Fiscal policy, pricing frictions and monetary accommodation.

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Abstract

We investigate the conditions set up in theory for government consumption expenditure expansions to be effective using data for the US, the Euro area and the UK. The channels through which output is affected differ across countries and theoretical results are often contradicted in practice. The 2009-2010 expansions may produce significant output multipliers, have moderate debt effects and, only in the US, generate positive inflation. Expenditure expansions accompanied by consolidations schemes do not uniformly dominate non-reversed expansions and their success depends on how monetary policy behaves. Purely predictable expenditure patterns are inconsistent with the data.

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1. Introduction

The industrialized world suffered over the last few years a number of large negative shocks, initially driven by sharp declines in house and stock prices and by a tightening of credit and financial market conditions. The collapse in output and the increase in unemployment that resulted gave rise to a loss of confidence that considerably intensified the recessionary pressures in the majority of the developed economy. Governments and central banks responded to these developments by introducing measures that dealt with liquidity and solvency problems in financial institutions. In particular, central banks reduced interest rates to unprecedented low levels to support aggregate demand. They also used non-conventional measures, in the form of quantitative easing and qualitative or credit easing, to reduce risk premia and to provide the liquidity needed for the financial sector to properly work. Despite all of these efforts, credit remained tight and aggregate demand in many countries weakened rapidly. There were important spillovers from the industrialized economies to the less developed ones, and this increased the concern that the world economy might be moving into a period of deep and prolonged recession.

Given that nominal interest rates approached or hit the zero lower bound and that the room for maneuvering credit was limited by the inability of the banking system to properly function in the aftermath of the crisis, the scope for further monetary stimulus was limited and attention has turned to fiscal policy. At the beginning of 2009, governments around the world have announced major fiscal stimulus packages for the next two years to sustain employment and to bring back economies to a growth path. The packages were extraordinary in size (the total amount reached up to 2 percent of national GDP) and in breath (covering a number of sectors in the economy and involving both firms and workers). The U.S. Congress, for example, approved 787 billion dollars of additional spending, transfers and tax reductions with the 2009 *American Recovery and Reinvestment Act*; the European Union initiated the *European Economic Recovery Plan* while individual European governments announced national plans for fiscal stimuli, see e.g. the '' Pacchetto Fiscale'' in Italy, the ''Plan E'' in Spain, the ''Plan de Relance'' in France, the ''Konjunkurpaket I &II'' in Germany and the ''Pre-Budget Report'' in the UK. In this context, questions were raised as to how effective temporary government fiscal policy actions would be in lessening the depth and duration of the slowdown, and what the preferred mix of fiscal policy actions would be.

Part of the original expansionary fiscal programs in several European countries were reduced or eliminated during 2010 when the international sovereign debt crisis, following the adjustments needed to bring fiscal solvency to Greece, questioned the sustainability of the debt which would accumulate following the planned expenditure packages. In the North-American continent, instead, additional expenditures for roads and infrastructures are contemplated in the years to come. Beside issues of the long-run sustainability of deteriorating fiscal positions, questions concerning the potential long-run crowding-out effects of the debt accumulation started being asked with increasing frequency.

The economic impact of the announced expenditure plans has been difficult to assess, and the recent reversal of spending plans combined with the attempt to consolidate government

debt makes it even more complicated to measure the combined effect of the measures on macroeconomic aggregates and on future growth prospects. Proponents of fiscal stimulus typically emphasize the traditional Keynesian multiplier effects: when consumption is solely a function of after-tax income, a deficit-financed increase in government spending tends to boost total spending (and total output) more than one for one. The increase in output will bring about higher revenues and this secondary effect will contain the increase in government debt or even eliminate it, if the fiscal stimulus is appropriately phased out as output grows. However, since in open economies well integrated in the global environment, domestic spending may partly be diverted to imports, proponents of fiscal expansions have typically called for coordinated action, both on the two sides of the Atlantic, and within Europe. Critics of fiscal stimulus, on the other hand, argue that government spending is likely to displace private consumption and/or investment and negatively affect domestic competitiveness. Deficit financed government spending increases will in fact drive up real interest rates and this will induce consumers to save and firms to reduce private investment therefore nullifying the expansionary aggregate demand effects of the initial government spending increase. In addition, if the terms of trade are affected by changes in the real interest rates, the foreign spending component may also be reduced. Finally, deficit financed expenditure increases may quickly raise debt to an unsustainable level, especially when real interest rates increase. Thus, corrective measures will be required to bring the debt back to a more normal level and this combination of initial expansionary expenditure increases followed by either expenditure cuts or tax increases at later date may generate perverse output effects, making the recession worse than it otherwise would be. Such a bleak point of view is not necessarily shared by all critics of fiscal stimuli. By reducing debt, governments may generate expectations of permanently lower future costs (both in terms of lower principal and of lower interest payments) and thus, via a permanent income type mechanism, stimulate current consumption and private spending. In other words, debt consolidations could be expansionary rather than contractionary.

A number of authors have tried to assess the effects of the announced measures, both in the US and in the Euro area. For example, Romer and Bernstein (2009) estimated that, in the US, and other things being equal, a (permanent) 1 percent increase in government purchases out of GDP would induce an increase in real GDP of 1.6 percent. Given the magnitude of the US fiscal package, the measures designed at the beginning of 2009 were thus expected to boost U.S. GDP by roughly 3.6 percent. Cogan, et al. (2010), however, argue that the magnitude of this boost dramatically depends on the model used to evaluate the effect and that in specifications commonly used in policy circles, this boost could be as low as 0.6 percent. Cwik and Wieland (2009) similarly indicate that the impact of the fiscal stimulus in the Euro area varies substantially depending on the model used and emphasize that the presence of a large portion of "Keynesian'' consumers, i.e. consumers which make consumption decision solely a function of current income, is necessary to produces output multipliers greater than one and no crowding out of consumption (and investment). Coenen et al. (2008) on the other hand, examine the effects of different debt consolidation schemes using the New Area-Wide Model of the ECB and find that while beneficial effects are possible in the long run, primarily when the improved budgetary position is used to lower distorting taxes, short run costs may be significant, a result confirmed also in Forni et. al (2010). Afonso (2010), on the contrary, finds both short and long run gains.

To a keen observer this disagreement over the effectiveness of fiscal measures in stimulating aggregate demand is not surprising. The theoretical discussion on these issues, which dates back, at least, to Baxter and King (1993), often emphasizes that the effects of fiscal policy are fragile, depend on parameter choices, on expectations of future policy actions, and on a number of details about how the fiscal stimulus is implemented. In general, the uncertainty surrounding the expected effects of fiscal measures reflects the lack of consensus on how close to the pure Keynesian framework developed economies are.

Proponents of the fiscal stimulus have also argued that the current conditions are special and that both the empirical evidence collected on the basis of historical data and the predictions of theoretical models, which are designed to characterize the dynamics of macroeconomic variables in response to fiscal expansions in normal times, are not well suited to explain the effects that government spending increases and debt consolidations scheme may have today. In other words, the current situation - in which many central banks are more likely than normal to keep interest rates low for a protracted time period - makes the evidence provided by the empirical literature less relevant to gauge the effects of fiscal actions, primarily because estimated models are designed to assess the effects of fiscal stimulus in situation where central banks will more aggressively act to keep inflation and inflation expectations down. Similarly, calibration exercises conducted with dynamic stochastic general equilibrium models do not provide a reliable term of comparison to project the effects of planned government spending increases, even if the models were correctly specified and policy actions appropriately designed, because parameters historically estimated are unlikely to describe well current economic conditions. For example, the elasticity of consumption to changes in the real interest rate may be much smaller today than it has been on average over the last 20 or 30 years and the responsiveness of the labor supply to the fiscal expansion different when the unemployment rate is large (as suggested, for example, by Barro and Redlick (2009)). On the other hand, expectations of debt sustainability may be state dependent and current debt accumulation may be considered a relative minor cost when agent's welfare is severely hit.

Hall (2009), Woodford (2010) have recently provided simple analytical frameworks within the mainstream New Keynesian paradigm to understand the effects of government spending in general, and to evaluate in which sense current conditions are special relative to historical experience. Coenen et al. (2010) have conducted similar exercises in seven large scale model used in the main central banks of the developed world and in international institutions. The general conclusions these authors reach is clear: in normal conditions, expenditure increases may induce only modest output multipliers. Their size could be significantly larger if currently spending expansions comes with provisions of future spending cuts (but not future tax increases). In addition, the short run output effects could dramatically increase when monetary policy is accommodative, when pricing frictions are important, or when the price markup is strongly countercyclical. Finally, as Christiano et al. (2009)) indicate, the timing of expenditure increase may be crucial to determine the magnitude of the output multiplier effects.

This paper empirically investigates whether the necessary conditions set up in theory for government expenditure expansions to be effective are likely to hold in the data. We take the predictions of a large class of New Keynesian models currently used in academic and

policy institutions at face value and ask whether the conditions that the theory has laid out for fiscal effectiveness hold in the data or not, on average and in special circumstances which can be thought to capture some features of the current situation. We wish to evaluate whether one is justified in making the claim that current fiscal expansions are likely to produce economic and welfare consequences which are different from those obtained in other recessions or other historical episodes and ask (i) whether output multipliers are likely to be larger in these situation, whether (ii) the debt may become undesirably large and (iii) whether inflation is likely to respond so as to give monetary policy some room for maneuvering nominal interest rates. The focus is very much on the issue of short-run effectiveness of government expenditure expansions but we occasionally discuss long run consequences of current measures. Also, while welfare statements are not possible, we presume that more output is likely to indicate an improved macroeconomic environment which may benefit consumers of different types.

We address the questions of interest with a relatively standard structural VAR model. However, we use state-of-the-art techniques to produce expenditure shocks with the required characteristics and explicitly quantify the uncertainty present in the data in terms of parameter estimates, identification and timing of the shocks. We identify consumption spending shocks using sign restrictions on the response of expenditure, deficits, and output growth and distinguish ''average'' situations from the current one by imposing additional restrictions on the dynamics of tax receipts, inflation and the magnitude of the shocks. We consider the possibility that expenditure shocks are anticipated and examine consolidation schemes similar to those now in place in many European countries. With the identified shocks, we will examine the dynamic responses of the real interest rate which is, in general, determined by the interaction of fiscal and monetary policy decisions, of the real wage and of the profits rate, which depend, among other things, on the frictions present in goods and labor markets. We also measure the output effects of various fiscal expansions programs and evaluate their debt and inflation consequences.

One unique feature of our investigation is a comparison of the dynamics induced by expansionary spending shocks in the US, the Euro area (EA) and the UK, a comparison which seems to be missing from the literature. While one can guess that the same type of fiscal measures may not be appropriate to expand output and decrease unemployment for all countries and all states of the world (as noted in Spilimbergo et al. (2009)), most analyses have focused on individual experiences and have not been able to draw general conclusions about the suitability of current fiscal measures. Given the different size, the different types of product market regulation and labor market rigidities present in the three economies, our analysis can not only shed some light on the question of whether fiscal policy could be used to boost aggregate demand and in what conditions but also inform policymakers on the role of market frictions and policy institutional arrangements in determining the magnitude of the multipliers effects of government spending shocks. Therefore, our analysis contains valuable information that can support the decision-making process faced by many governments in the industrialized world.

Our work differs from the existing ones along a number of dimensions. First, rather than examining the magnitude of the changes in consumption and investment responses induced by expenditure expansions, as it is common in the literature, we focus attention on the

dynamics of the real wage, the real rate of interest and the profit rate since, in theory, they are likely to give us the most effective information about whether output multipliers are large or small and whether certain conditions are special or not. Second, while most of the policy debate focuses on the magnitude of the output effects one should expect from the current packages, we are instead primarily interested in examining whether the economic conditions under which the current packages has been designed are such that fiscal expansions could have a larger role than it had in history. Third, our focus on fiscal and monetary policy interaction allows us to study whether lack of coordination has prevented fiscal policy to be more effective than otherwise would be. Finally, since price and wage rigidities are, in theory, crucial elements to deliver sizable multipliers, our investigation of the connection between economic frictions and fiscal policy expansions can also be seen as indirect test of the mainstream New-Keynesian paradigm.

Given that most fiscal packages involve large increases in government consumption expenditure rather than increases in government investment, government transfers or cut in taxes – increases in government consumption vary between 40 and 60 percent of the packages in the three countries of interest, we will concentrate attention on the effects of government consumption expenditure shocks only. This focus does not allow us to answer the question of which fiscal instrument could be more effective in lessening the current recession, but has the advantage of maintaining a close focus on the current situation.

The rest of the paper is organized as follows. Section 2 presents theoretical considerations that help to guide our empirical analysis and briefly reviews the existing literature. Section 3 describes the data and the methodology we employ. Section 4 describes our findings. Section 5 concludes with an overview of the results and of the policy conclusions one can draw from our exercises.

2. Some theoretical considerations

There is a considerable debate in the literature concerning the effects on fiscal shocks (expenditure increases or tax reduction) in the economy and their spillover effects to other countries. Much of the debate has initially focused on either the sign of the consumption and the investment responses to shocks (see e.g. Blanchard and Perotti (2002)) or the magnitude of output multipliers at different horizons. Since this literature is not concerned with normative statements, the presumption is that the larger are the responses of either output or some of its private expenditure components the more benign is the policy.

The empirical evidence on these two issues is quite heterogeneous and any statement concerning both the sign and the magnitude of these responses is likely to generate controversy in the profession. Values for the output multipliers varying from 0.5 to 3 or even larger have been estimated by researchers (see e.g., Barro and Redlick (2009) or Romer and Bernstein (2009)) and positive or negative consumption and investment responses have been obtained depending on the assumptions made in the empirical analysis and on whether durables or non-durables consumption and residential or non-residential investments are considered.

Existing theories have sharp prediction regarding the sign of consumption responses and the magnitude of output multipliers in response to government consumption spending shocks, while there is more uncertainty about the sign of the investment responses. With standard preferences and a competitive labor market, when government expenditure is unproductive and yields no utility to the private agents, temporary, deficit financed government expenditure increases crowd out private consumption and generate output multipliers which are significantly below one. This is true in both neoclassical and in New Keynesian models, and in the latter case, when either price or wage frictions or both are present, as long as monetary policy is conducted with a standard Taylor rule. The reason for this outcome is quite simple. Increases in government consumption expenditure reduce the portion of output available for private uses. Thus, unless agents fell compelled to increase the productive input substantially, either consumption or investment must fall. The negative wealth effect that increases in government consumption expenditure generate does increase the supply of labor. However, the effect on capital input is typically ambiguous. When the production function displays decreasing returns to scale, output then will typically increases less than one to one with the increase in government consumption expenditure. In models where a permanent income motive is in place, the increase in public deficit will induce the real rate to increase and private consumption expenditure will then fall to compensate for the slack created by the increase in public consumption expenditure. In other words, private saving will increase to match the fall in public savings.

Theory also suggests that the output effects could be magnified if public consumption expenditure yields utility for the agents (see e.g. Bouakez and Rebei (2007)), or if it creates production externalities of some form (see e.g. Baxter and King (1993)). They could also be increased if preferences are represented with different functional forms (see e.g. Monacelli and Perotti (2008)), if increasing returns to scale are allowed in production (see Deveraux et al. (1996)) or if a large share of consumers are not optimizers and simple consume a constant fraction of income (see e.g. Galí et al. (2007)). However, the main conclusion that it is difficult to produce output multipliers exceeding one and consumption responses which are significantly positive in relatively standard frameworks remains.
Given the difficulties in matching the predictions of standard models with the data, and given the large amount of measurement error likely to be present in consumption and output, many authors have shifted attention to other aspects of the data that could inform us about the effects of government consumption expenditure disturbances in the economy. For example, Rotemberg and Woodford (1992), Galí et al.(2007) look directly at the dynamics of hours while Pappa (2009) examines the responses of both real wages and hours (or employment) to expenditure shocks while Caldara and Kamps (2008), Burnside, et al. (2004) examine a variety of macroeconomic variables and important sectorial aggregates. While important information is produced, which gives us a better picture of the transmission properties of government consumption expenditure shocks, robust stylized facts are hard to construct and conclusions likely to be whimsical.

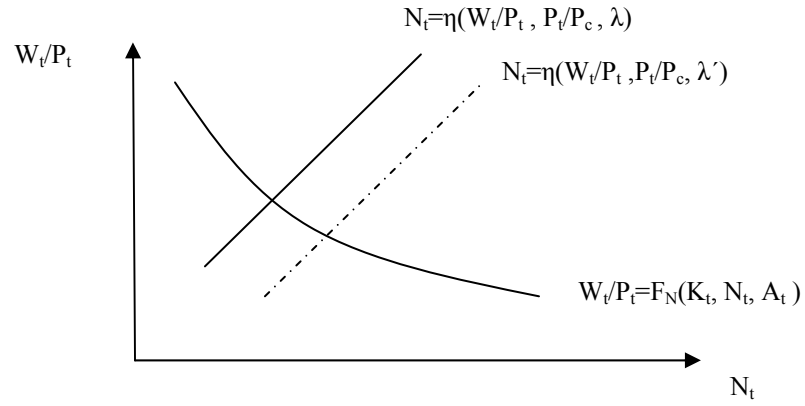
Recently, Hall (2009) and Woodford (2010) have examined the conditions under which government consumption expenditure shocks can have large output effects and induce positive consumption dynamics in simple models featuring a variety of market arrangements and government policies. Their analysis indicates that three crucial conditions

need to be satisfied, in general. First, the real wage should increase substantially in response to the shock. Such an increase will induce consumers to increase their labor supply considerably, making the wealth effect of government spending shocks stronger. As emphasized in Pappa (2009), the dynamics of the real wage in response to government spending shocks can be used to test Neoclassical versus New-Keynesian models of transmission of government spending shocks. The neoclassical approach predicts that an increase in government spending raises labor supply through a negative wealth effect. With perfect competition and diminishing returns to labor, the rise in hours should be accompanied by a short-run fall in real product wages (see first box in figure 1) and productivity. In contrast, the standard New Keynesian approach assumes imperfect competition and either sticky prices or price wars during booms. This model predicts that a rise in government spending lowers the markup of price over marginal cost monopolistic competitive firms charge. Thus, an increase in government spending can lead to a rise in both real wages and hours, despite a decline in productivity. In this case, as it is clear from the second box in figure 1, both the labor supply and the labor demand move making it possible for real wages to increase, if the slopes and the magnitude of the movements in the two curves are right. If increasing returns to scale in production are added to monopolistic competition in the product market, an increase in government spending raises real wage, hours, and also productivity (see e.g. Deveraux et al (1996)). As the third box of figure 1 shows, the labor demand curve is upward sloping rather than downward sloping in this case and shifts in the supply curve for labor can increase real wages substantially, without any need for the labor demand curve to move.

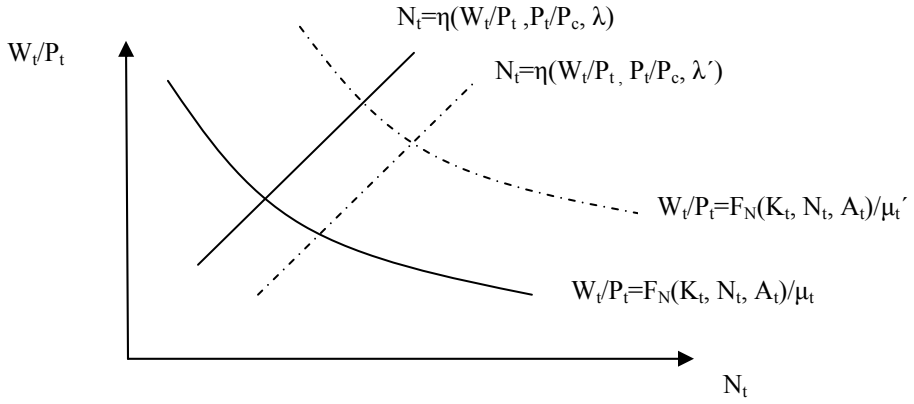
Empirically, little is known about the dynamics of real wages in response to government spending shocks. Pappa (2009 and 2010) and Perotti (2007) report that aggregate real wages typically increase in response to consumption spending disturbances, both in US states and in a number of OECD countries; Nekarda and Ramey (2010) find that real wages fall at industry level when there is an increase in the demand of the goods produced by that industry by the government. Some of the differences in the results appear to be related to the measurement of real wages, that is, whether nominal wages are deflated by CPI (the consumption real wage) or if they are deflated by the GDP deflator (the production real wage). Regardless of measurement issues, absolute changes in real wages are in general estimated to be moderate in magnitude, therefore casting some doubts about the possibility of generating large multipliers through the ‘’supply’’ channel.

The second condition needed for expansionary government consumption expenditure shocks to have large positive effects on the real economy is that the labor-efficiency wedge, that is the inverse of the difference between real wages and the marginal product of labor, is negatively responding to the government spending shock. This condition is closely related to the previously mentioned real wage condition but it is not identical since the efficiency wedge can have the correct cyclical behavior even if the real wage does not. In standard neoclassical models, even with monopolistic competition, the efficiency wedge is constant. One simple way to make it time varying is to assume that there are delays in the adjustment of prices and wages which, in turns, requires some form of nominal stickiness to be present in the economy. Intuitively, increases in government expenditure increase hours (or employment), make the marginal product of labor fall and increase the marginal costs for the monopolistic competitive firms. If prices can’t be instantaneously adjusted, the labor-

a) Competitive model



b) Pricing Frictions



c) Increasing returns to scale

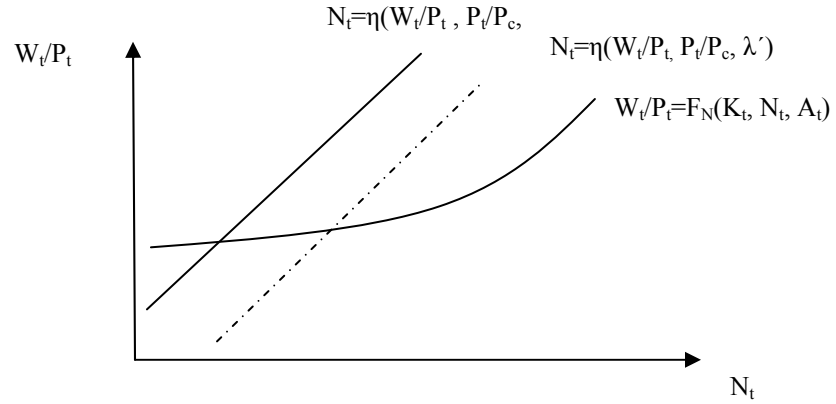


Figure 1: Labor market adjustments in response to government consumption spending shocks. W_t/P_t is the real product wage, P_c is the consumption deflator, λ is the marginal utility of wealth and η is the Frisch labor supply function. F_n is the marginal product of labor, K_t is capital, N_t is labor, A_t is a technological shifter, μ_t the labor efficiency wedge.

efficiency wedge must fall to ensure that an equilibrium is reached in the labor market. If the sensitivity of the labor wedge to changes in output is sufficiently large, sizeable multipliers can be created because the increase in the aggregate demand generated by the increase in government expenditure is translated less in price increases and more in output expansions.

It is important to stress that price stickiness is sufficient but it is by no means necessary to make the labor-efficiency wedge behave counter-cyclically. For example, as discussed in Rotemberg and Woodford (1992), if an increase in government expenditure reduces the ability of oligopolistic producers to maintain collusion, multipliers can be uniformly larger than in the case in which producers do not have market power. Thus, it would be incorrect to use movements in the labor-efficiency wedge in response to demand shocks to test the sticky price assumption. Similarly, evidence of pro-cyclicality in the wedge does not signal failure of the sticky price theory, since countercyclical movements are only necessary to make the output multiplier larger.

How does the efficiency wedge behave over the business cycle and, in particular, in response to government spending shocks? Recently, Nekarda and Ramey (2010) have examined at industry level how this wedge responds to industry specific government consumption demand shocks. They find that increases in government demand that raise output and hours in the sector, lower productivity and real product wages, leaving the efficiency wedge roughly unchanged. Interestingly, evidence reported by Gali et al (2007) and Ramey (2009) using aggregate data, indicates that labor productivity increases moderately, making increases in real wages a necessary condition, and large increases in real wages a sufficient condition for output multipliers to be large.

The third condition that needs to be satisfied for unexpected expansions in government consumption to make output changes large is that monetary policy is accommodative. Unexpected increases in government spending will, in normal conditions, increase inflation. If the monetary authority is strongly reacts to inflation, as it would be the case in inflation targeting countries or in countries where the inflation coefficient in the Taylor rule is large, the real rate would generally increase, discouraging consumption (and investment) expenditure and increasing private savings. When instead an unexpected expansion in government expenditure is accompanied by a (temporarily) weak response of the nominal rate to the inflation increase, the real rate may fall thus stimulating private spending on both consumption and investment. In the unlikely case in which the real rate is unchanged after the spending shock – this would require a one-to-one adjustment of the nominal rate to changes in inflation, the multiplier will be exactly one as private spending will be unaltered by the government expenditure shock.

Clearly, such a mechanism is present only in New Keynesian models. In standard neoclassical models without participation constraints private decisions, rather than monetary policy, determine the real rate of interest. In this world, the real rate will always increase in response to government consumption spending shocks since it is determined by an Euler equation in which consumption growth is predetermined. Thus, economies where price stickiness is substantial have the potential to generate larger output multipliers following fiscal expansions. To put this result in a different way, in New Keynesian

models, the ability of monetary policy to affect real variables via changes in the real rate of interest constitutes a channel that makes monetary and fiscal interactions important. Whether this potentiality is realized or not, that is whether monetary policy helps or leans against fiscal policy, is an empirical question.

It should also be clear that in models with sticky prices, the ability of fiscal policy to positively affect the real side of the economy is magnified when the nominal interest rate is stuck at the zero bound and, conversely, fiscal policy may help monetary policy out of a liquidity trap. At the zero bound, monetary policy is unlikely to respond to inflation – the preferences of monetary authorities are likely to shift in this situation. Thus, as long as expansionary expenditure shocks generates inflation, the real rate will fall making fiscal policy more effective. An interesting empirical question is whether fiscal actions can generate inflation in general, and in the conditions which have brought the nominal interest rate at the zero bound. One can conjecture that the fiscal stimulus must be large to be able to produce such an effect and that, if the recession which has driven the nominal interest rate to zero is deep and protracted, the ability to generate sufficient inflation is limited. On the other hand, it should be clear that as long as this policy succeeds in generating sufficient inflation, it can give the monetary authorities some room to maneuver the nominal interest rate. Such a view seems behind many recent measures that the Federal Reserve and its Chairman have designed: the large increase in the balance sheet of the Fed, of its holding of government debt and the liquidity poured into the system appear all to be consistent with an attempt to create inflation and to make the real rate negative.

Christiano et al. (2009) have emphasized that the magnitude of the output multipliers induced by government expenditure shocks depend on how much time the economy spends at the zero interest rate bound and on the timing of the fiscal actions. In particular, they find that output multipliers are much larger when the fiscal expansion is designed and implement at the time when a shock pushes the nominal interest rate at the zero bound. Delays can cause the fiscal expansion to be much less effective in bringing the economy back to track. In the simulation they run with their model, delays of even one quarter can cut the output multiplier in half.

These considerations suggest that in the current conditions, when nominal interest rates in the industrialized world are close to zero, when a deep recession has materialized, when inflation is low or even negative, and when prospects to quickly return to sustained growth path are dim, fiscal expansions could have larger effects than otherwise and ’’ large’’ fiscal actions are probably required to lead the economy back to a reasonable growth track.

Simple models are great tools to build intuition about the mechanics of transmission of fiscal shocks; however, they may be unsuited to analyze existing events and experience indicates that more complicated setups with a richer set of sectorial or cross country interdependencies are likely to make conclusions much fuzzier. Luckily this does not appear to be the case for the questions of interest. In fact, Coenen et al. (2010) examined the predictions of seven medium or large scale domestic and international dynamic stochastic general equilibrium models widely used in the policy arena and found that the same mechanisms and the same trade-offs are present. Thus, the insights obtained from small scale and closed economy models are maintained in larger scale and open economy

setups.

It is theoretically unclear which of these three conditions plays the most important role in making private spending and output large in response to government spending shocks. The first two requirements are likely to boost the supply side effects of the shock while the later affects the demand side. Thus, if output is supply driven, the first two effects are crucial; if it is demand determined all could a-priori to be important and the last is probably likely to dominate. Intuitively, expansions of the private expenditure component are necessary for output increase substantially. However, unless the real wage increases sufficiently to convince agents to supply the labor needed to make output expansions possible, and unless the demand increase is translated in quantity rather than price expansions, the increase in government consumption expenditure simply crows out private demand or increases inflation.

To the best of our knowledge, no existing work has examined whether the three conditions described in this section hold in the data, whether they are necessary for making output multipliers large, whether they are more likely to hold when the special conditions characterizing today's world economy are in place and, in general, whether the predictions of models with non-competitive setups and pricing frictions have sufficient support in the data. Auerbach and Gorodnichenko (2010) have examined the effects of fiscal policy in recessions and expansions and found that they are different. Kirchner et al. (2010) also study whether the state of the economy affects the nature of the transmission of fiscal shocks and the magnitude of the output multiplier. They notice that the size of the long run multipliers have declined over time and attribute this fact to a weaker response of the real wages and a stronger response to the nominal interest rate to government spending shocks However, neither paper addresses the questions we are interested in nor provides evidence on the interactions between labor markets, pricing frictions and monetary policy in determining the dynamics induced by government consumption spending disturbances.

Most theoretical (and empirical) analyses of the effects of fiscal expansions assume either that increases in government consumption expenditure they are financed by lump sum taxes or, if debt is generated, that it will be eventually be reduced back to the steady state via lump sum taxation. Furthermore, it is typically assumed that such policy does not affect either the credibility of government policies or expectations of future fiscal sustainability. Uhlig (2010), using a standard neoclassical model with endogenous labor supply, highlights an old but often forgotten issue: the financing of government expenditure matters for the conclusion one riches. When the more realistic assumption that only distorting taxation is available is used, output multipliers can be negative – the expected distortions due to the increase in taxation dominates the employment and output gains induced by the shocks.
Furthermore, he shows that the speed of adjustment matters: how fast the government seeks to return the debt to its original level may affect not only the size but also the sign of the multipliers. He also finds that cutting distorting taxes now, and increasing distorting taxes in the future, produce output multipliers that are larger than those produced by deficit financed expenditure increases which will eventually be closed with increases in distorting taxes. In general, who finances the deficit (domestic or foreign residents), how debt consolidations are performed, and which fiscal instrument is used to expand the economy are going to be crucial indicators to understand the effects of fiscal changes in the economy.

Finally, one should remember that fiscal expansions are unlikely to exercise an instantaneous effect on the economy. Apart from gestation and legislative delays, there is some evidence that fiscal and monetary policies affect the variability of real variables at frequencies. For example, Rossi and Zubairy (2009) show that government expenditure shocks explain a large portion of output variability in the medium run, but their ability to affect output variability at business cycle frequencies is small – and the opposite is true for monetary policy. Thus, the fiscal lever may take much longer time than the monetary lever to exercise its effects on the economy and the lack of noticeable output growth effects in many OECD countries, despite the large fiscal impulse in 2009, is consistent with this fact.

3. The data and the empirical framework

We use quarterly data for the US, the Euro Area (EA) and the UK in our exercises. Data for the US comes from the FRED data base at the Federal Reserve Bank of Saint Louis, the Bureau of Economic Analysis (BEA) and the Bureau of Labor Statistics (BLS); for the EA it comes from the Area-wide model data base (version 9), and for the UK from the OECD data base and IFS statistics of the IMF.

The variables entering the VAR for all countries are: the log ratio of government consumption expenditure to output, the log ratio of total tax receipts to output, the log of one plus the annualized quarter-on-quarter growth rate of real per-capita output, the log of one plus the annualized quarter-on-quarter growth rate of real wages, the log of one plus the ex-post annualized real interest rate, the log of the profit rate and the log of one plus the annualized inflation rate. The choice of scaling for each variable insures that the VAR is roughly free from low frequency movements. The construction of each variable from the available raw series is described in Appendix A. For the EA we have also considered the new fiscal data base constructed by Paredes et al. (2009) and the fiscal data base used by Forni et al. (2009). The series for government consumption expenditure and for total tax receipts differ in the three data bases, primarily in the early part of the sample, because of different interpolation procedures used to transform annual into quarterly data and because the sources of information are different. From the beginning of the 1990s, the series largely overlap and their correlation is above 0.95. Thus, for the more recent period, it is immaterial which dataset is used.

Ramey and Shapiro (1998) have argued that to properly measure the effects of government shocks on real wages, real wages need to be computed deflating nominal wages by a product market deflator rather than a consumption deflator. While the difference is irrelevant in a one-sector model, in a model with two sectors the two series may have very different dynamics. We have constructed both consumption and product real wages using CPI and the GDP deflator and compared their dynamics in responses to government consumption expenditure shocks. While the two type of series are not necessarily similar (with the consumption real wage typically being much more volatile and less correlated with output), government spending shock induce dynamics for these series which are, by and large, quite similar. In the exercises we present below, only product real wages

responses are reported.

To measure profits we have tried two different series. One is simply based on the difference between one and the labor share in output. This measure is very rough and may be contaminated by considerable measurement error. The second, which is more related to the theory, uses the difference between the real wage and labor productivity. It turns out that, while the two measures have typically different levels, they have similar cyclical fluctuations. Thus, we present only results based on the first profit measure.

The sample period used to estimate the VAR depends on the country. For the US we start in 1984Q1 and end in 2009:4, for the EA we start at 1993Q1and end in 2008Q4 and for the UK we start in 1993Q1 and end in 2009Q4. We choose the starting periods tying to maintain the sample as homogenous as possible in each country. Since data for the US is available since the early 1950s, while for the EA and the UK since the early 1970, we have also examined whether the conclusions we present are altered when the longer samples are considered. Overall, the qualitative features of the results are insensitive to the choice of the sample but the standard error of the estimates in the longer periods are larger reflecting the presence of considerable time heterogeneity in the samples.

Given the relatively small size of the samples in each of the three countries, we use four lags for each variable and a constant in the VAR, and employ a Bayesian prior to conserve degrees of freedom. The prior is quite standard in the literature (see e.g. Canova, 2007, chapter 9), it is described in appendix B and allows analytical computation of the posterior distribution of the coefficients of the VAR. We then draw from this distribution 2000 coefficient vectors using Monte Carlo techniques, and for each draw we try to identify a deficit financed expansionary government consumption expenditure shock imposing three instantaneous sign restrictions: (i) that government consumption expenditure increases; (ii) that the deficit increases; (iii) that the growth rate of output increases. Sign restrictions are preferable to other more traditional type restrictions for the identification of fiscal shocks because they can be made consistent with the theory that is used to interpret the results. Moreover, as mentioned below, sign restrictions easily allow us to design government consumption expenditure shocks which have more complex patterns - more standard approaches based triangular decompositions or the Blanchard and Perotti (2002) approach do not have this flexibility. We choose to impose only contemporaneous restrictions on the response of government consumption expenditure, government deficit and output growth because existing theories have fragile dynamic predictions. The cost of using a small number of restrictions is that, potentially, other types of shocks could be confused with the one of interest (see Canova and Paustian (2010) for a detailed description of the problems). For each draw of the coefficient vector, we draw up to 3000 orthonormal matrices rotating the contemporaneous covariance matrix of the shocks – appendix B contains details on how to implement these draws. Thus, up to 6,000,000 Monte Carlo extractions are performed for each country and each setup we consider. Contrary to many similar exercises in the literature, the impulse responses we present reflect both coefficient and identification uncertainty – coefficient and identification matrices are assumed to be random.

Since recent literature (see e.g. Ramey (2009), Forni and Gambetti (2010)) has indicated that fiscal shocks extracted with a VAR may not be structural because fiscal policy may

have a large predictable component due to political and implementation lags. To take this possibility into account, we have also tried to identify anticipated government consumption expenditure shocks assuming. That is, we assume that government consumption expenditure is unchanged from t to t+k, k=0,1,2,…but that at t+k+1 a shock, known at time t, occurs. This shock is assumed also to increase government consumption expenditure and deficit at t+k+1, while output growth and all other variables in the VAR are left unrestricted at any date. We also try to identify a weaker type of anticipated expenditure shocks, by allowing expenditure to increase also from t to t+k as long as the increase is small relative to the increase occurring at t+k+1.

Finally, we compute output multipliers by scaling the responses of the log of output per capita by the time t response of the log rate of government consumption expenditure to output. This effectively measures how much a one percent increase in government consumption expenditure to output ratio affects output per capita at different horizons. It is important to stress that since we are using, as theory would suggest, the log of government consumption expenditure over output and the log of output per-capita in the VAR, the multipliers we construct are not directly comparable to those presented in the empirical literature – the log of government consumption expenditure and the log of output are typically employed [1]. However, the multipliers we present are compatible with those derived in theory when population is exogenously growing and output growth is, on average, positive

4. The evidence

4.1 Unconditional analysis

To start with we examine the dynamic response of real wages, the real rate of interest and profit rate in the three countries, identifying government consumption expenditure shocks via restrictions on the instantaneous response of consumption expenditure, output growth and the deficit. Figure 2 shows the dynamic responses of the three variables and of the per-capita output multiplier for horizons up to 20 quarters; we report the point-wise median response (red line) and the point-wise one standard error posterior interval (blue lines) at each horizon; row 1 refers to the US, row 2 to the EA and row 3 to the UK.

[1] To have an idea of how to compare, suppose that population does not change and that the partial change operator commutes with the log operator - which is not necessarily the case. Then, the effect of a change in expenditure to output ratio on output (scaled by the steady state values of the two variables) is equivalent to how much the square of output will change when expenditure changes (scaled by the steady state G/Y^2 ratio). Thus, the multipliers usually found in the literature are, roughly, square root of the numbers we present.

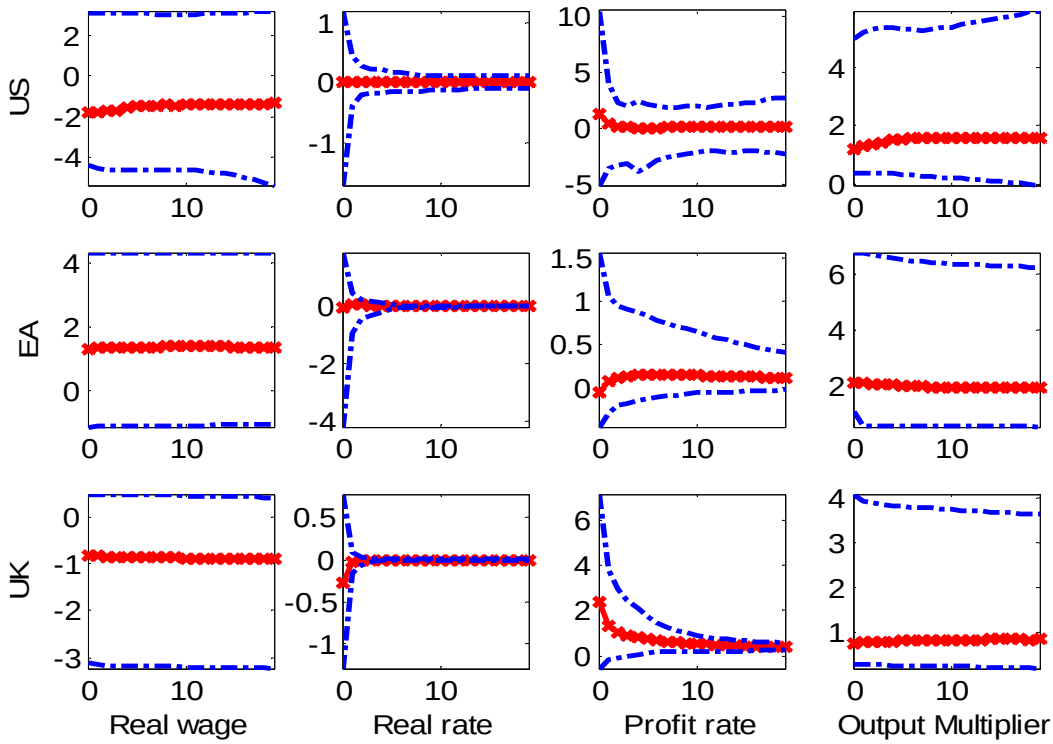


Figure 2: Responses to a deficit financed government consumption expenditure shock and per-capita output multipliers. On the horizontal axis forecasting horizons (in quarters) are reported.

Overall, the data is not very informative about the dynamics of the real wage, the real rate of interest and the profit rate in response to deficit financed expansionary government consumption shocks. In terms of point estimates, the real wage falls in the US and the UK, and increases in the EA; the real rate increases in the US and the EA and falls in the UK; and the profit rate increases in the US and the UK and falls in the EA. However, in all countries, responses are insignificant at all horizons. Intuitively this occurs because, within the sample periods we consider, there are episodes when deficit financed expansionary consumption expenditure shocks are associated with positive responses of each of the three variables and episodes when the responses are negative. To put this observation in another way, the restrictions we have imposed are insufficient to get clear information about the dynamics of these variables. Labor markets, monetary policy and the markups may react both ways, depending on circumstances that our analysis has not controlled for.

The dynamics of the real wage in the US are at odds with the characterization of the empirical evidence presented in Ramey (2009). She, in fact, claims that in the US the real wage increases when expenditure shocks are identified though VARs and falls when expenditure shocks are identified with large unexpected military expansions. In contrast, figure 1 shows that the median estimate we obtain in the VAR is negative. More importantly, the figure indicates that, unless other restrictions are imposed, the responses of the real wage can not be signed with high probability at any horizons in the systems we consider.

Perhaps unsurprisingly, given that we are unable to sign the response of the three variables that the theory has singled out as crucial for understanding the magnitude of the output effects of government expenditure shocks, we can not say much about the magnitude of the per-capita output multipliers either. In the US the median estimate is slightly above 1.0 and increases with the horizon (the maximum value is 1.8); in the EA it is slightly above 2.0 and it is roughly constant across horizons; in the UK is below 1.0 and marginally increases with the horizon. However, the multipliers are very imprecisely estimated and, for example, we cannot exclude with high probability that the multipliers are less than 1 at any horizon, except for the EA in the impact period.

4.2 Conditional analysis

Since the data does not seem to be particularly informative about the issues of interest, and the patterns present in figure 2 are quite robust to standard specification changes analyzed in the literature (for example, they are robust to changes in the sample period, the lag length and the transformation of the variables entering the VAR, etc.) one could stop the analysis at this point and simply conclude that the data is unable to provide sharp conclusions regarding the relevance of the theory. Rather than giving up the investigation, we study whether inference could be made shaper by adding identification restrictions. Thus, to the basic constraints we impose on the instantaneous responses of government consumption expenditure, output growth and the deficit, we also impose restrictions on either the contemporaneous real wage responses, the contemporaneous real rate responses, the contemporaneous profit rate responses or all three contemporaneous responses, while leaving the magnitude of the output responses unrestricted. In table 1 we report the instantaneous output per-capita multiplier we have obtained in the unconditional case studied in the previous subsection (median estimate and one standard error interval) and the median estimate obtained in each of the four conditional exercises we conduct.

	Unconditional	(one standard) (error interval)	r<0	w>0	profits<0	All
US	1.1741	(0.36, 4.97)	0.7647	0.4709	1.9693	0.2073
EA	2.1323	(1.12, 6.76)	1.1872	0.5164	1.0057	0.3497
UK	0.7602	(0.28, 4.08)	0.1494	2.0011	1.3371	2.5029

Table 1: Contemporaneous per-capita output multipliers. Median estimates.

Overall, different restrictions produce instantaneous per-capita output multipliers which are different in different countries. Imposing that the real rate must fall produces the largest EA multiplier; imposing that the wage rate increases induces the largest UK multiplier; finally, imposing that the profit rate falls induces the largest US multiplier. Thus, different mechanisms may matter for generating larger output effects in different countries.
Interestingly, while imposing one of the three restrictions makes the point estimates of the multiplier larger relative to the unconditional case in the US and the UK, this is not the case

in the EA – factors other than the one singled out by the theory may matter. The presence of important cross country structural heterogeneities in the transmission of government consumption expenditure shocks is confirmed by the last column of table 1. When the restrictions on the contemporaneous responses of the real wage, the real rate of interest and the profit rate are simultaneously imposed, the output multiplier increases in the UK, but falls in the US and in the EA, it is significantly below one and it is the smallest of all we report in the table.

Hence, it appears that the standard workhorse New Keynesian model we have used to predict the output effects of government consumption expenditure shocks has a hard time to simultaneously account for the experience of the three countries and that different transmission mechanisms matter in different countries, making it difficult to derive policy conclusions which are generally valid. In addition, the evidence we have collected is incapable to tell us whether to maximize the magnitude of the output effects of government consumption expenditure shocks it is better to have all three channels of transmission simultaneously working or not

4.3 Are the conditions of 2009-2010 different?

In policy circles, it is often claimed that the current conditions are different from those prevailing, on average, in the past. Commentators often cite the fact that the current recession is much deeper than any other post WWII recession; that the fiscal packages followed an important financial crisis; that they were enacted at a time when the ability of monetary policy to stabilize cyclical fluctuations was limited; and that unprecedented global factors matter. To the extent that the current fiscal expansion occurs in a truly unique environment, it is impossible to use historical data to learn about its macroeconomic consequences – to understand and forecast an outlier is close to impossible. However, if episodes with similar characteristics could have been realized in the past – in the sense that the existing economic conditions had some probability to have materialized in the sample - we can study whether the three necessary conditions for effectiveness of fiscal policy are more likely to hold in the data of the three countries in these situations and analyze whether the perceived wisdom that the magnitude of the output multiplier is larger than in normal times is correct or not.

Given the size of the VAR, the lack of important measures of financial tightness in the model, and the linear framework we use, our exercise is necessarily limited in scope. In our empirical model, we can mimic the current situation in two important respects. First, we can analyze the dynamics of the system when the size of the consumption expenditure shock (size of the induced deficit) is large relative to historical standards and the nominal rate cannot move in response to the shock. Second, we can study whether consumption expenditure shocks taking place in recessions, where by this we mean that expenditure shocks are accompanied by a fall in tax revenues and in inflation, are different from those we have recovered on average in the sample. To produce the first set of circumstances, we impose, in addition to the three previous restrictions, the constraints that, on impact, the consumption expenditure to output ratio (deficit to output ratio) increases by at least 1

percent (0.5 percent) and that the nominal rate is unchanged. In the second case, we add the restrictions that tax revenues and the inflation rate contemporaneously fall in response to the shock. Given that restrictions on the magnitude of the impact response of the government expenditure to output ratio or the deficit to output ratio produce qualitatively similar dynamics, we only report results obtained restricting the former.

The first two rows of figures 3 to 5 report the responses of the real wage, of real rate of interest, of the profit rate and the per-capita output multipliers for the two cases of interest. Figure 3 corresponds to the US, figure 4 to the EA and figure 5 to the UK.

In the US, large expenditure shocks occurring in situations when the nominal rate cannot respond increase real wages substantially and make the real rate of interest and the profit rate fall – precisely what the theory suggests would make multipliers large. Indeed, per-capita output multipliers are sizable and significantly bigger than in the situations we have considered in table 1: the median estimate of the instantaneous multiplier is around 2.7 and it slightly increases for horizons up to two and half years. Thus, we need large expenditure shocks and an unchanged nominal interest rate to produce the conditions that we have imposed at the identification stage in the previous section. In recessions, the real wage increases and the real rate falls but the order of magnitude of the changes is much smaller than in the previous case, while the profit rate increases. In this case, the per-capita output multiplier is much more modest is size and can be confidently measured to be below one for the first 10 horizons (two and a half years). Thus, in the US, an elastic and positive response of the real wage to a government expenditure shock makes the increase in output per-capita considerable.

In the EA the real wage and the real rate of interest increase and the profit rate falls, both when large expenditure shocks are associated with an unchanged nominal rate and when they occur in a recession. However, while the magnitude of the response of the profit rate is similar in the two cases, the magnitude of both the real wage and the real rate responses is quite different and the reaction stronger in recessions. Notice that, unlike the US, neither of the two shocks generates the ideal conditions for fiscal policy effectiveness setup in theory. Consistent with this fact, output multipliers tend to be significantly smaller than one in the first setup and roughly similar in size and shape to those produced by requiring that the real wage instantaneously increases (see table 1). However, contrary to what theory would predict, government consumption expenditure shocks occurring in recessions are strongly expansionary and a per-capita output multiplier significantly above two is generated at all horizons.

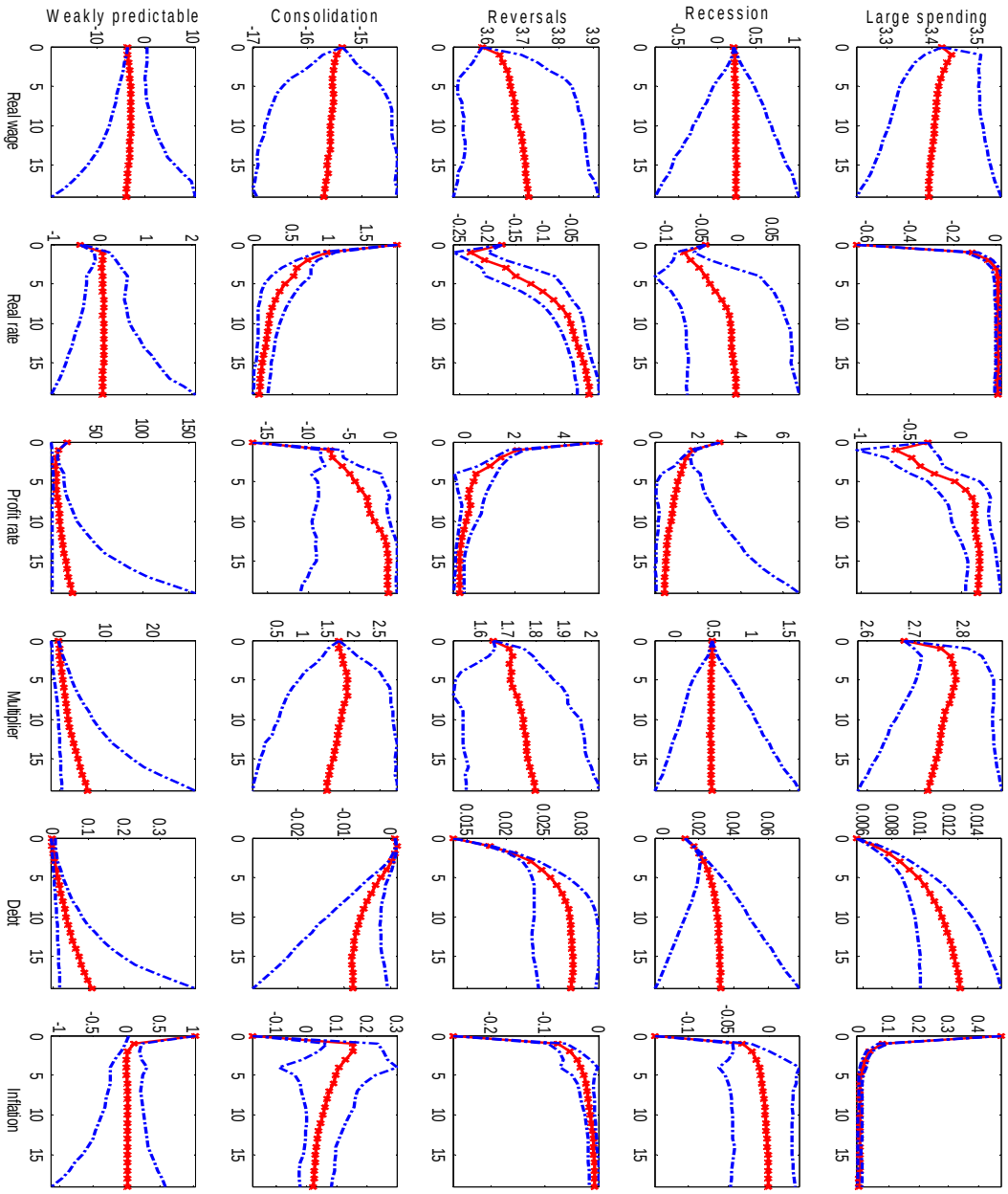


Figure 3: Responses to deficit financed US government consumption expenditure shock

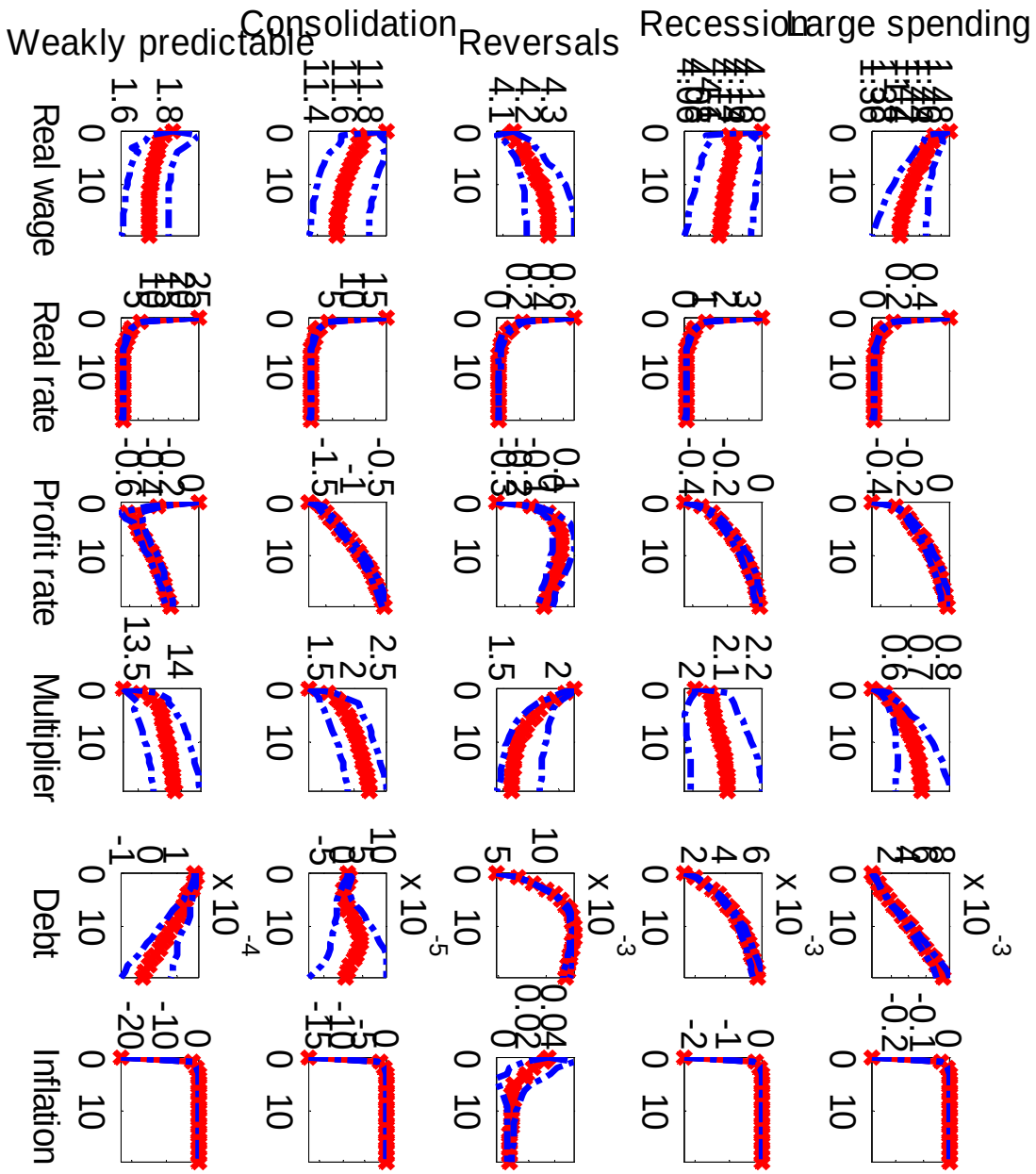


Figure 4: Responses to a deficit financed EA government consumption expenditure shock

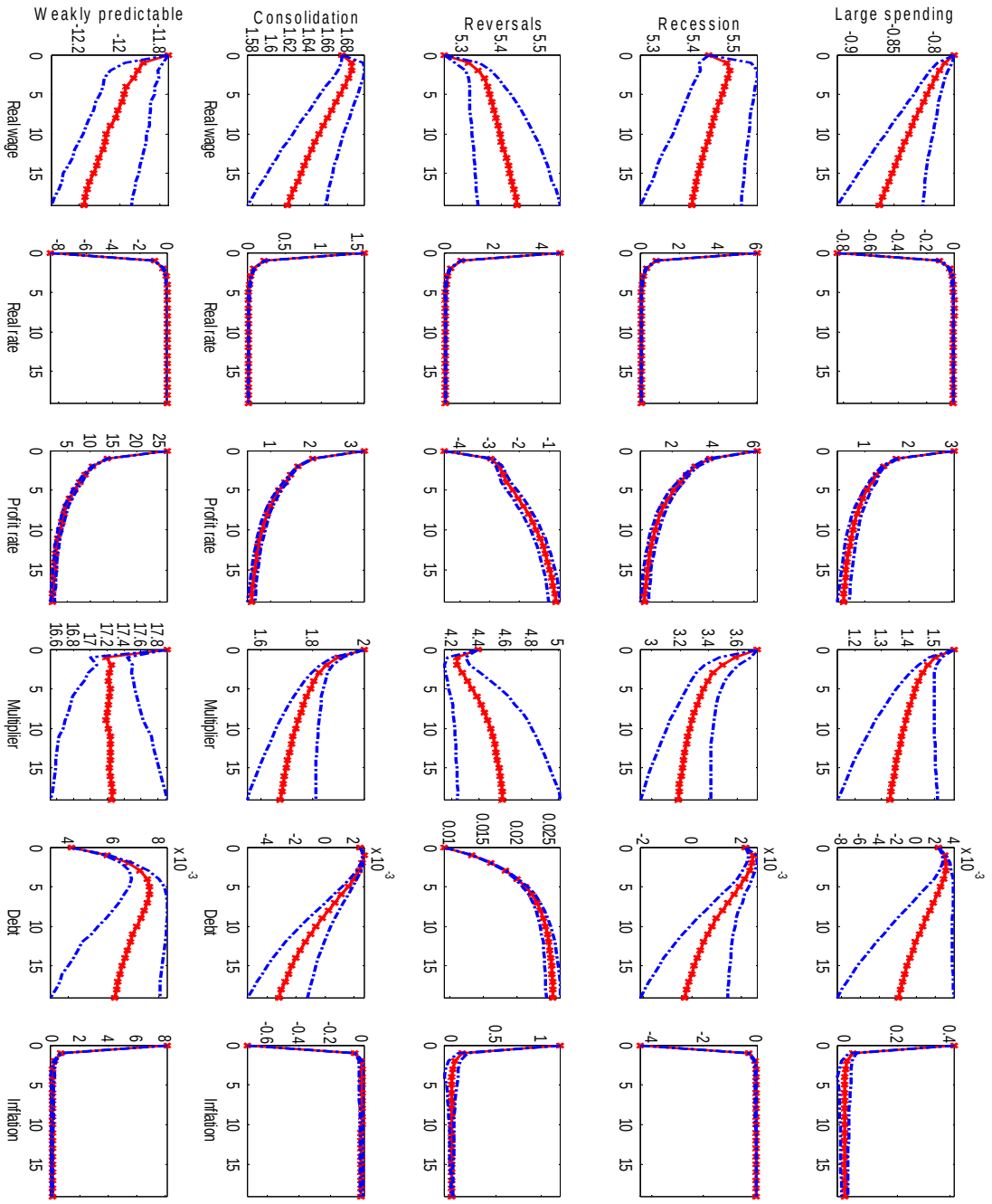


Figure 5: Responses to a deficit financed UK government consumption expenditure shock

In the UK, large expenditure shocks occurring when the nominal rate is unchanged induce a fall in the real wage and in the real rate of interest and an increase in the profit rate. Since two of the three conditions that the theory deems necessary to make output effects large are not satisfied, one should expect small multipliers. Indeed, the per-capita output multiplier we generate in this case is smaller, for example, than the one produced when the real wage increases, but it is significantly larger than one and larger than those produced by imposing that the real rate of interest or the profit rate fall.
On the other hand, government expenditure shocks occurring in a recession lead to a large increase in the real wage and in the real rate of interest and to a modest increase in the profit rate. Thus, two of the three crucial variables appear to have the wrong sign in response to government expenditure shocks, even in recessions. Nevertheless, the instantaneous per-capita output multiplier in this case exceeds 3.0 and it is significantly larger than those we have presented in table 1. To put this result in another way, in the UK as in the EA, the conditions set up in theory for fiscal expansions to be effective do not appear to be necessary to deliver the result.

Several conclusions can be drawn from the analysis of this section. On the one hand, per-capita output multipliers generated in situations like those prevailing in 2009-2010 could be larger than those obtained on average in the sample. However, it is unclear which of the conditions characterizing the current situations matter most; the per-capita output multiplier is large when the nominal rate is unchanged and the size of the shocks is large in the US, but in recessions in the EA and UK. Interestingly, in the US, the role of fiscal policy in recessions seems to be minimal: the per-capita output multiplier we generate in this situation is the smallest of all we obtain (compare this conclusion with the ones of Auerbach and Gorodnichenko (2010), who employ a different technique to approach the problem). Also, while in the US multipliers are larger when the signs of the impact response of the real wage, the real rate of interest and the profit rate are consistent with what theory considers as necessary to make the effects of fiscal expansions large, in the EA and the UK this need not be the case. In particular, in the EA and the UK, the sign of the real rate responses does not appear to be crucial to gauge the effectiveness of the fiscal expansion: large per- capita output multipliers can be generated even if the real rate increase and, conversely, small multipliers can be obtained even if the real rate falls. Thus, the interaction between fiscal expansions and monetary policy reaction in the US appears to be quite different from the one prevailing in the UK and the EA in similar states of the world.
Finally, we find that the larger is the response of the real wage, the larger is the per-capita output multiplier in all countries. In other words, substantial shifts in the labor supply curve are needed to make changes in the aggregate demand curve exercise their largest output effects.

4.4 The effects on debt and inflation

An important part of the public debate following the extraordinary fiscal packages many countries legislated in 2009 had to do with the size of the debt they would produce and with the induced inflation effects. Many commentators believed that the legislation would have generated unsustainable debt dynamics and financial markets agreed and reacted in the spring of 2010 by increasing substantially the spread between bonds prices of countries with potentially unsustainable debt. On the other hand, many policy-markers believe that the fiscal packages would not have impaired the sustainability of the debt if they managed to generate some inflation. There would have been also an important by-product if this happened: higher inflation meant that central banks could have acquired some room for maneuvering again the traditional monetary policy instrument – a possibility which waned when nominal interest rates reached the zero bound. In this section, we therefore examine the debt and inflation dynamics induced by expansionary deficit-financed consumption expenditure disturbances taking place in the two systems we have previously analyzed. The last two columns of figures 3 to 5 present the dynamic responses of the debt to output ratio and of inflation. Once again, figure 3 refers to the US, figure 4 to the EA and figure 5 to the UK.

Since government debt is not a variable of the VAR, we construct debt to output dynamic responses using a budget constraint identity, as in Favero and Giavazzi (2007), assuming that at time zero the debt to output ratio is at the steady state, that one-period real bonds are used to finance the deficit and that no corrective measures are taken at any horizons in the future. Thus, the debt dynamics we present are those that would have been generated if the government completely disregarded the effect that a temporary shock to consumption expenditure would have on future debt.

In the US, shocks that increase expenditure by a large amount and leave the nominal rate unchanged have small but positive effects on the debt to output ratio. In the median, after 10 quarters, one should expect about a one percent increase from the steady state level. Authors' calculations suggest that if the shock lasts 6 periods rather than one period, the debt to output ratio effect at the 10 quarter horizon would roughly be 5 times larger. Thus, the fact that shocks are large does not necessarily induce uncontrolled debt to output dynamics, primarily because the fall in the real rate reduces the service costs of the debt. Given that the nominal rate is instantaneously fixed and the real rate falls, large expenditure shocks also increase inflation. However, the increase is quite short lived and relatively small in size. Overall, it appears that shocks with these characteristics to take place in states of the world where private expenditure is weak – a fact that makes them particularly representative of the conditions prevailing in the last two years.
The response of the debt to output ratio during a recession is significantly positive and somewhat larger in size relative to the previous situation since the real rate falls less. In the median, a deficit financed government consumption to output expansions is likely to add 2 percentage points to the debt to output ratio in the medium run.

In the EA, the debt to output ratio and the inflation dynamics are quite similar in the two situations we consider: the debt to output ratio modestly but significantly increases, while

the inflation rate falls. However, the fall in inflation is considerably larger in recessions. In terms of magnitudes, the effect on the debt to output ratio is one tenth of the effect obtained in the US. This is somewhat surprising given the constant attention given to the debt consequences of expansionary fiscal policy in the Euro area. This fact can be easily reconciled with the common wisdom noting that while the standardized dynamics are smaller in size, the fiscal impulse (that is, the standard deviation of the government consumption expenditure shock) is much larger in the EA than in the US. The magnitude of the inflation and of the real rate of interest responses suggests that the nominal interest rate increases considerably in response to government spending shocks during recessions. Since the nominal rate was falling in the US, monetary policy appears to be much less actively adjusting the nominal rate to inflation in recessions in the EA, probably because of concerns that the fiscal expansion would have generated important inflation effects if not curbed with a tight monetary stance.

In the UK, large expenditure shocks occurring when the nominal rate is instantaneously unchanged induce significantly positive but moderate debt dynamics in the short run. Interestingly, while the bands at long horizons include zero, the point estimate of the debt to output ratio response turns negative after about three years. This is due to the strong positive medium term response of tax revenues. Qualitatively, the debt to output dynamics in recessions are similar but the magnitude of the effect is reduced, because the response of the growth rate of output is larger in this case. As in the EA, the nominal rate of interest increases in recessions indicating that, also in the UK, the monetary authorities were quite concerned about the potential inflationary effects that fiscal expansions may generate. One way to see that this is indeed the case is to notice that historically, in both the EA and UK, increases in government consumption expenditure are typically associated with a larger size of the public sector, with stronger union demands and with large increase in public sector (and overall) real wages and, thus, with potentially dangerous effects on inflation.

In sum, expansionary expenditure shocks occurring in situations that mimic the current state of the world induce modest debt to output ratio dynamics. The magnitude of the responses appears to be country and somewhat state dependent and, in the US, the magnitude of the response is depends on the dynamics of output and the real rate that the shocks induce. In the EA and the UK, on the other hand, the strong dynamics of tax revenues and the tight monetary policy stance help to keep debt dynamics within control. The inflation effects of large expansionary shocks appear to be different across countries, but in all cases, only temporary movements are generated. Thus, while in theory there is a possibility that fiscal expansions may give monetary policy some lever to move nominal rates, in practice this remain just a wishful hope.

4.5 Consolidation schemes

The tensions in the markets for sovereign debt of the spring of 2010 have brought back at the center stage of public attention the question of the sustainability of public debt in many developed countries and the need of fiscal consolidation schemes which bring the level of debt back at manageable levels. As we have seen in the previous subsection, fears of

uncontrolled debt dynamics and of defaults did not appear to have a strong empirical foundation. Nevertheless, an analysis of consolidation schemes is useful since it may shed important light on the nature of the transmission mechanism following consolidation announcements.

Since earlier work by Giavazzi and Pagano (1990), there is a widespread folk wisdom in the profession that consolidation schemes could be expansionary. The basic idea is that by creating expectations of a permanently sounder stance of fiscal policy, agents may be induced to expand private activity by more than the fall in government absorption. Recent work by Afonso (2010) empirically shows that effects of this type are present in the EA when consolidation schemes helped to considerably reduce the real rate of interest and therefore the financing cost of existing government debt. Coenen et al. (2008), on the other hand, using the estimated DSGE model currently employed at the ECB, show that fiscal consolidation are always contractionary in the short run even though, in the long run, they may have positive output effects. Forni et al (2010) confirm that short run costs could be large, in particular in terms of consumption, and suggest that i) the best way to achieve a reduction of public debt to output is to simultaneously decrease public expenditure and tax rates – this has the largest long run positive effects on output and its components – and ii) it is preferable to cut expenditure on goods and services rather than transfers or expenditure for public employment.

This variety of opinions about the design consolidation schemes and their macroeconomic consequences is also present in the policy arena and, following the 2010 summer G-20 meeting, many US based commentators believed that the measures adopted by the EA would have led the Euro area into a new great depression – cutting expenditure when economic activity had not recovered would have made the situation worse than no action at all.

Our empirical model allows us to consider two types of schemes that have been discussed in the literature: current expenditure expansions accompanied by future cuts in expenditure (the so-called spending reversals); current expenditure expansions accompanied by future deficit cuts (obtained by future increases in revenues and expenditure reductions). Notice that while the first scheme will potentially stabilize the debt to output ratio, the second is likely to produce a long run reduction of the debt to output ratio. Corsetti et al. (2009) claim that, other things being equal, spending reversals can help to make the size of the output multiplier larger by signaling agents the temporary nature of the measures and the commitment of the government to return to the fiscal orthodoxy as soon as the current negative circumstances are removed. Uhlig (2010) warns instead against deficit consolidation schemes that are carried out when only distorting taxes are available.
In the context of a standard RBC model, he shows that expectations of future increases in distorting taxes can make output multiplier negative. Canova and Pappa (2006) document that shocks with these characteristics had historically large and negative effects in US states that are required by constitution or legislation to balance the budget at the end of the year (or of the fiscal cycle).

Rows 3 and 4 of figures 3 to 5 present the dynamic responses of the variables of interest when these two debt controlling schemes are in place. Once again, figure 3 refers to the

US, figure 4 to the EA and figure 5 to the UK. We present expenditure schemes which are reversed after two quarters, but the picture is qualitatively unchanged if the debt reducing measures are expected to take place four periods after the initial government consumption expenditure shock occurs. Also, it is important to stress that both the spending reversal and the deficit consolidation program are assumed to be known to the agents when government consumption expenditure unexpectedly increases.

In the US, the two schemes produce different dynamics. Under spending reversals, the real wage significantly increases, the real rate of interest significantly falls and the profit rate significantly increases. Under deficit consolidation, instead, the real wage significantly falls; the real rate significantly increases and the profit rate significantly falls. Despite these differences in the signs of the responses of these variables, the point estimate of the per-capita output multipliers are similar in the two cases and of the order of 1.5. However, the uncertainty surrounding the estimates is much larger when the deficit consolidation scheme is in place. Interestingly, both schemes produce per-capita output multipliers which are smaller than those obtained when the nominal rate is unchanged and the initial government consumption shock is not reversed one way or another. Since output effects are smaller, the level of debt to output ratio over the adjustment path is larger with the spending reversal scheme than in the two previously considered cases of non-reversed shocks - the principal falls after a while, but accumulation of debt is larger in this case because the service costs are larger. Both spending reversals and deficit consolidation programs have instantaneously negative effects on inflation, although for different reasons. In the case of spending reversals, a recession is generated so that both revenues and inflation fall. In the case of deficit reversals, the increase in the real rate temporarily contracts the aggregate demand, making inflation fall. However, the inflation effect is quite short lived and positive inflation is produce 2 quarters after the shock.

In the EA, spending reversals and deficit consolidation schemes have similar effects on the three variables of interest: the real wage and the real rate of interest increase and the profit rate falls. The magnitude of the changes in these three variables is substantial, especially in the case of deficit consolidation schemes. However, the per-capita output multipliers which are generated are roughly similar to those produced in recessions.
Spending reversals tend to generate some inflation, but the effect is small and quite short lived, while deficit consolidation schemes make inflation fall. Interestingly, the dynamics of the inflation rate and the real rate of interest indicates that the nominal rate is roughly unchanged over the adjustment path under the deficit consolidation scheme. Thus, it appears that monetary policy is somewhat accommodative when deficit reducing provision are announced at the time when the expenditure expansion takes place and that monetary authorities see deficit consolidation schemes more benignedly than spending reversal.

In the UK, both schemes increase the real wage and the real rate of interest, while the reaction of the profit rate is negative with spending reversals and positive with deficit consolidations. Here spending reversals produce large per-capita output multipliers, much larger than those previously obtained, and at least twice as large as those obtained with a deficit consolidation scheme. Again, the size of the increase in the real wage is crucial to understand the differences in the magnitude of the per-capita output multipliers.
With spending reversals inflation increases while with deficit consolidation schemes it

falls. In both cases, the nominal interest rate increases indicating that over the adjustment path monetary authorities prefer to remain conservative and lean against the expansionary shocks even though they are expected to be reversed.

What have we learned from these two exercises? Neither the pessimistic view about debt consolidation programs contained in Uhlig (2010) nor the optimistic view about spending reversals contained in Corsetti et al. (2009) are fully supported in the data. We find evidence that well designed and well understood expansionary expenditure schemes could lead to output expansions that are larger than those obtained with an expansionary government expenditure shock which is not expected to be reversed in the UK, but not in the US or the EA. We also find some evidence that the announcements today of future cuts help to tone down the negative output effects of expenditure cuts or tax increases in the future. However, there is no consolidation program which seems strictly superior in terms of output performance in every country. In addition, how the monetary authority responds to the program seems to be crucial to determine the output effects of the measures and different pattern of responses lead to the largest effects in different countries. In the US debt stabilization programs which are accompanied by falls in the nominal rate lead to the largest (long run) output effects. In the UK, larger output effects are generated when monetary policy is tighter during the adjustment while in the EA the largest (long run) effects are obtained when the nominal rate is roughly unchanged. In general, it is unclear whether temporary deviations from the Taylor type rules which have been repeatedly estimated in the literature are welcome or not following expenditure expansions which are expected to be reverted in the future. The main reason is that these deviations may provide substantially different signals in different countries. All in all, the evidence confirms that the experience of the three countries is quite heterogeneous; it indicates that the connection between movements in the real wages, the real rate of interest and the profit rate and output are much weaker than what theory predicts; and it warns against adopting the view that one consolidating recipe may be appropriate for all countries and all situations.

4.6 Predictable expenditure expansions

Because fiscal policy decisions are typically taken in a parliament, legislation and implementation lags may make fiscal changes predictable. That is, rational agents may react to the announcement of the fiscal change, anticipating the effect of the expenditure expansion and, conversely, the economy may not display any visible change at the time when the actual expenditure takes place. This problem is clearly potentially larger with fiscal than with monetary policy decisions, but the predictability issue has been largely ignored, both in the theoretical and the empirical macroeconomic literature analyzing the effects of fiscal expansions, primarily because such effects were difficult to measure. This state of affairs has recently changed thanks to work of Leeper at al. (2009) and Ramey (2009). Leeper et al. construct theoretical examples where anticipatory effects are present and show what kind of distortions may result in VAR analyses when anticipatory effects are disregarded. Ramey (2009), on the other hand, shows that, in the US, expenditure shocks extracted from standard VARs are Granger-caused by both the Ramey-Shapiro dates and professional forecasts of government expenditure. In plain words, this means that increases in military and non-military government spending are anticipated several quarters before they

actually take place. She also shows that failure to take into account the presence of anticipation effects distorts estimates of the dynamics induced by government spending shocks in the economy. On the other hand, Forni and Gambetti (2010) find that the VARs typically used to determine the dynamic effects of fiscal shocks suffer from non-fundamentalness problems, which could be generated by potential anticipatory effects.

Since it is hard to know precisely what the anticipatory lag structure of expenditure expansions is, one typically tries to reduce the distortions caused by their presence including in the VAR variables which have the potential to capture the predictable components present in the estimated shocks. The procedure is very much akin to the one employed by the literature trying to study the effects of monetary shocks. In this literature, variables such as commodity, oil or stock prices, which are known to capture future developments of expectations, are now typically included to insure that estimated monetary disturbances are unpredictable (see e.g. Sims (1992)). Along the same lines, in the literature concerned with the effects of fiscal policy, Mertens and Ravn (2008) add Romer and Romer's tax dummies to the model while Auerbach and Gorodnichenko (2010) use data from the Survey of Professional Forecast or similar sources in the VAR. While adding variables which can capture fiscal news may in part reduce the anticipatory effects of fiscal shocks, it is by no means obvious that it will eliminate them or that the approach would be effective in capturing all possible types of predictable patterns which may be present in the data. Furthermore, since adding a variable expands the number of shocks in the VAR, it is possible that the changes one observes going from one system to the other are due to generic forms of misspecification present in the original model.

The methodology we employ is capable of addressing predictability issue more directly without requiring any change in the structure of the VAR. In fact, one can design deficit financed expenditure shocks with the required anticipatory characteristics by adding restrictions at the identification stage. Thus, for example, a deficit financed government consumption expenditure shock which is anticipated two periods in advance can be obtained by imposing restrictions on the responses of government consumption expenditure and the deficit at t+2 while requiring that nothing occurs to these two variables at t and t+1. Clearly, the rest of the variables of the VAR could react at time t, thus inducing an anticipatory effect. Since we do not impose any restrictions on the dynamics of the variables in the anticipatory interval, the data will tell us whether shocks with these characteristics exist in the data, whether anticipatory effects on the variables of interest are present and whether they are sizable or negligible.

As we have mentioned, it is difficult to precisely determine the anticipatory lag of expenditure shocks. Given the historical experience of the countries we consider, one could reasonably place it between 1 and 6 quarters – Bruckner and Pappa (2010) consider longer types of anticipatory effects produced by the assignment of Olympic Games, world expositions and similar events. We have imposed the identification restrictions we are interested in at all of these horizons. Since results differ very little in terms of qualitative and even quantitative pattern of responses, we only present the dynamics obtained when the anticipatory effects take place two periods in advance.

It turns out that pure anticipatory effects, that is, situations when government consumption

expenditure is known to increase two quarters form now but no changes occur the current and the following quarter, are rare events with very low probability for all three countries. In fact, it is very hard to construct responses which are consistent with the estimated coefficients and that imply that government consumption expenditure at times t and t+1 do not react when a shock at t+2 is known to occur: the chance that a shocks with this characteristics would occur in the data of these three countries is smaller than one over 250,000. In other words, there is very little support in the data for the idea that government expenditure displays this form of predictability. Since, as we have mentioned, this conclusions is independent of the predictability horizon we choose, one should conclude that government expenditure shocks obtained in our original VARs are unlikely to be contaminated by pure predictable patterns.

To further investigate the issue, we look for milder forms of predictability. That is, we allow government consumption expenditure to react at t and t+1 but impose that the restriction that the reaction is smaller than the reaction occurring at t+2. Deficits are restricted to be positive at all three dates while output reaction is unrestricted. This implies that the estimated government consumption expenditure responses have a hump shaped pattern, which is known to occur at time t. The last row of figures 3 to 5 reports the dynamic effects on the six variables of interest in the US, EA and UK when government consumption expenditure shocks have these characteristics.

Having predictable shocks does not alter two important conclusions we had obtained: the responses of the three basic variables of interest show considerable heterogeneity across countries; and the conditions set out in theory appear to be neither necessary nor sufficient to insure the largest output effects of fiscal expansions. In fact, in response to weakly predictable government consumption expenditure shocks, the real wage falls in the US and UK but increases in the EA; the real rate increases in the US and the EA and falls in the UK; and the profit rate increases in the US and the UK and decreases in the EA. Despite this heterogeneity in the sign of the responses, the per-capita output multipliers we generate are the largest of all we have presented and in the EA and the UK they are of extraordinary magnitude. Inspection of the figures indicates that the magnitude of these multipliers is not necessarily associated with the magnitude of the response in the real wages, with the stance of monetary policy – the nominal rate is roughly unchanged over the adjustment path in all countries - nor with the strength of pricing frictions. In other words, mechanisms not considered by the theory may be at play here. The dynamics of the debt to output ratio do not give clues about what could these mechanisms be – debt is positively and strongly responding in the US, moderately reacting in the UK and strongly falling in the EA. Similarly, the dynamics of tax revenues and inflation are heterogeneous across countries, both in terms of signs and magnitude, and this makes it hard to draw general conclusions about the nature of these shocks. All in all, the shocks we have identified in this section appears to be different from the one we have produced in previous ones, in the sense that they signal a much larger and more persistent path of expenditure to output ratio in the next 3-4 years after the shocks. But apart from the change in persistence, which would somewhat justify in theory the larger output multipliers we obtain, explanations for the patterns these shocks produce are difficult to find. In this respect, it is useful to compare our outcomes with those of Auerbach and Gorodnichenko (2010). As in that paper, we find that allowing for predictable patterns in expenditure increases the size of the output

multiplier. However, our analysis indicate that such conclusions can be drawn only for weakly predictable but not for purely predictable expenditure patterns and that, in any case, both the nature of the shocks and their macroeconomic interpretation appear to be different. Thus, until a more comprehensive study of the predictable structure of government expenditure increases is undertaken, it seems unwise to compare the multipliers generated excluding or allowing for predictability, as it is often done in the literature, since the shocks which are extracted they may capture non-comparable changes in government consumption expenditure patterns.

5. Conclusions

What conclusions can one draw from our study? First, the three countries under investigation display considerable structural heterogeneity and the main channels through which government consumption expenditure shocks exercise their largest output effects differ, making it difficult to draw conclusions which are generically valid.

Second, the current state of the economy is such that fiscal expansions could make per-capita output multipliers larger than on average. However, this does not happen because the responses of the real wage, the real rate of interest and the profit rate are larger, more significant or more consistent with theory. In fact, large multipliers can be generated even when the predictions of the theory are partially or completely violated.

Third, deficit financed expenditure expansions taking place in situations similar to the ones we are living in have moderate debt effects. Thus, neither the fact that the current packages are large as percentage of output nor the fact that output growth is currently low appear to threaten fiscal sustainability. Moreover, the expenditure increases contemplated for 2009 and 2010 are unlikely to lead to a significant increase in inflation. Thus, it is highly improbable that fiscal policy will help to liberate monetary policy from the zero nominal interest rate traps.

Fourth, expenditure expansions accompanied by well designed future deficit reduction schemes may lead, in certain countries, to output expansions that are larger than those obtained with expenditure expansions which are not expected to be corrected in the future. The evidence we have collected also indicates that there is no deficit consolidation scheme that is strictly superior across countries in terms of output expansions.

Fifth, because the monetary authorities react differently across countries and deficit reduction programs, it is unclear whether temporary deviations from Taylor type rules are welcome or not. Given that a temporary relaxation of monetary policy rules may provide different signals to agents in different countries, fiscally induced expansionary output effects are largest when a tight policy is implemented in Europe and a more accommodative one in the US.

Finally, purely predictable government consumption expenditure patterns which are consistent with estimated parameters and the uncertainty surrounding the identification of these shocks are difficult to find. Weakly predictable pattern exist but the nature of the shocks they imply and the transmission patterns they generate are considerably different from those produced when predictability is excluded.

These results naturally lead to a few important conclusions. First, even setting aside welfare considerations, it is unclear that the New-Keynesian class of models we have used as organizing principle for our analysis offers guidelines which are appropriate for all countries. Thus, the practice of using the same type of models to analyze the consequences of policy choices in all countries may be dangerous because national idiosyncrasies matter. In addition, since sizable output effects can be generated from expenditure expansions even when the theoretical conditions on the responses of real wages, the profit rate and the real rate of interest are violated, our investigation casts serious doubts about the suitability of the mainstream class of models to inform on the consequences of policy decisions. Second, the current economic conditions may make fiscal policy a more attractive tool to expand output than in standard situations but one should be aware that there are limits to the use of fiscal policy. Well designed temporary expenditure expansions, which do not generate expectations of changes in the stance of fiscal policy, appear to be the most expansionary, at least in Europe. Third, while the coordination between fiscal and monetary policy appears to be a crucial ingredient to understand the output effects of fiscal expansions, national specificities, the details of the fiscal programs and their medium term phase-in clauses, and the state of the economy are as or more important. Thus, to the question '' What should monetary policy do when expenditure policy is expansionary?'' the answer is really ''It depends'' and leaning against the fiscal expansion may be preferable in terms of output expansions in some circumstances.

We are well aware of the limitations of our analysis and we have tried to spell out some of the concerns in the paper. While the results we obtain lead to a consistent pattern of conclusions, one should mention that our analysis completely disregards open economy considerations. While a closed economy point of view may not be a huge problem for the US and EA, which are large in size, it may be more relevant for the UK and international spillovers and twin deficits (see Corsetti and Muller (2006)) may result. In addition, our analysis focuses entirely on government consumption expenditure shocks and does not analyze expansions that occur, for example, because of increases in transfers or reductions in the social security contributions of firms and employees. While our focus on the current situation justifies our choice, one should be aware that they may be other government programs that more expansionary in terms of output than government consumption expenditure increases. Similarly, it is important to recognize that policies reducing the size of the government sector (i.e. combination of tax and expenditure cuts) could have important expansionary effects, while leaving the deficit unchanged. Finally, we would like to remind the reader that our empirical framework allows us to consider only certain types of consumption expenditure shocks. Other interesting shocks, for example, shocks which occur in combination with financial disturbances and which may generate important non-linear effects, need to be analyzed with more complicated nonlinear and time varying coefficient models.

Appendix A: Data Construction

US:
1) Ratio of consumption expenditure to GDP: nominal consumption expenditure (BEA A955RC1) divided by real GDP (BEA A191RX1) times GDP deflator (BEA B191RG3).
2) Ratio of total tax receipts to GDP: total nominal receipts (BEA W066RC1) divided by real GDP (BEA A191RX1) times GDP deflator (BEA B191RG3).
3) Growth rate of real GDP per-capita: First difference of the log of real GDP (BEA A191RX1) divided by working age population 16 to 65 (FRED POP16OV), annualized.
4) Growth rate of real wages: first difference of the log of Nonfarm Business Sector Nominal Compensation per Hour (BLS COMPNFB) divided by the GDP deflator (BEA B191RG3), annualized in percentages.
5) Real interest rate: nominal 3-Month Treasury bill: Secondary Market Rate (FRED TB3MS) minus the annualized first difference of the log of GDP deflator (BEA B191RG3).
6) Profit rate: one minus the product of total non-farm employment rate (FRED CES0000000001) times Nonfarm Business Sector Nominal Compensation per Hour (BLS COMPNFB) divided by nominal GDP (BEA A191RC1)
7) Inflation rate: first difference of the log of GDP deflator (BEA B191RG3), annualized.

EU (all form the AW9 database).
1) Ratio of consumption expenditure to GDP: nominal government consumption expenditure to nominal GDP.
2) Ratio of total tax receipts to GDP: total nominal government revenues to nominal GDP.
3) Growth rate of real GDP per-capita: First difference of the log of real GDP, scaled by the labor force, annualized.
4) Growth rate of real wages: first difference of the log of the nominal wage per head scaled by the GDP deflator, annualized.
5) Real interest rate: nominal short term interest rate minus the annualized first difference of the log of GDP deflator.
6) Profit rate: one minus the product of nominal wage per head and number of persons employed, scaled by nominal GDP.
7) Inflation rate: first difference of the log of GDP deflator annualized.

UK
1) Ratio of consumption expenditure to GDP: nominal seasonally adjusted consumption expenditure (from the IFS) divided by nominal seasonally adjusted GDP (from the IFS).
2) Ratio of total tax receipts to GDP: sum of seasonally adjusted direct and indirect taxes (from the OECD) divided by nominal GDP (from the IFS).
3) Growth rate of real GDP per-capita: First difference of the log of nominal GDP (from the IFS) divided by the GDP deflator and total population (both from IFS), annualized.
4) Growth rate of real wages: first difference of the log of nominal employee compensation (AR) CURA (from the OECD) divided by the seasonally adjusted GDP deflator (from the IFS), annualized.
5) Real interest rate: nominal 3-Month Treasury bill rate (from the IFS) minus the first annualized difference of the log of GDP deflator (from the IFS).

6) Profit rate: one minus the product of real UK employee compensation (AR) CURA (from the OECD) and number of persons employed (from IFS) scaled by real GDP (from IFS).
7) Inflation rate: first difference of the log of GDP deflator (from IFS) annualized.

Acronyms: BEA: Bureau of Economic Analysis, National Income and product Accounts; BLS: Bureau of Labor Statistics, FRED: Fed of St. Louis, IFS: International Finance Statistics, OECD: Organization of Economic Cooperation and Development.

Appendix B: The Bayesian prior and the algorithm to identify shocks.

The Bayesian prior we use assumes that the VAR coefficients are random and that the covariance matrix of the shocks is fixed. Letting A denote the vectorized version of the coefficients of the VAR, we assume that A is normally distributed with mean M and covariance S. Furthermore, we assume that M is vector of zeros except for the first own lag of the variables entering in logs in the VAR (i.e. G/Y, T/Y, R, Profit, Inflation). The covariance matrix S depends on four hyperparameters: s(1) regulates the general tightness of the prior; s(2) regulates the importance of lags of other variables in one equation; s(3) regulates the tightness of the constant term; s(4) regulates the lag decay of the prior.
Values for the hyperparameters are obtained using a simple grid search and maximizing the in-sample predictive power of the model over the training sample preceding the estimation sample and the interpretability of the results for each country. For the US s=[0.0005, 0.5, 0.1,2], for the EU and the UK s=[0.0001, 0.1, 0.1,2]. Given the OLS estimates of A, posterior estimates are obtained combining sample and prior information using a Theil-mixed type estimator – see Canova (2007) for details. Denote the posterior distribution of A, by P(A). Such a distribution is normal with mean and variance which weight sample and prior information with weights given by the relative precision of the two types of information. Given P(A), we draw vectors A(1),….A(m) using standard Monte Carlo methods.

Government expenditure shocks are identified using the following approach. Let HH'=I, let Q(j, k) be the impulse response matrix at horizon j produced by some orthogonal decomposition of S and the draw k from the posterior distribution of the coefficient vector and let Q(1,j,k) the response vector for the k-th draw produced at horizon j by the first orthogonal shock. We compute R(j,k)=Q(j,k)H and check whether the signs of R(1,j,k) for the appropriate variables are correct. If they are, R(1, j, k) is stored, if they are not the resulting impulse responses are tossed. To generate draws for H, we draw n times n random normal matrices with zero mean and unit variance are drawn; the QR decomposition is performed for each draw and H is selected as H=Q.

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