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Estimating Fiscal multipliers in the Eurozone. A Nonlinear Panel Data Approach

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Abstract

During the sovereign debt crisis, all euro countries have deployed "austerity packages", believing that they could regain the path of growth implementing structural reforms and cutting government spending. Such policies should have led to an initial decline in GDP followed by recovery and a reduction of the debt to gdp ratio. A key issue is the size of fiscal multipliers when the economy is in recession. We estimate a nonlinear model allowing variations based on the state of the economy and we control for the macroeconomic characteristics across the Euro Area. The empirical evidence suggests that, an increase in government spending will be particularly effective to boost aggregate demand, increase private consumption and investment in the short-to-medium run, without raising the debt to gdp ratio but rather decreasing it.

JEL CLASSIFICATION:E32, E62.

Keywords: Fiscal Multipliers, State-Dependent, Fiscal Policy, Public Finance.

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1 Introduction

The burst of 2008 financial crisis and the subsequent recession have revived a heated debate in policy circles and academic research on whether countercyclical fiscal policy is effective in stimulating private activity during times of financial stress. After the collapse of Lehman Brothers in September 2008 all advanced countries adopted fiscal stimulus in an attempt to speed up recovery. Expansionary fiscal stimulus has been a source of disagreement among economists based on widely divergent empirical estimates of the impact of such stimulus. Moreover, the beginning of the sovereign debt crisis, in early 2010, with the associated mounting tensions in the sovereign debt markets have pushed many Euro area Countries to take action in an attempt to reduce fiscal imbalances and keep the credibility of their sovereign debt. Despite, in the countries that have undergone significant, and unprecedented, efforts to divert fiscal imbalances, "austerity" measure did not result, so far (short-medium run), in a reduction in the debt-to-GDP ratio whereas economic growth, employment, consumption and investment turned out weaker than expected. Actual fiscal consolidation plans in the Euro area were criticised. One of the criticism being that fiscal consolidation was front-loaded and untimely, as it took place at time when fiscal multipliers were thought to be larger than most studies suggested (Blanchard and Leigh (2013)). The so-called "expansionary fiscal austerity" has not occurred as Alesina, Favero and Giavazzi (2015) have argued in their paper.

In the years following the global crisis, the impact of fiscal policy on output and other macroeconomic aggregates has been a central part of fiscal policy analysis (i.e., Romer and Romer (2010), Ramey (2011), Auerbach and Gorodnichenko (2013)). As mentioned before the fiscal retrenchment occurred when European economies were barely recoverying from financial crisis and the sovereign debt crisis had just started (2010) with several Euro countries entering a new recession. The core of the recent literature revalue Keynesian arguments that government spending is likely to have larger expansionary effects in recessions than in expansions. Intuitively, when the economy is in a recession,

expansionary government spending shocks are less likely to "crowd out" private consumptions or investmenst. The government spending should be used in recessions to stimulate aggregate demand. In the wake of these events, policymakers and researchers have questioned whether the timing and size of the fiscal adjustment in the euro area was appropriate.

The main goal of this paper is to settle the debate on the effects of fiscal consolidation in the Eurozone by emirically assessing benefits and costs of increasing government spending in Euro-countries at a time of financial distress and recession. It is, therefore, critical to determine which macroeconomic impact government spending will have on GDP, private consumption, private investment and especially on the "health" of public finance as measured by surplus/deficit-to-GDP, debt-to-GDP and on primary surplus during the different phases of business cycle. The following research questions are therefore addressed: 1)How large is the fiscal spending multiplier in the Eurozone? 2)Are Eurozone fiscal multiplier higher in recessions than in expansions? 3)Does higher government spending always increase the public debt-GDP ratio or the impact of fiscal stimulus on debt depends on the state of the business cycle? Does it increase the primary surplus linearly or is conditional on the state of the economy? 4)Are fiscal multipliers higher under a peg exchange rate (as the Euro system, Corsetti et al. 2012)? 5)Does government spending compositions affect the size of fiscal multipliers?

The answers to these questions are interesting to policymakers in designing stabilization strategies. Also, it can help the economics profession to reconcile conflicting predictions about the effects of government spending shocks considering the different macroeconomic characteristics of the Euro countries (i.e., the openness to trade, the level of government debt, the state of the business cycle) with a unique econometric technique (linear projection approach, Jordá (2005)).

Our starting point is the seminal paper by Auerbach and Gorodnichenko (2013), which estimate multipliers for government spending for a panel of OECD countries on semi-annual frequency. They use as a measure of the unanticipated government spending shock the forecast error between the actual growth rate

of government spending and the forecast growth rate prepared by professional forecasters.

Building on Auerbach and Gorodnichenko (2013) and the subsequent studies, our paper extends the existing literature in three ways. First, we estimate different multipliers (i.e., spending multiplier, investment multiplier, consumption multiplier) for the Eurozone both through a linear and a non-linear model. Second, we bring together different branches of the literature on the effects of government spending on the several macroeconomic aggregates (GDP, private consumption, private investment, inflation) and public finance indicators (Deficit, Primary Balance, Debt / GDP) for the Eurozone. The novelty is that we are able to estimate the effects of government spending on several macroeconomic variables with a unique econometric methodology. Third, as different public expenditures may have widely different impacts, we also estimate multipliers for some disaggregate public spending variables such as government consumption and government investment.

We analyze the experience of 12 Eurozone countries over 1985 to 2015 and we find that government spending has a stimulatory effect on output, private consumption, private investment, employment and it is beneficial on public finance during recession. Also, the level of debt does not affects the size of government spending multipliers. Moreover, in times of recession, the countries with a low degree of openness to trade, a fixed exchange regime and high deficit show higher government spending multipliers with respect to the ones with a high degree of openness to trade, a flexible exchange rate regime and low deficit as the simple Mundell-Fleming model predicts. A countercyclical fiscal policy prove to be expansionary while procyclical fiscal policy depresses GDP, private consumption and private investment during a recession.

The paper is organized as a follows. Section 2 examines the literature. Section 3 analyzes the data and the methodology. Sections 4 and 5 present the main results. Section 6 develops and presents some robusteness check and sensitivity analysis. Section 7 concludes.

2 Literature Review

Most contributions to the literature rely on two distinct methods to derive fiscal multipliers: one is based on empirical estimation, the other one is a model-based approach. The empirical estimation strand is mainly focused on the advanced economies, with the largest number of studies devoted to the US. The model-based approach has been applied to many different countries, usually changing the models assumptions. In the empirical literature the size of the government spending multipliers range from negative values to positive values as high as 4. The main question is why estimates vary so widely. Different approaches may contribute part of the explanations. The seminal paper of Blanchard and Perotti (2002) explores this issue in the context of a structural vector-autoregression model (SVAR), which relies on the existence of a one-quarter lag between output response and fiscal impulse. The Blanchard and Perotti (2002) identification strategy has been debated by Ramey (2011), Forni and Gambetti (2012) and others. Ramey (2011) pointed out that what is an orthogonal shock for a SVAR may not be such for private forecasters. Forni and Gambetti (2010) shows evidence that government-spending shocks are non-fundamental for the variables typically considered in standard closed-economy specifications ("fiscal foresight"). This imply that VAR models comprising these variables are unable to consistently estimate the shock. These findings confirm the result obtained in Ramey (2011) that the fiscal policy shock estimated with a VAR as in Perotti (2007) is predicted by the forecast of government spending from the Survey of Professional Forecasters. Briefly, there seems to be, at least for US, a meaningful correlation among orthogonal shocks in a SVAR and private forecasts. In order to fix this, Barro and Redlick (2011) and Romer and Romer (2010) have suggested the use of a "natural experiment approach" or a narrative approach. Barro and Redlick (2011) uses as shocks the military spending, Romer and Romer (2010) identifies exogenous tax changes from the narrative record, such as presidential speeches and Congressional reports. An additional explanation for differing estimates is that the fiscal multiplier may depend on

several characteristics of the economy as its degree of openness, the exchange rate regime, and the state of the business cycle. For example, fiscal multipliers may be larger in recession because of a milder "crowding out" of private consumption and investment due to less responsive prices, a constrained reaction of nominal interest rates due to the zero-lower bound, an higher return from public spending due to countercyclical financial frictions and credit constraints and lower crowding out of private employment due to a milder increase in labour market tightness. Several authors provide empirical evidence in favour of state-dependent fiscal multipliers, such as Tagkalakis (2008), Auerbach and Gorodnichenko (2012a, 2012b, 2013), Bachmann and Sims (2012), Batini, Callegari, and Melina (2012), Mittnik and Semmler (2012), Baum, Poplawski-Ribeiro, and Weber (2012), Fazzari, Morley, and Panovska (2014). Tagkalakis (2008) studies how private consumption responds to fiscal shocks when the economy is in recession or expansion in the presence of binding liquidity constraints agents. Tagkalakis (2008) finds that both tax and spending shocks affect consumption changes more in bad times than in good times in OECD countries and especially in those featuring financially constrained individuals. This enteils that some degree of fiscal flexibility could be helpful in economic downturns, in particular in those countries where people have a limited access to credit. Batini, Callegari, and Melina (2012) use regime-switching VARs to estimate the impact of fiscal adjustment in the United States, Europe and Japan allowing for fiscal multipliers to vary across recessions and booms. The main finding is that smooth and gradual consolidations are to be preferred to frontloaded or aggressive consolidations, especially in recession economies facing high-risk premia on public debt, because sheltering growth is key to the success of fiscal consolidation in these cases. Bachman and Sims (2012), using a standard structural VAR and a non-linear VAR, investigates if confidence is an important channel by which government spending shock affect economic activity. They find that the endogenous response of confidence explains almost the entire output stimulus in a recession, whereas its role in normal times is only minor. However, the positive response of output and productivity to a government spending shock during

times of slack is mild on impact, gradual and prolonged. The authors argue that fiscal stimulus in recessions has a different impact than in normal times or during booms. Indeed, spending shocks during downturns predict productivity improvements through a persistent increase in government investment relative to consumption, which is reflected in higher confidence. Steven M. Fazzari, James Morley, and Irina Panovska (2014) investigates the asymmetric effects of government spending on U.S. output by means of a threshold structural vector autoregressive model. The empirical investigations present a strong evidence in favour of non-linear, state-dependent effects of fiscal policy. Fazzari et al. (2014) shows that government spending raises output, but this effect is both larger and more persistent when capacity utilization is low. Although stimulus policy may increase government debt, the effect is smaller than a simple calculation would suggest because higher government spending raises output, income, and therefore tax revenues, and the effect of spending stimulus on public debt is less than one dollar for a dollar. Auerbach and Gorodnichenko (2013) estimates government purchase multipliers for a large number of OECD countries, allowing these multipliers to vary smoothly according to the state of the economy and using real-time forecast data to purge policy innovations of their predictable components. Authors use direct projections rather than the SVAR approach to estimate multipliers, to economize on the degrees of freedom and to relax the assumptions on impulse response functions imposed by the SVAR method. They find large differences in the size of spending multipliers in recessions and expansions with fiscal policy being considerably more effective in recessions than in expansions. The results of the paper suggest that fiscal policy activism may indeed be effective at stimulating output during a deep recession, and that the potential negative side effects of fiscal stimulus, such as increased inflation, are less likely under these circumstances. These empirical results call into question the results from the standard new Keynesian literature, which suggests that shocks to government spending, even when increasing output, will "crowd out" private economic activity. Corsetti, Meier, and Muller (2012) investigates the sensitivity of government spending multipliers to different economic scenarios.

They find fiscal multipliers to be particularly high after financial crisis. Rossi and Zubairy (2011) and Canova and Pappa (2011) show that fiscal multipliers tend to be larger when positive spending shocks are accompanied by a decline in the real interest rate. Blanchard and Leigh (2013) emphasise that during the "Great Recession" the size of fiscal multipliers was underestimated by the IMF and others institutions. This suggests that fiscal multipliers may vary over time. Indeed, the literature focused on the linear effects of a tax or government spending shock on output on a single country (i.e., Pereira and Wemans, 2013; Hayo and Uhl, 2014; Cloyne, 2013), and particularly on the US economy (i.e., Blanchard and Perotti, 2002; Mountford and Uhlig, 2009; Romer and Romer, 2010; Favero and Giavazzi, 2012; Perotti, 2012; Mertens and Ravn, 2014), whereas a few studies have focused on a cross-country panel datasets (see e.g., Guajardo, Leigh, and Pescatori, 2011) or on multi-country analysis (i.e., Bnassy-Qur and Cimadomo, 2012). The literature focusing on the non-linear effects of government spending is scant especially for the Euro area. This paper tries to fill this gap estimating the non-linear effect of a government spending shock on the various macroeconomic aggregate (i.e., GDP, private consumption, private investment) and on the public finances indicators (i.e., debt to gdp, deficit to gdp). In a single framework, we investigate whether the size of the different multipliers vary based on macroeconomic characteristics of the countries considered in the analysis (Euro Countries). The novelty and the key insight is that estimates are made through a single methodological approach (linear projection Jordá (2005)).

3 Data and Methodology

3.1 Data

Our sample comprises 12 Euro Countries.[1] The macroeconomic variables come from the OECDs Statistics and Projections database[2]. We use semi-annual frequencies for our macroeconomics aggregate, as government spending (is the sum of real government consumption and real government gross capital formation). As mentioned above, in addition to the real GDP we examine responses of other macroeconomic variables to government spending shocks: real private consumption, real private gross capital formation, real exports and imports. Second, we analyse the reaction of labour market variables such as total employment, employment in the private sector, the unemployment rate and the real compensation per worker in the private sector. Third, we investigate the responses of the variables describing the "health" of public finance: deficit-to-GDP, Debt-to-GDP and the Primary surplus. Finally, we go through how prices, calculated by the consumer price index (CPI), the consumer price index harmonized (CPIH) and the GDP deflator, react to government spending shocks. All the variables except the unemployment rate, deficit-to-GDP, Debt-to-GDP and Primary surplus are in logs.

3.2 Methodology

We follow the single-equation approach advocated by Jordá (2005) and Stock and Watson (2007), which does not impose the dynamic restriction that are present in the SVAR methodology and is able to accommodate nonlinearities in the response function. As shown in Jordá (2005) the advantages of local projections with respect to standard VAR are numerous: 1) local projections can be estimated by simple regression technique, 2) local projections are more robust to misspecification, 3) joint or point-wise analytic inference is simple and,

[1] The countries are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal and Spain. The sample periods covers 1985-2015

[2] I am grateful to Prof. Auerbach who shared with me his database from 1960 to 2010.

4) local projections easily accommodate experimentation with highly nonlinear specifications. When we use GDP as the dependent variable, the response of Y at the horizon h is estimated by using the following regression:

$$\begin{aligned} Y_{i,t+h} = \alpha_i + \mu_t + F(z_{i,t})\Pi_{R,h}(L)Y_{i,t-1} + (1 - F(z_{i,t}))\Pi_{E,h}(L)Y_{i,t-1} + \\ F(z_{i,t})\Psi_{R,h}(L)G_{i,t-1} + (1 - F(z_{i,t}))\Psi_{E,h}(L)G_{i,t-1} + \\ F(z_{i,t})\Phi_{R,h}(L)FE^G_{i,t} + (1 - F(z_{i,t}))\Phi_{E,h}(L)FE^G_{i,t} + u_{i,t} \end{aligned} \quad (1)$$

$$with : F(z_{i,t}) = \frac{exp(-\gamma z_{i,t})}{(1 + exp(-\gamma z_{i,t}))}, \gamma > 0 \quad (2)$$

Following Auerbach and Gorodnichenko (2013), i and t index countries and time, α_i is the country fixed effect, μ_t is the time fixed effect, $G_{i,t-1}$ is the log of real government purchases[3] $F(\cdot)$ is the transition function for each country in the sample with the range between 0 (strong expansion) and 1 (deepest recession), $z_{i,t}$ is a variable measuring the state of the business cycle, which is based on the deviation of the 1.5 years moving average of the output growth rate. The advantages of using the 1.5 years moving average as z are numerous: one is that we can use the full sample for estimation and this allows us not to miss observations and our estimates will be as precise and robust as possible. The $z_{i,t}$ is normalized such that $E(z_{i,t}) = 0$ and $Var(z_{i,t}) = 1$ for each i. Moreover, we allow the trend to be time-varying inasmuch some countries show low frequency variations in the output growth rate. For this reason, we use the HP filter[4] to extract the trend with a high smoothing parameter $\lambda = 10,000$.

We interpret $FE^G_{i,t}$ as the surprise government shock. It is the forecast error for the growth rate in the forecast prepared by professional forecasters at time *t-1* for time *t*.[5]. We control $FE^G_{i,t}$ for information contained in the lags of Y and G

[3]Government consumption + Government investment

[4]We use the Hodrick-Prescott filter to separate a time series into trend and cyclical components. The trend component may contain a deterministic or a stochastic trend. The smoothing parameter determines the periods of the stochastic cycles that drive the stationary cyclical component.

[5]It is the difference between the actual and forecast series of the government spending (Government Consumption + Government Investment)

to purify any predictable component from the dynamic effects of output and the effects of past government spending changes. We include $FE^G_{i,t}$ dated by time t because it is consistent with the recursive ordering of government expenditure first in the VARs. Moreover, using $FE^G_{i,t}$ as the surprise government shock we overcome two factors that often are criticized in the literature. First, using forecast errors we eliminate the problem of "fiscal foresight"[6] (Ramey (2010); Corsetti e Muller (2011); Forni and Gambetti (2010); Leeper et al. (2013); Zeev and Pappa (2014) and others). Second, we minimize the likelihood that estimates capture the potentially endogenous response of fiscal policy to the business cycle due to authomatic stabilizers.

In the STVAR or standard VAR analysis of how government spending shocks affect the economy, the impulse response is constructed in two steps. First, the contemporaneous responses are derived from a Cholesky decomposition. Second, the propagation of the responses over time is obtained by using estimated coefficients in the lag polynomials. The direct projection method effectively combines these two steps into one.

The lag polynomials $\{\ \Pi_{R,h}(L), \Psi_{R,h}(L), \Pi_{E,h}(L), \Psi_{E,h}(L)\ \}$ are used to control for the history of shocks. The impulse response fuction dynamic are constructed varying the horizon h of the Y. In other words, the impulse response function dynamic is estimated by $\{\ \Phi_{E,h}(L)\ \}_{h=0}^{H}$ for expansion and $\{\ \Phi_{R,h}(L)\ \}_{h=0}^{H}$ for recession. The direct projection allows to construct the impulse response fuction as a moving average of the series of interest where the lag polynomial terms control for initial condition and the $\{\ \Phi_{E,h}(L)\ \}_{h=0}^{H}$ and $\{\ \Phi_{R,h}(L)\ \}_{h=0}^{H}$ describe the reaction of the economic system to a structural exogenous shock. In practise, if we think, we regress our variable of interest Y for each time $t+h$ on an unanticipated shock at time t and via this we obtain

[6]Fiscal foresight is the phenomenon that legislative and implementation lags ensure that private agents receive clear signals about the tax rates they face in the future and it is intrinsic to the tax policy process. Fiscal foresight produces equilibrium time series with a non-invertible moving average component, which misaligns the agents' and the econometrician's information sets in estimated VARs (Leeper (2008)).

the average response of the dependent variable h periods after the shock which is our impulse response function.

This estimation method has several advantages. First, it involves only linear estimation. Second, it obviates the need to estimate the equations for dependent variables other than the variable of interest (i.e., GDP) and thus economize on the number of estimated parameters. Third, it does not constrain the shape of the impulse response function , rather then imposing the pattern achived by the SVAR. Fourth, the error term in equation is likely to be correlated across countries and would be particularly hard to handle in the context of nonlinear STVARs but is easy to address in linear estimation by using i.e., Newey-West (1987) standard errors, Driscoll-Kraay (1998) standard errors or clustering standard errors by time period[7]. Fifth, we can use specification (1) to construct impulse responses for any macroeconomic variable of interest as we are not constrained by the VARs curse of dimensionality. Finally, because the set of regressors in (1) does not vary with the horizon h, the impulse response incorporates the average transitions of the economy from one state to another, this means that we do not have two separate models when z changes. If the spending shock has an effect on the state of the economy, this effect is absorbed within the polynomial $\{ \Phi_{E,h}(L) \}_{h=0}^{H}$ and $\{ \Phi_{R,h}(L) \}_{h=0}^{H}$ (Auerbach and Gorodnichenko (2013)).

The linear specification is given by equation (3), where the response of the dependent variable is constrained to be the same over the business cycle ($z_{i,t}$); i.e. $\Pi_{Lin,h}(L) = \Pi_{E,h}(L) = \Pi_{R,h}(L), \Psi_{Lin,h}(L) = \Psi_{E,h}(L) = \Psi_{R,h}(L), \Phi_{Lin,h}(L) = \Phi_{E,h}(L) = \Phi_{R,h}(L)$ for all L and h.

$$\begin{aligned} Y_{i,t+h} = \alpha_{i,h} + \Pi_{Lin,h}(L)Y_{i,t-1} + \\ \Psi_{Lin,h}(L)G_{i,t-1} + \Phi_{Lin,h}(L)FE^{G}_{i,t} + u_{i,t} \end{aligned} \tag{3}$$

[7]To overcome this issue, we re-estimate the model using the FGLS estimator. The findings do not change. We do not show the results in the paper but they are available from the author upon request.

4 Result

Panels 1-16 show the impulse responses of our macroeconomic variables of interest to one percent increase in the government spending shock[8]. In each panel there are two subpanels showing the response (black, thick line) in recession[9] and expansion[10]. The thin, dashed lines indicate the 90% confidence bands which are based on Newey and West (1987) standard errors that provide consistent estimates when there is autocorrelation in addition to possible heteroskedasticity of the error term in specification (1). In each subpanel is reported the response of the linear specification (3) (thin red line) and associated 90% confidence bands (shaded region) which are also based on Newey and West (1987) standard errors.

As panel 1 shows the GDP responses are striking by different accross regimes. In the linear model, the response is near zero and not statistically significant. The GDP responses in recession is positive and statistically significant for all periods (approximately 2.5 years). The maximum size of the government multipleir is about 2 with 90% confidence interval being (0-3.52). The average multipleir is about 1.68. The GDP responses during expansions is quite different. In the first two years the GDP responses to an unticipated increase in government spending is near zero and not statistical significant. Conversely, after 2.5 years the response is negative (about -0.8) and statistically significant. The result is consistent with the estimates reported in the recent literature that explores the state-dependence of fiscal multipliers where the multipleirs are approximately zero during expansion and about 1-4 in recession. Auerbach and Gorodnichenko (2012a, 2013, 2014) estimates that the spending multiplier is approximately 0.5 (0) for the OECD countries, 1.7 (-0.2) for US and 2.4 (1.2) for Japan in recession (in expansion). Batini et al. (2012) estimates a spending multiplier of 2.08 (0.82); Baum et al. (2012) of 1.22 (0.72), Hernandez

[8] All the responses are normalized. We scale all responses so that government spending moves by one percent to a shock in $FE^G_{i,t}$

[9] F is near 1 and the response is given by $\{ \Phi_{R,h}(L) \}_{h=0}^{H}$

[10] F is near 0 and the response is given by $\{ \Phi_{E,h}(L) \}_{h=0}^{H}$

de Cos and Moral-Benito (2013) of 1.3 (0.6); Owyang, Ramey, Zubairy (2013) of 0.8 (0.7) for the USA and 1.6 (0.4) for Canada in recession (in expansion). Vegh et al.(2015) estimates a spending multiplier of 2.3 compared to 1.3 if they distinguish between recession and expansion while in extreme recessions, the long-run spending multiplier reaches 3.1. Vegh et al.(2015) estimates that the linear spending multiplier varies between 0.2 - 1.2. For the Euro Area, the linear model predicts a multiplier near zero. Obviously, the linear model can understimate the fiscal multiplier in recessions and overstimante in expansions.

One might criticize the results that we find because there might be a correlation between the growth of GDP and the spending shock. We recall that we use as spending shock the forecast errors of the professionals forecaster and through this we remove any systematic pattern between GDP growth and government spending if there is any. Also, we do not find an economically significant correlation across the $FE^G_{i,t}$ and the state of business cycle $F(z_{i,t})$. This means that when an economy is in one regime a contractionary or expansionary government spending shock is equally probable. Hence, it is scarcely possible that the results are induced by some singularity of the government spending shock (i.e., automatic stabilizer during a downturn).

Panels 2,3 and 4 investigate the effect of an increase in government spending on public finance variables: Debt to GDP, surplus / deficit to GDP and on primary surplus. During the European Sovreign debt crisis most peripheral euro countries have been forced to implement a strong fiscal consolidation, invoked for hight debt countries, also with the admonition that if they did not reduce their debts they would lose their access to the financial market. The empirical evidence shows that there is a large heterogeneity among different regimes. During recession, an increase in government spending does not imply neither an increase in debt-to-GDP ratio (Panel 2a) nor in surplus/deficit to GDP (Panel 3a). Rather, we find that an increase in government spending in recession leads to a decrease in the debt to GDP ratio and an improvement of the surplus to GDP after about two years. Moreover, an increase in government spending leads to an improvement of the primary surplus after two years from the shock

(Panel 4a). Instead, when the economy is in expansion either debt to GDP (Panel 2b), the surplus/deficit to GDP (Panel 5b) and primary surplus (Panel 4b) deteriorate, consistent with many results found in the literature (Ilzetzki et al.(2013); Nickel, C. and Tudyka, A. (2013); A. Abiad, D. Furceri and P. Topolova (2015)).

How can we explain this empirical evidence? As demonstrated in Delong and Summers (2012), in the short term an increase in government spending as a share of GDP(Δi) leads to a change in the debt-to-GDP ratio (Δd) given by:

$$\Delta d = (1 - \mu\tau)\Delta i$$

where μ is the fiscal multiplier and τ is the marginal tax rate.

An increase in goverment spending can raise GDP and obviously the Debt-to-GDP ratio over the medium and long term. Over the time the rise in government spending will affect the Debt-to-GDP ratio by affecting its debt-financing burden:

$$(r - g)\Delta d = (r - g)(1 - \mu\tau)\Delta i$$

In the medium and long run if the growth rate of GDP g is greater than the borrowing rate r the impact of government spending on the pubblic finance variables may be positive as the empirical evidence shows.[11] The effects of an increase in government purchases on private consumption are strongly countercyclical. Panel 5b exhibits that private consumption is decreasing in expansion (there is a "crowding out" effect), vice versa the government spending shock increases private consumption in recession (Panel 5a). A euro increase in government spending in recessions may increase private consumption up to 2.5 euro with a 90% confidence interval (0-4.40). Furthermore, the linear model shows that an increase in government spending is not equivalent to an increase in private consumption. Vice versa, during an economic boom, the "crowding out" effect of private consumption is consitent (the mean response in expansion is -1.15).

[11] $g > r \rightarrow \Delta d < 0$

Panel 6 present the estimated effects of a government spending shock on private investment. Over the three years, a unit increse in government spending shock increases private investment in recession by 4 euro (but is not stasticial signifcant, (Panel 6a) and decreases it during expansion by 6 euro (Panel 6b). The joint considerations of Panel 5 and 6 suggests that the stimulus effect of an increased public spending in recession is more effective through increased consumption than through increased private investment that is the supply effect seems to be not statistically significant. Instead, an increased public expenditure in expansion "crowd out" consumption and private investment as the standard New-Keynesian model predicts. The linear model point out that private investment decreases after a government spending shocks, but it is statisical significant only in the short run (1-2 years).

Panel 7,8 and 9 present the impact of a government spending shock on total employment, employment in the private sector and the unemployment rate. During recessions, the increase in government spending is followed by an increase in total employment (Panel 7a). The total employment increases is statistically significant after 1.5 year (before that, the responses is positive but not stastistically significant) and it reaches its maximum after two years (the max response of total employment is 2.02). The increase in total employment could be caused by the rise in the private sector employment. Indeed, after 2 years, the total employment increases by 2% while the private employment increases by 1% in responses to a 1% increase in government spending when the economy is in a recession. Consistent with the response of total employment and private employment, the unemployment rate descreases, during recession, more precisely it becomes statistical significant one year after the government spending shock (Panel 9a). Vice versa, the response of the total employment and the unemployment rate to a government spending shock in expansion is generally negative and statistically different from zero (Panel 9b). Moreover, the response of the private employment is anemic and it is generally close to zero and not statistically significant. Further, we investigate the effects on real wages of an increase in public spending during expansion and recession (Panel

10a, 10b). We find that real wages remain unchanged in response to government spending shocks both when the economy is in recession and in expansion.The same effect results when we consider the economy wide unit labour cost (Panel 11a, 11b).

Panels 12 and 13 exhibit the response of real exports and imports. We do not find a robust reaction of these variables to government spending shocks. Only the response of exports are statistical significant across regimes. During recession the effect is negative (Panel 12a) while during expansion the response is positive (Panel 12b). Vice versa the response of imports are not economically significant in both regimes: recession (Panel 13a) and expansion (Panel 13b).

Finally, Panels 14, 15 and 16 present the reactions of prices measured by Consume price index (CPI), Consumer price index harmonized (CPIH) and GDP deflator. Generally, an increase in government spending leads inflationary effect during recession and deflationary during expansion. The result for prices in expansion is surprising. It should be noted that it is common to expect a stronger positive price response during expansion than in recession as well as standard theory predict. The results that we found for expansion is not consistent with standard theory. However, the multiplier is statistical different from zero only for the Consumer Price Index (Panel 14a, 14b).

5 Does Government spending composition matter?

The European Commission writes: "For the countries with high deficits, the budgetary consolidation strategy, based on expenditure restraint, should not be achieved at the expenses of the most "productive" components of public spending (such as public investment, education and research expenditures)." (European Commission (2004), p. 28). In the theoretical literature it is usually maintained that an increase in government investment has a greater impact on GDP than an increase in government consumption of the same size (i.e., Bax-

ter and King (1993), Galí, López-Salido and Vallés (2003)). In the long run, the superiority of public investment seems hard to refute on theoretical grounds. For instance, in the standard neoclassical model government expenditure has all the effects of government consumption, plus a positive externality on the productivity of private inputs. Hence, the "Golden Rule" of public finance states that government should borrow only for investment and not for consumption, as investment pays, through future tax gains covered by the new capital stock (See e.g. Blanchard and Giavazzi (2004)). Additionally, the "Golden Rule" allows potentially socially worthwhile investment opportunities to be undertaken, without violating the "sustainability" of public finances. A strand of the literature uses VAR model to estimates the effects of public investment (i.e., Perotti (2004), Ilzetzki et al.(2013)). Ilzetzki et al. (2013) finds that the multiplier on government investment in developing countries is positive and larger than one in the long run (2-3 years). This indicates that the composition of expenditure may play an important role in assessing the effect of fiscal stimulus in developing countries consistent with the findings of Perotti (2004). A. Abiad, D. Furceri and P. Topolova (2015) provide that increased public investment rises output, "crowds in" private investment and reduces unemployment. Moreover, when the economy is in a recession and monetary policy is accommodating, demand effects are stronger and the Debt to GDP ratio may decline. In the empirical literature there seems to be an agreement that public investment is likely to have more positive growth effects than public consumption (Nijkamp and Poot(2004), Gechert (2014, 2015) and A. Abiad et al. (2015)). In this section of the paper, we explore whether government investments have a larger multiplier than that of government consumption. To examine the role of spending composition, we estimate the following specification:

$$\begin{aligned} Y_{i,t+h} = \alpha_i + \mu_i + F(z_{i,t})\Pi_{R,h}(L)Y_{i,t-1} + (1 - F(z_{i,t}))\Pi_{E,h}(L)Y_{i,t-1} + \\ F(z_{i,t})\Psi_{R,h}(L)G_{i,t-1} + (1 - F(z_{i,t}))\Psi_{E,h}(L)G_{i,t-1} + \\ F(z_{i,t})\Phi_{R,h}(L)FE^{j}_{i,t} + (1 - F(z_{i,t}))\Phi_{E,h}(L)FE^{j}_{i,t} + + u_{i,t} \end{aligned} \quad (4)$$

where $j=$ is egual to $FE^{C}_{i,t}$[12] or $FE^{I}_{i,t}$[13]

$$with : F(z_{i,t}) = \frac{exp(-\gamma z_{i,t})}{(1 + exp(-\gamma z_{i,t}))}, \gamma > 0 \tag{5}$$

Just as government multipliers differ according to the state of the economy in which they occur, they can also differ for different components of government purchase. As mentioned above, several studies (i.e., Nijkamp and Poot(2004), Ilzetzki et al.(2013), Gechert (2014, 2015) and A. Abiad et al. (2015)) show that investment multiplier may be higher than consumption multiplier. We shall now investigate such an issue by focusing on Euro Area countries from 1985 to 2015. Panels (17)-(22) show the results of consumption and investment spending shocks on output, debt to gdp ratio, surplus/deficit, private investments, unemployment rate and CPI. One again, the result are heterogeneous by regime and spending composition. Government Consumption and Government Investment have a positive effects on output in recession and negative in expansion. Moreover the effect of investment spending are stronger only in the long run similar with the findings of Perotti (2004) and Ilzetzki et al.(2013), particularly during the last two semester when the impact on output exceeds 4 for investment and is around 3.20 for consumption. As F. Skidelsky (2001) stresses, government investment is considered the most powerful policy instrument for the reason that it combine the short-run support of an aggregate demand boost with the long-term supply-side benefits. Indeed, we shows that public investments have a greater effect on output than public consumption only on the medium/long-term.

Panel (18) shows the effects of investment and consumption spending on the debt to gdp ratio. Government consumption shock, in recession, reduces the debt to gdp and the size of consumption multiplier is sizeble (it reaches 8% after 3 years). While in periods of expansion, the estimates suggest a rise in public debt. Public investment shock does not affect the debt to gdp ratio

[12]Forecast error of Government Consumption

[13]Forecast error of Government Investment, we have data only for 6 Euro Countries: Belgium, Germany, Finland, France, Italy and Netherland.

neither in recession nor in expansion.

Panel (19) exhibits the effects of investment and consumption spending on the deficit. We find that a one percent increase in public investment does not have effect on deficit during the recession and the expansion. Vice versa a one percent increases in public consumptions raises surplus during economic slack and reduces it during economic expansion. During recession, either public consumption and investment increase private investment in the medium term and the multipliers reach 5 after 3 years, suggesting the presence of the "crowding in" effect. However, during expansion the opposite happens either for consumption and investment spending, suggesting the possibility of "crowding out" when the economy is outside the recession consistent with the findings of A. Abiad et al. (2015).

Panel (21) shows that both public consumption and investment shocks reduce the unemployment rate with a similar multiplier during economic slack, by about 0.5% for consumption and 0.75% for investment. Indeed, during expansion either consumption and investment spending have a negative effect on the unemployment rate in accordance with A. Abiad et al. (2015).

Finally, an increase in public consumption and investment leads inflationary effect during recession (Panel (22)). Particularly, the inflationary effect is effective only on the short-run for public investment, however, if we consider the public consumption the inflationary effect is observed both in the short and medium run. The opposite happens in expansion where an increase in public consumption and investment leads to a deflation in the short-medium term.

In conclusion, what emerges from the analysis, in accordance with the literature, is that an increase in public investment spending has a stimulus effect on GDP, private investment, unemployment rate and inflation in the long run (after two years) during an economic slack due to the fact that government investment combines the attractions of purchases of goods as a countercyclical tool in the short run with the long run virtues of a supply policy tool (demand and supply effects).

5.1 Multipliers when government spending is Procyclical and Countercyclical

Generally, economists believe that countercyclical fiscal policies have stabilizing effects that work through both automatic stabilizers and occasional discretionary actions[14]. However, in economic downturns, countercyclical policies increase government indebtedness, raising future debt service obligations. Also, the new expenditure must be financed by higher taxes, lower spending or with a higher money growth. Than the expectations of how future policies will adjust current savings rates can matter for the efficacy of countercyclical policies (Baxter and King (1993)) that might become recessionary. Alesina et al. (2015) shows that expenditure-based adjustments are not associated with deep and long recessions but, rather, fiscal consolidation can be "expansionary". Conversely, Vegh et al. (2015) shows that the spending multiplier may vary with the sign of government spending changes, i.e. the size of the multipliers can be greater (smaller) when spending is increased than it is when spending is reduced in downtourn (expansion). Moreover, in extreme recession, a cutting in spending reduces output by more than one. As seen in the previous sections the size of fiscal multipliers may depend on the various characteristics of the economy, as the state of the business cycle, the degree of openness, the exchange rate regime, the level of debt, the level of deficit, the composition of government spending and as well if government spending is procyclical or countercyclical. By combining the sign of the spending change with the phase of the business cycle one has four possible outcomes: expansionary/contractionary policy in a downturn, expansionary/contractionary policy in an expansion. Quite normally, two combinations will be examined under the heading of procyclical fiscal multiplier (recession vs expansion), whilst other two combinations will be examined under the countercyclical fiscal multiplier (recession vs expansion). For this purpose, we modify our early specification (1) by including the interaction be-

[14]See, for example, Rommer and Rommer (2010), Ilzetzki et al.(2013), Auerbach and Gorodichenko (2012a, 2012b, 2013) and Vegh et al. (2015).

tween recession/expansion and whether government spending is increasing or decreasing:[15]

$$
\begin{aligned}
Y_{i,t+h} = \alpha_i + \mu_i + F(z_{i,t})\Pi^{NEG}_{R,h}(L)Y^{NEG}_{i,t-1} + (1 - F(z_{i,t}))\Pi^{NEG}_{E,h}(L)Y^{NEG}_{i,t-1} + \\
F(z_{i,t})\Pi^{POS}_{R,h}(L)Y^{POS}_{i,t-1} + (1 - F(z_{i,t}))\Pi^{POS}_{E,h}(L)Y^{POS}_{i,t-1} + \\
F(z_{i,t})\Psi^{NEG}_{R,h}(L)G^{NEG}_{i,t-1} + (1 - F(z_{i,t}))\Psi^{NEG}_{E,h}(L)G^{NEG}_{i,t-1} + \\
F(z_{i,t})\Psi^{POS}_{R,h}(L)G^{POS}_{i,t-1} + (1 - F(z_{i,t}))\Psi^{POS}_{E,h}(L)G^{POS}_{i,t-1} + \\
F(z_{i,t})\Phi^{NEG}_{R,h}(L)FE^{G_{NEG}}_{i,t} + (1 - F(z_{i,t}))\Phi^{NEG}_{E,h}(L)FE^{G_{NEG}}_{i,t} \\
F(z_{i,t})\Phi^{POS}_{R,h}(L)FE^{G_{POS}}_{i,t} + (1 - F(z_{i,t}))\Phi^{POS}_{E,h}(L)FE^{G_{POS}}_{i,t} + u_{i,t}
\end{aligned}
\tag{6}
$$

Panel 23 shows that the spending multiplier is higher when government spending is increasing than when it goes down, i.e. an expansionary fiscal policy is more effective than a contractionary one.

Panels (23)-(25) figure out the multipliers for each possibles cases: (i) expansion and decrease in public spending (Countercyclical multiplier); (ii) expansion and increase in public spending (Procyclical multiplier); (iii) recession and decrease in public expenditure (Procyclical multiplier); and (iv) recession and increase in public expenditure (Countercyclical multiplier).

Not surprisingly, the highest multiplier is found in a recession and when public spending is increasing (countercyclical fiscal policy). In this case, the mean response of output to a countercyclical spending shock is 1.44 (and statistically different from zero) and reaches 3.45 after 3 years. The max response multiplier is about twice than the one found in the first econometric specification (1), when we focused only on the state of the economy (recession vs expansion) without discriminate whether the spending shock is procyclical or countercyclical in accordance with Vegh et al. (2015). On the other hand, the effect on output of reducing government spending in recession is not statistically significant[16].

[15] In other words, $FE^{G_{NEG}}(FE^{G_{POS}}) = FE^G$ if $FE^G < 0 (FE^G > 0)$ and $\Delta G < 0 (\Delta G > 0)$ and zero otherwise. By the same for Y^{POS} (Y^{NEG}) and G^{POS} (G^{NEG}).

[16] It should be noted that it is surprising that reducing government spending during economic

When we consider an expansion, the fiscal multiplier is essentially zero at all horizons when public expenditure is increasing or decreasing. However, when we observe a decrease in public spending during an expansion, the multiplier is only marginally not statistically significant. The effect of a spending cut, in periods of expansion could lead to a decrease in GDP (in the long run the multiplier reaches 3%).

Panels (24)-(25) show the effect of government spending on consumption and investment. The private consumption multiplier is higher than the multiplier that we found in the first specification (1). Specifically, the response of output to an increasing in government spending during times of economic slack has a extraordinary positive impact on private consumption (the mean response is 3.44 and it reaches 4.81 after 3 years). While the opposite policy during recession has no impact on private consumption. As the economic theory predicts, a procyclical government shock, in times of expansion, "crowds out" the private consumption (the mean response is -2.17%). On the other side, a countercyclical government policy has a negative effect on private consumption but it is not statistically different from zero. When we observe the effect of procyclical and countercyclical fiscal policies on private investment, we notice some interesting results. First of all, a procyclical policy either during times of economic slack, either during a economic boom, will decrease private investment, after 3 years, about -11.30% (on average) in recession and -3.44% (on average) in expansion. Conversely, countercyclical policy, during the downturn, initially will reduce investment and then bring them back to rise after two years. (Top-left, Panel 25).

An important statement with respect to the work of Alesina et al. (2015), is that a cut in government spending depress the private investment in all Euro countries rather than increasing it as Alesina et al. (2015) exhibit, due to the fact that a cut in government spending will "crowding in" private investment. This could take place because the private sector, rather than buy government

slack does not affect output. Certainly, it has not an expansionary effect, but the relationship remains unclear.

bonds will invest in private activities. This could work during normal times, but if the economy is in a deep recession, the private sector is reluctant to invest in private activities that are much risky during an economic slack, therefore, there will be not the "crowding in" of the private investment but quite the opposite ("crowding out") as our results show in accordance with Vegh et al. (2015).

In sum, from the empirical results it is confirmed that countercyclical fiscal policy is effective in smoothing GDP fluctuations. Especially, during a recession, the first thing to do seems to be increasing goverment spending. Also, during economic slack a reduction of government spending (procyclical fiscal policy) depress private investment, private consumption and obviously GDP.

6 Robustness Check and Sensitivity analysis

In this section, we test the robustness of our findings in 3 ways: 1) we control for several macroeconomic characteristics across countries; 2) we re-estimate the fiscal multipliers distinguishing between countries with similar public finance characteristics, splitting the sample into two groups; 3) we also examine if the size of fiscal multiplier varies according to different sample periods considered, i.e. before the Great Recession (1985-2006) and during the crisis (2007-2015).

6.1 Macroeconomic charecteristics across countries matter?

Since we have significant variation in macroeconomic characteristics across countries and time, we can explore how some key characteristics are correlated with the size of government spending multipliers. In the baseline formulation we do not control for macroeconomic characteristics across countries that may change the size of the fiscal multiplier. We will now investigate this issue for six macroeconomic characteristics: the level of government debt (as a share of GDP), ope-

ness to trade,[17] the level of spread across countries [18], the introductions of the euro, the level of surplus/deficit (as a share of GDP) and when the interest rate is constrained at the zero lower bound.[19] For this issue, we estimate the following equation:

$$\begin{aligned} Y_{i,t+h} = \alpha_i + \mu_i + F(z_{i,t})\Pi_{R,h}(L)Y_{i,t-1} + (1-F(z_{i,t}))\Pi_{E,h}(L)Y_{i,t-1} + \\ F(z_{i,t})\Psi_{R,h}(L)G_{i,t-1} + (1-F(z_{i,t}))\Psi_{E,h}(L)G_{i,t-1} + \\ F(z_{i,t})\Phi_{R,h}(L)FE^G_{i,t} + (1-F(z_{i,t}))\Phi_{E,h}(L)FE^G_{i,t} + \\ F(z_{i,t})\tilde{\Phi}_{R,h}(L)FE^G_{i,t}I_{i,t} + (1-F(z_{i,t}))\tilde{\Phi}_{E,h}(L)FE^G_{i,t}I_{i,t} + \mu I_{i,t} + + u_{i,t} \end{aligned} \tag{7}$$

$$with: F(z_{i,t}) = \frac{exp(-\gamma z_{i,t})}{(1+exp(-\gamma z_{i,t}))}, \gamma > 0 \tag{8}$$

where $I_{i,t}$ is the macroeconomic characteristic that we would like to analyze. Coefficients $\Phi_{R,h}$ and $\Phi E, h$ describe the response of Y to a government spending shock $FE?G_{i,t}$ when $I_{i,t} = 0$, while $(\Phi_{R,h} + \tilde{\Phi}_{R,h})$ and $\Phi_{E,h} + \tilde{\Phi_{E,h}}$ describe the response of Y to a government spending shock $FE^G_{i,t}$ when $I_{i,t} = 1$. Generally, high-debt countries have lower multipliers, as fiscal consolidation is likely to have positive credibility and confidence effects on private demand and the interest rate risk premium (Ilzetzki et al. (2013)). Table (2) reports the mean and the max response of output across countries over three year. We find that large government debt does not reduce the positive response of output to a government spending shock: in recession. In detail, when the Debt to GDP ratio is low, a one percent increment in government purchases increses output about 2.42% over three years. Vice versa, if the level of debt is high, the mean response of output is 2.40%. Indeed, when the level of government debt is low, the max response of output is 3.72 whereas when the level of debt is high the

[17] Openness=(export+import)/GDP, if the proxy for one country is higher than the average, the economy is open vice versa is not.

[18] The spread is the difference in yield between a bond and some comparative benchmark bond. In this case the benchmark is the 10 years German Bund vs other Euro Countries Government bond with the same maturity.

[19] $ZTL = i_s$ if $i_s < 1\%$ where i_s is the short interest rate.

max response is 3.70. The results do not show any adverse effect of public debt on the size of the fiscal multiplier.

Conventional wisdom wants that countries with a high public debt ratio do not incur in further debt, especially in times of economic recession, as an increase in the public debt ratio could boost the cost of borrowing. Our result shows that an increase in government spending during economic downturns has a similar effect in countries with low and high public debt over three year. Conversely, when the economy is in expansion, an increase in government spending has no effect on GDP for both countries with high or low debt.

Besides the level of debt we investigate whether the presence of a high deficit or spread in the euro zone countries affect the size of the spending multiplier. The empirical results show that an increase in public expenditure in high deficit countries during recession increases GDP approximatelly by 2.50%. In contrast, if we consider the case of an increase in government spending in surplus/low deficit countries, the output response is just 0.26% and is not stastistically significant.[20]

We have similar results as we consider the spread. We find that the spending multiplier associated with an increase in government spending when the spread is above 150 basis point is larger than the one associated with an increase in government spending when the spread is under 150 basis point. In fact, the spending multiplier for the first case is 1.35 on average and reaches a maximum of 2.20 after three years. In contrast, the multiplier when the spread is under 150 basis point is 1.17 on average and reaches a maxium of 1.79 after three years. The Countries that have experienced a high sovereign risk are Spain (1991-1996),(2010-2014); Finland (1991-1995); Italy (1991-1996),(2011-2014); Portugal (1991-1996),(2010-2015); Belgium (2010) and Ireland (2010-2013). The results show that a stimulus of public spending, in downturn, is more effective to rise GDP of high risk countries than in ones that are considered safe. The joint consideration of deficit and spread cases in Table (2) suggests that the stimulus

[20]The max response in the high deficit case is 3.83%, whilst for surplus/low deficit is 0.77% and is not statistically significant.

effect of an increased government spending in recession is more effective in high deficit/spread countries than in low deficit/debt countries.[21]

Ilzetki et al. (2013) showed that government spending multiplier is higher in closed economies than in open economies, which is consistent with the standard macroeconomics literature. We find evidence that supports this prediction. We show that for both open and closed economy the mean and max response of output to a government spending shock is sizeble. The size of government spending multiplier is higher for a closed economy, a one percent increse of government spending increses output of about 1.73%, in contrast for a open economy the mean response is lower 1.09%.[22].

Corsetti et al. (2010, 2012) investigates if the exchange rate regime determine the size of fiscal multipleir. In the traditional Mundell-Fleming model, government spending is ineffective in stimulating domestic demand under flexible exchange rates because a fiscal expansion "crowds out" net exports as a consequence of the exchange rate appreciation. In contrast, under fixed exchange rates, fiscal policy becomes effective because the exchange rate appreciation is immediately offset through monetary expansion.

Since the European Monetary Union can be represented as tantamount to a fixed exchange rates regime for the member countries, it is relevant to investigate whether the spending multiplier in a monetary union is as high as in a fixed exchange rate regime. We show evidence that support this prediction. Under fixed exchange rates regime, a one percent increase in government spending during economic slack raises output by approximately 1.87%. In sharp contrast, under a fully flexible exchange rate regime the response of output in recession is never significantly different from zero.

The last, but not the least, macroeconomic characteristic that we investigate is the zero lower bound. Since the financial crisis the European Central

[21]That means that a boost in the aggregate demand (particularly for the countries more risky) will help to speed up recovery.

[22]The maximum response for a closed economy is 3.12% rahter for an open economy is 1.75%

Bank adopted several conventional and unconventional policies to spur the recovery in the Eurozone. However, when recession is deep and monetary policy is constrained by the zero lower bound, fiscal stimulus can become effective to avoid the drop of GDP and the deflationary dynamics. Moreover, Canzonieri et al. (2016), Christiano et al. (2011), Hall (2009), Erceg and Linde (2010), or Woodford (2011) derive fiscal multipliers on output which exeed one.

We show that in a zero lower bound, the output response is extremerly positive and statistically significant during expansion. More precisely, the mean response of output to a one percent increase in government spending is 2.87% and the max response is 7.29%. Peculiarly, if we observe the spending multiplier in recession is not statistically different from zero. One of the possible explanation is the fact that we have only few observations for the case of a zero lower bound during recession and our results may, therefore be biased.

Table (3) reports the mean and the max response of private consumption across countries over three years. We show that large government debt does not reduce the response of private consumption to a government spending shock. Specifically, the consumption multiplier does not change taking into account the different macroeconomic characteristics, for example the private consumption response to a one percent increase in government spending when the government debt ratio is low is 2.25%, viceversa when the government debt is high the response is 2.24%.[23] An interesting result comes when we consider the presence of a high deficit and an high spread. The empirical evidence shows that a rise in government spending in deficit during recession increases private consumption approximate by 2.93%. Differently, if the government spending is in surplus/low deficit the effect is not statistically significant.[24] We have similar results when we consider the spread. We show that a one percent increase in government spending is associated with an increase in private consumption by nearly 2.02%,

[23]The max response is about 2.77% when the debt ratio is low and is 2.76% when the debt is high.

[24]The max response with high deficit is 3.82%, on the contrary the max response in surplus/low deficit is not statistical different from zero.

while if we consider the same increase in government spending in surplus/low deficit, there is not a statistically significant effect. As for output, the mean and max response of private consumption to a government spending shock is higher for a closed economy respect to an open economy. In detail, the spending multiplier associated to a closed economy is 2.27, whilst for an open economy it is 1.62. The empirical results confirm that a spending shock is larger in recession for a closed economy than for an open economy. In expansion, the government spending shock is negative as predicted by theoretical models. Moreover, the spending multiplier is higher and statistically significant during the monetary union. In the case of monetary union in recession, the mean response is 2.85 after three years, whereas the max response reaches a peak of 4.68. Lastly, when we consider the zero lower bound, the mean and max response of private consumption to a one percent increase in government spending is higher with respect to the condition when the interest rate is above 1%. Exactly, the mean response is 2.24 and the max response reaches 4.12 in recession.

Table (4) reports the mean and the max response of private investment across countries over the three year. Traditional economic theory predicts that rises in public sector spending "crouwd out" the private sector spending. Our empirical results confirm that the effect of "crowding out" occurs during periods of economic expansion. However, when the economy is in a recession, the effect of an increase in government spending does not "crowd out" but actually stimulates private investment. Moreover, we look at whether some economic characteristics of the euro area countries, such as the level of public debt, high deficit, high spreads, the introduction of the euro influence the size of spending multiplier. We find that the spending multiplier is quite similar in countries with high and low debt.[25] However, it turns out that countries that have implemented an increase in spending in deficit during recession, have experienced an increase in private investment and the mean and the max response are respectively 4.76 and 7.47. Also, it is interesting to observe that at the zero lower bound, the

[25]The mean and max response for high debt countries is 4.78 and 9.11, while for low debt countries are 4.84 and 9.24

effect of "crowding in" is big, otherwise an increase in government spending during recession may raise private investment to a maximum of 6.93 over three years.[26] The empirical analysis shows that the spending multiplier (in deficit) is larger than the one when interest rate is at the zero lower bound. This result is the opposite of what you would expect. Actually, if the government spending in deficit coincides with the interest rates close to zero, the spending multiplier in deficit may be larger than the one when interest rate is at the zero lower bound[27], as in our case[28].

Table (5) reports the mean and the max response of debt to GDP across countries over three year. The most important statement that emerges from the results is that an increase in government spending, during recession and within a fixed exchange rate system as the European Monetary Union, decreases the debt to GDP ratio of about 2.01%. While the same policy, in expansion, raises the debt ratio to GDP by approximately 1.79.

Table (6) reports the mean and the max response of total employment across countries over three year. We find that in the recessionary regime, an increased government spending leads to higher total employment indipendently of the public debt ratio or the spread level (above or below 150 basis points). An interesting result is that an increase in government spending in deficit during recession increases total employment by approximately 1.84% (and reaches its maximum at 2.66% after three years). To the contrary, the effect of the same policy, in countries with surplus or low deficit, is not statistically different from zero.

[26] Before the introduction of the euro the max response is 5.67.

[27] This due to two effects: the positive demand effect of government spending ($\Delta G_{DEFICIT} = \Delta G + \Delta D$) and the interest rate effect at the zero lower bound, where the conventional negative effect of interest rate on the aggregate demand is zero, i.e. $i \approx 0$.

[28] The countries where the short interest rate is near zero and deficit is above 3% are: Belgium (2012-2013), Spain (2010-2015), France (2010-2015), Ireland (2010-2014), Italy (2010-2012), Netherland (2010-2013), Portugal (2010-2015).

6.2 Southern Countries vs Northern Countries

In the baseline formulation of the empirical model, we do not distinguish between countries with different patterns in the public finance variable as well as the debt-GDP ratio growth and the deficit trend. As Bacchiocchi et al (2011) finds different behaviour of OECD countries according to the level of their public debt and whether they comply with the Stability and Growth Pact and given the panel structure that we used in the analysis, we choose to re-estimate the baseline empirical model (1) splitting the sample into two groups[29] according to the level of public financial liabilities (as a share of the GDP) during the sample period (1985-2015) [30]. This reflects the fact that there is not a single fiscal stance in the Eurozone and different member countries have different targets and constrains in their fiscal policy making, within boundaries defined by the EU Commission and the Treaties. Panels (26-27) show the impulse responses of two macroeconomic variables (GDP and debt-GDP) [31] to a one percent increase in the government spending shock. In each panel, there are two subpanels showing the response (black, thick line for Recession and red, thick line for Expansion) in the two subsamples (Panel (a) Sud Countries, Panel (b) Nord Countries). The thin dashed lines indicate the 80% confidence bands which are based on Newey and West (1987) standard errors that provide consistent estimates when there is autocorrelation in addition to possible heteroskedasticity of the error term in specification (1).[32] Panel (26) shows the result of an increase in government spending on GDP. Panel (a) shows that the spending multiplier is higher and statistically significant over the 3-year horizon during an economic slack. It reaches its maximum after 3-years (more than 5). Conversely, in Panel

[29] We exclude Greece inasmuch is an outlier.

[30] Sample A (Sud Countries): Belgium, Spain, France, Ireland, Italy, Portugal) vs (Sample B (Nord Countries): Austria, Germany, Finland, Luxemburg and Netherland

[31] We only show the results for the GDP and debt-GDP. The findings are similar even when we consider other macroeconomic variables, such as: private consumption, private investment, deficits; the results are available upon request.

[32] The choice to increase the confidence interval is due to the fact that the observations of the subsamples are fewer with respect to the total sample.

26 (b), when we consider the second group of Countries (Austria, Germany, Finland, Luxemburg and Netherland), the spending multiplier is positive over the 3-year horizon but is not statistically significant and its maximum is lower (slightly greater than 2) with respect to the first group of Countries considered (Belgium, Spain, France, Ireland, Italy, Portugal). Vice versa, when we consider the expansionary regime, in both subgroups, the GDP responses are quite equivalent. The GDP responses is positive in both cases. In addition, when we consider the countries of the first group, the spending multiplier is statistically significant only in the first year and turns out to be slightly larger than one. While, when we consider the countries of the second group, the spending multiplier is always statistically significant and reaches its maximum after three years. It should be noted that the maximum reached by the countries of the second group is very similar to the maximum level reached by the countries of the first group when the economy is in recession. Panel (27) shows the results of an increase in government spending on the debt to GDP ratio. Panel 27(a) shows that a positive government spending shock leads to a decrease in the debt to GDP ratio over the 3-year horizon during an economic slack (Belgium, Spain, France, Ireland, Italy, Portugal). However, when we consider the second subgroup (Austria, Germany, Finland, Luxemburg and Netherland) an unexpected increase in the government spending deteriorates the debt to GDP ratio over two years (it is statistical significant only in the first half of the year, Panel 27(b)). It is noteworthy that the debt multiplier remains lower than one for the all time horizons considered (no multiplicative effect). Differently, when we are looking for the expansionary regime, a government spending shock leads to an increase of the debt to GDP ratio for both subgroups considered (Panel 27(a,b), red lines). We also estimated the fiscal multiplier dropping one country each time. The multiplier remains positive and statistically significant (GDP, and improve the debt-GDP ratio in recession). The size varies, depending on the country that is not considered (the multiplier is smallest when we exclude countries such as France, Ireland, Italy, Portugal and Spain).[33]

[33]Results are available upon request.

6.3 Is the fiscal multiplier time varying?

Another test of robustness for our findings consists in splitting the total sample into two subsamples: one that considers the period before the crisis (1985-2006) and one that considers only the crisis period (2007-2015). As Blanchard and Leigh (2013) emphasises that during the "Great Recession" the size of fiscal multiplier has been underestimated, it is possible that fiscal multiplier may be higher during the Great recession with respect to "standard recessions" due to the combination of low interest rate (ZLB) at the time of a positive government shock. In order to investigate this hypothesis, we therefore re-estimate the baseline formulation of model (1) for the two subsample. Panels (28-29) show the impulse responses of two macroeconomic variables (GDP and debt-GDP) [34] to a one percent increase in the government spending shock. In each panel, there are two subpanels showing the response (black, thick line for Recession and red, thick line for Expansion) in the two subperiods (panel (a) before the Great Recession, panel (b) during the Great Recession). The thin dashed lines indicate the 80% confidence bands which are based on Newey and West (1987) standard errors that provide consistent estimates when there is autocorrelation in addition to possible heteroskedasticity of the error term in specification (1).[35] Panel (28) shows that the spending multiplier is higher and statistically significant over the 3 years horizon in the period following the global financial crisis (Panel 28(b), in recession). While, when we consider the subsample before the Great Recession, the spending multiplier reached is maximum after one year (2.24) and became not statistical significant after the first year (Panel 28(a), in recession). Conversely, when we consider the expansionary regime, in both subsamples, the responses are quite analogous. The GDP response to an unexpected increase in the government spending is negative but not statistically significant, before the

[34] We only show the results for the GDP and debt-GDP. The findings are similar even when we consider other macroeconomic variables, such as: private consumption, private investment, deficits; the results are available on request.

[35] The choice to increase the confidence interval is due to the fact that the observations of the subsamples are fewer with respect to the total sample.

2007 (Panel 28(a)), and it is near zero after the 2006 (Panel 28(b)). Panel (29) presents the effect of an increase in government spending on the Debt to GDP ratio. We control the effect of government spending shock on the Debt to GDP ratio in order to account the effect of spending shock on the health of the public finance. Panel (29)b shows that an increase in the government spending leads to a decrease in the debt to GDP ratio over the 3 years horizon in the period following the Great Recession (2007-2015, in recession). However, when we consider the subsample that excludes the crisis period (1985-2006), the effect of government spending is strikingly different. Before the outbreak of the crisis, an unexpected increase in government spending deteriorates the debt to GDP ratio over the 3 years horizon (Panel 29(a), in recession). It is noteworthy that the debt multiplier follows a bell-shaped curve. The debt multiplier remains lower than one for about one year and a half; the second year it reaches its maximum (1.27) and then after the second year, it still drops below one. Therefore, is interesting to note, that it is true that an increase in government expenditure initially may deteriorate the debt to GDP ratio, however, the multiplier is almost always less than one (no multiplicative effect). Vice versa, when we are looking at an expansionary regime, the impulse responses are quite similar in both subsamples. A government spending shock leads to an increase in the debt to GDP ratio either before 2007 and during the crisis (2007-2015).

7 Conclusions

In this paper we brought together a few strand of literature on the effects of government spending on different macroeconomic aggregates in a unified framework of analysis, featuring the linear projection approach advocated by Jordá (2005) that allows to construct impulse responses for any macroeconomic variable of interest and also, we are not constrained by the VARs restrictions. We focused on the Eurozone and we estimate the effects of governement spending on the key macroeconomic aggregates (GDP, private consumption, private investment), on pubblic finace indicators (deficit, primary balance, debt to gdp

ratio) and allowing the spending multipliers to vary smoothly according to the business cycle. The results suggest that fiscal policy activism have a stimulatory effect on output, private consumption, private investment, employment and it is beneficial on public finance during recession provided fiscal policies is actually countercyclical. Fiscal consolidations in recession (i.e procyclical fiscal policies) prove not to be expansionary, rather, fiscal expansion (i.e. countercyclical fiscal policies) prove to be expansionary and not recessionary. Our main finding are as follows: a) increased government spending rises GDP during economic slack, especially when we consider countercyclical fiscal policy (the procyclical fiscal policy, does not seem to have the desired "expansionary austerity effect"); b) increased government spending, in recession, could have a "crowding in" effect on private consumption and investment (these effects are pronounced if a countercyclical fiscal policy is implemented), and the predicted "crowding out" effect appears in times of expansion; c) an increase in government spending lowers the debt to gdp ratio and improves the surplus after two years during recession, vice versa worsens the public finance indicators during expansion; d) finally, an increase in government spending reduces the unemployment rate and increase the total and private employment during recession, while in times of expansion it increases the unemployment rate and reduce the total and private employment. All these effects could vary depending on: (1) the level of debt; (2) the exchange rate regime; (3) the openness to trade; (4) how public investment is financed; and (5) the public spending composition: (1) in times of recession, an increase in government spending has the same fiscal multipliers either in countries with low debt either in countries with high debt; (2) when there is a recession and the exchange rate is fixed (as after introduction of the euro), the output effect is greater than in countries experiencing a flexible exchange rate regime; (3) when there is a recession in a closed economy, the output effect is greater than one that has an open economy; (4) when there is recession and the government spending is financed through high deficits, the output effect is larger than one that is in surplus or with low deficit; (5) government consumption and government investment have a positive effects on output in recession and negative in

expansion. Hence, the effects of investment spending is stronger only in the long run, particularly after two years when the impact on output exceeds 4 for government investment shock and is around 3.20 for government consumption shock. The same result when we consider the response of private consumption, private investment and the "helthy" of public finance indicator. Everything that has been done by the European countries is the reverse of what our analysis suggests. After few years from the Great Recession, the euro area countries, especially the countries in deep recession as Spain, Italy, Greece, Portugal, have cut more than 70% of the net government investment and they have also cut government consumption spending. These austerity policies have led to an increase of debt to GDP ratio, a decrease in consumption, private investment, employment rate and GDP (in all countries of the euro area). What emerges from our analysis is consistent with the simple Keynes model, an increase in government spending during recession will increase GDP and private consumption. Also, we do not observe the "crowding out" effect of private investment (that is precisely what the simple Keynes model predicted), but rather its rise in the medium term. Such multiplicative effects are much larger if the countries are under a fixed exchange rates regime (as the European Monetary Union) and the government spending is countercyclical in recession. The euro zone still has the option to exit from the so-called "secular stagnation" (Delong and Summers (2012)). It should identify the common policies to revitalize the government spending on consumption and investment that would facilitate economic recovery, especially when monetary policy is accommodative. Looking on a microeconometrics framework, the seminal paper of Areallano et al. (2016) shows that the impact of earnings shock varies substantially across earnings histories, and this nonlinearity drives heterogeneous consumption responses. However, further research within a macroeconometric framework should be done in order to understand the effect of income shocks, in particular further research should be done to analyze if non-linear effects of income increases inequalities and if drives asymmetric consumption responses.

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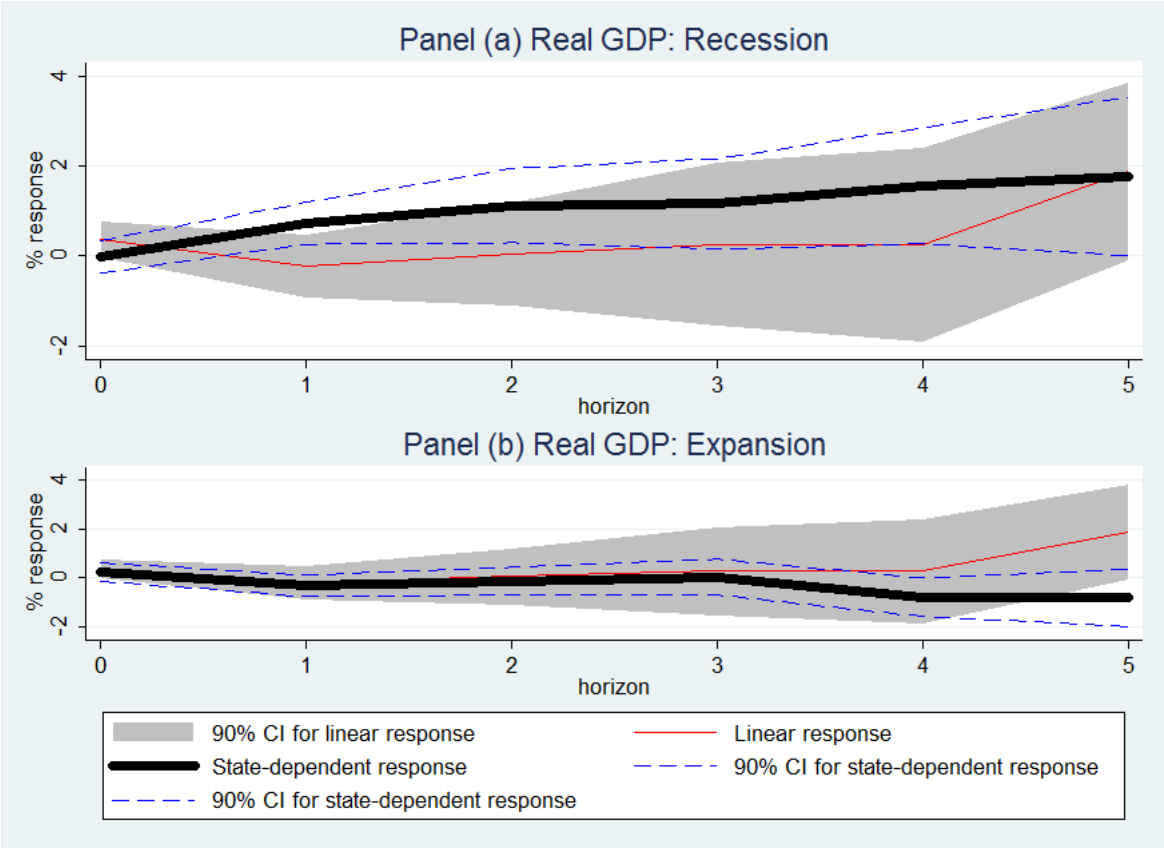
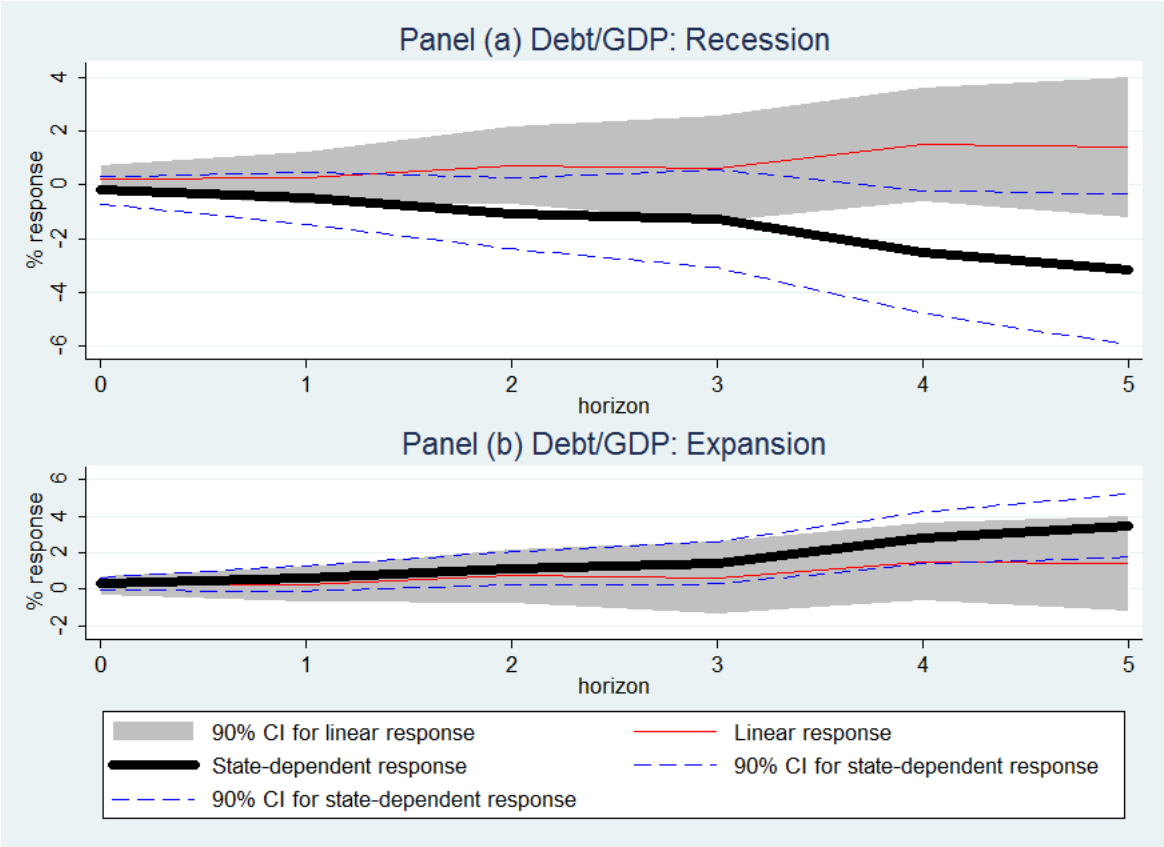
Panel 1. Real GDP

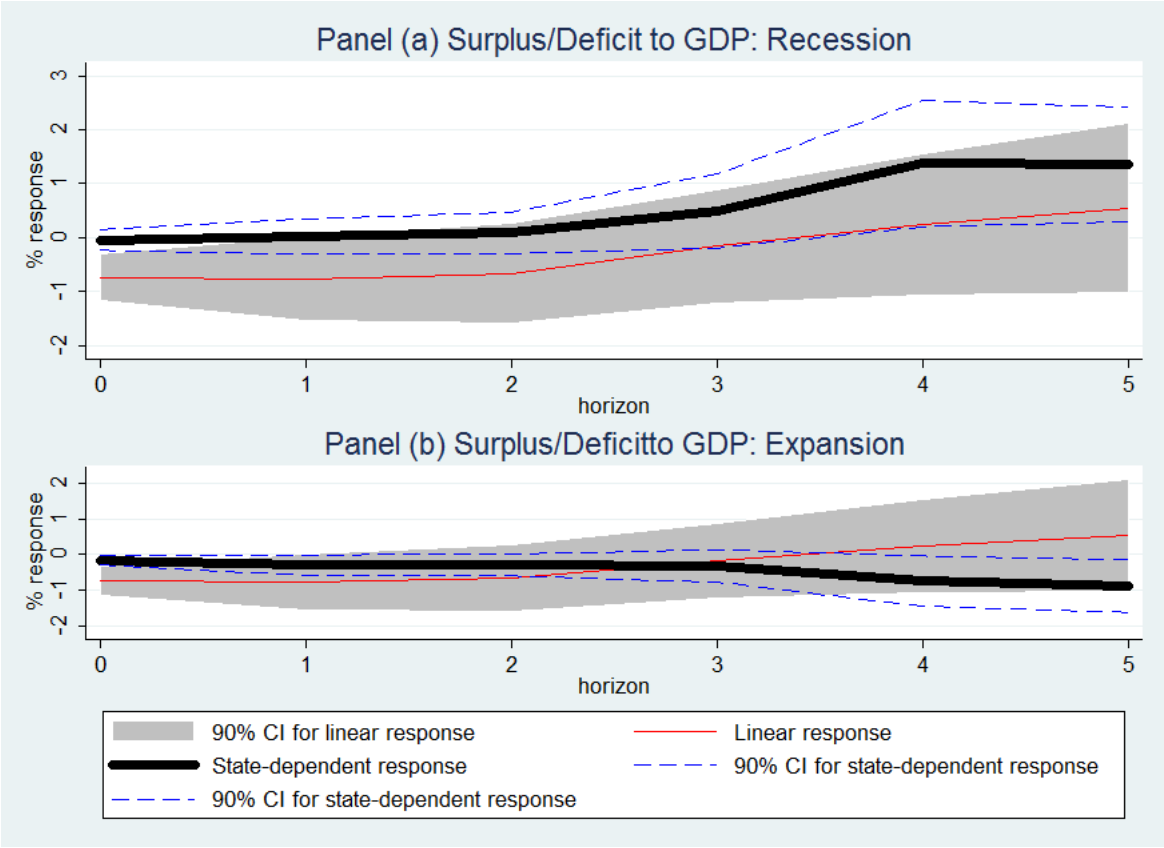


Appendices

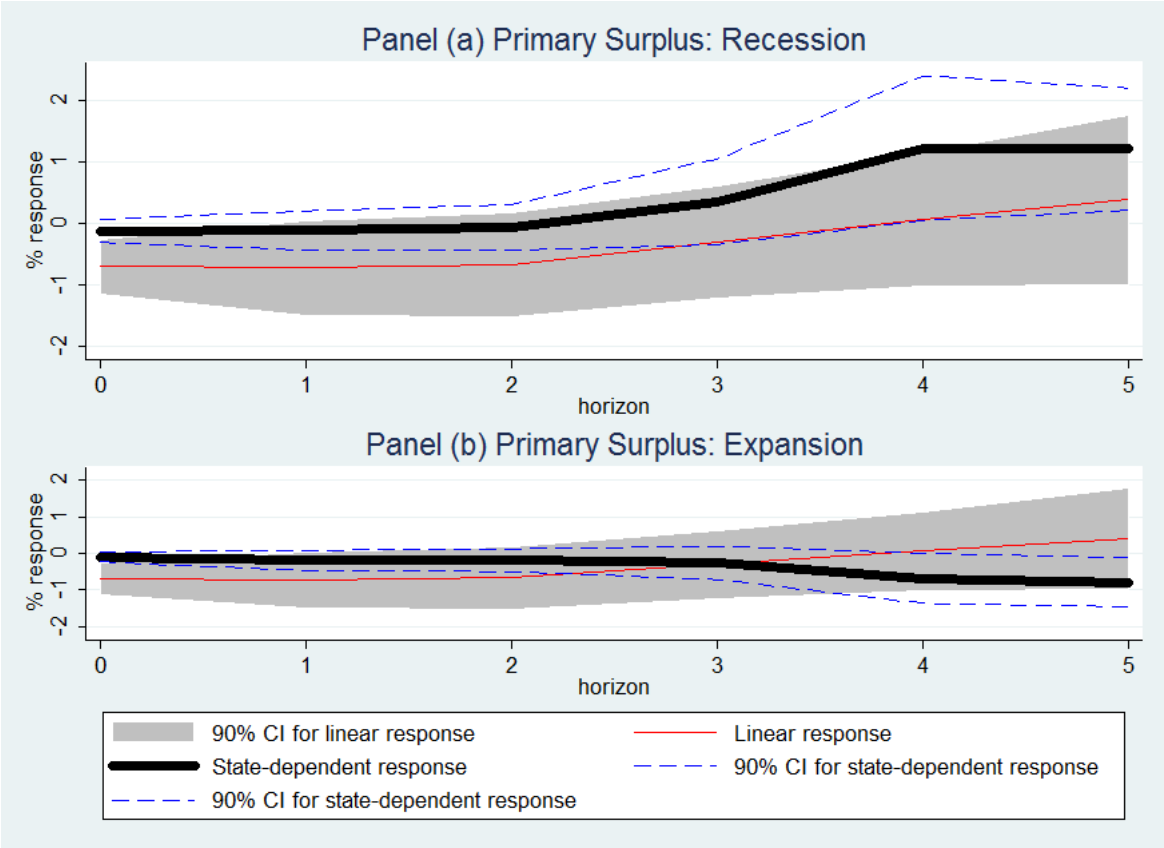
Panel 2. Debt-to-GDP



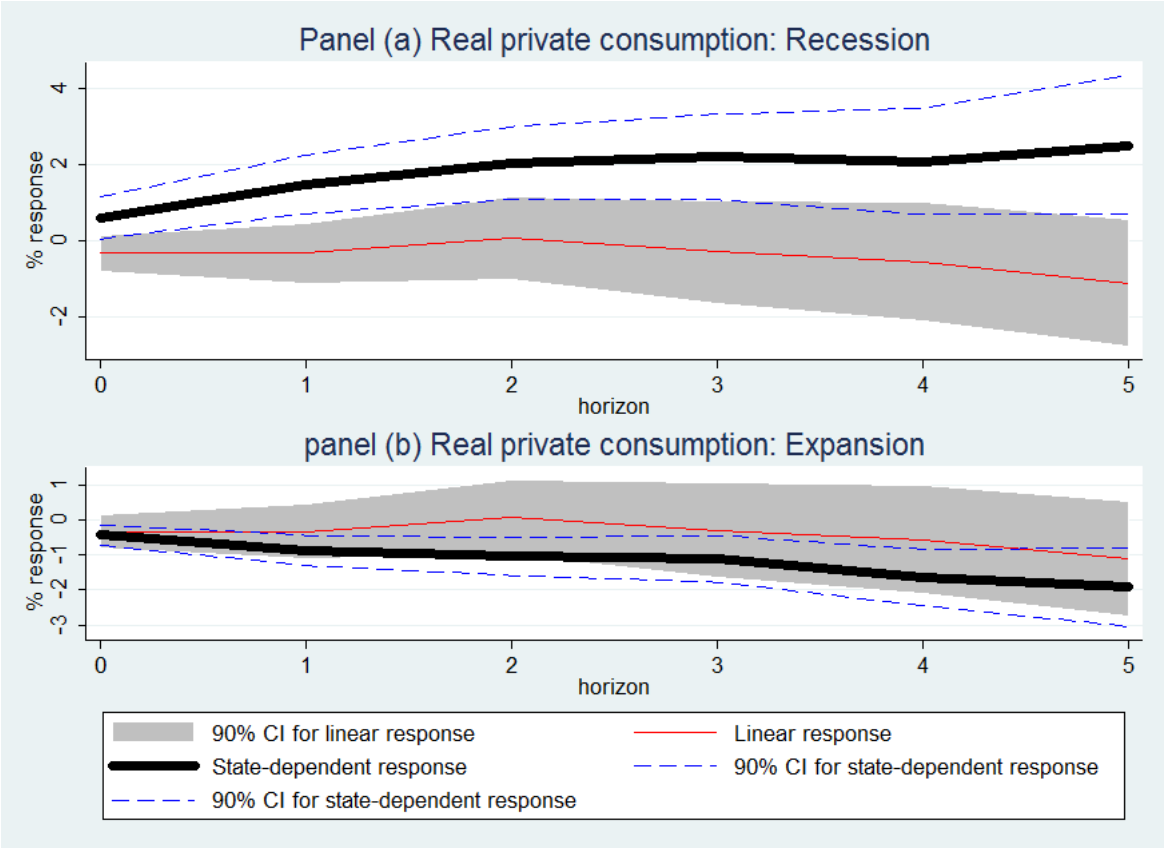
Panel 3. Surplus/Deficit



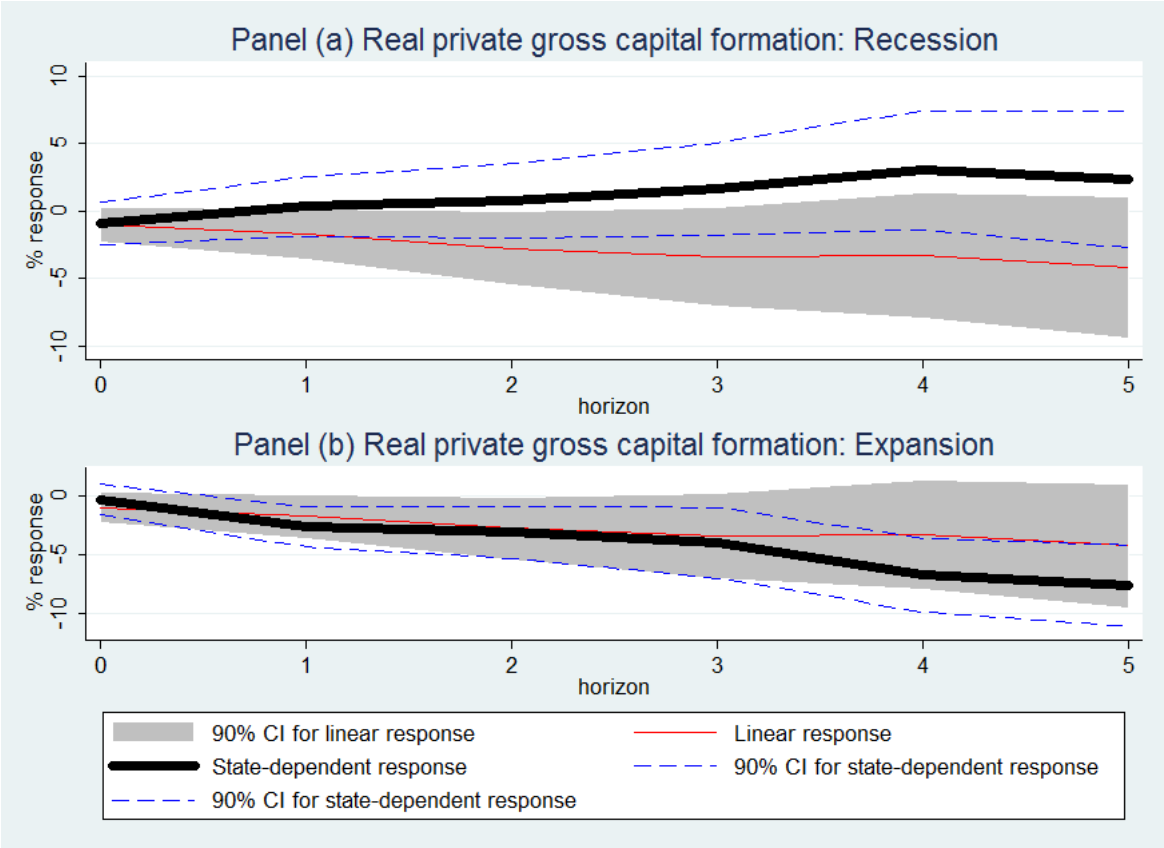
Panel 4. Primary Surplus



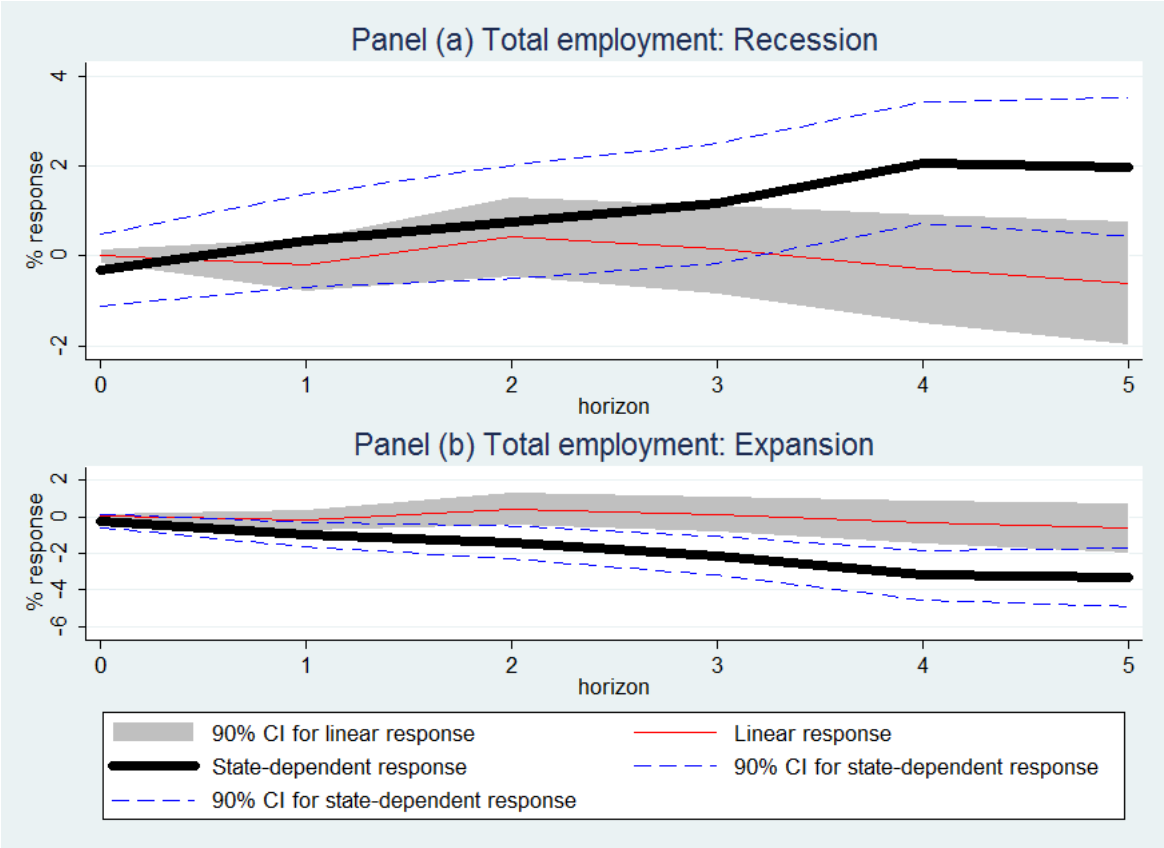
Panel 5. Real Private Consumption



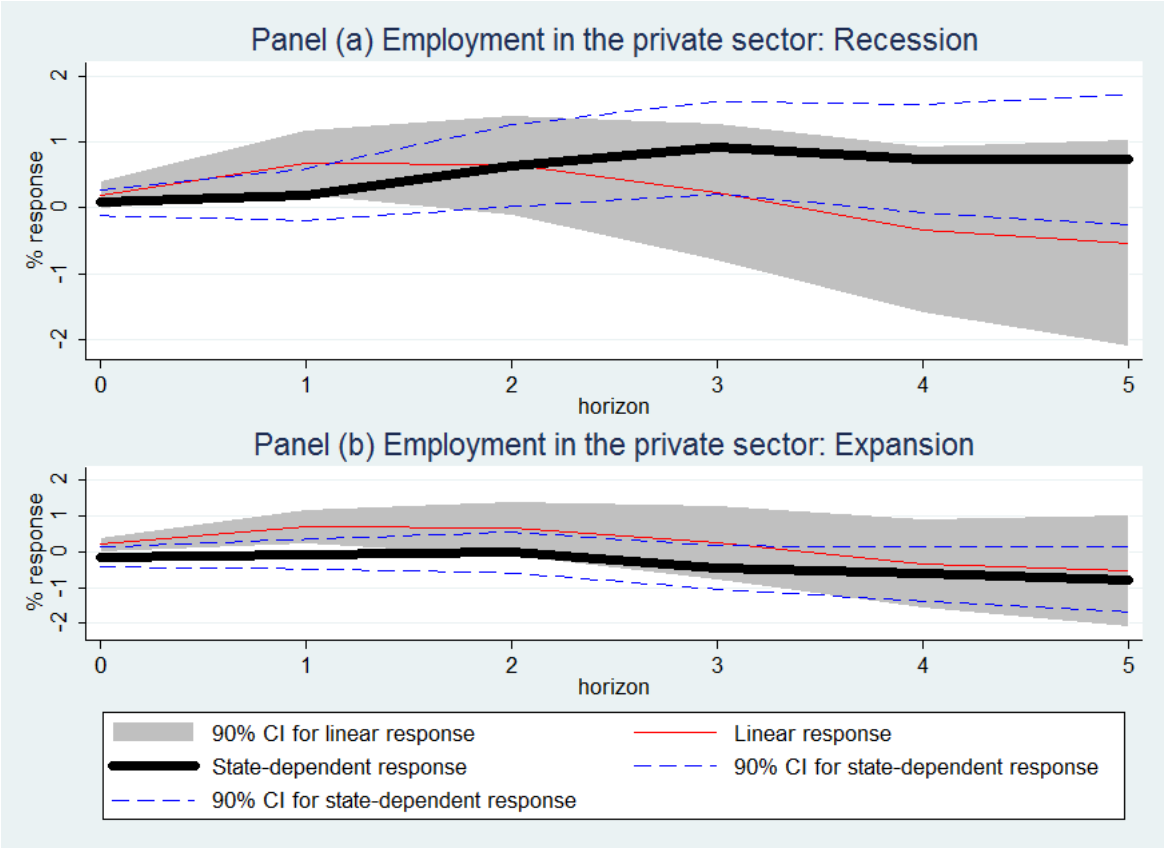
Panel 6. Private Capital Formation



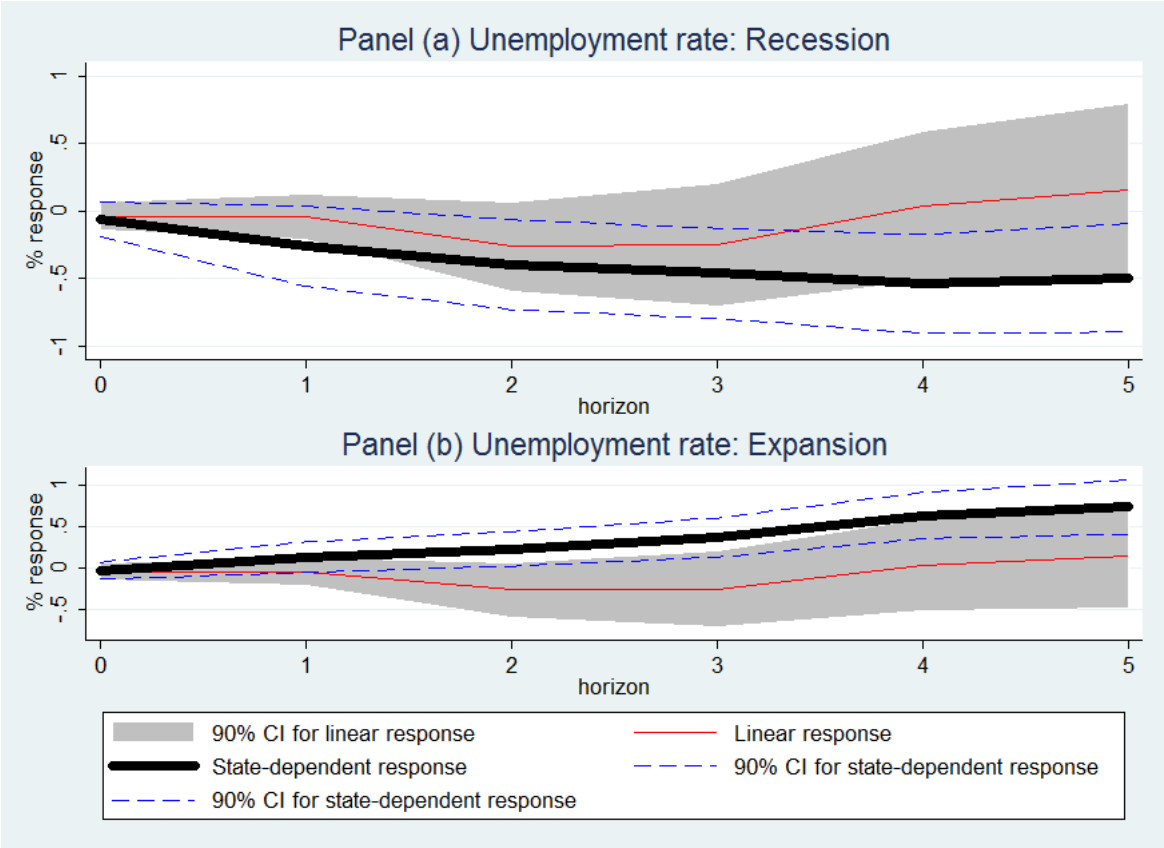
Panel 7. Total Employment



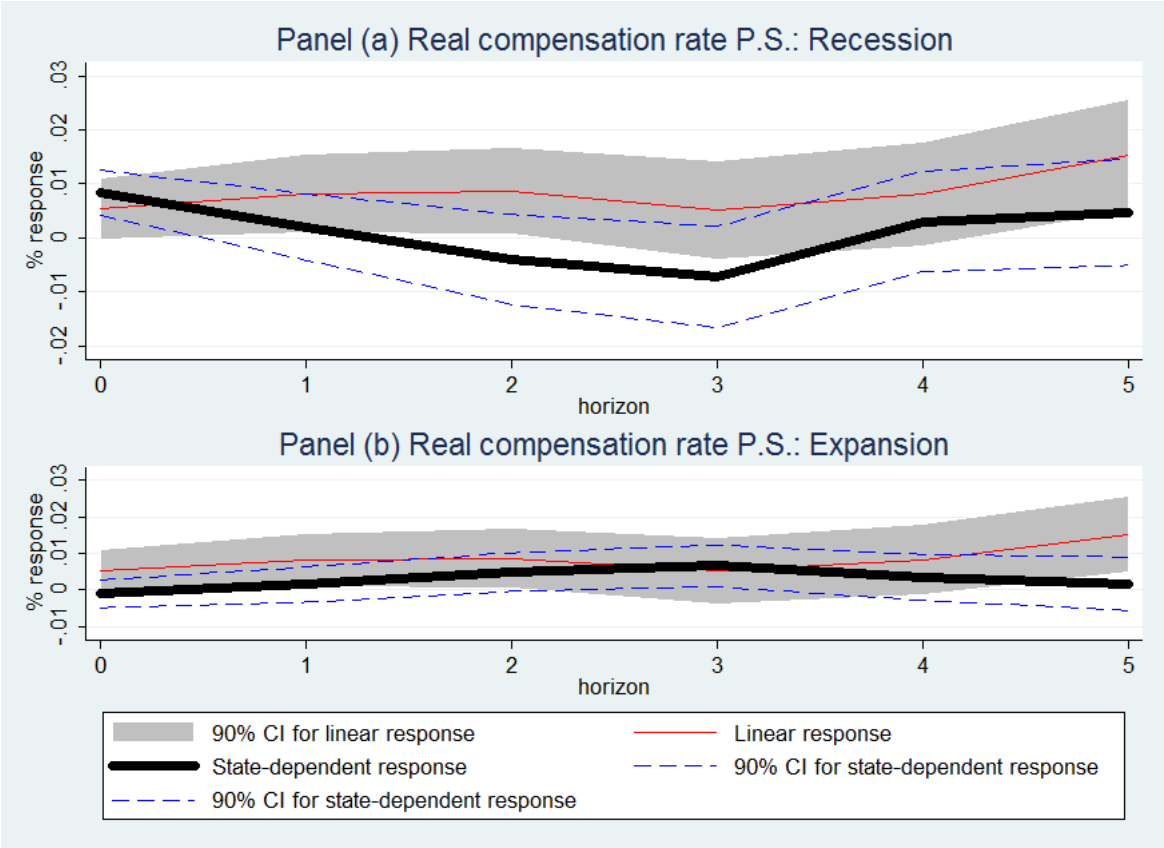
Panel 8. Employment in Private Sector



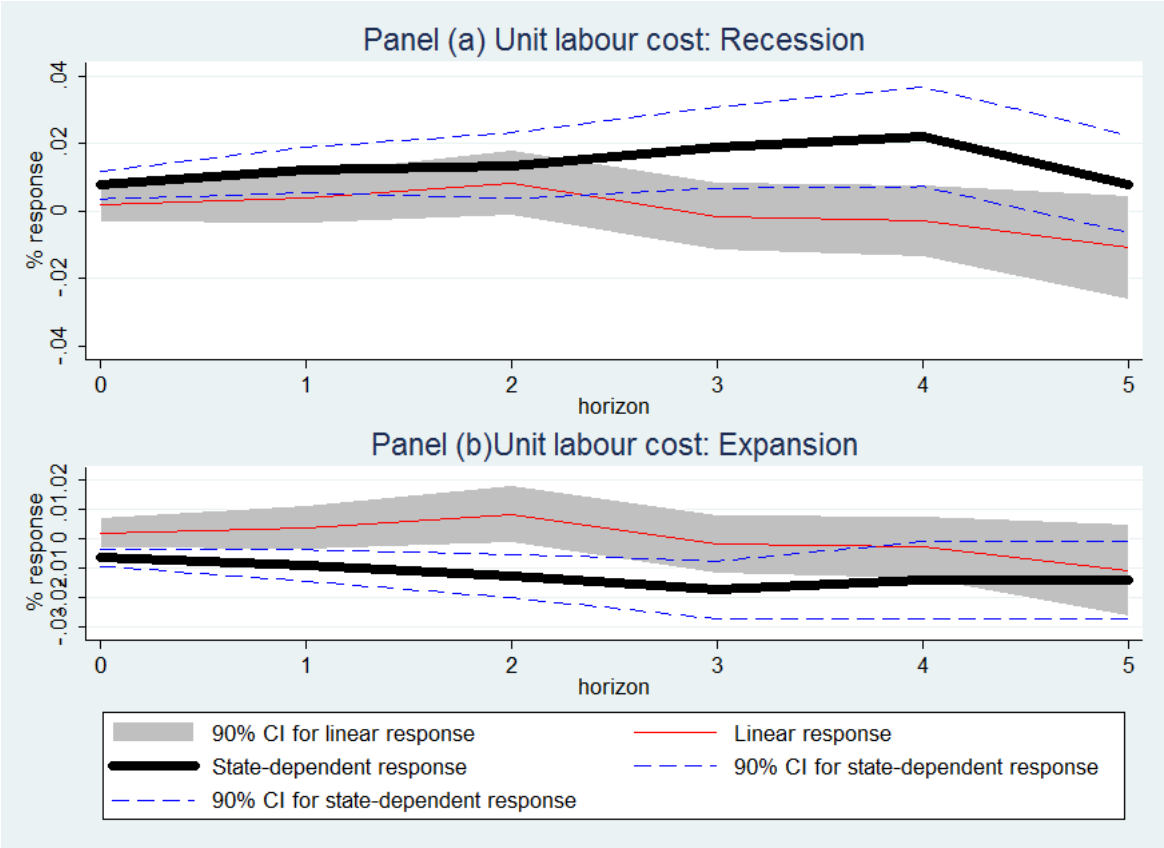
Panel 9. Unemployment Rate



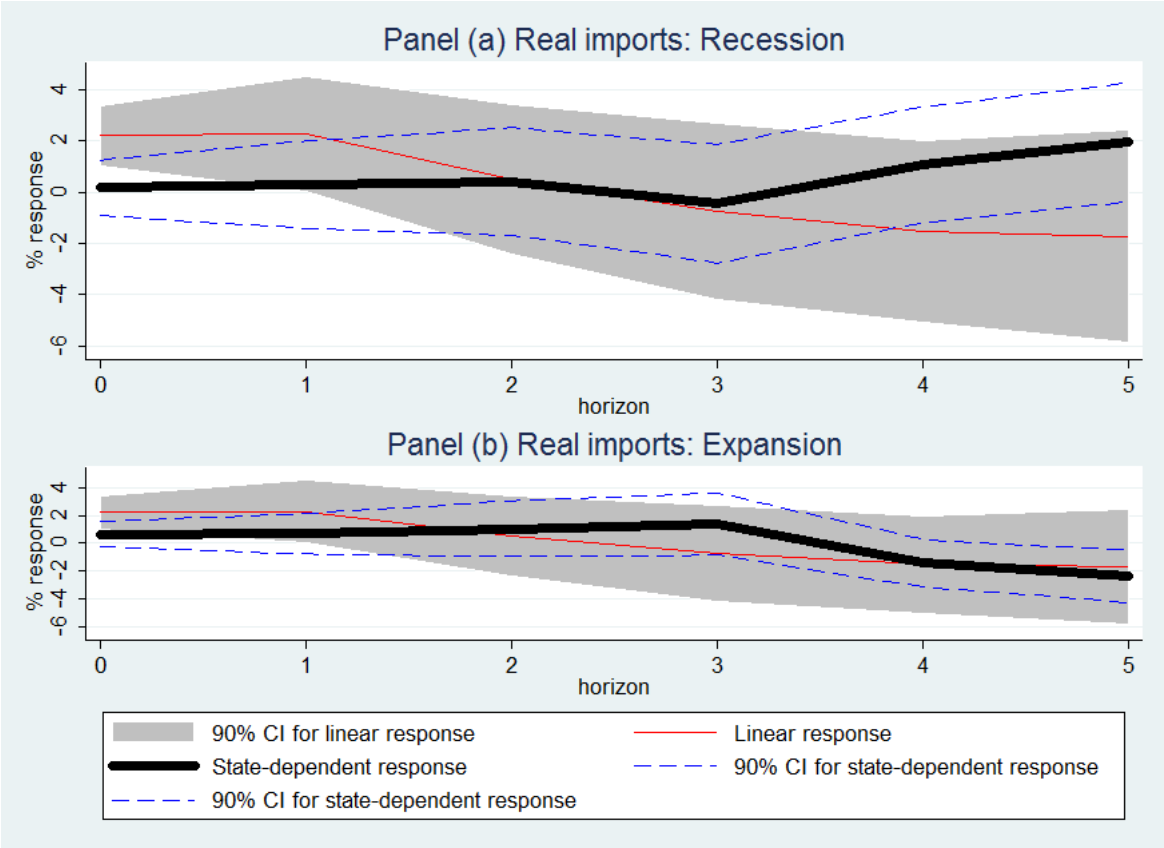
Panel 10. Real compensation rate of the private sector



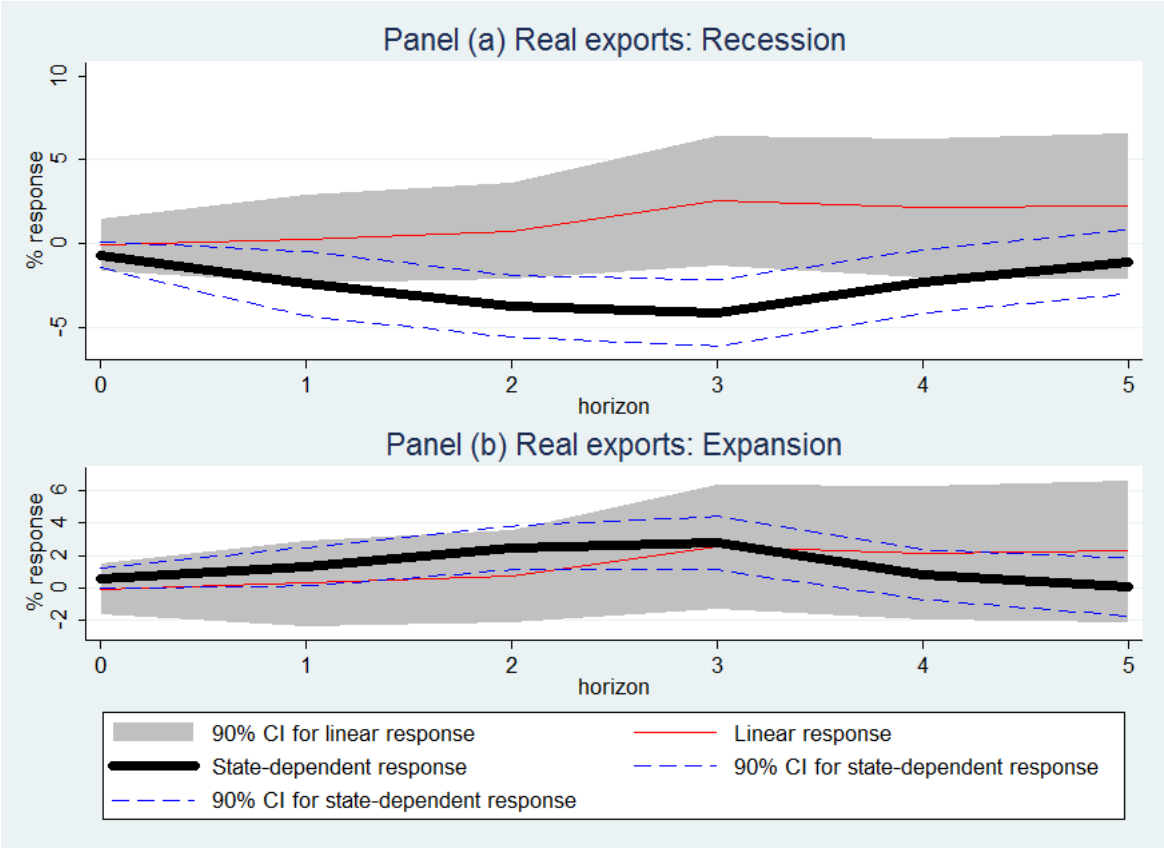
Panel 11. Unit labour cost in total economy



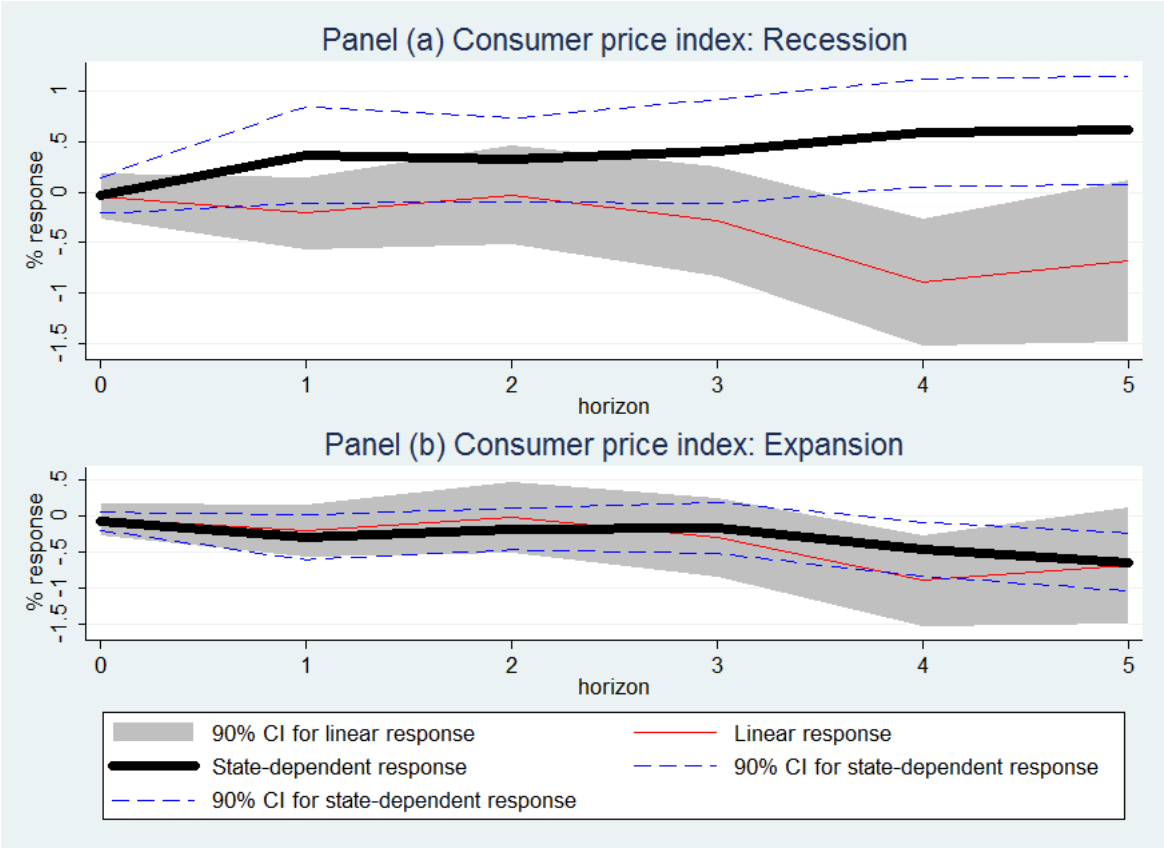
Panel 12. Real Imports



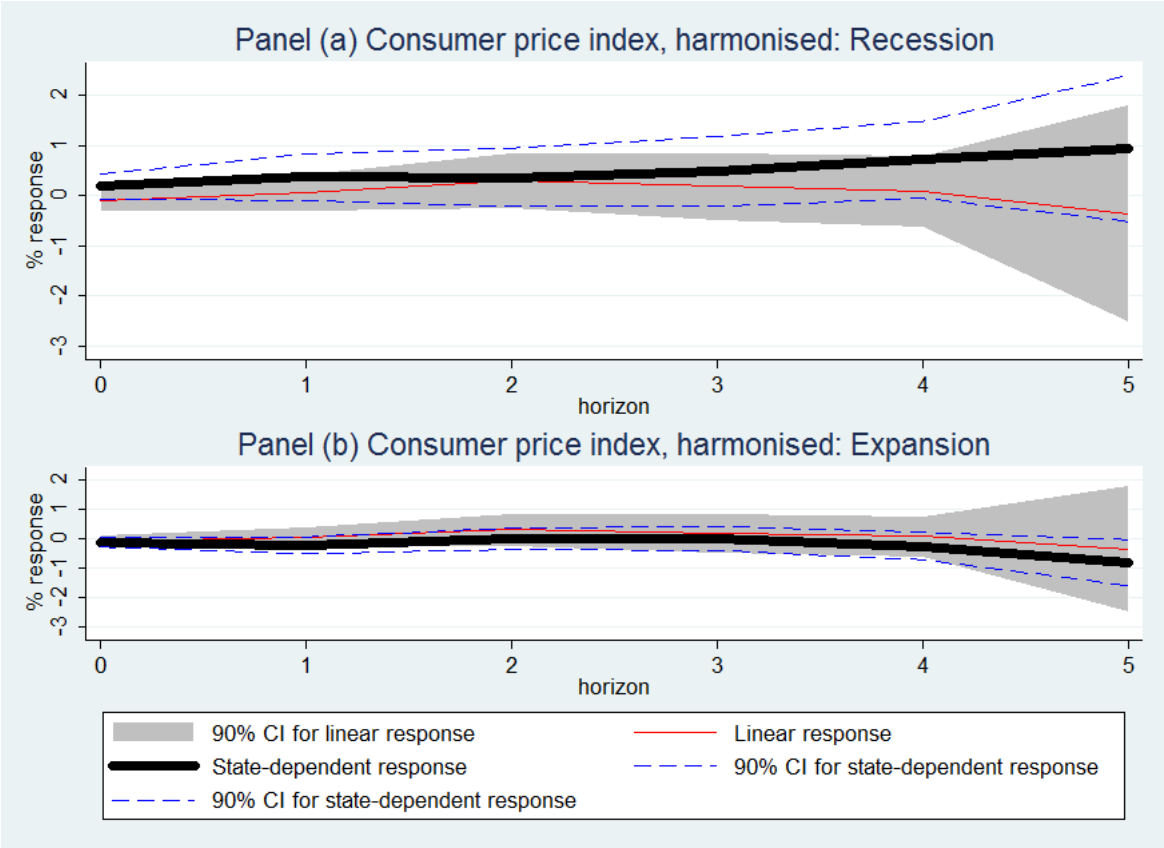
Panel 13. Real Exports



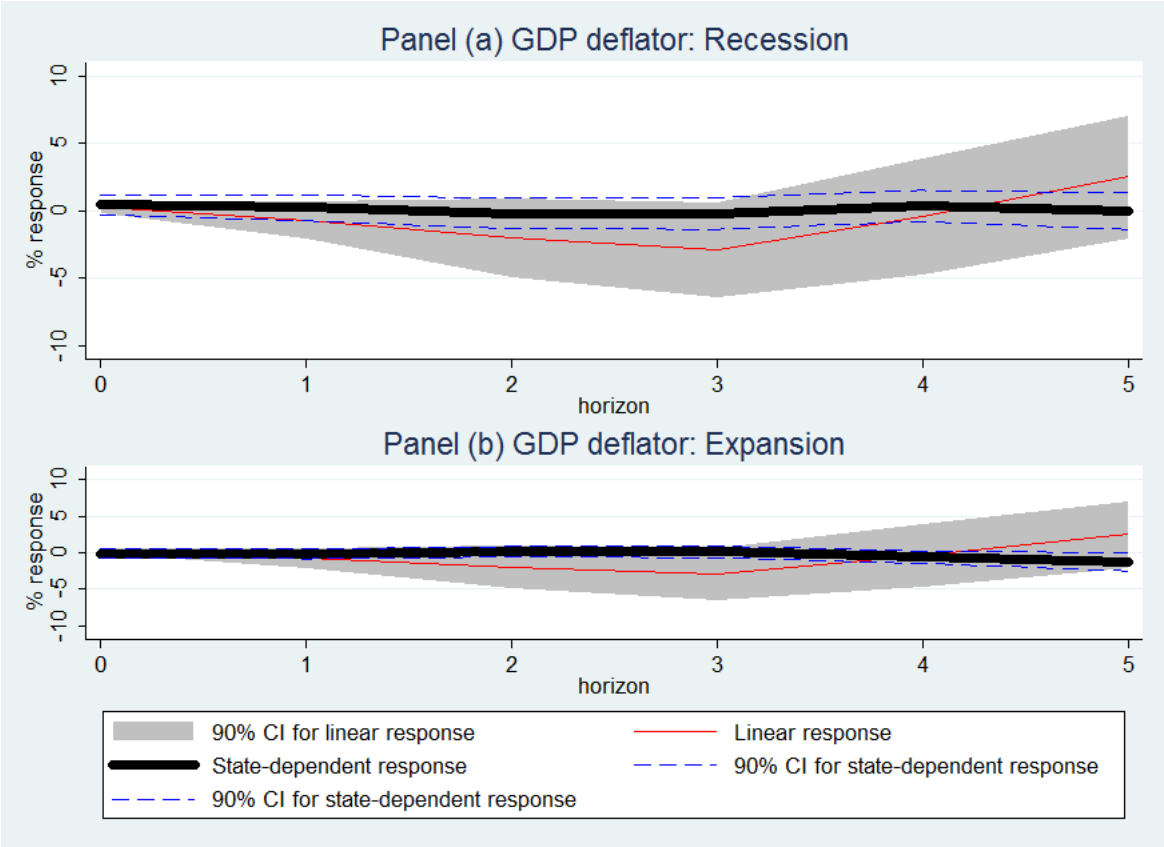
Panel 14. Consumer price index



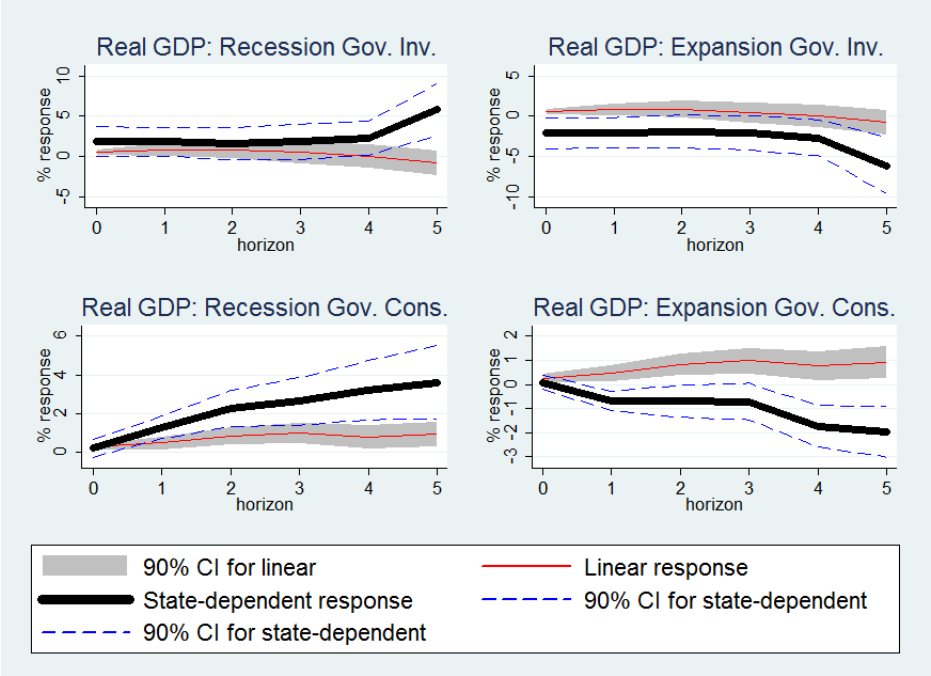
Panel 15. Consumer price index harmonized



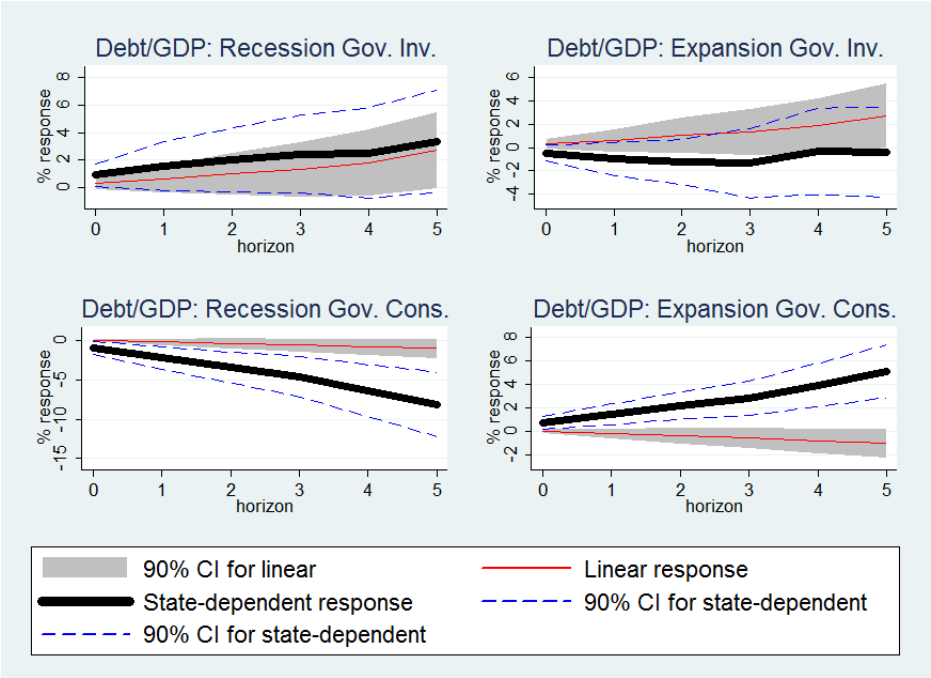
Panel 16. GDP Deflator



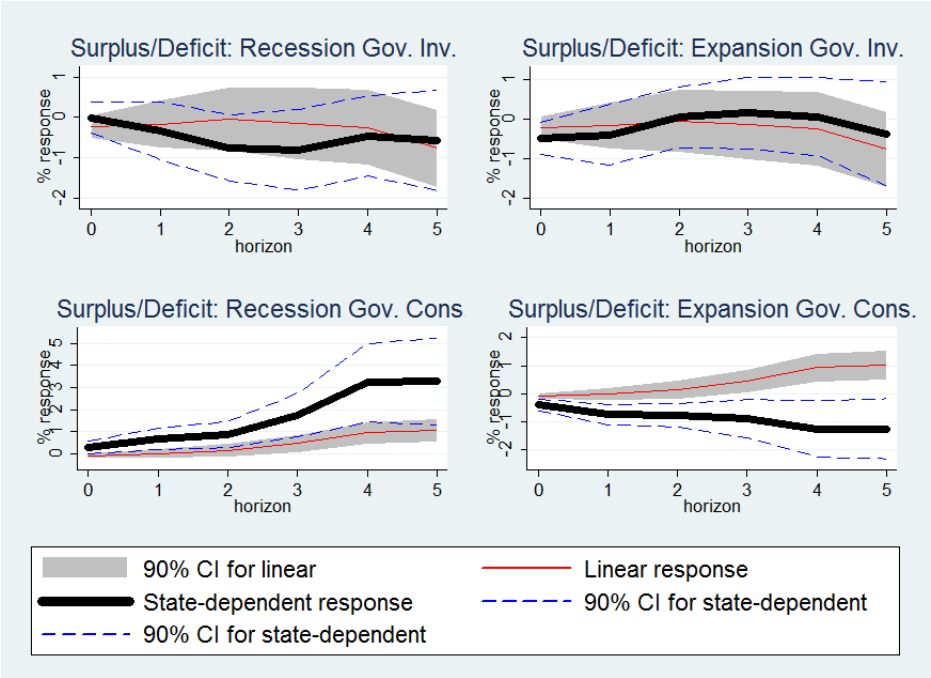
Panel 17. GDP Response to Consumption and Investment Government Spending



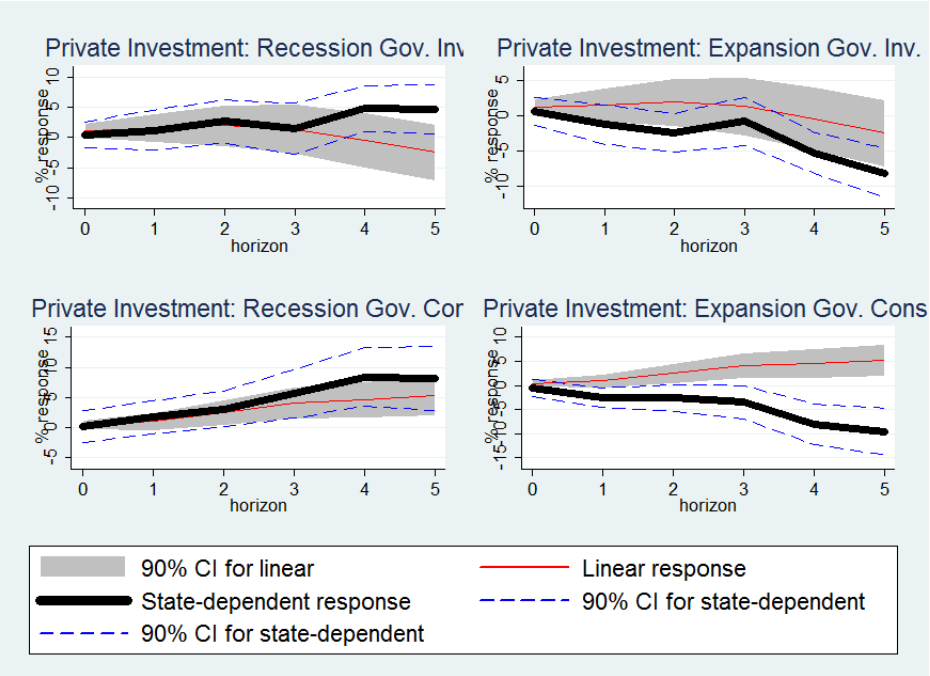
Panel 18. Debt/GDP Response to Consumption and Investment Government Spending



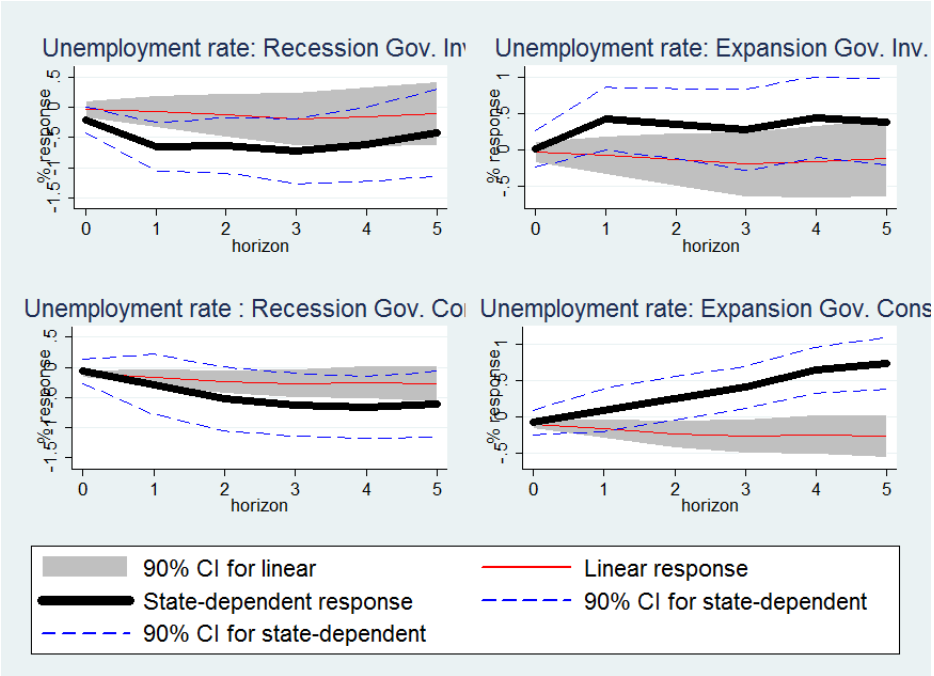
Panel 19. Surplus/Deficit Response to Consumption and Investment Government Spending



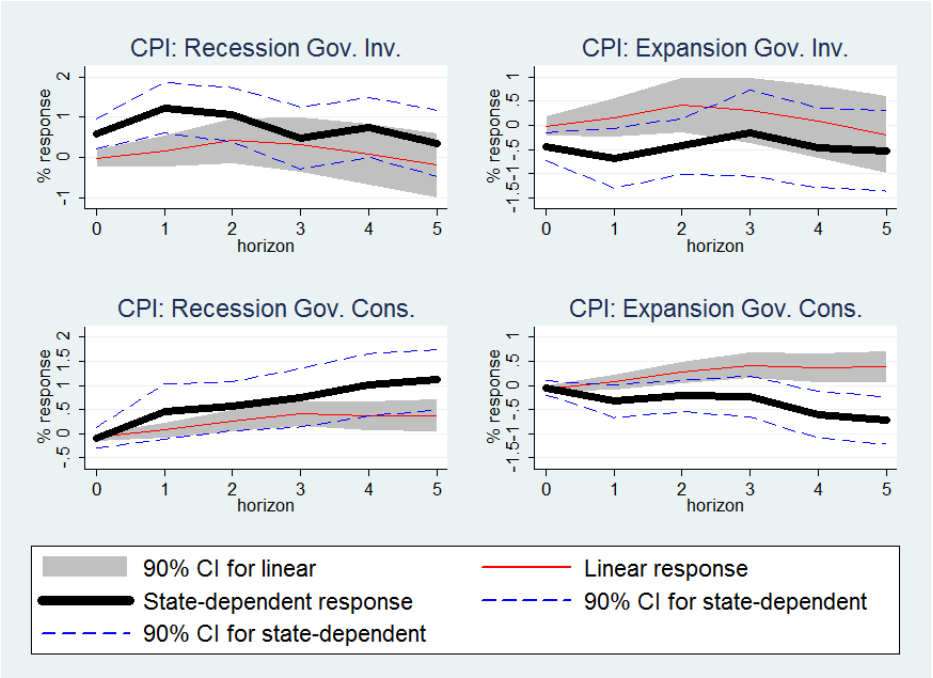
Panel 20. Private Investment Response to Consumption and Investment Government Spending



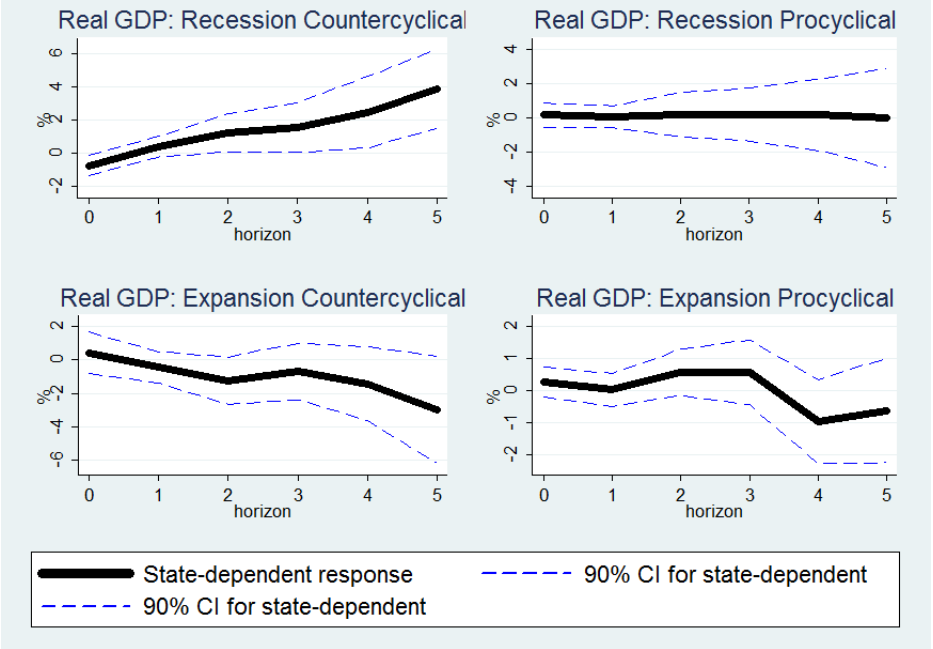
Panel 21. Unemployment rate Response to Consumption and Investment Government Spending



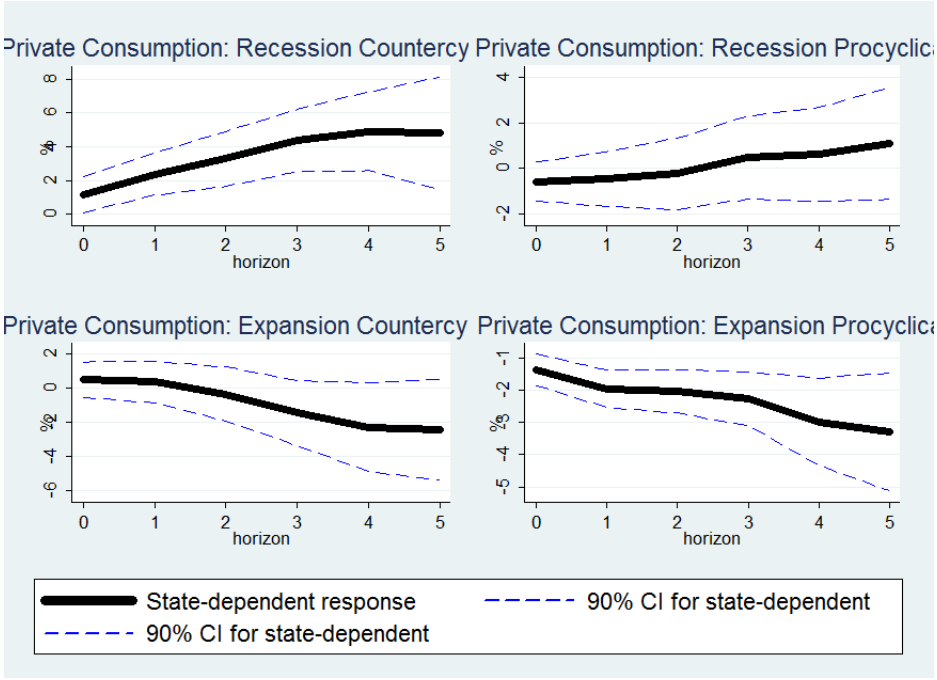
Panel 22. CPI Response to Consumption and Investment Government Spending



Panel 23. GDP Response to Countercyclical and Procyclical Fiscal policy



Panel 24. Private Consumption Response to Countercyclical and Procyclical Fiscal policy



Panel 25. Private Investment Response to Countercyclical and Procyclical Fiscal policy

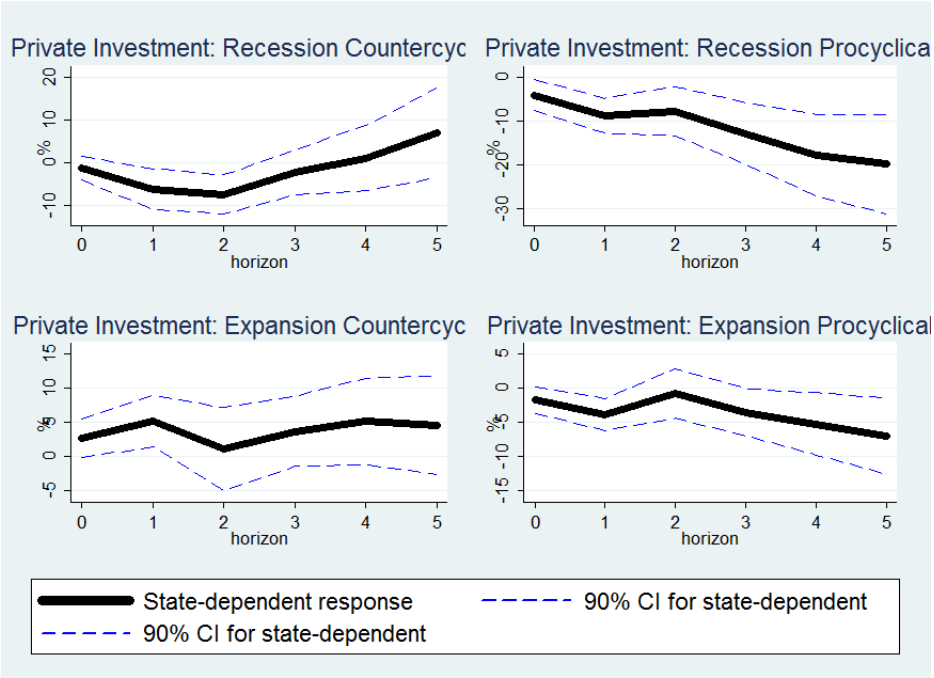


Table 1: Mean and maximum response to an unanticipated one percent government spending shock, control for year and country fixed effects

	Mean Response			Max Response		
	Recession (1)	Expansion (2)	Linear (3)	Recession (4)	Expansion (5)	Linear (6)
Real GDP	1.17***	-0.34	0.60***	1.91**	0.29	0.87***
	(0.48)	(0.39)	(0.21)	(0.96)	(0.18)	(0.26)
Debt to GDP ratio	-1.45	1.62***	-0.09	-0.21	3.47***	0.01
	(1.00)	(0.68)	(0.29)	(0.29)	(1.20)	(0.10)
Surplus/Deficit to GDP	0.55*	-0.45**	0.08	1.37*	-0.15*	0.32
	(0.30)	(0.21)	(0.12)	(0.74)	(0.08)	(0.25)
Primary Surplus to GDP	0.41	-0.37*	0.09	1.23*	-0.10	0.42
	(0.29)	(0.21)	(0.13)	(0.74)	(0.08)	(0.47)
Real Private Consumption	1.77***	-1.15***	0.42	2.38**	-0.41***	0.62*
	(0.55)	(0.39)	(0.29)	(1.08)	(0.17)	(0.33)
Real private gross capital formation	1.17	-4.03***	-0.34	2.99	-0.35	0.22
	(2.12)	(1.16)	(1.01)	(3.43)	(0.91)	(1.23)
Real Total Gross Capital Formation	2.95*	-2.01**	0.80	3.76**	-0.57	1.45
	(1.59)	(0.99)	(0.72)	(1.94)	(1.54)	(1.13)
Real Gross fixed capital formation, housing	1.38	-1.99	1.01	2.27	0.23	1.59
	(1.85)	(1.32)	(0.83)	(2.93)	(0.86)	(1.47)
Total Employment	0.99	-1.86***	-0.51*	2.02***	-0.23	-0.26
	(0.61)	(0.48)	(0.31)	(0.81)	(0.18)	(0.23)
Employment in the Private Sector	0.52*	-0.35	0.23	0.85**	-0.01	0.43*
	(0.27)	(0.32)	(0.19)	(0.42)	(0.32)	(0.24)
Unemployment rate	-0.39***	0.46***	0.00	-0.05	0.90***	0.09
	(0.13)	(0.11)	(0.05)	(0.04)	(0.20)	(0.10)
Real Exports	-2.38***	1.35***	-0.35	-0.67	2.77***	0.12
	(0.62)	(0.57)	(0.30)	(0.42)	(1.04)	(0.18)
Real Imports	0.56	0.01	0.67	1.94	1.36	1.21***
	(1.16)	(0.97)	(0.42)	(1.47)	(1.56)	(0.51)
Consumer Price Index	0.38**	-0.30*	0.03	0.62*	-0.07	0.13
	(0.19)	(0.16)	(0.09)	(0.33)	(0.06)	(0.13)
Consumer Price Index Harmonized	0.50*	-0.24	0.12	0.93	0.01	0.22*
	(0.29)	(0.21)	(0.12)	(0.61)	(0.24)	(0.13)
GDP Deflator	0.09	-0.32	0.03	0.42	0.13	0.18
	(0.57)	(0.40)	(0.19)	(0.42)	(0.51)	(0.15)
Real Compensation rate of the private sector	0.12	0.29	0.34*	0.84***	0.66**	0.51*
	(0.41)	(0.26)	(0.20)	(0.23)	(0.34)	(0.28)
Unit Labour Cost Economy	1.36**	-1.24***	0.00	2.19*	-0.65***	0.32
	(0.69)	(0.51)	(0.25)	(1.14)	(0.20)	(0.38)

Notes: The table reports percent responses of variables indicated in the left column. The estimated specification is given by equation (1). For unemployment, columns (9)-(11) show the minimal response. Mean and maximum responses are calculated over three years. Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Table 2: Variation in the mean response of output across countries, control for time and country fixed effects

	Response when characteristic is equal to zero				Response when characteristic is equal to one			
	Mean Response		Max Response		Mean Response		Max Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Level of Government Debt	2.42***	-0.88	3.72***	0.23	2.40***	-0.87	3.69***	0.24
	(0.87)	(0.83)	(1.01)	(0.24)	(0.85)	(0.82)	(0.99)	(0.24)
Surplus/Deficit	0.26	0.28	0.77	0.90**	2.50***	-1.64***	3.83***	-0.04
	(0.51)	(0.39)	(1.00)	(0.46)	(0.66)	(0.65)	(1.23)	(0.17)
Spread	1.17***	-0.30	1.79***	0.33***	1.35***	-0.58	2.20***	0.32
	(0.49)	(0.29)	(0.74)	(0.14)	(0.40)	(0.56)	(0.84)	(0.25)
Openness	1.73***	-1.15***	3.12***	0.02	1.09**	0.03	1.75**	0.73***
	(0.52)	(0.46)	(0.84)	(0.15)	(0.52)	(0.25)	(0.84)	(0.31)
Currency Union	-0.86	0.26	-0.27	0.46	1.87***	-0.43	3.19**	0.53
	(0.74)	(0.37)	(0.24)	(0.65)	(0.62)	(0.46)	(1.39)	(0.63)
Zero lower bound	1.20***	-0.63***	1.74***	0.10	0.98	2.87***	1.85	7.29**
	(0.37)	(0.27)	(0.50)	(0.09)	(1.27)	(0.72)	(2.41)	(3.26)

Notes: The table reports estimate of equation (3). *Level of government debt* is measured as a percent of GDP (Source: OECD). *Surplus/Deficit* is measured as a percent of GDP (Source: OECD). *Spread* is the difference in yield between a bond and some comparative benchmark bond. In this case the benchmark is the 10 years German Bund vs other Euro Countries Government bond with the same maturity(Source: OECD). *Openness to trade* is measured as (export+import)/GDP, if the proxy for one country is higher than the average, the economy is open vice versa is not (Source: OECD). *Currency Union* is a dummy that takes the value 1 after the introductions of the euro. *Zero lower bound* is measured as $ZTL = i_s$ if $i_s < 1\%$ where i_s is the short interest rate (Source: OECD). Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Table 3: Variation in the mean response of private consumption across countries, control for time and country fixed effects

	Response when characteristic is equal to zero				Response when characteristic is equal to one			
	Mean Response		Max Response		Mean Response		Max Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Level of Government Debt	2.25*	-1.16*	2.77**	-0.56*	2.24*	-1.16*	2.76**	-0.56*
	(1.31)	(0.63)	(1.26)	(0.32)	(1.29)	(0.62)	(1.24)	(0.32)
Surplus/Deficit	0.87	-0.65*	1.47	-0.27	2.93***	-2.08***	3.82***	-0.61*
	(0.99)	(0.38)	(1.32)	(0.32)	(0.98)	(0.72)	(1.18)	(0.35)
Spread	1.07	-0.49	1.46	-0.19	2.02***	-2.07***	2.90***	-0.71***
	(0.74)	(0.36)	(0.96)	(0.34)	(0.72)	(0.40)	(1.08)	(0.30)
Openness	2.27**	-1.55**	3.16***	-0.49*	1.62**	-1.00***	2.47***	-0.39
	(1.00)	(0.68)	(1.24)	(0.30)	(0.72)	(0.32)	(0.97)	(0.29)
Currency Union	-0.69**	0.15	0.17	0.87	2.85***	-2.37***	4.68***	-0.79***
	(0.30)	(0.26)	(0.64)	(0.59)	(0.79)	(0.50)	(1.32)	(0.31)
Zero lower bound	1.58***	-1.04***	2.10***	-0.34*	2.24*	-1.57**	4.12**	-0.79***
	(0.37)	(0.21)	(0.46)	(0.19)	(1.26)	(0.77)	(2.07)	(0.29)

Notes: The table reports estimate of equation (3). *Level of government debt* is measured as a percent of GDP (Source: OECD). *Surplus/Deficit* is measured as a percent of GDP (Source: OECD). *Spread* is the difference in yield between a bond and some comparative benchmark bond. In this case the benchmark is the 10 years German Bund vs other Euro Countries Government bond with the same maturity(Source: OECD). *Openness to trade* is measured as (export+import)/GDP, if the proxy for one country is higher than the average, the economy is open vice versa is not (Source: OECD). *Currency Union* is a dummy that takes the value 1 after the introductions of the euro. *Zero lower bound* is measured as $ZTL = i_s$ if $i_s < 1\%$ where i_s is the short interest rate (Source: OECD). Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Table 4: Variation in the mean response of Private investment across countries, control for time and country fixed effects

	Response when characteristic is equal to zero				Response when characteristic is equal to one			
	Mean Response		Max Response		Mean Response		Max Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Level of Government Debt	4.84***	-6.58**	9.24***	-0.70	4.78***	-6.47**	9.11***	-0.69
	(1.81)	(2.91)	(1.58)	(1.71)	(1.78)	(2.86)	(1.55)	(1.68)
Surplus/Deficit	0.80	-1.75*	2.60*	-0.04	4.76**	-1.43	7.47***	2.16
	(0.81)	(0.97)	(1.39)	(0.89)	(2.42)	(1.42)	(3.09)	(2.31)
Spread	4.22***	-2.88**	6.26***	-0.23	2.96***	-1.11	4.78***	2.18
	(1.52)	(1.39)	(2.00)	(1.15)	(1.19)	(2.25)	(1.87)	(3.91)
Openness	-0.12	0.23	1.12	0.86	4.17***	-2.73***	5.38***	-0.68
	(1.55)	(0.78)	(1.18)	(1.26)	(1.44)	(0.93)	(2.01)	(1.03)
Currency Union	4.28***	-2.71***	9.01***	0.51	2.35	-1.47	5.11**	2.85***
	(1.19)	(1.01)	(2.32)	(1.26)	(1.55)	(1.42)	(2.48)	(1.19)
Zero lower bound	4.27***	-3.07**	5.67***	-0.41	-0.69	1.75	6.93**	12.98**
	(1.39)	(1.49)	(1.86)	(0.84)	(2.00)	(3.12)	(3.50)	(6.50)

Notes: The table reports estimate of equation (3). *Level of government debt* is measured as a percent of GDP (Source: OECD). *Surplus/Deficit* is measured as a percent of GDP (Source: OECD). *Spread* is the difference in yield between a bond and some comparative benchmark bond. In this case the benchmark is the 10 years German Bund vs other Euro Countries Government bond with the same maturity(Source: OECD). *Openness to trade* is measured as (export+import)/GDP, if the proxy for one country is higher than the average, the economy is open vice versa is not (Source: OECD). *Currency Union* is a dummy that takes the value 1 after the introductions of the euro. *Zero lower bound* is measured as $ZTL = i_s$ if $i_s < 1\%$ where i_s is the short interest rate (Source: OECD). Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Table 5: Variation in the mean response of Debt to GDP across countries, control for time and country fixed effects

	Response when characteristic is equal to zero				Response when characteristic is equal to one			
	Mean Response		Max Response		Mean Response		Max Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Zero lower bound	-2.26**	2.10***	-0.28	3.84***	0.34	0.33	1.45	4.68
	(1.02)	(0.55)	(0.43)	(0.97)	(2.21)	(0.97)	(2.74)	(4.05)
Openness	-1.53	1.95**	-0.98**	2.69	-1.80***	1.48***	-0.04	3.73***
	(1.56)	(1.01)	(0.49)	(1.73)	(0.72)	(0.29)	(0.36)	(0.72)
Currency Union	0.27	1.08*	0.95	2.00*	-2.01**	1.79***	-0.42	5.27***
	(1.61)	(0.65)	(0.97)	(1.15)	(0.95)	(0.43)	(0.35)	(1.30)
Spread	-1.04	0.75	0.15	2.39***	-1.81***	2.85***	-0.32	5.51***
	(1.08)	(0.46)	(0.41)	(0.91)	(0.71)	(0.39)	(0.28)	(0.89)

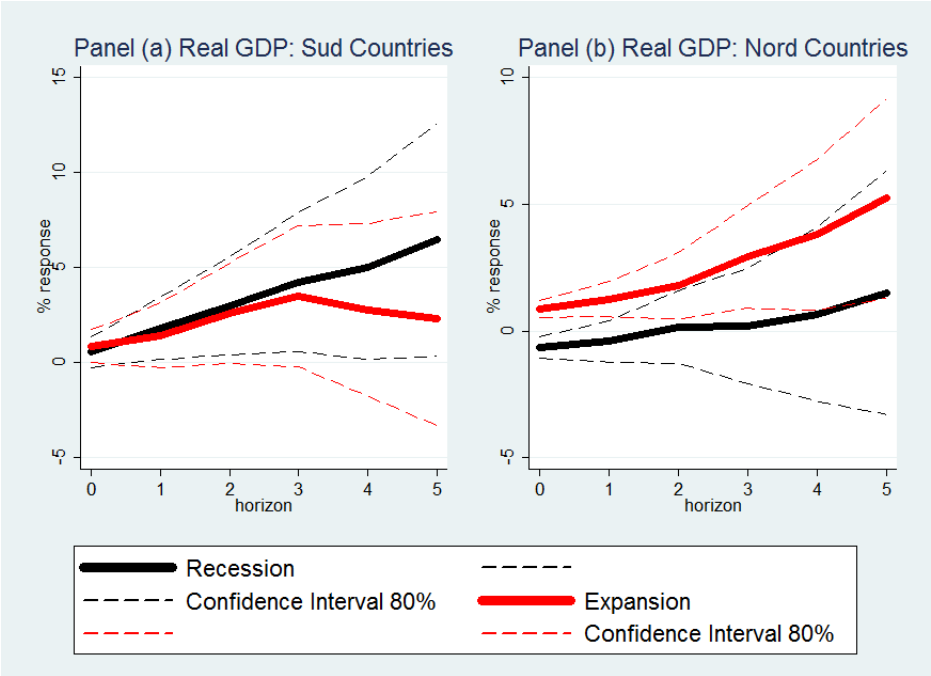
Notes: The table reports estimate of equation (3). *Level of government debt* is measured as a percent of GDP (Source: OECD). *Surplus/Deficit* is measured as a percent of GDP (Source: OECD). *Spread* is the difference in yield between a bond and some comparative benchmark bond. In this case the benchmark is the 10 years German Bund vs other Euro Countries Government bond with the same maturity(Source: OECD). *Openness to trade* is measured as (export+import)/GDP, if the proxy for one country is higher than the average, the economy is open vice versa is not (Source: OECD). *Currency Union* is a dummy that takes the value 1 after the introductions of the euro. *Zero lower bound* is measured as $ZTL = i_s$ if $i_s < 1\%$ where i_s is the short interest rate (Source: OECD). Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Table 6: Variation in the mean response of Total employment across countries, control for time and country fixed effects

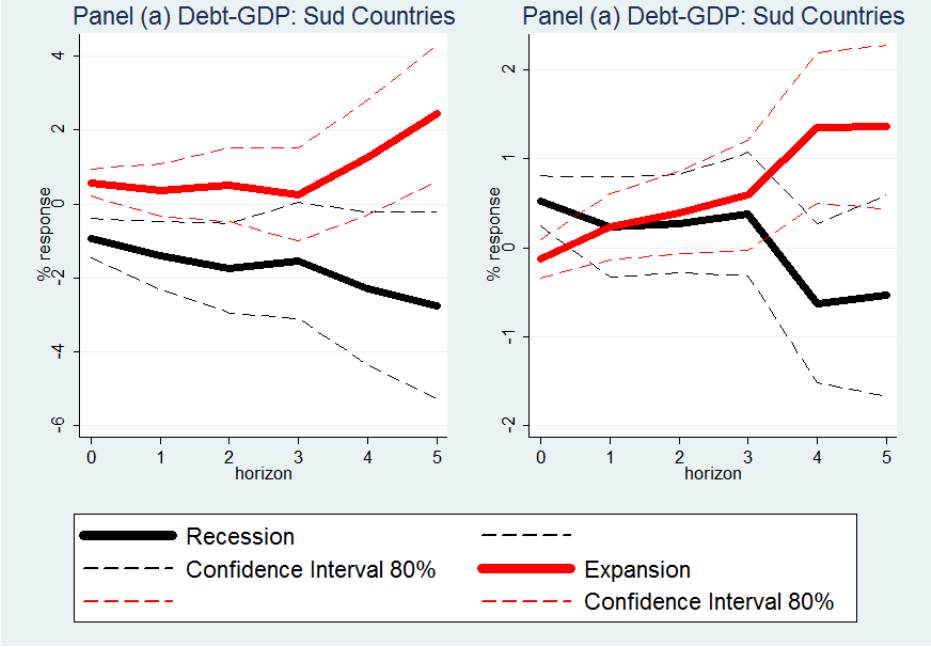
	Response when characteristic is equal to zero				Response when characteristic is equal to one			
	Mean Response		Max Response		Mean Response		Max Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Level of Government Debt	1.30	-4.02***	5.02***	-0.44	1.28	-3.97***	4.96***	-0.43
	(2.27)	(0.75)	(1.70)	(0.45)	(2.25)	(0.74)	(1.68)	(0.44)
Surplus/Deficit	-0.13	-1.73***	1.07	-0.08	1.84*	-1.57***	2.66**	-0.21
	(0.44)	(0.41)	(0.87)	(0.16)	(1.03)	(0.67)	(1.20)	(0.24)
Spread	1.03	-2.13***	2.55**	-0.21	0.98*	-1.05**	1.96***	0.16
	(0.87)	(0.57)	(1.21)	(0.25)	(0.56)	(0.53)	(0.57)	(0.34)
Openness	0.06	-0.38	0.42	0.18	1.22	-2.58***	2.64***	-0.46**
	(0.43)	(0.49)	(0.64)	(0.21)	(0.83)	(0.50)	(1.13)	(0.21)
Currency Union	1.60***	-2.52***	4.01***	-0.53***	0.65	-1.04**	1.33*	0.06
	(0.54)	(0.49)	(1.21)	(0.22)	(0.67)	(0.51)	(0.76)	(0.20)
Zero lower bound	1.44*	-2.34***	2.88***	-0.39*	-0.50	1.73**	-0.09	5.86***
	(0.84)	(0.66)	(1.13)	(0.22)	(0.61)	(0.81)	(1.01)	(2.43)

Notes: The table reports estimate of equation (3). *Level of government debt* is measured as a percent of GDP (Source: OECD). *Surplus/Deficit* is measured as a percent of GDP (Source: OECD). *Spread* is the difference in yield between a bond and some comparative benchmark bond. In this case the benchmark is the 10 years German Bund vs other Euro Countries Government bond with the same maturity(Source: OECD). *Openness to trade* is measured as (export+import)/GDP, if the proxy for one country is higher than the average, the economy is open vice versa is not (Source: OECD). *Currency Union* is a dummy that takes the value 1 after the introductions of the euro. *Zero lower bound* is measured as $ZTL = i_s$ if $i_s < 1\%$ where i_s is the short interest rate (Source: OECD). Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

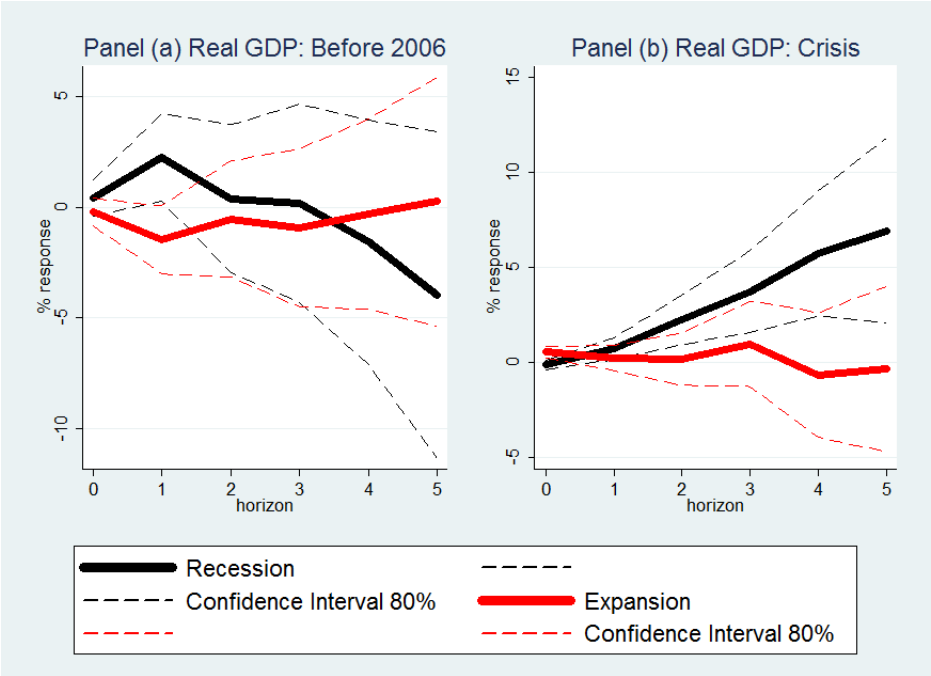
Panel 26. Real GDP



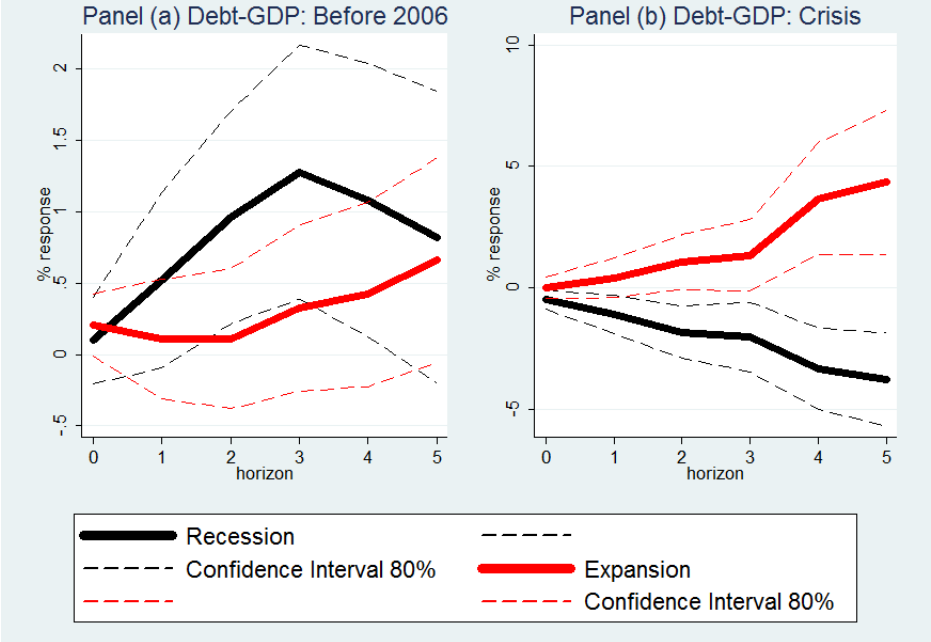
Panel 27. Debt-GDP



Panel 28. Real GDP



Panel 29. Debt-GDP



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