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Public debt and state-dependent effects of fiscal policy in the euro area [☆]

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ABSTRACT

We investigate public debt related state dependencies of fiscal policy shocks for fifteen euro area economies during the period from 2000:Q1 to 2019:Q4. Our estimated impulse response functions suggest that the impact of fiscal policy shocks varies depending on the level of public debt characterizing an economy. Macroeconomic variables, notably output and consumption, go up in response to a positive government spending shock in the high-debt cross-sectional state, and these responses are distinctly different from those in the low-debt state. Using an extended model that considers both cross-sectional and time-serial high- and low-debt states we find that, for euro area economies, cross-sectional debt variation is more important than time-serial debt variation in driving differences in the responses of macroeconomic variables to government spending shocks.

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1. Introduction

Public debt has been a rising concern for policy makers as of the recent financial and European sovereign debt crises, and is set to remain a primary concern for many years to come in the aftermath of the global pandemic crisis that has seen public debt levels reach historical heights for economies across the world.

While the potential effects of public debt levels have received a lot of attention, we focus on an aspect that has not been studied as much, namely the idea that the impact of fiscal policy shocks on economic activity and economic expectations varies across space and time depending on the level of public debt. The potential state-dependence of fiscal policy is a key issue for individual euro area economies in the face of high and rising public debt levels, given that monetary policy can-

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not be tailored to their specific needs and that this common monetary policy is itself constrained by the zero-lower bound, leaving fiscal policy as the main policy tool that can be used to alleviate the impact of business cycle recessions or major crises such as the COVID-19 pandemic or the Russian invasion of Ukraine.

To explore the above issue, we estimate the effects of fiscal policy shocks on economic activity and economic expectations allowing for state-dependent effects associated with the debt-to-GDP ratio. Given the substantial variation in public debt levels across euro area economies, we identify high- and low-debt states utilizing this cross-sectional variation at each point in time rather than focusing solely on time-series variation in debt-to-GDP as in previous work.¹ Considering cross-sectional variation in debt-to-GDP to identify low- and high-debt states makes good sense in the case of the euro area where the latter source of variation accounts, based on our calculations, for nearly 80 percent of the total variation in debt-to-GDP across these economies over time.² Using the *Jordà (2005)* local projection approach, we then estimate impulse response functions for a low- and a high-debt state for a panel of fifteen euro area economies during the period from 2000:Q1 to 2019:Q4.

Our results provide strong evidence in favor of state-dependent effects. When we consider cross-sectional variation in debt-to-GDP, we find that real GDP, real consumption and the inflation rate increase in response to an expansionary government spending shock in the high-debt state, differently than in previous work using time-series variation to identify debt states. Furthermore, these responses are significantly different than those in the low-debt state. We also find that measures of survey expectations such as consumption intentions, inflation expectations, firms' selling price expectations and firms' production expectations respond to the shock in a manner resembling the above macroeconomic developments in line with the standard propagation mechanism.³

Using an extended model that considers time-series and cross-sectional high- and low-debt states simultaneously, our results suggest that cross-sectional debt variation is more important in driving cross-country differences in the reaction of output, inflation, consumption intentions, inflation expectations, firms' selling price expectations and firms' production expectations to government spending shocks across the euro area. The same is true for the reaction of consumption expenditures once we purge government spending shocks from anticipation effects.

Our results have important implications for the effectiveness of fiscal policy across euro area economies and beyond. Previous work suggests that government spending is less effective in the face of high debt and might even have adverse effects due to looming fiscal consolidation and investors' concerns about sovereign credit risk (see e.g. *Blanchard et al., 1990; Sutherland, 1997; Corsetti et al., 2012; Huidrom et al., 2020*). Our results suggest that these channels are primarily linked to the evolution of public debt over time. By contrast, cross-sectional variation in public debt affects the effectiveness of fiscal policy in quite the opposite way. As state-dependencies associated with public debt are mainly driven by cross-sectional variation in public debt, this should be taken into account to a larger degree in the assessment and conduct of fiscal policy.

As to the possible reasons behind the above results, it could be that high public debt induces banks to limit the credit they extend, which leads to a higher prevalence of liquidity-constrained agents in high-debt economies. Indeed, empirical estimates of household financial frictions relate positively to public debt-to-GDP ratios in the eurozone.⁴ This could happen simply due to crowding-out as banks in high-debt economies may hold large amounts of domestic government debt, or because debt dilution becomes more likely in a high-debt economy reducing the present value of debt-holding banks' balance sheets and their implied ability to lend, or, finally, due to forward-looking banks viewing the future tax liabilities of households and firms as a factor that reduces the present value of borrowers' net worth. In this sense, public debt could play a similar role to private debt, which has been shown to amplify the effects of fiscal policy (*Klein, 2017; Klein et al., 2022*). While our findings are consistent with private sector credit constraints being tighter in high public debt states, in Section 5 we examine different potential explanations.

The remainder of the paper is structured as follows: In Section 2, we describe the data, in Section 3 we present the econometric approach and in Section 4 we present our empirical findings. In Section 5, we provide a discussion and interpretation of the main results. The last section briefly concludes.

¹ *Geiger and Zachariadis (2021)* exploit time-series variation to identify high- and low-debt states for the US while *Huidrom et al. (2020)* exploit public debt states identified over time, having removed fixed country effects, to explore how fiscal multipliers vary in a panel of 34 countries. These papers find that the effects of positive government spending shocks on consumption are negative when public debt is at the high state.

² Cross-sectional variation is also important in the case of OECD countries, accounting for 77 percent of total variance during the period under study.

³ Related but distinct from our findings here, *Coibion et al. (2021)* find that providing households with information about how high public debt is expected to be in the future, has pronounced effects, with news about higher future debt levels leading households to expect higher inflation.

⁴ Using household-level EU-SILC data for 2008–2018, we construct the share of hand-to-mouth consumers based on households that were in arrears on mortgage and non-housing loan payments or utility bills over the past 12 months, and compute the correlation of each of these measures with debt to GDP and its time-series and cross-sectional components. For example, we compute a correlation of 0.499 between public debt-to-GDP ratios and the fraction of households that were in arrears on their utility bill over the last year, a proxy for the share of hand-to-mouth consumers also used in *Almgren et al. (2022)*.

2. Data

2.1. Macroeconomic data

We measure economic activity using real GDP derived by dividing nominal GDP with the GDP deflator with 2015 as the base year. To measure inflation we use the annual rate of change in the harmonised consumer price index (HICP) for all items.⁵ Government spending is measured as the final consumption expenditure of general government plus gross capital formation.⁶ Those values are in real terms and are seasonally and calendar adjusted. The macroeconomic data that we use in our study for real GDP, inflation, and real government total spending are from the Eurostat database. Household consumption expenditure is also measured in real terms and is provided by the OECD database.⁷ Taking into account the zero lower bound period, we use the Krippner's shadow short rate as an indicator of monetary policy.⁸ Particularly, we use the monthly average of shadow short rates estimates for the Euro Area. Finally, our analysis takes into account the price of crude oil⁹ and the financial market risk aversion measured by the implied volatility index for the major stock market index, VSTOXX.¹⁰

2.2. Survey data

We use survey-based measures of consumers' and firms' expectations in fifteen euro area economies. We mainly focus on consumers' inflation expectations and consumption intentions over the next 12 months. We also consider firms' selling price and production expectations. Particularly, data that we use for agents' expectations are from the Joint Harmonized EU Programme of Business and Consumer Surveys database, which is published monthly by the European Commission.¹¹ The sample size of the survey varies across countries and is generally positively related to their respective population size. The consumer survey is mainly qualitative although, as of 2003, two quantitative questions are asked concerning perceived and expected price changes. However, the results of the questions on consumers' quantitative inflation perceptions and expectations have so far not been part of the European Commission's comprehensive monthly survey data releases. Neither has the micro data set on consumers' quantitative inflation perceptions and expectations been publicly released.¹² Arioli et al. (2017) mention that the quantitative inflation estimates are found to be consistent with the results from the corresponding qualitative survey questions.¹³ Mestre (2007), studying the European Commission Consumer survey, finds that models used by survey respondents were of sufficient quality to enable them to actually build good forecasts. In our analysis, we concentrate on qualitative data since quantitative European data are currently not publicly available.

We use seasonally adjusted monthly data for total consumers and firms across fifteen euro-area economies¹⁴ for the period 2000:Q1-2019:Q4. As mentioned above, the data that the European Commission uses for inflation expectations are qualitative and are obtained from the question "By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will...". Consumers have six options to answer this question as follows: prices will increase more rapidly (PP), increase at the same rate (P), increase at a slower rate (E), stay about the same (M), fall (MM), and don't know (N). Data for consumption intentions over the next twelve months derive from the question "Compared to the past 12 months, do you expect to spend more or less money on major purchases (furniture, electrical/electronic devices, etc.) over the next 12 months? I will spend...". Consumers have six options to answer this question as follows: much more (PP), a little more (P), about the same (E), a little less (M), much less (MM), and don't know (N). Similarly, data for firms' selling price expectations derive from the question "How do you expect your selling prices to change over the next 3 months? They will...increase, remain unchanged, decrease." We also use data for firms' production expectations derived from the following question: "How do you expect your production to develop over the next 3 months? It will...increase, remain unchanged, decrease."

Since the data obtained from the questionnaire is qualitative, they have to be quantified. To quantify these qualitative data, we use the simple balance statistic defined as the difference between the proportions of respondents considered,

⁵ The Harmonised Indices of Consumer Prices (HICP) measure the changes over time in the prices of consumer goods and services acquired by households. They give a comparable measure of inflation as they are calculated according to harmonised definitions. Data is available on a monthly basis on the following link https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_hicp_manr&lang=en

⁶ Data is available here https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_10_gdp&lang=en

⁷ Data for household consumption expenditure is from the link below <https://stats.oecd.org/#>, where the data for private final consumption expenditure by durability can be found in the quarterly national accounts section.

⁸ The data that we use are produced from the research of Leo Krippner available at <https://www.rbnz.govt.nz/research-and-publications/research-programme/additional-research/measures-of-the-stance-of-united-states-monetary-policy/comparison-of-international-monetary-policy-measures>

⁹ We smooth the log of commodity price by removing the trend using a Hodrick-Prescott time series filter and then take the smoothed change of the price of crude oil

¹⁰ VSTOXX provides a benchmark of market volatility in European markets. In our study we use the historical data of closing prices.

¹¹ The link for consumers' inflation and consumption expectations as well as firms' selling price expectations is <https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/business-and-consumer-surveys/download-business-and-consumer-survey-data/time-series.en>.

¹² Arioli et al. (2017) mention that following the agreement between the European Commission (DG ECFIN) and its EU partner institutes that perform the data collection at national level, the ECB was given access to the (anonymised) micro data set for the purpose of conducting their evaluation and related future research jointly with DG ECFIN.

¹³ Based on the evaluation of consumers' survey data Arioli et al. (2017), respondents who indicate rising inflation for the qualitative questions generally report higher inflation rates also for the quantitative questions.

¹⁴ The nineteen euro-area economies minus Cyprus, Malta, Latvia and Lithuania due to data unavailability.

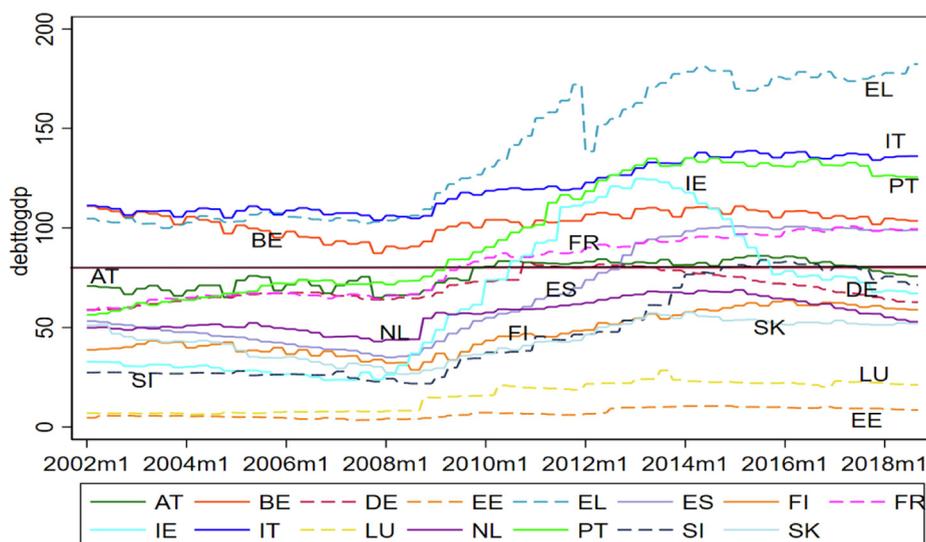


Fig. 1. Debt-to-GDP ratio. *Notes:* This figure presents debt-to-GDP levels over time and across countries in the euro area. Countries included are: Austria (AT), Belgium (BE), Germany (DE), Estonia (EE), Greece (EL), Spain (ES), Finland (FI), France (FR), Ireland (IE), Italy (IT), Luxembourg (LU), the Netherlands (NL), Portugal (PT), Slovenia (SI) and the Slovak Republic (SK).

e.g., in Nielsen (2003) and Lyziak (2010). The simple balance statistic is given as the difference between positive and negative answering options measured as percentage points of total answers, and is calculated as $B = (PP + 1/2P) - (1/2M + MM)$ on the basis of weighted averages that add up to 100, $PP + P + E + M + MM + N = 100$. Thus, values range from -100 , when all respondents choose the negative option to $+100$, when all respondents choose the positive option. The Commission calculates and seasonally adjusts the balance series that we use in our analysis.

Finally, since the real GDP and government spending data that we use in our analysis, are only available with quarterly frequency, we aggregate the monthly series of consumers' and firms' expectations using quarterly averages.

2.3. The state of public finances

To study potential state-dependency associated with public debt differentials in the euro area, we will exploit methods that can help us identify different debt states. The transition variable we use is the debt-to-GDP ratio, which is the quarterly consolidated gross government debt in percent of GDP provided by the Eurostat database.¹⁵ Fig. 1 presents the debt-to-GDP ratio across fifteen euro area economies along with an indication for 80 percent, which is often referred to as a critical threshold in the literature (see e.g. Reinhart and Rogoff, 2010).

Overall, variation in debt-to-GDP levels over time and across countries in the euro area is large. As we can see in Fig. 1, the financial crisis of 2008 played a crucial role increasing government debt for all of the countries of our sample. At the same time, the dispersion of debt-to-GDP levels across countries in the euro area increased markedly.

As an indication for the role of cross-sectional and time-serial variation in our sample we consider the variance decomposition of debt-to-GDP. We find that 79.43 percentage of total variance is explained by between variation, and 20.57 percentage is explained by within variation.¹⁶ This already highlights the important role of cross-sectional variation in debt-to-GDP ratios across euro area economies.

To scrutinize cross-sectional and time-serial variation, we construct states using smooth transition functions in which we evaluate government debt as a percentage of GDP in line with previous studies (see, for example, Teräsvirta (1994), Jansen and Teräsvirta (1996), Geiger and Zachariadis (2021)). In particular, following Granger and Teräsvirta (1993), we employ the logistic function and evaluate the backward-looking seven quarter moving average of the debt-to-GDP ratio, which we denote z_{it} .¹⁷ Since we want to study transition processes over time and across countries, we analyze each case separately by constructing two different state variables.

¹⁵ Quarterly data for general government gross debt are provided at https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10q_ggdebt&lang=en. Public debt is defined in the Maastricht Treaty as consolidated general government gross debt at nominal value, outstanding at the end of the year. Data for the general government sector are consolidated between subsectors at the national level. Data are non-seasonally adjusted.

¹⁶ In decomposing the total variance of debt-to-GDP into within and between variation, we are using the biased-corrected variance estimates (i.e., multiplied by $n/(n-1)$ where n is equal to the number of panels).

¹⁷ These types of smooth transition functions are widely used to model differential dynamic responses to structural shocks estimated from univariate as well as multivariate models. The logistic transformation effectively smooths the time series, and its continuous nature makes estimates more stable and precise compared to binary state variables, while the fact that it is bounded by 0 and 1 allows for a simple interpretation.

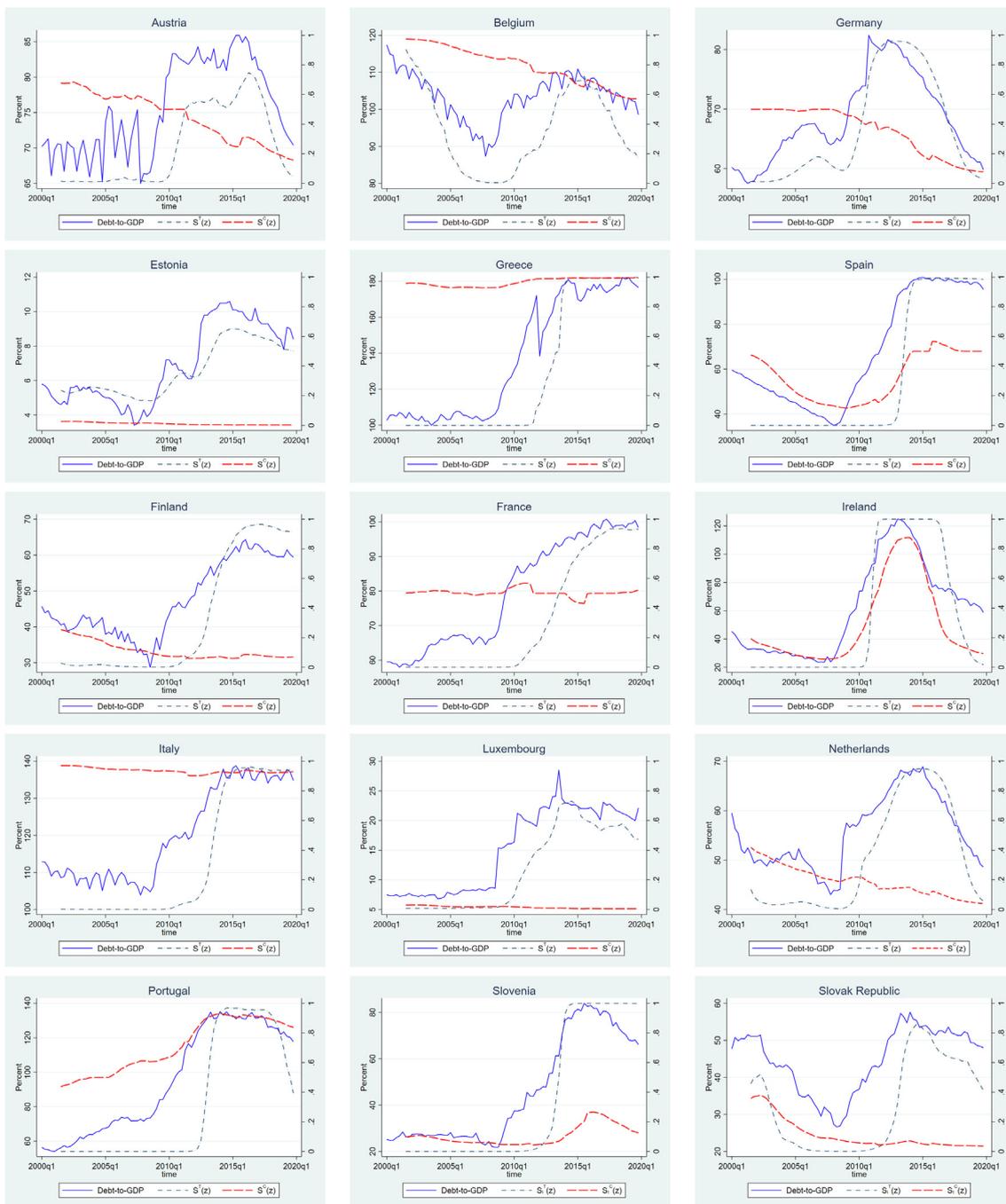


Fig. 2. State variables of public finances. Notes: The figure shows the two transition function (right axis) along with the debt-to-GDP ratio (left axis).

First, we capture time-serial variation for each country i as

$$S^T(z_{it}) = \frac{\exp(\theta \frac{z_{it} - c_i}{\sigma_z})}{1 + \exp(\theta \frac{z_{it} - c_i}{\sigma_z})}$$

where c_i is country-specific and sets the proportion of the sample the economy is located in either state, and σ_z is the standard deviation of the state variable z . Here, as in Geiger and Zachariadis (2021), c is selected so that approximately two-thirds

of the distribution of z_{it} is in a state of low debt so that the average economy is operating in a low debt regime most of the time.¹⁸ The parameter θ determines how much time the state variable spends close to the $[0,1]$ bounds of the process. Higher values move the model closer to a discrete regime-switching setup. In line with [Tenreyro and Thwaites \(2016\)](#), [Geiger and Zachariadis \(2021\)](#), and others, we set θ to 3 which gives an intermediate degree of intensity to the regime switching.¹⁹ In the robustness section, we explore alternative parameter assumptions.

Second, we capture cross-sectional variation of debt-to-GDP as

$$S^c(z_{it}) = \frac{\exp(\theta \frac{z_{it} - c_t}{\sigma_z})}{1 + \exp(\theta \frac{z_{it} - c_t}{\sigma_z})}$$

where c_t is time-specific.

[Fig. 2](#) shows the debt-to-GDP ratio for each country i along with the smooth transition function $S^T(z_{it})$ which captures the time-serial variation, and $S^c(z_{it})$ which captures the cross-sectional variation. Comparing the two transition functions, we see that the two transition processes pick up different variation in the data. While the time-serial smooth transition process mainly reflects the patterns of the raw time series, the cross-sectional smooth transition process reflects the relative debt position within the population of Eurozone countries. Notably, $S^c(z_{it})$ is relatively low for countries such as Estonia, Finland, Luxembourg, Slovenia and Slovak Republic, while for Greece, Italy and Portugal it is high.

2.4. Government spending

Following previous practice, we measure government spending as the sum of (the log levels of) real gross government investment and the real final consumption expenditure of general government. To evaluate changes in government spending we employ the [Blanchard and Perotti \(2002\)](#) identification scheme. This identification scheme is based on the assumption that within-quarter government spending does not *contemporaneously* respond to macroeconomic variables. [Blanchard and Perotti \(2002\)](#) justify this assumption by pointing out that institutional procedures imply that the adjustment of government spending in response to business cycle fluctuations is implemented with a certain lag so that at high enough frequency, i.e. within a quarter, there is little or no response of fiscal policy to such fluctuations. Since the set of controls in Eq. (1) below includes lagged values of GDP and government spending in addition to current government spending, the shock is simply given by the coefficient of current government spending which amounts to the arguably exogenous shock from [Blanchard and Perotti \(2002\)](#).

To take account of potential anticipation effects not fully captured by our identification scheme, in the robustness analysis we utilize changes in a purged measure of government spending. We purge this measure by regressing government spending on expectations about spending from the OECD Economic Outlook. We then utilize the residuals from this regression instead of the raw government spending series in our local projections (see e.g. [Ramey \(2011\)](#) and [Auerbach and Gorodnichenko \(2012\)](#) for similar approaches). This further handles any anticipation effects that might result into endogeneity biases and in particular, simultaneity issues between our shock and the state variable, potentially arising, e.g., from a looming consolidation.

3. The econometric approach

The econometric framework that we use to estimate the dynamic responses of agents' expectations to fiscal policy shock is the local projection method developed by [Jordà \(2005\)](#). This method allows us to estimate the response of a dependent variable (e.g. real GDP) to shocks at different horizons conditional on the state of the economy. Given the flexibility of the local projection method, we introduce state-dependence in the evaluation of the effects of government spending. Specifically, following [Auerbach and Gorodnichenko \(2013\)](#), [Jordà et al. \(2013\)](#), [Tenreyro and Thwaites \(2016\)](#), [Ramey and Zubairy \(2018\)](#), we allow that coefficients of the model vary according to the state of the economy by incorporating interactions terms and estimate the equation below for each forecasting horizon h .

$$\begin{aligned} y_{i,t+h} = & \alpha_{i,h} + \beta_h G_{i,t} + \sum_{j=1}^p \gamma_{h,j} y_{i,t-j} + \sum_{j=1}^p \delta_{h,j} G_{i,t-j} + \sum_{j=1}^p \zeta_{h,j} \mathbf{X}_{i,t-j} \\ & + S^S(z_{i,t-1})(\alpha_{i,h}^S + \beta_h^S G_{i,t} + \sum_{j=1}^p \gamma_{h,j}^S y_{i,t-j} + \sum_{j=1}^p \delta_{h,j}^S G_{i,t-j} + \sum_{j=1}^p \zeta_{h,j}^S \mathbf{X}_{i,t-j}) \\ & + \theta_h D_{i,t}^{rec} + \kappa_h t + \lambda_h t^2 + \epsilon_{i,t+h} \end{aligned} \quad (1)$$

where the dependent variable, $y_{i,t+h}$, denotes in each case the log of real GDP, the actual inflation rate, the log of actual consumption expenditure, consumers' inflation expectations, and consumption intentions over the next year in country i at time

¹⁸ Particularly, c is the 66th percentile of the distribution of the backward-looking seven quarter moving average of the debt-to-GDP ratio.

¹⁹ The smooth transition process is parameterized along the lines of [Auerbach and Gorodnichenko \(2013\)](#), [Tenreyro and Thwaites \(2016\)](#) and [Ramey and Zubairy \(2018\)](#).

t . We also consider additional dependent variables such as production expectations and selling price expectations of firms in the total manufacturing sector. The state variable indicates the state of public finances and is captured by the smooth transition function $S^s(z_{i,t-1})$, which we evaluate at 0 (low debt) and 1 (high debt).²⁰ The transition function $S^s(z_{i,t-1})$ depending on the dimension that we want to explore could be either time-serial ($s = T$) or cross-sectional ($s = C$). Coefficients on $G_{i,t}$ capture the effects of an increase in the log of government spending in country i at time t as described in Section 2.2. We regress the dependent variable on its lagged values, $y_{i,t-j}$, current and lagged values of government spending, $G_{i,t-j}$.

Also, we consider a set of control variables which are used to capture the state of the business cycle. Those control variables are contained in vector $\mathbf{X}_{i,t}$, which are the log level of real GDP, the annual rate of change of harmonised consumer price index, the euro area shadow short rate, smoothed log of price of crude oil and the closing value of VSTOXX. Moreover, we control for recession periods by including a country-specific recession indicator, $D_{i,t}^{rec}$, which is specified based on a business cycle dating algorithm of [Harding and Pagan \(2002\)](#). In particular, we identify potential turning points as the local minima and maxima in the quarterly GDP series. Finally, taking into account the upward trend in government spending, we control for a linear and a quadratic time trend. Based on the Akaike information criterion (AIC), the number of lags p is equal to one.

We calculate the confidence bands using the [Driscoll and Kraay \(1998\)](#) standard errors that allow arbitrary correlations of the error term across countries and time (see, for example, [Iacoviello and Navarro \(2019\)](#)). The impulse response functions (IRFs) in a state of low-debt are just the sequences of the estimated β_h coefficients, while in a high-debt state are the sequences of $\beta_h + \beta_h^s$.

In our second specification, we estimate our model by simultaneously considering the two states, $S^T(z_{i,t-1})$ and $S^C(z_{i,t-1})$, as per the equation below:

$$\begin{aligned}
 y_{i,t+h} = & \alpha_{i,h} + \beta_h G_{i,t} + \sum_{j=1}^p \gamma_{hj} y_{i,t-j} + \sum_{j=1}^p \delta_{hj} G_{i,t-j} + \sum_{j=1}^p \zeta_{hj} \mathbf{X}_{i,t-j} \\
 & + S^T(z_{i,t-1})(\alpha_{i,h}^T + \beta_h^T G_{i,t} + \sum_{j=1}^p \gamma_{hj}^T y_{i,t-j} + \sum_{j=1}^p \delta_{hj}^T G_{i,t-j} + \sum_{j=1}^p \zeta_{hj}^T \mathbf{X}_{i,t-j}) \\
 & + S^C(z_{i,t-1})(\alpha_{i,h}^C + \beta_h^C G_{i,t} + \sum_{j=1}^p \gamma_{hj}^C y_{i,t-j} + \sum_{j=1}^p \delta_{hj}^C G_{i,t-j} + \sum_{j=1}^p \zeta_{hj}^C \mathbf{X}_{i,t-j}) \\
 & + S^T(z_{i,t-1})S^C(z_{i,t-1})(\alpha_{i,h}^{TC} + \beta_h^{TC} G_{i,t} + \sum_{j=1}^p \gamma_{hj}^{TC} y_{i,t-j} + \sum_{j=1}^p \delta_{hj}^{TC} G_{i,t-j} \\
 & + \sum_{j=1}^p \zeta_{hj}^{TC} \mathbf{X}_{i,t-j}) + \theta_h D_{i,t}^{rec} + \kappa_h t + \lambda_h t^2 + \epsilon_{i,t+h}.
 \end{aligned} \tag{2}$$

With this specification we further isolate the partial effects of state dependencies arising from the cross-sectional and time-serial dimension of variation in public debt. Moreover, by considering the two phenomena simultaneously we can evaluate their relative importance.

4. Results

4.1. Baseline

In this section, we present the impulse responses to a positive government spending shock for real GDP, the actual level of inflation and real consumption spending, along with their inflation expectations and consumers' buying intentions. More specifically, [Fig. 3](#) shows the impulse response functions obtained from estimating Eq. (1) with $s = T$ so that the state function captures time-serial variation, while [Fig. 4](#) shows the corresponding impulse response functions from estimating Eq. (1) with $s = C$ so that the state function captures cross-sectional variation. The first two columns show the responses to a one-standard-deviation shock in government spending in the low and high-debt states respectively. The third column presents the t -statistic showing the significance of the difference between high-debt and low-debt states, together with one and two standard error bands corresponding approximately to the 68 and 96 percent confidence intervals.

In [Fig. 3](#) where we consider time-serial variation, we see that a positive government spending shock has positive and significant impact in the low-debt state as compared to typically insignificant impact in the high-debt state for all measures we consider: real GDP, the actual level of inflation, real consumption spending, consumers' buying intentions and consumers' inflation expectations. As shown in the third column of [Fig. 3](#), these responses are often significantly different in the low-versus the high-debt state for real GDP, the inflation rate and real consumption.²¹ These results are well in line with the existing literature. Lower effectiveness, or even negative effects of government expenditures in high-debt economies, are docu-

²⁰ In line with previous literature we use lagged values of the state variables to avoid contemporaneous feedback from policy actions (see e.g. [Auerbach and Gorodnichenko, 2012](#)).

²¹ The same goes for firms' production expectations and selling price expectations shown in Figure A1(a).

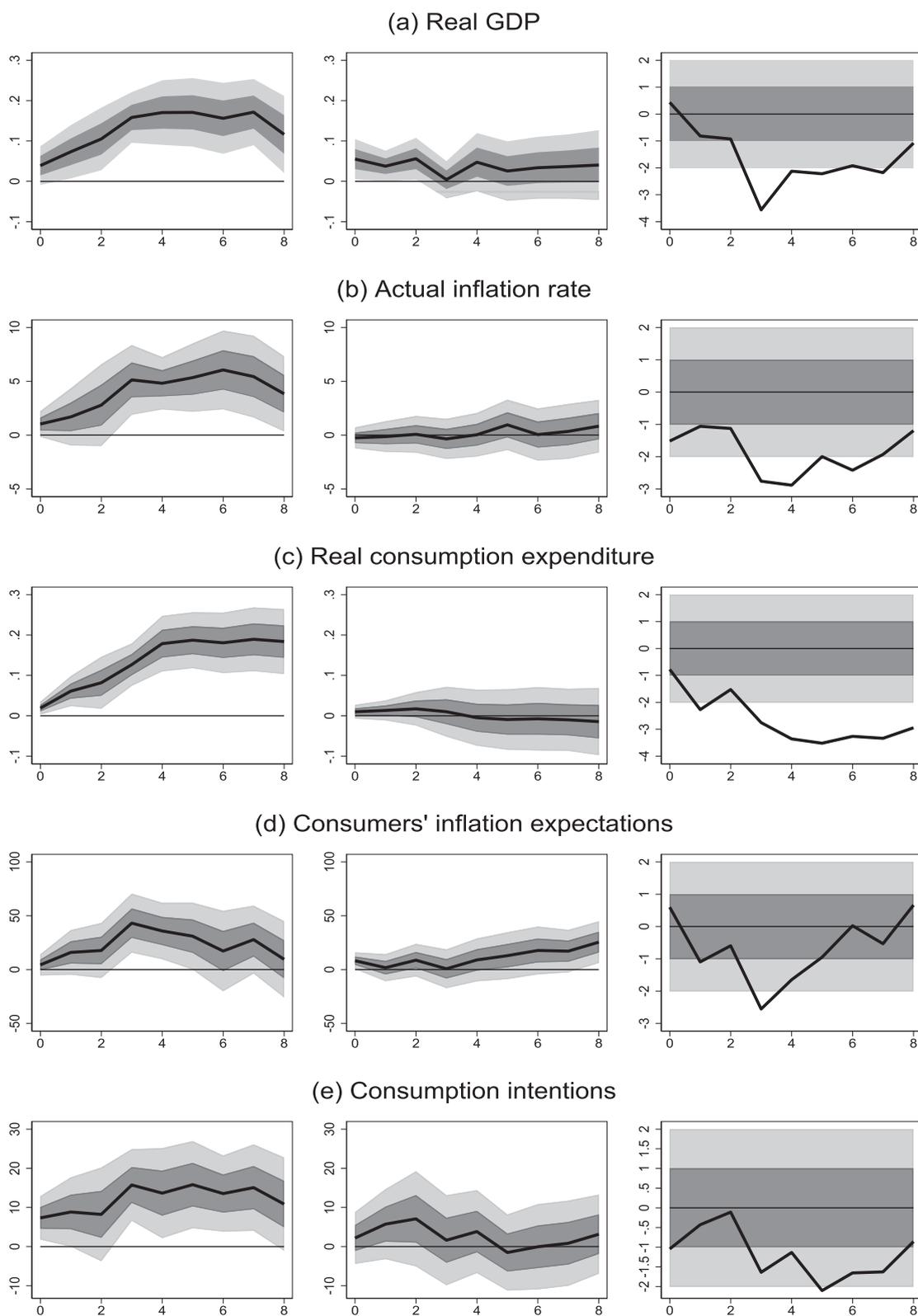


Fig. 3. Responses to positive government spending shock - State variable $S^T(z_{i,t-1})$. Notes: In each Panel, the first column shows responses together with one- and two-standard-error bands in the low-debt state, the second column responses in the high-debt state, and the third column the t-statistic showing the significance of the difference between the high-debt state and the low-debt state.

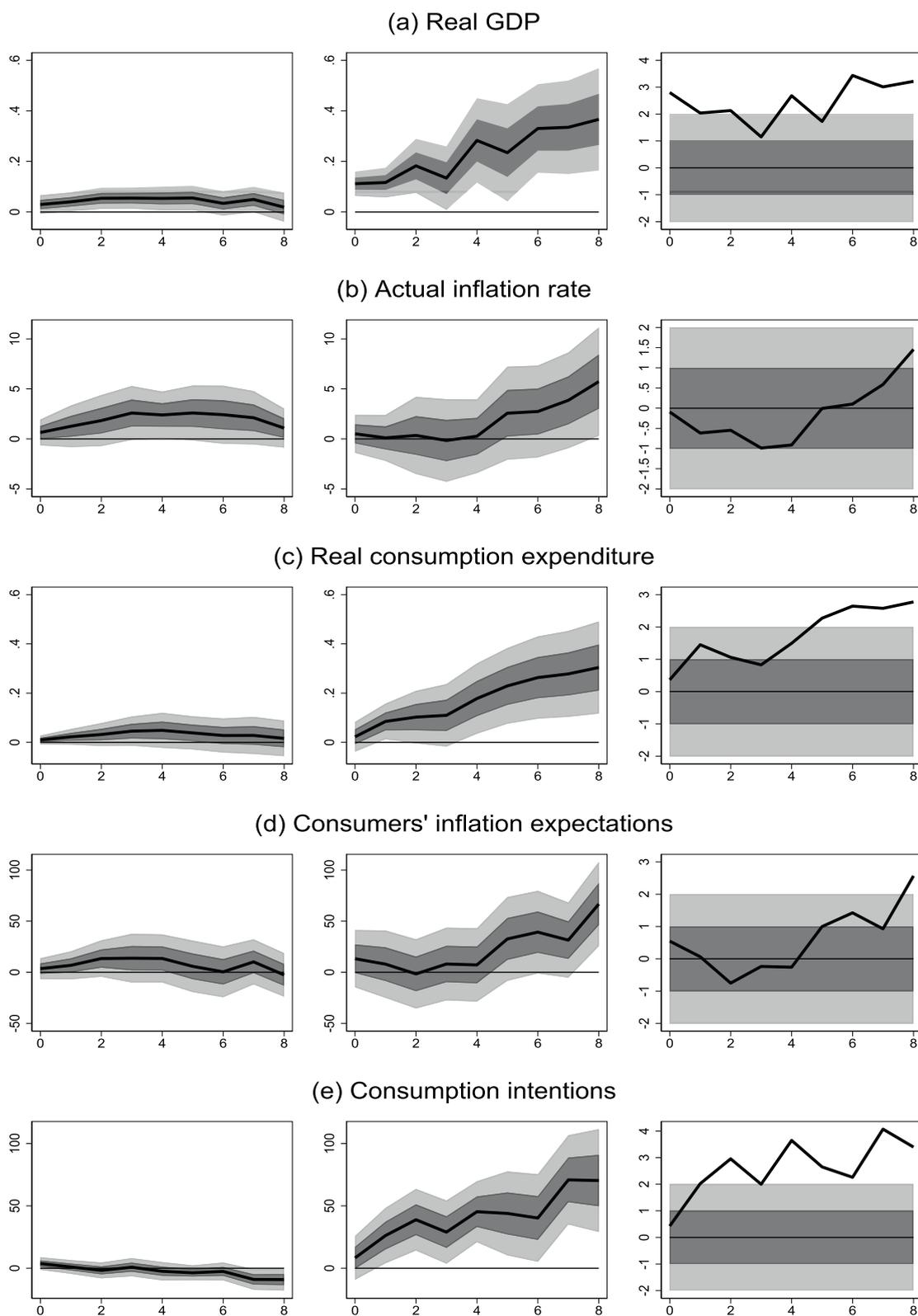


Fig. 4. Responses to positive government spending shock - State variable $S^c(Z_{it-1})$. Notes: In each Panel, the first column shows responses together with one- and two-standard-error bands in the low-debt state, the second column responses in the high-debt state, and the third column the t-statistic showing the significance of the difference between the high-debt state and the low-debt state.

mented in several studies entertaining comparable empirical analyses (see e.g. Corsetti et al., 2012; Huidrom et al., 2020; Geiger and Zachariadis, 2021).

Shifting our focus to cross-sectional variation, in Fig. 4 we see that a government spending shock has positive and significant impact in the high-debt state as compared to typically insignificant impact in the low-debt state for all measures we consider, i.e. for real GDP, the actual inflation rate, real consumption spending, consumers' inflation expectations and consumption intentions. This effectively reverses the findings regarding the state-dependent impact of government spending shocks based on time-serial variation shown in Fig. 3.

As we can see in Fig. 4(a), real GDP increases on impact after a positive government spending shock and the response remains positive and significant all the way to the end of the eight-quarter horizon we consider. This positive response in the cross-sectional high-debt state is much stronger as compared to the low-debt state where the responses are smaller but become significantly positive between two and four quarters after impact. As a result, as shown in the third column of Fig. 4(a), the responses in the high-debt state are typically significantly different (greater) than those in the low-debt state. Moreover, the response of firms' production expectations presented in Figure A1(b) is consistent with the response of real GDP: firms' increase their production expectations on impact and this positive impact persists for six quarters after the shock hits. Again, this positive response of firms' production expectations in the high-debt cross-sectional state is greater and statistically different from that in the low-debt state.

Turning to actual inflation and inflation expectations in Figs. 4(b) and 4(d) respectively, we see that there is a delayed positive response to a government spending shock in the high-debt state, which turns significant by the eighth quarter after impact in both cases. Interestingly, the increase in real GDP in Fig. 4(a) precedes the response of the actual inflation rate and of consumers' inflation expectations in Figs. 4(b) and 4(d) respectively, going up on impact while consumers come to anticipate higher inflation starting in the seventh quarter after impact.²² This suggests that inflation expectations and inflation go up following higher economic activity rather than the other way round.

In Fig. 4(c), we see that households' real consumption expenditure increases in response to a positive government spending shock in the high-debt state, and that this increase is typically statistically significant and quite persistent.²³ At the same time, the response in the low-debt state revolves insignificantly around zero. The third column of Fig. 4(c) shows that the difference between the response in the high-debt and the low-debt state is typically statistically significant beginning in the first quarter after impact.

Comparing Figs. 4(c) and 4(e), we see that the response of consumption spending is entirely consistent with the response of consumption intentions which move positively, significantly and persistently following a government spending shock in the high-debt state. As shown in Fig. 4(e), consumers in the high-debt state increase their consumption intentions following a positive government spending shock, while the response of consumers in the low-debt state is statistically insignificant. The distinct response of consumption in the high-debt state as compared to the low-debt state could be due to the anticipation of higher taxes in high debt economies reducing the present value of consumers' net income flows thus rendering forward-looking banks less willing to lend to them. These borrowing-constrained or liquidity constrained consumers in high-debt economies would tend to raise their consumption intentions and expenditure more than those in low-debt economies following an unexpected increase in government spending.

Fiscal Multipliers

To what extent do non-linearities in the response to government expenditure shocks feature into different fiscal multipliers associated with time-serial and cross-sectional variation in public debt? Table 1 shows estimates of spending multipliers, i.e. the change of real GDP to a discretionary change in government spending at short to medium term horizons.²⁴ In other words, the integral under the impulse response of GDP divided by the integral of the impulse response of government spending. Following Ramey and Zubairy (2018), among others, we estimate the multipliers in an integrated approach by reformulating the estimation problem as an instrumental variable (IV) estimation. To this effect, we rewrite Eq. (1) as

$$\begin{aligned} \sum_{i=0}^h y_{i,t+h} &= \alpha_{i,h} + \beta_h \sum_{i=0}^h G_{i,t+h} + \sum_{j=1}^p \gamma_{hj} y_{i,t-j} + \sum_{j=1}^p \delta_{hj} G_{i,t-j} + \sum_{j=1}^p \zeta_{hj} \mathbf{X}_{i,t-j} \\ &+ S^s(Z_{i,t-1})(\alpha_{i,h}^s + \beta_h^s \sum_{i=0}^h G_{i,t+h} + \sum_{j=1}^p \gamma_{hj}^s y_{i,t-j} + \sum_{j=1}^p \delta_{hj}^s G_{i,t-j} + \sum_{j=1}^p \zeta_{hj}^s \mathbf{X}_{i,t-j}) \\ &+ \theta_h D_{i,t}^{rec} + \kappa_h t + \lambda_h t^2 + \epsilon_{i,t+h} \end{aligned}$$

²² Similarly, the response of firms' selling price expectations in Figure A1(b) follows the increase in production expectations which becomes evident on impact in the same figure.

²³ In particular, consumers raise their consumption beginning in the first quarter after impact until the eighth quarter. This relatively long duration of the government spending shock impact on actual consumption along with the delayed response of inflation expectations in the seventh and eighth quarters, suggests the possibility that feed-back effects of the latter consistent with a standard Euler equation may play a role in sustaining the initial rise in consumption.

²⁴ We calculate spending multipliers only up to horizon 8 as spending shocks estimated following the Blanchard and Perotti (2002) tend to exhibit high instrument relevance over the short and medium horizon, but are somewhat weaker instruments over the long run (Ramey and Zubairy, 2018).

Table 1
Spending multiplier estimates.

(a) Time-serial variation					
horizon	IV		cumulated IRFs		high debt
	low debt	high debt	low debt	high debt	
0	0.26	0.20	0.20	0.28	0.28
4	0.72	0.46	0.98	0.38	0.38
8	1.02	0.66	1.18	0.58	0.58
(b) Cross-sectional variation					
horizon	IV		cumulated IRFs		high debt
	low debt	high debt	low debt	high debt	
0	0.20	0.41	0.15	0.57	0.57
4	0.51	0.82	0.60	1.08	1.08
8	0.87	1.23	0.71	1.51	1.51

Notes: Multipliers are either estimated through the instrumental variable (IV) approach or as the ratio of cumulated IRFs of the log of real GDP and the log of real government spending. The estimated elasticities are converted into spending multipliers based on the sample average of the ratio of GDP to government spending.

with the sum of the log of real GDP from t to $t+h$, $\sum_{i=0}^h y_{i,t+h}$, being regressed on the sum of government spending, $\sum_{i=0}^h G_{i,t+h}$, where the latter is instrumented using $G_{i,t}$ and lagged values of real government spending as well as the log of real GDP. In addition, we also estimate multipliers as the ratio of cumulated responses of the log of real GDP and the log of real government expenditures based on Eq. (1) from above. The estimated elasticities are converted into spending multipliers using the sample average of the ratio of GDP to government spending.

The estimates of spending multipliers shown in Table 1 reflect the state-dependent patterns evident in the impulse response functions shown in Figs. 3 and 4. Considering time-serial variation in public debt, multipliers are larger when the economy is located in the low-debt state as compared to the high debt state. In the former case, spending multipliers are around one over the medium run whereas they remain clearly below one in the high-debt case. The opposite holds true when we consider the cross-sectional variation in public debt, with spending multipliers exceeding values of one when debt is high in the cross-sectional dimension and clearly below one when public debt is low. Multipliers are of similar orders of magnitude irrespective of whether they are estimated through the IV approach or through cumulated IRFs. The estimated spending multipliers are within the range documented in the existing literature (see e.g. Ramey, 2011) and square well with the results in Górnicka et al. (2020), who show that multipliers in Europe are at times well below one, especially during the so called Sovereign Debt Crisis.

4.2. Multi-state model

Next, we estimate our model shown in Eq. (2) which considers the two states, $S^T(z_{i,t-1})$ and $S^C(z_{i,t-1})$, simultaneously. Our results are presented in Figs. 5 and A2 to A7 for real GDP, the actual inflation rate, real consumption spending, consumers' inflation expectations, consumers' buying intentions, firms' production expectations and firms' selling price expectations respectively. Eq. (2) allows for four different cases depending on the realization of each of the two states. Thus, we have a low-debt state (given by parameter β_h) shown in sub-figure (a) of each of Figs. 5 and A2-A7, a high-debt time-serial state (given by $\beta_h + \beta_h^T$) shown in sub-figure (b), a high-debt cross-sectional state (given by $\beta_h + \beta_h^C$) shown in sub-figure (d), and a high-debt state in both dimensions (given by $\beta_h + \beta_h^T + \beta_h^C + \beta_h^{TC}$) shown in sub-figure (e) of each Figure.

Moreover, in sub-figures (c), (f), (g), (h) and (i) of Figs. 5 and A2-A7 we show the t-statistics for the null hypothesis that the responses for each pair of the four cases shown in sub-figures (a), (b), (d) and (e) are equal. More specifically, in sub-figure (c) we compare the responses in sub-figures (a) and (b) shown in the same row (i.e. test the null hypothesis that $\beta_h^T=0$), in sub-figure (f) we compare the responses in sub-figures (d) and (e) shown in the same row (i.e. test the null that $\beta_h^T + \beta_h^{TC}=0$), in sub-figure (g) we compare the responses in sub-figures (a) and (d) shown in the same column (i.e. test the null that $\beta_h^C=0$), in sub-figure (h) we compare the responses in sub-figures (b) and (e) shown in the same column (i.e. test the null that $\beta_h^C + \beta_h^{TC}=0$), and in sub-figure (i) we compare the responses in sub-figures (a) and (e) shown across the diagonal (i.e. test the null that $\beta_h^T + \beta_h^C + \beta_h^{TC}=0$).

Overall, the results from estimating the multi-state Eq. (2) concur with those from estimating our baseline Eq. (1). That is, in the low-debt state, responses are significantly greater than in the high-debt time serial state as shown in sub-figure (c) of Figs. 5 and A2 to A7, and significantly smaller than those in the high-debt cross-sectional state as shown in sub-figure (g) of Figs. 5, A3, and A5 for real GDP, consumption expenditure and consumption intentions respectively, as well as for firms' production expectations and selling price expectations in Figures A6 and A7, but not in Figures A2 and A4 for inflation and inflation expectations.

Our extended multi-state specification where we model the effects of the different state variables simultaneously, helps us disentangle time-serial and cross-sectional variation in public debt-to-GDP and to assess the relative importance of mech-

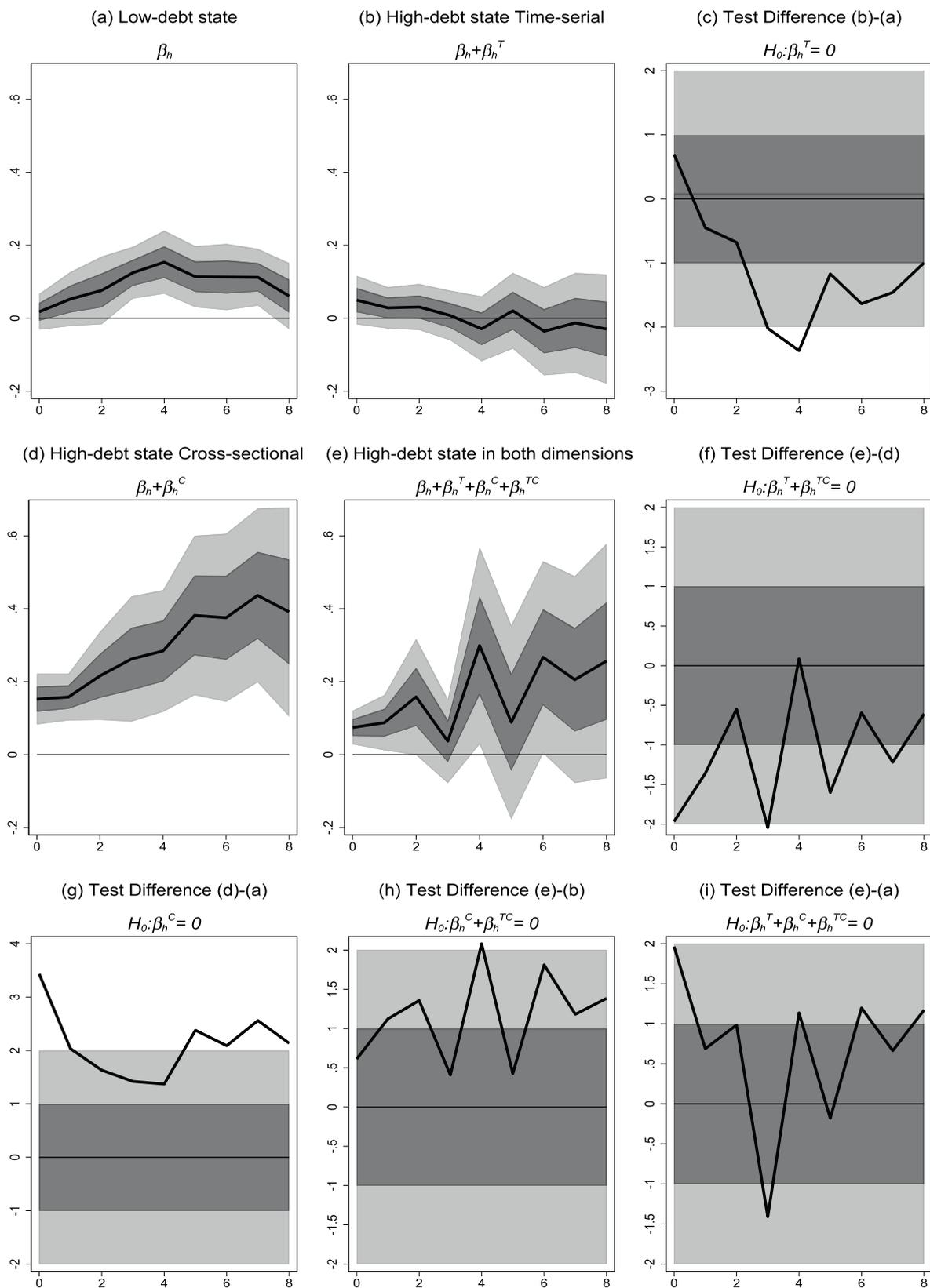


Fig. 5. Responses of real GDP to positive government spending shock. *Notes:* Subfigures (a), (b), (d), and (e) show state-dependent impulse responses together with one and two standard error bands corresponding approximately to the 68 and 96 percent confidence intervals. The solid lines in the remaining sub figures show the t-statistics for the null hypothesis that the responses for each pair of the four cases shown in sub-figures (a), (b), (d) and (e) are equal.

anisms active in, e.g., a state of high cross-sectional debt versus those active in a state of high time-serial debt, for the determination of macroeconomic variables and economic expectations. As we can see in sub-figure (e) of Figs. 5, A2, A4 and A5, real output, the actual inflation rate, inflation expectations and consumption intentions go up following a positive government spending shock in a state where both cross-sectional and time-serial debt-to-GDP levels are high, suggesting that mechanisms active in the high cross-sectional debt state dominate. This also holds for firms' production expectations and selling price expectations in sub-figure (e) of Figures A6 and A7. The reverse is the case in sub-figure (e) of Figure A3 for actual consumption expenditure. However, once we purge our government spending shocks from anticipation effects, the response of actual consumption spending shown in sub-figure (e) of Figure A8 concurs with the results for the other variables, corroborating that mechanisms active in the high cross-sectional debt state dominate those in the high time-serial debt state for the macroeconomic and expectations variables we consider.

4.3. Robustness

4.3.1. Anticipation effects

In this section, we evaluate the robustness of our main results. We now take into account anticipation effects by purifying the changes of government spending of the anticipated component. To this purpose, we use expectations of real total government consumption and real government gross fixed capital formation from the OECD Economic Outlook. Estonia, Slovenia and the Slovak Republic are now excluded as we have data gaps for government consumption expectations and no data for government gross fixed capital formation expectations for these three countries. We note that even though forecasts are made twice a year, the forecasting horizon is on a quarterly basis and we have expected values for each quarter.²⁵

In a first step, we regress the log level of real government spending on log levels of real government consumption and real government investment expectations elicited from the survey of professional forecasters to obtain the residuals to be later used instead of actual government spending. In the second step, we use local projections based on Jordà (2005) and estimate the response of the dependent variables to the forecast error of government spending. The IRFs for each of the variables we consider (real GDP, the actual level of inflation, real consumption spending, consumers' buying intentions and consumers' inflation expectations) are presented in Figs. 6 and 7 for the time-serial and cross-sectional dimensions respectively. These figures show the response of these variables to a fiscal policy shock which captures unanticipated/non-systematic innovations in government spending.

We find that accounting for anticipation effects in Figs. 6 and 7 does not change our baseline results from Figs. 3 and 4 for the time-serial and cross-sectional dimension respectively. A positive government spending shock has positive and significant impact in the low-debt state as compared to typically insignificant impact in the high-debt state for time-serial variation, and positive and significant impact in the high-debt state as compared to typically insignificant impact in the low-debt state in the case of cross-sectional variation.

Allowing for the four different states simultaneously to consider the responses of each dependent variable (real output, the actual inflation rate, actual consumption spending, inflation expectations and consumption intentions) to a positive government spending shock purged from anticipation effects while allowing for the low-debt, high-debt, time-serial and cross-sectional states, results are mostly comparable with the baseline ones.

Notably, as in the baseline specifications, the responses are significantly larger in the high-debt cross-sectional state relative to the low-debt state as shown in sub-figure (g) of Figure A8 for consumption for example. The same holds for the responses of real GDP and consumption intentions but not for inflation and inflation expectations.²⁶ A notable change relative to the baseline results is that the response of actual consumption spending in sub-figure (e) of Figure A8 differs from that in Figure A3 concurring with our earlier results for the other variables, thus corroborating that mechanisms active in the high cross-sectional debt state dominate those in the time-serial one.

4.3.2. Additional state variables

As a next step, we consider additional state variables in order to further examine the robustness and enable the interpretation of our results. First, we use slack as an additional state variable.²⁷ More specifically, we construct a country-specific recession dummy by identifying potential turning points as the local minima and maxima in the quarterly GDP series based on a business cycle dating algorithm of Harding and Pagan (2002). As shown in Figs. 8 and 9, our results are robust and the debt-to-GDP ratio retains its role when we allow for other sources of state dependence.

Second, we use trade openness as an additional state variable.²⁸ We measure trade openness as the share of exports and imports of goods and services to GDP. The rationale for using trade openness as a state variable in assessing the impact of gov-

²⁵ The government spending expectations are compiled twice a year by the OECD in Economic Outlook Statistics and Projections. Before 2004:S1, the forecasting horizon was semiannual with projections made in one semester for the next semester. Since 2003:S2 the forecast target period of expectations refers to quarterly values (expectation made in semester 1 for the next two quarters). Prior to 2004:S1, we assign the expected values made in the current semester to the next two quarters so that the expected values for the next two quarters are identical.

²⁶ The figures for the latter four variables are not shown here but are available upon request.

²⁷ Auerbach and Gorodnichenko (2012) and Ramey and Zubairy (2018), among others, show that spending multipliers vary depending on the state of the business cycle.

²⁸ Data for trade openness is from the link below <https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS>

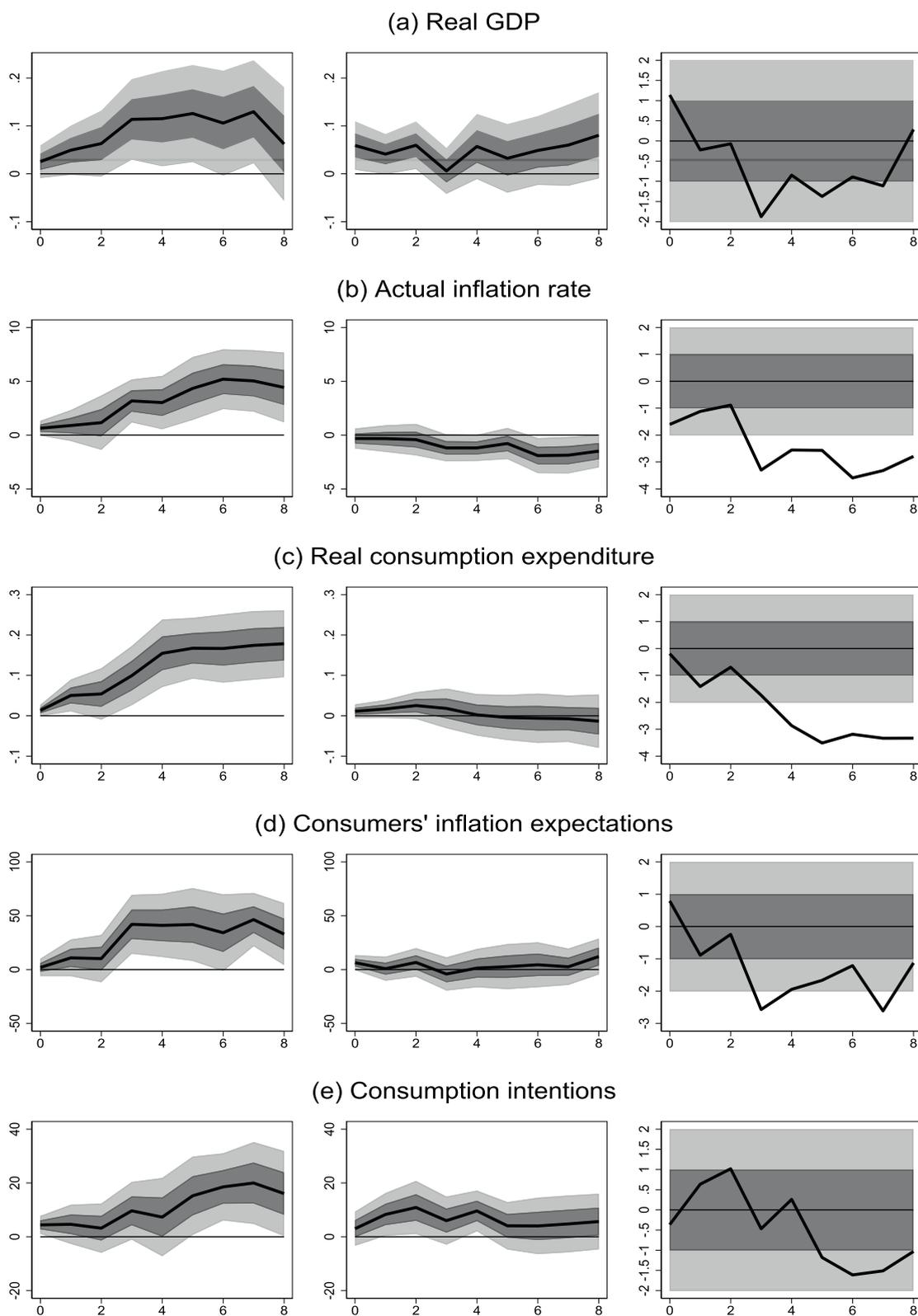


Fig. 6. Responses to positive government spending shock purged from anticipation effects - State variable $S^T(Z_{i,t-1})$. Notes: In each Panel, the first column shows responses together with one- and two-standard-error bands in the low-debt state, the second column responses in the high-debt state, and the third column the t-statistic showing the significance of the difference between the high-debt state and the low-debt state. Due to data unavailability of professional forecasts, we exclude Estonia, Slovenia and Slovak Republic from our sample here.

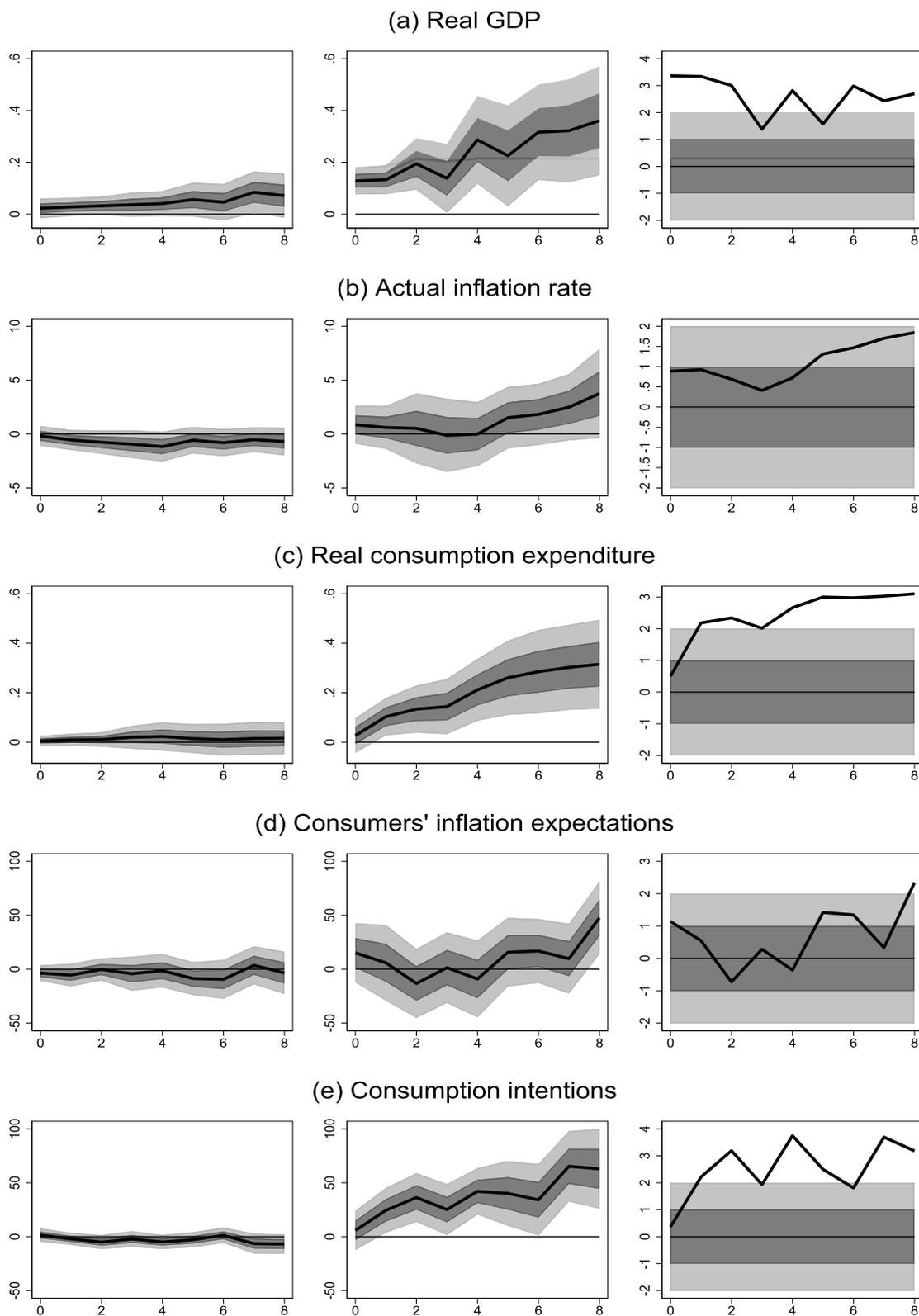


Fig. 7. Responses to positive government spending shock purged from anticipation effects - State variable $S^C(z_{i,t-1})$. Notes: In each Panel, the first column shows responses together with one- and two-standard-error bands in the low-debt state, the second column responses in the high-debt state, and the third column the t-statistic showing the significance of the difference between the high-debt state and the low-debt state. Due to data unavailability of professional forecasts, we exclude Estonia, Slovenia and Slovak Republic from our sample here.

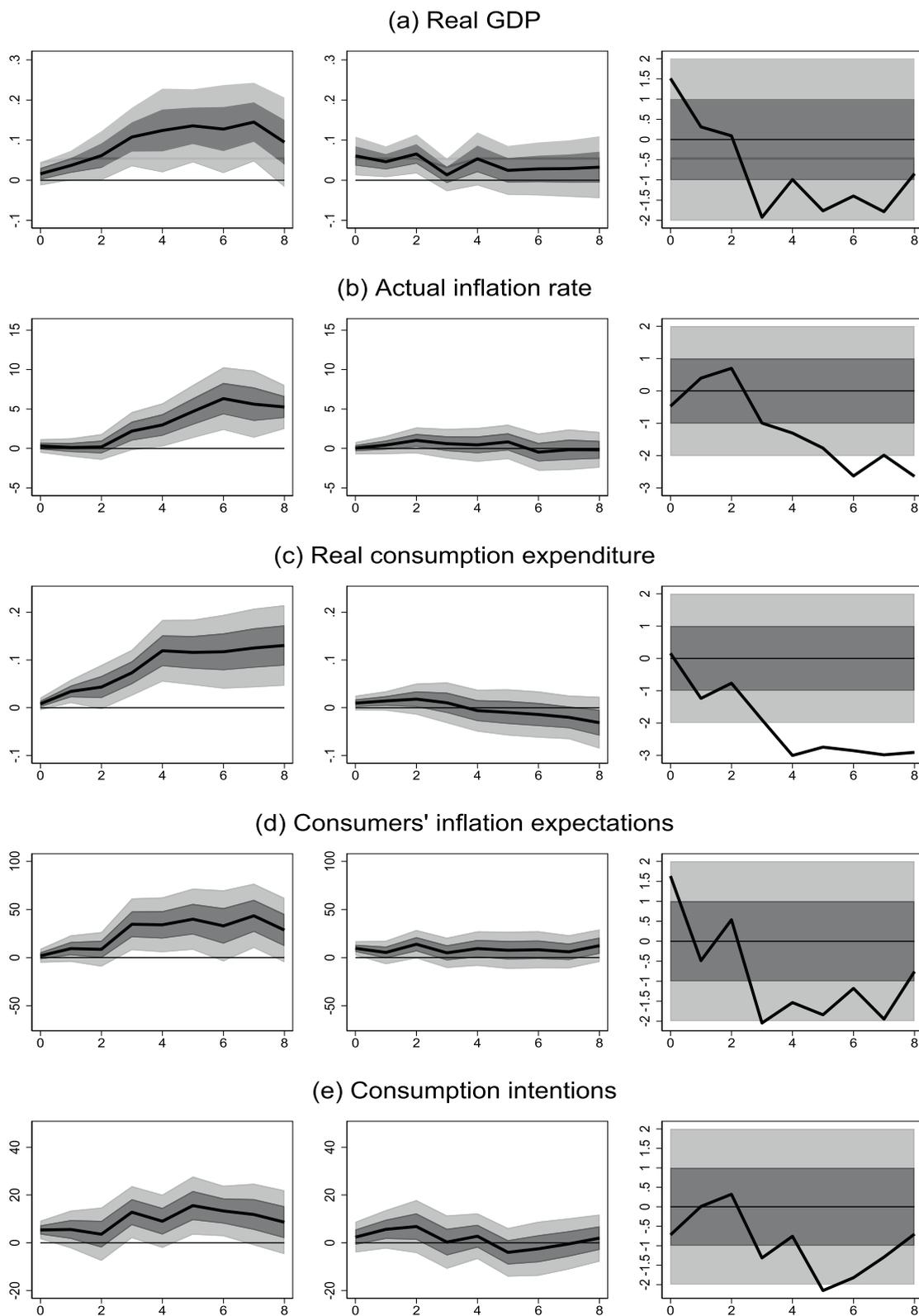


Fig. 8. Responses to positive government spending shock - State variable $S^T(Z_{i,t-1})$ plus recession dummy as an additional state variable. *Notes:* In each Panel, the first column shows responses together with one- and two-standard-error bands in the low-debt state, the second column responses in the high-debt state, and the third column the t-statistic showing the significance of the difference between the high-debt state and the low-debt state.

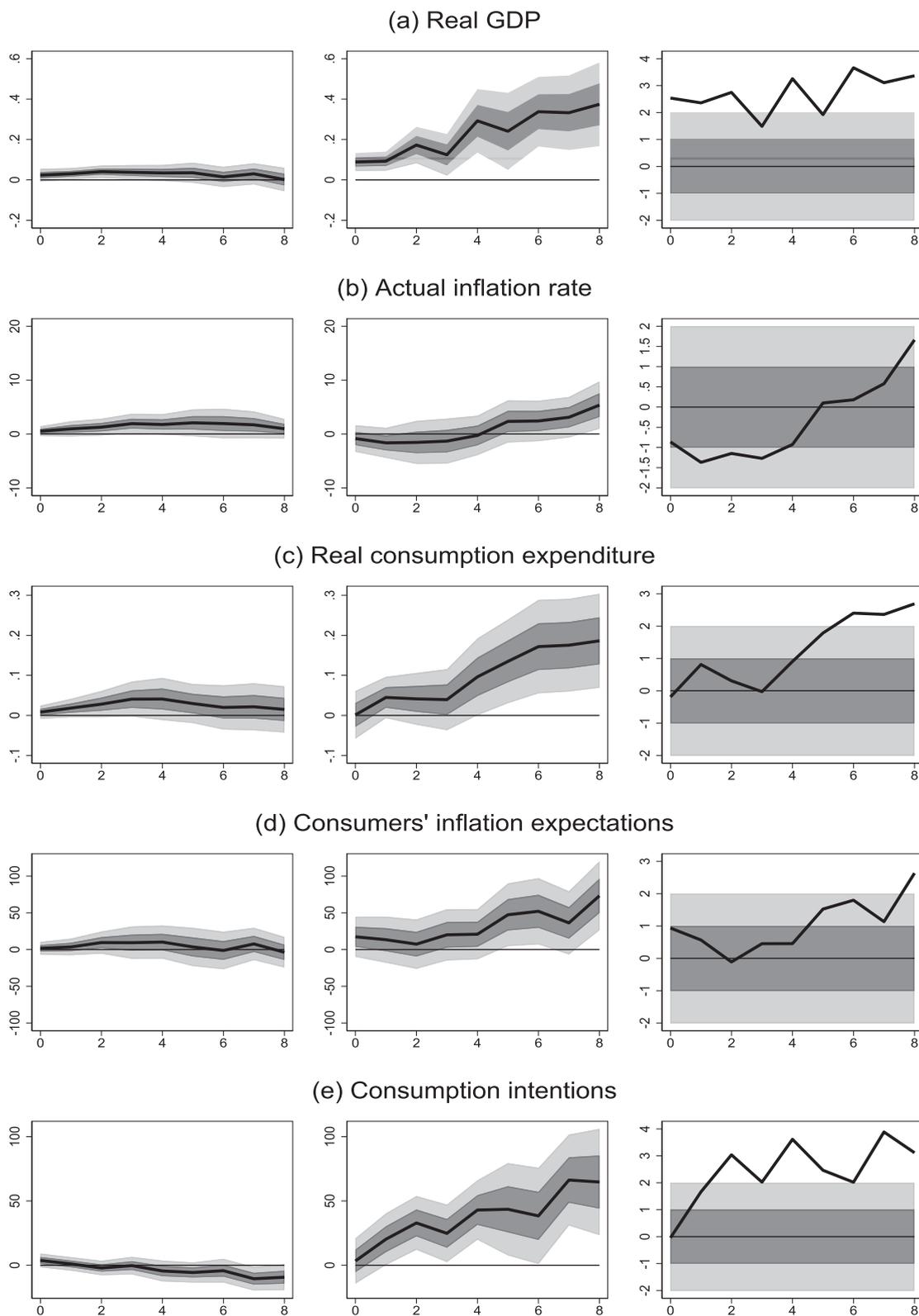


Fig. 9. Responses to positive government spending shock - State variable $S^C(Z_{i,t-1})$ plus recession dummy as an additional state variable. *Notes:* In each Panel, the first column shows responses together with one- and two-standard-error bands in the low-debt state, the second column responses in the high-debt state, and the third column the t-statistic showing the significance of the difference between the high-debt state and the low-debt state.

ernment spending on the macroeconomy is that this impact could depend on a country's trade openness, as in the theoretical literature comparing closed and open economy fiscal multipliers. The results shown in Figures A9 and A10 in the appendix suggest that the responses of GDP in sub-figure (a), consumption in sub-figure (c) and consumption intentions in sub-figure (e), resemble the baseline ones from Figs. 3 and 4. However, comparing the results for inflation and inflation expectations shown in Figures A10(b) and A10(d) for cross-sectional variation, state-dependent differences are less pronounced and not statistically significant, indicating that trade openness needs to be accounted for in order to correctly assess public debt related state dependencies.

Finally, we consider the imports-to-GDP ratio as an additional state variable.²⁹ The rationale for using imports to GDP as a state variable in assessing the impact of government spending on the macroeconomy is that this impact could very well depend on the degree to which a country tends to increase imports of final goods rather than demand for domestically produced goods when government spending increases.³⁰ In this case, the impact of fiscal policy would be expected to be smaller. The results shown in Figures A11 and A12 in the appendix resemble those we get when including trade openness as an additional state variable.

4.3.3. Sensitivity to parameter assumptions

For the time-serial as well as the cross-sectional state variables, we assume smooth transition processes determining in which state the respective economy is located. Recall that the regime switching process depends on two parameters: a cut-off, c , that governs the proportion of the sample close to 0 and 1, and a parameter, θ , that governs the intensity of the regime switching. Higher values of θ push the model towards discrete regime-switching setup. In our baseline model, we choose the 66th percentile of the debt-to-GDP ratio (in time-serial and the cross-sectional dimension, respectively) and $\theta = 3$. To evaluate the sensitivity of our results with respect to these parameter choices, we replicate the baseline estimation with alternative values. Specifically, we re-run the estimation with a lower cut-off (50th percentile) and two alternative values for θ . The results are shown in Figures A13 and A14. Point estimates obtained with different specifications of the smooth transition function are generally within the error bands, and state-dependent patterns resemble the baseline ones.

5. Discussion

The channels through which public debt erodes the effectiveness of fiscal policy in stimulating the economy are intensively discussed in the literature (see e.g. Blanchard et al., 1990; Sutherland, 1997; Corsetti et al., 2012). Huidrom et al. (2020) identify the so-called Ricardian channel as a main driving force behind weaker, or even adverse responses to higher government spending in periods of high-debt. Our results suggest that this channel is related to the evolution of public debt over time, i.e. the time-serial variation in public debt. This would be explained by Ricardian concerns being elevated during periods of relatively high-debt as people then anticipate higher taxes over time. Thus, the relevance of the Ricardian channel becomes apparent when taking into account the dynamics of public debt distinguishing between periods of high- versus low-debt. In line with the Ricardian channel, we find weaker responses of realized consumption expenditures and consumption plans in periods of high debt.

However, as shown in the previous section, fiscal policy shocks exert distinctly positive and significantly more pronounced macroeconomic effects in countries with relatively high levels of public debt as compared to the effects in countries with low public debt, which cannot be explained by the textbook Ricardian channel. Thus, in this section, we provide an interpretation of the above result with respect to the potential mechanisms that may be the source of this state-dependent effect associated with cross-sectional variation in debt-to-GDP ratios.

To begin with, the stronger responses in the high debt state could be related to relatively strong expectation effects. For example, if households believe that a fiscal expansion is associated with the possibility of debt monetization by the central bank in the future, then households adjust their inflation expectations upwards. Holding nominal interest rates constant, the Fisher equation together with the standard Euler equation then suggest that households increase consumption.³¹ Thus, according to this argument, the fiscal policy shock primarily propagates to macroeconomic aggregates via households' inflation expectations and consumption decisions. And since debt monetization becomes more likely if the existing amount of government debt is higher, this mechanism could in principle be consistent with the state-dependent effects described in the previous section. However, given that monetary policy in the euro area is common, expectations of debt monetization would be shared across the euro area members giving rise to higher inflation in all euro area economies. It is thus not clear why inflation expectations would rise only in the high-debt euro-area economies in response to a positive fiscal shock, as a result of this particular mechanism. Hence, our finding that inflation expectations respond positively to fiscal shocks in high-debt economies but not in the low-debt ones, could not possibly be a consequence of expected debt monetization in the euro area. Furthermore, as we

²⁹ Data is available here <https://data.worldbank.org/indicator/NE.IMP.GNFS.ZS>

³⁰ The presumption would be that economies with greater shares of imports to GDP would tend to increase imports more than others when government spending increases.

³¹ Although the empirical relationship between expected inflation and consumption is not without controversy, several papers (see e.g. Dräger and Nghiem, 2021; Duca-Radu et al., 2021) document that consumers' willingness to spend increases with higher expected inflation (see also Bachmann et al., 2015). Coibion et al. (2022) directly show that exogenous changes in inflation expectations induced by monetary policy news, result in changes in individuals' future consumption spending in line with the consumer Euler equation.

have shown in the previous section, the increases in real GDP and consumption in Fig. 4 evidently precede the response of consumers' inflation expectations. Based on the preceding, it appears more likely that inflation expectations adjust upwards in response to economic activity and the associated upward pressure on inflation, rather than the other way round.

Alternatively, the positive and distinctly stronger responses in the high-debt state as compared to the low-debt state could be the result of positive wealth effects if higher nominal government debt is perceived as higher real wealth as in the "non-Ricardian" imperfect knowledge setting of Eusepi and Preston (2018) where "holdings of the public debt generate (positive) wealth effects on aggregate demand" that "get larger as the average scale of issued debt increases". In this setting, non-Ricardian effects from fiscal policy are larger when the average debt-to-GDP ratio is high since, in this case, the aforementioned wealth effects dominate. Our results do not rule out this theoretical explanation. We note, however, that whereas this model predicts wealth effects become larger as public debt rises, the fiscal theory of the price level predicts the opposite, as explained in Eusepi and Preston (2018). As a result, the inflationary consequences of wealth effects from fiscal policy increase with higher levels of debt in the Eusepi and Preston (2018) framework, while as these authors explain "this is not true in the fiscal theory of the price level", suggesting that the latter theory could not possibly explain our finding of a greater response of inflation and inflation expectations in high-debt economies.^{32,33}

Having examined expectation effects and wealth effects as possible drivers of the state-dependent effects we observe, we now turn to private sector credit constraints as a potential alternative explanation. Klein (2017) shows that fiscal consolidations exert larger effects when the private sector is more highly indebted, which suggests that fiscal shocks have stronger effects if private agents face stronger credit constraints (see also Klein et al., 2022). It appears conceivable that public debt could play a similar role as private debt.

High levels of government debt may give rise to tighter private sector constraints for at least two reasons (see also Pozzi et al. (2004)): First, banks may consider the tax liabilities associated with high public debt as a factor limiting borrowers' capacity to repay loans, and thus limit the amount of credit extended to the private sector. In other words, the anticipation of higher taxes lowers borrowers' net worth as the present value of households' net income and firms' net cash flows fall, which then results in tighter credit constraints as banks become less willing to lend to them. In such a setting, high public debt would then be associated with a relatively higher prevalence of liquidity-constrained agents in high-debt economies, resulting in stronger and possibly distinct effects of fiscal shocks on economic activity in these economies.³⁴ Second, to the extent that banks in high-debt economies hold domestic government debt, this crowds out private credit as domestic banks become less willing to extend credit to private borrowers in high-debt economies. Related to this, debt dilution becomes more likely in a high-debt economy which reduces the present value of debt-holding banks' balance sheets and their implied ability to lend. Huang et al. (2018) using firm-level data, find that government debt makes investment more sensitive to firms' cash-flows, which is consistent with the above view. Thus, our empirical findings can be rationalized within a setting where high public debt is associated with tighter private sector credit constraints, resulting in stronger and distinct effects of fiscal shocks in high-debt economies as compared to low-debt economies.

To further support the interpretation of our empirical findings, we present in Table 2 correlations of debt to GDP and its time-serial and cross-sectional components with measures of the share of hand-to-mouth consumers. In particular, we construct three different variables using household-level data from the European Union Statistics on Income and Living Conditions (EU-SILC) questionnaire for 2008–2018.³⁵ Thus, we construct aggregate measures for each country separately by taking the share of households who were in arrears in their payments at least once as a percentage of all households in that particular year. Particularly, we calculate the fraction of households that were in arrears on their mortgage or rental payments over the past 12 months (HS011), the fraction that were in arrears on their utility bill over the past 12 months (HS021), and the fraction that were in arrears on hire purchase instalments or other loan payments for non-housing related debts over the past 12 months (HS031).³⁶ The sample size over which our correlations were computed is typically 159 observations for fifteen countries and, depending on the country, 8 to 11 years.

As shown in Table 2, we find significant positive correlations between each of these measures with debt to GDP and with its cross-sectional component ranging between 54.6% and 41.5%. By contrast, the correlations of these measures of the share of liquidity-constrained households with the time-serial component of debt to GDP is small and mostly insignificant.

The significant positive correlation of these measures with the cross-sectional component as compared to the small insignificant correlation with the time-serial component of debt to GDP suggests that the liquidity constraints mechanism is likely active in the cross-sectional dimension but not in the time-serial one. This might in turn explain the difference

³² We note that, even if the fiscal theory of the price level could play some role, the positive wealth effect for domestic debt holders implied by such a setting would be weaker to the extent that government debt issued by high-debt eurozone economies is partly held by foreign entities.

³³ The interest rate channel associated with sovereign risk (see e.g. Corsetti et al., 2012; Huidrom et al., 2020) could also be active, impairing the effectiveness of government spending in countries with higher levels of public debt. However, as responses to government spending are estimated to be stronger, not weaker, in instances of high cross-sectional public debt, the interest rate channel does not appear to be dominant.

³⁴ Given integrated financial markets, it is conceivable, for example, that relatively more credit would be extended to borrowers in economies with low public debt giving rise to tighter credit constraints in high debt economies and amplifying the cross-country heterogeneities in the responses to government spending.

³⁵ Data for the questions that we focus on is available from 2008 onwards for most countries. For Italy, data are available since 2009, while for Germany and Ireland these are available since 2011. The sample size varies from 3250 to 8250 households depending on the country and year.

³⁶ Households have three options to answer to this type of questions 1) Yes, once 2) Yes, twice or more, 3) No. Based on their answers we calculate the proportion of households who were in arrears on their payments during the last 12 months relative to the total number of households who answered the particular question.

Table 2

Correlations of debt to GDP and its components with measures of the share of hand-to-mouth consumers constructed using the (EU-SILC) questionnaire.

hand-to-mouth share	debt-to-GDP	cross sectional state	time serial state
arrears on mortgage (HS011)	0.512*** (obs. 159)	0.427*** (obs. 159)	0.079 (obs. 159)
arrears on utility bills (HS021)	0.499*** (obs. 159)	0.415*** (obs. 159)	0.150* (obs. 159)
arrears on non-housing loans (HS031)	0.546*** (obs. 158)	0.469*** (obs. 158)	0.102 (obs. 158)

Notes: We use data for 15 euro-area economies during the period 2008–2018. Statistical significance is indicated as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

between the time-series and cross-sectional results regarding the impact of fiscal policy in high-debt states relative to low-debt states. That is, with the liquidity constraints mechanism active in the cross-sectional dimension, cross-sectional high-debt states are not surprisingly associated with a greater impact of government spending shocks on the macroeconomy as compared to low-debt states. This is not the case with time-serial high-debt states where the liquidity constraints mechanism does not appear to be active based on the small insignificant correlations of measures of the share of liquidity-constrained agents with the time-serial component of debt-to-GDP.

That the liquidity constraints mechanism appears to be at work when looking at high-debt states across countries but not over time, plausibly relates to the much larger variation in debt-to-GDP that we observe across countries as compared to the small part of overall variance in debt-to-GDP that is due to the time-series component. The implication would be that for public debt changes over time to activate the liquidity constraints mechanism and lead to stronger and distinct positive responses to fiscal shocks in high-debt states, these changes would have to be above a threshold, larger than the ones we observe in our time-series sample and closer in size to the large cross-sectional differences in debt-to-GDP observed across the euro area.

6. Conclusion

The findings reported in this paper are informative for policy and theory alike. To begin with, the state-dependence of fiscal policy we find in this paper is of particular importance for the euro area given the large dispersion in public debt levels across euro area economies. After all, given that the common monetary policy in the euro area has been constrained by the zero-lower bound and that in any case it could not possibly be perfectly tailored to individual country needs, fiscal policy is the main policy tool for alleviating the impact of asymmetric business cycle recessions or crises facing these countries.

Our findings suggest that higher government spending would boost economic activity and economic expectations more in the high-debt economies as compared to the low-debt economies in this cross-section. By the same token, the strong impact of government spending on economic activity and economic expectations in the high-debt state suggests that, given high debt levels in some euro area economies, the implementation of austerity measures to bring public debt levels under control would be particularly painful. This is important to take into account in planning co-ordinated action in regards to debt sustainability in the euro area in the aftermath of the pandemic crisis.

Given that the pandemic crisis, like the financial crisis before it, have seen public debt levels reach unprecedented heights in the eurozone and elsewhere, our findings based on time-serial variation suggest a tendency for expansionary fiscal policy to become less effective during this period. Nevertheless, our multi-state model results suggest that cross-sectional concerns are overall dominant in shaping the impact of fiscal policy on the economy in the case of the eurozone.

Beyond their significance for policy, our empirical findings offer some guidance as to the type of theoretical mechanisms we should be focusing on in order to understand the macroeconomic effects of fiscal policy and in particular, to understand state-dependent effects related to the level of public debt. More specifically, we are able to rule out some standard theoretical settings as plausible explanations for the type of state-dependent effects we uncover here. As discussed in the last section, the textbook Ricardian channel, the inflation expectations channel, wealth effects along the lines of the fiscal theory of the price level, and interest rate effects as those in Huidrom et al. (2020), are not satisfactory explanations for the public-debt related state-dependent effects of fiscal policy we have found. Instead, private sector credit constraints related to the level of public debt appear to offer a promising explanation, pointing to one direction theoretical modeling could take in order to be reconciled with the empirical facts documented here.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.jimonfin.2022.102746>.

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