Fiscal expansions, unemployment and labor force participation: theory and evidence

Markus Brückner
School of Economics, University of Adelaide

Evi Pappa*
Universitat Autònoma de Barcelona, MOVE and CEPR

30th June 2011

Abstract

Structural VARs indicate that for many OECD countries labor force participation, employment and the unemployment rate significantly increase following increases in government expenditures under a variety of specifications and identification schemes. Fiscal expansions also tend to increase real wages. Existing models have difficulties in generating such responses. We show that the empirical regularities can be reproduced with two additions into a standard New Keynesian model with matching frictions: (a) a labor force participation choice and (b) workers’ heterogeneity.

JEL classification: E32, E62.

Key Words: unemployment, participation rate, VARs, matching frictions, insiders, outsiders.

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*We would like to thank Ayseşul Sahin, Fabio Canova, Yota Deli, Rodica Calmuc, Stefano Gnocchi, Eugenia Vella, Jacob Wong and participants at the Bellaterra Macro Seminar and the Macro Research Workshop in the EUI for useful suggestions, as well as, Jesus Fernandez Villaverde and three anonymous referees for invaluable suggestions. Evi Pappa acknowledges the financial support from the Spanish Ministry of Science and Innovation through grant ECO2009-09847, the Generalitat of Catalonia through grant SGR2009-00350, and the Barcelona Graduate School Research Network. Markus Brückner acknowledges the financial support of the Spanish Ministry of Science and Technology provided by CICYTECO2008-04997.
1 Introduction

Most macroeconomists would agree that expansionary fiscal policy stimulates employment and lowers unemployment. Indeed, existing studies for the US economy (see, Ravn and Simonelli (2007) and Monacelli et al. (2010)) confirm this conventional wisdom. Our empirical analysis extends the literature by studying the effects of fiscal policy on unemployment in other OECD countries and shows that increases in government spending can actually increase unemployment and employment simultaneously by inducing increases in the labor force participation. This fact is robust, in the sense that it holds for a number of OECD countries and sample periods and a variety of VAR specifications and identification schemes that one can use to extract fiscal shocks from the data.

Despite the difficulties in their identification, economists have tried to characterize the responses of macroeconomic variables such as investment, consumption and output to fiscal disturbances. Blanchard and Perotti (2002), Perotti (2004) and Gali et al. (2007) use the restriction that government spending does not contemporaneously react to changes in macrovariables to identify fiscal shocks. Ramey and Shapiro (1998), Edelberg et al. (1999), and Burnside et al. (2004) identify fiscal shocks as episodes of significant exogenous and unforeseen increases in government spending in national defense.\(^1\) Canova and Pappa (2007) and Mountford and Uhlig (2009) identify fiscal shocks using sign restrictions. Pappa (2009a), using robust theoretical sign restrictions, was the first to investigate the effects of fiscal shocks on labor market variables such as the real wage and employment. The analysis we conduct here considers many more labor market variables, covers as many as ten OECD countries, and focuses attention on the dynamics of the unemployment and the labor force participation rate. Determining how labor market variables respond to fiscal expansions is important because many fiscal packages in the real world are typically designed to "create jobs" and because models have recently been proposed to explain their time series properties.

Our empirical analysis shows that the labor force participation, employment and the unemployment rate can increase significantly in response to government expenditures shocks in many OECD countries. Results are robust to alternative identification schemes, the inclusion of control variables and different sub-periods for most countries but the US where

\(^1\) Depending on the identification approach the results on the effects of government spending on private consumption differ. Perotti (2007) critically reviews this literature.
the response of unemployment to fiscal shocks seems to have changed pattern substantially over time.

Our empirical findings are difficult to reconcile with existing theoretical models for several reasons. First, analyzing the effects of government spending shocks on unemployment in standard RBC and NK models is impossible since standard versions of these models only allow for movements in hours worked and/or employment. Second, even if we incorporate the Diamond-Mortensen-Pissarides search and matching model into standard frameworks, as suggested in Andolfatto (1996), or Walsh (2005), we cannot account for the responses of the participation rate – in these models participation is constant. But, even disregarding participation choices, simultaneously generating increases in output, real wages, the employment and the unemployment rate in response to fiscal shocks is difficult.

To circumvent these difficulties we add a participation margin in a New Keynesian model with labor market frictions as in Ravn (2008) and, in the spirit of Lindbeck and Snower (1988), we consider a labor market with insiders and outsiders, where insiders are defined as active job seekers that recently lost their job and outsiders as long term unemployed. Endogenous participation generates an increase in the pool of job seekers after a fiscal expansion since the wealth effect induced by the shock in government’s absorption increases labor market participation. The assumptions on workers’ heterogeneity and price stickiness are crucial to generate increases in total employment and the unemployment rate. Sticky prices are necessary for inducing an increase in demand that counteracts the crowding out of vacancies due to the increase in government absorption. However, for low values of the labor supply elasticity participation does not increase enough and the increased labor demand by the sticky price firms is strong enough to fully absorb the supply of new participants. The fact that some new entrants, characterized as outsiders, have a less efficient matching technology guarantees that even for low values of the labor supply elasticity unemployment can increase. The existence of heterogeneous agents in the model is crucial for this result: apart from the negative wealth effect, in sticky price environments the increase in government spending generates a labor demand effect and outsiders find it optimal to participate in the labor market since in times of high labor demand their probability of finding a job and improving their matching efficiency augments.

Our paper is related to a number of recent works which have appeared in the literature. Relative to Monacelli et al. (2010), our model incorporates features such as endogenous
participation and workers’ heterogeneity that can generate increases in unemployment, employment, labor participation, output, and the real wage after a fiscal expansion. Faia et al. (2010) also assume that workers are heterogeneous and introduce labor frictions in the form of labor turnover costs but do not examine the dynamics of unemployment or labor participation in response to fiscal shocks. Finally, Gomes (2009) uses a two-sector dynamic stochastic general equilibrium model with search and matching frictions to study the labor market effects of shocks to public sector employment and wages. In his model unemployment decreases in response to generic government consumption shocks.

The remainder of the paper is organized as follows. Section 2 describes the econometric framework. Section 3 presents the main empirical results. The theoretical model is presented in Section 4. Section 5 describes the dynamics of the benchmark economy and highlights the features that are crucial for replicating qualitatively the empirical results and Section 6 concludes.

2 Data and Estimation Methodology


To identify the impact that government expenditure shocks have on labor market outcomes we use a structural VAR approach. The variables entering our baseline specification are: the logs of real per capita government expenditures, GDP, consumption, investment, the interest rate, real CPI wage, labor force participation, employment, and the unemploy-
ment rate. Our main identifying assumption is that government consumption expenditures are contemporaneously unaffected by all variables in the model. This assumption appears plausible to us because fiscal policy usually reacts with at least a quarter lag to changes in the economic environment (see for instance Blanchard and Perotti, (2002); Perotti, (2004)). The lag length of our VAR model is based on information criteria and set equal to one. All variables in the VAR model enter as log-deviations from a constant and a quadratic time trend.\footnote{We have checked the stability of our VAR by computing the eigenvalues of the estimated coefficient matrix. We found that all of the eigenvalues lie within the unit circle. We have also checked the robustness of our estimates using a VAR with up to 4 lags. Impulse responses from the 4-lag VAR are similar to our parsimonious 1-lag specification. Also, our results hold independently of the omission of the time trend in the specification. Responses for these specifications are available from the authors upon request.}

3 Empirical Results

The first column of Figure 1 shows the unemployment responses for our baseline SVAR model. The main result is that for all ten OECD countries the unemployment response to government expenditure increases is positive and statistically significant at the 95 percent confidence level for nine out of ten countries. The estimates imply that a 10% increase in government expenditures typically increases the unemployment rate at peak by around 0.2-0.5%. Responses are persistent, indicating that government expenditure increases have effects on the unemployment rate that are of a long-lasting nature, which is in line with the hysteresis hypothesis (see Blanchard and Summers, (1987)).

The second column of Figure 1 suggests that the government expenditure increase had a significant positive effect on labor force participation and the third column also shows that for the majority of countries the government expenditure increase led to a significant increase in employment. Hence, our baseline VAR regressions suggest that for many of the OECD countries increases in the unemployment rate were associated with significant increases in employment and, in particular, with significant increases in labor force participation.

The fourth column of Figure 1 reports the impulse response of the real wage. These impulse responses are positive for the majority of countries, indicating an increase in the labor demand after the fiscal expansion. The fifth column of Figure 1 reveals that for the majority of countries output significantly increased following the government expenditure increase. Hence, for the average/median OECD country in our sample the government
expenditure increase had an expansionary effect on output. For Finland, Japan, and Sweden the government expenditure increase had a significant negative effect on output; but as shown in the previous two columns of the figure, in these countries also employment and labor force participation significantly decreased. To complete the picture we report in the last column of Figure 1 the impulse responses of consumption. These are also significantly positive for the majority of countries. Our baseline VAR analysis therefore shows that the increase in unemployment that was triggered by the government spending increase was accompanied by a significant expansion of average income and consumption, as well as by increases in the wage, labor force participation, and employment.

The results presented in Figure 1 are somewhat surprising and given the controversy for the identification of fiscal shocks in the VAR literature it is worth investigating their sensitivity to changes in the identification scheme used to extract fiscal shocks from the data, the subsample period, and the inclusion of additional control variables. For economy of space we document the robustness exercises we have performed in a supplementary appendix that is available online at https://sites.google.com/site/markusbrucknerresearch/research-papers.

First, if automatic stabilizers are present at any point in time, government expenditure series may react to all VAR variables contemporaneously. This is equivalent with ordering government spending last in our VAR specification. Because our analysis uses quarterly data, it is unlikely that our results are driven by government spending rising contemporaneously due to increases in unemployment since there are significant implementation lags in the conduct of fiscal policy, see for example Blanchard and Perotti (2002). However, even when we allow government spending to react within the same quarter the VAR analysis continues to show a significant increase in unemployment after the fiscal expansion.

Second, one important issue for the estimation of the causal effects that government spending has on labor market variables is whether the spending shocks that we identify in the VAR are unanticipated. Ramey (2011), for example, shows in a recent empirical study that the output multiplier is significantly smaller when one controls for changes in expectations in the VAR. The empirical fiscal policy literature is still debating the extent to which anticipation matters for VAR estimation of fiscal policy effects. Mertens and Ravn (2009) show that using the simple Choleski decomposition (as we do in our baseline VAR regressions) might deliver nearly correct impulse responses even if shocks are anticipated
by the private sector. Recently, Perotti (2011) casts serious doubts about the validity of Ramey’s results, showing that "expectations - augmented" VARs and SVARs give virtually the same results. Mountford and Uhlig (2009) develop a VAR approach that deals with the anticipation of fiscal policy by means of sign restrictions. To ensure that our results are not subject to the fiscal foresight problem, we carry out a number of robustness checks such as using the Ramey-Shapiro war dummy approach to identify episodes of unforeseen increases in government military spending and using Ramey’s (2011) direct measure of the private sector’s forecast revisions of federal spending to estimate the effects of government spending shocks in a VAR, obtaining the "expectations - augmented" VAR. Results are robust to both of these changes.

Third, the impulse responses depicted in Figure 1 are based on a VAR that does not include tax revenues. Reliable quarterly time-series data on tax revenues are only available for five out of the ten OECD countries we consider (Australia, Canada, Japan, the UK, and the US). The omission of tax revenues could affect substantially our results since it implies that our baseline VAR model does not control for changes in fiscal deficits and it does not rule out (potentially important) contemporaneous effects of distortionary tax changes on output. The results we present here hold also when we include tax revenues as an endogenous variable in the VAR.

Fourth, results are also robust to the use of alternative identification schemes for extracting fiscal shocks from the data. Following Pappa (2009b), we use the restriction that government expenditures, output and deficits are positively correlated contemporaneously, while tax revenues are not allowed to respond negatively to the shock. By requiring deficits, output and government spending to co-move we exclude the possibility that the shocks we identify are technology, or monetary policy shocks. This is because these type of shocks tend to increase output and tax revenues, thus reducing deficits in countries where government spending is acyclical or countercyclical (as is the case for the OECD countries we consider, see for example Lane (2003)). The sign restriction approach confirms the main findings of

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3 Given that in the theoretical model we use output might not react contemporaneously to expenditure shocks, we also use the above restrictions on the second period after the shock. Results are robust to this change as well.

4 We note that even in the case of procyclical government expenditures, as long as the elasticity of tax revenues to changes in income is higher than the elasticity of government expenditures to changes in output, the restriction that deficits co-move with output guarantees that shocks to technology and government spending are not confused.
our baseline VAR analysis.

Fifth, in economies where the expected present value of future taxes and expenditures matters for private sector agents’ choices, current fiscal developments can have complex and sometimes surprising effects since current policy can play a crucial role in shaping expectations of future policy changes. So, for example, an expansionary fiscal shock may end up being contractionary if it induces sufficiently strong expectations of future policy changes in the opposite direction. To control for such effects we have repeated our exercise by including a forward looking variable like stock prices in the baseline VAR. We have also made an attempt to further deal with anticipation effects by including changes of the international oil price in the VAR. Also these regressions produce a significant positive effect of government spending on the unemployment rate and the participation rate.

Sixth, according to Gomes (2009) public sector wages may play an important role in shaping unemployment dynamics, since high public wages may induce unemployed to queue for public sector jobs. This is a relevant issue since a large component of government consumption expenditures corresponds to public wages. For example, public wages cover 52% of total government expenditures in Australia, 59% in Canada, 38% in Japan, 53% in the UK and 66.5% in the US. To exclude the possibility that unemployment increases are driven by increases in government wages, we have repeated our exercise replacing the government expenditure series with series of government consumption purchases. The results we obtain are unchanged relative to the benchmark model.

In contrast to our results, Ravn and Simonelli (2007) and Monacelli et al. (2010) find that, for the US, unemployment significantly decreases after an expansionary expenditure shock. One possible reason for this difference in the results is the differences in the sample period used for the estimation. Ravn and Simonelli (2007) use data from 1959 to 2004, Monacelli et al. (2010) use data from 1954 to 2006 while our data from OECD Statistics cover only the period 1964-2009.5 Perotti (2004) also finds that the effects of fiscal shocks change when considering the pre-80s and the post-80s samples. In order to investigate whether this is the case also for the unemployment response and in order to examine the robustness of our results to the subsample used we present in Figure 2 the unemployment

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5In order to have reliable and comparable series we use OECD statistics data for all countries considered. However, our results for the US hold also for data from the BEA and the BLS, and for the data of Simonelli and Ravn (2007) available at: http://www.eui.eu/Personal/Ravn/.
responses for the 1968-1980 period and the 1985-2005 period, thus excluding the recent
financial crisis and the oil price shock that occurred around the turn of the 80s. The first
row of Figure 2 presents the unemployment responses for the 1968-1980 period for Australia,
Canada and the US (the three countries where we have long enough data to cover the pre-
1980 period). The main result is that unemployment significantly increases for Australia
and Canada, while for the US unemployment decreases significantly. Hence, for the pre-1980
period our results show a similar unemployment response for the US as the one documented
in Monacelli et al. and Ravn and Simonelli. However, the positive unemployment response
for Canada and Australia shows that this time heterogeneity in the unemployment response
is specific to the US. Rows 2 to 5 of Figure 2 show, moreover, that for the 1985-2005 period,
which excludes the recent financial crisis and the oil price shock that occurred around the
turn of the 80s, the unemployment responses are positive and significant at the 95 percent
confidence level for the majority of OECD countries.

Moreover, in the online appendix we show that our results hold for further subsamples.
Given that the responses for the US economy in the two subsamples considered in Figure
2 imply some parameter instability we have estimated time-varying parameter VARs to
investigate more formally this possibility for the countries we had long enough data. The
main message from this analysis is that the average/median unemployment response is
significantly positive and stable over time for the majority of those countries. Hence, the
parameter instability for the US appears to be an exception.

In the next section we describe how a model with endogenous labor force participation
and insiders and outsiders can generate an increase in unemployment following increases
in government consumption expenditures. The model offers possible explanations for the
change in the pattern of the unemployment response to fiscal shocks in the US over time.

4 The Model

Analyzing the effects of government spending shocks on unemployment, or the participation
rate in standard models is hard since most models allow only for voluntary movements in
hours of work and employment. To analyze unemployment fluctuations researchers found
it natural to incorporate the Diamond (1982) and Mortensen and Pissarides (1994) search

\footnote{We start in 1968 to have the longest possible symmetric sample across the three countries.}

However, these studies assume that the labor market participation rate is constant. The empirical analysis has revealed that government spending shocks do affect labor force participation. Hence, it is central to introduce a participation margin in our theoretical model. Following Ravn (2008), we model the labor market participation choice in terms of a trade-off between the reduction in leisure time to participate in the labor market search and the benefits associated with the prospect of finding a new job. Labor market non-participants are modeled as agents that are unmatched and that do not currently look for a job, while unemployed are unmatched agents that actively look for a job.

The traditional macroeconomic literature on unemployment (see Layard et al. (1991) for a literature review) discusses many reasons for why unemployment may occur in equilibrium. Lindbeck and Snower (1988) propose a model of insiders and outsiders for explaining unemployment. In their framework, unemployment occurs because some agents (the outsiders) cannot sell as much labor services as they wish to supply. We find this setup attractive, since in the real world many classes of agents, such as long-term unemployed, spouses, students, or elderly workers may be viewed as outsiders in the sense of Lindbeck and Snower (1988). These agents may often decide not to participate in the labor market and they might differ from the typical unemployed worker in their matching market prospects. Thus, the expected payoff from engaging in search activities is smaller for labor market non-participants (outsiders) than for search active agents (insiders).

To incorporate the notion of insiders and outsiders in our model we introduce heterogeneity in the matching function. In particular, we assume that there are two types of unemployed workers that differ in their prospects of being matched with vacancies, with outsiders facing a less efficient matching technology than insiders. Finally, we will assume that prices are sticky in the short run, as a short-cut for generating a demand effect after a government spending shock.

The economy consists of households that have employed, unemployed and non-participants.

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7Notice that differently from Lindbeck and Snower (1988) insiders are active job seekers in our model, while the latter authors define insiders as employed workers.
members. There are two types of firms in the economy: (i) competitive intermediate firms that use capital and labor to produce a good, and (ii) monopolistic competitive retailers that use all intermediate varieties to produce the final good which is then used for consumption, investment and government spending. Price rigidities arise at the retail level, while search frictions occur in the intermediate goods sector.

4.1 Preferences

There is a measure one of households. Households consist of a continuum of agents and the number of individuals in the household is large enough to guarantee insurance over consumption of its members.

At any point in time a fraction $n_t$ of the household’s members are employed, a fraction $u_t$ are unemployed and a fraction $l_t$ are labor market non-participants. The difference between non-participants and unemployed is that the latter are actively looking for a job.

$$1 = n_t + u_t + l_t$$

The preferences of the representative household are defined by:

$$u(c_t, l_t) = \frac{c_t^{1-\eta}}{1-\eta} + \Phi \frac{l_t^{1-\zeta}}{1-\zeta}$$

where $c_t$ denotes consumption, $1/\eta$ is the intertemporal elasticity of substitution, $\Phi > 0$ is a preference parameter and $\zeta$ is the inverse of the elasticity of labor supply. That is, households obtain utility from consumption and from the fraction of households that do not participate in market activities and enjoy leisure. Notice that each household member’s consumption is the same independently of their labor market status due to income pooling. Notice also that a member of a household that searches for a job or that is employed suffers the same disutility. That is, search effort is as costly in terms of utility as a full time job.

4.2 Matching

The process through which workers and firms find each other is represented by a matching function that accounts for imperfections and transaction costs in the labor market.

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8 Such a utility function can be rationalized by the production of home goods. That is, it is equivalent to assuming that households derive utility from market and home goods, $c_t^h$ whereas the home goods are produced by the following production function: $c_t^h = \frac{l_t^{1-\zeta}}{1-\zeta}$. 

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We model heterogeneity in the matching functions of insiders and outsiders as follows. Every period a constant fraction \( \sigma \) of the currently employed worker-job matches is destroyed and a measure of \( M \) new matches is formed. Workers that experience a termination of their match are characterized as insiders and they enter into a period of unemployment. An insider may either remain unemployed, find a new job match, or become an outsider. Insiders become outsiders with probability \( \mu \in [0, 1] \). The number of new matches between vacant jobs and unmatched agents will depend on both the labor market tightness and the structure of unemployment. The aggregate number of matches is given by:

\[
M(v_t, u^I_t, u^O_t) = m_I(v_t, u^I_t) + m_O(v_t, u^O_t), \quad \text{with}
\]

\[
m_I(v, u) > m_O(v, u) \quad \text{for } \forall v, u > 0
\]

where \( v \) denotes vacancies, \( u^I \) denotes the measure of insiders, while \( u^O \) denotes the measure of outsiders looking for a job. We assume that the efficiency of the matching process is higher for unemployed insiders than for unemployed outsiders. Thus, the matching function for the two groups of individuals is assumed to satisfy:

\[
m_j(v, u^j) = \varrho_m^j v^\alpha (u^j)^{1-\alpha} \quad \text{with} \quad j = I, O \quad \text{and} \quad \varrho_m^I > \varrho_m^O > 0
\]

The probability that a vacant job is matched with a worker is going to depend on the overall labor market tightness, \( \theta_t = \frac{u}{u_t} \), as in the standard framework, and on the relative size of insiders and outsiders. If we denote by \( \gamma^I_t \) this probability, we have:

\[
\gamma^I_t = \frac{m_t}{v_t} = \theta_t^{\alpha-1} \left[ \varrho_m^I \left( \frac{u^I_t}{u_t} \right)^{1-\alpha} + \varrho_m^O \left( \frac{u^O_t}{u_t} \right)^{1-\alpha} \right]
\]

where \( u = u_I + u_O \), and the ratio \( \frac{u^j}{u} \), \( j = I, O \), defines the share of unemployment for agents of type \( j \). Thus, an increase in the unemployment rate for each type of agents increases the probability that a vacancy will be filled. However, an increase in the unemployment rate for insiders has a stronger impact on this probability than an increase in the unemployment rate of outsiders. The probability for an unemployed worker (insider or outsider) to find a job is:

\[
\gamma^h_t = \frac{m_t}{u_t} = \theta_t^\alpha \left[ \varrho_m^I \left( \frac{u^I_t}{u} \right)^{1-\alpha} + \varrho_m^O \left( \frac{u^O_t}{u} \right)^{1-\alpha} \right]
\]
Again, the relative size of the two types of unemployed workers in the economy matters. Hence, an additional outsider searcher creates less of a negative externality for the total sum of individuals looking for a job. The probabilities to find a job for each type of agents are given by:

$$\gamma_{jh}^j = \frac{m_t^j}{u_t^j}, j = O, I$$
(7)

The employment transition equation is given by:

$$n_{t+1} = (1 - \sigma)n_t + m_{It} + m_{Ot}$$
(8)

The transition equation for insiders’ unemployment is given by:

$$u_{t+1}^I = (1 - \mu)u_t^I + \sigma n_t - m_{It}$$
(9)

Notice that insiders are more often (that is, for many parameter specifications) better off searching than non-participating since they are faced with a better matching technology. Outsiders instead have to decide whether they should participate in the labor market and their decision takes into account the fact that they are less advantageous in matching with firms.

4.3 The problem of the household

The household owns the economy’s capital stock. The capital stock evolves over time according to:

$$k_{t+1} = (1 - \delta)k_t + i_t - \xi \left( \frac{k_{t+1}}{k_t} \right) k_t$$
(10)

where $\delta$ is the capital’s depreciation rate, $i_t$ is gross investment and $\xi(.)$ is a function that regulates capital adjustment costs. We adopt a quadratic specification of the form:

$$\xi \left( \frac{k_{t+1}}{k_t} \right) = \frac{\omega}{2} \left( \frac{k_{t+1}}{k_t} - 1 \right)^2$$
(11)

where the parameter $\omega$ regulates the importance of capital adjustment costs for the accumulation of capital.

The representative household maximizes its expected utility given by:

$$E_t \sum_{t=0}^{\infty} \beta^t u(c_t, l_t)$$
(12)
choosing sequences of consumption, $c_t$, the number of insiders in the next period, $u^I_{t+1}$, and the number of outsiders, $u^O_t$, employment for next period, $n_{t+1}$, next period’s bond holdings, $B_{t+1}$ and capital, $k_{t+1}$, subject to (1), (4), (8), (9), (10) and its budget constraint given by:

$$c_t + i_t + \frac{B_{t+1}}{p_t R_t} \leq r_t k_t + w_t n_t + b u_t + \frac{B_t}{p_t} + \Pi_t - T_t$$

(13)

where $p_t$ is the price level, $w_t$ is the real wage, $r_t$ is the real return to capital, $b$ is the real unemployment benefit, $R_t$ is the gross nominal interest rate, $\Pi_t$ are the profits of the monopolistic competitive firms and $T_t$ are lump sum taxes paid to the government.

If we denote by $\lambda_{ct}$, $\lambda_{nt}$, $\lambda_{ut}$ the multipliers in front of the budget constraint, the law of motion for employment and insiders unemployment, respectively, optimization implies:

$$c_t^{-\eta} = \lambda_{ct}$$

(14)

$$\lambda_{ct} \left(1 + \omega \left[ \frac{k_{t+1}}{k_t} - 1 \right] \right) = \beta E_t \lambda_{ct+1} \left(1 - \delta + r_{t+1} + \frac{\omega}{2} \left[ \left( \frac{k_{t+2}}{k_{t+1}} \right)^2 - 1 \right] \right)$$

(15)

$$\lambda_{ct} \pi_{t+1} = \beta E_t \lambda_{ct+1} R_t$$

(16)

$$\lambda_{nt} = \frac{\Phi_l^{-\zeta} - b \lambda_{ct}}{\gamma_t^{Oh}}$$

(17)

$$\lambda_{nt} = \beta E_t [\lambda_{ct+1} w_{t+1} + (1 - \sigma) \lambda_{nt+1} + \sigma \lambda_{ut+1} - \Phi_l^{-\zeta}]$$

(18)

$$\lambda_{ut} = \beta E_t [\lambda_{nt+1} r_{t+1} + \lambda_{ct+1} b + \lambda_{nt+1} (1 - \mu) - \gamma_t^{1h} - \Phi_l^{-\zeta}]$$

(19)

where $\gamma_t^{1h}, \gamma_t^{Oh}$ are defined in (7).

The first three conditions are standard and represent arbitrage conditions regarding the returns to capital and bonds. The remaining conditions determine the values of being employed, unemployed insider and outsider: it follows from conditions (18) and (19) that the value of being employed equals $V_t^E = c_t^{-\eta} w_t - \Phi_l^{-\zeta} + \sigma \beta V_{t+1}^{UI} + (1 - \sigma) \beta V_{t+1}^E$, where $V_t^{UI}$ defines the value of being an insider unemployed, $V_t^{UI} = c_t^{-\eta} b - \Phi_l^{-\zeta} + \gamma_t^{1h} \beta V_{t+1}^E + ((1 - \mu) - \gamma_t^{1h}) V_{t+1}^{UI}$. Conditions (17) and (18) present an arbitrage condition that states that the value of being search active rather than non-participating, $b \lambda_{ct}$, should equal the utility loss $\Phi_l^{-\zeta}$ minus the expected marginal value of being employed, $\lambda_{nt}$, weighted with the job finding probability for an outsider in the coming period.
4.4 Intermediate goods firms and job creation

Intermediate goods firms employ the household’s labor and capital to produce goods. The production function for intermediate goods is given by:

\[ y_t = F(k_t, n_t) = k_t^\varphi n_t^{1-\varphi} \]  \hspace{1cm} (20)

Intermediate firms maximize the discounted value of future profits. Firms adjust employment by varying the number of workers (extensive margin) rather than the number of hours per worker. According to Hansen (1985), most of the employment fluctuations arise from movements in this margin. The firm takes as given the number of workers currently employed and its employment decision concerns the number of vacancies that it posts in the current period, \( v_t \). Firms open as many vacancies as necessary to employ the desired number of workers next period and there is a utility cost from posting a vacancy, \( \varphi \). Firms also need to decide on the size of the capital stock that they need for production. The problem of a firm with \( n_t \) currently employed workers consists of choosing capital and vacancies to maximize:

\[ V^F(n_t, k_t) = \max x_t F(k_t, n_t) - w_t n_t - r_t k_t - \varphi v_t + E_t \Lambda_{t+1} V^F(n_{t+1}, k_{t+1}) \]  \hspace{1cm} (21)

where \( x_t \) is the relative price of intermediate goods and \( \Lambda_{t+s} = \frac{\beta^s U_{t+s}}{U_t} \) is the discount factor. The maximization takes place subject to the production function, the law of motion for aggregate productivity and the job transition function that links the future number of filled jobs to the current stock of filled jobs plus net hiring.

\[ n_{t+1} = (1 - \sigma)n_t + \gamma^F_t v_t \]  \hspace{1cm} (22)

Optimization implies that:

\[ x_t F_{kt} = r_t \]  \hspace{1cm} (23)

\[ \frac{\varphi}{\gamma^F_t} = \beta E_t \left( \frac{c_t}{c_{t+1}} \right) \eta \left[ x_{t+1}F_{nt+1} - w_{t+1} + (1 - \sigma) \frac{\varphi}{\gamma^T_{t+1}} \right] \]  \hspace{1cm} (24)

The marginal product of capital should equal the real rate and the cost of filling a vacancy, \( \varphi \), should equal the expected value of filling a vacancy \( V^F_t = x_t F_{nt} - w_t + (1 - \sigma)\Lambda_{t+1} V^F_{t+1} \) weighted by the vacancy filling rate, \( \gamma^F_t \).
4.5 Bargaining over wages

Workers and firms split rents through Nash bargaining and the part of the surplus they receive depends on their bargaining power\(^9\). If we denote by \(\theta \in (0, 1)\) the firms bargaining power, the Nash bargaining problem is to maximize the weighted sum of log surpluses:

\[
\max_{w_t} (1 - \theta) \ln V_t^E + \theta \ln V_t^F
\]

where \(V_t^E\) and \(V_t^F\) were derived above.

The solution of the bargaining problem defines the contractual wage as:

\[
 w_t = (1 - \theta) \left[ (1 - \varphi) x_t \frac{y_{t+1}}{n_t} + \frac{\mathcal{K}_{t+1} \mathcal{K}_{t}^\gamma}{\gamma_t^\beta} \right] + \vartheta b - \theta \sigma c_t^\gamma E_t V_t^{UI}
\]  

(25)

Note that in equilibrium, the value of working is the same for insiders and outsiders because otherwise firms could make profits by hiring less of those workers with a lower value and more of those workers with a higher value. In other words, there are decreasing returns in matching to unemployment, so in equilibrium the value of work should be the same in order for there to be no arbitrage opportunities. The wage paid to matched unemployed insiders will therefore be the same as the wage paid to matched unemployed outsiders.

4.6 Retailers and price setting

There is a continuum of monopolistically competitive retailers indexed by \(i\) on the unit interval. Retailers buy intermediate goods from firms and differentiate them with a technology that transforms one unit of intermediate goods into one unit of retail goods. Retail goods are then used for consumption, government spending and investment. Note that the relative price of intermediate goods, \(x_t\), coincides with the real marginal cost faced by the retailers. Let \(y_{it}\) be the quantity of output sold by retailer \(i\). Final goods can be expressed

\(^9\)Shimer (2005) criticizes the assumption of Nash bargaining for mainly two reasons: (a) it cannot explain the magnitude of movements in recruiting activity, (b) it implicitly assumes that wages are bargained in new matches and continually renegotiated to get a solution for the wage. As an alternative to Nash bargaining Hall (2005) uses sticky wages and Hall and Milgrom (2008) use a "non-cooperative alternating offer bargaining," while Gertler and Trigari (2009) allow for staggered multi-period Nash wage bargaining generating greater variation in the employer surplus, employer recruiting efforts, and employment. We acknowledge that our analysis does not address this criticism. However, our results should not depend crucially on the wage setting assumption, since the responses of the economy do not change substantially when we assume sticky wages.
as the composite of individual retail goods:

\[ y_t = \left[ \int_0^1 \frac{\varepsilon - 1}{\varepsilon} \frac{d\varepsilon}{y_i^{\varepsilon}} \right]^{\frac{1}{\varepsilon - 1}} \]  

(26)

where \( \varepsilon > 1 \) is the constant elasticity of demand for intermediate goods. The retail good is sold at its price, \( p_t = \left( \int_0^1 p_{it}^{1-\varepsilon} d\varepsilon \right)^{\frac{1}{1-\varepsilon}} \). The resulting demand for each intermediate good depends on its relative price and aggregate demand:

\[ y_{it} = \left( \frac{p_{it}}{p_t} \right)^{-\varepsilon} y_t \]  

(27)

Following Calvo (1983) we assume that in any given period each retailer can reset its price with a fixed probability \( 1 - \chi \). Hence, the price index is given by:

\[ p_t = \left[ (1 - \chi) p_t^{1-\varepsilon} + \chi p_{t-1}^{1-\varepsilon} \right]^{1/(1-\varepsilon)} \]  

(28)

The firms that are able to reset their price, \( p_t^* \), choose it so as to maximize expected profits given by:

\[ E_t \sum_{t=0}^{\infty} \chi^s \Lambda_{t+s} \left[ \frac{p_{it}^*}{p_{t+s}} - x_{t+s} \right] y_{it+s} \]  

(29)

4.7 Fiscal policy

The government consumes exogenously part of the retail goods and finances its expenditures via lump sum taxes.

\[ bu_t + G_t = T_t \]

4.8 Monetary Policy

There is an independent monetary authority which sets the nominal interest rate as a function of current inflation, according to the rule:

\[ R_t = \bar{R} \exp(\zeta \pi_t) \]  

(30)

where \( \pi_t \) measures inflation in deviation from the steady state.
4.9 Closing the model

Aggregate production must equal private and public demand:

\[ y_t = c_t + i_t + G_t + \xi v_t \]  \hspace{1cm} (31)

4.10 Parameterization

We solve the model by approximating the equilibrium conditions around a non-stochastic steady state in which all prices are flexible. The full list of our parameter choices is given in Table 1. In order to parametrize the model we adopt the following strategy. First, we set the steady state employment rate, participation rate and job finding rate using values close to the observed average values in the U.S. economy. We set the unemployment rate equal to 0.055 and following Shimer (2010) we calibrate the job finding rate to be equal to 0.83. Using (8) this implies that the job separation rate \( \sigma = 0.0483 \). Davis, et al. (1996) compute a quarterly worker separation rate of about 8 percent, while Hall (1995) reports this rate to be between 8 and 10 percent. Our estimate is much lower but comparable with the estimates for the job separation rate in Hobijn and Sahin (2009). We also set the participation rate equal to 0.62 and the vacancy filling rate equal to 2/3. According to these values market tightness, \( \theta \), equals 1.245. According to Barnichon and Figura (2011) having a spell of unemployment lasting six months reduces the job finding rate by 1-1.5% points. Hence, using the definition of the aggregate job finding rate implies that the job finding rate for outsiders is equal to \( \gamma^{Oh} = 0.4181 \) and the one of the insiders, \( \gamma^{Ih} = 0.4245 \), if we assume that long-term unemployed have a 1.5% smaller finding rate than short-term unemployed. Petrongolo and Pissarides (2001) and Mortensen and Nagypal (2007) estimate the firms’ bargaining power in the (0.3,0.5) interval, we set \( \vartheta = 0.4 \) and, using Hosios condition, we also set the elasticity of matching, \( \alpha = \vartheta \). Also, according to the previous authors replacement rates are estimated in the (0.2,0.4) interval. We set \( b/w = 0.4 \). Long term unemployment, defined as the share of unemployed with a spell longer than 27 weeks, represents 16% of total unemployment, according to CPS data. Using the definition for market tightness for outsiders and insiders relative to aggregate market tightness and the relation between the ratio of tightness for insiders and outsiders with the ratio of insiders and outsiders unemployment we can determine the tightness parameters for each group of unemployed, \( \theta^O \) and \( \theta^I \). In turn, \( \rho^O_m \) and \( \rho^I_m \) are determined as: \[ \rho^j_m = \gamma^j \theta^j \alpha \] for \( j = I, O \).
The value of $\mu$ is determined by the law of motion of insiders in the steady state (9), and is set equal to 0.27. Following Hagedorn and Manovskii (2008), we take the average cost of hiring a worker to be 4.5% of the quarterly wage. In the steady state this implies that the share of hiring costs in GDP is 0.0014.

The quarterly discount factor is set to 0.99, which implies a quarterly real rate of interest of approximately 1 percent. The steady state markup is set equal to 1.2. The risk aversion parameter $\eta$ is set to 2 and the depreciation rate is set equal to 0.01, while the capital share is set equal to 0.3. This leaves us with one free parameter the elasticity of the utility of leisure, $\zeta$ (the parameter scaling that utility, $\Phi$ is determined residually given a value for $\zeta$ by equation (17) in the steady state). We set $\zeta = 4$. The implied value of the labor supply is low and within the range of estimates by Domeij and Floden (2006). In the next section we will show that workers’ heterogeneity is key for using low values of this elasticity.

Finally, the model’s steady state is independent of the degree of price rigidities, of the monetary policy rule and of the size of the capital adjustment costs. We set the probability that a firm does not change its price within a given period, $\psi = 0.75$, implying that the average period between price adjustments is around 4 quarters and the inflation coefficient in the monetary policy rule equal to 1.5. Capital adjustment costs are included to moderate the response of investment with respect to fiscal shocks. We set parameter $\omega$ to match the ratio of the investment to output variance for the US economy when we include TFP and monetary shocks in the model. The value used for the persistence of the government spending shock is the average of the cross country values we have obtained in Section 3.

5 How expansionary government spending shocks increase unemployment

We first investigate the properties of the benchmark model and examine the mechanisms leading to the results of interest.

5.1 The benchmark model

Figure 3 presents the effects of a government expenditure shock on output, employment, unemployment (total and for the two types of workers), the real wage, the participation rate, consumption and investment.
An increase in government spending induces a negative wealth effect that makes households increase their labor supply. As a result, the participation rate increases. Kruger and Pischke (1993) and List and Rasul (2011) also document, using micro data, a significant response of the labor force participation choice to fiscal policy induced changes in lifetime income. The increase in government absorption is crowding out private consumption, investment and hiring. On the other hand, the increase in demand induced by the government expansion increases labor demand, and, in turn, wages and employment increase. Non-participants evaluate that it is good to invest in search when government spending increases since there is the extra benefit of facing the more efficient search technology after an employment spell. But, since it is the insiders that get the extra jobs, the unemployment rate of the outsiders increases. Consequently, total unemployment increases on impact because of the increase in participation and the increase in the unemployment rate of outsiders. As insiders are hired by the firms to face the increased demand, total unemployment decreases; but when the demand effect fades away total unemployment starts rising again. In line with the empirical results, the responses of unemployment are very persistent.

5.2 The role of price stickiness

Price stickiness is necessary for obtaining our results. In Figure 4 with dotted lines we present the responses of an economy which is otherwise identical to the benchmark except for the assumption of price stickiness. With flexible prices, the increase in government absorption would crowd out vacancy posting (as it crowds out consumption and investment) since it would decrease the resources available for filling vacancies. Although the wealth effect of the shock would increase participation and the labor supply in equilibrium, the decrease in vacancy posting would decrease demand for employment and output and increase the unemployment of both types of agents, generating output and employment responses which are in contrast with the empirical evidence we have reported.

In contrast, a high degree of price stickiness would reinforce so much the demand effect of the shock that it would decrease unemployment of both insiders and outsiders in equilibrium. This case is represented with discontinuous lines in Figure 4. The graph plots the responses of the macro variables of interest when we assume that prices remain sticky for approximately six quarters ($\psi = 0.85$). In this case, the increase in vacancy posting and, hence, labor demand is such that both types of agents are absorbed by the monopolistic
competitive firms.

5.3 The role of the participation margin and workers’ heterogeneity

We have modeled the participation margin in order to be able to analyze the behavior of labor force participation in reaction to expenditure shocks. However, the use of the participation margin might be important in generating the results. In Figure 5 we plot the responses of the variables when agents are homogeneous, prices are sticky and there is no participation margin (dotted line) and when agents are homogeneous, prices are sticky and there is a participation margin (continuous line). The fact that there is a pool of non-participants that move into the labor force when the negative wealth effect from the increase in the government absorption kicks in is not enough to generate a sustained increase in unemployment after a government spending shock. In fact, the two models with or without the participation decision look almost identical except for a slight increase in unemployment on the impact period in the model with the participation margin. Workers’ heterogeneity is crucial for generating the increase in total unemployment after the spending shock for low values of the labor supply elasticity. If agents were homogeneous, an increase in government spending would increase labor demand and unemployment would be reduced. It is the fact that outsiders have a hard time to find a job relative to the insiders that makes total unemployment increase in equilibrium when the labor supply elasticity is low.

For higher values of the labor supply elasticity, the presence of a participation margin would be sufficient to generate increases in unemployment after a fiscal expansion but only on impact. We show this in Figure 5 where we plot the responses of the macro variables (dash-dotted lines) in the homogeneous agents model when we set the variable determining the Frisch elasticity, $\zeta = 2$. For high values of the labor supply elasticity, the wealth effect increases participation and makes unemployment increase on impact even when agents are homogenous. Thus, while both the presence of the labor participation margin and workers’

$^{10}$For the homogeneous workers’ model, the variable $u'$ disappears and $u^O = u$. The matching function is given by: $m_t = \rho_m v^\sigma u^{1-\alpha}$ and agents maximize:

$$u(c_t, n_t) = \frac{c_t^{1-\eta}}{1-\eta} - \Phi \frac{n_t^{1-\zeta}}{1-\zeta}$$

subject to (10), (8), and (13), and (1) becomes: $m_t + u_t = 1$.

With the participation margin, agents solve the same problem as in the benchmark economy with the only difference that $u' = 0$. All models are parameterized to deliver comparable steady state values for the labor market variables.
heterogeneity matter, the latter is crucial for generating a positive and persistent response of total unemployment when the labor supply elasticity takes low values.

5.4 Other important features

We performed a number of sensitivity analysis exercises to investigate the robustness of our conclusions with respect to changes in the remaining parameters of the model. The most crucial parameters for the dynamics of unemployment are the adjustment cost parameter, \( \omega \), the labor supply elasticity, \( 1/\zeta \) and the relative size of outsiders to total unemployment.

The presence of capital adjustment costs ensures that the crowding out of investment is limited so that capital and employment do not fall after the expenditure expansion. The size of capital adjustment costs affects the magnitude of the initial response to the shock as well as its persistence since it affects the accumulation of capital. The sensitivity of total unemployment responses to changes in \( \omega \) is presented in Panel A of Figure 6. When there are no capital adjustment costs \( \omega = 0 \), the crowding out of investment is such that both output and employment fall after the shock increasing persistently unemployment. On the other hand, in the model with no capital (\( \omega \to \infty \)) the wealth effect of the increase in government absorption becomes stronger and unemployment increases significantly on impact after the fiscal expansion, but falls substantially in the subsequent periods since the labor demand effect becomes stronger in a model with no capital and outsiders are absorbed by the higher demand for labor in this scenario.

On the other hand, when the labor supply elasticity decreases (for values of \( \zeta \geq 20 \)), the wealth effect of the increase in government absorption does not increase labor force participation significantly. As a result, the unemployed of both types can be employed in firms that face increased demand for their products and unemployment decreases instantaneously after the fiscal expansion (see Panel B of Figure 6).

Finally the relative size of insiders and outsiders in total unemployment matters. The relative size of outsiders and insiders in total unemployment is set to 16\%. Panel C of Figure 6 plots the responses of total unemployment when we vary \( \frac{\omega}{n} \). Unemployment decreases after an expansionary expenditure shock if the share of outsiders in total unemployment is below 10\%.

Hence, for low values of the relative size of outsiders, the model predicts reductions in total unemployment after a fiscal expansion. Interestingly for the US the share of long-
term unemployed to total unemployment is significantly different for the different subsamples considered. According to the Labor Force Statistics from the Current Population Survey, the average value of the percentage of unemployed with unemployment duration higher than 27 weeks in total unemployment is 16% for the sample period 1964:2010, while for the sample period 1964:1979 it is 10% and for the period 1980:2010 it accounts for 18.4% of total unemployment. Thus, our theoretical model can reconcile this evidence with the empirical findings of the instability of the responses of unemployment in the US. The behavior of unemployment in response to fiscal shocks is different over time in the US. Unemployment falls in response to a fiscal expansion in the beginning of the sample and increases towards the end of the sample. This difference in the pattern of unemployment responses can be explained by changes in the share of outsiders (viewed as long-term unemployed).

5.5 The importance of the wealth effect

The negative wealth effect associated with the increase in government spending is the main mechanism through which unemployment increases in our model, but it is important to note that this is not the only mechanism. An additional mechanism that is important is the positive output-demand effect associated with government spending. This positive output-demand effect makes it particularly attractive for outsiders (non-labor force participants) to search for jobs when demand for labor increases since they have a higher probability to find a job, become insiders and, hence, improve their matching technology. In Figure 7 we present the responses of the model economy when, following Gali (forthcoming), we modify the utility function to allow for smaller wealth effects (dotted lines). In particular, we assume a utility of the form:

$$U(c_t, l_t) = \Theta_t \frac{c_t^{1-\eta}}{1 - \eta} - \Phi \frac{l_t^{1-\zeta}}{1 - \zeta}$$

where \(\Theta_t = C_t^n / Z_t\) and \(C_t\) is aggregate consumption (taken as given by each individual household) and \(Z_t = Z_{t-1}^{\vartheta} C_t^{1-\vartheta}\), where \(0 < \vartheta < 1\).

The marginal rate of substitution between consumption and labor in logs is given by: \(mrs_t = (1 - \vartheta) c_t - \vartheta z_t - \zeta l_t\). Hence, if \(\vartheta\) takes values close to one, changes in consumption will have small effects on labor supply. Figure 7 plots responses for \(\vartheta = 0.75\). Besides the fact that the wealth effect is small, an increase in government consumption still generates increases in labor force participation. The reason is that outsiders find it optimal to increase
their participation when the likelihood to find a job increases. Relative to the benchmark (continuous lines) the increase in labor force participation is smaller and hence the increase in labor supply is also smaller. Given that the increase in the real rate decreases consumption\(^\text{11}\) the demand effects of the shock are weakened and labor demand increases by less, there are less vacancies posted in equilibrium, and there is also a slight fall in the real wage. Obviously, output and employment also increase by less.

5.6 The response of private consumption

Our model was designed to show that it is possible to generate an increase in total unemployment after an expenditure expansion under reasonable assumptions and the goal of the previous section has been to highlight the elements needed to reproduce the empirical regularities. However, the proposed model fails to account for the consumption dynamics in the data. In particular, in the model private consumption decreases after expenditure increases, while for many countries in the sample private consumption increases. Given that we are primarily concerned with reproducing the dynamics of the labor market after an expenditure increase, we have not included in the baseline model mechanisms that would overcome this shortcoming. Here we show that if government and private consumption are complements as in Linnemann and Schaubert (2003), the theoretical consumption responses become more consistent with the data.

Preferences are now defined by:

\[
\begin{align*}
\nu(c_t, l_t) &= \frac{\left\{ \nu c_t^{\frac{\xi + 1}{\xi}} + (1 - \nu) G_t^{\frac{\xi + 1}{\xi}} \right\}^{\frac{\xi}{\xi + 1}} 1^{1-\eta}}{1 - \eta} + \Phi \frac{l_t^{1-\xi}}{l_t^{1-\xi}}
\end{align*}
\]

where the degree of substitutability between private and public consumption is regulated by \(\xi\). The share parameter \(\nu\) determines how much public consumption affects utility: when \(\nu = 1\), public consumption is useless from the agents’ point of view and the model is identical to the baseline specification.

In Figure 8 we present responses when \(\nu = 0.7\) and \(\xi = 0.4\). When public and private consumption are complements an increase in government expenditures increases private consumption. See Hall and Milgrom (2005) for detailed discussion on the role of government consumption in consumption dynamics.

\(^{11}\)Complementarity between consumption and leisure in homogeneous agents models (see Hall and Milgrom (2005)) can generate increases in private consumption after a fiscal shock as long as the intertemporal elasticity of substitution is high. In our specification the intertemporal elasticity of substitution is one and the increase in the real rate makes consumption fall in equilibrium.
consumption at the expense of a larger crowding out of investment in equilibrium. At the same time, the complementarity between private and public consumption does not cancel out completely the negative wealth effect due to the increase in government’s absorption nor it affects the incentives of outsiders to look for a job and become insiders when demand conditions are favorable and labor force participation increases generating an increase in total unemployment in equilibrium.

6 Conclusions

We empirically examined the effect of government expenditure shocks on labor market variables and, in particular, on unemployment and labor force participation for OECD countries and found that a fiscal expansion can lead to a significant increase in the unemployment and participation rate and employment for many countries and many of the time periods considered. We have shown that results are robust to the identification scheme used to extract fiscal shocks from the data, the subsample period, and the inclusion of additional control variables for the majority of countries that we have available data, except for the US where the response of unemployment to government spending shocks is sensitive to the time period analyzed.

Existing theoretical models have difficulties in explaining our empirical results. Following a recent trend we consider a New Keynesian model with search frictions, endogenous participation and workers’ heterogeneity. In contrast to the existing literature, our model can generate depending on the exact parametrization, positive or negative responses of unemployment in response to positive government spending shocks and can possibly explain the reason behind the differences in the unemployment responses to government spending shocks in the US subsamples. The introduction of workers’ heterogeneity is crucial for deriving our results. When the economy is populated by insiders and outsiders facing different matching prospects in the labor market, total unemployment may increase after a fiscal expansion. This is because the negative wealth effect induced by the increase in government absorption increases labor force participation. However, outsiders unemployment increases more than the fall in insiders unemployment because non-participants have an extra incentive to look for a job when demand conditions are favorable and total unemployment increases in equilibrium.
While our empirical analysis is potentially subject to the standard critiques raised to VAR exercises (see, e.g., Chari et al. (2007) and Ramey (2011)) it is unlikely that empirical analysis conducted with different tools will lead to results that are different from those we have since the dynamics we present are robust to different identification schemes, possible controls for anticipated effects and specifications of the VAR. Thus, any model with features different from those we consider must be compared with the particular stylized facts we present.
7 References


Perotti, R., "In search of the transmission mechanism of fiscal policy," NBER Macro Annual 2007, 22.


Table 1: Parameter Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
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<tr>
<td>( u/(n+u) )</td>
<td>total unemployment rate</td>
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<td>( \gamma^h )</td>
<td>aggregate job finding rate</td>
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<td>( \Sigma )</td>
<td>separation rate</td>
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<td>( 1-l )</td>
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<td>market tightness</td>
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</tr>
<tr>
<td>( \gamma^{Oh} )</td>
<td>outsiders job finding rate</td>
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</tr>
<tr>
<td>( \gamma^{ih} )</td>
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<td>( \rho_\varphi )</td>
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Figure 1. Baseline VAR Impulse Responses
Figure 2. Unemployment Response 1968-1980 and 1985-2005 Period
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Figure 5. Theoretical Impulse Responses: Participation Margin
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B. Labor supply elasticity

C. Relative size of outsiders
Figure 7: Reducing the Wealth Effect
Figure 8: Complementarities of Private and Public Consumption