Public consumption multipliers in slack and good periods: evidence from the Euro area

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Abstract

The paper estimates public consumption multipliers and whether they vary depending on the slack of the economy. To this aim, linear and smooth-transition panel local projections are applied to a dataset composed of quarterly data on nine selected Euro area countries for the period 1999Q1-2018Q4. The results of the linear analysis show that the public consumption multiplier is around 1.3, and so quite broadly above the unity. This is, however, an "average result" as clear evidence is found in favour of state-dependency. Particularly, results show that the size of the multiplier is around 2.0 in the slack regime while it is generally below 0.5 in the good regime. These results are robust along several dimensions, such as using alternative measures of slackness and controlling for fiscal foresight. Some linear and state-dependent transmission channels are also investigated.

Keywords: Public consumption multipliers; state-dependent fiscal multipliers; local projections.

1 Introduction

When the recent global financial crisis impacted real economies, policymakers around the world turned to fiscal policy to sustain production and employment. Subsequently, the sign of fiscal policy changed in many advanced countries, especially in the Euro area, as several governments switched to fiscal consolidation measures in an attempt to improve public finance conditions. This occurred despite many economies were still experiencing weak conditions. Meanwhile, interest rates fell to zero, largely undermining the use of conventional monetary policy tools to support the economy. These processes, among others, have contributed to revitalizing interest and debate on fiscal policy. The Covid-19 pandemic has further pushed the interest in this direction, as governments worldwide have recurred to large fiscal stimuli to counteract the adverse effects of the pandemic on the economic and social systems.

This renewed interest in fiscal policy has also been accomplished by a new wave of research on this subject. Indeed, a "renaissance in fiscal research" has taken place over the last decade, with a growing body of literature that has investigated the macroeconomic effects of fiscal policy applying new and improved econometric techniques to better data (Ramey, 2019). Along with improved methodologies, this fresh vein of research has been characterized by the progressive spread of non-linear models aimed at empirically testing the intuition that the effects of fiscal policy may change depending on the state of the economy. Most of the literature on state-dependent fiscal multipliers has focused on public spending. In particular, a strand of literature has analysed whether public spending multipliers are higher in slack economic situations or recessions than in good economic situations or expansions (e.g. Auerbach and Gorodnichenko, 2012). Another strand of literature has focused, instead, on the interaction between fiscal and monetary policy, trying to assess whether public spending multipliers are higher in periods of zero-lower bound (e.g. Christiano et al., 2011; Miyamoto et al., 2018).

This research effort has led to substantial advances in methodologies and understanding of fiscal policy, with the merit of placing state-dependency at the core of the analysis. However, a broad consensus on the macroeconomic effects of fiscal policy has not yet emerged. For example, very relevant issues such as whether public spending multipliers are lower or higher than one, on average, and whether they vary over the busyness cycle remain widely debated in the literature, with conflicting empirical evidence (cf. Section 2). This leaves policymakers with a high degree of uncertainty in predicting the effects of their fiscal interventions and economic theories without clear empirical evidence to use as a benchmark for their predictions. So, this lack of consensus urgently calls for more work on these issues, as recently pointed out for example by Castelnuovo and Lim (2019).

The paper fits into this recent debate estimating public consumption multipliers and whether they vary depending on the slack of an economy. To this end, I apply linear and smooth-transition panel local projections to a dataset composed of quarterly data on nine selected Euro area countries for the period 1999Q1-2018Q4. Following the "best practices" suggested by Ramey (2019), I compute fiscal multipliers in a cumulative way and using ex-ante conversion factors. Both methodological aspects are particularly relevant, especially to properly compare fiscal multipliers across different states (cf. Ramey and Zubairy, 2018). Several robustness checks were also carried out, including alternative indicators of slack and the inclusion of the forecasts in the model to control for fiscal foresight. Finally, some linear and state-dependent transmission channels of public consumption shocks are investigated.

The analysis contributes to the literature for at least three main reasons. First, as most of the state-dependent analyses have so far focused either on the United States or on a set of advanced countries, there is an evident lack of research focused on the Euro area. The analysis contributes to filling this gap. Second, most of the studies have focused on public spending as a whole, considering public consumption and investment together. This study is less aggregate as it focuses exclusively on public consumption. Finally, several preceding analyses on state-dependent fiscal multipliers have been recently severely questioned for some methodological features (cf. Ramey and Zubairy, 2018), thus making the contribution of new analyses based on the most recent methodological improvements even more crucial. This analysis, taking advantage of the recent methodological advances, goes precisely in this direction.

Concerning the results, I find that, not conditioning on the state of the economy, public consumption multipliers are around 1.3, in the medium term, and so quite broadly above the unity. This result is confirmed also excluding the post-crisis period and the periods of possible zero lower bound from the sample, indicating that these specific circumstances hardly explain my findings. Instead, I find strong evidence suggesting that the size of the multiplier varies according to the state of the economy. Particularly, results show that the size of the public consumption multiplier is extremely different in slack and good periods, with a value generally below 0.5 in the good regime and around or above 2.0 in the slack regime. These results hold for all the variables used to catch the state of the economy, thus appearing extremely robust along this dimension. The state-dependent reactions of private consumption and investment largely inform these results, while they do not seem to be explained by differences in the way in which shocks are financed or in the reaction of the long-term real interest rate in the two regimes of the economy. This suggests more structural explanation behind these results.

The rest of the paper is organized as follows. Section 2 provides a brief literature review on the linear and state-dependent fiscal multipliers connected to public spending as a whole and to public consumption. In section 3, I present the baseline model specifications and the data. Section 4 shows the linear and state-dependent public consumption multipliers estimates. Section 5 focuses on the fiscal foresight problem, how I address it, and how this affects estimates. In section 6, some linear and state-dependent transmission channels of public consumption shocks are investigated. Section 7 concludes.

2 Review of the empirical evidence

This section summarizes the empirical evidence on public spending and public consumption multipliers. Starting from public spending as a whole, what does the empirical evidence tell us about the size of the multiplier? A first comprehensive answer to this question can be found in Ramey (2011a), which, based on a survey of the empirical literature, concludes that a reasonable range is between 0.8 and 1.5. Gechert and Rannenberg (2018) extend the analysis to a broad set of empirical studies, finding a mean value of 0.9 and a sizable standard deviation of 0.8. Several reasons may explain this huge variability, ranging from the structural characteristics of the countries on which multiplies are estimated (Ilzetzki et al., 2013)[1] to the definition of multipliers adopted, which may dramatically affect the estimates of the multiplier (cf. Ramey, 2019). In this regard, Ramey (2019) finds that when multipliers are computed in a cumulative way, which is likely the more convincing way to compute multipliers (cf. Mountford and Uhlig, 2009)[2], the bulk of the empirical estimates shrinks to the narrower range of 0.6 to 1.0. Cumulative multipliers outside this range and above one, in any case, are found in several analyses, such as Ben Zeev and Pappa (2017) and Deleidi (2021).

Yet, few studies have analyzed public consumption explicitly. Among them: Burriel et al. (2010) estimate cumulative public consumption multipliers for the Euro area, as a whole, and for the United States, finding multipliers above 1.0 in the first case and around 0.5 in the second case; Auerbach and Gorodnichenko (2012) find a public consumption multiplier of 1.2 for the United States; Ilzetzki et al. (2013) estimate cumulative public

[1]See Spilimbergo et al. (2009) for a review of the channels that may potentially impact the size of the fiscal multipliers.

[2]This measure, indeed, has the advantage of taking into consideration the entire GDP-gain and cost of the policy.

consumption multipliers for a large set of countries, concluding that the size of the multipliers is between 0.3 and 0.7 for high-income countries; Boehm (2020) find a value of 0.8 for the cumulative multiplier, using a panel of OECD countries; Deleidi (2021) estimates cumulative public consumption multipliers above 2.0 for Italy, and Deleidi et al. (2021b) finds cumulative public consumption multipliers in the range of 2.0, using regional Italian data.

The results reported above refer to linear multipliers. What about state-dependency? In particular, what does the literature tell us about the size of the multipliers in slack/recession and in good/expansion periods[3]? In this regard, a first very influential contribution is provided by Auerbach and Gorodnichenko (2012) that, applying a smooth-transition SVAR model to the U.S. data, find that government spending multipliers are extremely higher in recession (2.5) than in expansion periods (0.3). This conclusion is also confirmed for public consumption, with a multiplier around 2.1 in recessions and 0.5 in expansions. By applying a panel smooth-transition local projections model to a set of OECD countries, Auerbach and Gorodnichenko (2013, 2017) confirm the evidence of state-dependent public spending multipliers for a broader set of countries and definitions of slack of an economy. Batini et al. (2012) estimate a threshold SVAR on a group of countries (United States, Japan, France, Italy, and Euro Area as a whole) and find that multipliers, associated with cuts in the government expenditure, are larger during periods of negative growth rate of the GDP (around 2.0) than in periods of positive growth rate. Owyang et al. (2013) apply a threshold local projections model and find evidence of higher multipliers in periods of high unemployment than in periods of low unemployment for Canada but not for the United States. Fazzari et al. (2015) apply a threshold SVAR to U.S. data, using capacity utilization rate as a measure of slack, and find that government spending multipliers are higher in slack (1.6) than in good periods (0.8). Caggiano et al. (2015) estimate a smooth-transition SVAR on the U.S data and find evidence of higher government spending multipliers in "deep recessions" than in "strong expansionary periods", but not the same evidence comparing "normal recessions" with "normal expansions". Alloza (2017), estimating a non-linear SVAR and a threshold local projections model on the U.S. data, finds higher government spending multipliers in booms than in recessions and, therefore, pro-cyclical multipliers. Ramey and Zubairy (2018) apply a threshold local projections model to a long sample of data for the U.S. and find no clear differences between government spending multipliers in periods of high and low unemployment rate, with multipliers below one in both states of the economy.

[3]Readers interested in the empirical evidence around the fiscal multipliers at the zero lower bound can refer to Ramey (2019) and Castelnuovo and Lim (2019).

This conclusion is confirmed also comparing recessions vs expansions. Gomes et al. (2020) investigate state-dependency in a panel of emerging countries, finding government spending multipliers below one, regardless of whether the economy is in slumps or in normal times, also finding evidence of multipliers close to zero in slump conditions.

The empirical evidence on this relevant issue is therefore mixed. On top of that, it is important to further highlight as some recent studies, such as Ramey and Zubairy (2018), have challenged the robustness of some of the most influential analyses supporting the conclusion of counter-cyclical government spending multipliers, by showing that these results tend to be fragile to small changes in model specifications or improvements in the methods of calculating multipliers[4]. So, Ramey (2019, p.90) claims that "the evidence for higher spending multipliers during recessions or times of high unemployment is fragile, and the most robust results suggest multipliers of one or below during these periods".

Finally, some studies have investigated the same question for the government fiscal stance and, therefore, not specifically focusing on public expenditure. In this regard: Jordà and Taylor (2016), applying a panel threshold local-projections model to a set of OECD countries, find clear evidence of higher fiscal multipliers in recessions than in expansions for fiscal consolidation measures; Cohen-Setton et al. (2019), applying a panel smooth-transition local projections model to a set of OECD countries, find higher multipliers in slumps than in booms for large fiscal stimulus; Banerjee and Zampolli (2019) estimate a panel threshold local projections model to a set of advanced countries, finding that multipliers associated to consolidation policies are largely a-cyclical and less than unity.

3 Methods and data

In line with several recent contributions, reported in the previous section, I estimate public consumption multipliers using the local projections method proposed by Jordà (2005). This methodology requires estimating a series of regressions of this type:

$$y_{t+h} = \alpha_h + \beta_h shock_t + controls + \epsilon_{t+h}; \qquad h = 0, ..., H \tag{1}$$

[4]Specifically, Ramey and Zubairy (2018) challenge the conclusions of Auerbach and Gorodnichenko (2012, 2013) and Fazzari et al. (2015) claiming that, in turn, their results are affected by methodological issues, such as: ad-hoc assumptions used to obtain state-dependent impulse response functions from non-linear VAR models; fiscal multipliers computed not in a cumulative way; the use of ex-post conversion factor to transform elasticities to multipliers; the use of questionable specific measures of recessions or slack. The methodology applied in this paper builds on these criticisms.

where y is the variable of interest, *shock* is the fiscal policy shock and *controls* are optional control variables. This is enough to compute the impulse response of y to fiscal shocks, which is equal to $\{\beta_h\}_{h=0}^{h=H}$. This methodology presents some advantages compared to the SVAR methodology, as it tends to be more robust to model misspecification than SVAR approach and it can be easily adapted to accommodate state-dependence and avoid bias in converting elasticities to multipliers. On the other hand, SVAR methodology tends to be more efficient than local projections, especially at long horizons, if it adequately captures the data-generating process[5].

Regardless of the methodology used, a major difficulty in estimating fiscal multipliers lies in the identification of structural fiscal shocks. Several identification strategies have been in fact proposed in the literature, but none of them is immune to problems (cf. Ramey, 2016). In this work, taking advantage of the quarterly frequency of my dataset, I rely on one of the most popular identification strategies, which is the one proposed by Blanchard and Perotti (2002). This identification strategy has been largely used both in the SVAR context (e.g Fatás and Mihov, 2001; Caldara and Kamps, 2008; Auerbach and Gorodnichenko, 2012; Ilzetzki et al., 2013; Fazzari et al., 2015; Alloza, 2017) than, more recently, within the local projections approach (e.g. Auerbach and Gorodnichenko, 2013, 2017; Bernardini and Peersman, 2018; Ramey and Zubairy, 2018). This identification is made operational, in the present analysis, by assuming that, due to the existence of decision lags and the absence of automatic stabilizers affecting public consumption, public consumption does not respond to unexpected changes in macroeconomic dynamics within a quarter. I defer a discussion on a well-known potential weakness of this identification strategy and how I address it to section 5. Let us now focus, instead, more deeply on the linear and non-linear baseline model specification.

3.1 Linear and non-linear baseline specification

Exploiting the panel structure of the dataset, I estimate the linear effects of public consumption shocks, identified à la "Blanchard-Perotti", trhough a series of regressions of this type:

$$y_{i,t+h} = \alpha_{i,h} + \beta_h g_{i,t} + \sum_{l=1}^{L} \phi_{l,h} w_{i,t-l} + \tau_{t,h} + \epsilon_{i,t+h}; \qquad h = 0, ..., H \tag{2}$$

[5]For more details on the pros and cons of the two methodologies, see Ramey (2016). An interesting comparison between the empirical performance of the two methodologies can be found in Li et al. (2021).

where i and t index countries and time, α and τ are country and time fixed effects, g refers to the public consumption variable, better defined immediately below, and $w \equiv \{g, gdp, nt, R\}$ contains all the variables composing the dynamical model of the economy[6]. More specifically, these variables are the logarithm of quarterly real per capita and seasonally adjusted public consumption (g), gross domestic product (gdp) and net-taxes (nt) and the long-term real interest rate (R)[7]. The latter variable has been included as it is expected to influence both public consumption decisions and, mainly through its effect on private consumption and investment, the dynamics of GDP (Perotti, 2005). As standard in the fiscal multiplier literature based on quarterly data, I set $L = 4$. Note that, having added as control variables the lagged time series, equation (2) effectively imposes the Blanchard-Perotti ordering of the variables[8]. So, the impulse response function of y to structural public consumption shocks is directly equal to $\{\beta_h\}_{h=0}^{h=H}$[9].

Regarding the specification of the left-hand side variables, to avoid potential biases in converting elasticities to multipliers, I apply the transformation proposed by Hall (2009) and Barro and Redlick (2011), estimating the following set of equations:

$$\begin{aligned} \frac{GDP_{i,t+h} - GDP_{i,t-1}}{GDP_{i,t-1}} &= \alpha_{i,h}^{(gdp)} + \beta_h^{(gdp)} g_{i,t} + \sum_{l=1}^{L} \phi_{l,h}^{(gdp)} w_{i,t-l} + \tau_{t,h}^{(gdp)} + \epsilon_{i,t+h} \\ \frac{G_{i,t+h} - G_{i,t-1}}{GDP_{i,t-1}} &= \alpha_{i,h}^{(g)} + \beta_h^{(g)} g_{i,t} + \sum_{l=1}^{L} \phi_{l,h}^{(g)} w_{i,t-l} + \tau_{t,h}^{(g)} + \epsilon_{i,t+h} \end{aligned} \tag{3}$$

The main advantage of this transformation is that, by expressing the left-hand side variables in terms of lagged GDP, the regression coefficients are in the same unit. This allows to directly compute multipliers without the need of using any ex-post conversion factor. Accordingly, cumulative multipliers can be easily computed as:

[6]Henceforth, the variables expressed in lower case refer to logarithmic values, while the variables expressed in upper case refer to variables in levels.

[7]I have also considered expanded versions of the model, where variables like public investments and private consumption have been added to the baseline model. However, as the results shown in the next sections turn out to be very robust to the inclusion of these variables, I avoid reporting such additional results, which are available upon request.

[8]For more details on the implementation of several "classical" identification strategies within the local projections see Plagborg-Møller and Wolf (2021).

[9]This single-step procedure is convenient and equivalent to a two-step procedure in which public consumption shocks are first estimated, regressing public consumption on L lags of w, and then inserted into the equation (2) at the place of g. I apply the two-stages procedure whenever I need information about the public consumption structural shocks retrieved by the model.

$$Mult_p = \frac{\sum_{h=0}^{h=p} \beta_h^{(gdp)}}{\sum_{h=0}^{h=p} \beta_h^{(g)}} \tag{4}$$

where $0 \leq p \leq H$ indicates the horizon over which cumulative multiplier is computed.

To analyse whether public consumption multipliers vary over the busyness cycle, following Auerbach and Gorodnichenko (2012, 2013), I modify the linear specification into the following panel smooth-transition local projections model:

$$\begin{gathered} y_{i,t+h} = \alpha_{i,h} + \beta_{1,h} g_{i,t} * F(z_{i,t-1}) + \sum_{l=1}^{L} \phi_{1,l,h} w_{i,t-l} * F(z_{i,t-1}) + \\ \beta_{2,h} g_{i,t} * (1 - F(z_{i,t-1})) + \sum_{l=1}^{L} \phi_{2,l,h} w_{i,t-l} * (1 - F(z_{i,t-1})) + \\ \theta_h * F(z_{i,t-1}) + \tau_{t,h} + \epsilon_{i,t+h}; \qquad h = 0, ..., H \end{gathered} \tag{5}$$

where 1 and 2 index the two regimes of the economy, namely slack and good regime, z is the state (transition) variable, capturing the slack in the economy, and $F(z)$ is the transition function which takes values between zero and one. Particularly, the higher the value of the transition function $F(z)$, the higher the "relative weight" assigned to the first state of the economy and vice versa[10]. The impulse response function of y to public consumption shock in the first and second regime of the economy is respectively given by $\{\beta_{1,h}\}_{h=0}^{h=H}$ and $\{\beta_{2,h}\}_{h=0}^{h=H}$.

To close the model, the state variable and the functional form of the transition function must be specified. Regarding the state variable, I test a range of possible variables constructed using several busyness cycle indicators used in the literature. Specifically, I built the state variables in such a way that $Var(z_i) = 1$, alternatively using data on the unemployment rate (Barro and Redlick, 2011; Owyang et al., 2013; Ramey and Zubairy, 2018), the employment rate (Auerbach and Gorodnichenko, 2013) and the "dynamics" of the GDP (Auerbach and Gorodnichenko, 2012, 2013, 2017). Since there is no compelling reason to prefer one state variable over the other, I report results for all the state variables tested. This is important as it allows me to test and evaluate the robustness of the findings extensively. I select, in any case, a "preferred" state variable to use as the benchmark scenario. This choice is made by looking at the empirical performance of the different non-linear models in a quarter head prevision of public consumption[11].

[10] These weights are computed using lagged state-variable to avoid any potential contemporaneous effect of public consumption shocks on the value of the state variable.

[11] Specifically, I choose as the benchmark the z variable which leads to the higher adjusted R^2 in the

Regarding the transition function, the following functional form is assumed:

$$F(z_{i,t-i}) = \frac{exp(-\gamma z_{i,t-1})}{1 + exp(-\gamma z_{i,t-1})}; \qquad \gamma > 0 \tag{6}$$

This transition function takes values from potentially unlimited support and transforms them into values between zero and one. An equal weight between the two regimes - $F(z) = 0.5$ - is obtained for $z = 0$. The parameter γ define the "speed" of the transition between the regimes: the higher is γ, the faster is the transition between the regimes of the economy. I calibrate γ in a way that the economy spends around 20% of the time in slack, where slack is defined as a period in which $F(z) > 0.8$[12]. This translates into a value for γ between 1.5 and 1.75, depending on the specific state variable considered.

3.2 Data

The dataset is composed of quarterly data for nine Euro area counties and covers the period 1999Q1-2018Q4[13]. The time series are shorter for Austria and Germany due to the lack of data, respectively, starting in 2001Q1 and 2002Q1.

The dataset is constructed using the OECD statistic database as a source. The variables in real terms are obtained by deflating nominal variables with the GDP-deflator. The variables in per-capita terms are obtained by dividing by the total population. Regarding seasonality, most of the variable are seasonally adjusted by the source. Where this is not the case, the time series are seasonally adjusted using the X-13-ARIMA-SEATS procedure.

Regarding the variables, public consumption (g) refers to the "Government final consumption expenditure", that is the sum of collective and individual consumption expenditure of the government. The variable named net-taxes (nt) is constructed as in Blanchard and Perotti (2002) and refers to the total revenues minus total transfers. The long-term real interest rate (R) refers to an ex-post interest rate and is calculated as the difference between the 10-year nominal interest rate on treasury bonds and the inflation rate, calculated as the percentage change on the same quarter of the previous year.

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regression $g_{i,t} = \alpha_{i,h} + \sum_{l=1}^{4} \phi_{1,l,h} w_{i,t-l} * F(z_{i,t-1}) + \sum_{l=1}^{4} \phi_{2,l,h} w_{i,t-l} * (1 - F(z_{i,t-1})) + \theta_h * F(z_{i,t-1}) + \tau_{t,h} + \epsilon_{i,t+h}$

[12] See Auerbach and Gorodnichenko (2012) or Caggiano et al. (2015) for more details.

[13] The countries included in the dataset are: Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Portugal and Spain.

4 Linear and state-dependent estimates of the multipliers

This section shows the estimates obtained with the baseline specification, starting with the linear results and then moving on to the state-dependent analysis.

Figure 1 shows the impulse response of GDP and public consumption, in GDP-unit, to a 1% shock to public consumption. Both impulse responses are shown together with their 90% confidence intervals[14]. Two interesting results emerge from the analysis of these responses. First, public consumption shocks produce a statistically significant and long-lasting positive effect on GDP. The GPD reaction is hump-shaped, with a peak effect about two-three years after the shock. Second, public consumption shocks are highly persistent over time, with half of the shock still there after four years.

[Insert Figure 1 almost here]

By transforming these impulse responses to multipliers, I obtain the (cumulative) public consumption multipliers shown in the top row of Table 1. The size of the multiplier is around 0.7 in the first year and above 1.0 in the medium term, stabilizing around a value of 1.25. In other words, an increase (decrease) in public consumption of one euro raises (decreases) output by about 1.25€. Thus, differently from the conclusions of Ramey (2019), my results suggest that public consumption stimulates additional private activity.

Table 1 also reports results for subsample periods. Indeed, I have controlled whether the inclusion in the analysis of the post-global financial crisis period or periods of possible zero lower bound affects the results. The results show that this is not the case, as the estimates show strong subsample stability. Particularly, I do not find any clear difference between pre-crisis (Pre GFC) and post-crisis (Post GFC) multipliers, using 2008Q2 as the break period, and I find that the exclusion of possible zero lower bound periods (No ZLB), namely after 2012Q4 (cf. Amendola et al., 2020), does not affect the estimates. This leads me to reject the hypothesis that particular characteristics of the post-crisis period largely explain my results.

[Insert Table 1 almost here]

Let us now investigate whether the size of the public consumption multipliers differs between slack and good economic conditions. Starting with the benchmark state variable that, using the metric described in the previous section, is represented by (negative) standardized deviations of the unemployment rate from the country-mean, Figure 2 shows the

[14]The confidence intervals shown in the paper are based on Driscoll and Kraay (1998) standard errors.

state-dependent impulse responses of GDP and public consumption, in GDP-unit, to a 1% shock to public consumption. As it emerges from the figure, the reaction of the GDP turns out to be highly different in the two regimes of the economy. Specifically, the response of GDP is strong, long-lasting and statistically significant in the slack regime, while it is very weak and never statistically different from zero in the good regime. Regarding the persistence of the shocks, as in Ramey and Zuibary (2018), I find higher persistence in the slack than in the good regime, but the difference is mild. So, transforming these impulse responses to cumulative multipliers, the values of the public consumption multiplier turn out to be utterly different in the two regimes. Specifically, in the medium term, multipliers are above two, with a four-year multiplier of 2.2, in the slack regime and between 0.3-0.4 in the good regime (cf. Table 2, left block). The difference is sizably even over shorter horizons. For example, two years after the shock, the multipliers are respectively about 1.7 and 0.4 in the two regimes.

[Insert Figure 2 almost here]

Let us now check whether these findings are robust to the use of alternative state variables. In this regard, a first interesting robustness check is to consider (negative) standardized deviations of the unemployment rate from the Hodrick-Prescott (HP) trend as the state variable. This appears important as a possible concern for the benchmark state variable is that, being based on the country-mean unemployment rates, it imposes a constant "threshold" (location parameter) over time, ruling out potential structural changes in the labour market. This alternative state variable does not introduce such an assumption, thus representing an important robustness check. Regarding the smoothing parameter (λ) of the HP trend, I test two possibilities[15]: i) a very high λ equal to 10^6; ii) a smaller λ equal to $4 * 10^4$. Concerning the results, Table 2 shows that they are highly robust to the use of these alternative state variables.

Let us now switch from the unemployment rate to alternative variables. In particular, as in Auerbach and Gorodnichenko (2013, 2017), let us first consider standardized deviations of the GDP from the HP trend as the state variable. For the smoothing parameter, I use the same two values as before. Table 2 shows that results are largely in line with the previous ones, with medium-term multipliers around 2.0 in the slack regime and below 0.5 in the good regime. Evidence in favour of state-dependency is also confirmed for shorter horizons.

[15] The higher smoothing parameter is equal to the one used by Ramey and Zuibary (2018) while the lower one is more in line with Auerbach and Gorodnichenko (2013), which use $\lambda = 10^4$ but with semi-annual data.

Finally, let us consider the employment rate as the variable catching the slack in the economy. More in detail, as in Auerbach and Gorodnichenko (2013), this state variable is constructed as the standardized deviations of the (log) employment rate from the HP trend. I use the high $\lambda = 10^6$ for the smoothing parameter[16]. Previous findings are confirmed once again: medium-term multipliers are above two (2.2) in the slack regime and below 0.5 in the good regime (cf. Table 2).

To sum up, my findings provide clear evidence in favour of higher public consumption multipliers in slack than in good economic conditions, with a sizable difference between the two regimes. This conclusion appears very robust, holding regardless of the specific state variable used and the horizon considered. Particularly, considering all the tested state variables, estimates suggest a medium-term multiplier between 1.9 and 2.2 in the slack regime and between 0.1 and 0.4 in the good regime[17].

[Insert Table 2 almost here]

5 Dealing with the fiscal foresight problem: the expectations-augmented model

A well-known potential weakness of the identification strategy applied in the previous section is that it is not immune to the fiscal foresight problem. Indeed, due to the usual presence of implementation lags in fiscal policy, public consumption shocks identified à la "Blanchard-Perotti" could be partly anticipated by the private sector. The predictability of the "traditional-SVAR" fiscal shocks is generally confirmed by the empirical literature (Ramey, 2011b; Auerbach and Gorodnichenko, 2012, 2013), and it is particularly problematic as it may potentially seriously bias the estimates (Leeper et al., 2013)[18].

To check whether the baseline public consumption shocks are partly predictable, in line with Ramey (2011b) and Auerbach and Gorodnichenko (2012, 2013), I employ real-time professional forecasts. Particularly, following Auerbach and Gorodnichenko (2013, 2017), I use the forecasts provided by the OECD in the "Economic Outlook". These forecasts

[16] This choice is motivated by the fact that, in this case, the performance of the non-linear model appreciably worsens, in terms of quarter head prevision of public consumption, decreasing the value of the smoothing parameter. This suggests that using a low value for the smoothing parameter leads to a "poor" state variable. In any case, results are robust to the use of $\lambda = 4 * 10^4$.

[17] The state-dependent impulse response functions obtained with the different state variables are reported in Figure 6 in the Appendix A.

[18] Note that although the theoretical problem is clear, the empirical relevance of the problem is more controversial. Mertens and Ravn (2010) and Perotti (2014), for example, find very weak empirical relevance for the "fiscal foresight".

are reliable (Vogel, 2007) and perfectly fits the present analysis as they explicitly refer to public consumption expenditure and cover all the countries and the timespan considered in the work[19]. In this regard, by regressing baseline public consumption shocks on one lag of the forecasts, with the right-hand side variables of the baseline model as controls[20], I find that the forecasts help predict baseline public consumption shocks in a statistically significant way. This means that part of the shocks is predictable and that previous results are effectively exposed to the fiscal foresight problem.

There are different methods to deal with this problem (see Ramey, 2016). The one I follow here is to augment the model with the real-time professional forecasts to directly include expectations about public consumption (Auerbach and Gorodnichenko 2012; Perotti, 2014; Boehm, 2020; Deleidi, 2021). This helps in purifying public consumption shocks from their potentially predictable component and, therefore, in constructing impulse responses based only on unanticipated public consumption shocks. More specifically, being g^{fc}_{t-1} the forecast on public consumption made in period $t-1$, I construct the expectation-augmented linear and non-linear model as:

$$y_{i,t+h} = \alpha_{i,h} + \beta_h g_{i,t} + \rho g^{fc}_{i,t-1} + \sum_{l=1}^{L} \phi_{l,h} w_{i,t-l} + \tau_{t,h} + \epsilon_{i,t+h}; \qquad h = 0, ..., H \tag{7}$$

$$\begin{gathered} y_{i,t+h} = \alpha_{i,h} + \beta_{1,h} g_{i,t} * F(z_{i,t-1}) + \rho_1 g^{fc}_{i,t-1} * F(z_{i,t-1}) + \sum_{l=1}^{L} \phi_{1,l,h} w_{i,t-l} * F(z_{i,t-1}) + \\ \beta_{2,h} g_{i,t} * (1 - F(z_{i,t-1})) + \rho_2 g^{fc}_{i,t-1} * (1 - F(z_{i,t-1})) + \sum_{l=1}^{L} \phi_{2,l,h} w_{i,t-l} * (1 - F(z_{i,t-1})) + \\ \theta_h * F(z_{i,t-1}) + \tau_{t,h} + \epsilon_{i,t+h}; \qquad h = 0, ..., H \end{gathered} \tag{8}$$

As I directly control for public consumption expectations in equation (7) and (8), through lagged real-time forecasts, the coefficients $\{\beta_h\}_{h=0}^{h=H}$ and $\{\beta_{1,h}\}_{h=0}^{h=H}$, $\{\beta_{2,h}\}_{h=0}^{h=H}$ can now be interpreted as the linear and state-dependent impulse response of y to "unanticipated" public consumption shocks. Indeed, the public consumption shocks are orthogonal, by construction, to the set of information contained in the forecasts and lagged time series.

[19]Unfortunately, these forecasts are released at a lower frequency then my dataset, as they are published twice a year, in June and December. I address this problem by applying a linear interpolation technique to the forecasts, making the forecasts' frequency compatibles with the frequency of the dataset.

[20]The inclusion of these controls allows to retrieve the effect of information included in the professional forecasts that is orthogonal to the information contained in the macroeconomic time series included in the model.

I call this specification the E-model, which stands for expectations-augmented model[21].

Public consumption multipliers estimated with the linear E-model are reported in the right part of Table 1. Results show that the inclusion of the forecasts into the model does not sizably affect the estimates. More precisely, if something, in line for example with Deleidi (2021), controlling for expectations slightly increases the size of the multiplier, which in the medium term is confirmed to be above one (1.35). The subsample stability of the estimates is also confirmed.

The right part of Table 2 reports the state-dependent multipliers obtained with the smooth-transition E-model. As it emerges from the results, I continue to find strong evidence of higher public consumption multipliers in the slack regime than in the good regime, even controlling for expectations. As for the previous results, this conclusion holds regardless of the horizon and the state variable considered. In particular, in the medium term, most estimates suggest multipliers greater than two in the slack regime and less than 0.5 in the good regime. For example, using the benchmark state variable, the four-year multipliers are respectively about 2.4 and 0.4 in the slack and good regime.

Summing up, it can be argued that the results are extremely robust to the inclusion of the forecasts into the model and, therefore, to potential problems connected to the predictability of public consumption shocks[22].

6 Transmission channels

Having assessed the robustness of the multipliers estimates along several dimensions, let us now try to shed more light on the transmission channels behind them. Accordingly, this section focuses on the linear and state-dependent impulse responses of other variables to public consumption shocks. Specifically, I focus on private consumption, private investment, net taxes and real interest rate[23]. The impulse responses refer to a 1% shock in public consumption and are expressed in GDP-unit, except for the real interest rate one, which is in basis points[24].

Figure 3 reports the linear impulse response functions. As it emerges from the figure, in

[21] I also estimate an alternative version of the expectations-augmented model in which all the variables, except the interest rate, enter in growth rates: $w \equiv \{\Delta g, \Delta gdp, \Delta nt, R\}$. This alternative version (E-model - FD) directly tackles possible concerns related to the non-stationarity of the data. Results are reported in the Appendix A.

[22] Multipliers estimated with the E-model in first differences are in line with this conclusion (Cf. Table 4)

[23] Private consumption and private investment are, respectively, added to the model in estimating the reactions of these variables to public consumption shocks, in order to control for their lagged dynamics.

[24] The impulse responses are computed with the baseline specification and are shown together with their 90% confidence interval.

line with the findings of several studies analyzing the effects of public spending (e.g. Blanchard and Perotti, 2002; Galí et al., 2007; Caldara and Kamps, 2008; Mertens and Ravn, 2010; Auerbach and Gorodnichenko, 2013), I find a clear crowding-in effect on private consumption, which positively reacts to a positive public consumption shock. The reaction is statistically significant and long-lasting. In terms of cumulative multipliers, my results suggest that an increase in public consumption of one euro stimulates around 0.45€ of additional private consumption (cf. Table 3). Controlling for expectations, such crowding-in dynamics strengthens slightly, with an increase in the medium-term private consumption multiplier of 0.1 units. This mainly explains why I find marginally higher public consumption multipliers in the expectations-augmented model. The reaction of private investment is less clear. There is some evidence of crowding-out on impact and then some tendency of crowding-in in the short-term, which explain the low but positive values of the cumulative multipliers shown in Table 3 (0.1). In any case, the reaction of private investment is not statistically different from zero at any horizon, so that no robust conclusions can be drawn.

Regarding net taxes and real interest rate, according to estimates, both variables turn out to be largely insensitive to public consumption shocks. Indeed, their impulse responses fluctuate around zero, with zero always contained into the confidence intervals (cf. Figure 3). Concerning net taxes, this means that my results are likely capturing the effects of public consumption shocks in a scenario of no "offsetting forces" coming from this variable. In a sense, therefore, the results can be interpreted as the effects of "fully deficit-financed" public consumption shocks. The fact that the real interest rate does not show any increasing tendency in response to public consumption shock is particularly interesting and in line with several empirical analyses (e.g. Ramey, 2011b; Corsetti et al., 2012; Batini et al., 2012; d'Alessandro et al., 2019). Interestingly, no clear reaction of the real interest rate is founded even if potential zero lower bound periods are excluded from the sample, suggesting that this result is not due to this circumstance.

[Insert Figure 3 almost here]

Shifting the focus to the non-linear analysis, results show that the difference in the size of the public consumption multiplier between slack and good periods is mainly driven by a completely different reaction of the private components of the GDP in the two regimes. Indeed, both variables are strongly crowded-in in the slack regime, while they tend to be crowded-out in the good regime, even if the absence of crowding-out cannot be rejected, especially for consumption (cf. Figure 4, 5). More precisely, regarding private consumption, the reaction of this variable is strong, long-lasting and statistically significant in the slack regime, while it is slightly negative, even if not statistically different from zero, in the good regime. In terms of cumulative multipliers, by averaging results across the different state-variables, my findings suggest that an increase in public consumption of one euro stimulates around 1.25€ of additional private consumption in the slack regime while it crowds-out around 0.30€ of private consumption in the good-regime. Regarding private investment, I find a weak negative effect on impact in both regimes, but then the reaction of this variable strongly diverge in the two regimes. In the slack regime, results show a strong positive reaction of the private investment, peaking in the second year after the shock. In terms of multipliers, one euro of increase in public consumption triggers around 1.3€ of additional private investment in the medium-term (cf. Table 3). On the other hand, in the good regime, public consumption shocks produce a long-lasting negative reaction of the private investment, translating into a reduction in private investment for every euro of increase in public consumption of 0.5€ in the short term, and around 1.1€ in the medium-term.

The analysis of the state-dependent impulse responses of net taxes and real interest rate reveals that these variables do not seem to play a crucial role in explaining previous state-dependent findings (cf. Figure 4, 5). Regarding net taxes, this means that the cause behind my results does not seem to be sought in a less favourable way of financing public spending, i.e. recurring less to the deficit and more to additional taxes, in the good than in the slack regime. Moreover, the response of the real interest rate hardly informs my findings as it remains not statistically different from zero in both regimes. So, all in all, my results suggest that the state-dependent transmission channels of public consumption shocks lie in some more structural features of the economic systems analyzed here[25].

[Insert Figure 4 almost here]

[Insert Figure 5 almost here]

[Insert Table 3 almost here]

7 Conclusions

In this paper, I have investigated the size of the public consumption multiplier and whether it varies depending on the slack of the economy. The analysis has been conducted by applying linear and smooth-transition panel local projections models to a set of Euro area countries over the period 1999Q1-2018Q4.

[25] State-dependent impulse response functions of private consumption, private investment, net taxes and real interest rate for the different state variable tested are reported in Figure 7 and 8 in the Appendix A.

The results show that public consumption shocks produce a sizable effect on aggregate output, with a medium-term multiplier above one (1.3). This is, however, an "average result", as a major finding concerns the strong and robust evidence that I have found in favour of higher public consumption multipliers in slack than in good economic conditions. The difference is sizable, with multipliers around, and even above, 2.0 in the slack regime and positive but generally below 0.5 in the good regime.

The policy implications of these results are significant. For example, my findings raise big concerns about pro-cyclical fiscal consolidation measures, based on cuts to public consumption, as substantial negative effects on aggregate output, private consumption and investment are expected from these policies. On the contrary, in line with Keynesian intuitions, my findings show that public consumption stimuli may be crucial to sustain aggregate production and stimulate private consumption and investment in slack economic conditions. In good economic conditions, the story is different as the effects of public consumption shocks are mild, crowding-out effects are likely, and multipliers are low.

Such conclusions are in line with different previous analyses (cf. section 2) but contrast with those provided by some recent and influential studies, such as the work of Ramey (2019). Importantly, however, I claim that the divergence between my findings and Ramey's conclusions can hardly be explained by methodological issues. Indeed, other than being extremely robust under different dimensions, the results shown in the present work are based on an econometric specification built upon the "best practices" suggested by Ramey. The reasons behind this divergence, therefore, should be sought elsewhere.

As such, the present work leaves many avenues open for future research. For example, as the present analysis is one of the first attempts to estimate state-dependency in the Euro area, an interesting question is whether my results are due to some peculiar features of the sample considered. Extending the current analysis to other advanced countries, and comparing results inside and outside the Euro area, can be particularly useful to shed more light on this point. Furthermore, it may be interesting to extend the current analysis to other fiscal instruments, such as public investments. In fact, except for some recent analyses (e.g Deleidi et al., 2021a), there is not much literature on the values of public investment multipliers in the Euro area, and even less that analyzes this issue in a non-linear way. These are some of the research questions that could be explored in future works.

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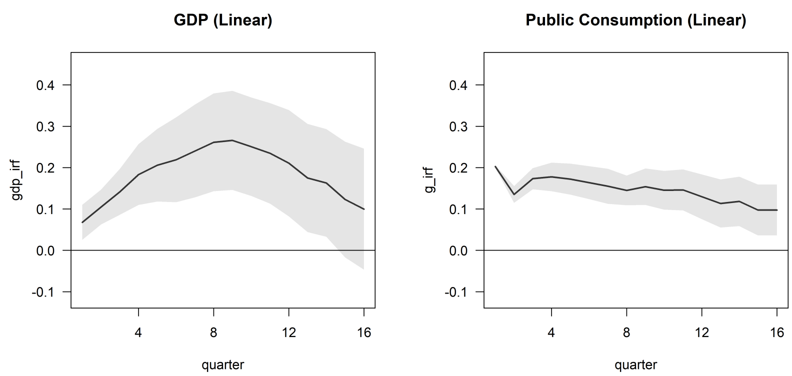

Figure 1: Linear impulse responses to a 1% shock to public consumption. Shaded areas represent 90% confidence intervals, based on Driscoll and Kraay (1998) standard errors.

	Baseline				E-model			
	1-year	2-year	3-year	4-year	1-year	2-year	3-year	4-year
Full sample	0.72	1.08	1.25	1.25	0.72	1.13	1.33	1.35
Subsample:								
Pre GFC	0.66	1.04	1.33	1.31	0.67	1.12	1.36	1.29
Post GFC	0.68	1.02	1.18	1.22	0.65	0.99	1.12	1.17
No ZLB	0.74	1.07	1.24	1.23	0.76	1.17	1.37	1.38

Table 1: Linear public consumption cumulative multipliers.

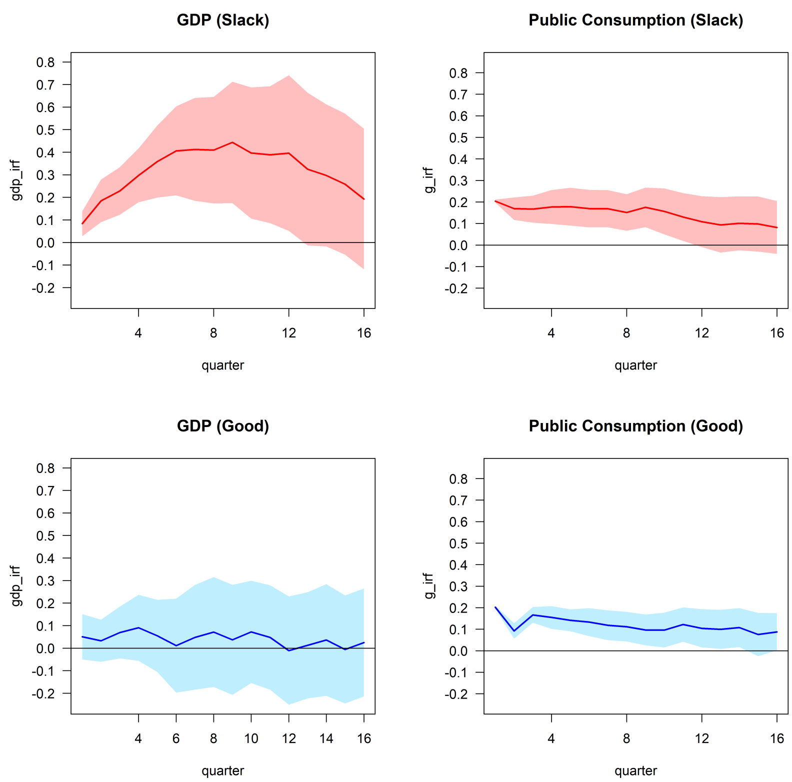

Figure 2: State-dependent impulse responses to a 1% shock to public consumption. Shaded areas represent 90% confidence intervals, based on Driscoll and Kraay (1998) standard errors. State variable: negative standardized deviations of the unemployment rate from the country mean.

	Baseline				E-model			
Regime	1-year	2-year	3-year	4-year	1-year	2-year	3-year	4-year
			Unemployment (mean)					
Slack	1.11	1.72	2.05	2.18	1.16	1.91	2.27	2.37
Good	0.39	0.38	0.37	0.35	0.41	0.45	0.44	0.43
			Unemployment (HP-trend, $\lambda = 10^6$)					
Slack	1.00	1.63	2.01	2.17	1.08	1.88	2.25	2.36
Good	0.42	0.38	0.37	0.30	0.41	0.43	0.43	0.39
			Unemployment (HP-trend, $\lambda = 4 * 10^4$)					
Slack	0.93	1.57	1.90	1.98	1.02	1.84	2.16	2.16
Good	0.48	0.49	0.43	0.40	0.46	0.51	0.49	0.43
			GDP (HP-trend, $\lambda = 10^6$)					
Slack	0.94	1.60	1.95	2.07	0.90	1.56	1.93	2.02
Good	0.50	0.55	0.54	0.36	0.56	0.65	0.57	0.31
			GDP (HP-trend, $\lambda = 4 * 10^4$)					
Slack	0.88	1.48	1.84	1.90	0.88	1.51	1.80	1.89
Good	0.45	0.50	0.48	0.22	0.47	0.56	0.50	0.16
			Employment gap					
Slack	1.01	1.66	2.03	2.22	0.93	1.72	2.08	2.37
Good	0.51	0.42	0.42	0.10	0.74	0.91	0.68	0.38

Table 2: State-dependent public consumption cumulative multipliers.

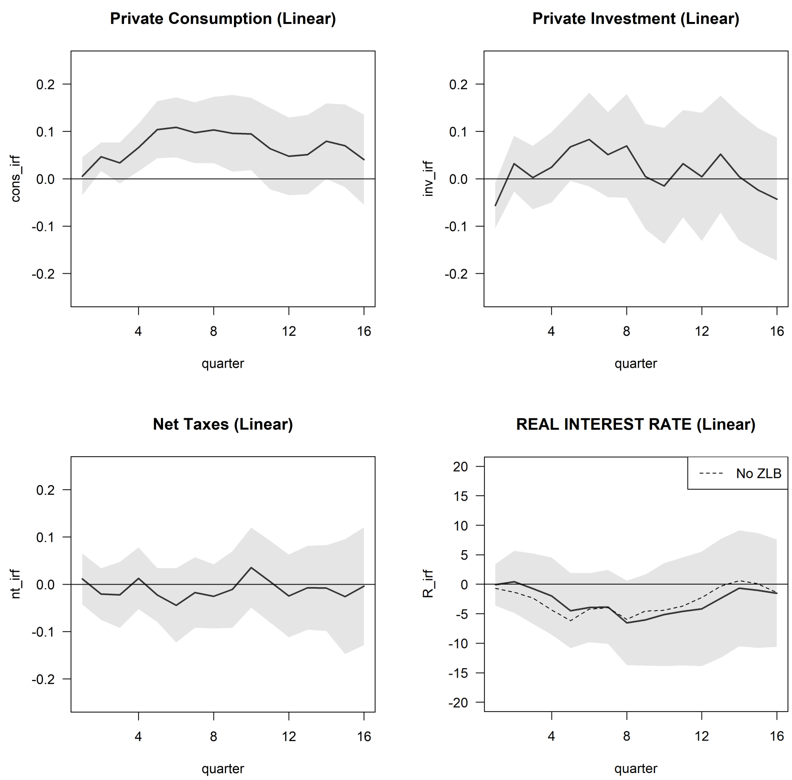

Figure 3: Linear impulse responses to a 1% shock to public consumption. Shaded areas represent 90% confidence intervals, based on Driscoll and Kraay (1998) standard errors.

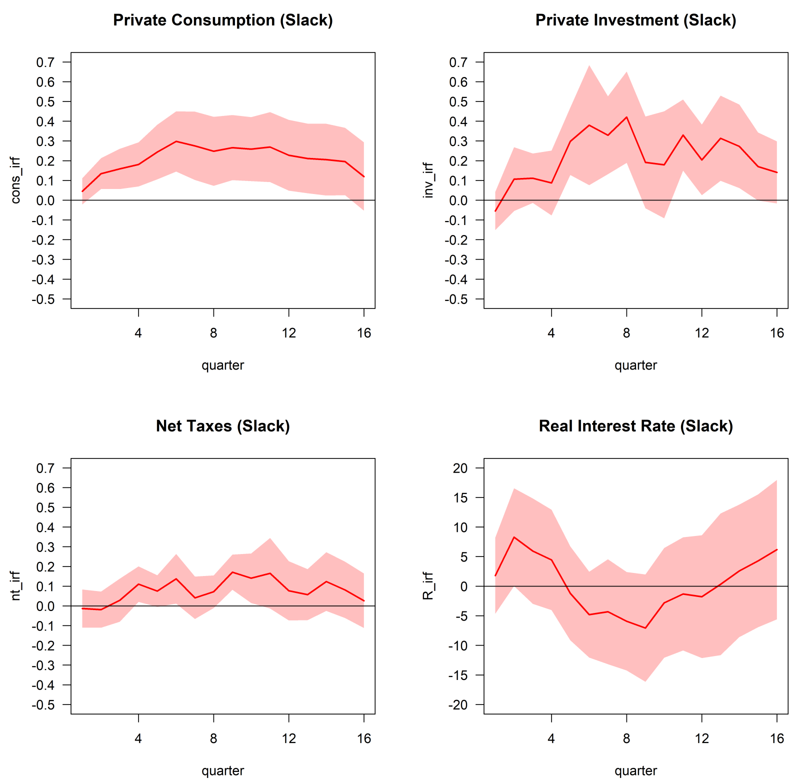

Figure 4: Slack-regime impulse responses to a 1% shock to public consumption. Shaded areas represent 90% confidence intervals, based on Driscoll and Kraay (1998) standard errors. State variable: negative standardized deviations of the unemployment rate from the country mean.

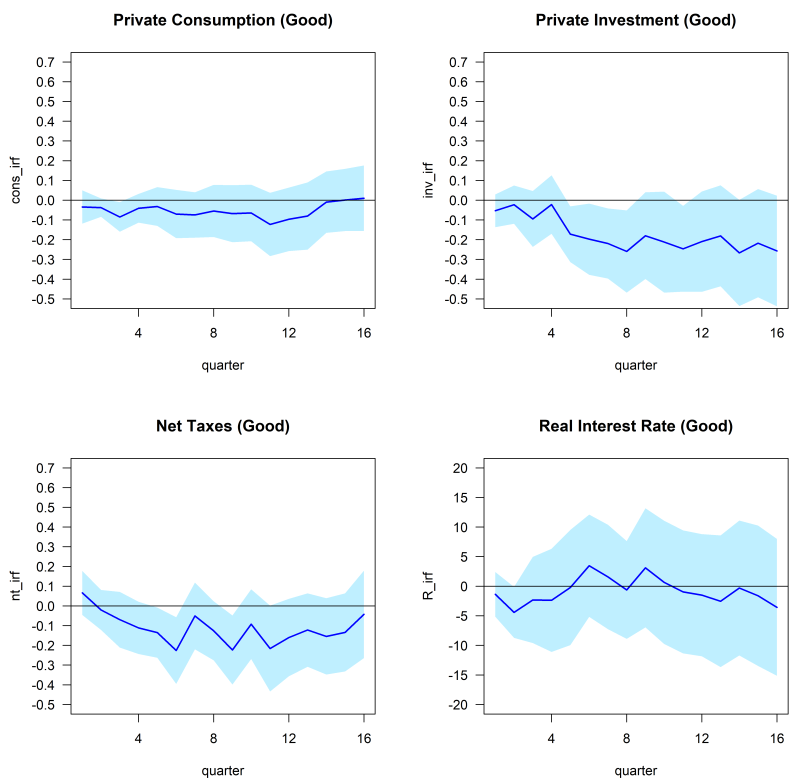

Figure 5: Slack-regime impulse responses to a 1% shock to public consumption. Shaded areas represent 90% confidence intervals, based on Driscoll and Kraay (1998) standard errors. State variable: negative standardized deviations of the unemployment rate from the country mean.

	Consumption			Investment		
	Linear	Slack	Good	Linear	Slack	Good
Baseline:						
2-year:	0.43	0.99	-0.19	0.21	0.88	-0.55
4-year:	0.46	1.28	-0.30	0.12	1.30	-1.07
E-model:						
2-year:	0.47	0.98	-0.13	0.22	0.89	-0.39
4-year:	0.55	1.24	-0.31	0.11	1.23	-0.98

Table 3: Linear and state-dependent cumulative multipliers for private consumption and investment. State-dependent values are the averages across different state variables.

A Appendix A - Additional results

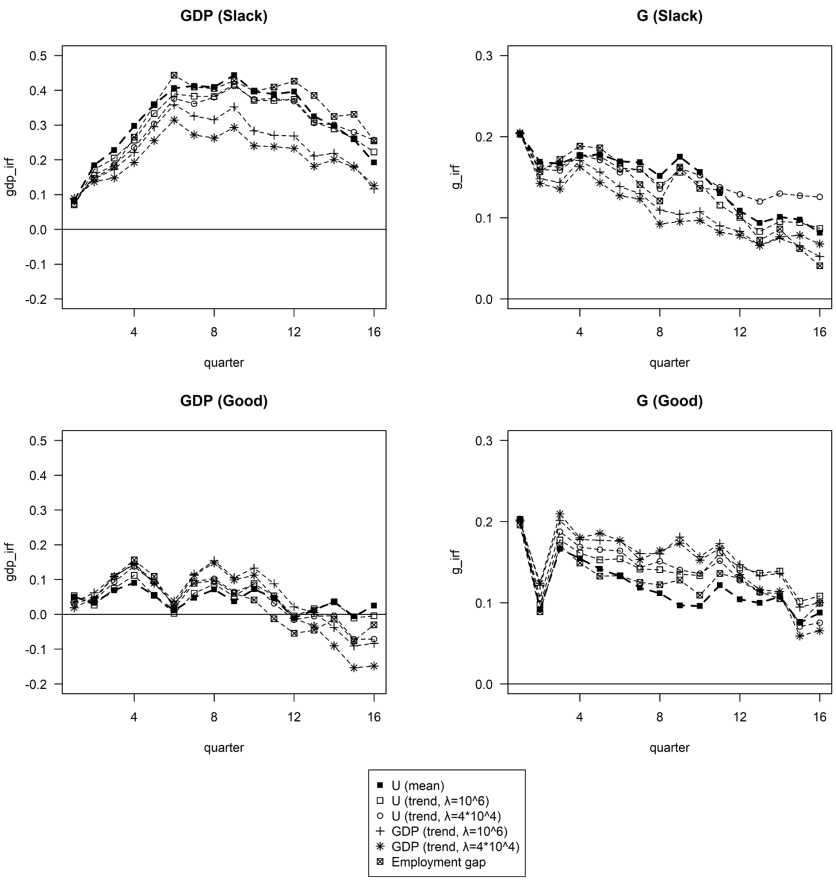

Figure 6: State-dependent impulse responses to a 1% shock to public consumption. All state variables tested.

E-model - FD

Linear

	1-year	2-year	3-year	4-year
Full sample	0.74	1.13	1.30	1.30
Pre GFC	0.71	1.03	1.17	1.08
Post GFC	0.88	1.27	1.38	1.35
No ZLB	0.74	1.14	1.33	1.31

Non-linear

	Slack				Good			
z-variable:	1-year	2-year	3-year	4-year	1-year	2-year	3-year	4-year
U (mean)	1.27	2.01	2.35	2.49	0.25	0.15	0.00	-0.19
U (HP, $\lambda = 10^6$)	1.13	1.90	2.26	2.37	0.35	0.30	0.21	0.10
U (HP, $\lambda = 4 * 10^4$)	1.07	1.88	2.23	2.31	0.46	0.49	0.43	0.35
GDP (HP, $\lambda = 10^6$)	0.92	1.56	1.92	2.03	0.56	0.63	0.50	0.20
GDP (HP, $\lambda = 4 * 10^4$)	0.95	1.59	1.93	2.00	0.46	0.50	0.40	0.09
Employment gap	0.83	1.48	1.79	1.94	0.71	0.87	0.66	0.48

Table 4: Linear and state-dependent public consumption cumulative multipliers. First differences specification.

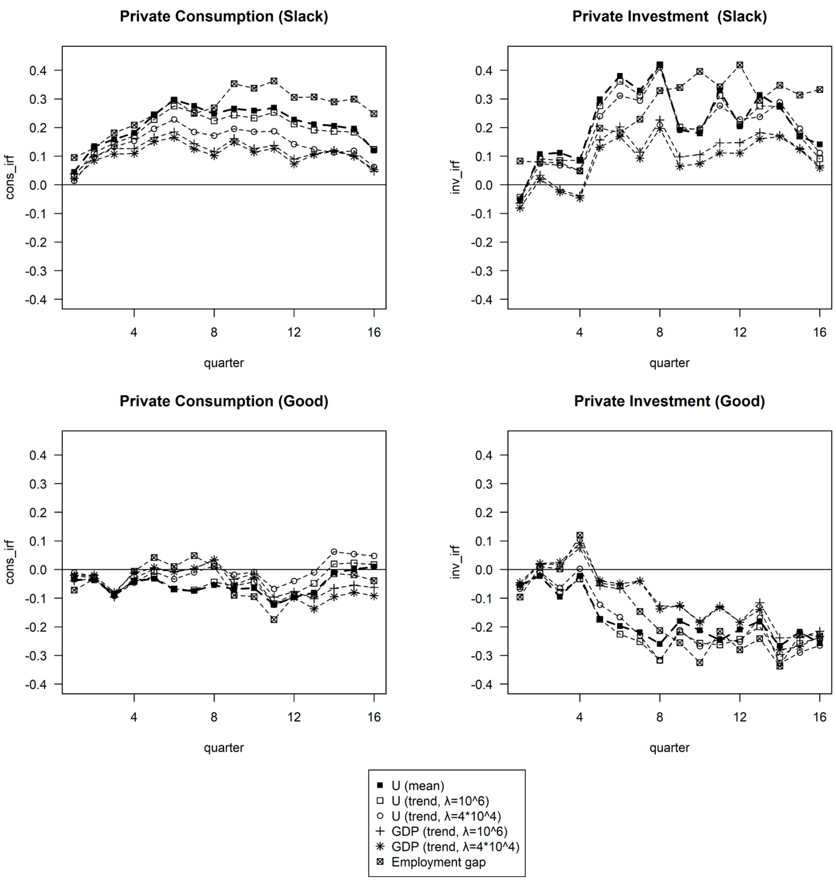

Figure 7: State-dependent impulse responses to a 1% shock to public consumption. All state variables tested.

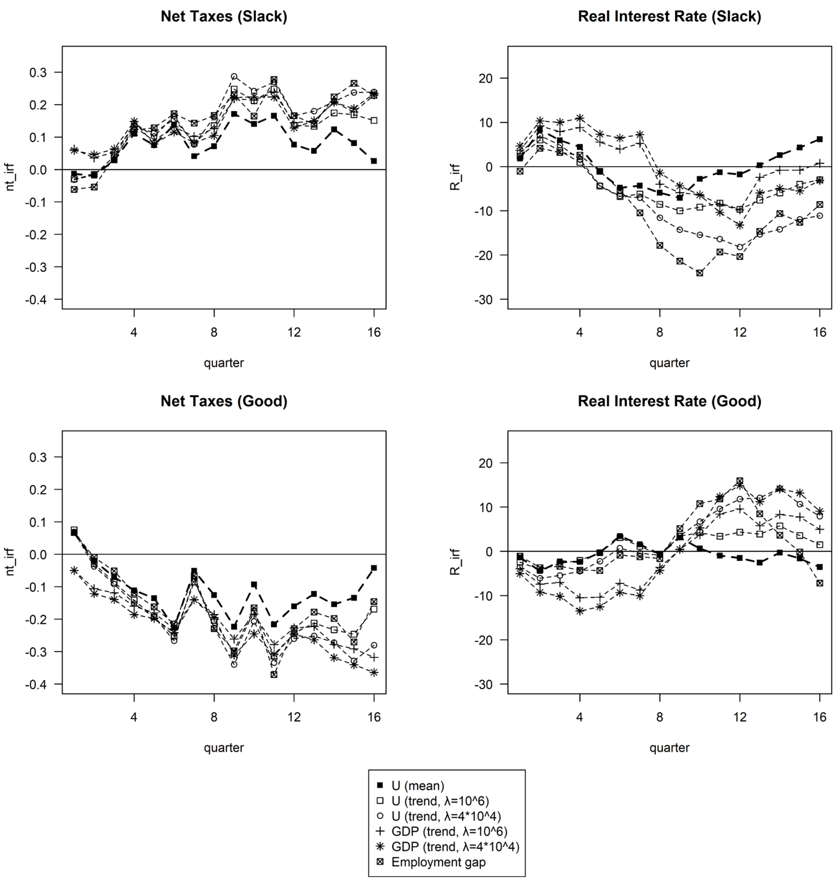

Figure 8: State-dependent impulse responses to a 1% shock to public consumption. All state variables tested.