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THE SHORT-RUN EFFECTS OF FISCAL ADJUSTMENT IN OECD COUNTRIES

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Abstract

This paper investigates the short-run effects of fiscal adjustment shocks on macroeconomic aggregates in a group of 24 OECD economies from 1990 to 2019. The analysis controls for recession and expansions, high and low public debt ratio, tight and loose monetary conditions, and trade openness. We find no evidence of expansionary fiscal consolidations or non-Keynesian effects. The empirical findings suggest that unanticipated fiscal consolidation shocks lead to lower real GDP, private consumption, investment, and inflation and to higher unemployment rate. The effects are more pronounced in bad economic times, high debt countries, closed economies and when monetary conditions are tight. Consequently, in these cases, the decline of the public debt ratio is more subdued.

JEL-classification: H60, E62, E32

Keywords: Fiscal consolidation, public debt, bad and good times, monetary conditions, openness.

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1. Introduction

The outbreak of the COVID-19 virus necessitated an unprecedented fiscal expansion, in most countries around the globe, to contain the health and economic consequences of the pandemic. Because of these support measures fiscal deficits soared and public sector indebtedness reached very high levels. Rapidly rising energy prices and inflation, primarily because of the Russian invasion in Ukraine, made necessary the initiation of a new round of income support measures in various OECD economies. In this context, the general escape clause of the Stability and Growth Pact, which was activated in the European Union during the pandemic, was extended until the end of 2023.

This new fiscal expansion is increasing fiscal risks in many countries because of two factors. First, public finances were already in bad shape on account of the pandemic-related expansion. Second, contrary to the pandemic era, monetary policy is now moving in the opposite direction, with major central banks around the globe raising rates to contain rising inflation and keep inflation expectations anchored. Rising borrowing costs will put further pressure on public finances. Therefore, eventually many countries, particularly those with high debt ratios, will have to initiate fiscal consolidations to restore public finances and safeguard fiscal sustainability.

Consequently, there is now a renewed interest on the macroeconomic effects of fiscal consolidation. This is particularly relevant at the current juncture because it will allow policy makers to design credible medium-term fiscal consolidation plan. Motivated by this adverse macroeconomic environment, this paper studies the short run effects of fiscal consolidation shocks in a group of 24 OECD countries from 1990 to 2019.

Despite the renewed interest on this research question, there is wide literature covering the topic. Several studies such as Giavazzi and Pagano (1996), Alesina and Perotti (1997), Alesina and Ardagna (1998, 2010), Giavazzi et al (2000) found that fiscal consolidations could have so-called non-Keynesian effects, i.e., boosting GDP growth. The punchline of this analysis is that when fiscal consolidation is credible it will improve private sector's expectations and wealth and will reduce the real interest rate leading to increased consumption and investment. Most of these studies identified fiscal consolidation episodes as the change in the cyclically adjusted primary balance (ΔCAPB), a readily available indicator that excludes the automatic responses of fiscal variables and reflects only the discretionary fiscal policy changes. Usually, these studies examined only

the most important fiscal consolidation episodes, i.e., where the cyclically adjusted primary balance improves more than 2.0% of GDP within a year or 1.5% on average in a two-year period (see e.g., Alesina and Ardagna, 1998; Tagkalakis, 2009; Afonso, 2010).

The critics of this approach claimed that the changes in the cyclically adjusted primary balance could be affected by other factors, e.g., asset price booms and busts. Moreover, ΔCAPB might reflect an intentional fiscal policy change driven by economic conditions, which could be anticipated by economic agents that know the policy maker's fiscal policy reaction function. In addition, measurement issues become relevant, and, particularly, whether the potential output used in the calculation of CAPB is constructed based on the production function approach or on purely statistical procedures such as the Hodrick-Prescott filter (see e.g., Afonso et al 2022).

In this context, Yang et al (2015) proposed a new definition of CAPB that takes account of fluctuations in asset prices and reflects idiosyncratic features of fiscal policy in individual countries and showed that once this new definition is used fiscal adjustments always have contractionary effects on economic activity in the short term. Afonso et al.(2022) using data from 1970 to 2018, for 37 advanced economies and 137 developing economies and employing three alternative measures of the cyclically adjusted primary balance to determine adjustment episodes show that (i) tax increases have a positive effect on private consumption in the presence of fiscal consolidation, (ii) fiscal contractions create a crowding-in effect on private investment in particular in advanced economies, (iii) expansionary fiscal consolidations occur in particular in highly indebted advanced economies after an increase in taxes. However, they also report that an increase in general government final consumption expenditures have a positive (Keynesian) effect on real per capita private consumption. Nevertheless, their analysis does not control for the effect of asset price changes on CAPB, which is particularly relevant as shown by Tagkalakis (2011) and Yang et al (2015).

Several other studies, such as Guajardo et al. (2014), Cimadomo et al (2014), Jorda and Taylor (2016), Klein (2017), Banerjee and Zampolli (2019), Ağca and Igan (2019) criticized the CAPB approach claiming that it is not fully exogenous and relied on the narrative fiscal consolidation shocks constructed by Devries et al (2011) to identify the effects of fiscal consolidation. Most of these studies conclude that there is no evidence of expansionary austerity. In several of the papers examined, the effects of fiscal consolidations were conditioned on the state of the business cycle, the level of public and

private debt, tight or loose monetary policy, high or low credit growth, and positive or negative current account.

Cimadomo et al (2014) showed that fiscal consolidation improves capital adequacy ratio because they induce a portfolio re-balancing from private to public debt securities which reduces the risk-weighted value of assets. While Ağca and Igan (2019) showed that fiscal consolidations are associated with higher cost of credit. This finding is especially true for firms that operate in sectors directly affected by related tax hikes and for firms that are small, highly leveraged, domestic, in government-dependent industries, and have limited access to alternative financing resources. As Ağca and Igan (2019) point out spending cuts related to specific sectors do not have a significant effect on firms operating in these directly affected sectors, while the increase in the cost of credit tends to be lower when fiscal consolidations are large.

Contrary to previous studies (see e.g. Jorda and Taylor, 2016; Banerjee and Zampolli, 2019; Klein, 2017), which use narrative series of fiscal consolidation shock, we opt for the use of national account data and, in particular, we consider a more appropriate and readily available for policy purposes indicator of the fiscal policy stance, i.e., the change in the cyclically adjusted primary balance as a percent of GDP (ΔCAPB). ΔCAPB is used by many international economic institutions like the IMF and the European Commission for policy purposes, i.e., to judge whether a country's fiscal stance is expansionary or contractionary. A positive value of ΔCAPB implies that, after having stripped the effect of cyclical conditions, the fiscal policy maker engages in contractionary fiscal policy i.e., fiscal consolidation. Moreover, as correctly pointed out by Afonso et al (2022) the publicly available dataset of narrative fiscal consolidation episodes covers only 16 advanced economies and ends in 2014, which makes it outdated.

However, ΔCAPB reflects both anticipated and unanticipated fiscal policy changes. To address this problem, building on studies such as Gali and Perotti (2003), Corsetti et al (2012), and Auerbach and Gorodnichenko (2012) we estimate a fiscal policy rule and extract the positive residuals, which are treated as fiscal consolidation shocks. Next, we examine the short run effects of fiscal consolidation by means of the local projection method (Jorda, 2005). We find no evidence of expansionary fiscal consolidation. We then condition the effect of fiscal consolidation on various states, such as bad and good times, high and low debt, open and closed economies, and tight and loose monetary policy. We find that fiscal consolidations have negative effects on real GDP in states of

bad economic conditions, high debt ratio, tight monetary conditions, and low trade openness and consequently the debt to GDP ratio declines to a smaller extent.

However, it could be the case that even the discretionary fiscal consolidation shock is driven by economic conditions, i.e., it is endogenous. Therefore, to address this concern, building on the work of Jorda and Taylor (2016), we use a probit model to predict the treatment effect and then we estimate the average treatment effect (ATE) of fiscal consolidation by applying the augmented-inverse probability weighting estimator (AIPW). We find evidence that once accounting for the forecasting component of the unanticipated fiscal consolidation shocks the average treatment effect of fiscal consolidation is more pronounced than the baseline model and in a high debt ratio state.

The remainder to the paper is organized as follows. Section 2 presents the data and the methodology. Section 3 presents the empirical estimates. Section 4 conducts robustness checks, while Section 5 concludes.

2. Methodology and data

We use annual data from the OECD for a group of 24 advanced economies from 1990 to 2019[1]. In this paper, we follow Auerbach and Gorodnichenko (2012, 2013), Banerjee and Zampolli (2019), Ramey and Zubairy (2014), Owyang et al (2013) and Klein (2017) in estimating impulse responses to exogenous innovations in the cyclically adjusted primary balance, using the local projection method (Jorda, 2005), to investigate the effects of fiscal consolidations shocks on key macroeconomic variables. The advantages of local projections over VARs are that they are more resistant to model misspecifications, do not impose the implicit dynamic limitations that VARs do and provide a simple technique to account for state dependence (see Klein, 2017; Banerjee and Zampolli, 2019).

Building on Klein (2017) and Banerjee and Zampolli (2019) we let $Y_{i,t+h} - Y_{i,t-1}$ signify the cumulative response of the variable of variable to an exogenous fiscal

[1] Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States. We intentionally terminate the analysis in 2019, because 2020 was an exceptional or "outlier" year in terms of public finances and growth performance on account of the COVID-19 pandemic.

consolidation shock ($D_{i,t}$) at time t. In more detail, we run a set of $Y_{i,t+h}$ - $Y_{i,t-1}$ regressions (where h =0, 1, 2, 3, 4) on $D_{i,t}$ as well as a set of control variables $X_{i,t-1}$:

$$Y_{i,t+h} - Y_{i,t-1} = \psi_{A,h}(L)X_{i,t-1} + \beta_h Di,t \; + + \alpha_{i,h} + \eta_{t,h} + u_{i,t+h}. \; (1).$$

$\alpha_{i,h}$ are country-specific constants, $\eta_{t,h}$ captures time fixed effects and $u_{i,t}$ is the error term, which is assumed to have a zero mean and strictly positive variance. The variables considered (one at a time) in Y are the following: log of real GDP, unemployment rate, the log of CPI, log of real private consumption, log of real government consumption, log of private investment (gross fixed capital formation), log of real exports of goods and services, log of real imports of goods and services, the public debt to GDP ratio and the cyclically adjusted primary balance as a percent of GDP.[2] β_h indicates the response of $Y_{i,t+h} - Y_{i,t-1}$ to the fiscal consolidation shock at time t. The lag operator is denoted by the symbol L (=1). The control variables included in $X_{i,\,t-1}$ are the following: the lag of real GDP growth rate, the lag of the public debt to GDP ratio, the lag of trade openness, the lag of the nominal long term (10-year) government interest rate, the lag of net exports to GDP ratio, the lag of inflation rate. In addition, to this common set of controls, following Banerjee and Zampolli (2019) we also include one lag of log changes in the dependent variable in their respective local projection (expect in case of the unemployment rate, the log of CPI and the cyclically adjusted primary balance). For example, in the private investment's local projection we include one lag of log changes in real private investment but do not include this variable in other variables' local projections.

While Banerjee and Zampolli (2019) and Klein (2017) use narrative series of fiscal shock (see Devries et all 2011 and Guajardo et al 2014) we opt for the use of national account data and in more particular we consider a more appropriate and readily available for policy purposes indicator of fiscal policy stance, i.e., the change in the cyclically adjusted primary balance as a percent of GDP (ΔCAPB). A positive value of ΔCAPB implies that, after having stripped the effect of cyclical conditions, the fiscal policy maker engages in contractionary fiscal policy i.e., fiscal consolidation. However, ΔCAPB reflects both anticipated and unanticipated fiscal policy changes. If the changes in CAPB are unanticipated because, e.g., agents know the fiscal policy rule, then a fiscal

[2] As in Klein (2017), all variables of interest (except the public debt ratio, the cyclically adjusted primary balance as a percent of GDP and the unemployment rate) are expressed in level log or level units and the responses are not scaled by GDP.

consolidation at time t will have no effect on macroeconomic aggregates at the same time, because economic agents will have already adjusted their expectations.

To address this problem, building on Gali and Perotti (2003), Golinelli και Momigliano (2009), Alesina and Ardagna (2010), Tagkalakis (2011), Corsetti et al (2012) and Auerbach and Gorodnichenko (2012), we first estimate a fiscal policy rule of the form:

$$\Delta CAPB_{i,t} = \alpha_i + \upsilon_t + \beta * \Delta CAPBY_{i,t-1} + \gamma * YGAP_{i,t} + \delta * DEBT_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

α_i stand for unobserved country effects, υ_t captures time effects, ΔCAPB stands for the change in the cyclically adjusted primary balance as a percent of GDP, YGAP is the output gap and DEBT stands for the debt to GDP ratio. To account for the contemporaneous correlation between the output gap and the dependent variable we estimated equation (2) by means of an IV technique where the output gap is instrumented by each own lag and the first lag of real GDP growth rate. Given that N=24<T=29 the estimates are less susceptible to the so-called Nickel bias (Nickel, 1981). According to Gali and Perotti (2003) the response of the dependent variable to output gap reflects the systematic discretionary fiscal policy component, while ε_{it} is the random component, which reflects the non-systematic fiscal policy response or the unanticipated fiscal policy shocks, which are independent across countries.

Next, we construct the fiscal consolidation shock as follows: $D_{it}= \varepsilon_{it}$ if $\varepsilon_{it} >0$ and $D_{it}=0$ if $\varepsilon_{it} \leq 0$, which is used in (1), i.e., it has positive value in times of fiscal consolidation, hence the cyclically adjusted primary balance increases.

As a next step, building on the Auerbach and Gorodnichenko 2012, Ramey and Zubairy 2014, Klein (2017), and Banerjee and Zampolli (2019) we examine the effect of fiscal consolidation shocks in various states:

a. high and low public debt to GDP; two cases are considered, the first uses a threshold of 100% (1st definition) and the second one a threshold of 80% (2nd definition);

b. bad and good economic times. We consider two definitions of bad times. In the first one, the growth rate of real GDP is negative [Δlog(real GDP)<0]. In the second one, following Auerbach and Gorodnichenko, (2012, 2013), we employ a transition function F(.) which is given by the logistic function:

$F(w_{i,t}) = \frac{\exp(-kw_{i,t})}{1+\exp(-kw_{i,t})}$, with κ > 0. $F(w_{i,t})$ is interpreted as the probability of being in a recession, given the state of the economy $w_{i,t}$. Where $w_{i,t}$ is a two year moving average of GDP growth (standardized). Hence, when $F(w_{i,t}) = 1$ the economy is in extreme recession, whereas when $F(w_{i,t}) = 0$ the economy is in extreme expansion. We set κ=1.5 in line with Auerbach and Gorodnichenko (2013a).[3]

c. high and low trade openness, with trade openness being high when it is above the sample mean [(exports+imports)/gdp >72.3%].

d. High and low real long term government interest rate. We want to condition the effect of fiscal consolidation in tight and loose monetary conditions. The real long term government interest rate (*RLTGR)* is a benchmark rate for an economy because it determines the cost of credit that is relevant for long term consumption and investment decisions. However, the real long term government interest rate is contemporaneously affected by fiscal and macroeconomic conditions. To this end, we first estimate an equation of the form:

$$\Delta RLTGR_{i,t} = \alpha_i + \upsilon_t + \beta * \Delta RLTGR_{i,t-1} + \gamma * \Delta GDP_{i,t} + \delta * DEBT_{i,t} + \Delta CAPB_{I,t} + \varepsilon_{i,t} \quad (3)$$

α_i stand for unobserved country effects, υ_t captures time effects, *ΔRLTGR* stands for the change in the real long term government interest rate, ΔCAPB stands for the change in the cyclically adjusted primary balance as a percent of GDP, ΔGDP is the real GDP growth rate and DEBT stands for the debt to GDP ratio. To account for the contemporaneous correlation between the dependent variable and the real GDP growth rate, the debt ratio and the cyclically adjusted primary balance we estimated equation (3) by means of an IV technique where the real GDP growth rate, the debt ratio and the cyclically adjusted primary balance are instrumented by their own lags. As above N=24<T=29, hence, the estimates are less susceptible to the so-called Nickel bias. Next, we extract the residuals from equation (3), which reflect changes in the real long term government interest rate which are not linked to fiscal and macroeconomic conditions. We then employ a similar transition function $F(w_{i,t})$ as before, but now in $w_{i,t}$ we use the residuals of equation (3). Hence, $F(w_{i,t})$ is now interpreted as

[3] When κ = 0, we are in the linear case, while when κ takes very high values, the indicator resembles a usual dummy. Auerbach and Gorodnichenko (2013) calibrate κ so that the economy spends about 20% of time in recession.

the probability of being in a low real cost of credit regime (or loose monetary conditions) and 1- $F(w_{i,t})$ the probability of being in a high real cost of credit regime (or tight monetary conditions).

When the above variables (the public debt ratio, the bad times indicators, trade openness and monetary policy conditions) are above the specified threshold the indicator I_{it-1} takes value 1 and zero otherwise. As in relevant literature (e.g., Auerbach and Gorodnichenko 2012, Ramey and Zubairy 2014, Klein 2017, Banerjee and Zampolli, 2019) we use the first lag of $Ii,t-1$ or $F(w_{i,\ t-1})$ in the estimation to minimize the contemporaneous correlation between the fiscal consolidation shock and changes in the indicator variable. In this case, the equation (1) becomes:

$$Y_{i,t+h} - Y_{i,t-1} = I_{i,\ t-1,}[\psi_{A,h}(L)X_{i,t-1} + \beta_{A,h}D_{i,t}] + (1 - I_{i,t-1})[\psi_{B,h}(L)X_{i,t-1} + \beta_{B,h}D_{i,t}] + \alpha_{i,h} + \eta_{t,h} + u_{i,t+h}. \quad (4).$$

Similarly, when we employ the transition function we have:

$$Y_{i,t+h} - Y_{i,t-1} = F(w_{i,\ t-1})[\psi_{A,h}(L)X_{i,t-1} + \beta_{A,h}D_{i,t}] + (1 - F(w_{i,\ t-1}))[\psi_{B,h}(L)X_{i,t-1} + \beta_{B,h}D_{i,t}] + \alpha_{i,h} + \eta_{t,h} + u_{i,t+h}. \quad (4)'.$$

The state-dependent responses of variable $Y_{i,t+h}$ -$Y_{i,t-1}$ at time t + h to the shock at time t are directly provided by the collection of $\beta_{A,h}$ and $\beta_{B,h}$. For example, $\beta_{A,h}$ reflects the effects of fiscal consolidation in states when the debt ratio is high, economic times are bad and trade openness is high and the cost of credit is low. Analogously, $\beta_{B,h}$ reflects the effects of fiscal consolidation in states when the debt ratio is low, economic times are good and trade openness is low and the cost of credit is high.

3. Empirical results

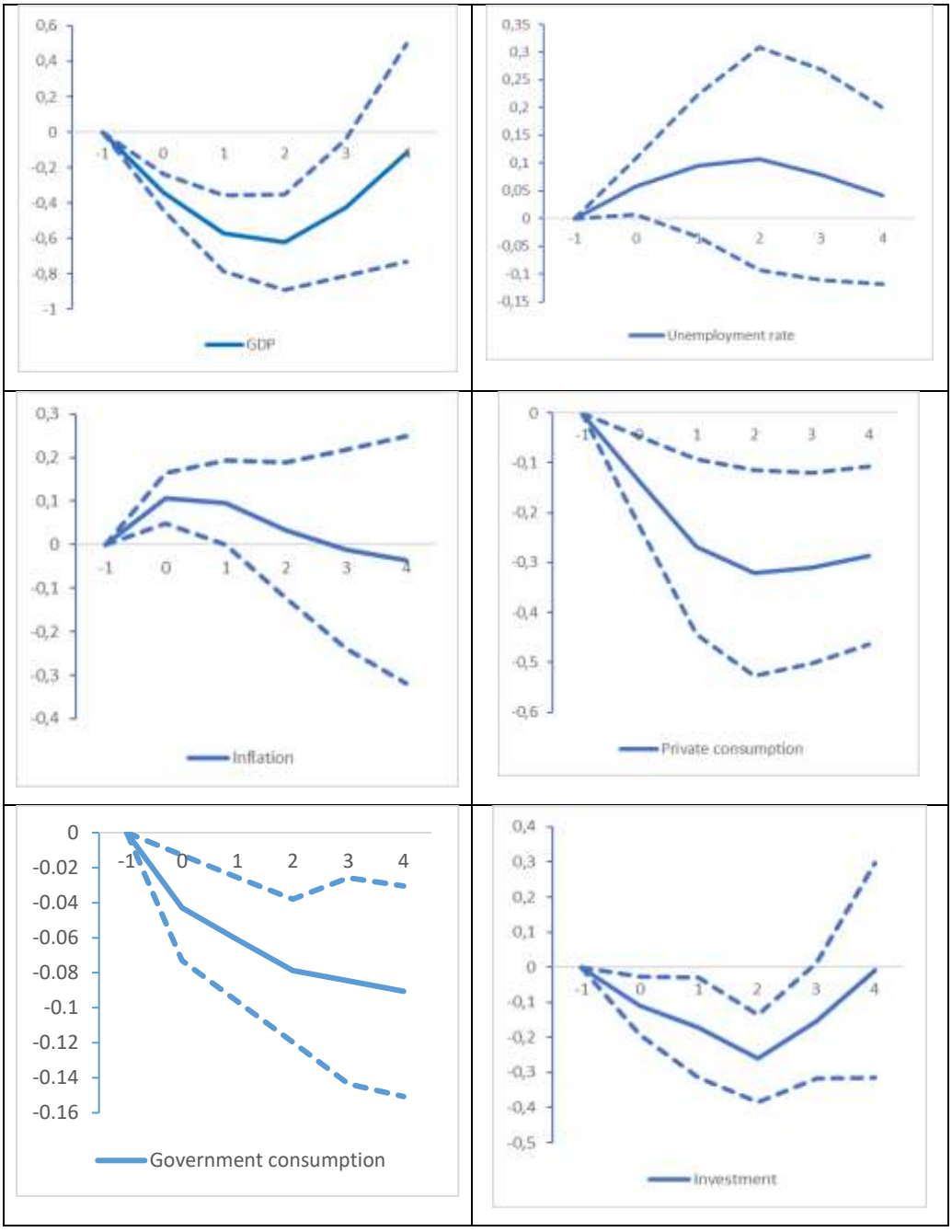
Figure 1 presents the results based on the baseline specification (1). It shows the cumulative effects on the real GDP, unemployment rate, inflation, private consumption, government consumption, investment, exports, imports, public debt ratio and the cyclically adjusted primary balance as a percent of GDP from year 0 to year 4 in response to an unanticipated fiscal consolidation shock, where 0 indicates the year in which the shock occurs. The 90% confidence bands (shaded areas) are based on robust standard errors clustered by country. The responses are normalized so that the cyclically adjusted primary balance rises by 1% of GDP in year 0. Following Klein (2017), the consolidation

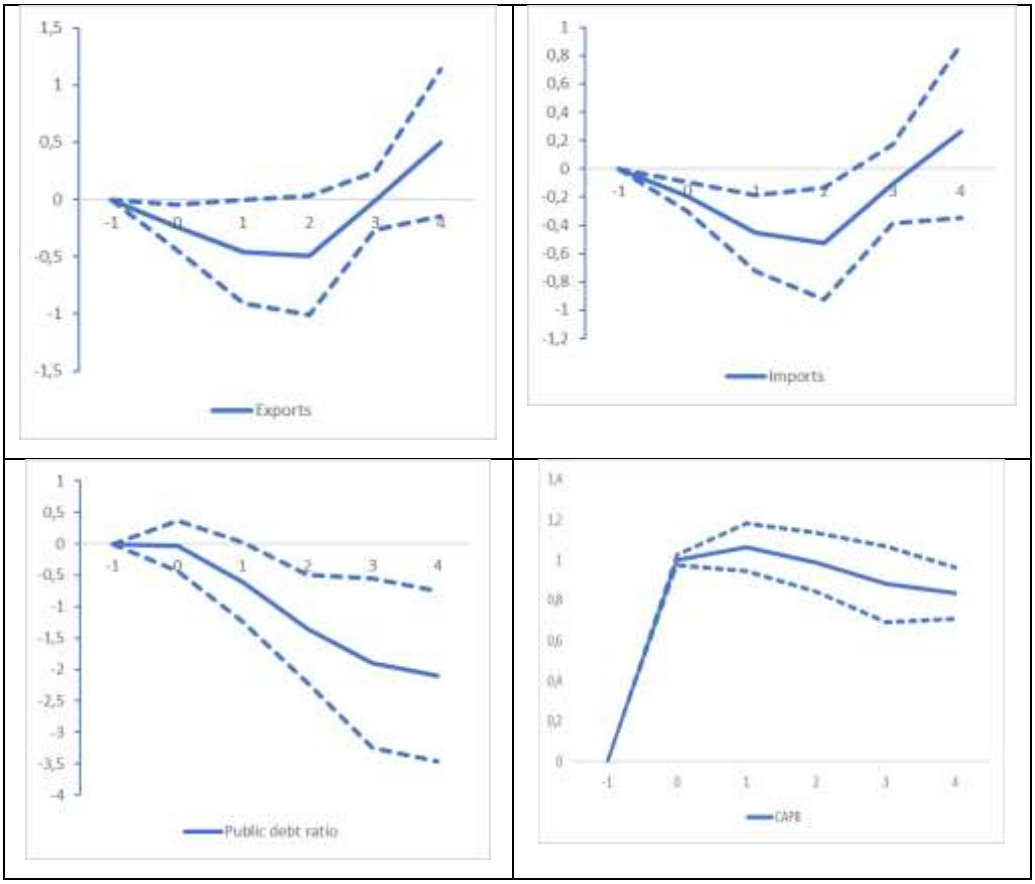
shock is expressed in percent of GDP and the impulse responses reflect cumulative percentage changes (i.e., they are not scaled by GDP).

GDP shows a U-shaped decline after a fiscal consolidation shock, with the maximum negative response of -0.56% in year 2. A similar response pattern is shown by private consumption, investment, exports, and imports, with the maximum negative response in year 2 being -0.29%, -0.22%, -0.47% and -0.49%, respectively. Government consumption declines continuously over the forecast horizon, but to a much lesser extent, i.e., it is only 0.08% lower after 5 years. Note that both exports and imports improve over the end of the forecast horizon, with net exports ending up higher in year 4. Hence, there is some evidence of the twin deficit hypothesis as in Beetsma and Giuliodori (2011), Corsetti et al. (2012) and Banerjee and Zampolli (2019), i.e., a 1 percentage point fiscal consolidation shock in year 0 increases the net export to GDP ratio in year 4 by 0.24 percentage point. The response profile of imports closely resembles the one of real GDP, hence, when the economy recovers after the fiscal consolidation shock import demand increases as well. On the other hand, exports improve after year 3 on account of improved competitiveness in line with Alesina et al (2002), Lane and Perotti (1998) and Tagkalakis (2015). However, both impulses responses are not highly statistically significant.

Both unemployment and inflation rates increase after a fiscal consolidation shock, but their impulse responses are insignificant after year 1. The cyclically adjusted primary balance increases at 1.06 percent of GDP in year 1 and then gradually declines at 0.85 percent of GDP in year 4. Because of the fiscal tightening the debt to GDP ratio is lower by 2.3 percentage points after 5 years. Hence, based on the findings above there is no evidence of expansionary fiscal consolidation.

Figure 1: The short run effects of fiscal consolidation shock – baseline specification





Notes: The impulse responses reflect cumulative changes (in percent) in response to a fiscal consolidation shock of 1% of GDP to the cyclically adjusted primary balance over h = 0, 1, 2, 3, 4 years, h=-1 is the year prior the fiscal consolidation shock. The 90% confidence bands are based on robust standard errors clustered by country.

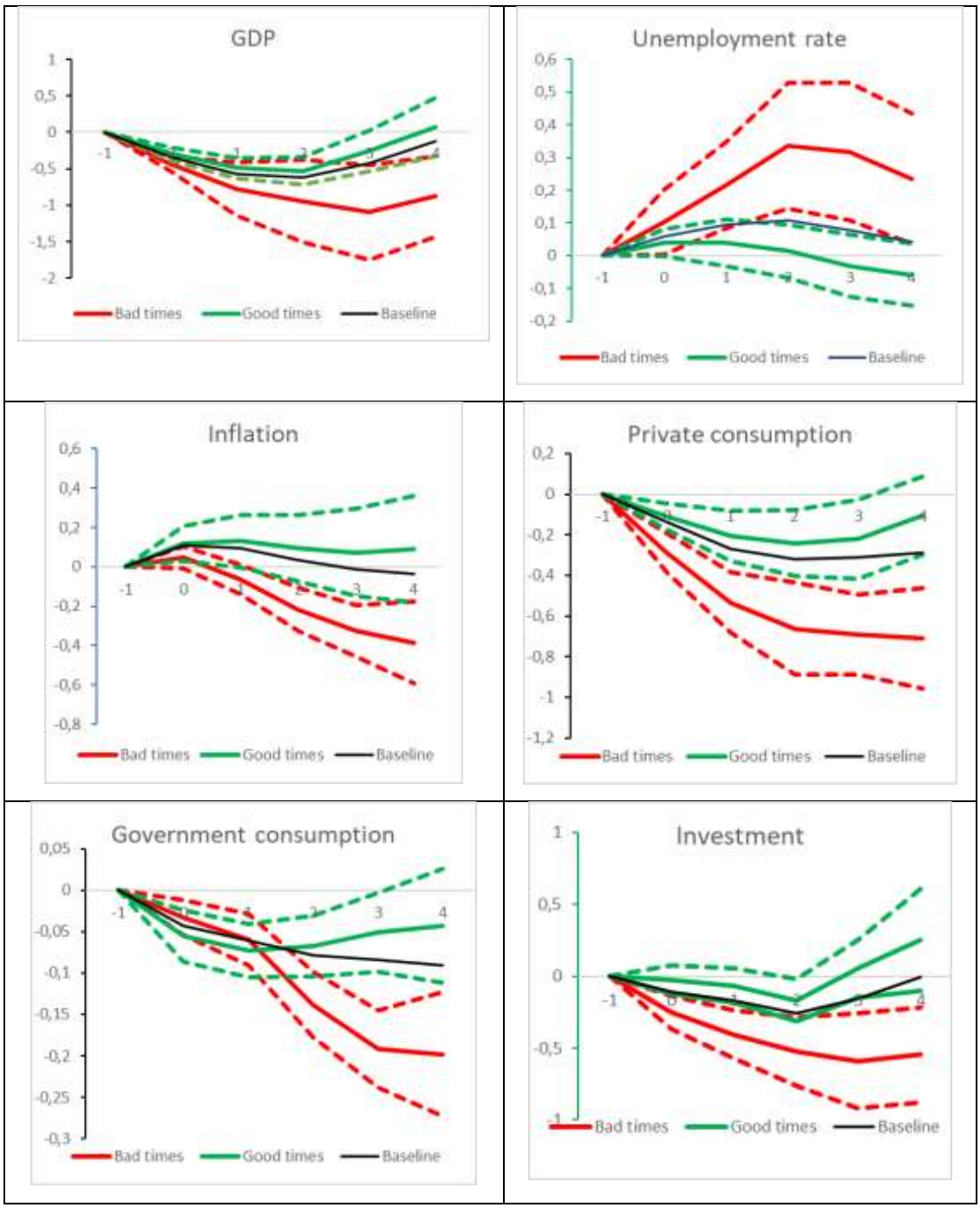
Next, we examine whether the effects of fiscal consolidation vary across several states. Figure 2 reports the evidence based on the first definition of bad times. The impulse responses have the same shape as in the baseline model; however, the magnitude and statistical significance of the results differs in the good and bad times. First, the decline of real GDP is much more pronounced in bad times and reaches its minimum value -0.81 in year 3, while in good times the minimum value of -0.52 is reached in year 2. This evidence resembles the findings of Auerbach and Gorodnichenko (2012), Jorda and Taylor (2016) and Yang et al. (2015). Similarly, private consumption, government consumption and investment show a more pronounced decline after a fiscal consolidation shock in bad times, being -0.62%, -0.17% and -0.39% lower in year 4, respectively. There is some evidence that, after an unanticipated fiscal consolidation shock, investment increases in years 3 and 4 in good economic times in line with the findings of Afonso et al (2022), but the estimated impulse response has weak statistical significance.

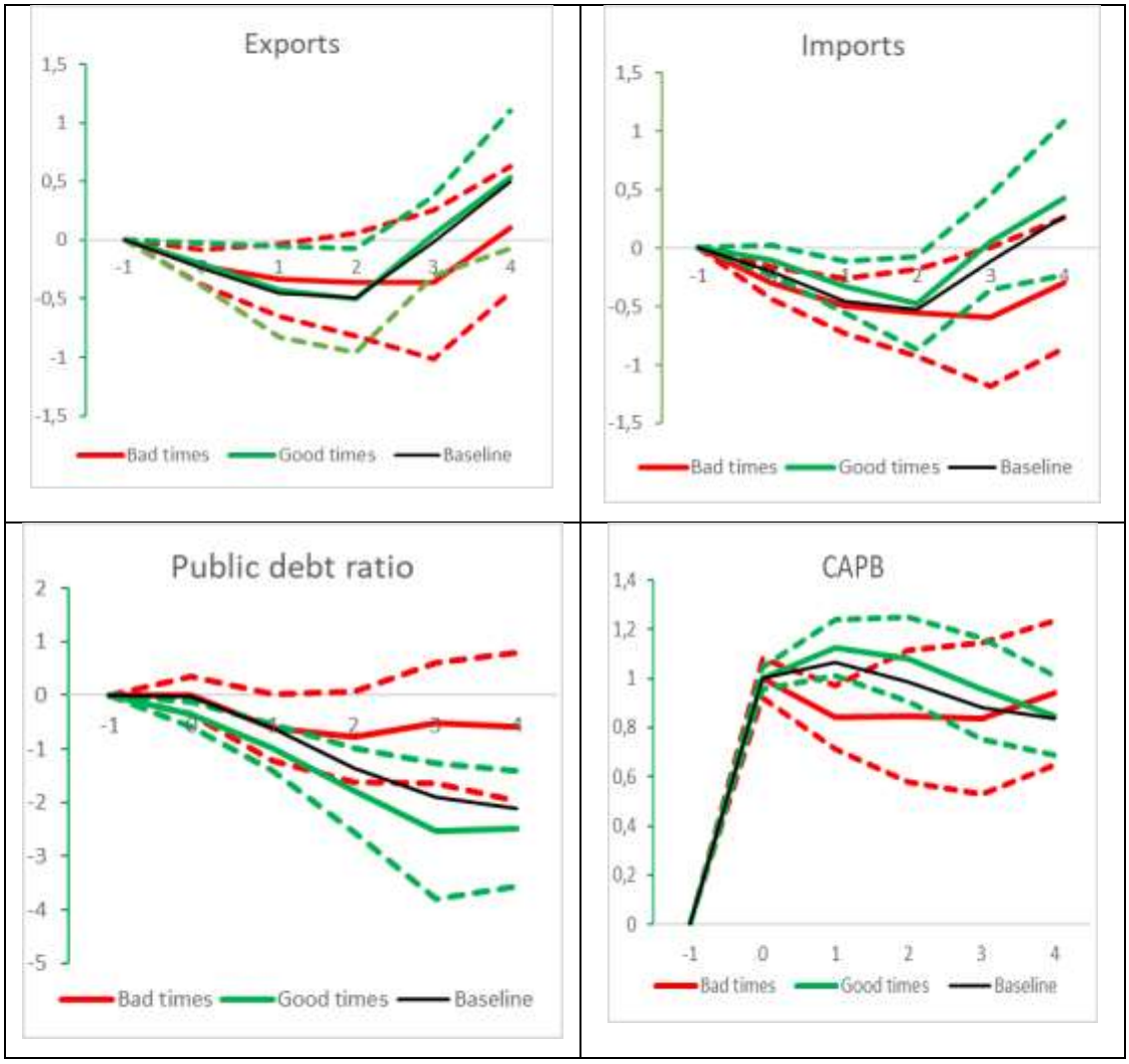
Exports and imports decline after a fiscal consolidation shock, however, there is an indication of faster recovery at the end of the forecast horizon in case of fiscal consolidation shocks in good times. The recovery of imports follows the recovery of real GDP in case of good economic times, while exports improve by the end of the forecast horizon in line with the argument of improved competitiveness based on labor cost channel of Alesina et al. (2002) and Lane and Perotti (1998). Unemployment increases persistently after a fiscal consolidation shock in bad times and remains 0.32 percentage points higher in year 4, while the effect in good times is much smaller and dissipates fast. The inflation rate shows an entirely different response pattern between the two states. In bad times, after a positive impact response, it declines persistently and remains -0.18 percentage points lower in year 4, while in good times it remains positive over the forecast horizon.

In good times, the cyclically adjusted primary balance increases by 1,13 percentage points of GDP in year 1 and the gradually declines at 0.87 percentage points in year 4 and consequently the public debt ratio declines persistently and is lower by 2.58 percentage points in year 4. The increase in the cyclically adjusted primary balance is less pronounced in bad times and the same applies for the debt ratio, which is lower by only 0.98 percentage points in year 4. The negative response of real GDP and the inflation rate contribute to the slower decline of the debt to GDP ratio in bad times after a fiscal consolidation shock. The findings are qualitatively similar when we use the second definition of bad times[4].

[4] The results are not shown here but can be found in the not-for-publication annex.

Figure 2: Bad versus good economic times – 1st definition of Bad times (ΔlogReal GDP<0)





Notes: The impulse responses reflect cumulative changes (in percent) in response to a fiscal consolidation shock of 1% of GDP to the cyclically adjusted primary balance over h = 0, 1, 2, 3, 4 years, h=-1 is the year prior the fiscal consolidation shock. The 90% confidence bands are based on robust standard errors clustered by country. Definition of Bad times: ΔlogReal GDP<0.

Figure 3 reports the evidence based on the first definition of high debt ratio. The impulse responses have the same shape as in the baseline model; however, the magnitude and statistical significance of the results differ in the high and low debt ratio states. First, the decline of real GDP is much more pronounced in the high debt ratio case and reaches its lowest values of -1.05 in year 2 and -1.04 in year 3, while in case of low debt ratio the decline of real GDP following a fiscal consolidation shock is much smaller (the lowest value is -0.34 in year 2). Similarly, private consumption, government consumption and investment show a more pronounced decline after a fiscal consolidation shock in a high debt ratio state (the minimum values being -0.58%, -0.20% in year 4 and -0.56 in year 3, respectively). The evidence reported here is in line with Klein (2017) for private debt but contrary to the findings of with Banerjee and Zampolli (2019) for public debt who find

that a high level of public debt (above 80%) makes the output costs of fiscal consolidation smaller.

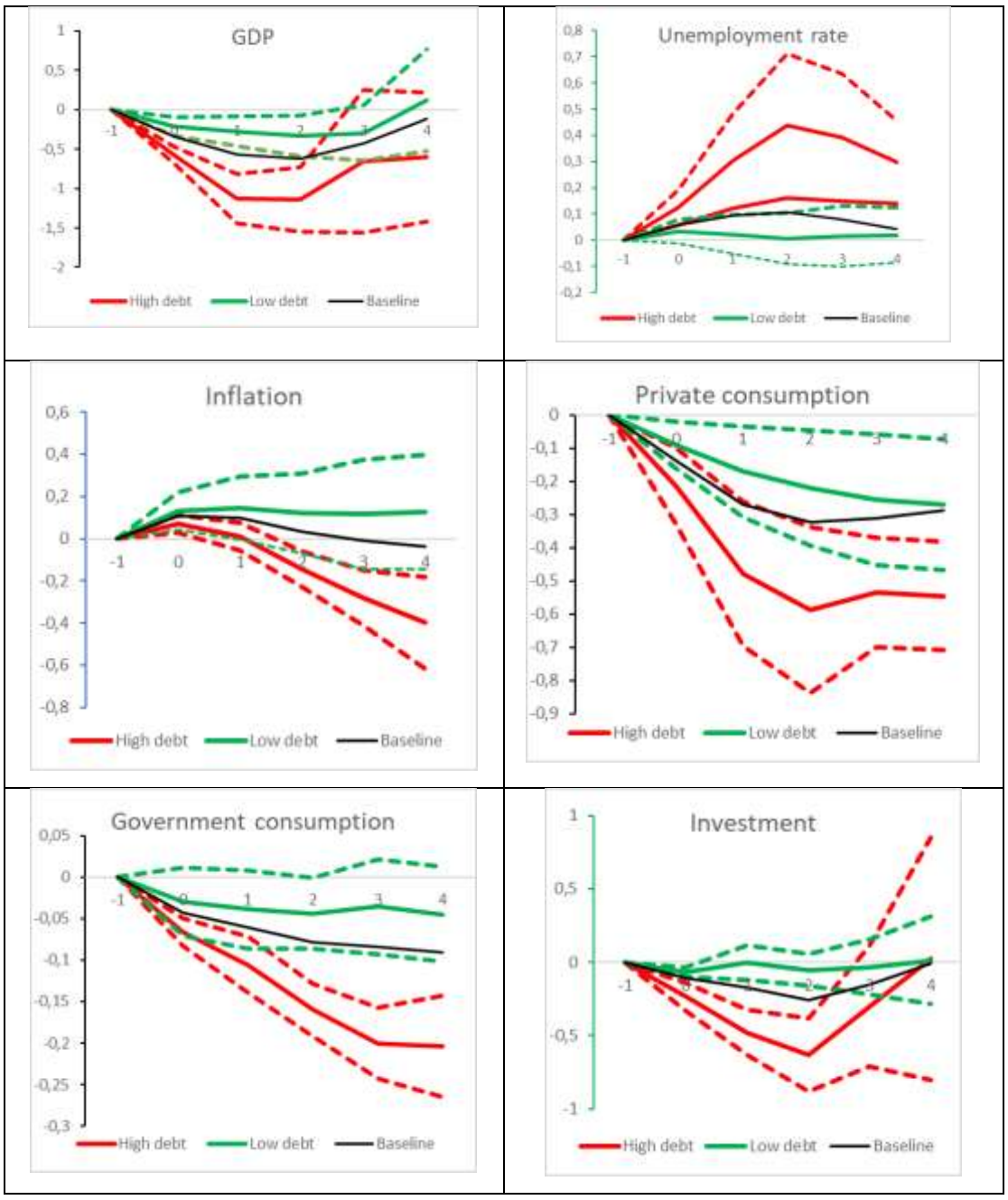
Exports and imports decline after a fiscal consolidation shock, however, as in the case of bad times, they recover faster at the end of the forecast horizon in the low debt ratio state. With net exports increasing in year 4 in the low debt ratio state.

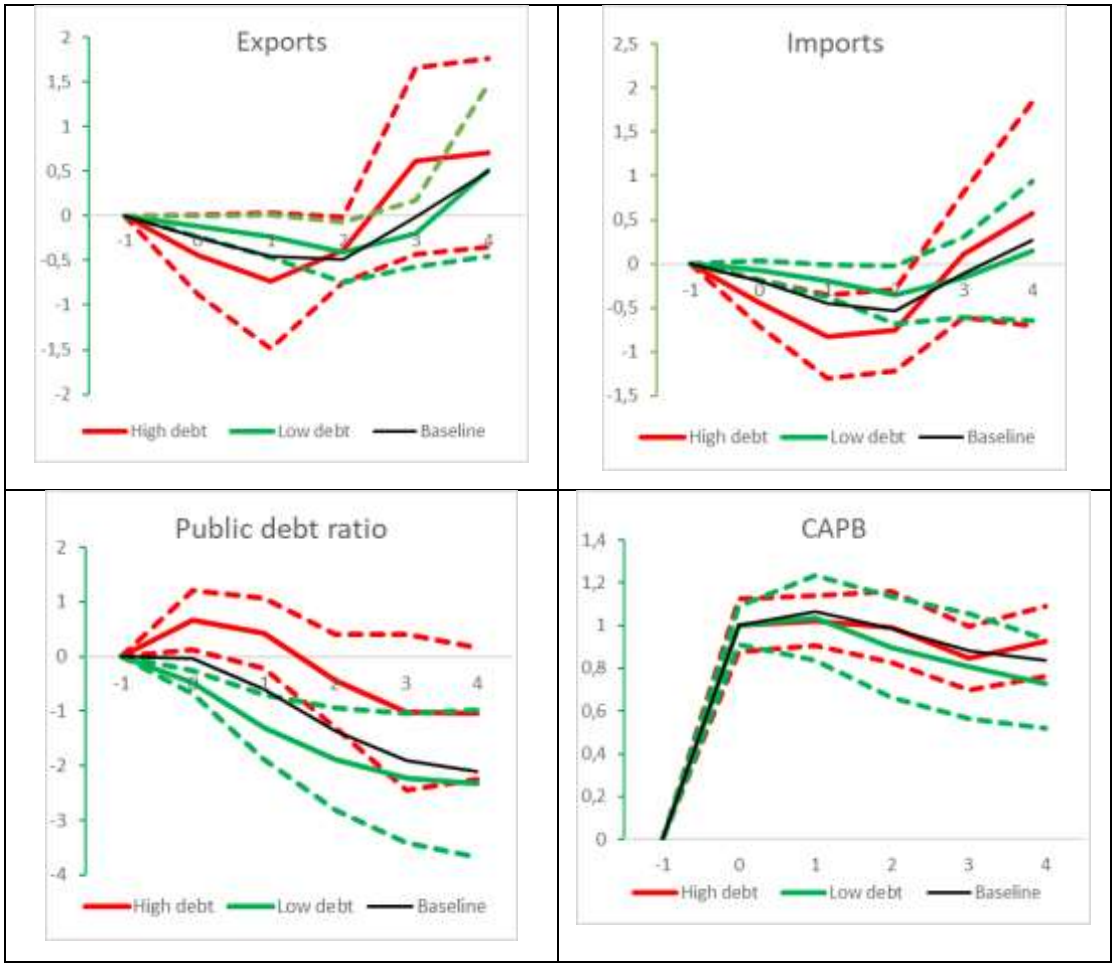
The unemployment rate increases persistently after a fiscal consolidation shock in a high debt ratio state and remains 0.39 percentage points higher in year 4, while the effect in the low debt ratio state is much smaller and insignificant. The inflation rate shows an entirely different response pattern between the two debt ratio states, resembling the response pattern in bad and good times. In the high debt ratio state, after a positive impact response, it declines persistently and remains -0.27 percentage points lower in year 4, while in the low debt state it remains positive over the forecast horizon (+0.11 percentage points in year 4).

In the high debt ratio state, the debt to GDP ratio increases on impact and then declines persistently, being -1.31 percentage points lower in year 4. In the low debt ratio state, the debt ratio declines persistently after a fiscal consolidation shock ending up -2.36 percentage points lower in year 4. The different response pattern of the debt to GDP ratio is explained by differential real GDP and inflation rate responses in the high and low debt ratio states. The cyclically adjusted primary balance increases in year 4 by 0.93 and 0.73 percentage points of GDP in the high and low debt ratio states, respectively. The findings are qualitatively similar when we use the second definition of high debt ratio.[5]

[5] The results are not shown here but are available in the not-for-publication annex.

Figure 3: High versus low debt ratio – 1st definition (100% debt ratio threshold)





Notes: The impulse responses reflect cumulative changes (in percent) in response to a fiscal consolidation shock of 1% of GDP to the cyclically adjusted primary balance over h = 0, 1, 2, 3, 4 years. The 90% confidence bands are based on robust standard errors clustered by country. The impulse responses show the effects of fiscal consolidation in high versus low debt ratio states; the 100% debt ratio threshold is used.

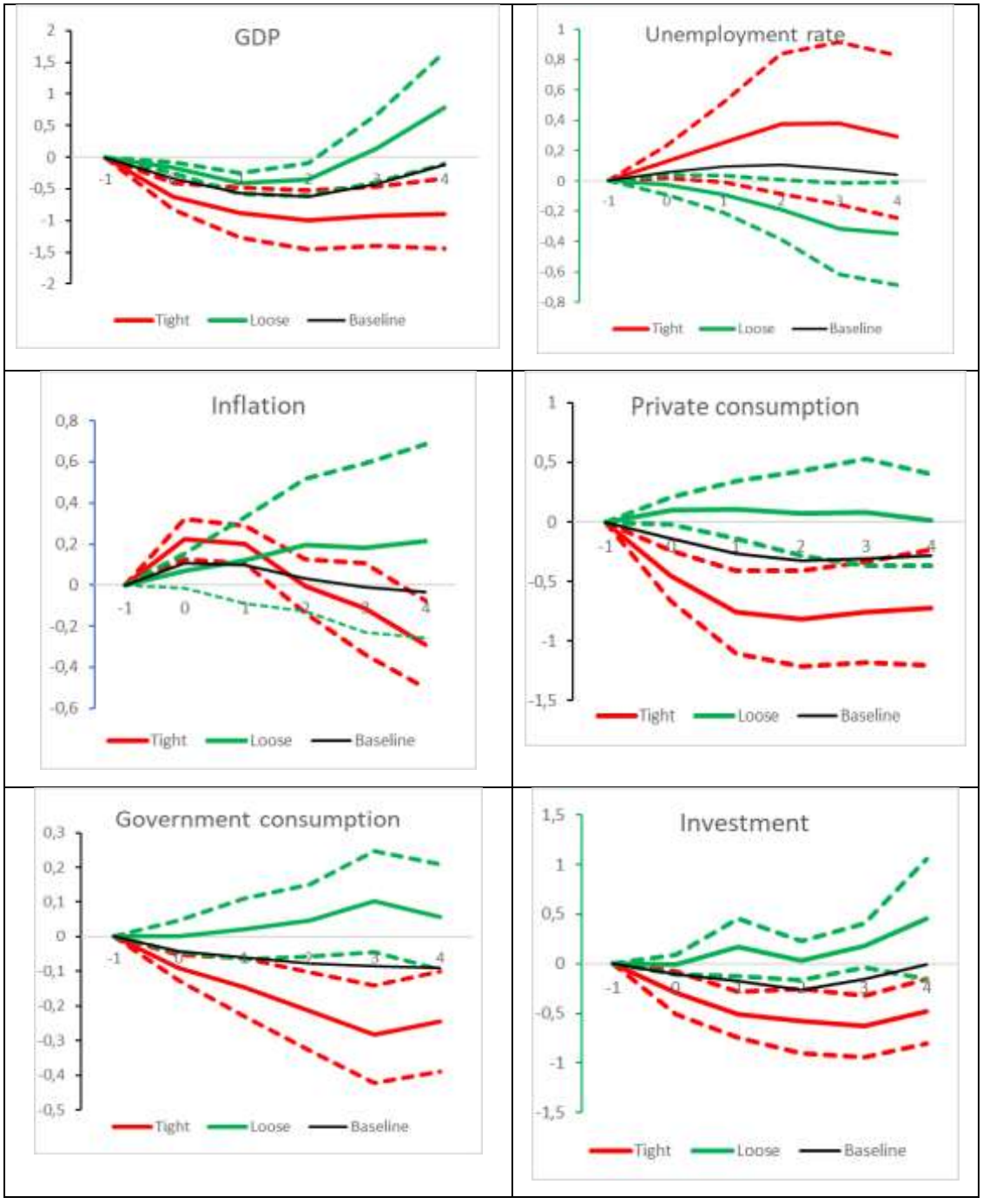
Figure 4 reports the evidence based on tight versus loose monetary conditions. Real GDP declines significantly in tight monetary conditions, reaching is lowest value of -0.92 percent in year 2 and ending up at -0.80 percent in year 4. While, in loose monetary conditions the decline in real GDP is much smaller and there is indication of expansion at the end of the forecast horizon as in Banerjee and Zampolli (2019). Private consumption, government consumption and investment show a quite pronounced decline after a fiscal consolidation shock in tight monetary conditions (the minimum values being -0.76% in year 2 and -0.27% and -0.59 in year 3, respectively), while their response is positive but insignificant in loose monetary conditions. Private consumption and investment respond positively after an unanticipated fiscal consolidation shock in times of loose monetary conditions in line with the expansionary fiscal consolidation approach, but the impulse responses are not statistically significant.

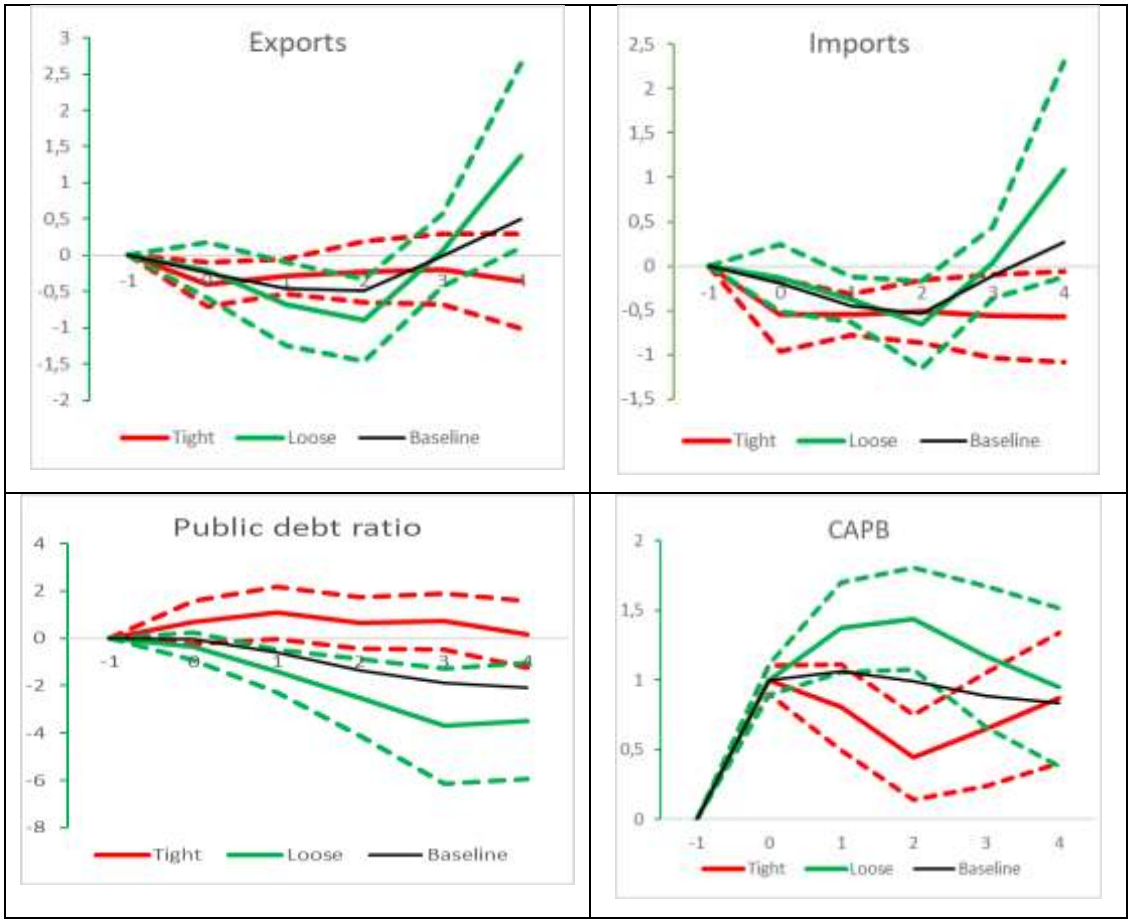
Exports and imports decline after a fiscal consolidation shock, however, in loose monetary conditions they recover faster towards the end of the forecast horizon. The recovery of imports follows the recovery of real GDP in case of loose monetary conditions, while exports improve by the end of the forecast horizon in line with the argument of improved competitiveness (Bénétrix and Lane, 2010).

The unemployment rate increases persistently after a fiscal consolidation shock in tight monetary conditions and remains 0.26 percentage points higher in year 4, while in loose monetary conditions the effect is positive, pointing to lower unemployment rate. The inflation rate, after a positive impact response, declines and remains -0.26 percentage points lower in year 4, while in good times it remains positive, but the effect is insignificant over the forecast horizon.

The fiscal consolidation shock leads to a persistent decline of the debt ratio in a loose monetary state, with the debt ratio ending up -3.22 percentage points lower in year 4. This effects in driven both by the more sizeable increase in the cyclically adjusted primary balance over the forecast horizon and the more limited decline in real GDP. In tight monetary conditions, the fiscal consolidation fails to lower the debt to GDP ratio, which increases but not in a statistically significant manner.

Figure 4: Tight versus loose monetary conditions





Notes: The impulse responses reflect cumulative changes (in percent) in response to a fiscal consolidation shock of 1% of GDP to the cyclically adjusted primary balance over h = 0, 1, 2, 3, 4 years, h=-1 is the year prior the fiscal consolidation shock. The 90% confidence bands are based on robust standard errors clustered by country. The impulse responses show the effects of fiscal consolidation in tight (high interest rate) versus loose (low interest rate) monetary conditions.

Finally, figure 5 reports the evidence based on open versus closed economies, in terms of trade openness. In line with a standard macroeconomic textbook and Beetsma and Giuliodori (2011), a fiscal consolidation shock leads to bigger output loss in closed rather in open economies. The same conclusion applies for private consumption, government consumption and investment.

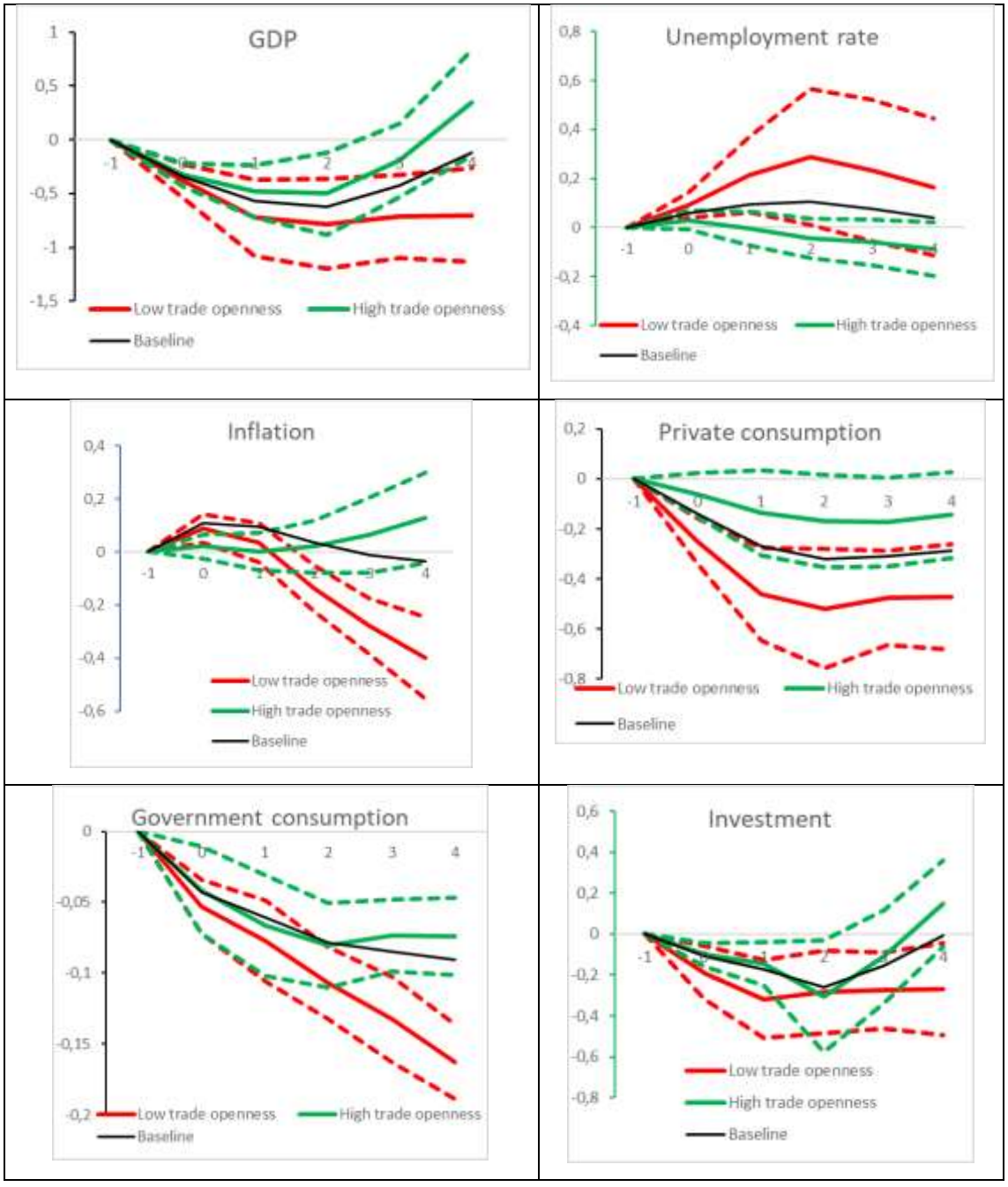
The response of exports is insignificant in closed economies, while imports decline (with the minimum value being -0.20% in year 1) in line with the fall in real GDP and the effect is significant at least for year 0 and 1. Hence the fiscal consolidation improves the trade balance in line with the twin deficits hypothesis. In open economies, exports decline reaching the minimum value of -0.76% in year 2. On the other hand, imports fall because the negative income effect arising from lower real GDP. Imports record their biggest fall of -0.78% in year 2. The much more sizeable decline of imports after a fiscal consolidation shock is in line with the increased trade leakages in open versus closed

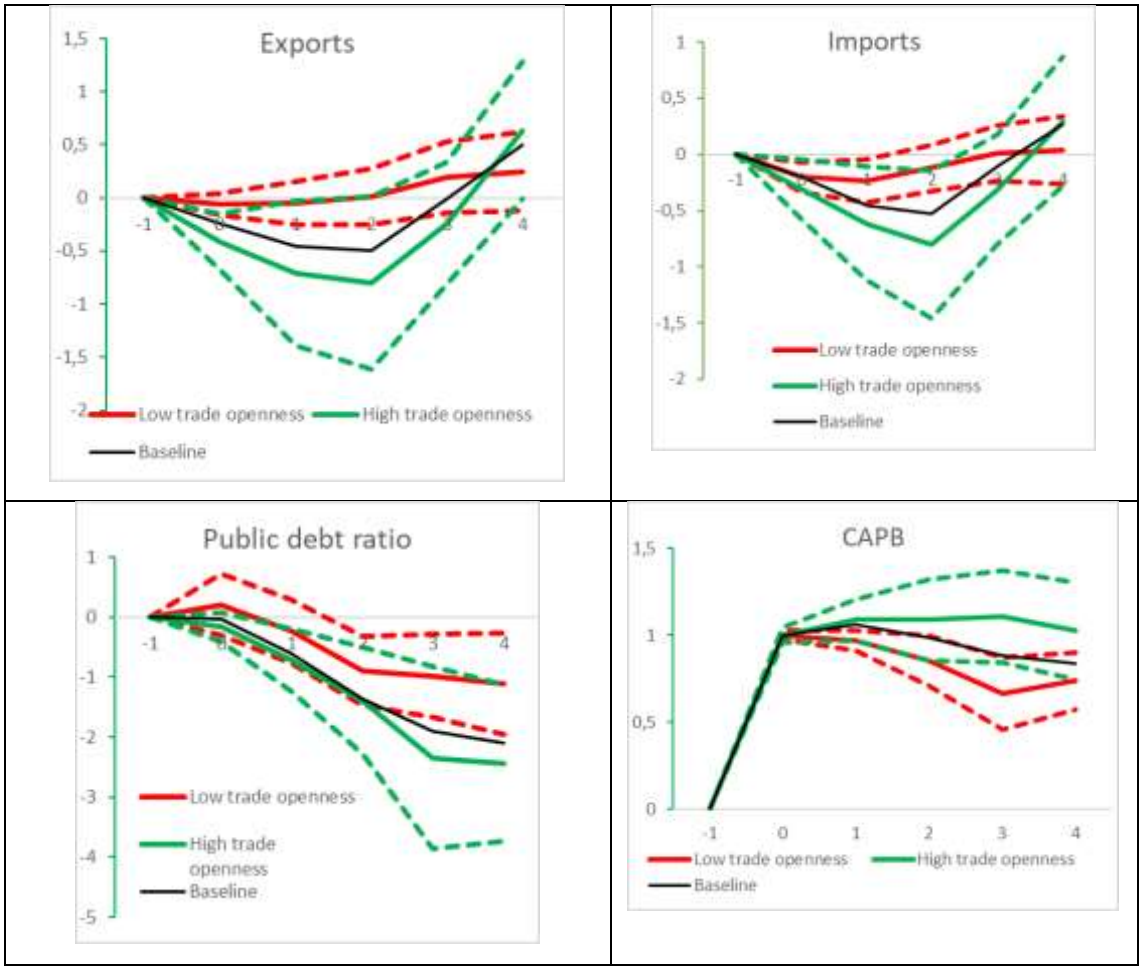
economies. Over the end of the forecast horizon, both exports and imports recover. Imports follow the improvement in the real GDP response, while exports benefit from improved competitiveness (Bénétrix and Lane, 2010).

The unemployment rate increases in closed economies, but the response is statistically significant only until year 1 – the impulse response is insignificant in open economies. The inflation rate, after a positive impact response, declines and remains -0.30 percentage points lower in year 4 in closed economies, while in open economies the response is positive but insignificant.

In closed economies, the fiscal consolidation shock leads to a moderate decline of the debt ratio, with the debt ratio ending up -1.34 percentage points lower in year 4. This effects in driven both by the less sizeable increase in the cyclically adjusted primary balance over the forecast horizon and the more pronounced decline of the real GDP and the inflation rate. In open economies, the fiscal consolidation is more sizeable, given that the cyclically adjusted primary balance remains above 1 percentage point over the forecast horizon. Coupled with the smaller decline in real GDP (and the indication of positive inflation response) this ends up to a more sizable reduction of the debt to GDP ratio (which is lower by 2.42 percentage points in year 4).

Figure 5: Open versus closed economies





Notes: The impulse responses reflect cumulative changes (in percent) in response to a fiscal consolidation shock of 1% of GDP to the cyclically adjusted primary balance over h = 0, 1, 2, 3, 4 years, h=-1 is the year prior the fiscal consolidation shock. The 90% confidence bands are based on robust standard errors clustered by country. The impulse responses show the effect of fiscal consolidation in high and low trade openness economies.

4. Robustness check

The results presented so far rely on the assumption that we can extract from a fiscal rule, like the one shown in equation (2), purely exogenous, discretionary, fiscal consolidation shocks. These fiscal consolidation shocks do not reflect the systematic response of the fiscal policy maker and are supposed to be unpredictable. However, it could be the case that even the discretionary fiscal consolidation shock is driven by economic conditions, i.e., it is endogenous. Therefore, to address this concern, building on the work of Jorda and Taylor (2016), we estimate the average treatment effect (ATE) of fiscal consolidation by applying the augmented-inverse probability weighting estimator (AIPW).

Turning to the treatment, i.e., the fiscal consolidation episodes, we construct the dummy variable D1 which takes the value 1 when the residuals from equation (2) are positive ($e_{it}>0$) and zero otherwise. This definition of fiscal consolidation episodes is closely linked to the definition of the fiscal consolidation shocks used in Section 2 (we used as fiscal consolidation shocks the positive residuals from equation (2)) and generates 258 cases of fiscal consolidation episodes out of 518 data points.

As a next step, we want to examine whether the fiscal consolidation episode at time t could be predicted by the information available at time t-1. To this end, we estimate a probit model (the treatment equation) which considers various initial macroeconomic and fiscal conditions that could predict the fiscal consolidation episode. The following variables were used: the first lag of the output gap, the lagged change of the public debt to GDP ratio, the first lag of the cyclically adjusted primary balance as a percent of GDP, the lagged value of trade openness [(exports+imports)/GDP], the first lag of the nominal long term government bond yields, the first lag of net exports [(exports-imports)/GDP] and the first lag of the CPI based inflation rate (see e.g. von Hagen and Strauch, 2001, Lambertini and Tavares, 2005, Tagkalakis, 2009, Jorda and Taylor 2016 etc). The treatment model includes country fixed effects as well as the lagged value of the fiscal consolidation episode. As pointed out by Jorda and Taylor (2016), being in treatment today is a good predictor of being in treatment tomorrow because fiscal consolidation episodes usually last for more than a year.

Table 1: Probit model of fiscal consolidation episode (treatment) at time t

Variables	1	2	3	4	5
output gap(t-1)	0.3759 (0.6807)	0.2814 (0.7675)	0.8010 (0.759)	0.4173 (0.6936)	0.2387 (0.7164)
Δ(public debt ratio)(t-1)	0 .1058 (0.5006)	0.2348 (0.5096)	-0.0946 (0.5551)	-0.0564 (0.5308)	-0.4079 (0.5815)
CAPB/Y (t-1)	-2.6998*** (0.7661)	-2.9429 *** (0.7104)	-4.449*** (1.0772)	-3.5638*** (0.7080)	-5.4896*** (1.0998)
Long term interest rate (t-1)	0.6632 (0.9556)	0.6598 (1.0369)	3.0714* (1.6415)	0.8953 (0.8771)	2.6919 * (1.4848)
Trade Openness(t-1)		-0.0280 (0.0845)	0.3058 (0.2347)	-0.0235 (0.0824)	0.1978 (0.2323)
Net Exports (t-1)		0.9780 (0.6589)	0.4662 (1.2409)	1.0146 (0.6260)	1.037 (1.061)
Inflation rate(t-1)		1.2418 (1.4976)	1.4501 (1.8770)	0.5065 (1.3642)	0.641 (1.758)
Fiscal consolidation episode (treatment) (t-1)				0.1970*** (0.0447)	0.1899*** (0.0474)
Country fixed effects	No	No	Yes	No	Yes
No of Obs.	493	493	493	490	490
Area under the ROC curve	0.5965 (0.0255)	0.6018 (0.0253)	0.6571 (0.0246)	0.6554 (0.0246)	0.6940 (0.0238)

Notes: The table reports average marginal effects. Standard errors are shown in parentheses. ***/**/* Indicate $p < 0.01/0.05/0.10$. ROC stands for Receiver Operating Characteristics. If the model had no predictive ability, the area under the ROC curve would be 0.5. A perfect classification ability would correspond to an area under the ROC curve equal to 1. The area under the ROC curve has an approximate normal distribution in large samples.

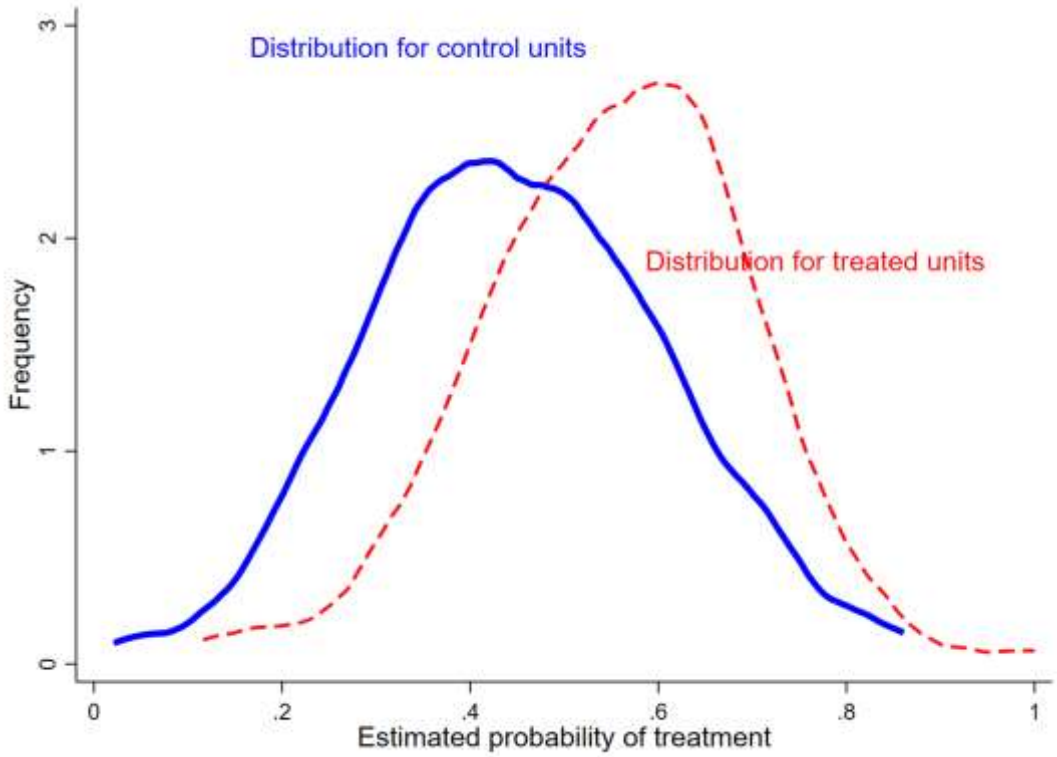
As shown in Table 1, a high cyclically adjusted primary balance at time t-1 implies that a fiscal consolidation episode is less likely to occur at time t. Therefore, a country with a strong initial fiscal position will, probably, avoid a fiscal consolidation in subsequent years. Moreover, there is evidence suggesting that an increase in government borrowing costs at time t-1 increases the probability of a fiscal consolidation at time t.

Finally, a fiscal consolidation at time t-1 is a good predictor for a subsequent fiscal adjustment episode.

Even though only three variables are statistically significant, the classification test "area under the ROC curve" is statistically difference from 0.5 and it has a value close to 0.7 in model 5. This implies that the fiscal consolidation episode that was constructed from the estimated unanticipated fiscal consolidation shocks can be forecasted based on the evidence presented in column 5 of Table 1.

Figure 6 presents smooth kernel density estimates of the distribution of the propensity scores for treated and control units to check for overlap. These densities are based on model 5 in Table 1. As pointed out by Jorda and Taylor (2016) in the ideal RCT setting, " *the empirical distributions of the propensity score for treated and control units would be uniform and identical to each other* ". Taking into account the satisfactory predictive ability of model 5, Figure 6 shows that there is significant overlap between the distribution of propensity scores for treated and control units. Hence, we can use the probit model 5 to identify the average treatment effect of fiscal consolidation using the AIPW estimator.

Figure 6: Overlap of propensity scores for fiscal consolidation episodes



Turning to the outcome equation, it corresponds to equation (1) and involves $Y_{i,t+h} - Y_{i,t-1}$ regressions (where h =0, 1, 2, 3, 4) with Y being the log of real GDP. The control variables used correspond to those employed in equation (1), i.e., the first lag of the GDP growth rate, the public debt ratio, the inflation rate, the nominal long term government bond yields, trade openness and net exports. Country fixed effects and year effects are included in the outcome model.

According to the evidence presented in Table 1 the average treatment effects (ATE) of fiscal consolidations based on the AIPW estimator (ATE of D1) are substantially larger compared to those reported in Figure 1, which for the shake of comparison are also reported in Table 1.[6] The average treatment size is 1.07% of GDP, hence it close to the shock of 1% of GDP increase in the cyclically adjusted primary balance that was considered in the baseline analysis. Therefore, the ATE reported in Table 1 could be rescaled by means of (1/1.07) in order to make a formal comparison with the previous

[6] The full set of results are presented in the not-for-publication annex.

estimates. The rescaled ATE become -0.67, -0.84, -0.69, -0.78 and -0.63, and are still substantially larger than those implied in the baseline analysis.

Table 1: Average treatment effect of fiscal consolidations on real GDP

	Year 0	Year 1	Year 2	Year 3	Year 4
ATE of D1	-0.719*** (0.1942)	-0.901*** (0.3371)	-0.737* (0.4246)	-0.838** (0.4127)	-0.668 (0.4086)
No of obs.	490	467	443	419	395
Fiscal multiplier	-0.32*** (0.057)	-0.52*** (0.113)	-0.56*** (0.142)	-0.36* (0.211)	-0.06 (0.362)
No of obs	511	488	464	440	416

Notes: Average treatment effect (ATE) of fiscal consolidation based on the augmented-inverse probability weighting estimator (AIPW). Deviations of real GDP from t-1 in % of GDP. The outcome model was fit by means of the weighted nonlinear least-squares (WNLS) estimator which is more robust to outcome model misspecification. The outcome model incorporates country and year effects. The specification of the probit model (treatment model) is as described in the text and included country fixed effects. Standard errors (clustered by country) in parentheses. The fiscal multiplier estimates are obtained from the estimation of equation (1) and correspond to the impulse responses of Figure 1 as regards real GDP. They are the cumulative change of real GDP at h=0,1,2,3,4 following a 1% of GDP unanticipated fiscal consolidation shock obtained from the estimation of equation (2). *** p<0.01, ** p<0.05, * p<0.1.

5. Conclusions

Motivated by the adverse macroeconomic environment and the literature on expansionary fiscal consolidations, this paper investigates the effects of unanticipated fiscal consolidation episodes on various macroeconomic aggregates. Employing local projection methods in a group of 24 OECD countries over the period 1990-2019, we find no evidence of expansionary fiscal consolidation. On the contrary, fiscal consolidation lowers real GDP, inflation, and other macroeconomic aggregates, increases unemployment, and delays the reduction of the public debt in states of bad economic conditions, high debt ratio, tight monetary policy, and low degree of trade openness, with the effects being more pronounced compared to the baseline model. The effects of fiscal consolidation are more muted in states of good economic condition, low debt ratio, loose monetary conditions, and high trade openness. In some cases, though, there were indications of positive consumption (in loose monetary conditions) and investment (in expansions and in loose monetary conditions) responses, as well as of improvements in exports by the end of the forecast horizon in line with an argument of improved competitiveness after a fiscal consolidation shock. Moreover, we report evidence

supporting the twin deficit hypothesis. Robustness checks performed show that the effects of fiscal consolidation on real GDP are negative and more pronounced compared to the baseline model. This effect is more sizeable in a high debt ratio state.

In view of the already weak fiscal position in several OECD countries and the initiation of contractionary monetary policy by many central banks around the globe our results show that fiscal consolidation can have quite adverse effect on real economic activity and could be self-defeating as regards its ability to lower debt ratio in the short run.

Contrary to the COVID-19 pandemic where both monetary and fiscal policy were expansionary, in the context of the energy crisis they must work in opposite directions in order to address different challenges. In the short run, fiscal policy, through targeted income support measures, could sustain real disposable income which has been seriously affected by inflation. However, in the medium run, fiscal policy should aim at preserving fiscal sustainability, i.e., fiscal consolidation is warranted to correct fiscal imbalances. On the other hand, monetary policy is already geared towards increasing interest rates to fight rapidly rising inflation and to keep inflation expectations anchored. Eventually, this will increase both the cost of credit and reduce real GDP, putting upward pressure on the debt ratio.

Therefore, the initiation of fiscal consolidation in this adverse macroeconomic environment, in particularly in countries with limited fiscal space, is a very important decision and deserves detailed planning as regards the choice of both the right instruments (tax increases versus spending cuts) and the pace of fiscal adjustment. Building on Potrafke (2011), Afonso and Jalles (2017), Wiese et al (2018) and Alesina et al (2019) the analysis could be extended in the future to examine the interplay between initial macroeconomic conditions, the institutional structure, the political environment, the choice of the policy instruments and the timing and pace of fiscal consolidation.

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