Economic Shocks and their Effects on Unemployment in the Euro Area Periphery under the EMU

Pietro Dallari[a] and Antonio Ribba[b]*

[a]International Monetary Fund, Washington, USA
[b]Università di Modena e Reggio Emilia, Italy

April 20, 2016

Abstract. In this paper we aim to investigate the effects of several types of shocks on unemployment in peripheral European countries under the EMU. We use a structural near-VAR model to account for the supranational conduct of monetary policy on the one hand, and domestic fiscal policy and financial shocks on the other hand. Our main findings are: (i) the unemployment multipliers of government spending shocks are higher than the ones associated with government revenues shocks, and they vary across countries; (ii) instability in the unemployment responses over time is marked, with evidence that a regime shift took place in some countries since 2007; (iii) fiscal and financial shocks are not among the long-term drivers of unemployment, but instead a more important role is played by Euro area-wide shocks, with a pre-eminent role for the common monetary policy shock.

JEL Classification: E32, E62, C32;

Keywords: Business Cycles; Unemployment; Euro area; Near-Structural VARs;

* Correspondence to: Antonio Ribba, Department of Economics Marco Biagi, Università di Modena e Reggio Emilia, Viale Berengario 51, 41121 Modena, Italy.
E-mail: antonio.ribba@unimore.it

Pietro Dallari, International Monetary Fund, Washington, USA.
E-mail:pdallari@imf.org

1. Introduction

In recent years, the southern European countries - Greece, Italy, Portugal and Spain - and Ireland went through a number of unprecedented economic shocks.

The favorable borrowing costs and cross-border financial integration prevailing under the umbrella of the monetary union and, in the case of Ireland, a low corporate tax rate, have attracted large capital inflows since the late Nineties. The external financing contributed to growing current account deficits and fuelled bubbles in some sectors of the economy, primarily the real estate market. As the financial crisis shattered the world economy in 2007, these countries found themselves exposed to falling real estate prices, plummeting trading volumes in the universe of risky asset classes, and sudden stops in capital inflows. In turn, the recapitalization of domestic financial institutions and the cost of welfare policies, in place to mitigate the social fallout of the crisis, triggered a series of confidence shocks on the sustainability of public finances and, more generally, on the viability of the Euro.

This sequence of events generated renewed interest in understanding how similar or different peripheral Euro-area countries are in terms of the shocks they are exposed to, and their domestic transmission channels. It also stimulated a debate centered on the tension between the centralized conduct of monetary policy and domestic fiscal policies, albeit implemented within a set of collective rules. In fact, for the first time European policymakers faced unemployment at or above the levels last seen in the mid-Nineties, when the common monetary system was not yet operational, raising questions about the most effective policy tools available in a monetary union.

Against this background, we investigate the causal relations between several kinds of shocks and macroeconomic outcomes in the southern European peripheral economies and Ireland during the first fifteen years of the EMU to derive insights that can guide policy actions.

To this end, first we estimate a vector autoregressive model in which Greece, Ireland, Italy, Portugal and Spain are treated as small open economies acting in a monetary union. In the context of the Euro area it is important to take into account the particular institutional environment, with the conduct of monetary policy by the ECB at a supranational level, and fiscal policy decisions taken by governments at the single-country level. We accomplish this task by modeling both Euro area and national variables jointly, except that only the first group of variables is allowed to exert an influence on the second one.

Second, we study the sign, size and shape of the dynamic responses of indicators of prices, real activity and financial stress to shocks at the European and national level, and we identify their role in driving business cycle fluctuations. We focus in particular on the Euro area-wide monetary policy innovation, and on domestic fiscal policy and financial shocks. As a result of our modeling strategy, the set of common Euro-wide shocks remains invariant across specifications, and the dynamic effects of country-specific shocks can be studied controlling for the influence of Euro area disturbances. Also, the risk of omitting relevant information from the model specification, or to mischaracterize the interactions between subsets of variables is reduced as we simultaneously identify both monetary and fiscal policy innovations (Leeper, 1991).

In this work, we choose to use unemployment to describe the economic cycle, instead of opting for a measure of national income. Peripheral European countries have proved to be

particularly vulnerable to the rapid escalation of unemployment, which can stay persistently high even when upturns in output materialize. A recovery in aggregate income that is not followed by a comparable improvement in employment inevitably leads to increasing inequality which, according to recent cross-country empirical evidence, hurts growth for given levels of redistribution (IMF, 2014). High unemployment also leads to human capital losses, is more likely to determine social turmoil (Voth and Ponticelli, 2012), and leads to shortfalls in income that increase economic volatility (Gerardi et al., 2013). Also, maximizing social welfare is typically part of the political mandate that policymakers receive from the electorate, and is commonly assumed among their preferences in a large class of economic models. Therefore, we believe that a number of reasons make unemployment a relevant yardstick to assess the impact of policy initiatives on the economy.

Several interesting findings stem from our analysis. To start with, the effects of fiscal policy shocks on unemployment vary considerably depending upon the fiscal policy tool and the country.

On the first point, we find that changes in unemployment induced by government spending shocks are larger and more persistent than those associated with government revenues shocks. For example, according to our results an increase in government consumption and investment equal to 1 percent of GDP lowers the level of unemployment by 5.2 percent over two years in Italy; however, the fall in unemployment associated with a reduction in taxes by an equal amount is around unity.

Cross-country heterogeneity is also marked. Our results are consistent with the predictions of the standard New Keynesian model only in Italy and Greece; in Ireland we identify perverse effects of fiscal policy shocks on unemployment; and in Portugal and Spain the results are blurred by high uncertainty. Since heterogeneity in the responses of unemployment is higher compared to that of the price level, this can be read as an indication that the progress made since the onset of the EMU in integrating the domestic labor markets has not been equal to the advances made on the monetary front.

However, time instability is also a factor in explaining the heterogenity observed in the baseline analysis. In particular, both Ireland and Spain show a negative and significant effect of government spending on unemployment before 2007, thus in line with the predictions of the New Keynesian economic theory; but this relationship is attenuated or reversed as the sample length is extended to include the crisis years. Instead, in Greece government spending shocks had a larger impact on unemployment in recent times.

Albeit noisy, the sovereigns' borrowing costs tend to increase in response to deficit-financed fiscal shocks. This suggests that a certain degree of market discipline has been in place in the past, and it cautions against maintaining a prolonged period of fiscal stimulus, as it may be difficult to achieve in practice. The financial shock has sizeable and persistent effects on unemployment in Italy, Portugal and, to a lesser extent, Greece.

When we measure the relative importance of the identified structural shocks in driving unemployment changes at different horizons, we find that unemployment fluctuations are primarily idiosyncratic in the short run. Instead, as far as the longer term is concerned, the Euro area-wide shocks are the dominant drivers, with a pre-eminent role played by common monetary policy shocks. As the other sources of fluctuations are controlled for, we interpret the residual idiosyncratic component as capturing primarily the institutional framework

regulating the domestic labor market. Among the countries in our sample, this component plays the largest role in Ireland, which stands out in our sample for a comparatively more liberal labor market.

The rest of the paper is organized as follows. In section 2 we review some relevant results of the literature related to our work. In section 3 the econometric approach of the paper is described. In particular, we present the main features of the estimated near-VAR model and focus on the strategy to recover the structural shocks. Section 4 presents the econometric evidence organized in several subsections. Section 5 examines in more details the shocks that drive domestic unemployment. Section 6 concludes.

2. Literature summary

In the present paper we use block exogeneity restrictions in order to characterize the dynamic interaction of small open economies which are part of the European Monetary Union (EMU) with the area-wide economy. Cushman and Zha (1997) used the near-VAR model to study the interaction between Canada (the small open economy) and the United States. In particular, they used such model to provide a sounder identification of the monetary policy shocks affecting the small open economy in a context of flexible exchange rates.
Instead, in a more recent paper, Peersman (2004) utilized this approach to investigate the dynamic effects of monetary policy shocks in the European economy.
Cavallo and Ribba (2015), in the context of EMU, have recently identified a structural near-VAR model to study the dynamic effects of monetary policy shocks on industrial production in a group of Euro-area countries in the first decade of the Euro.

The strand of the literature applying the structural VAR methodology to study the effects of fiscal shocks on aggregate output was initiated by Blanchard and Perotti (2002). They investigated the postwar US economy and they found results in line with the traditional Keynesian interpretation of the role of fiscal policy in stabilizing business cycle fluctuations.
Similar results for the US economy are obtained by Mountford and Uhlig (2009). The authors use a structural VAR in which government spending and revenues shocks are identified by imposing sign restrictions on the responses of the variables.
Canova and Pappa (2011) have used a structural VAR model to investigate the dynamic effects of government expenditures shocks on real activity in the United States, the Euro area and the United Kingdom. One of the main points of the study is that fiscal policy may exert large effects on the real economy in the presence of negative real interest rate, in turn caused by accomodative monetary policy.

In more recent years, a growing literature has broadened the scope of the analysis to include the dynamic effects of fiscal shocks on labor markets. Maybe not surprisingly, the results presented by researchers are far from homogeneous.
Monacelli et al. (2010) provide estimates of both output and unemployment fiscal multipliers for the postwar US economy using a structural VAR model. The exogenous innovations are identified by imposing a contemporaneous causal ordering, with government spending ordered first. The estimated unemployment multiplier, measured at the peak, equals 0.6, i.e. an increase of 1 percent of GDP in government spending causes a maximum decrease of

0.6 percent in unemployment.

Brückner and Pappa (2012) find instead that fiscal expansions can increase unemployment, both in the US economy and in other OECD countries. The authors show that, while the sample specification can in some cases play a role in determining opposite outcomes, the positive response of unemployment to expansionary fiscal shocks is robust to a number of alternative identification strategies and model specifications. In the paper, a rationale for this puzzling outcome is offered by introducing worker heterogeneity and assuming that outsider unemployment increases more than the reduction in insider unemployment.

Bermperoglu et al. (2013) investigate the effects of several categories of government outlays, such as government consumption, investment, vacancies and wages in the US, UK, Japan and Canada and their conclusion is that contractionary shocks to government wages can produce expansionary effects on output and reduce unemployment, while vacancy cuts lead to output losses and increases in unemployment.

3. The estimated VAR model

For each of the countries included in the investigation, we estimate the following near-VAR model:

$$X_t = A(L)X_{t-1} + e_t \qquad [1]$$

where X_t is a 9×1 vector of macroeconomic variables, including both Euro-area and national variables, and e_t is the 9×1 vector of error terms, such that $E(e_t) = 0$ and $E(e_t e_t') = \Sigma_e$. More precisely, and in order to fix the notation, we have:

$$X_t' = (\begin{array}{ccccccccc} p_t & u_t & i_t - i_t^* & \epsilon_t & g_{it} & t_{it} & p_{it} & u_{it} & spread_{it} \end{array})$$

$A(L)$, the 9×9 matrix polynomial in the lag operator L, has the following structure:

$$\begin{pmatrix}
A_{11}(L) & A_{12}(L) & A_{13}(L) & A_{14}(L) & 0 & 0 & 0 & 0 & 0 \\
A_{21}(L) & A_{22}(L) & A_{23}(L) & A_{24}(L) & 0 & 0 & 0 & 0 & 0 \\
A_{31}(L) & A_{32}(L) & A_{33}(L) & A_{34}(L) & 0 & 0 & 0 & 0 & 0 \\
A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) & 0 & 0 & 0 & 0 & 0 \\
A_{51}(L) & A_{52}(L) & A_{53}(L) & A_{54}(L) & A_{55}(L) & A_{56}(L) & A_{57}(L) & A_{58}(L) & A_{59}(L) \\
A_{61}(L) & A_{62}(L) & A_{63}(L) & A_{64}(L) & A_{65}(L) & A_{66}(L) & A_{67}(L) & A_{68}(L) & A_{69}(L) \\
A_{71}(L) & A_{72}(L) & A_{73}(L) & A_{74}(L) & A_{75}(L) & A_{76}(L) & A_{77}(L) & A_{78}(L) & A_{79}(L) \\
A_{81}(L) & A_{82}(L) & A_{83}(L) & A_{84}(L) & A_{85}(L) & A_{86}(L) & A_{87}(L) & A_{88}(L) & A_{89}(L) \\
A_{91}(L) & A_{92}(L) & A_{93}(L) & A_{94}(L) & A_{95}(L) & A_{96}(L) & A_{97}(L) & A_{98}(L) & A_{99}(L)
\end{pmatrix}$$

The sample ideally covers the period of the EMU, although in practice it differs slightly in some countries due to data availability constraints: the data start in 2000:Q1 and in 2001:Q1 for Spain and Greece respectively, and in 1999:Q1 in all remaining countries; the sample ends in 2014:Q1 in Portugal, 2014:Q3 in Italy and in 2014:Q2 elsewhere.

The structural near-VAR that we adopt allows for a separation of the macroeconomic variables into two distinct blocks: a first exogenous block, including only Euro-area variables, and a second fully endogenous block, including national variables unidirectionally caused by the Euro-area variables.

In particular, the reduced-form representation of the model described in equation [1] has the first block which includes the Euro area consumer price index, p_t, and unemployment (in number of unemployed people), u_t, the differential between the Eonia and the federal funds rate, $i_t - i_t^*$, and the nominal exchange rate, ϵ_t, defined as US dollars per currency units. The first two series proxy aggregate supply and demand respectively. We use the differential between the Euro area and US short-term interest rate in order to account for the relative stance of the ECB via-à-vis the Fed in setting domestic monetary policy. In other words, the reaction function of the ECB is specified as a monetary rule for an open economy[1]. As standard in the literature, we adopt the short-term interest rates to measure the stance of monetary policy (see, *e.g.* Bernanke and Mihov, 1998 and Taylor, 1999).

It is worth stressing that, as the Euro area-wide series remain the same across specifications, the identified euro-wide shocks are invariant across simulations, allowing us to study the domestic dynamics conditional on common impulses that are identical despite we estimate a separate VAR system for each country.

The second block of the model instead includes country-specific series. These are government spending, g_{it}; revenues, t_{it}; the consumer price index, p_{it}; unemployment, u_{it}; and the differential between the yield on 10-years domestic government bonds and the corresponding German bond, $spread_{it}$.

Government spending is constructed as the sum of government consumption and government investment, whereas revenues are obtained by subtracting transfers and interest expenses to the total revenue stream (see Blanchard and Perotti, 2002)[2]. This approach is justified in light of the fact that public spending on goods and services impacts aggregate demand directly, while tranfers and taxes change the amount of disposable income, and therefore the savings-investment decisions[3].

To account for feedback loops between the stock of existing public debt and fiscal policy (see Favero and Giavazzi, 2007), the first lag of government debt is added as an exogenous series to the country-specific block. We also include dummies that take unitary value in the quarters when the country is under an IMF-ECB-EU supported program, and when the Euro area is in recession[4]. The former is intended to account for policy changes and structural reforms that may have taken place in the context of a financial support program; the latter controls for the different stages of the business cycle.

The fiscal variables are expressed as a percentage of GDP, which is convenient for the purpose of comparing fiscal shocks across different countries. Unemployment, the consumer price index and the exchange rate enter the model in natural logs and the interest rate

---

[1]Indeed, the interactions between the ECB and the Fed in the first fifteen years of the EMU have been substantial (see Scotti, 2011).

[2]Including the compensation of employees when computing government spending does not change the results substantially.

[3]In a next section of the paper, we make some robustness exercises and, in that context, we adopt alternative definitions for government spending and revenues.

[4]As established by the Euro Area Business Cycle Dating Committee.

differential in basis points. The model is specified with the series in levels, a constant, a linear and a quadratic trend[5]. The lag length is set to one, a choice which strikes a balance between purging the residuals from autocorrelation and preserving as many observations as possible given the relatively short sample available.

Estimation of system [1] by using OLS ensures consistent estimates. However, potential gains might be obtained by estimation based on Seemingly Unrelated Regressions (SUR) methods (Zellner 1962). We obtain the impulse response functions together with the confidence bands by utilizing Monte Carlo integration techniques and the Gibbs sampling (Doan, 2010).

Having estimated the VAR reduced form [1], the next step is to recover the structural shocks affecting the economic systems, both at the Euro-area and at the national level. Thus, we first obtain the reduced-form moving average representation of system [1]:

$$X_t = C(L)e_t \qquad [2]$$

where $C(0) = I$.

Then, the structural shocks are recovered by imposing a contemporaneous recursive structure to the estimated VAR model:

$$X_t = B(L)\eta_t \qquad [3]$$

Where $B(L) = C(L)B$ and $\eta_t = B^{-1}e_t$. B is the Cholesky factor of Σ_e, $i.e.$ is the unique lower triangular matrix such that $BB' = \Sigma_e$.

In particular, identification in the Euro area-wide block is achieved by assuming that a monetary policy shock does not influence either the price level or unemployment within the period; a demand shock exerts a delayed effect on prices; the exchange rate does not exert a contemporaneous effect on the differential between Eonia and the federal funds rate nor on other Euro area variables[6]. This orthogonalization of the structural shocks is widely adopted in the VAR literature studying the dynamic behaviour of large economies (see, for example, Christiano et al., 1999 and Eichenbaum-Evans, 1995).

As for the domestic block, the fiscal shocks are backed out by assuming that the government does not react within the same quarter to economic developments like those in financial markets or in supply and demand[7]. While reasonable, this identification delivers a non-fundamental representation if economic agents foresee the fiscal shocks - e.g. because it is announced in advance, or as a result of delays in the process of parliamentary approval - and rationally respond to them before the shock actually occurs.

---

[5]More precisely, a quadratic trend is included in the specification for Italy and Spain. The inclusion of a linear and a quadratic trend helps to have all roots inside the unit circle and therefore to keep the VAR dynamically stable.

[6]Inverting the order of the monetary policy and the exchange rate series does not change the results.

[7]Similar identifying restrictions are adopted, among others, by Blanchard and Perotti (2002) and by Monacelli et al. (2010).

Although the strategy of backing out the shock directly from the news narrative can help to overcome the non-fundamentalness (Ramey, 2011), the time-series of news announcements is not readily available for any of the countries in our dataset. Moreover, while effective in dealing with the non-fundamentalness problem, the narrative approach may be subject to biases in the distribution between expansionary and contractionary shocks that do not seem to characterize the recursive identification scheme (Barnichon and Matthes, 2015). As an alternative, leading indicators like stock prices and business confidence indexes can help to recover the true sequence of structural shocks (Forni and Gambetti, 2014). To this end, we add the composite index of the domestic stock market as an exogenous variable to each country VAR model.

The remaining restrictions in the domestic block involve restricting to zero the contemporaneous response of the price level to a local aggregate demand shock, and ordering last in the VAR the interest rate differential between national and German bonds, an assumption consistent with the practice of considering financial variables as fast moving series that react quickly to economic developments.

When referring to the unemployment multipliers, we mean the change in the unemployment level for a given change in either government spending or revenues. The multipliers can refer to any horizon j, in which case they are constructed as:

$$\text{Impact multiplier } j \text{ periods ahead} = \frac{\Delta U_{t+j}}{\Delta G_t},$$

where U denotes unemployment and G the government series. Or they can be cumulated over a certain period of time - e.g. quarters - in which case they are defined as:

$$\text{Cumulative multiplier at horizon } j = \frac{\Sigma_{t=1}^{j} \Delta U_{t+j}}{\Sigma_{t=1}^{j} \Delta G_{t+j}},$$

following IMF (2009).

4. The effects of economic shocks in the Euro area periphery

Here we discuss our evidence. In order to economize on space and provide some structure to the discussion, we have organized this section in several subsections. In particular, we concentrate on the evidence concerning the common Euro area monetary policy shock, the domestic fiscal and financial shocks, and we examine the effects of using alternative definitions of the fiscal policy variables as well as sample specifications. When reporting the impulse response functions and the multipliers, we display the median responses together with the error bands set at the 16th and the 84th percentiles following Sims and Zha (1999).

4.1 Common monetary policy shock

A 100 basis points increase in the interest rate differential between the eonia and the federal funds rate causes a decrease in domestic prices in all countries included in the analysis except Spain, while the responses of domestic unemployment are more heterogeneous (Figure 1).

The contractionary monetary policy shock has the expected effects on the price level: prices gradually fall, reaching the maximal effect between eight and twelve quarters after the shock. On impact, the dynamic response of the price level is muted across all countries, but differences emerge along the path back to the long-term equilibrium. While in Greece, Portugal and Ireland the price level falls fairly steeply and by about 1 percent, in Italy the change is smaller, with prices falling by less than 0.5 percent, and in Spain the response is not statistically significant.

The trasmission of a common monetary policy shock to unemployment in the peripheral economies is less homogeneous[8]. Unemployment increases in response to the monetary contraction in Greece, Italy and Spain, while it falls on impact in Portugal and Ireland. The heterogeneity is observed both in the magnitude and in the timing of the change in unemployment in response to the shock. In Greece the increase in unemployment is short lived compared to Italy and Spain, and the effect of the shock vanishes approximately after one year. The peak response is slightly above 3 percent and occurs in the second quarter after the shock. In Italy and in Spain the common monetary policy shock takes more time to reach its maximal effect, which appears clearly in a more pronounced hump-shaped pattern of the impulse response: the shock peaks to 5 percent after about one year and subsequently fades.

Insert Figure 1 about here

4.2 Domestic fiscal policy shocks

Figure 2 collects the responses of the price level, unemployment and the spread to a government spending shock, while Figure 3 does the same for a revenue shock (black lines). In each figure we also report the conditional impulse response of the fiscal series that is not subject to the shock[9].

In Greece, an increase in government expenditures equal to 1 percent of GDP reduces unemployment by 0.55 percent on impact and the maximal effect of 1.75 percent is reached three quarters after the shock[10]. The unemployment response is consistent with the evidence obtained in Tagkalakis (2013) using a similar sample of data. The revenue shock determines a short-lived increase in unemployment.

Unemployment falls in response to a positive government consumption shock also in Italy. The peak response is reached approximately one and a half year after the shock and it is equal to 2.2 percent. In turn, a positive revenue shock increases unemployment by approximately 1 percent.

Greece and Italy are the only two cases where we find responses of unemployment fully in line with the predictions of standard Keynesian models, i.e. increases in government con-

---

[8]See Cavallo and Ribba (2015) for a recent application of a similar approach in a selected group of Euro area countries using industrial output as a measure of real activity.

[9]To allow for cross-country comparability, we rescaled the fiscal variables by domestic GDP and normalized the impulse response to one, so that the shock can be interpreted as a 1 percent of GDP innovation.

[10]It must be noted that, here and in the rest of the paper, the analysis considers percent changes in the level of unemployment, not in the rate.

sumption are expansionary, while higher collection of revenues has contractionary effects. To the contrary, the evidence for Ireland supports the hypothesis that expansionary fiscal policies can be detrimental to unemployment (Brückner and Pappa, 2012). Here unemployment increases by almost 2 percent several quarters after a positive government consumption shock and it falls by approximately 0.7 percent in response to a positive government revenue shock. In Portugal and Spain, unemployment does not respond significantly to fiscal policy shocks.

The impact on unemployment of revenue shocks is more muted compared to expenditure shocks, and the effects over time last less. This appears clearly from Table 1 and 2 where we report the cumulative unemployment multipliers: these measure the cumulative change in unemployment over a specified interval of time in relation to the cumulative change in the fiscal policy variable that is shocked (IMF, 2009). With the exception of Ireland, the cumulative unemployment multiplier to a revenue shock remains below unity even in the long-run. This is not the case in response to a government consumption shock: for example, the evidence for Greece and Italy suggests that the median cumulative fall in unemployment is around 7 percent after three years from the shock.

The spread between the yield on 10-years national bond and the yield on 10-years German bond in some cases reflects the joint dynamics of government expenditures and revenues. For example, in Spain revenues fall by 1.8 percent of GDP conditional upon the positive government consumption innovation, which widens the public deficit and pushes the spread higher; in Portugal the conditional response of revenues is also negative and the spread increases; in Greece revenues undershoot from the second quarter in response to the government spending shock and the spread increases. In Italy, we observe that in response to the positive innovation in government revenues, expenditures grow less and the yield differential eases.

The behavior of prices conditional upon the identified fiscal shock is consistent with the theoretical predictions of the Phillips curve in Greece (government spending shock), Ireland (both shocks) and Italy (government revenue shock).

Insert Figure 2 about here

Insert Figure 3 about here

Insert Table 1 about here

Insert Table 2 about here

4.3 Domestic financial shocks

The real effects associated with a 100 basis points increase in the differential between the yield on 10-years national bond and the yield on 10-years German bond appear quite severe in Italy, Portugal and Greece (Figure 4). In particular, in Italy the financial shock produces its maximum effect after five quarters when unemployment is 2.5 percent above its

10

long-term level. In Portugal the maximal effect is around 1.5 percent, whereas in Greece it reaches 0.4 percent. Thus, the peak responses are not distant from the magnitude of those observed in the case of a shock to government spending. Similarly to that case, the dynamic responses build up slowly over time and it takes up to two years for unemployment to go back to steady state.

However, an adverse financial shock does not always translate into higher levels of unemployment. This is the case in Ireland, which experienced a harsh but confined banking crisis. Here, unemployment falls significantly in response to the financial shock. Spain, which was also exposed to the predicaments of other Mediterranean countries, but has proved to react strongly, appears to be better able to prevent a financial shock from spilling over to the real economy.

The financial shock generally exerts inflationary pressures: the consumer price index increases by 0.3 percent in Italy, 0.25 in Ireland and 0.1 in Greece, and it reverts back to equilibrium after six to twelve quarters; in Spain and Portugal the dynamic responses are positive too, but the statistical uncertainty is also higher. It is worth noting that the evidence for Italy and Greece goes against the conventional wisdom that inflation and unemployment move in opposite directions. While our approach lacks the microfoundations necessary to discriminate between competing explanations, the literature has proposed several mechanisms that can rationalize empirical evidence of this kind. Gilchrist et al. (2015) show in a general equilibrium model with heterogenous firms that the ones facing liquidity constraints have an incentive to raise their prices in response to an adverse financial shock. Others suggested that if agents' inflation expectations are strongly anchored - either to central banks forward guidance (Bernanke, 2010), or to commodity prices (Coibon and Gorodnichenko, 2013) - inflation could rise when activity is falling. Indeed, any of such mechanisms, or a combination of them, could have been at work in our sample of countries throughout the period under examination and help explain the weak link between inflation and unemployment.

Insert Figure 4 about here

4.4. Alternative categories of government spending and revenues

The analysis presented in the previous sections was based on a particular definition of government spending and revenues, introduced for the first time by Blanchard and Perotti (2002). However, other definitions are commonly used in the literature. Furthermore, some international evidence was found in support of the hypothesis that different fiscal policy tools have a different impact on the economy (Bermperoglou et al., 2013). We explore these avenues below[11].

The first variation that we test involves defining government revenues as total government receipts, and constructing government spending by subtracting transfers, subsidies and interest expenses from total expenditures. Interest expenses were subtracted from government consumption in line with the basic accounting principles to derive the primary

---

[11]The size of the shock is kept equal to one percent of GDP throughout all the robustness exercises.

deficit and given their exogenous nature, in particular in the case of small open economies; transfers were also subtracted to government consumption based on the argument that they do not represent discretionary spending, but instead respond to the state of the economic cycle. The results are reported in Figures 2 and 3 in blue.

The size of the unemployment responses is usually smaller compared to the baseline case discussed in earlier sections. Italy is the only case where the peak response of unemployment to an expenditure shock is close to 1 percent; Spain and Portugal score approximately 0.5 percent; in Ireland and Greece unemployment jumps by only 0.2 percent. The evidence is similar for a government revenue shock: the largest response is observed in Italy, while in all other countries unemployment moves by less than half of a percentage point.

The qualitative conclusions remain broadly in line with previous evidence, although some differences emerge in the case of Greece, Spain and Ireland. In Greece, the response of unemployment to a government consumption shock turns positive, and the one to a government revenue shock becomes negative. In Spain unemployment increases by 0.4 percent in response to the government consumption shock. Therefore, Italy remains the only country where unemployment behaves consistently with the predictions of the New Keynesian model. In the case of Ireland, the responses become statistically non significant.

The spread remains sensitive to the joint behavior of government spending and revenues. In particular, in response to a positive expenditure shock, a sufficiently large increase in revenues can lead to a decline in the spread. We observe this pattern in Greece, where revenues jump by 0.4 percent of GDP; Italy, where revenues increase by 0.2 percent; and in the initial response in Spain. In Spain, as revenues overshoot and remain below the long-term equilibrium level for several quarters thereafter, the spread remains positive. Therefore, it appears that financial markets discriminate between public spending measures based on the capacity of the government to also mobilize revenues.

Next, we assess the effects of a shock to the compensation of public employees only. This spending category represents from 10 to 15 percent of GDP in our sample of countries over the period we consider. This is less than the share of public consumption and investment - except in Greece, where the latter is below 10 percent of GDP - but its economic impact can nonetheless be sizeable since it directly affects disposable income of a large share of the population[12].

The evidence is largely consistent with the one obtained using the Blanchard and Perotti (2002) definition of government spending (Figure 5). The qualitative results remain practically unchanged: the increase, rather than the drop, in the spread in Ireland is the only noticeable difference. The quantitative size of the responses is also close under both scenarios: in Italy and Ireland the maximal change in unemployment is approximately 1 percent larger when the wage component of government spending is considered; the opposite is observed in Greece and Portugal, where unemployment reacts less strongly in response to the shock in the compensation of public employees.

Overall, we do not find evidence in support of a remarkably different impact of fiscal policy

---

[12]Government employees represent approximately 15 percent of the labor force in peripheral European countries according to statistics compiled by the OECD. This figure is as low as 8 percent in Greece. However, compared to other countries, Greece has a much higher share of the workforce employed in public corporations (13 percent versus, for example, Ireland where only 3 percent of the workforce is affiliated to public corporations), which brings the overall total closer to the sample average.

in peripheral European countries when using wage versus non-wage policy levers. Interestingly, the public wage bill, which usually absorbs fewer resources than public spending for consumption and investment when expressed as a share of GDP, appears to have similar economic outcomes in terms of its impact on unemployment.

Insert Figure 5 about here

4.5. Evolution of unemployment multipliers over time

The sample period that we consider in the baseline analysis includes major shocks that the European economies faced since 2007. To allow for the possibility of structural breaks while preserving the parsimonious set-up that characterizes the class of linear models used in this paper, we repeat the analysis over sub-samples.
In particular, in each country we consider sub-samples of the same length, with the first sample ending in 2007:Q4 and the following ones obtained by rolling the sample window forward by four quarters in each round up to 2013:Q4. We therefore obtain a total of seven sub-samples.

We focus on the evidence obtained for Greece and Ireland, given the magnitude of the shocks that these countries have been exposed to, and Spain, since the baseline results are noisy. Figure 6 plots the median reponse of unemployment at quarters 1, 4 and 8 to a 1 percent of GDP shock in either government spending or government revenues for the different sub-samples, and the upper and lower confidence intervals obtained over the full sample.

In Greece, the impact multipliers to a government spending shock fall within the full sample estimates, or they remain close enough. Instead, the response of unemployment to a government spending shock at horizons beyond the first quarter has become more negative over time. For example, the multiplier in quarter four is around 1.5 when using the sample 2001-2007, but it is -2.2 when estimated from the 2007-2013 sample - a value near the lower bound obtained using the full sample of data. This points to a larger impact of government spending shocks on unemployment in crisis times. The results on the government revenues shocks confirm that a positive shock raises unemployment on impact, but the effect dies out fairly quickly.

In Ireland, the sub-sample analysis does not confirm the increase in unemployment that is observed in the full sample in response to a positive government consumption shock. Instead, it appears that the impact multipliers are negative and large in the pre-crisis samples, and only recently do they tend to become positive but short-lived. In the case of the government revenue shock, the impact unemployment multipliers fall within the confidence set obtained from the full sample, except for the samples 2001-2009 and 2002-2010: we view these results as a spurious outcome stemming from the large increase in unemployment and simultaneous fall in revenues that the country experienced in 2009 and 2010, when the sample window is truncated.

In Spain, the impact multiplier to a government spending shock usually remains inside the spectrum identified by the full sample. Instead, the multipliers at future horizons go

from negative to positive over time. This suggests that Spain has experienced a regime shift since the country was hit by the crisis, with unemployment becoming less responsive, or even incresing, in response to positive government spending shocks. This shift can also help to explain the large uncertainty that is observed when using the full sample: as the sign of the multiplier has switched over time, the full sample estimates average out across regimes and deliver an output that contains zero.

Insert Figure 6 about here

5. The drivers of unemployment

The implicit assumption underlying the identified structural VAR model is that changes in the model's variables are driven by a set of innovations which include both Euro-area exogenous shocks, common to all countries, and national structural disturbances.
In particular, given the structural representation [3] and the orthonormality of the structural disturbances, the variance of the forecasting error can be expressed as:

$$Var(X_{t+s} - E_t X_{t+s}) = B_0 B_0' + B_1 B_1' + B_2 B_2' + ... + B_{s-1} B_{s-1}' \qquad [4]$$

The representation above is used to measure the relative importance of the various shocks that drive unemployment fluctuations at various horizons in each country.

We focus on unemployment since in recent years fiscal policy has often been called into question as a stabilization tool that governments can use to steer the domestic cycle, as opposed to the nominal interest rate and exchange rate which respond to area-wide aggregates in a monetary union.

In Table 3 we report the fraction of the forecast error variance of national unemployment which is ascribable to the common Euro area monetary policy shock. Further, in Tables 4 to 8 we have collected the contribution of each national structural shock in composing the variation of national unemployment at different horizons. The main takeaways from these tables are discussed below.

First, unemployment appears to be a highly idiosyncratic phenomenon in the short run, when half or more of its variation is usually ascribed to the shock itself. For example, the demand shock explains 73.8 percent of the forecast error variance in the first quarter in Ireland, 57.8 in Greece, 55.7 in Spain, 52.7 in Portugal and 38.6 in Italy[13]. Interestingly, domestic demand has the largest weight in driving unemployment in Ireland which, compared to the other countries in the sample, was an early adopter of labor market reforms under the EMU as well as following the 2007 crisis (IMF 2007).

---

[13]Although we do not separately investigate the role played by private consumption and investment, these results are consistent with the narrative that assigns a pre-eminent role to the collapse of aggregate demand in explaining the deep recession experienced in these countries in 2007 and beyond.

14

Second, fiscal policies have the largest effect on the dynamics of unemployment in the short and medium run. However, such effect looks quantitatively small: as for Italy and Portugal the sum of spending and revenues shocks combined explain around 5-6 percent of the forecast error variance in the fourth and eighth quarter; in Ireland the sum of the two shocks explains around 9 percent of the forecast error variance. However, a partial exception is represented by Greece, where fiscal shocks explain around 12 percent of the variance of unemployment at horizons from four to eight quarters.

Instead, as shown in Table 3, the common monetary policy shock plays a relevant role as driver of national unemployment in all peripheral EMU countries. Its relative contribution grows steadily over the forecast horizon: if, for example, we look at the horizon of 24 quarters we find that this shock explains from a minimum of 16.6 percent in Ireland to a maximum of 23.5 percent in Italy. In Ireland, the role of the monetary policy shock tends to be consistently smaller than in the other countries across horizons, which can result from the large share of non-Euro area trade and consequent stronger exposure to the economic cycle in the rest of the world.

Thus, according to our results, the short answer to whether fiscal policy is the appropriate tool to temporarily mitigate the unemployment problems in peripheral European countries is yes, because it mostly affects the short-run dynamics of unemployment fluctuations. But it is unlikely that fiscal policy can significantly curb unemployment, since factors pertaining to the domestic business cycle and labor market, and the centralized conduct of monetary policy have a much stronger role since the onset of the monetary union.

Turning to the financial shock, it is worth noting that its share in the forecast error decomposition is close to zero in the first quarter: this confirms that it takes some time for a deterioration in the financing costs of sovereigns - and consequently of businesses and households - to have an impact on the real economy, and it is consistent with the hump-shaped pattern observed in the impulse response analysis. At later horizons the contribution of the financial shock in shaping unemployment fluctuations remains negligible everywhere but in Portugal, where it explains around 4 percent of the variability of unemployment at horizon of four quarters.

Insert Tables 3 about here

Insert Tables from 4 to 8 about here

6. Conclusion

We conducted an empirical analysis on a group of peripheral European countries covering the EMU years to ascertain the effects and relative contribution of national and common shocks on the behavior of several macroeconomic variables of interest, especially unemployment. Our findings can be summarized as follows.

To start with, shocks to the wage and non-wage component of government expenditures have similar effects on the unemployment dynamics, but have larger and more persistent effects compared to revenue impulses. For example, in Italy the cumulative change in

15

unemployment in response to a 1 percent of GDP shock in government consumption is around 5.2 percent over two years, but around unity in the case of a government revenues shock.

The dynamic effects of government spending and revenues shocks on unemployment are fully consistent with the predictions of the New Keynesian economic theory only in Italy and Greece. In Portugal and Spain the results are blurred by high uncertainty, while in Ireland we identify perverse effects of fiscal policy shocks on unemployment.

As the qualitative and quantitative heterogeneity in the responses of unemployment across countries is not reflected in the price responses, a case can be made that the coordination and integration of the domestic labor markets in terms of supply side reforms and legislative frameworks have been proceding more slowly than the progrosses made on the monetary front.

However, time instability is also a factor in explaining the heterogenity observed in the baseline analysis. In particular, both Ireland and Spain show a negative and significant effect of government spending on unemployment before 2007, thus in line with the predictions of standards New Keynesian models; but this relationship is attenuated or reversed as the sample length is extended to include the crisis years. Instead, in Greece, while the impact unemployment multiplier remained relatively stable over time, the multipliers at horizons of one and two years become more negative.

While the responses of the bond yields differential to fiscal impulses are generally noisy, a certain degree of market discipline has been in place, since domestic yields have a tendency to increase if the fiscal deficit widens. The financial shock has sizable and persistent negative effects on unemployment in Italy, Portugal and, to a lesser extent, Greece.

When we measure the relative importance of the identified structural shocks in driving unemployment changes at different horizons, we find that the role of fiscal and financial shocks has been negligible in the majority of countries. In defense of the use of fiscal policy as a stabilization tool available to policymakers is the fact that the largest contribution of fiscal shocks occurs in the short and medium term - when, for example, spending and revenues adjustments can be used as a countercyclical tool. However, from a quantitative perspective, unemployment fluctuations appear to be primarily idiosyncratic in the short run, while mainly driven by the Euro area-wide monetary policy stance and by other common Euro-area shocks in the longer term. As the other sources of fluctuations are controlled for, we interpret the residual idiosyncratic component as capturing primarily the institutional framework regulating the domestic labor market. Among the countries in our sample, this component plays the largest role in Ireland which has been a reformer since the late 1980s.

To conclude, if we take the empirical results obtained in this study as a good guide, the implications are: (1) the expansionary policies undertaken by the ECB can help the labor market of peripheral economies to recover from the current downturn; (2) fiscal measures should be carefully crafted to ensure that they deliver the desired effects, and that their size and composition meet fiscal discipline in order to keep borrowing costs low; (3) the institutional framework regulating the domestic labor market is critical in stabilizing unemployment over the business cycle.

References

Barnichon, R. and C. Matthes (2015). Stimulus Versus Austerity: The Asymmetric Government Spending Multiplier. CEPR Discussion Paper No. DP10584.

Bermperoglu, D., E. Pappa, and E. Vella (2013). Spending Cuts and their Effects on Output, Unemployment and the Deficit, Mimeo.

Bernanke, B.S. (2010). The Economic Outlook of Monetary Policy. Speech delivered at the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming, August 27, 2010.

Bernanke, B.S. and Mihov, I. (1998). Measuring the Monetary Policy. *Quarterly Journal of Economics* **113**, 869 − 902.

Blanchard, O. and R. Perotti (2002). An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output. *Quarterly Journal of Economics* **117**, 1329 − 1368.

Brückner, M. and E. Pappa (2012). Fiscal Expansions, Unemployment and Labor Force Participation: Theory and Evidence. *International Economic Review* **53**, 1205 − 1228.

Canova, F. and E. Pappa (2011). Fiscal Policy, Pricing Frictions and Monetary Accommodation. *Economic Policy* **26**, 555 − 598.

Caprioli, F. and S. Momigliano (2011). The Effects of Fiscal Shocks with debt-stabilizing Budgetary Policies in Italy. Banca d'Italia Working Paper, No. 839.

Cavallo, A. and A. Ribba (2015). Common Macroeconomic Shocks and Business Cycle Fluctuations in Euro Area Countries. *International Review of Economics & Finance* **38**, 377 − 392.

Christiano, L. Eichenbaum, M. and Evans CL (1999). Monetary Policy Shocks: What Have We Learned and to What End? in J.B. Taylor and M.Woodford, Eds., Handbook of Macroeconomics, North Holland, Amsterdam, pp. 65-148.

Coibon, O., and Y. Gorodnichenko (2013). Is the Phillips Curve Alive and Well After All? Inflation Expectations and the Missing Disinflation. *American Economic Journal: Macroeconomics* **7**, 197 − 232.

Cushman, D.O. and T. Zha (1997) Identifying Monetary Policy in a Small Open Economy under Flexible Exchange Rates. *Journal of Monetary Economics* **39**, 433 − 448.

Doan, T.A. (2010). RATS Users Manual, Version 8, Estima, 1560 Sherman Avenue, Suite 510, Evanston, IL 60201.

Eichenbaum, M. and C. L. Evans (1995). Some Empirical Evidence of Shocks to Monetary Policy on Exchange Rates, *Quarterly Journal of Economics* **110**, 975 − 1010.

Favero, C. and F. Giavazzi (2007). Debt and the Effects of Fiscal Policy. NBER Working Paper, No. 12822.

Forni, M. and L. Gambetti (2014). Sufficient Information in Structural VARs. *Journal of Monetary Economics* **66**, 124 − 136.

Gerardi, K., K.F. Herkenhoff, L.E. Ohanian, and P.S. Willen (2013). Unemployment, Negative Equity, and Strategic Default. Federal Reserve Bank of Atlanta Working Paper, No. 2013-4.

Gilchrist, S., R. Schoenle, Jae W. Sim, and E. Zakrajsek (2015). Inflation Dynamics During the Financial Crisis, Finance and Economics Discussion Series 2015-012. Washington: Board of Governors of the Federal Reserve System, http://dx.doi.org/10.17016/FEDS.2015.012.

IMF (2007). Lessons from Successful Labor Market Reformers in Europe. IMF Policy Discussion Paper, No. 07/01.

IMF (2009). Fiscal Multipliers. IMF Staff Position Note, No. 09/11.

IMF (2014). Redistribution, Inequality, and Growth. IMF Staff Discussion Note, No. 14/02.

Leeper, E. (1991). Equilibria under Active and Passive Monetary and Fiscal Policies. *Journal of Monetary Economics* **29**, $129 - 147$.

Mihov, I. (2001) Monetary Implementation and Transmission in the European Monetary Union. *Economic Policy* **16**, $369 - 406$.

Monacelli, T., Perotti, R. and A. Trigari (2010) Unemployment Fiscal Multipliers. *Journal of Monetary Economics* **57**, $531 - 553$.

Mountford, A. and H. Uhlig (2009) What are the effects of fiscal policy shocks? *Journal of Applied Econometrics* **24**, $960 - 992$.

Peersman, G., (2004). The Transmission of Monetary Policy in the Euro Area: Are the Effects Different Across Countries? *Oxford Bulletin of Economics and Statistics* **66**, $285 - 308$.

Ramey, V.A. (2011). Identifying Government Spending Shocks: It's All in the Timing. *The Quarterly Journal of Economics* **126**, $1 - 50$.

Scotti, C. (2011). A Bivariate Model of Federal Reserve and ECB Main Policy Rates. *International Journal of Central Banking* **7**, $37 - 78$.

Sims, C.A. and Zha, T. (1999) Error Bands for Impulse Responses. *Econometrica* **67**, $1113 - 1156$.

Tagkalakis, A.O. (2013). The Unemployment Effects of Fiscal Policy: Recent Evidence from Greece, *IZA Journal of European Labor Studies* **2**, $1 - 32$.

Taylor, J.H. (1999) A Historical Analysis of Monetary Policy Rules. In: Taylor, John H. (Ed.), Monetary Policy Rules. National Bureau of Economic Research, Chicago.

Voth, J. and J. Ponticelli (2012). Austerity and Anarchy: Budget Cuts and Social Unrest in Europe, 1919-2008. UPF Economics Working Papers, No. 1342.

Zellner, A. (1962). An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests of Aggregation Bias. *Journal of the American Statistical Association* **57**, $500 - 509$.

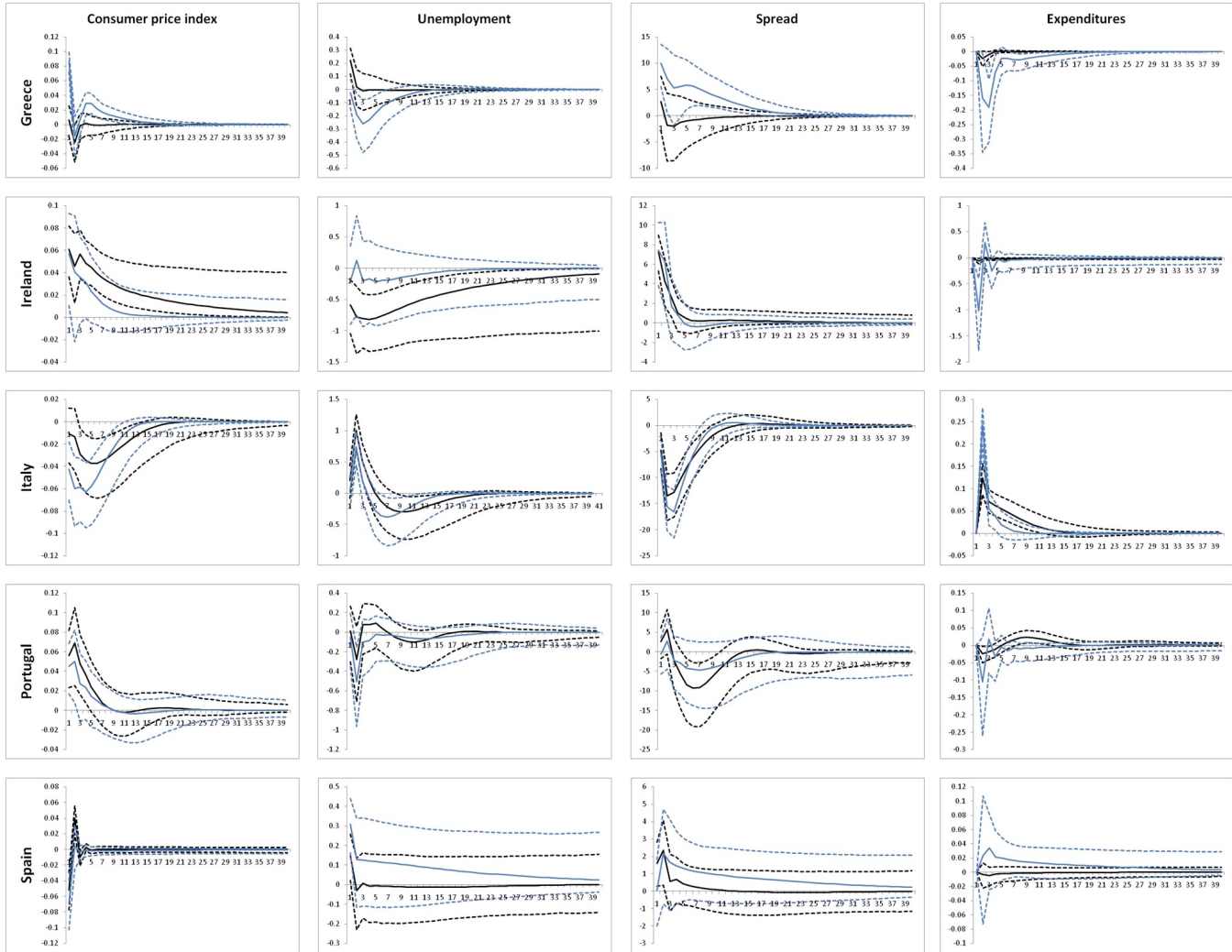Figure 1: Common monetary policy shock
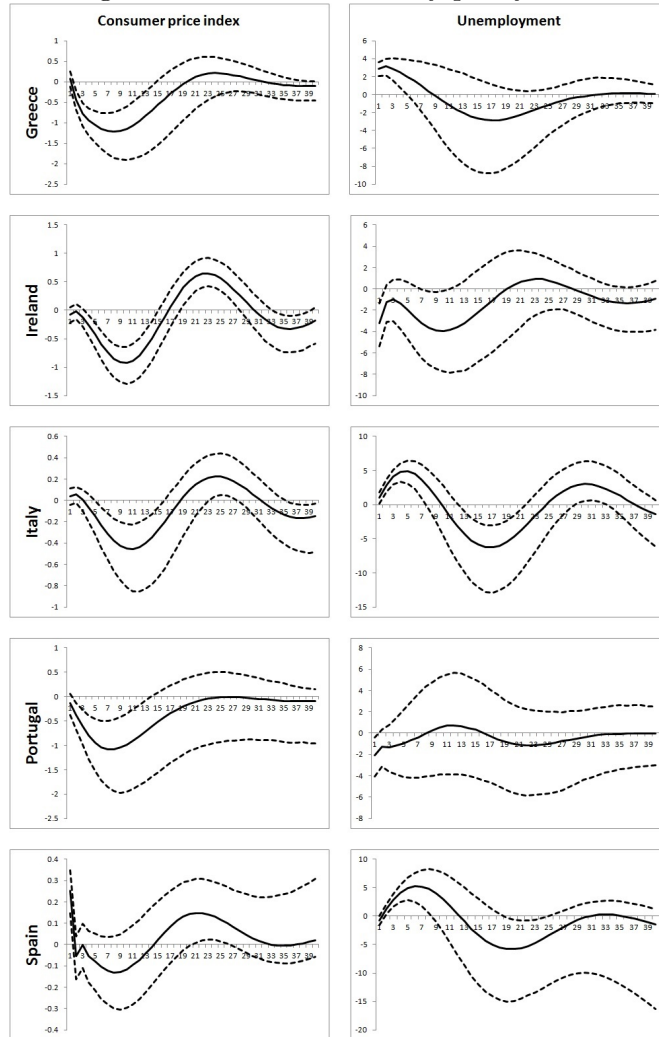
Notes. Impulse responses to a 100 b.p. increase in the difference between the Eonia and the Fed funds rate. Solid line: median estimate; dashed lines: 68th percent confidence interval.

Figure 2: Domestic government expenditures shock
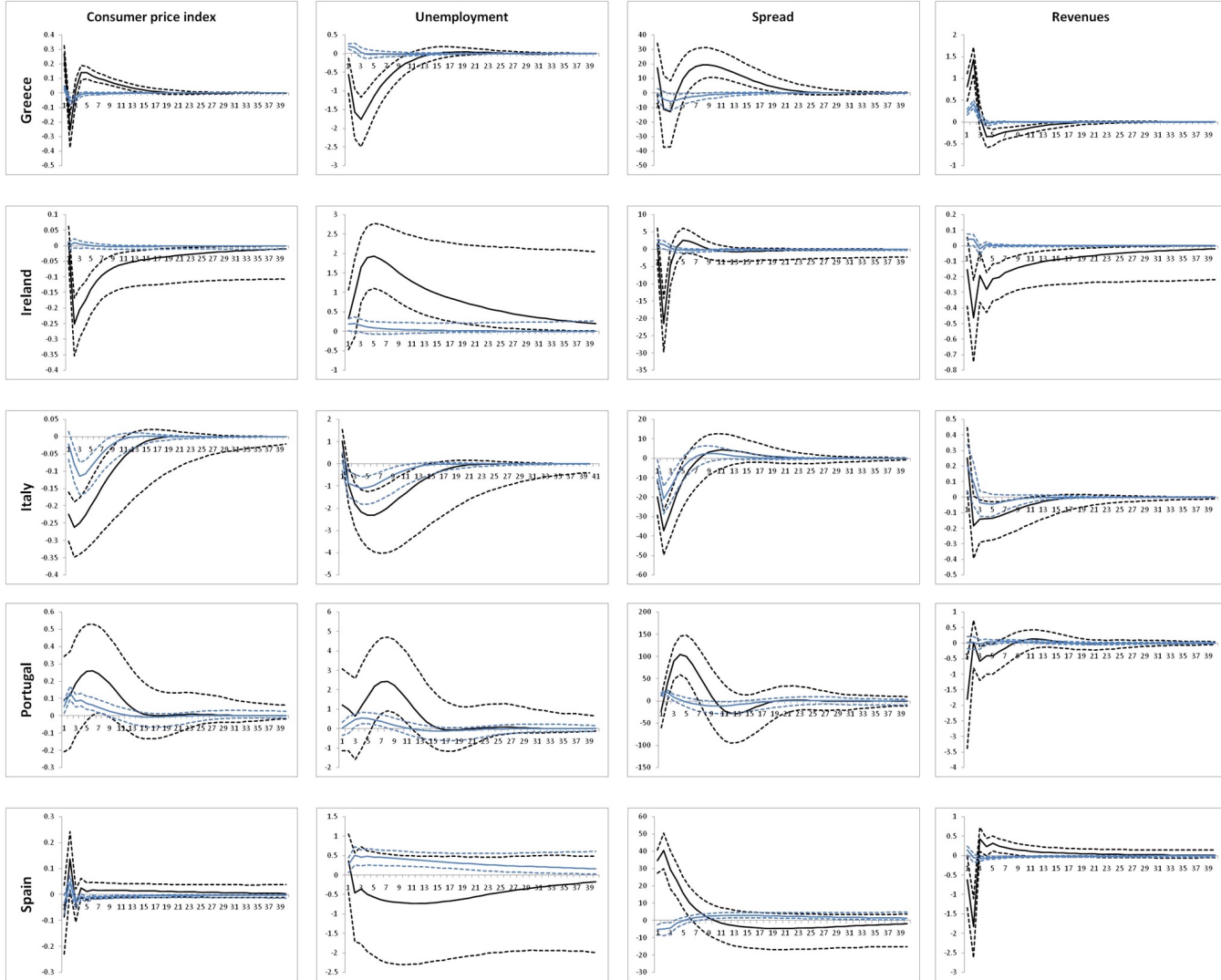
Notes. Impulse responses to a positive government expenditures shock equal to 1 % of GDP. Solid line: median estimate; dashed lines: 68th percent confidence interval. Black: government expenditures defined as government consumption plus investment and government revenues defined as government receipts minus interest expenditures and transfers; blue: government expenditures defined as total government spending minus interest expenses and transfers and government revenues defined as total government receipts.

Figure 3: Domestic government revenues shock

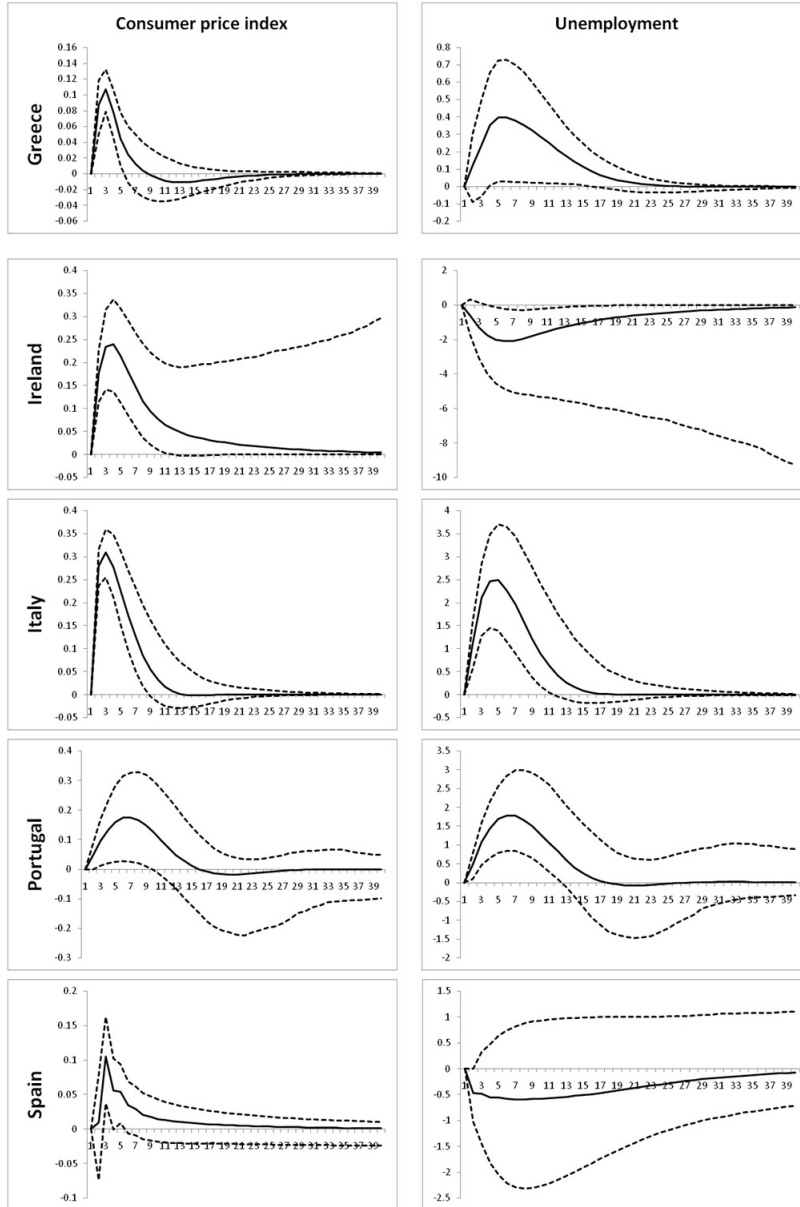*Notes.* Impulse responses to a positive government revenues shock equal to 1 % of GDP. Solid line: median estimate; dashed lines: 68th percent confidence interval. Black: government expenditures defined as government consumption plus investment and government revenues defined as government receipts minus interest expenditures and transfers; blue: government expenditures defined as total government spending minus interest expenses and transfers and government revenues defined as total government receipts.

Figure 4: Domestic financial shock

Notes. Impulse responses to a 100 b.p. increase in the yield differential between the domestic and German bonds. Solid line: median estimate; dashed lines: 68th percent confidence interval.

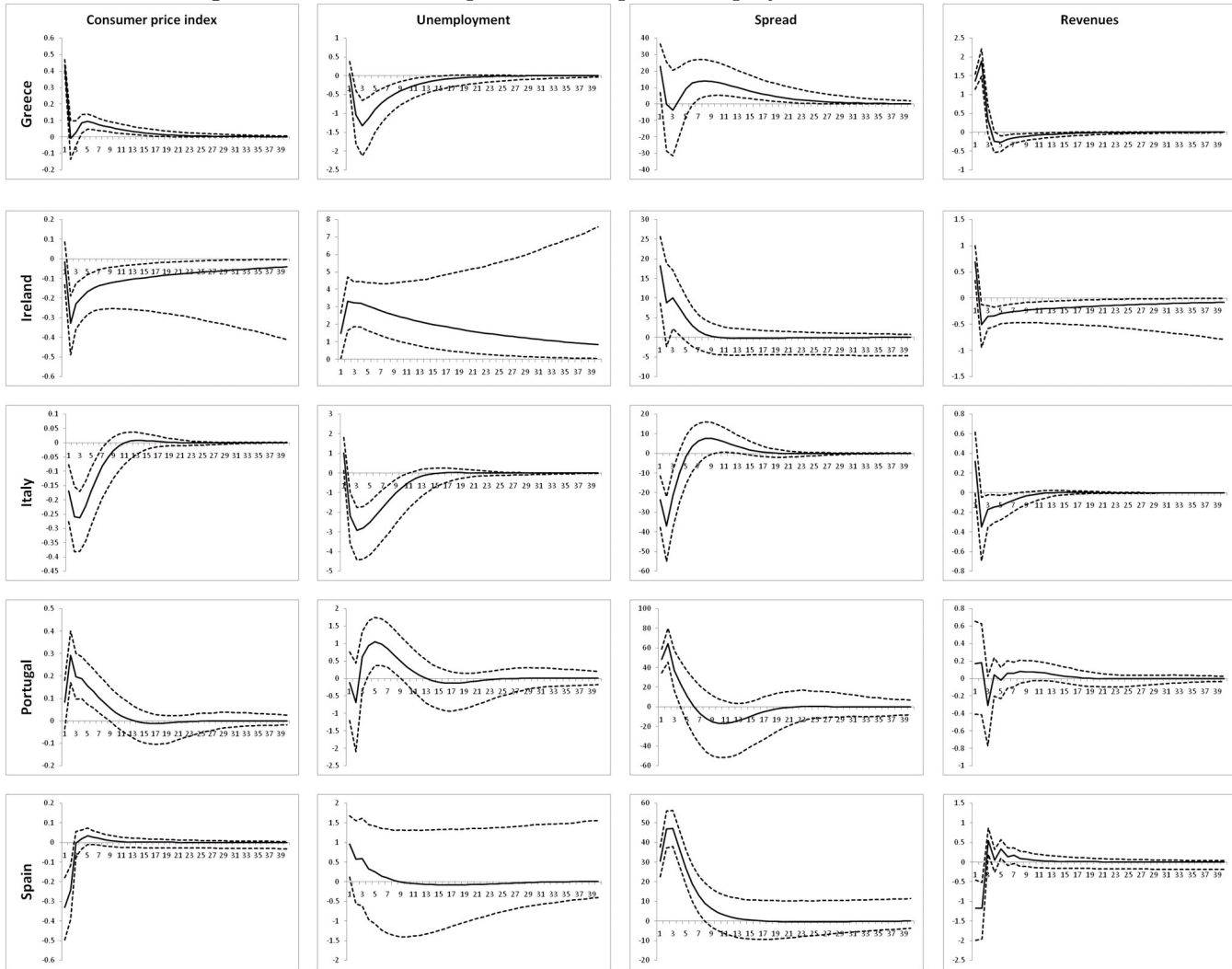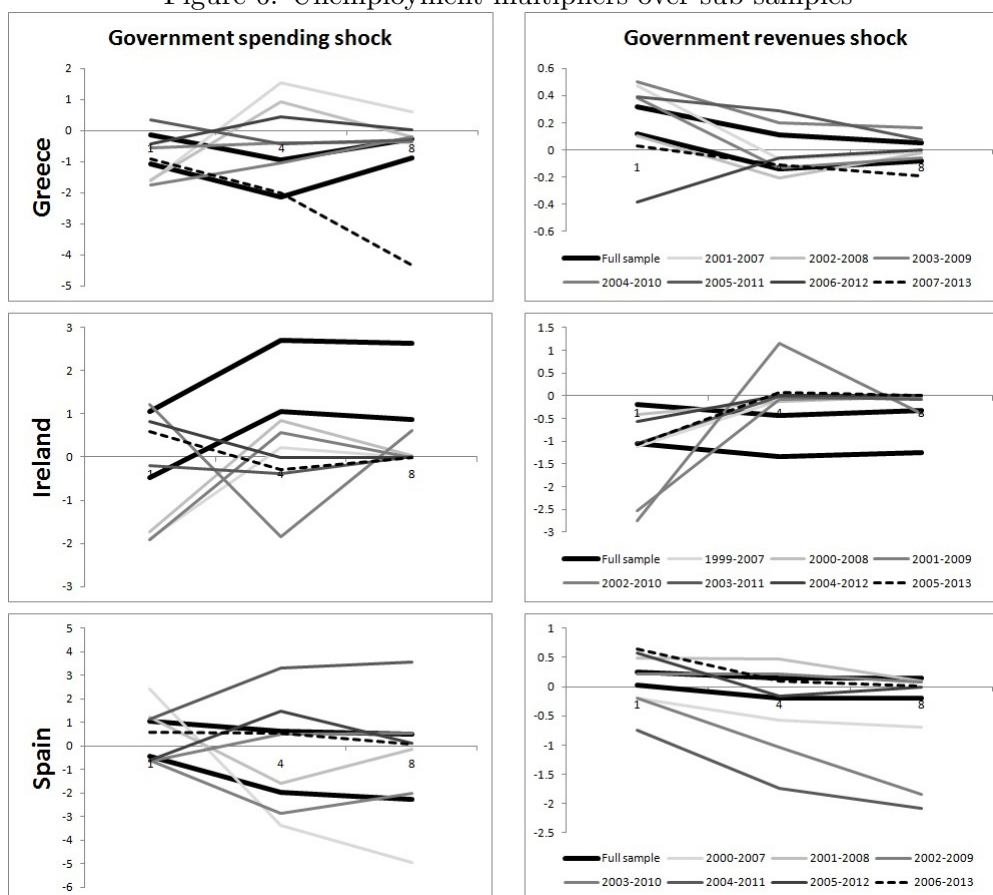Figure 5: Domestic compensation of public employees shock

Notes. Impulse responses to a positive government wage shock equal to 1 % of GDP. Solid line: median estimate; dashed lines: 68th percent confidence interval.

Figure 6: Unemployment multipliers over sub-samples

Notes. The figure presents the response of unemployment to a positive shock in government spending and revenues at horizon 1, 4 and 8 quarters for Greece, Ireland and Spain. The multiplier at horizon j is computed as $\frac{\Delta U_{t+j}}{\Delta G_t}$, where U denotes unemployment and G the government series. The thick black lines are the upper and lower confidence bands estimated over the full sample; the thinner lines are the median multipliers estimated over each sub-sample, with more recent ones in darker colors.

Table 1. Cumulative unemployment multipliers to a government expenditures shock.

Horizon	Greece	Ireland	Italy	Portugal	Spain
1	-0.55 (-1.06,-0.12)	0.32 (-0.46,1.06)	1.01 (0.43,1.55)	1.22 (-1.14,3.08)	0.36 (-0.44,1.05)
4	-4.90 (-9.02,-2.54)	4.55 (1.39,6.44)	-2.02 (-4.54,-0.29)	1.84 (-2.61,4.75)	-1.01 (-9.50,2.54)
8	-7.17 (-13.9,-3.59)	10.2 (6.12,12.6)	-5.25 (-12.6,-1.63)	7.99 (-8.22,11.6)	-5.82 (-54.9,4.62)
12	-7.70 (-16.1,-3.42)	13.4 (8.64,16.3)	-7.26 (-22.3,-1.88)	15.6 (-11.3,16.0)	-15.9 (-39.1,6.17)
24	-7.44 (-18.2,-2.20)	17.6 (11.1,22.17)	-8.60 (-47.4,-1.28)	12.2 (-5.98,13.1)	-11.1 (-27.2,9.37)
40	-7.40 (-18.7,-1.95)	19.4 (11.7,26.06)	-8.62 (-57.7,-1.03)	12.5 (-5.28,13.6)	-10.3 (-25.3,11.9)

Note: The table presents the cumulative response of unemployment to a positive shock in government spending at various horizons and for each country. The cumulative multiplier at horizon j is computed as $\frac{\Sigma_{t=1}^{j}\Delta U_{t+j}}{\Sigma_{t=1}^{j}\Delta G_{t+j}}$, where U denotes unemployment and G government spending. In parentheses are reported the error bands set to the 16th and the 84th percentiles.

Table 2. Cumulative unemployment multipliers to a government revenues shock.

Horizon	Greece	Ireland	Italy	Portugal	Spain
1	0.22 (0.12,0.31)	-0.59 (-1.04,-0.19)	0.20 (-0.08,0.44)	0.01 (-0.30,0.26)	0.15 (0.02,0.26)
4	0.17 (-0.28,0.47)	-2.85 (-6.09,-1.04)	1.87 (0.82,2.53)	-0.12 (-2.76,0.76)	0.14 (-0.95,0.69)
8	0.16 (-0.71,0.62)	-4.42 (-10.2,-1.63)	1.35 (-2.11,2.92)	-0.02 (-4.33,1.08)	0.10 (-2.54,1.16)
12	0.15 (-0.99,0.68)	-5.30 (-13.6,-1.79)	0.22 (-8.27,2.77)	-0.36 (-7.94,1.04)	0.04 (-4.49,1.58)
24	0.14 (-1.29,0.73)	-6.45 (-23.4,-1.54)	-0.90 (-31.2,2.77)	-0.49 (-19.1,1.26)	-0.11 (-13.4,2.64)
40	0.14 (-1.35,0.74)	-6.92 (-36.2,-1.15)	-0.92 (-43.7,2.93)	-0.50 (-26.9,1.30)	-0.17 (-77.7,3.87)

Note: The table presents the cumulative response of unemployment to a positive shock in government revenues at various horizons and for each country. The cumulative multiplier at horizon j is computed as $\frac{\Sigma_{t=1}^{j}\Delta U_{t+j}}{\Sigma_{t=1}^{j}\Delta T_{t+j}}$, where U denotes unemployment and T government revenues. In parentheses are reported the error bands set to the 16th and the 84th percentiles.

Table 3. Fraction of the forecast error variance at various horizons of national unemployment attributable to the common, Euro-area monetary policy shock.

Horizon	Greece	Ireland	Italy	Portugal	Spain
1	9.4 (4.3,15.7)	3.6 (0.4,12.1)	1.4 (0.2,4.1)	5.5 (0.9,14.6)	2.7(0.4,7.4)
4	10.8 (5.0,19.1)	3.7 (1.1,10.3)	11.1 (5.2,18.4)	7.3 (1.9,18.6)	11.8 (6.0,18.9)
8	12.6 (6.1,24.0)	5.9 (1.6,17.6)	14.2 (5.6,25.3)	11.0 (3.3,25.8)	13.2 (8.7,19.4)
12	17.7 (8.9,30.3)	9.8 (2.2,25.9)	16.0 (8.9,24.6)	13.6 (4.4,28.7)	19.2 (12.1,29.1)
24	22.5 (12.2,34.4)	16.6 (4.4,34.4)	23.5 (15.9,31.6)	18.3 (7.7,33.5)	21.8 (14.0,31.1)
40	22.1 (12.3,33.2)	17.4 (4.9,34.8)	24.2 (16.0,31.5)	20.2 (8.6,35.5)	22.1 (14.3,31.5)

Note: The table presents the fraction of variability of unemployment at various horizons and for each country which is due to the Euro-area monetary policy shock. In parentheses are reported the error bands set to the 16th and the 84th percentiles.

Table 4. Fraction of the forecast error variance of unemployment attributable to fiscal shocks and to other national shocks: Greece.

Horizon	Expenditures	Revenues	Supply	Demand	Financial
1	0.4 (0.0,1.7)	2.8 (0.8,5.9)	0.4 (0.0,1.6)	57.8 (49.7,66.2)	0 (0.0,0.0)
4	10.6 (4.7,18.8)	1.5 (0.6,3.5)	0.6 (0.2,2.7)	48.1 (38.9,57.1)	0.7 (0.1,2.9)
8	9.7 (4.1,17.6)	1.2 (0.4,2.9)	0.5 (0.2,1.5)	39.0 (27.7,50.0)	1.6 (0.2,6.3)
12	7.7 (3.0,15.0)	0.9 (0.3,2.4)	0.5 (0.2,1.3)	31.5 (18.4,44.1)	1.7 (0.2,5.7)
24	4.6 (1.4,11.0)	0.6 (0.2,1.7)	0.3 (0.1,0.9)	19.3 (7.1,35.8)	1.2 (0.2,3.1)
40	4.0 (1.1,10.3)	0.5 (0.1,1.5)	0.2 (0.1,0.8)	17.2 (5.8,34.0)	1.0 (0.2,2.8)

Note: For each country, the total variance of the forecast error for unemployment is computed and then decomposed in the part attributable to each structural shock (cf. formula [4]). The table presents the fraction of variability at various horizons which is due to the five national macroeconomic shocks. In parentheses are reported the error bands set to the 16th and the 84th percentiles.

Table 5. Fraction of the forecast error variance of unemployment attributable to fiscal shocks and to other national shocks: Ireland.

Horizon	Expenditures	Revenues	Supply	Demand	Financial
1	1.2 (0.2,5.1)	1.9 (0.2,6.5)	0.9 (0.1,4.0)	73.8 (61.0,84.4)	0
4	4.9 (1.0,12.7)	4.0 (0.9,10.4)	4.8 (1.2,11.5)	51.1 (34.7,66.9)	0.5 (0.1,1.8)
8	4.8 (1.0,13.1)	4.3 (1.0,11.0)	5.3 (1.1,13.5)	35.8 (20.2,53.4)	1.2 (0.2,3.9)
12	3.9 (0.7,11.8)	3.7 (0.8,10.2)	4.3 (0.8,12.4)	27.3 (13.3,45.6)	1.3 (0.2,4.4)
24	2.4 (0.3,9.0)	2.4 (0.4,8.0)	2.6 (0.4,9.5)	16.2 (5.5,33.2)	0.9 (0.1,3.8)
40	1.9 (0.2,8.0)	1.8 (0.2,7.2)	2.0 (0.2,8.4)	12.9 (3.2,33.2)	0.7 (0.1,3.4)

Note: See Table 4.

Table 6. Fraction of the forecast error variance of unemployment attributable to fiscal shocks and to other national shocks: Italy.

Horizon	Expenditures	Revenues	Supply	Demand	Financial
1	0.8 (0.1,2.4)	0.3 (0.0,1.1)	0.5 (0.1,1.6)	38.6 (31.9,46.6)	0
4	3.0 (1.4,5.8)	1.8 (0.8,3.8)	0.5 (0.2,1.6)	25.2 (18.7,33.8)	0.9 (0.2,2.4)
8	4.0 (1.6,8.3)	1.4 (0.7,2.8)	0.5 (0.1,1.6)	16.7 (11.2,24.5)	2.2 (0.6,5.5)
12	3.8 (1.5,7.8)	1.4 (0.7,2.8)	0.8 (0.1,1.4)	13.4 (8.8,20.2)	2.5 (0.6,5.8)
24	2.3 (1.0,4.7)	0.9 (0.4,1.8)	0.3 (0.1,0.8)	8.0 (4.4,13.7)	1.6 (0.5,3.4)
40	1.8 (0.7,4.0)	0.7 (0.3,1.5)	0.2 (0.1,0.7)	6.3 (3.0,11.8)	1.2 (0.4,2.8)

Note: See Table 4.

Table 7. Fraction of the forecast error variance of unemployment attributable to fiscal shocks and to other national shocks: Portugal.

Horizon	Expenditures	Revenues	Supply	Demand	Financial
1	0.9 (0.1,3.5)	0.7 (0.1,2.9)	5.0 (1.3,11.3)	52.7 (41.6,64.9)	0
4	2.6 (1.0,6.5)	1.9 (0.7,4.9)	11.0 (4.8,19.7)	32.8 (23.1,44.6)	1.8 (0.4,4.8)
8	4.5 (1.5,11.0)	1.5 (0.5,3.7)	7.7 (3.5,15.0)	19.7 (11.6,31.1)	3.8 (0.9,9.5)
12	3.8 (1.3,9.5)	1.2 (0.4,3.1)	7.3 (3.2,14.1)	13.2 (6.6,23.6)	3.4 (0.8,8.5)
24	2.4 (0.7,6.4)	0.8 (0.2,2.4)	5.8 (2.1,12.5)	7.3 (2.7,15.9)	2.3 (0.6,5.6)
40	1.9 (0.5,5.5)	0.7 (0.1,2.2)	4.9 (1.4,11.5)	5.4 (1.3,13.7)	1.8 (0.4,4.8)

Note: See Table 4.

Table 8. Fraction of the forecast error variance of unemployment attributable to fiscal shocks and to other national shocks: Spain.

Horizon	Expenditures	Revenues	Supply	Demand	Financial
1	0.3 (0.0,0.9)	0.3 (0.0,1.2)	0.7 (0.1,2.4)	55.7 (47.5,64.7)	0
4	0.5 (0.2,1.1)	1.1 (0.3,1.5)	0.8 (0.3,1.9)	30.9 (24.1,39.0)	0.2 (0.0,0.9)
8	0.5 (0.2,1.2)	0.9 (0.3,2.0)	0.7 (0.2,1.6)	24.4 (18.2,31.2)	0.3 (0.0,1.1)
12	0.5 (0.2,1.2)	0.7 (0.2,1.7)	0.6 (0.2,1.4)	20.32(14.5,26.8)	0.3 (0.0,1.1)
24	0.4 (0.1,1.0)	0.5 (0.2,1.3)	0.4 (0.1,1.1)	15.4 (9.2,22.6)	0.2 (0.0,1.1)
40	0.4 (0.1,1.0)	0.5 (0.2,1.2)	0.4 (0.1,1.0)	14.5 (8.1,22.0)	0.2 (0.0,0.9)

Note: See Table 4.

Data Appendix

Most data come from the International Monetary Fund International Financial Statistics Database. The list of the relevant series and their respective codes follow below:

Government revenues: C136J1@IFS, C184J1@IFS, C182J1@IFS, C174J1@IFS, C178J1@IFS.
Subsidies: C136J25@IFS, C184J25@IFS, C182J25@IFS, C174J25@IFS, C178J25@IFS.
Social benefits: C136J27@IFS, C184J27@IFS, C182J27@IFS, C174J27@IFS, C178J27@IFS.
Government expenses: C136J2@IFS, C184J2@IFS, C182J2@IFS, C174J2@IFS,C178J2@IFS.
Compensation of employees: C136J21@IFS, C184J21@IFS, C182J21@IFS, C174J21@IFS,C178J21@IFS.
Government consumption: C136GG@IFS, C184GG@IFS, C182GG@IFS, C174J22@IFS, C178GG@IFS.
Government consumption of fixed capital: C136J23@IFS, C184J23@IFS, C182J23@IFS, C174J23@IFS, C178J23@IFS.
Interest expenses: C136J24@IFS, C184J24@IFS, C182J24@IFS, C174J24@IFS, C178J24@IFS.
Public debt: C136J6M3@IFS, C184J6M3@IFS, C182J6M3@IFS, C174J6M3@IFS, C178J6M3@IFS.
Government 10 years bond yields: C136IB@IFS, C184IB@IFS, C182IB@IFS, C174IB@IFS, C178IB@IFS.
GDP deflator: C136GJ@IFS, C184GJ@IFS, C182GJ@IFS, C174GJ@IFS, C178GJ@IFS.

Unemployment data were retrieved from Eurostat (series code: S023U@EUDATA S136U@EUDATA S184U@EUDATA S182U@EUDATA S174U@EUDATA S178U@EUDATA S997U@EUDATA)
and the consumer price index from the OECD Main Economic Indicators.

When necessary, the seasonal trend was eliminated using the X-12-ARIMA seasonal filter.