Public Expenditure Multipliers in Recessions. Evidence from the Eurozone

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Abstract

We estimate, for the Eurozone countries, expenditure multipliers in recession and expansion using the local projections approach and forecast errors to identify exogenous expenditure shocks. The empirical evidence suggests that multipliers are strongly state dependent: in a recession, an increase in government spending will be effective in boosting aggregate demand, crowding-in private consumption in the short-to-medium run, without affecting wages and inflation. Special attention is devoted to the relations between multipliers and government debt/GDP and deficit/GDP ratios. In recessions the expansionary effects of pumping up public spending go without raising the debt/GDP ratio but rather decreasing it. The opposite applies in expansions. Estimates also show that expenditure multipliers, in a recession, are larger in low fiscal space, high-debt, South countries than in low-debt, North countries. It turns out that GDP multiplier effects in recessions were magnified after the 2008 world-wide financial crisis. It also appears that the debt/GDP reduction after a public expenditure increase is confined to the after-crisis period.

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"The employment of a given number of men on public works will (on the assumptions made) have a much larger effect on aggregate employment at a time when there is severe unemployment, than it will have later on when full employment is approached"
J.M. Keynes, *The General Theory*, p. 127.

1 Introduction

Are public expenditure multipliers significantly higher in recession (high unemployment) than they are in expansion low unemployment, as predicated by Keynes and empirically found by Auerbach and Gorodnichenko (2013) for a panel of OECD countries? Or there is no significant difference in multipliers between recessions and expansion, as found by Ramey and Zubairy (2018) for the US over a very long time span (1889-2015)? Are multipliers in recession high and durable enough to lead o debt-to-GDP reductions? Do differences in initial macroeconomic conditions affect the size of multipliers? More specifically is it the case that expanding public expenditure in countries with a low fiscal space, due to high public debt, is little output effective (Ilzetzki et al., 2013), while contributing to even higher future public debt? Were multipliers significantly higher in the recession following the 2007-08 financial crisis than they were in previous recessions?

Some of these empirical research questions have been addressed in the literature by means of different econometric models and different shock measures, and also by focusing on different country-sets and time periods (see Section 2 for a survey). This to some extent has impaired the comparability of the results and contributed to add noise to "the cacophony of competing estimates of fiscal multipliers" (Jordá and Taylor, 2016, p. 248).

The present paper contributes to the literature on state-dependent fiscal multipliers by approaching the above research questions (and a few others) for 12 Eurozone (EZ) countries in the period 1985-2015 within a unified econometric framework based on local projections, and using the same measure of unanticipated expenditure shocks in all estimations. Following Auerbach and Gorodnichenko (2013), we identify the shock with the forecast error of public expenditure, that is the difference between the actual growth rate of government spending and the forecast growth rate prepared by professional forecasters, after showing that the shock to military expenditures employed for the US by Ramey and Zubairy (2018) would not capture much if applied to Euro countries. We also follow Auerbach and Gorodnichenko (2013) and Ramey and Zubairy (2018) in using local direct projections (Jordá, 2005) rather than the SVAR approach to estimate multipliers in order to economise on the degrees of freedom and to relax the assumptions on impulse response functions imposed by the SVAR method.

We find that increases in government expenditure in recessions have a marked expansionary effect on output and employment and do not "crowd out" private consumption and private investment, whilst impacts on inflation are negligible and statistically non significant. Expansionary effects are independent of the initial "fiscal space". It actually turns out that a positive unexpected public expenditure shock, in a recession, is more expansionary in high public debt and deficit countries than in low debt countries. In a recession, fiscal expansions do not lead to higher public debt to GDP ratios in the medium

run, i.e., anti-cyclical fiscal policies prove to be compatible with "debt sustainability". Moreover, we find that in times of recession, countries that are less open to trade, or that are in a fixed exchange regime show higher government spending multipliers than those estimated for countries with a high degree of openness to trade, a flexible exchange rate regime (as the simple Mundell-Fleming model predicts). Our analysis confirms, for the Eurozone, the results found by Auerbach and Gorodnichenko (2013, 2017); Blanchard and Leigh (2013); Jordá and Taylor (2016); Abiad, Furceri Topalova (2016), whilst contrasts those found by Ramey an Zubairy (2018). We deem important to point out that GDP multiplier effects in recessions were magnified after the 2008 world-wide financial crisis. It also results that the debt/GDP reduction after a public expenditure increase is confined to the after-crisis period.

The burst of the 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 at stimulating private activity when the economy is under financial stress. After the collapse of Lehman Brothers in September 2008 all advanced countries adopted fiscal stimulus in an attempt to speed up recovery. The beginning of the sovereign debt crisis, in 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, by reducing the public debt-to-GDP ratio. As Blanchard and Leigh (2013, p. 1) wrote, "some policy-makers claimed that confidence effects associated with fiscal consolidation could overwhelm direct contractionary effects, leading to small or even negative multipliers". That is: some policy makers believed that fiscal consolidation would not hamper growth and might actually turn to be expansionary, even if implemented in a slump (for scientific background see Giavazzi, Pagano, 1990, 1996, popularised by Alesina, 2010, and accepted by the then president of the ECB Jean Claude Trichet). Reducing public expenditure was deemed to be effective at stimulating economic activity, at least in the long run, as lower expenditure should have allowed for lower taxes, and hence less economic distortion. Reducing public expenditure was also predicated to be the most efficient and safest way to reduce public debt and preserve market access of some high indebted southern Eurozone countries. In other words, there was no alternative to "austerity".

However, in the countries that have undergone significant efforts to reduce fiscal imbalances, "austerity" measures implemented in the midst of a slump did not result in a reduction in the debt-to-GDP ratio, whereas output, employment, consumption and investment resulted weaker than expected and their rates of change turned out to be negative. Actual fiscal multipliers turned out to be larger than expected when front loaded fiscal consolidation plans were implemented (especially in the Eurozone) and had the standard Keynesian sign (Blanchard and Leigh, 2013), pointing to a clear state dependence of fiscal multipliers. Focusing on fiscal consolidation (i.e. a mix of expenditure cuts and tax hikes) Jordá and Taylor (2016) provides empirical evidence for the UK that "if a 1% of GDP fiscal consolidation is imposed in a slump then it results in a real GDP loss of around 3.5% over five years, rather than just 1.8% in a boom" (p. 220).

In order to provide guidance for future stabilization strategies if new deep recessionary episodes were to be faced in the Eurozone, we empirically assess the macroeconomic

benefits and costs of increasing government spending in EZ-countries by estimating the cycle-contingent impact of increased public spending and of different components of spending (such as investment and public consumption) on the ratios between deficit and GDP and debt to GDP, as well as on private expenditure, the inflation dynamics and the current account balance. We also enquire whether differences in initial macroeconomic conditions across EZ countries affect the size of multipliers. It may be expected that countries affected by high interest rate spreads will experience lower effectiveness of a public spending expansion, as the high spread will make the expansion short lived, as soon as the boundaries of public debt sustainability are met. For the same reason expanding public expenditure in countries with a low fiscal space is regarded as being little output effective (Ilzetzki et al., 2013). To settle this issue we directly estimate expenditure multipliers in high public debt and low public debt countries (once again in recessions and in expansions). We also test the traditional open economy macroeconomics tenet that multipliers are negatively related to the degree of openness to trade, and are lower under a free-floating exchange rate than under exchange rate pegging. To this purpose we interpret the Eurozone as a peg-exchange rate area (Corsetti et al., 2012). Finally we tackle the supposed singularity of the Great Recession. More precisely we find that estimated expenditure multipliers are markedly different (higher) in the Great recession than in other milder recessions of the previous twenty years. Which may partly explain why multipliers were underestimated (as documented by Blanchard and Leigh, 2013) when the Great Recession erupted out of the financial crisis.

The paper is organized as a follows. Section 2 surveys the relevant empirical literature on fiscal multipliers. Section 3 introduces the data and the econometric methodology employed. Sections 4 presents the main results, whilst 5 goes deep into the potential effects of initial conditions on the size of multipliers. Section 6 develops some robustness check and sensitivity analysis. Section 7 concludes.

2 Related literature

There are two distinct methods to derive fiscal multipliers: one is based on empirical estimation, the other one is model-based. 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 explanation. The seminal paper of Blanchard and Perotti (2002) explores this issue in the context of a structural vector-autoregressive 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 (2010) 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 implies 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 the 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 the military spending as shocks, 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. Economic theory suggests that fiscal multipliers may be larger in recession because of a milder "crowding out" of private consumption and investment due to (a) less responsive prices, a constrained reaction of nominal interest rates due to the zero-lower bound (Eggertsson, 2011; Eggertsson Mehrotra, Robbins, 2017), (b) higher returns from public spending due to countercyclical financial frictions and credit constraints (Canzoneri, Collard, Dellas, Diba, (2015)) and (c) lower crowding out of private employment due to a milder increase in labour market tightness (Gorodnichenko, Mendoza, Tesar, 2012; Michaillat, 2014).

Several authors provide empirical evidence in favour of state-dependent fiscal multipliers. Tagkalakis (2008) studies how private consumption responds to fiscal shocks when the economy is in recession or expansion in the presence of liquidity constrained 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 entails 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 front-loaded 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.

Fazzari, Morley, and 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 mixed 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 get policy shocks which are purged of their predictable components. Auerbach and Gorodnichenko (2013) finds large differences in the size of spending multipliers in recessions and expansions with fiscal policy being considerably more effective in recessions than in expansions. 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 investment, at least to some extent (Woodford, 2011). Ramey and Zubairy (2018) also use the local projection method of Jordá (2005) applied to a time series of US data from 1889 through 2013. The shock variable employed is news about future military spending. The results displayed differ from those of Auerbach and Gorodnichenko (2013), as Ramey an Zubairy (2018) find no relevant difference between multipliers in recessions and expansions and no relevant effect of zero-lower-bound states on the size of multipliers. However, as Ramey and Zubairy (2018) recognize, the shock-variable chosen does not allow the authors to assess the size of (non military) investment or public consumption multipliers. Also Jordá and Taylor (2016) employ local projections with the aim of estimating the state dependent effects of fiscal consolidation (on the expenditure and revenue sides), by correcting for the endogeneity of the fiscal treatments. They find that, in a slump, austerity prolongs the pain more than in an expansion.

Corsetti, Meier, and Muller (2012) investigates the sensitivity of government spending multipliers to different economic scenarios. They find fiscal multipliers to be particularly high in the aftermath of a 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) emphasize that during the "Great Recession" the size of fiscal multipliers was underestimated by the IMF and other institutions. This once more suggests that fiscal multipliers may vary over the business cycle. 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., Bénassy-Quéré and Cimadomo, (2012)).

The literature focusing on the non-linear effects of government spending is scant especially as for the Euro area. This paper tries to fill this gap by estimating the non-linear effect of a government spending shock on key macroeconomic variables (i.e., GDP, private consumption, private investment) and on some public finance indicators (i.e., debt to GDP, deficit to GDP).

3 Data and Methodology

3.1 Data

Our sample comprises the countries in the Euro-12 area from 1985 through 2015. We decided to remove Greece and Luxemburg from the dataset[1]. The macroeconomic and forecast variables come from the OECD's Statistics and Projections database[2]. As already said, the shock variable used is the forecast error of public expenditure. That is we choose not to follow Ramey, Zubairy (2018) in employing news on future military spending. Using military spending may be well suited for estimating US multipliers, where military spending is both high (as a share of total public expenditure: 19.14% on average between 1985 and 2016) and variable (variance 15.4 in the same time interval). In the Euro area countries - on which the present paper is focussed - military spending represents on average 4.6% of total public expenditure from 1985 to 2016 and its variance is barely 1.04 (*https://data.worldbank.org/indicator/*). See Figure 1.

[Insert Figure 1]

We use semi-annual frequencies for our macroeconomic variables. As mentioned above, in addition to 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 which are key to sustainability of public finance: deficit-to-GDP, debt-to-GDP and the Primary surplus.

Finally, we examine 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

[1]The countries under analysis are then Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal and Spain.

[2]We are grateful to Alan Auerbach who shared with us his database from 1960 to 2010.

methodology and is able to accommodate non-linearities 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, 4) local projections easily accommodate experimentation with highly non-linear specifications. When we use GDP of country i as the dependent variable, the response of Y_i at the horizon h is estimated by using the following regression:

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

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

where 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]. Following Auerbach and Gorodnichenko (2013), we adopt a measure of the business cycle state which is not affected by the well known difficulties in estimating potential output and the output gap. $F(\cdot)$ is the transition function for each country in the sample with the range between 0 (strong expansion) and 1 (deepest recession), $z_{i,t}$[4] 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. There are multiple advantages of using the 1.5 years moving average for $z_{i,t}$: 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[5] to extract the trend with a high smoothing parameter $\lambda = 10,000$.

In this framework $FE^G_{i,t}$ can be read 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*.[6] We control $FE^G_{i,t}$ for the information contained in the lags of Y and G 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 as in Cholesky decompositions

[3]Government consumption + Government investment.

[4]where z_i is the deviation from the output growth rate calculated as the moving average over 1.5 years from its trend, normalized by the standard deviation of the output growth rate; i.e. $z_i = \frac{\text{(output growth rate)-(trend output growth rate)}}{\text{standard deviation of output growth rate}}$.

[5]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.

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

in the VARs. Moreover, using $FE^G_{i,t}$ as the surprise government shock we overcome two factors that are often criticized in the literature.

First, by using forecast errors we eliminate the problem of "fiscal foresight" (Ramey, 2010; Corsetti and Muller, 2011; Forni and Gambetti, 2010; Leeper et al., 2013; Zeev and Pappa, 2017 and others)[7]. Second, we minimize the likelihood that estimates capture the potentially endogenous response of fiscal policy to the business cycle due to automatic stabilizers[8]. Figure 1 shows the scatter-plots of our shock $FE^G_{i,t}$ and (Panel a) our measure of the state of the business cycle ($z_{i,t}$); (Panel b) the actual level of public expenditure ($G_{i,t-1}$); and (Panel c) the actual GDP ($Y_{i,t}$). No correlation emerges between our shock and the cited variables, relieving concerns about the endogeneity of our expenditure shock.

[Insert Figure 2]

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 function dynamics are constructed by varying the horizon h of the Y. In other words, the impulse response function dynamic is estimated by $\{\Phi_{E,h}(L)\}^H_{h=0}$ for expansion and $\{\Phi_{R,h}(L)\}^H_{h=0}$ for recession. The direct projection allows to construct the impulse response function as a moving average of the series under scrutiny where the lag polynomial terms control for initial conditions and the $\{\Phi_{E,h}(L)\}^H_{h=0}$ and $\{\Phi_{R,h}(L)\}^H_{h=0}$ describe the reaction of the economic system to a structural exogenous shock. In practice, we regress our variable of interest Y_i for each time $t+h$ on an unanticipated shock at time t and thus we obtain the average response of the dependent variable h periods after the shock which is precisely the definition of an impulse response.

This estimation method has several advantages. First, it involves only linear estimation, if one fixes (as we have throughout our work) the parameter γ in expression (2).

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 achieved by the SVAR.

Fourth, the error term in equation (1) is likely to be correlated across countries. Hence,it would be particularly hard to handle it in the context of nonlinear STVARs but it can be easily addressed in a linear estimation by using Newey-West (1987) standard errors, Driscoll-Kraay (1998) standard errors or clustering standard errors by time period.[9]

[7]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 econometricians' information sets in estimated VARs (Leeper (2008)).

[8]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.

[9]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 corresponding author upon request.

Fifth, we can use specification (1) to construct impulse responses for any macroeconomic variable of interest as we are not constrained by the VAR's curse of dimensionality. Finally, because the set of regressors in specification (1) does not vary with the time 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)).

Finally, the linear specification can be found as a special case of (1), 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.

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

In the empirical literature there are basically two approaches for computing fiscal multipliers. The first ("standard") approach is employed by Blanchard, Perotti (2002) and Auerbach, Gorodnichenko (2013) and it may be summarized by the following equation:

$$logY_t = \beta * logG_t + error \rightarrow multiplierM = \beta * \overline{(\frac{Y_t}{G_t})}$$

The second approach is employed by Ramey, Zubairy (2018):

$$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \beta * \frac{G_t - G_{t-1}}{Y_{t-1}} + error \rightarrow multiplierM = \beta$$

Ramey, Zubairy (2018) criticise the "standard" approach on the ground that the $\frac{\bar{Y}_t}{\bar{G}_t}$ ratio may vary systematically with the business cycle[10]. However the approach of Ramey, Zubairy (2018) may in turns be criticised because $\frac{Y_t - Y_{t-1}}{Y_{t-1}}$ and $\frac{G_t - G_{t-1}}{Y_{t-1}}$ are correlated as Y_{t-1} figures in the denominators of both ratios.

In the present paper we employ the "standard" approach. In order to match Ramey, Zubairy (2018)'s criticism we calculated for each and every year the maximum and minimum values of the $\frac{\bar{Y}_t}{\bar{G}_t}$ ratio, as well as the median and the mean values. It can be seen in Figure 3 that the gap between the maximum and the minimum values shrinks over time from about 5.5 to 3. However, we chose to be on the safe side and select a constant $\frac{\bar{Y}}{\bar{G}} = 3.25$, which is only slightly above the minimum value. Hence our multipliers are, if anything, under-estimated.

[Insert Figure 3]

[10]Ramey, Zubairy (2018) also calculate multipliers using the cumulative response method, that is, the integral under the impulse responses up to horizon h.

4 Multipliers: estimation

4.1 GDP, employment, real wages and prices

We first establish the result that multipliers in the Eurozone are widely different across regimes: i.e., they are much higher in recessions than in expansions, whether GDP or employment is considered as the dependent variable. Real wages and unit labour costs are unaffected by shocks to public expenditure both in recessions and in expansions.

In this and the following section the Panels show the impulse responses of our macroeconomic variables of interest to one percent increase in the government spending shock.[11] In each panel there are two sub-panels showing the response (black, thick line) in recession[12] and expansion.[13] 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 sub-panel the response of the linear specification (3) (thin red line) is reported together with the associated 90% confidence bands (shaded region) which are also based on Newey and West (1987) standard errors.

[Insert Figure 4]

Panel 1 shows the GDP responses. In the linear model, the response is near zero and not statistically significant. The GDP response in recession (**Panel 1a**) is positive and statistically significant for all periods (approximately 2.5 years). The maximum size of the government multiplier is about 2 with 90% confidence interval being (0-3.52). The average multiplier is about 1.68. The GDP response during expansions (**Panel 1b**) is quite different. In the first two years the GDP responses to an unexpected increase in government spending is near zero and not statistical significant. Conversely, after 2.5 years the response becomes negative (about -0.8) and statistically significant. The result is broadly consistent with the estimates reported in the recent literature that explores the state-dependence of fiscal multipliers, where the multipliers are approximately zero during expansion and range from 1 to 4 in recession (Auerbach and Gorodnichenko, 2012a, 2013, 2014; Batini et al., 2012; Baum et al.,2012; Hernandez de Cos and Moral-Benito, 2013; Ramey, Zubairy, 2013; Vegh et al., 2015). For the Euro Area, the linear model predicts a multiplier near zero. Hence, the linear model underestimates the fiscal multiplier in recessions and overestimates it in expansions.

It should be stressed that our spending shock are the forecast errors of the professionals forecaster and through this we remove any systematic correlation 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 in either regime a contractionary or expansionary government spending shock is

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

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

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

equally probable. It is thus unlikely that the results are induced by some singularity of the government spending shock (i.e., automatic stabilizer during a downturn).

Panel 2 and 3 present the impact of a government spending shock on total employment and the unemployment rate. During recessions, the increase in government spending is followed by an increase in total employment (**Panel 2a**). The total employment increase is statistically significant after 1.5 year (before that, the responses is positive but not statistically significant) and it reaches its maximum after two years (the max response of total employment is 2.02).

Consistent with the response of total employment, the unemployment rate decreases when an expansionary fiscal policy is implemented in the midst of a recession. The impact on the unemployment rate becomes statistical significant with a one year lag from the government spending shock (**Panel 3a**). Vice versa, the response of total employment and the unemployment rate to a government spending shock in expansion is generally negative and statistically different from zero (**Panel 3b**).

Further, we investigate the effects on real wages of an increase in public spending during expansion and recession (**Panel 4a, 4b**). We find that real wages remain unchanged in response to government spending shocks both when the economy is in recession and when it is in expansion. Also the economy wide unit labour cost (**Panel 5a, 5b**) is unaffected by government spending positive shocks taking place in recession. The results of panels 4-5 are consistent with the traditional (old) Keynesian view, according to which wages are broadly sticky both upwards and downwards when unemployment is high.

4.2 Public debt and deficit

A commonly held tenet is that an increase in public spending, even in a recession, negatively affects the debt and deficit to GDP ratios. As these are the crucial ratios under scrutiny by the so-called "bond vigilantes", it has often been argued by central bankers and policy makers that an expenditure expansion is hindered, even in a recession, by the need to preserve public debt sustainability. During the European sovereign debt crisis most peripheral high debt euro countries have been forced to implement a strong fiscal consolidation, in order not to lose their access to the bonds market. TINA (There is no alternative) arguments were commonplace for the fiscal consolidation policy.

[Insert Figure 5]

Our empirical evidence casts doubts on such policy prescriptions. During a recession, an increase in government spending does not imply neither an increase in debt-to-GDP ratio (**Panel 6a**) nor in the deficit-to-GDP (**Panel 7a**). Rather, we find that an increase in government spending in recessions leads to a decrease in the debt to GDP ratio and to an improvement of the deficit 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 8a**).[14] However, when the economy is in expansion either debt

[14]See De Long and Summers (2012) for a tentative explanation of these "unorthodox" effects of public expenditure on deficits and debt.

to GDP (**Panel 6b**), the deficit to GDP (**Panel 7b**) and primary surplus (**Panel 8b**) deteriorate, which is consistent with many results found in the literature (Ilzetzki et al. (2013); Nickel and Tudyka (2014); Abiad, Furceri and Topalova (2016)). **Panel 9 and Panel 10** show the markedly different response of long term interest rates and spreads (a widely used measure of relative public debt risks) in recessions and expansions. In recession (**Panel 9a, 10a**) an increase in public expenditure leads to a reduction of both absolute long term interest rates and spreads. Expanding public expenditure in recessions dos not lead to fears of debt non-sustainability and the yearly cost of the existing debt shrinks. The opposite applies in expansions (**Panel 9b, 10b**). This helps explaining both why the crowding out effect is absent in recessions and why expanding public expenditure in recession leads to actual reductions in the debt/GDP ratio.

These results give support to the view that, in recessions, public expenditure shocks boost output more than they add to deficit and debt, meaning that "fiscal stimulus in a weak economy can improve fiscal sustainability", as shown by Auerbach, Gorodnichenko (2017) and suggesting that fiscal consolidation should not be implemented in the midst of a recession and should better be rescheduled at a time when recovery is on track. The TINA argument for fiscal consolidation is not supported. As Cottarelli, Jaramillo (2012) puts it, "a deceleration of growth prompted by a fiscal consolidation could result in a rise in the government debt-to-GDP ratio. This is the case if the initial stock of debt is large and the fiscal multiplier is high. The effect of fiscal tightening on debt (the numerator of the ratio) in percentage terms is smaller the higher the initial stock of debt to GDP. Meanwhile, the negative effect of fiscal tightening on GDP (the denominator of the ratio) is larger the higher the fiscal multiplier" (p. 5). This does not imply denying the "imperative to lower public debt over time" (Cottarelli, Jaramillo, 2012, p. 3), in particular for high debt countries. It does however imply that "front loaded" adjustments may be counter-productive, if implemented in a recession (when multipliers are high) and with a starting high level of debt, especially if a country's cost of borrowing tends to rise with the Debt/GDP ratio and with the fall in the growth rate, both phenomena being associated with "perverse" fiscal consolidation (Nuti, 2013, Tamborini, 2013).

4.3 Components of aggregate demand

As for the transmission channels of fiscal expansions in a recession, we find that private consumption reacts positively and strongly to the stimulus, whilst the impact on private investment, export, imports and prices are only week or not statistically significant.

[Insert Figure 6]

The effects of an increase in government purchases on private consumption are strongly countercyclical. **Panel 11b** exhibits that private consumption, after a fiscal stimulus, is decreasing in expansions (there is a "crowding out" effect) and increasing in recessions (**Panel 11a**). Considering one 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, considering expansions, the "crowding out" effect of private consumption is present (the mean response in expansion is -1.15).

Panel 12 presents the estimated effects of a government spending shock on private investment. Over three years, a unit increase in government spending shock increases private investment in recession by 4 euro (but is not statistical significant, (**Panel 12a**) and decreases it during expansion by 6 euro (**Panel 12b**). The joint considerations of **Panel 11** and **12** suggests that the stimulus of an increased public spending in recession is more effective through increased private consumption than through increased private investment, that is the supply effect seems not to be statistically significant. Instead, an increased public expenditure in expansion "crowds out" consumption and private investment as the standard New-Keynesian model predicts. The linear model points out that private investment decreases after a government spending shocks, but it is statistical significant only in the short run (1-2 years).

Panels 13 and **14** 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 13a**), while during expansion the response is positive (**Panel 13b**) consistently with the opposite effects on internal demand. Vice versa the response of imports are not statistically significant in both regimes: recession (**Panel 14a**) and expansion (**Panel 14b**).

Finally, **Panels 15, 16 and 17** present the reactions of prices measured by the Consumer price index (CPI), the Harmonized Consumer price index (HCPI) and the GDP deflator. Generally, we find that an increase in government spending leads to minor inflationary effects during a recession and deflationary effects during an expansion. The result for prices in expansions is surprising. It should be noted that according to standard theory a stronger positive price response should be expected during expansions than in a recession. However, the multiplier is statistical different from zero only for the Consumer Price Index (**Panel 15a, 15b**).

[Insert Figure 7]

4.4 Does public spending composition matter?

In 2004 the European Commission wrote: "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 (e.g. Baxter and King (1993), Galí, López-Salido and Vallés (2007)).

In the long run, the superiority of public investment seems hard to refute on theoretical grounds. As F. Skidelsky (2001) stresses, government investment is considered the most powerful policy instrument as it combines the short-run support of an aggregate demand boost with the long-term supply-side benefits. In standard models government

investment 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 accruing from the increased capital stock (see e.g. Blanchard and Giavazzi (2004)). Moreover, the "Golden Rule" allows potentially socially worthwhile investment opportunities to be undertaken, without violating the "sustainability" of the public budget.

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 of government investment in developing countries is positive and larger than 1 in the long run (2-3 years). This suggests 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). Abiad, Furceri and Topalova (2016) find 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 public debt to GDP ratio may decline after an increase in public investment, more than after an increase in public consumption (Nijkamp and Poot, 2004; Gechert, 2014, 2015; Abiad, Furceri and Topalova, 2016). In this section of the paper, we explore whether the multiplier of government investments is indeed larger than that of government consumption, again with a special focus on the effects on government debt and deficit as a share of GDP. To examine the role of spending composition, we estimate the following specification:

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

where $FE^{j}_{i,t}$= is equal to $FE^{C}_{i,t}$[15] or $FE^{I}_{i,t}$[16]

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

One again we focus on the Euro Area countries from 1985 to 2015. **Panels (18-20)** show the results of consumption and investment spending shocks on output, the debt to GDP ratio and on deficit. One again, the result are heterogeneous by regime and spending composition. Both an increase in government consumption and in government investment have positive effects on output in recessions and negative in expansions **Panel 18**. However, the output effect of government investment spending is stronger than those of government consumption spending only in the long run. The multiplier exceeds 4 for investment and is around 3.20 for consumption. These results are broadly consistent with the findings of Perotti (2004) and Ilzetzki et al.(2013).

[15]Forecast error of Government Consumption.

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

[Insert Figure 8]

Panel 19 shows the effects for investment and consumption spending on the debt to GDP ratio. A 1% increase in government consumption, in recession, reduces the debt to GDP ratio by as much as 5% after 3 years. In expansions an increase in consumption leads to a sizeable increase in the debt to GDP ratio. On the other hand a positive public investment shock has smaller and non statistically significant impacts on the debt to GDP ratio both in recessions and expansions.

Panel 20 exhibits the effects of investment and consumption spending on the government deficit. In recession, a 1% increase in government consumption reduces the deficit-to-GDP ratio by 5% after 3 years. That is, starting with a 4% deficit/GDP in the midst of a recession a 1% boost to government consumption would reduce the deficit/GDP to 3,75% in three years. During expansions an increase in public consumption raises the government deficit. Increases in in public investment do not have relevant effects on deficit both in recessions and expansions. The "crowding in" effect on private investments of both government consumption and investment increases turns out to be strong. However, during expansions the classical "crowding out" emerges, consistently with the findings of Abiad, Furceri and Topalova (2016).[17]

The results of this section are broadly consistent with the literature confirming that public investment activated in recessions have both a short run (demand) effect and a long run (supply or "crowding in") effect, that combine to deliver high long run multipliers.

5 Multipliers and initial conditions

Initial conditions in which public expenditure shocks take place may affect the size of the multiplier. The level of public debt (as a share of GDP), the level of the interest rate spread across countries [18] the degree of openness to trade[19], for instance, are widely believed to influence the effectiveness of a fiscal stimulus. Since there were significant differences in macroeconomic initial conditions across Euro countries and over time, we can gauge the correlation between such initial conditions and the size of government spending multipliers by estimating the following equation:

$$\begin{aligned} Y_{i,t+h} = \alpha_i + \mu_i + F(z_{i,t})\Pi_{R,h}(L)Y_{i,t-1} + (1-F(z_{i,t}))\Pi_{E,h}(L)Y_{i,t-1} + \\ F(z_{i,t})\Psi_{R,h}(L)G_{i,t-1} + (1-F(z_{i,t}))\Psi_{E,h}(L)G_{i,t-1} + \\ F(z_{i,t})\Phi_{R,h}(L)FE^G_{i,t} + (1-F(z_{i,t}))\Phi_{E,h}(L)FE^G_{i,t} + \\ F(z_{i,t})\tilde{\Phi}_{R,h}(L)FE^G_{i,t}I_{i,t} + (1-F(z_{i,t}))\tilde{\Phi}_{E,h}(L)FE^G_{i,t}I_{i,t} + \mu I_{i,t} + + u_{i,t} \end{aligned} \tag{6}$$

[17] The detailed results about consumption and investment expenditure shocks on private investments, the unemployment rate and on inflation are available upon request.

[18] The spread is the difference in yield between a government bond and some benchmark bond with the same maturity. The benchmark used is the 10 years German Bund.

[19] Openness = (export+import)/GDP, if this proxy for one country is higher than the average, that country is labelled as "open".

$$with : F(z_{i,t}) = \frac{exp(-\gamma z_{i,t})}{(1 + exp(-\gamma z_{i,t}))}, \gamma > 0 \tag{7}$$

where $I_{i,t}$ is the macroeconomic characteristic that we would like to analyse 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 $I_{i,t} = 1$.

5.1 Are multipliers lower in high debt countries?

A common tenet is that a fiscal stimulus is less effective (fiscal multipliers are lower) in high public debt countries, as an increase in public expenditure fuels the expectations of future tax hikes which induce people to save more and spend less. Moreover, if an expansionary fiscal policy raises the public debt ratio, the risk premium on interest rates rises, ultimately boosting the cost of borrowing and negatively affecting aggregate demand (Ilzetzki et al., 2013).

Table 1 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 a recession. In detail, when the debt to GDP ratio is low, a one percent increment in government purchases increases output about 2.42% over three years. Vice versa, if the level of debt is high, the mean response of output is 2.40%. The results do not show significant adverse effects of the initial level of public debt on the size of the expenditure multiplier.

Our estimates show that an increase in government spending during economic downturns has a similar effect in countries with low and high public debt over three years. 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 of an interest rate spread in the Eurozone countries affects the size of the spending multiplier. The empirical results show that an increase in public expenditure in high deficit countries during recession increases GDP approximately by 2.50%. In contrast, an increase in government spending in surplus/low deficit countries, has an output response of just 0.26% and is not statistically significant.[20]

The joint consideration of deficit and spread cases in **Table 1** suggests that the stimulus effect of an increased government spending in recession is more effective in high

[20] We have similar results when we consider the spread, as an indicator of relative financial risk. 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. In contrast, the multiplier when the spread is under 150 basis point is 1.17 on average. 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 to public spending, in downturns, is more effective to rise GDP in high risk countries than in "safe" countries.

deficit/spread countries than in low deficit/debt countries.[21]

The results of this section, together with the negligible impact of public expenditure increases on the public debt/GDP ratio in recessions (section 4.2), cast doubts on the view that there was no alternative for high debt euro area countries but to go for fiscal consolidation in the midst of the 2011-2013 recession. The robustness of these results is confirmed by several tests. We have proved that an initial large public debt or an initial large public deficit or an initial wide spread do not reduce and actually enhance the response of private consumption, private investment and employment to a government spending shock.[22]

[Insert Table 1]

5.2 Multipliers in more and less open economies

Ilzetki et al. (2013) showed that the 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 during recession. We show (**Table 1**) that for both open and closed economies[23] the mean and max response of output to a government spending shock is sizeable The size of government spending multiplier is higher for a closed economy, a one percent increase of government spending increases output of about 1.73%; in contrast for a open economy the mean response is as low as 1.09%.[24]

Corsetti et al. (2010, 2012) investigates whether the exchange rate regime determines the size of the fiscal multiplier. In the traditional Mundell-Fleming model, government spending is ineffective at 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 proxied by a fixed exchange rates regime as for the member countries, it is relevant to investigate whether the spending multiplier is higher in fixed exchange rate regime than in a flexible 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 (1985-1998) the response of output in recession is never significantly different from zero. The same results apply if one checks for the impact of the interaction between government spending increases and trade openness on private consumption, private investment and employment.[25]

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

[22] Detailed results are available in the Appendix, Tables A1-A4.

[23] The degree of openness is proxied by the ratio (export+import)/GDP. If for a country this ratio is higher than the average value for the sample countries, that country is "open". Vice versa the country is "closed" if the above ratio is lower than the average value.

[24] The maximum response for a closed economy is 3.12% whilst for an open economy is 1.75%.

[25] Once again detailed results are available in the Internet Appendix, Tables A1-A4.

5.3 Is the fiscal multiplier time varying?

Blanchard and Leigh (2013) emphasizes that during the "Great Recession" the size of fiscal multipliers has been underestimated. Economists were indeed accustomed to low mulipliers estimated in the "Great Moderation" age, when business fluctuations were dampened and large fiscal stimuli/contractions were absent in most advanced economies. In order to investigate whether the Great Recession is different from previous recessions as regards the size of fiscal multipliers, we re-estimate the baseline formulation of model (1) for two sub-samples: pre-crisis (1985-2006) and crisis (2007-2105). In the (2007-2015) period the nominal interest rate in the Eurozone has been close to the zero lower bound. **Panels 21-22** show the impulse responses of two macroeconomic variables (GDP and debt-GDP) to a one percent positive shock to government spending[26]. As usual, in each panel, there are two sub-panels showing the response (black, thick line for Recession and red, thick line for Expansion) in the two sub-periods (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).[27] **Panel 21** shows that the spending multiplier is higher and statistically significant over the 3 years horizon in the period following the global financial crisis (**Panel 21b**, in recession). On the other hand, before the Great Recession, the spending multiplier reached its maximum after one year (2.24) and it became not statistical significant after the first year (**Panel 21a**, in recession). Conversely, when we consider the expansionary regime, the responses are quite analogous in both sub-samples The GDP response to an unexpected increase in government spending is negative but not statistically significant, before 2007 (**Panel 21a**), and it is near zero after 2007 (**Panel 21b**). **Panel 22** presents the effect of an increase in government spending on the debt to GDP ratio. We control for the effect of government spending shock on the debt to GDP ratio. **Panel 22b** shows that an increase in government spending leads to a decrease in the debt to GDP ratio over a 3 years' horizon in the period following the Great Recession (2007-2015, in recession).

Before the outbreak of the crisis the effect of government spending on the debt to GDP ratio is strikingly different. An unexpected increase in government spending deteriorates the debt to GDP ratio over the 3 years' horizon (**Panel 22a**, 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 drops below one. Therefore, 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, in an expansionary regime, the impulse responses are quite similar in both sub-samples A

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

[27] The choice to increase the confidence interval is due to the fact that the observations in the sub-samples are fewer than in the total sample.

government spending shock leads to an increase in the debt to GDP ratio both before 2007 and during the crisis (2007-2015).

[Insert Figure 9]

The results of this section confirm the exceptionality of the 2007-2015 crisis as compared to ordinary recessions in the period 1985-2006. The effectiveness of expansionary public spending shocks is magnified in the recent crisis years. Also, the effects of a public spending shock on the debt to GDP ratio proved to be different in the crisis years from what they used to be in more "normal" times. It may be observed that the Eurozone was actually close to the zero lower bound (ZLB) of nominal interest rates since 2011[28] and that at the ZLB expansionary fiscal policies may show enhanced effectiveness as the negative effect of interest rate increases can be ruled out.[29] To further investigate this issue we follow Miyamoto, Nguyen, Sergeyev (2017) and estimate the impact of an unforeseen positive shock to public expenditure respectively in the ZLB years (2011-2015) and in non-ZLB years (1985-2010), without distinguishing between recession and expansion. **Panel 23a** shows that a positive shock in the ZLB years is actually capable of triggering an output recovery. As monetary policy, in the period 1985-1998, was not in charge of a single central bank in EZ countries, we also controlled if our result is driven by the non-ECB years. After re-estimating our regressions for the sub-periods 1999-2010 and 2011-2015 we show that results do not change substantially (**Panel 23b**). The ZLB time span is short, and some North countries were already recovering in 2013-2014; hence our estimates should be considered with caution, and only used to explain why the fiscal multiplier in the Great Recession years are so much higher than in ordinary recessions.

[Insert Figure 10]

6 Robustness Checks

In this section, we test the robustness of our findings in 2 ways: 1) we control for different variables that measure the state of the business cycle; 2) we re-estimate the fiscal multipliers distinguishing between countries with similar public government deficit and debt features, splitting our Eurozone sample into two groups ("South" countries vs "North" countries).

[28] https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html

[29] Canzonieri et al. (2016), Christiano et al. (2011), Hall (2009), Erceg and Lindé (2014) and Woodford (2011) derive in theoretical models fiscal multipliers on output which exceed one at the zero lower bound. In a different setting Eggertsson, Mehrotra, Robbins (2017) find that increases in government spending at the ZLB "can carry zero or negative multipliers [...], depending on the distribution of taxes across generations". Ercolani, Valle and Azevedo (2018) use a standard New Keynesian model to show that multipliers may be close to unity at the ZLB, provided there is a high degree of substitutability between private and government consumption. In an empirical investigation concerning Japan, Miyamoto, Nguyen, Sergeyev (2017) estimate the effects of unexpected government spending increases both when the nominal interest rate is near the ZLB and outside of the ZLB period. They find an output multiplier equal to 1.5 on impact in the ZLB period, while it is as low as 0.7 outside of the ZLB period.

6.1 Is output responses depending on the variables that measure the state of business cycle?

In the baseline formulation of the empirical model, we use a moving average of the output growth rate to measure the state of the business cycle in each economy. The key advantage of using this variable is that the growth rate of output is a coincident indicator. Since the moving average is computed over 1.5 years and thus is cumulative, it should to some extent capture the output gap and thus the degree of slack in the economy. One may want to verify that using other measures of slack yields similar results. We employed alternative indicators of slack: (a) the de-trended log change in unemployment rate; (b) the de-trended log unemployment rate; b) the deviation from mean in unemployment rate by each Country and d) the the deviation from moving average over 1.5 in unemployment rate by each Country.

In either case, we de-trend all series making use of the Hodrick-Prescott filter with smoothing parameter λ= 10,000. Irrespective of which measure we use, the response in a recession is larger than the response in expansion[30]. We conclude that cyclical variation in the output responses is robust across different variables measuring the state of the business cycle.

6.2 Southern Countries vs Northern Countries

In section 5.1 we found that an initial high level of public debt and deficit increases the size of fiscal multipliers in the Eurozone. As in the Eurozone there are two groups of countries differing as for their ratios of public deficit/debt to GDP and their fiscal space (South and North countries in short), in order to check the robustness of our findings we followed Bacchiocchi et al (2011) in re-estimating the baseline empirical model (1) by splitting the sample into two groups according to the level of public financial liabilities (as a share of GDP) during the sample period (1985-2015).[31] The idea is to analyse whether the high/low deficit/debt countries are more or less affected by government spending shocks in the different phases of the business cycle. The results are shown in the Internet Appendix.[32] This robustness check strongly confirms the results obtained in section 5.1. To further investigate the question we also estimated the government multiplier by dropping one country at a time from the sample. Once again the results remain unchanged: the government multiplier turns out to be smaller when we drop one of the South countries and higher when we drop one of the North countries.[33] We feel entitled to conclude

[30]The response sometimes are marginally statistically significant at 80 percent. Detailed results are available in the Internet Appendix (Figure A.1 and A.2) for the GDP and debt-GDP.

[31]Sample A (South Countries) comprises the GIIPS countries plus Belgium and France, which have either high debt or high deficit over the entire period. Sample B (North Countries) comprises Austria, Germany, Finland, Luxembourg and Netherlands. The results discussed below do not change if Greece, as an obvious outlier, is left out of Sample A.

[32]We only show the results for the GDP and debt-GDP (Figure A.3). The findings are analogous even when we consider other macroeconomic variables, such as: private consumption, private investment, deficits.

[33]Results are available upon request

that, contrary to conventional wisdom, an expansionary fiscal policy in a recession is more output-effective in South highly indebted countries than in North low-debt countries.

7 Conclusions

This paper brings together many strands of the empirical literature on the effects of public expenditure on different macroeconomic aggregates in a unified econometric framework, featuring the local projection approach introduced by Jordá (2005) that allows to construct impulse responses for any macroeconomic variable of interest, whilst being not constrained by the VAR's restrictions. We focused on unforeseen government expenditure changes implemented in the Eurozone countries and estimated the effects of such policies on the key macroeconomic aggregates (GDP, private consumption, private investment), on public finance indicators (deficit, primary balance, debt to GDP ratio) and allowing the spending multipliers to vary smoothly according to the business cycle. This broad picture confirms for the Eurozone countries the existence of large differences in the size of public expenditure multipliers in recessions and in expansions, as found by Auerbach and Gorodnichenko (2013) for the broader set of OECD countries. A result theoretically anticipated in Keynes' General Theory (p. 127).

We find that an increase in public expenditure in the Eurozone has a high and positive multiplier effect on output, provided it is implemented in a recession, while this effect is negative or non-significant in expansions as predicted by Keynesian theory. Our analysis also shows that an expansionary fiscal policy in a recession has a strong "crowding in" effect on private consumption, whilst this crowding in effect on private investment is not statistically significant. Our estimates also confirm that an expansionary fiscal policy in a recession does not impact on prices, real wages and unit labour cost, entailing that Eurozone countries could implement such a policy without deteriorating the price competitiveness of their exports. A central result of our paper (confirming and extending Abiad, Furceri, Topalova, 2016 and Auerbach, Gorodnichenko, 2017) is that countercyclical expansionary expenditure policies in a recession may prove to be beneficial for the public budget on a five years horizon: both the deficit/GDP and the debt/GDP ratios would improve after the expansionary treatment, whilst the long term interest rate and the spread goes down. Moreover (i) in a recession fiscal multipliers are higher in the high debt EZ countries than in the low debt EZ countries, implying that the absence of "fiscal space" does not cause the ineffectiveness of expansionary fiscal policies (the reverse in an expansion); (ii) under prevailing fixed exchange rates fiscal multipliers in a recession are greater than under universal flexible exchange rates, implying that being in a monetary union actually enhances the effectiveness of expansionary fiscal policies (the reverse applies in expansions);(iii) increases in both government consumption and government investment have positive effects on output in a recession (negative in an expansion). However the effect of public investment is larger than that of public consumption in the long run (2 years after the shock); (iv) estimated fiscal multipliers were higher in the aftermath of the 2007-8 financial crisis than in previous recessions. (v) The exceptionality of the Great Recession in the Eurozone is confirmed by the fact that the reduction of public debt and deficits

after an expenditure expansion was observable (in recessions) only after the 2007 financial crisis. This result is possibly associated with the Eurozone experiencing the policy interest rate near the zero lower bound during the recent prolonged recession/stagnation. All these results survive several robustness checks.

Jeffrey Frankel asked in a 2014 conference, "what is the best fiscal policy, Austerity or Stimulus?". And his answer was: "The question is as foolish as the question 'should a driver turn left or right?' It depends where he is in the road. Sometimes left is the answer, sometimes right". The empirical analysis carried out in this paper suggests that, under all respects, when the Euro countries are "in recession road" the correct answer is expenditure stimulus, when the Euro countries are in "expansion road" the correct answer is expenditure austerity. From our findings it is confirmed that the aftermath of the sovereign debt crisis was not the right time to implement a front-loaded fiscal consolidation in many Eurozone countries.

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Appendices

Table 1: 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		Mean Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Level of Government Debt	2.42***	-0.88	2.40***	-0.87
	(0.87)	(0.83)	(0.85)	(0.82)
Surplus/Deficit	0.26	0.28	2.50***	-1.64***
	(0.51)	(0.39)	(0.66)	(0.65)
Spread	1.17***	-0.30	1.35***	-0.58
	(0.49)	(0.29)	(0.40)	(0.56)
Openness	1.73***	-1.15***	1.09**	0.03
	(0.52)	(0.46)	(0.52)	(0.25)
Currency Union	-0.86	0.26	1.87***	-0.43
	(0.74)	(0.37)	(0.62)	(0.46)

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. Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Figure 1: Military expenditure: EuroArea vs USA

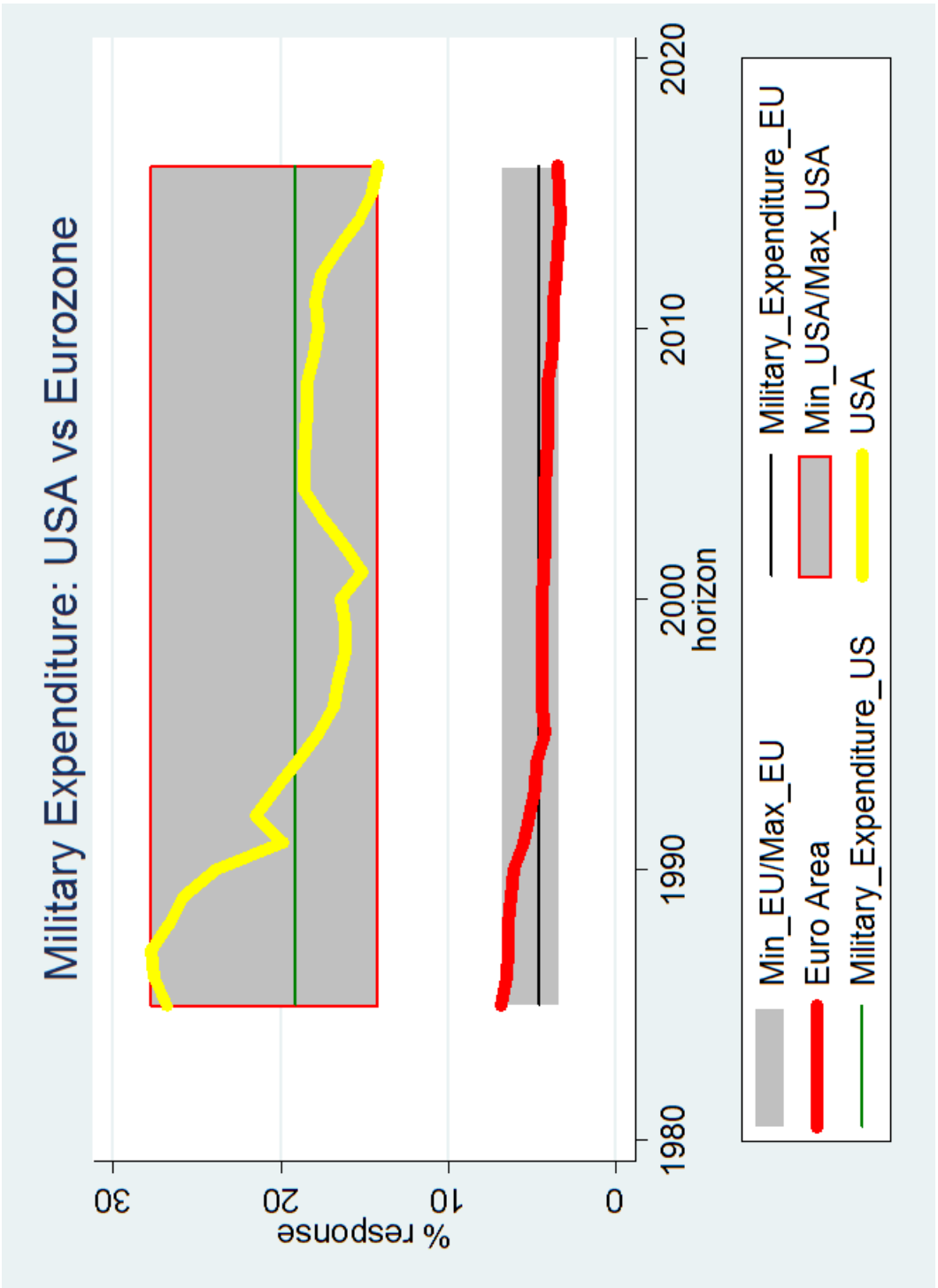


Figure 2: Fiscal Policy shock vs Economic Cycle (Z), Government Spending (C+I, gv) and Gross Domestic Product (gdpv)

Figure 3: Eurozone: Y (Gross Domestic Product, gdpv) / G (Government Spending, gv (C+I)) during 1985-2015.

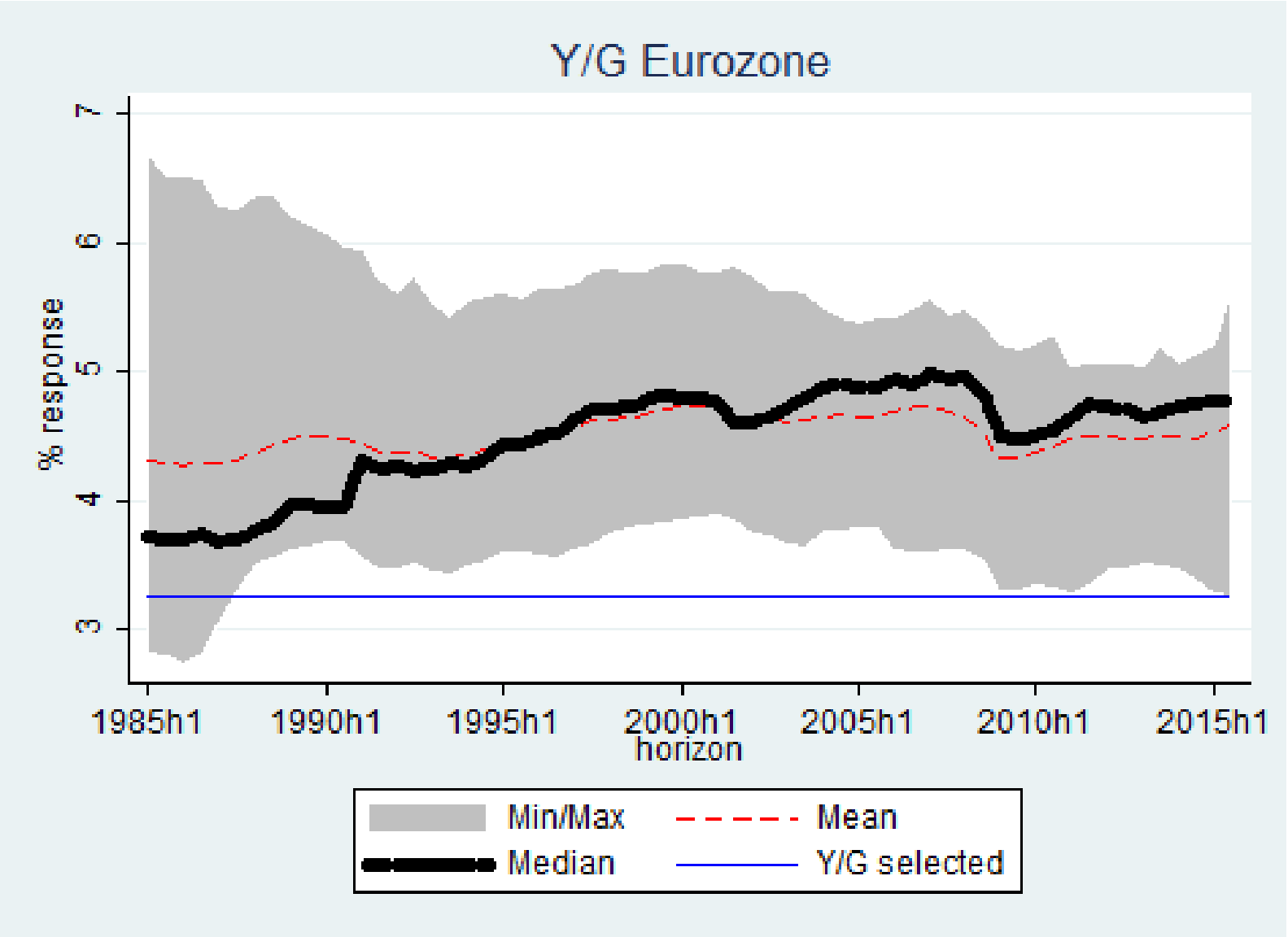


Figure 4: GDP, employment, real wages and prices response to Government Spending Shock: Recession vs Expansion

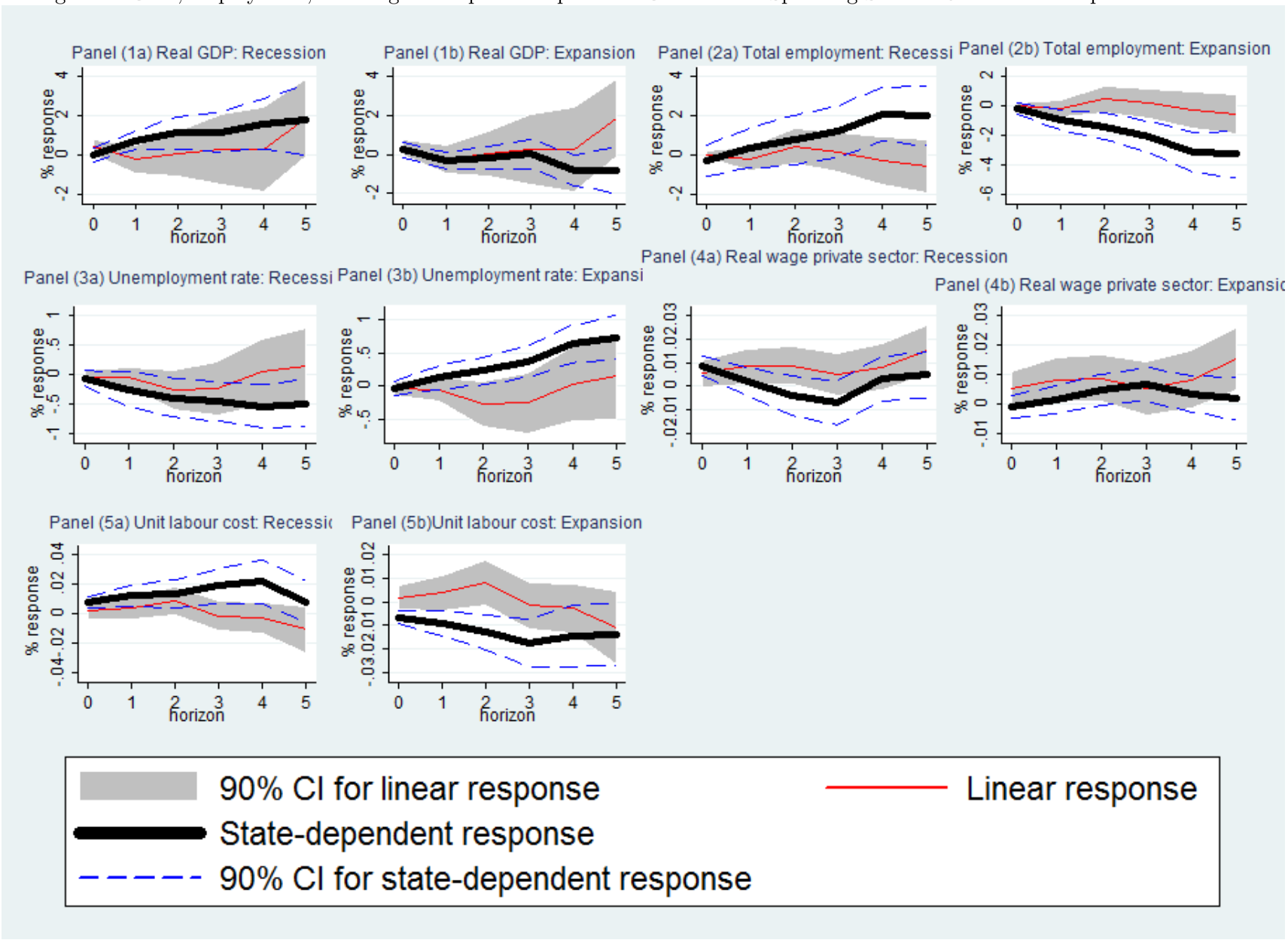


Figure 5: Debt to GDP, Deficit to GDP, Primary Surplus, 10-y Government interest rate and Spread response to Government Spending Shock: Recession vs Expansion

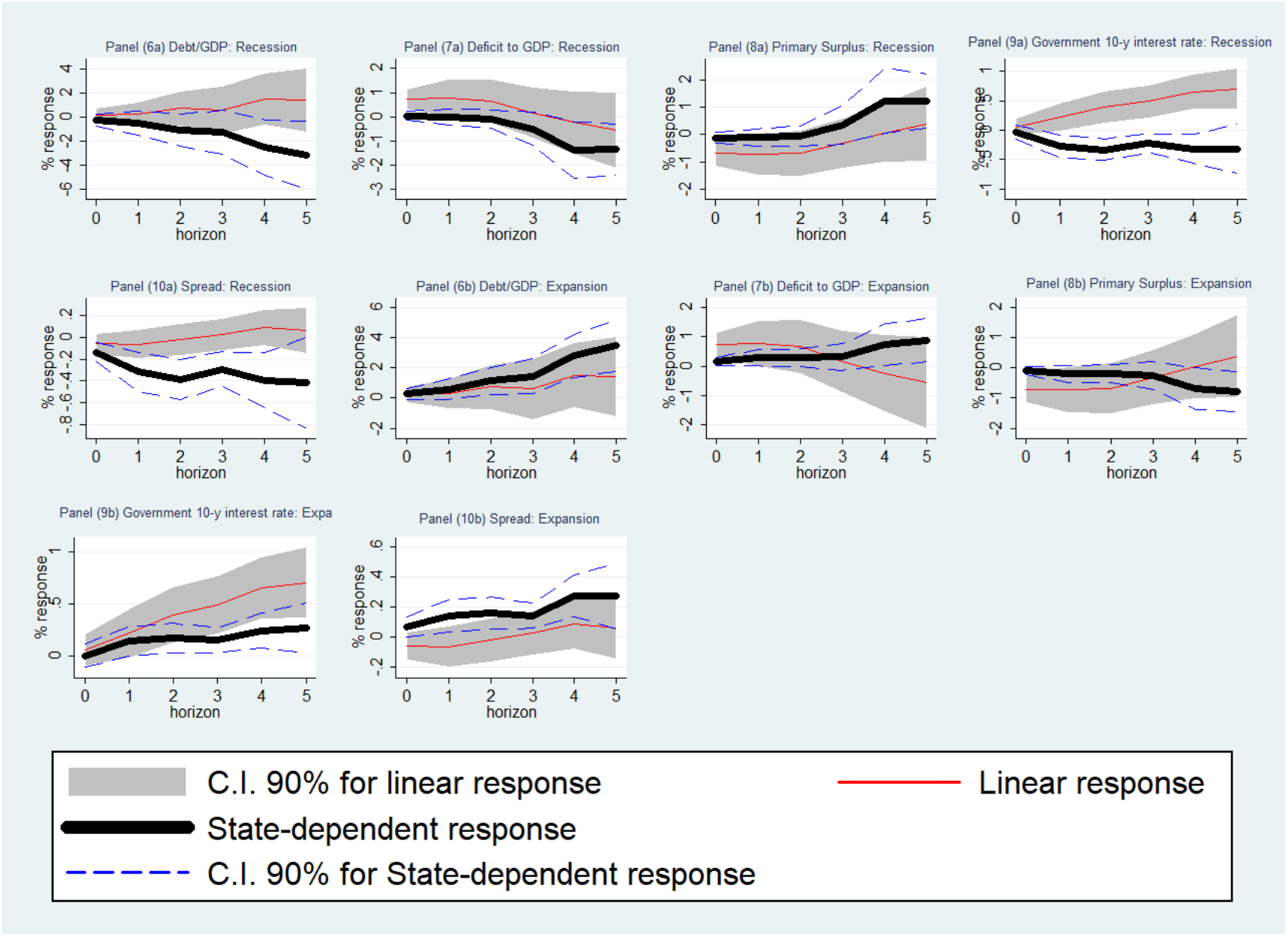


Figure 6: Private Consumption, Private Investment, Real Export and Import response to Government Spending Shock: Recession vs Expansion

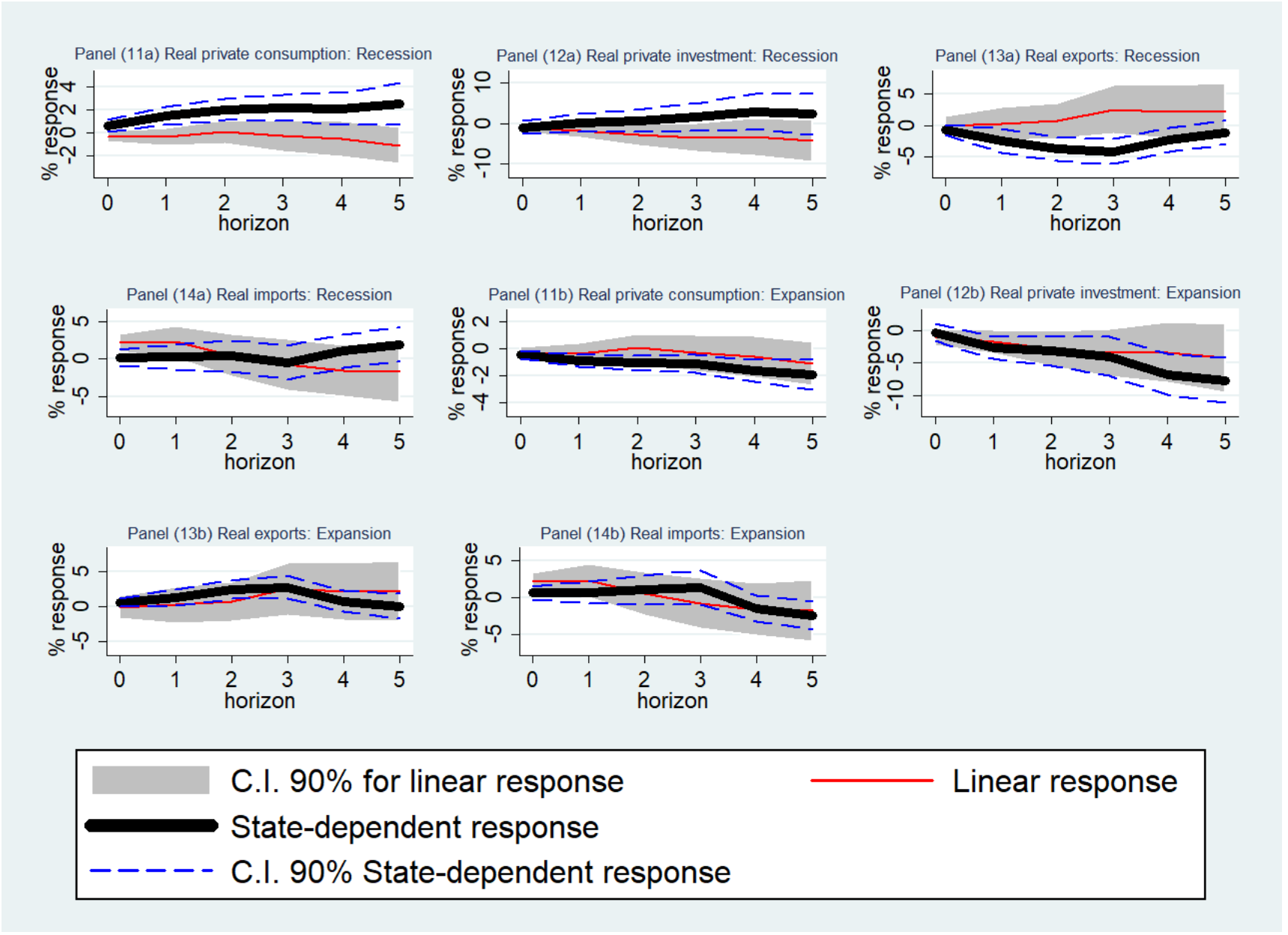


Figure 7: Consumer Price Index (CPI), Harmonized Consumer Price Index (HCPI) and GDP Deflator response to Government Spending Shock: Recession vs Expansion

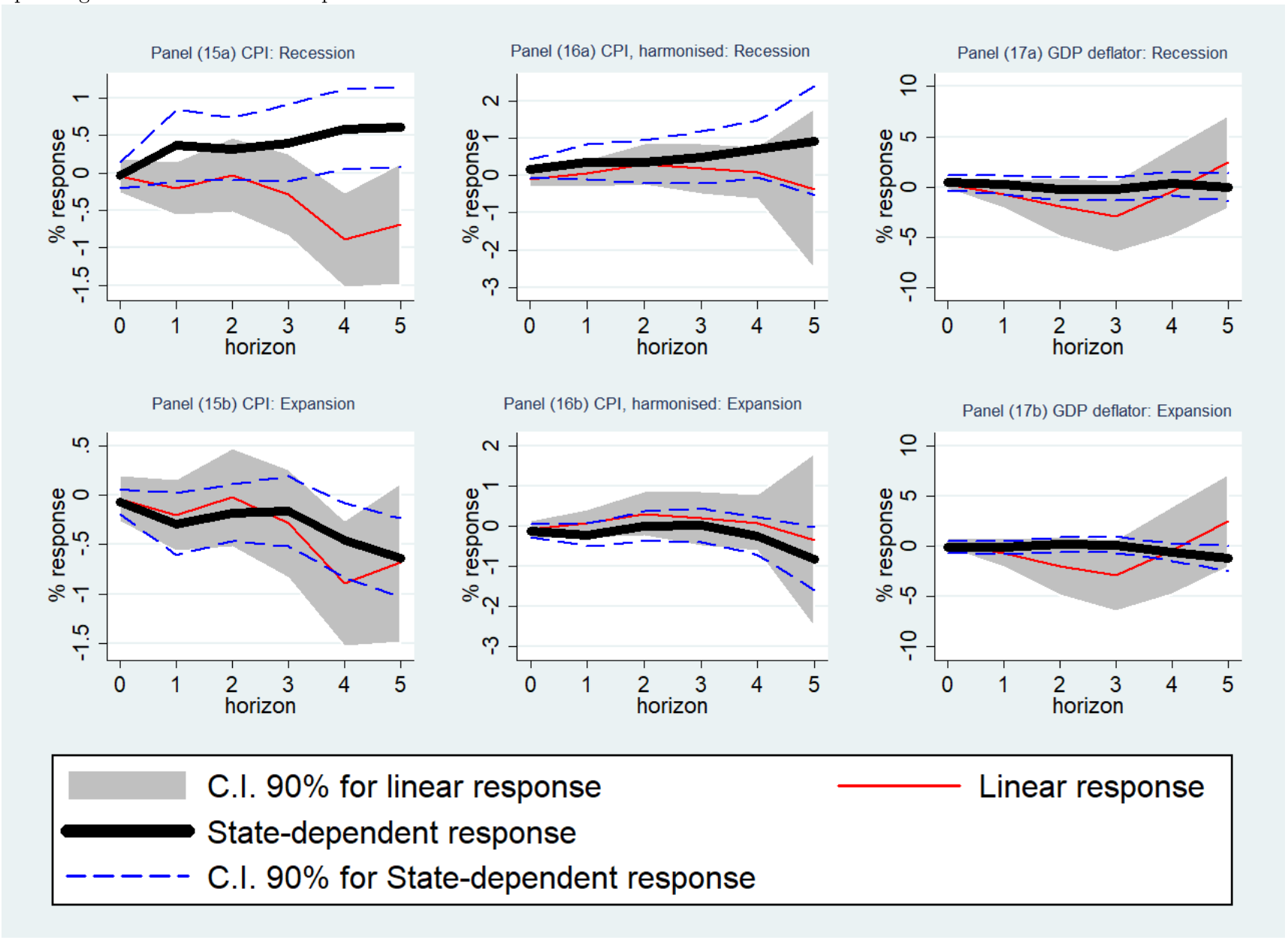


Figure 8: GDP, Debt to GDP, and Deficit response to Government Consumption and Investment Spending Shock: Recession vs Expansion

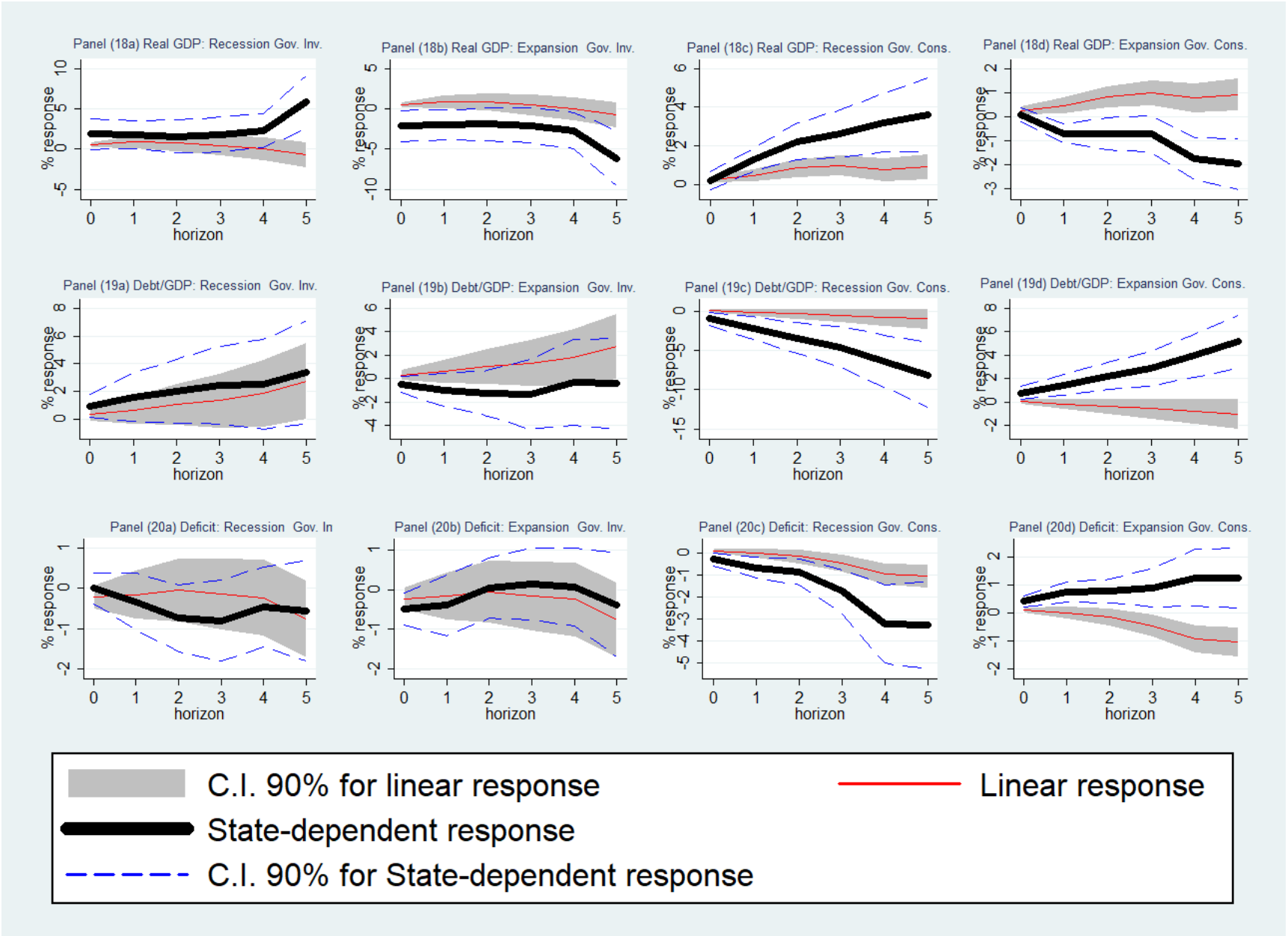


Figure 9: GDP and Debt to GDP response to Government Spending Shock: Pre-crisis (1985-2006) vs Great Recession (2007-2015)

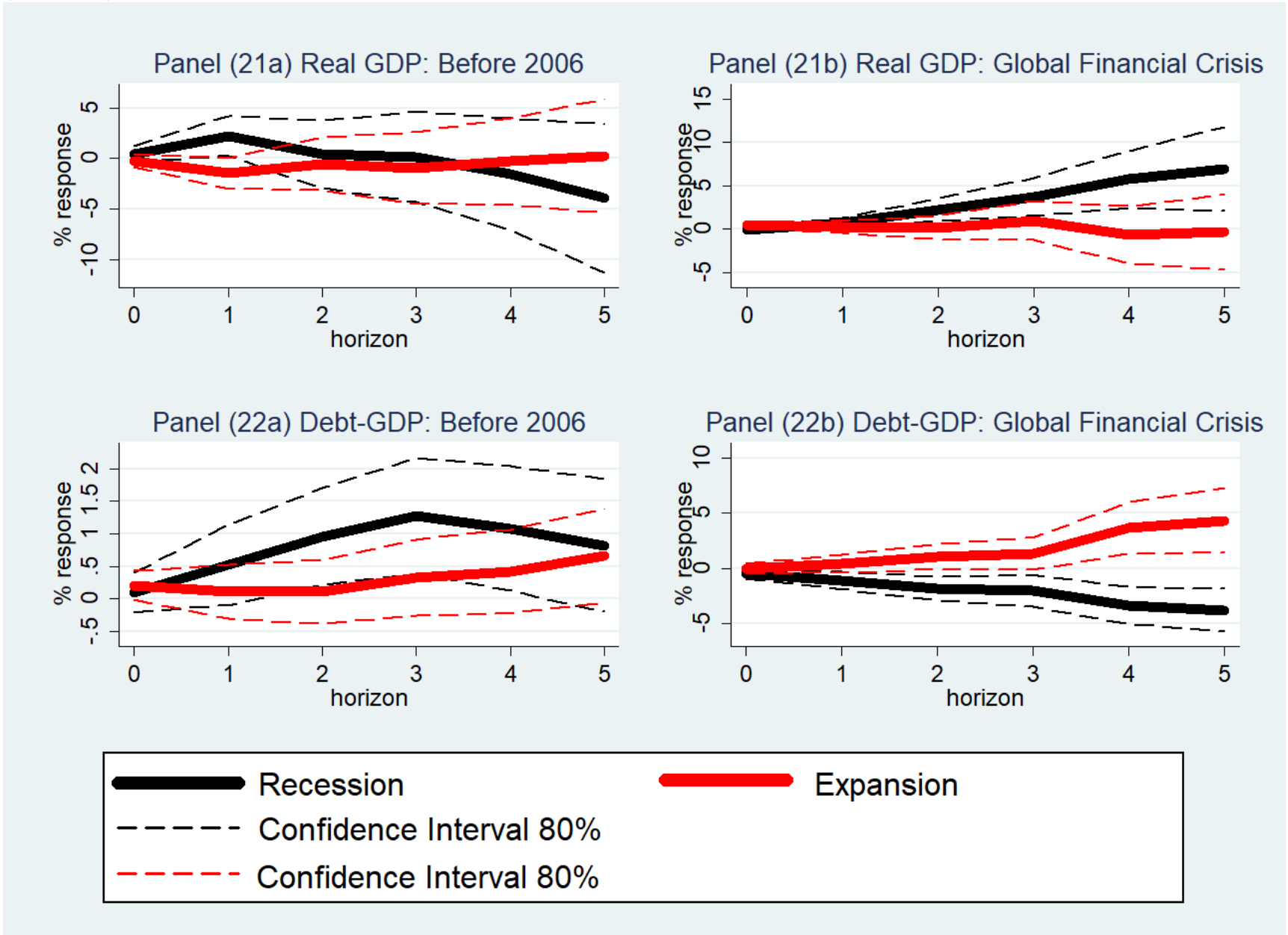
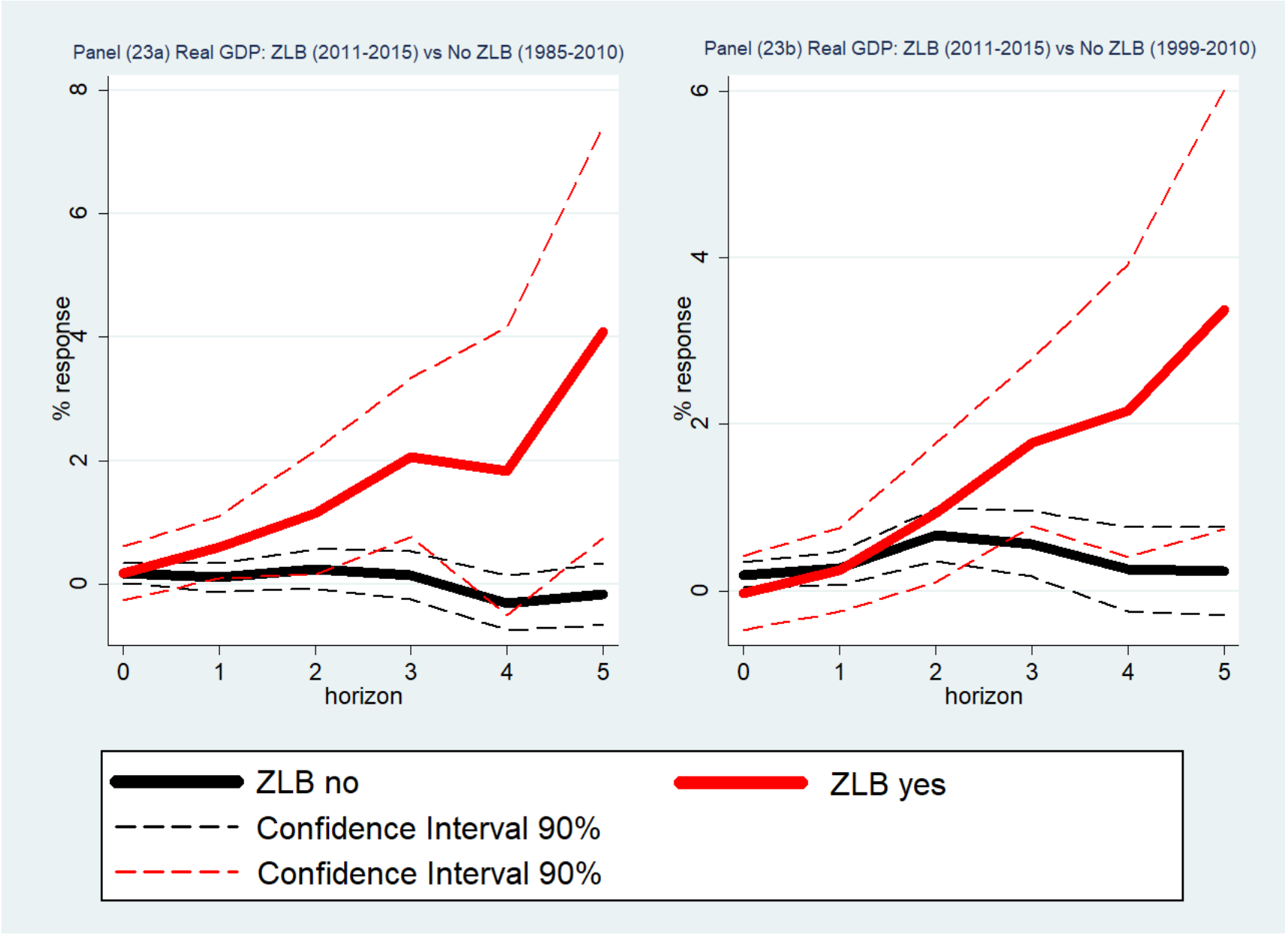


Figure 10: GDP response to Government Spending Shock: Zero Lower Bound (2011-2015) vs No Zero Lower Bound (1985-2010)-(1999-2010).



INTERNET APPENDIX.

Tables

Table A.1: 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		Mean Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Level of Government Debt	2.25*	-1.16*	2.24*	-1.16*
	(1.31)	(0.63)	(1.29)	(0.62)
Surplus/Deficit	0.87	-0.65*	2.93***	-2.08***
	(0.99)	(0.38)	(0.98)	(0.72)
Spread	1.07	-0.49	2.02***	-2.07***
	(0.74)	(0.36)	(0.72)	(0.40)
Openness	2.27**	-1.55**	1.62**	-1.00***
	(1.00)	(0.68)	(0.72)	(0.32)
Currency Union	-0.69**	0.15	2.85***	-2.37***
	(0.30)	(0.26)	(0.79)	(0.50)

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. Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Table A.2: 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		Mean Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Level of Government Debt	4.84***	-6.58**	4.78***	-6.47**
	(1.81)	(2.91)	(1.78)	(2.86)
Surplus/Deficit	0.80	-1.75*	4.76**	-1.43
	(0.81)	(0.97)	(2.42)	(1.42)
Spread	4.22***	-2.88**	2.96***	-1.11
	(1.52)	(1.39)	(1.19)	(2.25)
Openness	-0.12	0.23	4.17***	-2.73***
	(1.55)	(0.78)	(1.44)	(0.93)
Currency Union	4.28***	-2.71***	2.35	-1.47
	(1.19)	(1.01)	(1.55)	(1.42)

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. Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Table A.3: 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		Mean Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Openness	-1.53	1.95**	-1.80***	1.48***
	(1.56)	(1.01)	(0.72)	(0.29)
Currency Union	0.27	1.08*	-2.01**	1.79***
	(1.61)	(0.65)	(0.95)	(0.43)
Spread	-1.04	0.75	-1.81***	2.85***
	(1.08)	(0.46)	(0.71)	(0.39)

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. Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Table A.4: 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		Mean Response	
	Recession (1)	Expansion (2)	Recession (1)	Expansion (2)
Level of Government Debt	1.30	-4.02***	1.28	-3.97***
	(2.27)	(0.75)	(2.25)	(0.74)
Surplus/Deficit	-0.13	-1.73***	1.84*	-1.57***
	(0.44)	(0.41)	(1.03)	(0.67)
Spread	1.03	-2.13***	0.98*	-1.05**
	(0.87)	(0.57)	(0.56)	(0.53)
Openness	0.06	-0.38	1.22	-2.58***
	(0.43)	(0.49)	(0.83)	(0.50)
Currency Union	1.60***	-2.52***	0.65	-1.04**
	(0.54)	(0.49)	(0.67)	(0.51)

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. Robust standard errors are reported in parentheses. *, **, *** indicate statistical significance at 10, 5, and 1 percent levels.

Figure A.1: GDP and Debt-GDP response to Government Spending Shock using alternative indicators of slack: 1) the de-trended log change in unemployment rate (Panels a,b,e,f) and 2) the de-trended log unemployment rate (Panels c,d,g,h).

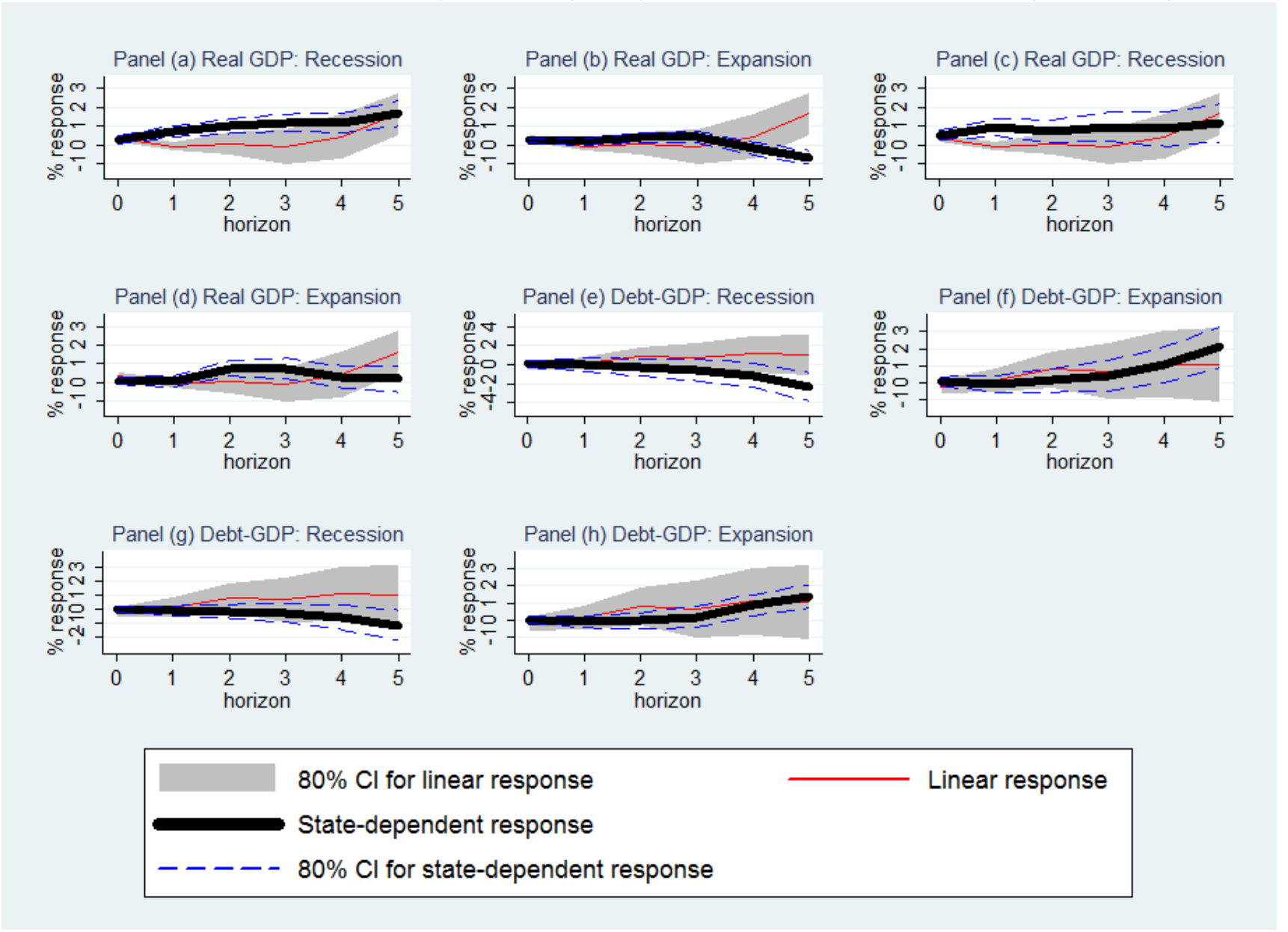


Figure A.2: GDP and Debt-GDP response to Government Spending Shock using alternative indicators of slack: 3) the deviation from mean in unemployment rate by each Country (Panels a,b,e,f) and 4) the the deviation from moving average over 1.5 in unemployment rate by each Country (Panels c,d,g,h).

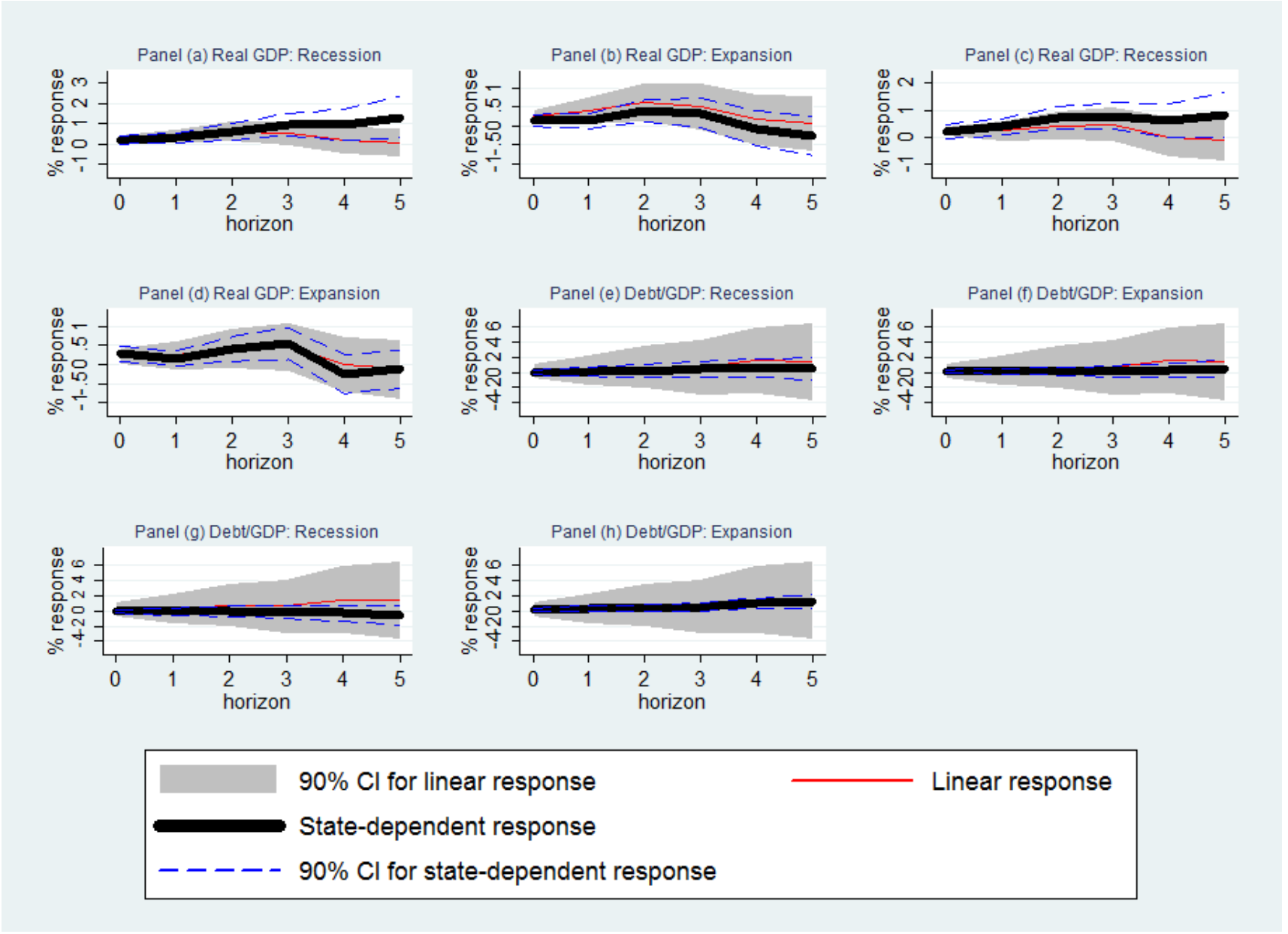


Figure A.3: GDP and Debt-GDP response to Government Spending Shock: South Countries vs North Countries