach and Gorodnichenko (2012a), who, using data for a large number of OECD countries, find that in recessions, an increase in government purchases increases GDP and employment, and reduces unemployment, while there is no significant effect in expansions. Also other studies report similar results: Auerbach and Gorodnichenko (2012b) find a larger fiscal multiplier in recessions than in expansions, using a regime-switching model on U.S. aggregate data; Nakamura and Steinsson (2012) find the same result exploiting differences across U.S. regions, while Batini et al. (2012) and Baum et al. (2012) report consistent evidence for some G7- countries. Using historical data, Owray et al. (2013) find no evidence that multipliers are higher during periods of high unemployment in the U.S., but some such evidence for Canada. For theoretical motivation for cyclical effects of fiscal policy, see the discussion of Michaillat (2012) in Section 3.3 below.

The systematic link between the output gap and the effect of government purchases has potentially vast policy interest, in particular for countries where fiscal tightening is required. The results in table 5 show that it matters when the fiscal tightening takes place, as the same fiscal tightening has a stronger effect on unemployment in a downturn of the economy.

Model 2 in table 5 shows that the effect of government purchases varies over time: In the 1960s and 70s, we find essentially no effect of government purchases on unemployment, in sharp contrast to the later period. As the relationship clearly has changed significantly after 1980, it would be misleading to put so different decades together by imposing the same relationship. This is the motivation for restricting attention to the time after 1980 in the other regressions.

One might speculate that the absence of any effect in the 1960s reflects that unemployment in almost all countries was very stable and low, not giving much room for an effect of government purchases. In contrast, in the 1970s, unemployment rose quite sharply in most countries, and some countries tried to counteract this rise by use of expansionary fiscal policy. Thus, there could be a downward bias in the estimate reflecting that the rise in unemployment induced increased government spending, suggesting the use of IV. However, the IV results in the third model in table 5 are broadly in line with the FE results, providing no support for this possibility.
Table 5: The effect of the cyclical situation and change over time

<table>
<thead>
<tr>
<th></th>
<th>Model 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th></th>
<th>Model 2&lt;sup&gt;b&lt;/sup&gt;</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>Std</td>
<td>p-value</td>
<td>Coef.</td>
</tr>
<tr>
<td>Unemployment previous period</td>
<td>1.16</td>
<td>0.09</td>
<td>0.00</td>
<td>1.24</td>
</tr>
<tr>
<td>Unemployment two years ago</td>
<td>-0.45</td>
<td>0.10</td>
<td>0.00</td>
<td>-0.38</td>
</tr>
<tr>
<td>Unemployment three years ago</td>
<td>0.06</td>
<td>0.05</td>
<td>0.20</td>
<td>-0.02</td>
</tr>
</tbody>
</table>

**Demand components:**

- Export market, 1st diff. (ΔXM<sub>t</sub>)
- Export market, prev. period (XM<sub>t-1</sub>)
- Export market, 1st diff. prev. period (ΔXM<sub>t-1</sub>)
- Change govt. purchases (g<sub>t</sub>)
- Interaction change govt. purchases (g<sub>t</sub> - 3) and output gap Y<sub>t</sub>
- Output gap from OECD (Y<sub>t</sub>)

- Change govt. purchases (g<sub>t</sub>), 1960s
- Change govt. purchases (g<sub>t</sub>), 1970s
- Change govt. purchases (g<sub>t</sub>), 1980s
- Change govt. purchases (g<sub>t</sub>), 1990s
- Dummy for 1970s
- Dummy for 1980s
- Dummy for 1990s
- Dummy for 2000s

|                     | 0.04 | 0.07 | 0.51 | 0.12 | 0.10 | 0.24 | 0.04 | 0.05 | 0.40 | 0.28 | 0.30 | 0.36 | -0.33 | 0.15 | 0.03 | -0.42 | 0.32 | 0.20 | -0.45 | 0.18 | 0.01 | -0.38 | 0.26 | 0.15 | -0.28 | 0.09 | 0.00 | -0.81 | 0.35 | 0.02 | 0.25 | 0.15 | 0.10 | 0.23 | 0.30 | 0.45 | 0.77 | 0.15 | 0.00 | 1.13 | 0.24 | 0.00 | 0.89 | 0.21 | 0.00 | 1.22 | 0.23 | 0.00 | 0.65 | 0.20 | 0.00 | 1.25 | 0.28 | 0.00 |

|                     | 4.58 | 0.65 | 0.63 | 0.58 | 0.65 | 0.63 | 4 (0.00) | 2 (0.09) | 2 (0.07) | 6 (0.00) | 3 (0.00) | 101.79 (0.00) | 162.75 (0.00) | 97.50 (0.00) | 2.81 (0.01) | 1.15 (0.25) | 1.57 (0.12) | 0.44 (0.66) | 15.98 (0.10) |

Dependent variable: The unemployment rate. We also control for labour market institutions.

<sup>a</sup> Fixed effect coefficients estimate. Huber-robust standard error (Stata command xtreg with cluster(code).

<sup>b</sup> Stata command xtivreg2, see Baum et al. (2002). IV: Change govt. purchases (g<sub>t</sub>) is treated as endogenous. Instruments are: (∆g<sub>t-1</sub>), (g<sub>t-2</sub>), (Δdebt<sub>t-1</sub>) and (debt<sub>t-1</sub>).

<sup>c</sup> First regression results of stata command xtivreg2, see Baum et al. (2002).

<sup>d</sup> Numbers in parentheses are p-values for the relevant null.
3.3 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 expenditures 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 1960-2007). We consider the same form of the left hand side variable as before, i.e., the change in each of this categories, in real terms, and measured as share of trend-GDP, see appendix A for a detailed explanation.

Model 1 in table 6 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 negative but small. Ramey (2012) also find a stronger effect on unemployment from government wage consumption - hiring workers - than from other parts of government purchases, while Ilzetzki et al. (2013) find fairly similar effects on GDP of from shocks in government consumption and investment for advanced countries, with multiplier estimates (the effect of government consumption on GDP) 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. Benetrix and Lane (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 non-wage consumption; incidentally, this result only applies for EMU countries, cf section 3.4 below.

In model 2 in table 6, we explore possible interaction with the cyclical state of the economy. 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, consistent with our prior results. The effect is large: with an output gap of minus 3, the coefficient is \(-0.55 + (-3) \times 0.13 = -0.94\), implying that an increase in government wage consumption equal to one percent of GDP reduces unemployment with almost one percentage point at impact. This finding is consistent with the predictions from the dynamic stochastic general equilibrium search model of Michaillat (2012). In this model increased public employment has a much stronger effect on total employment in 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.

The third model in table 6 presents the result of model 1 using IV; we find that the effect of government investment is much stronger, with a point estimate of \(-0.78\), and a p-value of 0.06. The point estimate of wage consumption is about as in the FE estimation, \(-0.61\), but not statistically significant.
Table 6: The effect of different types of government purchases

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>Std</th>
<th>p-value</th>
<th>Coef.</th>
<th>Std</th>
<th>p-value</th>
<th>Coef.</th>
<th>Std</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment previous period</td>
<td>1.27</td>
<td>0.07</td>
<td>0.00</td>
<td>1.04</td>
<td>0.08</td>
<td>0.00</td>
<td>1.27</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Unemployment two years ago</td>
<td>-0.51</td>
<td>0.10</td>
<td>0.00</td>
<td>-0.36</td>
<td>0.08</td>
<td>0.00</td>
<td>-0.53</td>
<td>0.10</td>
<td>0.00</td>
</tr>
<tr>
<td>Unemployment three years ago</td>
<td>0.01</td>
<td>0.05</td>
<td>0.78</td>
<td>0.05</td>
<td>0.04</td>
<td>0.19</td>
<td>0.02</td>
<td>0.05</td>
<td>0.66</td>
</tr>
</tbody>
</table>

**Demand components:**

- Export market, 1st diff. ($\Delta MX_t$)
  - Model 1: Coef. -0.43, Std 0.11, p-value 0.00
  - Model 2: Coef. -0.24, Std 0.07, p-value 0.00

- Export market, prev. period ($MX_{t-1}$)
  - Model 1: Coef. 0.17, Std 0.12, p-value 0.00
  - Model 2: Coef. 0.28, Std 0.12, p-value 0.00

- Export market, 1st diff. prev. period ($\Delta MX_{t-1}$)
  - Model 1: Coef. -0.23, Std 0.10, p-value 0.00
  - Model 2: Coef. -0.28, Std 0.08, p-value 0.00

- Change govt. investments, ($ig_t$)
  - Model 1: Coef. -0.13, Std 0.12, p-value 0.00
  - Model 2: Coef. -0.07, Std 0.08, p-value 0.43

- Change govt. non-wage consumption, ($cgnw_t$)
  - Model 1: Coef. -0.05, Std 0.02, p-value 0.00
  - Model 2: Coef. -0.03, Std 0.02, p-value 0.00

- Change govt. wage consumption, ($cgw_t$)
  - Model 1: Coef. -0.68, Std 0.20, p-value 0.00
  - Model 2: Coef. -0.55, Std 0.15, p-value 0.00

- Interaction ($ig_t - ig_{t-1}$) and $\bar{Y}_t$
  - Model 1: Coef. -0.01, Std 0.04, p-value 0.90
  - Model 2: Coef. 0.01, Std 0.01, p-value 0.35

- Interaction ($cgnw_t - cgnw_{t-1}$) and $\bar{Y}_t$
  - Model 1: Coef. 0.13, Std 0.05, p-value 0.00
  - Model 2: Coef. 0.13, Std 0.05, p-value 0.00

- Output gap from OECD ($\bar{Y}_t$)
  - Model 1: Coef. -0.17, Std 0.03, p-value 0.00
  - Model 2: Coef. -0.17, Std 0.03, p-value 0.00

- Obs = Country*Average groups
  - Model 1: 375, Std 16, 23.4
  - Model 2: 375, Std 16, 23.4
  - IV: 357, Std 16, 22.3

- Standard deviation of residuals
  - Model 1: 0.59
  - Model 2: 0.53
  - IV: 0.60

- F-test of additional instruments, govt. investments.\(^{cd}\)
  - Model 1: 5.03 (0.00)
  - Model 2: 1.87 (0.06)

- F-test of additional instruments, govt. non-wage consumption.\(^{cd}\)
  - Model 1: 3.13 (0.00)

- F-test of additional instruments, govt. wage consumption.\(^{cd}\)
  - Model 1: 229.65 (0.00)
  - Model 2: 241.64 (0.00)

- \(\chi^2\) of policy and exports.\(^b\)
  - Model 1: 1.73 (0.08)
  - Model 2: 2.82 (0.01)

- \(^b\) Numbers in parentheses are p-values for the relevant null.

- 1st order autocorrelation\(^b\)
  - Model 1: 1.70 (0.09)
  - Model 2: 0.82 (0.41)

- Hansen J Overidentification test
  - Model 1: 9.08 (0.11)

Dependent variable: The unemployment rate. We also control for labour market institutions.

a) Fixed effect coefficients estimate, robust standard errors (xtreg with ,robust)
b) Stata command xtivreg2 with option robust, see Baum et al. (2002). Change govt. investments ($ig_t$), non-wage consumption ($cgnw_t$) and wage consumption ($cgw_t$) are treated as endogenous. Instruments are: ($\Delta ig_{t-1}$), ($\Delta cgnw_{t-1}$), ($\Delta cgw_{t-1}$), ($ig_{t-2}$), ($cgnw_{t-2}$), ($cgw_{t-2}$) and ($\Delta debt_{t-1}$).
c) First regression results of stata command xtivreg2, see Baum et al. (2002).
d) Numbers in parentheses are p-values for the relevant null.
3.4 Monetary regime, labour market institutions, debt and openness

In this subsection we first explore whether the effect of government purchases depends on the monetary regime, as emphasized in recent literature, e.g. Coenen et al. (2010). 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 in the European Monetary Union (EMU). Countries that took part in the European Exchange Rate Mechanism ERM are defined as having a fixed exchange rate regime, except for Germany, which we define as floating in light of Germany’s dominating position and the independent status of the Bundesbank.

Model 1 in table 7 shows that the effect of government purchases differs sharply across monetary regimes. The point estimate is $-0.32$ in the EMU and $-0.43$ with a fixed exchange rate regime, both statistically significant. In contrast, the point estimate is smaller and imprecisely determined with a floating exchange rate. The difference across regimes is consistent with standard textbook macro models like the Mundell Fleming model: Under an inflation target, an expansionary effect of increased government purchases will be counteracted by a rise in the interest rate, partly offsetting the effect on unemployment. Also with other types of floating exchange rates, one would expect an expansionary effect from fiscal policy to be counteracted by changes in the exchange rate and the interest rate. In contrast, if the nominal interest rate is unaffected, as it will be with a fixed exchange rate and for a small country in a monetary union, and inflation and inflation expectations increase so that the real interest falls, the government multiplier might be considerably above unity.

The difference across exchange rate regimes is consistent with the results of Ilzetzki et al. (2013) who find a significant positive effect of increased government consumption on GDP for fixed exchange rate regimes, while the effect is significant and negative at impact for floating regimes. Model 2 displays the IV results: here the coefficient in the EMU is statistically significant and negative, while the other coefficients are fairly small and not statistically significant.

In model 3, we explore whether the effect of the cyclical situation depends on the monetary regime by including an interaction term between the output gap, a dummy for monetary regime and the change in government purchases, measured as a deviation from the country-specific mean. The interaction terms are all positive, consistent with our results above the fiscal policy has a stronger effect on unemployment during a downturn, but the coefficient is only significant for the fixed exchange rate.
Table 7: The effect of monetary regime and labour market institutions

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th></th>
<th>Coef.</th>
<th>Std</th>
<th>p-value</th>
<th>Coef.</th>
<th>Std</th>
<th>p-value</th>
<th>Coef.</th>
<th>Std</th>
<th>p-value</th>
<th>Coef.</th>
<th>Std</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment previous period</td>
<td>1.32</td>
<td>0.07</td>
<td>0.00</td>
<td>1.37</td>
<td>0.06</td>
<td>0.00</td>
<td>1.13</td>
<td>0.08</td>
<td>0.00</td>
<td>1.32</td>
<td>0.08</td>
<td>0.00</td>
<td>1.30</td>
<td>0.07</td>
</tr>
<tr>
<td>Unemployment two years ago</td>
<td>-0.56</td>
<td>0.10</td>
<td>0.00</td>
<td>-0.63</td>
<td>0.09</td>
<td>0.00</td>
<td>-0.43</td>
<td>0.09</td>
<td>0.00</td>
<td>-0.53</td>
<td>0.10</td>
<td>0.00</td>
<td>-0.53</td>
<td>0.10</td>
</tr>
<tr>
<td>Unemployment three years ago</td>
<td>0.04</td>
<td>0.04</td>
<td>0.36</td>
<td>0.06</td>
<td>0.04</td>
<td>0.19</td>
<td>0.06</td>
<td>0.04</td>
<td>0.19</td>
<td>0.02</td>
<td>0.05</td>
<td>0.65</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>Export market:</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Export market, 1st diff. (∆XM)_t</td>
<td>-0.47</td>
<td>0.09</td>
<td>0.00</td>
<td>-0.43</td>
<td>0.08</td>
<td>0.00</td>
<td>-0.27</td>
<td>0.07</td>
<td>0.00</td>
<td>-0.48</td>
<td>0.10</td>
<td>0.00</td>
<td>-0.47</td>
<td>0.10</td>
</tr>
<tr>
<td>Export market, prev. period (XM_{t-1})</td>
<td>0.15</td>
<td>0.08</td>
<td>0.06</td>
<td>0.19</td>
<td>0.09</td>
<td>0.03</td>
<td>0.28</td>
<td>0.07</td>
<td>0.00</td>
<td>0.21</td>
<td>0.08</td>
<td>0.01</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Export market, 1st diff. prev. period (∆XM_{t-1})</td>
<td>-0.19</td>
<td>0.09</td>
<td>0.03</td>
<td>-0.19</td>
<td>0.10</td>
<td>0.06</td>
<td>-0.21</td>
<td>0.07</td>
<td>0.00</td>
<td>-0.22</td>
<td>0.09</td>
<td>0.02</td>
<td>-0.22</td>
<td>0.10</td>
</tr>
<tr>
<td>Govt. purchases and monetary regime:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Change govt. purchases (g_t), Monetary union (EMU)</td>
<td>-0.32</td>
<td>0.16</td>
<td>0.05</td>
<td>-0.40</td>
<td>0.21</td>
<td>0.06</td>
<td>-0.55</td>
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<td>0.13</td>
<td>0.00</td>
<td>-0.44</td>
<td>0.11</td>
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<tr>
<td>Change govt. purchases (g_t), Fixed exchange rate</td>
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<td>0.13</td>
<td>0.00</td>
<td>-0.11</td>
<td>0.25</td>
<td>0.67</td>
<td>-0.21</td>
<td>0.10</td>
<td>0.04</td>
<td>-0.31</td>
<td>0.11</td>
<td>0.01</td>
<td>-0.33</td>
<td>0.08</td>
</tr>
<tr>
<td>Change govt. purchases (g_t), Floating exchange rate</td>
<td>-0.05</td>
<td>0.09</td>
<td>0.56</td>
<td>-0.25</td>
<td>0.24</td>
<td>0.30</td>
<td>0.04</td>
<td>0.08</td>
<td>0.62</td>
<td>-0.23</td>
<td>0.08</td>
<td>0.01</td>
<td>-0.24</td>
<td>0.09</td>
</tr>
<tr>
<td>Dummy for EMU</td>
<td>0.01</td>
<td>0.27</td>
<td>0.07</td>
<td>-0.14</td>
<td>0.26</td>
<td>0.58</td>
<td>0.06</td>
<td>0.25</td>
<td>0.81</td>
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<td>1.00</td>
<td>0.00</td>
<td>0.21</td>
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<tr>
<td>Dummy for Fixed exchange rate</td>
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<td>0.27</td>
<td>0.09</td>
<td>0.08</td>
<td>0.34</td>
<td>0.82</td>
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<td>0.28</td>
<td>0.56</td>
<td>0.33</td>
<td>0.21</td>
<td>0.11</td>
<td>0.33</td>
<td>0.21</td>
</tr>
<tr>
<td>Interaction change govt. purchases (g_t - ̄Y) and output gap ̄Y, Monetary union (EMU)</td>
<td>0.11</td>
<td>0.09</td>
<td>0.21</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Interaction change govt. purchases (g_t - ̄Y) and output gap ̄Y, Fixed exchange rate, credible</td>
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<td>0.02</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Interaction change govt. purchases (g_t - ̄Y) and output gap ̄Y, Floating exchange rate</td>
<td>0.02</td>
<td>0.05</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Output gap from OECD (̄Y)</td>
<td>-0.16</td>
<td>0.03</td>
<td>0.00</td>
<td></td>
<td></td>
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<tr>
<td>Govt. purchases and labour market:</td>
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<tr>
<td>Change govt. purchases, (g_t)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Interaction change govt. purchases and the predicted effect of labour market institutions</td>
<td>-0.31</td>
<td>0.07</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Obs = Country*Average groups</td>
<td>483</td>
<td>20</td>
<td>24.1</td>
<td>4.40</td>
<td>20</td>
<td>22.0</td>
<td>483</td>
<td>20</td>
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<td>24.1</td>
<td>483</td>
<td>20</td>
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<td>0.58</td>
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<td>0.57</td>
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<td>0.62</td>
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</tr>
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<td>F-test of additional instruments, EMU, ed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.63</td>
<td>(0.00)</td>
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<td>4.84</td>
<td>(0.00)</td>
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<td>F-test of additional instruments, Fixed exchange rate, ed</td>
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<td></td>
<td></td>
<td></td>
<td>5.98</td>
<td>(0.00)</td>
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</tr>
<tr>
<td>F-test of additional instruments, Floating exchange rate, ed</td>
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<td></td>
</tr>
<tr>
<td>$\chi^2$ of policy and exports, ed</td>
<td>135.87</td>
<td>(0.00)</td>
<td></td>
<td></td>
<td>127.24</td>
<td>(0.00)</td>
<td>103.79</td>
<td>(0.00)</td>
<td>138.21</td>
<td>(0.00)</td>
<td></td>
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<td></td>
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<tr>
<td>1st order autocorrelation, ed</td>
<td>1.26</td>
<td>(0.21)</td>
<td></td>
<td></td>
<td>2.73</td>
<td>(0.01)</td>
<td>1.51</td>
<td>(0.13)</td>
<td>0.99</td>
<td>(0.32)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd order autocorrelation, ed</td>
<td>-1.59</td>
<td>(0.11)</td>
<td></td>
<td></td>
<td>1.12</td>
<td>(0.30)</td>
<td>-1.48</td>
<td>(0.14)</td>
<td>-1.71</td>
<td>(0.09)</td>
<td></td>
<td></td>
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<tr>
<td>Hansen J overidentification test</td>
<td>8.10</td>
<td>(0.23)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Dependent variable: The unemployment rate. We also control for labour market institutions.

a) Fixed effect coefficients estimates, robust standard errors (xtreg with robust).

b) Huber-robust standard error stata command xttab with cluster(code).

c) First regression results of stata command xttab2, see Baum et al. (2002).

d) Numbers in parenthesis are p-values for the relevant null.
We then turn to the importance 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 market and labour market are segmented, that sticky wages are essential to obtain expansionary effects of fiscal policy.

First, as noted above we include institutions in all the regressions. This turns out to be of limited importance, as the effect of fiscal policy is only slightly larger in a regression without the labour market institutions (results available on request). Second, we explore whether the effect of fiscal policy depends on labour market institutions. To this end, we first construct a summary index of the labour market institutions by calculating the product of the estimated coefficients from model 3 in table B1 in the appendix and the actual values of the labour market institutions. We compute the deviation of the index from its sample mean to obtain an index with zero mean. We then interact the change in government purchases with the index of labour market institutions. The results in Table 7, column 4, shows that an increase in government purchases has a stronger negative impact on unemployment in country-years with labour market institutions that induce higher unemployment. The effect is highly significant statistically, and numerically rather strong: In Australia, labour market institutions are “employment-friendly” with mean index value \(-0.77\), and the effect on unemployment of an increase in government purchases equal to one percent of GDP is equal to \(-0.31 + (-0.77) \times (-0.26) = -0.11\). In contrast, in Sweden, institutions are more conducive to unemployment with mean index of 0.38, implying that the overall coefficient for an increase in government purchases is \(-0.31 + 0.38 \times (-0.26) = -0.41\). Thus, fiscal policy seems to have a stronger impact on unemployment in countries with adverse labour market institutions, in line with the analysis of Furlanetto (2011). This result correspond to Auerbach and Gorodnichenko (2012a), who find that as the rigidity in the labour market rises, the output response in recessions increases.

One possible concern with these results is that they may be caused by spurious correlation, as labour market institutions are generally more rigid in Continental Europe, where we also find most of the EMU countries. Thus, in column 5, we include the interaction of fiscal policy and monetary regime, and we find that the results still hold - fiscal policy has a larger effect with adverse labour market institutions. In fact, the coefficient for government purchases is now negative and statistically significant for all three monetary regimes, suggesting that an increase in government purchases has a negative impact also under a floating regime, as long as the labour market institutions are at the average.

We have also tried other possible interaction effects. Giavazzi and Pagano (1990) argue that a severe fiscal contraction might be expansionary in situations with concern for the risks of high public debt. This suggests that the effect of government purchases may depend on the level of public debt. In a recent study using structural VARs on quarterly data for 44 countries, both advanced and developing countries, Ilzetzki et al. (2013) find that the fiscal multiplier depends on the level of government debt, and that the fiscal multiplier is zero in high debt countries. To explore the possible importance of public debt, we interact the change in government purchases with lagged public debt as a ratio to GDP (measured as deviation from sample mean, which is equal to 0.65). We interact with debt above and below the mean separately, to allow for non-linear effects, and we also include debt as a separate explanatory variable, as the levels of debt might well be correlated with the level of unemployment, cf. Bertola (2010). However, the interaction terms have no explanatory power, with coefficients of about 0.001 and fairly small standard errors (0.006 and 0.004), implying that these effects are fairly precisely estimated to zero (results available on request).

We also explore whether the effect of government purchases depends on the openness of the country as suggested in traditional Keynesian analysis. In an analysis of 14 EU
countries, Beetsma and Giuliodori (2010) find a clear positive effect of a rise in government purchases on GDP in “closed economies” (defined as countries where the ratio of export plus import to GDP is below sample average), and no significant effect in the remaining “open economies”. Ilzetzki et al. (2013) also find a stronger expansionary effect in closed economies than in open. To analyse the effect of openness, we interact the change in government purchases with an indicator of openness, based on the ratio of export plus import to GDP. As the degree of openness has increased over time, we consider two different specifications of this indicator, one where the indicator measures the deviation of the export plus import ratio from the overall sample mean, implying that the indicator also captures the increase in openness over time, and one where the indicator is measured as deviation from year mean, thus omitting the change in openness over time. However, in both cases the interaction term is close to zero when we control for monetary regime (results available on request).

4 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 rate. Generally, we find effects which are very similar as those reported above, with coefficients of the opposite sign. For example, when we estimate equation 1 with the employment rate as the dependent variable, the coefficient for the change in government purchases is 0.23, with a p-value of 0.00, cf. Table 8. Models 2 and 3 show that it is essentially government wage consumption which has a positive effect on employment, and for this variable the effect is much stronger in recessions (when the output gap is negative), consistent with our unemployment findings above. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The corresponding between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on unemployment indicates that variation in government purchases usually has limited effect on labour supply. The correspondance between the effects on employment and on employment rate

As above, we find that the effect of government purchases on the labour market is stronger in countries with institutions that are conducive to unemployment. Furthermore, when we control for labour market institutions, we find that an increase in government purchases leads to higher employment also in countries with a floating exchange rate (Model 5 in Table 9), even if the point estimate is still considerably lower than under a fixed exchange rate.
Table 8: The effect on the employment rate

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Model 1 with time dummies</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coef.</td>
<td>Std</td>
<td>p-value</td>
<td>Coef.</td>
</tr>
<tr>
<td>Employment previous period</td>
<td>1.54</td>
<td>0.09</td>
<td>0.00</td>
</tr>
<tr>
<td>Employment two years ago</td>
<td>-0.76</td>
<td>0.12</td>
<td>0.00</td>
</tr>
<tr>
<td>Employment three years ago</td>
<td>0.14</td>
<td>0.05</td>
<td>0.00</td>
</tr>
<tr>
<td>Demand components:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export market, 1st diff. (∆XM_t)</td>
<td>0.40</td>
<td>0.09</td>
<td>0.00</td>
</tr>
<tr>
<td>Export market, prev. period (XM_t−1)</td>
<td>-0.16</td>
<td>0.07</td>
<td>0.01</td>
</tr>
<tr>
<td>Export market, 1st diff. prev. period (∆XM_t−1)</td>
<td>0.14</td>
<td>0.07</td>
<td>0.01</td>
</tr>
<tr>
<td>Change govt. purchases (g_t)</td>
<td>0.23</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Change govt. investments (ig_t)</td>
<td>0.45</td>
<td>0.16</td>
<td>0.00</td>
</tr>
<tr>
<td>Change govt. non-wage consumption, (cgnw_t)</td>
<td>-0.03</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Change govt. wage consumption, (cgw_t)</td>
<td>0.45</td>
<td>0.16</td>
<td>0.00</td>
</tr>
<tr>
<td>Interaction (ig_t−ig_t) and Y_t−Y_t</td>
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<td>0.04</td>
<td>0.92</td>
</tr>
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<td>0.00</td>
<td>0.91</td>
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<td>Interaction (cgw_t−cgw_t) and Y_t−Y_t</td>
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<td>0.02</td>
<td>0.00</td>
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<tr>
<td>Output gap from OECD (Y_t)</td>
<td>0.17</td>
<td>0.04</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Obs = Country*Average groups

Standard deviation of residuals

χ² of policy and exports

1st order autocorrelation

2nd order autocorrelation

Dependent variable: The employment to population rate.

Estimation method: Fixed effect coefficients estimate with huber-robust standard error (Stata command xtregr with cluster(code) and robust option is used in all the regressions. We also control for labour market institutions.

a) Numbers in parentheses are p-values for the relevant null.
Table 9: The effect on the employment rate

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2 IV</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
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<tr>
<td></td>
<td>Coef.</td>
<td>Std p-value</td>
<td>Coef.</td>
<td>Std p-value</td>
<td>Coef.</td>
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<td>0.09</td>
<td>1.64</td>
<td>0.07</td>
<td>1.31</td>
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<td>Employment two years ago</td>
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<td>-0.92</td>
<td>0.12</td>
<td>-0.62</td>
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<tr>
<td>Employment three years ago</td>
<td>0.14</td>
<td>0.04</td>
<td>0.19</td>
<td>0.06</td>
<td>0.19</td>
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<td>Export market:</td>
<td></td>
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<tr>
<td>Export market, 1st diff.</td>
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<td>0.09</td>
<td>0.31</td>
<td>0.09</td>
<td>0.21</td>
</tr>
<tr>
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<td>0.06</td>
<td>-0.11</td>
<td>0.10</td>
<td>-0.23</td>
</tr>
<tr>
<td>Export market, 1st diff. prev. period</td>
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<td>0.07</td>
<td>0.13</td>
<td>0.09</td>
<td>0.14</td>
</tr>
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<td>Govt. purchases and monetary regime:</td>
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<td></td>
<td></td>
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<td>Change govt. purchases (g_t) Monetary union (EMU)</td>
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<td>0.21</td>
<td>0.01</td>
<td>0.17</td>
</tr>
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<td>0.07</td>
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<td>-0.37</td>
<td>0.29</td>
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<tr>
<td>Dummy for Fixed exchange rate</td>
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<td>0.25</td>
<td>0.32</td>
<td>0.16</td>
<td>0.30</td>
</tr>
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<td>0.10</td>
<td>-0.28</td>
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<td>Change govt. purchases, (g_t)</td>
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<td>2.34 (0.02)</td>
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<td>-0.41 (0.68)</td>
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</table>

Dependent variable: The employment to population rate. We also control for labour market institutions.

a) Fixed effect coefficients estimate, robust standard errors (xtreg with cluster(code).

b) Stata command ivreg2, see Baum et al. (2002). Change govt. purchases (g_t) is treated as endogenous. Instruments, separately for each regime, are (∆g_{t-1}) and (∆debt_{t-1}).

c) First regression results of stata command ivreg2, see Baum et al. (2002).

d) Numbers in parenthesis are p-values for the relevant null.
5 Concluding remarks

We investigate the effect of changes in government purchases on unemployment and employment by use of panel data estimation, building on an empirical equation where long run unemployment is a function of a number of labour market variables, along the lines of Layard et al. (2005) and Nickell et al. (2005). Our study exploits a fairly large data set, covering 20 countries and 27 years, making it possible to explore how the effect differs according to the circumstances, like monetary regime, cyclical situation of the economy, and whether the labour market institutions are "employment-friendly". It turns out that the effect differs strongly with these circumstances, underscoring the importance of exploring the differences.

We find that a permanent increase in government purchases equal to one percent of GDP on average leads to a reduction in unemployment of 0.3 percentage point, using both fixed effects and IV estimation. The effect is somewhat smaller when controlling for omitted variables. There is considerable variation in the effect of government purchases depending on the specific circumstances. Consistent with recent studies like Auerbach and Gorodnichenko (2012b,a), Nakamura and Steinsson (2012), Baum et al. (2012) and Batini et al. (2012), we find that the effect is considerably larger when the economy is in a weak cyclical situation.

The systematic link between the output gap and the effect of government purchases has potentially vast policy interest. In many countries, the increasing public debt implies that fiscal policy has to be tightened before long, so there is limited scope for using fiscal policy to reduce unemployment. Our results suggest that the effects of fiscal tightening on unemployment is likely to be much larger if the tightening is undertaken during the current downturn, than if tightening is postponed until the economy is in better shape. This result is in line with the countercyclical effect of fiscal policy in the general equilibrium search model of Michaillat (2012). While other considerations also come into play, as to what extent large budget deficits can be financed without a rise in interest rates, the findings provide a clear argument against large cuts in public purchases during the current downturn. More generally, the results indicate that countercyclical fiscal policy, which is fiscal neutral over the cycle, may in fact reduce unemployment over time, as the effect in recessions is likely to be larger than the opposing effect in booms.

The monetary regime is important for the effect. In line with the Mundell Fleming model, we find a strong effect of government purchases on unemployment for countries within a monetary union or with a fixed exchange rate regime, and much weaker effects of government purchases for countries with a floating exchange rate. This finding is consistent with the argument of among others Coenen et al. (2010), that fiscal policy has a strong impact on the economy when 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 (2012). We also find that the fiscal policy has a stronger effect in countries with labour market institutions that are conducive to high unemployment, in line with Furlanetto (2011)’s finding that wage stickiness might be crucial for the existence of an expansionary effect of a fiscal stimulus. We find no indication that the effect of fiscal policy depends on the size of public debt; the relevant coefficient is fairly precisely estimated to zero.

Finally, we explore the effect of a change in government purchases on the employment rate. For the most part, the results correspond well to the unemployment results. Increased government purchases equal to one percent of GDP is estimated to increase the employment rate by 0.23 percentage points. The effect essentially comes from government wage consumption (i.e. public employment), it is stronger in a downturn, and also stronger
in countries with a fixed exchange rate.

We do not distinguish between tax-financed and debt-financed expenditure, as this requires that one is able to differentiate between tax changes induced by changes in the economy and tax changes linked to the financing of public expenditure. Given the identification problems that are involved, we have chosen not to do this at this stage. Thus, our results must be interpreted as an average effect, where the weights depend on the average method of financing over the sample period.

A Appendix: Data definitions and sources

The data are from OECD (2008b) unless otherwise noted. The sample period is from 1980 to 2007, except for Table 5, which also includes 1960-1979, with the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States (for Germany, the data starts in 1991). The labour market data is also based on the OECD (2008b), but the more detailed description is given in Sparrman (2011).

A.1 Government purchases

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

\[
g_{it} = \frac{CGV_{it} + IGV_{it} - (CGV_{it-1} - IGV_{it-1})}{CGV_{it-1} + IGV_{it-1}} \times \frac{CG_{it} + IG_{it} - CFKG_{it}}{YCT_{it}} \times 100 \quad (A1)
\]

where \( CG \) is government consumption, \( IG \) government investments, \( CFKG \) is consumption of fixed capital, and \( YCT \) is trend-GDP. The variables are in nominal prices, except those where the last letter \( V \) indicates real terms. Note that government purchases do not include transfers like social security expenditures etc. Note also that we subtract consumption of fixed capital \( CFKG \) from government consumption to obtain the actual expenditure, as the consumption of fiscal capital is an imputed measure. \( CFKG \) is not subtracted in the real growth rate for reasons of data availability, but this is unimportant as there presumably is little variation over time in the imputed consumption of fixed capital. Investment data is missing for some countries (Spain, Italy, Switzerland) and for these countries we use government consumption only. Trend-GDP is equal to the backward looking 10 year moving average of real GDP \( YQ \) multiplied with the two year moving average of the price deflator \( PGDP \) to a variable in nominal terms. Some of the volume variable series are calculated on the basis of the relevant identities with values and deflators, as they are not published by the OECD.

A.2 Monetary regime

We have constructed 3 dummies to account for the monetary regime over the sample period; a floating exchange rate, a fixed exchange rate, and membership in the European Monetary Union (EMU). The dummy \( D_{\text{float}} \) indicates a floating exchange rate: Australia, Canada, Germany, Japan, New Zealand, Switzerland, United States and United Kingdom (except 1990 and 1991). Germany is defined to have a floating regime in light of Germany’s dominating position European Exchange Rate Mechanism ERM, and the independent status of the Bundesbank. Later also Sweden (since 1992) and Norway (since

\[^4\] The UK was a member of the European exchange rate mechanism (ERM) from October 1990 to September 1992
1999, which is usually assumed to be the year with the de facto change of regime) adopted a floating exchange rate, with inflation targeting. The dummy $D_{fixed}$ indicates a fixed exchange rate, and this includes the countries that took part in the ERM, except Germany. $D_{EMU}$ indicates EMU membership, covering Austria, Belgium, Finland, France, Germany, Ireland, Italy, Portugal and Spain since 1999.

A.3 Export market indicator

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

$$X_{Mi} = \sum_j w_{ij} * GAP_{jt}$$

(A2)

where $w_{ij} = x_{ij} / \sum_j x_{ij}$. $x_{ij}$ is export from country $i$ to country $j$ in year $t$. The trading partners to one country in the sample are all the other countries in the sample and the rest of 'the world'. The exports data is from SITC Revision 2 OECD (2010), and are used to calculate the export shares for each country in the sample. The time series are prolonged backwards with the exports to the world when observations are missing. The GDP-gap for each of the twenty OECD countries is calculated using data from OECD (2008b). The world GDP-gap is constructed using data for the real GDP in The Conference Board (2010). We have used the $GP_{GK}$-series with GDP expressed in 1990 U.S. dollars, which covers 123 countries in the database.

A.4 Other variables

The unemployment rate - we use the standardized unemployment rate (UNR) from Economic Outlook OECD (2008a).

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

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

Gross Public Debt - is collected from Armingeon et al. (2010), and the original data source is several versions of Oecd Economic outlook. See details regarding versions and the mission observations in Codebook by Armingeon et al. (2010).

Openness - is total trade (export and imports) in percentage of GDP. The variable is collected from Armingeon et al. (2010). See details regarding versions and the mission observations in Codebook by Armingeon et al. (2010).
Table A1: Real growth in government purchases, multiplied by the ratio of government purchases to trend GDP - country specific mean and standard deviation

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<td>0.87</td>
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Table A2: Public debt for the countries in the panel over the sample period.

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Appendix: Additional information of Table 2

Model 2 in Table B1 presents the complete results from Table 2, including the estimates for the labour market variables. Model 1 displays the same specification but with a richer lag structure of the change in government purchases. We observe that the results are consistent with the simplification we have in model 2, as $\Delta g_{it}$ and $g_{it-1}$ have almost the same coefficient value, and thus can be put together in $g_{it}$, while the coefficient of $\Delta g_{it-1}$ is small and insignificant. Model 2i extends model 2 by including year dummies. We observe that the coefficients for the export market become much smaller, reflecting considerable co-movement of the export markets for all countries. In contrast, the coefficient for the change in government purchases is not affected, presumably because any comovement in government purchases across countries is not linked to comovement in unemployment.
Table B1: Estimation of equation (1) with the change government purchases and export markets (Table 11).

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<th>Model 2 a)</th>
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Obs = Country*Average groups: 483 241 483 241 483 241

Standard deviation of residuals: 0.63 0.63 0.63

χ² of all the exogenous variables: 2540.83 (0.00) 5777.60 (0.00) 51711.80 (0.00)

χ² of dummy, fiscal policy and exports: 121.25 (0.00) 107.61 (0.00) 68.73 (0.00)

1st order autocorrelation: 1.54 (0.12) 1.50 (0.13) 1.34 (0.18)

2nd order autocorrelation: -1.83 (0.07) -1.74 (0.08) -1.74 (0.08)

Dependent variable: The unemployment rate. Estimation method: Fixed effect coefficients estimate, robust standard errors (xtreg with, robust) is used in all the regressions.

a) With time dummies.

b) Numbers in parentheses are p-values for the relevant null.
Figure B1: Estimated residuals of fixed effect model in Table 2
References


