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ABSTRACT

This paper deals with one of the most pressing concerns that Eurozone periphery economies will face in the near future: how to achieve a sustained recovery from the COVID-19 crisis while dealing with growing public debt-to-GDP ratios. The paper assesses the macroeconomic relationship between public spending, economic growth and debt sustainability. We use a TSLS method to perform the econometric estimation of the public spending multiplier for a panel of 11 Eurozone economies over the 1995–2019 period. We find evidence that the multiplier is positive and close to 1,8, suggesting that the benefits of promoting public investment exceed its initial financing cost. As a result, we conclude that debt sustainability is not only compatible with, but in fact improved by a more expansive fiscal policy and present an alternative policy path for the Portuguese economy in the 2021–2025 period based on this conclusion.

KEYWORDS

Fiscal multiplier; public investment; debt sustainability; TSLS; post-Keynesian economics

Introduction

"Look after the unemployment," Keynes once claimed, "and the budget will look after itself" (Keynes 1933, 150). This idea dominated the fiscal policy debate in the postwar period, when there was a consensus about the role of the government in aggregate demand management. However, this consensus was shattered by the experience of the 1970s—the combination of stagnant economic activity and rising prices after the 1973 oil crisis—and by the reemergence of New Classical Economics (NCE) and its monetarist strand, which advocated contractionary policies as the only way out of the crisis. From then onwards, most economists turned to this view and thought the government should keep its intervention in the economy at a minimum in order to allow for the smooth functioning of the markets.

The Great Financial Crisis (GFC) of 2007–2008 and the historic recession that followed have brought the fiscal policy debate back to the forefront. While most developed economies pursued a similar expansionary stance in

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monetary policy, there were substantial differences in fiscal responses to the crisis. In the US, in early 2009, the Congress approved a large fiscal stimulus program—the American Recovery and Reinvestment Act—which amounted to $787 billion and included over $150 billion in public investment in areas such as education, energy and transports. Europe took a different fiscal approach: austerity measures were advocated as a way of rebalancing public accounts and dealing with over-indebtedness in the Eurozone periphery. The IMF and the European Commission pushed this agenda in line with the expansionary austerity doctrine, according to which fiscal discipline would not only help public finances, but also stimulate economic growth. However, the debt-to-GDP ratio in these countries did not fall—it actually rose significantly in some of them, including in Portugal—, while economic activity remained stagnant and unemployment skyrocketed. In addition, the Eurozone as a whole went through a decade of sluggish growth and weak recovery in the labor market, which has revived the debate over the values of fiscal multipliers and brought the discussion on the role of the State in economic development back to the center stage. The COVID-19 crisis and the unprecedented level of fiscal support measures adopted by governments have only fueled the debate further (Skidelski and Gasperin 2021).

In this paper, we aim to explain how an expansionary fiscal policy can be used to stimulate aggregate demand, generate higher growth and achieve a sustained reduction of the debt-to-GDP ratio in Portugal. In order to do so, we undertake an econometric estimation of the public spending multiplier in the Eurozone using a Two-Stage Least Squares (TSLS) method and discuss the links between public investment, economic growth and the public debt-to-GDP ratio. We then build on these findings to analyze the Portuguese government's projections for the 2021–2025 period and draw an alternative scenario based on a more expansive fiscal policy. Our findings suggest public spending has a large positive impact on growth—the multiplier is found to be close to 1.8, meaning that an expansionary policy can decrease the debt ratio. The existing literature on fiscal multipliers has mostly relied on DSGE or VAR methods (see section 3). The novelty of this paper is two-fold: firstly, the use of a single-equation TSLS method for a panel of Euro area economies has not been attempted before, to the best of our knowledge; secondly, the drawing of an alternative policy path for the Portuguese economy and the quantification of its macroeconomic impacts are also innovative aspects. The rest of the paper is structured as follows. Section 2 presents the Portuguese macroeconomic evolution over the pre-pandemic decade (2010–2019). Section 3 covers the theoretical discussion on fiscal policy and multiplier effects. Then, section 4 presents the methodology and results of the econometric estimation, while section 5

outlines the key implications for future policymaking in Portugal, drawing an alternative policy path for the government to promote the economic recovery from the crisis while ensuring debt sustainability. Section 6 offers some concluding remarks.

Portuguese economic performance over the pre-COVID decade (2010–2019)

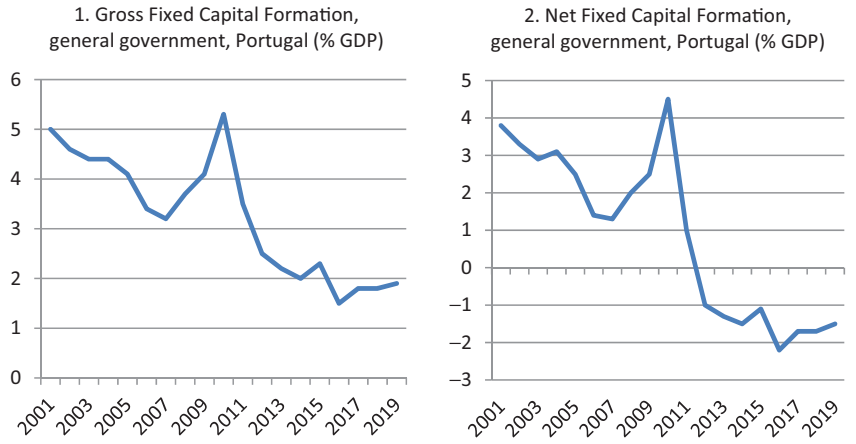
Following the GFC, the Eurozone went through a double-dip recession and experienced significant financial and economic turmoil. The region's real GDP growth rate dropped to −4.5% in 2009, having experienced a timid recovery only to go back to negative figures in 2012 and 2013 (−0.9% and −0.2%, respectively). However, there were significant differences in the way core and periphery countries were impacted by the GFC, the latter registering greater economic damage. Faced with rising interest rates and the absence of a lender of last resort in the Eurozone, Portugal was forced to seek international financial assistance. In 2011, the government signed a Memorandum of Understanding with the International Monetary Fund (IMF), the European Commission and the European Central Bank (ECB)—the so-called Troika. The country received a loan of around €78 billion and committed itself to follow a strict fiscal consolidation program in order to rebalance public accounts. This included cuts to pension and public-sector wages and a significant rise in taxation. The pro-cyclical approach led to a significant reduction in public expenditure and particularly in public investment (Abreu et al. 2013). Real GDP growth was negative during the majority of the adjustment period: −1.7% in 2011, −4.1% in 2012 and −0.9% in 2013, in annual terms (see Table 1, below). Meanwhile, the unemployment rate peaked at 16.2% by 2013, while the debt-to-GDP ratio grew continuously until it reached its peak at 132.9% by 2014.

Portugal concluded the adjustment program by mid-2014. After this period, and particularly after the election of a center-left government supported by the left parties in 2015, fiscal policy regained a more active role in the country and some of the measures that were implemented during

Table 1. Evolution of the main macroeconomic indicators in Portugal, 2011–2014 (Troika's program).

	2011	2012	2013	2014
Real GDP growth rate (%)	−1.7	−4.1	−0.9	0.8
Budget balance (% GDP)	−7.7	−6.2	−5.1	−7.4
Gross public debt (% GDP)	114.4	129	131.4	132.9
Unemployment rate (%)	12.7	15.5	16.2	13.9
Underemployment rate (%)	19.6	23.8	25.4	23
Total expenditure (% GDP)	50	48.9	49.9	51.7
Total revenue (% GDP)	42.4	42.7	44.8	44.4
Gross fixed capital formation, general government (% GDP)	3.5	2.5	2.2	2

Source: AMECO, Eurostat, INE.



Figures 1 and 2. Evolution of the Portuguese government's gross and net fixed capital formation, 2001–2019. *Source: AMECO.*

the Troika period have been reversed, such as the cuts to pensions, public sector wages and social transfers (Lopes and Antunes 2018). The minimum wage has been increased from €505 in 2015 to €635 by the beginning of 2020 and the unemployment rate has gradually declined until 2019, when it reached 6.5%. However, job creation has been essentially linked with the remarkable growth of the tourism industry, which is characterized by lower wages and higher levels of precariousness (Banco de Portugal, 2018). The country's underemployment rate, which also considers the underemployed (part-time workers) and a part of the inactive population (which is either looking for a job or available for one) was still considerably high in 2019 (12.7%). In addition, public investment was severely reduced by the Troika adjustment program and kept a declining trend in subsequent years. If we exclude the spike in public investment in 2009–2010, public investment has been persistently declining in Portugal since the turn of the twenty-first century, as shown in Figures 1 and 2.

The general government's GFCF has even been surpassed by its consumption of fixed capital, which is a measure of the annual depreciation of the public capital stock. In other words, the country's net public investment has been negative since 2012. As a result, the public capital stock has been shrinking over the last decade, as the above figure shows. The government's main argument for this fiscal consolidation effort was that it was necessary to significantly reduce—and eventually eliminate—budget deficits in order to achieve a sustained reduction in the public debt-to-GDP ratio (Centeno 2018). The government actually achieved this target by the end of 2019, just before the pandemic hit the global economy, having registered the first budgetary surplus in Portugal's short democratic history. The country also registered an important reduction in its debt ratio, which fell to 117.2% by

Table 2. Evolution of the main macroeconomic indicators in Portugal, 2015–2019.

	2015	2016	2017	2018	2019
Real GDP growth rate (%)	1.8	2.0	3.5	2.8	2.5
Budget balance (% GDP)	−4.4	−1.9	−0.9*	−0.3	0.1
Gross public debt (% GDP)	131.2	131.5	126.1	121.5	117.2
Unemployment rate (%)	12.4	11.1	8.9	7.0	6.5
Underemployment rate (%)	21.3	19.6	16.5	13.7	12.7
Total expenditure (% GDP)	48.2	44.8	45.4	43.2	42.7
Total revenue (% GDP)	43.8	42.9	42.4	42.9	42.7
Gross fixed capital formation, general government (% GDP)	2.3	1.5	1.8	1.8	1.9

Source. AMECO, Eurostat, INE.

**Note*. Initially, the deficit had been set at −0.9%, but then the government was forced to include the expenditure related with the capitalization of Caixa Geral de Depósitos, the country's public bank. Hence, the budget deficit was officially set at −3%. However, the latter does not reflect the country's fiscal consolidation effort.

2019. Tables 1 and 2 summarize the Portuguese macroeconomic scenario during and after the Troika's program, respectively.

The merits of such an approach, however, are far from being undisputed. In particular, the considerable drop in public investment, which is already perceptible in under-funded public services, has been criticized for undermining Portugal's economic development process. Disagreements over the most adequate strategy to ensure economic growth and debt sustainability in the country are linked with different views on the functioning of the economy and the role of fiscal policy. These will be discussed in the next section.

Fiscal policy and multiplier effects: a review of the literature

> The crisis has provided evidence that fiscal policy is an appropriate countercyclical policy tool when monetary policy is constrained by the zero lower bound, the financial sector is weak, or the output gap is particularly large. (IMF 2013, 1)

By the fall of 2013, the IMF had few doubts about the relevance and the benefits of an active fiscal policy when the economy is operating below its potential. However, no more than a couple of years before, the same institution had been responsible for promoting severe austerity programs as a recipe for the GFC in the Eurozone periphery. How can one explain such a dramatic change of position?

The institution's initial view is underpinned by the theoretical framework of sound finance. According to this approach, the government should aim at keeping a near-zero structural balance (i.e. the budget balance excluding cyclical effects and one-off measures) in order to stabilize public indebtedness. This approach can be traced back to the work of Haavelmo (1945), who developed a theory to explain why a fiscal expansion was not necessary to achieve full-employment. The Haavelmo theorem postulated that a balanced budget could serve this objective: raising public expenditure and taxes by the same amount could have a positive impact in aggregate

demand and output, since the expenditure multiplier is higher than the taxation one. During the New Classical-New Keynesian synthesis of the 1970s and 1980s, arguments against expansionary fiscal policies grew stronger due to the work of economists such as Robert Lucas, Milton Friedman or Thomas Sargent and the emergence of Dynamic Stochastic General Equilibrium—DSGE—models. These authors introduced the concept of "rational expectations," which would lead economic agents to change their behavior when faced with a change in government's policies, and coupled this concept with another crucial one: the Ricardian equivalence, according to which attempts to stimulate the economy via debt-financed expenditure would not be effective, since agents would anticipate the need to repay the debt with future taxes and would reduce their current level of consumption, thus offsetting the initial demand stimulus. The government's attempts to promote full-employment through an expansionary fiscal policy would be ineffective and generate higher inflation (De Vroey 2016).

The fiscal policy approach in the European Union is arguably inspired by the sound finance view, as the rules laid down in the Stability and Growth Pact (SGP) show: Member-States are bound to either comply with the limits imposed to the public debt ratio (60%) and the budget deficit (3%) or to follow an adjustment trajectory in which the debt ratio must be reduced by 1/20 of the difference between the actual debt ratio and the 60% threshold. In addition, Member-States are required to set a Medium-Term Objective (MTO) for their budgetary situation and define a target for their structural deficit which must not exceed 0.5% (or 1% if the debt ratio is below 60%). The European Commission states that "MTOs are set to ensure sound fiscal health. They take into account the need to achieve sustainable debt levels while ensuring governments have enough room to manoeuvre and a safety margin against breaching the EU's fiscal rules" (European Commission 2021, 1). Consequently, the notion of "fiscal space" is widely referred to by the Commission as an indicator of public finance sustainability, even if this concept is not defined in theoretical terms, but rather in relation to current SGP rules (Uxó, Álvarez, and Febrero 2018). Failure to comply with the rules means that the Member-State is not only incapable of pursuing expansionary fiscal policies, but also bound to restrict public expenditure in order to rebalance its public accounts. The adjustment programs designed by European institutions for highly-indebted Member States (such as Greece or Portugal) after the GFC were shaped by this view. However, austerity programs increased public debt-to-GDP ratios and aggravated the recession in these economies. This has even led former IMF director, Olivier Blanchard, to acknowledge the institution had committed crucial errors when designing the adjustment programs, particularly by significantly underestimating the fiscal multiplier in EU periphery

economies (Blanchard and Leigh 2013). Brancaccio and De Cristofaro (2020) extend the previous exercise with panel data up to 2018 and provide evidence that the European institutions have underestimated both short-run and long-run fiscal multipliers.

In contrast with the mainstream view, others have argued in favor of a functional finance approach. As Lerner (1943, 2) explained, "the central idea is that government fiscal policy, its spending and taxing, its borrowing and repayment of loans, […] shall all be undertaken with an eye only to the results of these actions on the economy and not to any established traditional doctrine about what is sound or unsound". Lerner argued that the role of the government is to manage public accounts in such a way as to achieve specific predefined objectives, such as full-employment or price stability. This resonates with the Post-Keynesian principle of effective demand, according to which the economy is demand-determined and investment is independent from savings (i.e. investment and capital accumulation are not tied to individual consumption decisions). In a monetary economy, markets do not necessarily clear for two reasons: households do not necessarily spend their entire income on consumption (so there may be leakages from the monetary circuit and lack of aggregate demand), and investment decisions by the firms may not be sufficient to offset these leakages (Keynes 1936). The growth rate of aggregate demand is therefore associated with both short-run and long-run economic fluctuations. In the short-run, this is translated into successive periods of expansion and recession; in the long-run, since private investment is driven by the existence of incentives for firms to expand production, technical progress and productivity growth are also strongly linked with the evolution of aggregate demand (Lavoie 2018). The notion of hysteresis—i.e. the idea that fluctuations in aggregate demand have a decisive influence on the growth rate of potential output—is an essential feature of the Post-Keynesian view. In this sense, the role of the government is to manage the level of aggregate demand according to the different phases of the cycle, so as to ensure full utilization of the productive capacity and full employment in the economy. In an economy with excess capacity, deficit-financed government spending is a powerful stabilization tool.

Fiscal policy controversies extend to the discussion over the value of macroeconomic multipliers. Multipliers are measured as a cause-effect relation between a change in a specific fiscal instrument (in real terms) and the subsequent change in real GDP, usually drawn from shocks or impulses to the fiscal instrument under analysis (Gechert 2017). Conventionally, the sign of the multiplier refers to an expansionary change corresponding to a budget deficit due to a spending increase or a revenue cut, so a positive multiplier means that a fiscal expansion leads GDP to expand. We can define the multiplier in comparative-static analysis as follows:

$$m = \frac{\Delta Y}{\Delta FI} \tag{1}$$

where m stands for the multiplier, ΔY is the change in total output (i.e. real GDP) and ΔFI stands for the change in the fiscal instrument.

There are several factors which may influence the sign and size of the fiscal multiplier. The economic environment plays a significant role: the impact of government spending on GDP is likely to be larger if the expansionary fiscal stance is accompanied by an accommodative monetary policy or by a similar expansion in the country's main trading partners, both of which favor the boost to domestic demand. Multipliers may also vary according to the choice of the fiscal instrument (expenditure vs. taxation), the different phases of the business cycle, the exchange rate regime, the degree of openness of the economy, the different propensities to import or the different taxation systems. The impact of an increase in public expenditure can be reduced in the presence of net leakages—i.e., if leak-outs from the domestic economy outweigh leak-ins. These leakages are related to the notions of crowding-in and crowding-out effects and are related to the above mentioned characteristics of the economy (Gechert 2017). There has been a vast academic literature on fiscal multipliers and, in the last two decades, there was a remarkable rise in the number of empirical studies. These will be covered in the next sub-sections.

Model-based estimations

Mainstream authors use DSGE models, like the New Keynesian (NK) or Real Business Cycles (RBC) ones, in order to estimate the effects of government expenditure. These models impose strong long-run restrictions, such as the existence of individual agents with rational expectations or the prevalence of a Taylor rule in monetary policy. An increase in public spending is assumed to result in higher interest rates, thus crowding-out private investment and leading households to reduce their consumption level due to the consumption intertemporal substitution effect (i.e. the idea that households reevaluate their permanent income expectations and change their behavior accordingly). Although NK models also incorporate nominal rigidities and imperfect competition, allowing for a slightly stronger role for government policy than the RBC ones, most DSGE models estimate a fiscal multiplier between 0 and 1 (see Ratto, Roeger, and Veld 2009, or Kaszab 2011).

There are, however, some authors who find multipliers slighlty higher than 1: Furceri and Mourougane (2010) achieve this result by modeling non-Ricardian households who consume their entire disposable income

(meaning that a fiscal expansion with positive effects on real wages can boost private consumption), while Christiano, Eichenbaum, and Rebelo (2011) find that positive multiplier effects arise when nominal interest rates are equal to zero (Zero Lower Bound), the reason being that fiscal expansions raise inflation expectations and lower the real interest rate, thus boosting consumption. It is worth noting that the relevance of general equilibrium models has been severely questioned since the GFC, mainly for their lack of realistic assumptions (Louçã, Abreu, and Costa 2021).

Var and local projections methods

A second line of research aims to estimate fiscal multipliers while reducing the theoretical impositions on the analyzed variables. Fatás and Mihov (2001) looked at the data from the US economy between 1960 and 1996 and used a recursive VAR approach to estimate a fiscal multiplier of 0.7–1.74. Blanchard and Perotti (2002), on the other hand, analyzed the US economy using a structural VAR (SVAR) approach, which is built upon the previous one but contemplates the possibility of imposing non-zero restrictions to the coefficients of the model. SVAR models take into account two-way causality in fiscal instruments: while changes in fiscal instruments influence the level of aggregate output, changes in the latter also affect fiscal policy. This approach, which allows the authors to define specific theoretically-derived values for the parameters of the model, has been used by Galí, López-Salido, and Vallés (2007) for the US economy and by Afonso and Aubyn (2019) for 17 OECD countries, the latter finding that public investment has a positive growth effect in most countries and can crowd-in private investment. Ilzetzki et al. (2013) estimate differentiated impacts in a set of 44 countries (using a SVAR method) and find that while the public consumption multiplier is lower than 1, the public investment multiplier is larger than unity. It is also possible to employ a sign-restrictions VAR method which, unlike the SVAR one, imposes only a positive or negative sign of impulse-responses (Mountford and Uhlig 2009).

Some authors have developed a narrative-based approach with a qualitative assessment of fiscal expansions and its uncorrelation with the business cycle (Ramey 2011). Others use the Local Projections methodology, which relies on running individual regressions for each horizon and then building impulse response functions: Auerbach and Gorodnichenko (2012) follow this approach for a group of OECD economies and argue that the fiscal multiplier is larger than 2 in recessions and close to 0 in expansions, while Deleidi, Iafrate, and Levrero (2020) use the same method for a panel of 11

Eurozone countries and study the macroeconomic impact of public investment, finding that it has a positive and permanent impact on growth.

TSLS method

In addition to the two previous approaches, it is possible to estimate fiscal multipliers by using single equation techniques, such as ordinary least squares (OLS) or generalized methods of moments. The advantage of these methods is that they impose no long-run restrictions and do not depend on prior assumptions about the functioning of the economy. Qazizada and Stockhammer (2015) estimate a fiscal multiplier in 21 advanced countries using a Two-Stage Least Squares (TSLS) approach, which comprises two OLS estimations and the use of an instrument variable to deal with the presence of endogeneity in the model. They find that the value of the multiplier depends on the phase of the business cycle: according to their estimation, it is close to 1 during periods of expansion and up to 3 during recessions. Afonso, Gruner, and Kolerus (2010) also use the TSLS method to analyze 98 countries during the period of 1981–2007, finding that the multiplier ranges from 0.6 to 1.1.

Supermultipliers

A different strand of the literature has worked on the notion of the "supermultiplier". This concept, originally defined by Serrano (1995), aims at linking the short-term Keynesian multiplier with the accelerator mechanism for aggregate investment, with a view to provide an explanation for the determinants of total output and employment in the long-run. According to this strand of research, the autonomous component of aggregate demand (i.e. exports, autonomous consumption and, more importantly, public spending) is a crucial driver of economic growth.

Some studies have attempted to quantify the impact of changes on autonomous demand on economic growth over longer periods of time. Girardi and Pariboni (2015) use a panel instrumental-variables approach for the US economy and find that a 1 dollar increase in autonomous demand increases output by 1.6 dollars over 4 years. Deleidi and Mazzucato (2021) present estimations for the impact of different types of government spending programs, distinguishing between "mission-oriented" and other programs. Overall, they find a positive multiplier effect on total output over the medium and long run (up to 8 years).

Multipliers in Portugal

Regarding the Portuguese economy, there have been some attempts to estimate fiscal multipliers, despite data limitations. Castro et al. (2013) use a NK-DSGE model with non-Ricardian households to estimate the impact of a permanent reduction of government spending in total output and public debt in a small euro area economy (such as Portugal). The authors conclude that although the fiscal consolidation strategy has negative output and welfare effects in the short-run, these become positive over the long-run due to the decline of the public debt-to-GDP ratio (and, consequently, of interest payments), the depreciation of the real exchange rate and the increase in international competitiveness. The study finds a fiscal multiplier of 1 for the Portuguese economy. Pereira and Roca-Sagalés (2011) use an unrestricted VAR and find that public investment has a strong positive long-term impact on growth. In turn, Bova and Klyviene (2019) use a structural VAR and rely on OECD elasticities in order to estimate the impact of several fiscal instruments, finding that the short-run multiplier for government consumption is positive.

Fiscal multipliers and debt sustainability

There are two main effects that induce changes in the debt-to-GDP ratio in an economy such as the Portuguese one, which is part of a monetary union: the deficit effect and the snowball effect. The first one depends on the fiscal policy stance chosen by the government: the debt-to-GDP ratio increases with primary budget deficits (since the government has to issue new bonds to finance the deficit) and decreases with primary surpluses. The second one depends on the evolution of the interest rate and the economy's growth rate: the former determines the government's expenditure with the interest on its current debt, while the latter determines its weight relative to GDP. The snowball effect tends to increase the debt-to-GDP ratio if the growth rate is lower than the rate of interest, and decrease this ratio if the rate of growth exceeds the interest rate.

This reasoning can be translated into the following equation for debt accumulation:

$$\Delta d_t = \frac{i_t - g_t}{1 + g_t} \cdot d_{t-1} - pb_t + o_t \tag{2}$$

where the change in the government debt-to-GDP ratio (Δd_t) is decomposed into (1) the snowball effect (which accounts for the impact of the difference between the nominal interest rate charged on public debt, i_t, and the nominal GDP growth rate, g_t, multiplied by the debt-to-GDP ratio of the previous period, d_{t-1}), (2) the primary balance effect (accounting for

the budget balance excluding interest payments, pb_t) and (3) the stock-flow adjustment effect, o_t, which takes into account the factors that are not included in the budget balance but may still affect the level of public indebtedness, such as debt adjustment effects, transactions of financial assets, effects of changes in asset valuations, etc. (Debrun et al. 2019). This is why the public spending multiplier is a crucial variable: if fiscal policy has an important impact on economic activity and growth, i.e. if the value of the multiplier is large, the aim of reducing the debt-to-GDP ratio may be better accomplished by promoting an expansionary fiscal policy (and inducing a positive snowball effect) rather than by restricting public expenditure, which may unnecessarily restrict economic growth and induce a negative snowball effect.

Multiplier estimation

Data

In order to estimate the public investment multiplier for an economy such as the Portuguese one, this empirical analysis covers a balanced panel of 11 Eurozone countries (10 founding members—Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain—plus Greece) during the 1995–2019 period using annual data. The reason for the choice of a panel analysis is linked with the limited number of annual observations for Portugal alone, which restricts the validity of time series analysis. Panel data analysis allows for a more accurate inference of parameters than the time series one, due to the increased information, efficiency and variability contained in the sample (Hsiao 2007). The choice of countries is justified by the fact that these are closely linked, since they belong to a single market with free movement of capital and labor and share common monetary and trade policies during most of the period under analysis (Greece was not a founder, but joined the monetary union shortly after).

Data for total output (GDP), public investment (GFCF), public final consumption expenditure (FCE), inflation (INF, measured by the change in the Consumer Price Index), long-term real interest rates (INT), real effective exchange rates (REER) and population (POP) comes from the AMECO database (see Appendix A1 for data sources and Appendices A2 and A3 for some descriptive statistics). GDP, GFCF and FCE are converted to real terms using the GDP deflator available in the same database. Then, a measure of public spending (Spend)[1] excluding the automatic stabilizers is constructed by adding GFCF and FCE, the idea being to deal—at least partially—with the issue of endogeneity. Control variables (POP, INF, INT and REER) are chosen based on the insights from growth theories and

previous empirical studies. In particular, INT is included so as to account for the impact of investment, while REER aims to account for the impact of exports.

Methodology

We study the effects of public spending on total output using a TSLS method. The TSLS model has advantages over conventional methods: on the one side, it is not directly derived from a general theoretical model of the economy, meaning that it does not depend on strong *a priori* assumptions about the functioning of the economy; on the other side, it does not impose long-run restrictions on the values or signs of the coefficients. It also has the advantage of dealing with the problem of endogeneity and the existence of feedback loops in the model, by using an instrument variable to replace a variable of interest which is correlated with the error term, thus allowing for the estimation of asymptotically unbiased coefficients (Semykina and Wooldridge 2010).

We estimate the following equation:

$$GDPi_t = Ci + \beta_1.GDPi_t{-}1 + \beta_2.Spendi_t + \beta_3.Xi_t + ui_t \quad (3)$$

where i denotes the country ($i = 1, \ldots, n$) and t denotes the period ($t = 1, \ldots, T$). *GDP* is the growth rate of real GDP and *Spend* is the growth rate of public spending (government's FCE plus GFCF), while X is a vector that includes other explanatory variables used as controls in the estimation process—these will include population growth, inflation, real interest rates and real effective exchange rates.

It is important to note that government spending is usually considered to be countercyclical due to the existence of automatic stabilizers, such as unemployment benefits and other social transfers, which are highly responsive to the business cycle. Although public investment is not as responsive to the state of the economy as other types of government expenditure, it is still likely to be influenced by the level of output, so we may consider it to be endogenous to economic activity (Bernoth, Hallett, and Lewis 2015). In order to deal with the endogeneity of *Spend*, the TSLS method entails the definition of an instrument variable and the estimation of an auxiliary regression for government spending in the first stage. In the second stage, the fitted values of the first-stage equation are included in the overall model and a second equation is estimated. In the estimation process, we use the growth rates of GDP, public spending and population; in addition, we use 1-year lagged *Spend* (which is, by definition, predetermined) as an instrument for *Spend*. The validity of such a variable as an instrument can be assessed by performing an *F*-test on the first TSLS regression, the null hypothesis being that the coefficient of the instrument variable is not

Table 3. Results of the econometric estimations.

	FE TSLS (1)	RE TSLS (2)	FE TSLS (3)	RE TSLS (4)	FE OLS	Pooled OLS
Const		0.006*		−0.011		−0.022
		(0.004)		(0.014)		(0.014)
GDPt_{-1}	0.353***	0.482***	0.259***	0.494***	0.243***	0.433***
	(0.061)	(0.060)	(0.075)	(0.063)	(0.074)	(0.060)
Popt_{-1}	−1.853***	0.084	−1.53***	−0.121	−1.577***	−0.309
	(0.435)	(0.281)	(0.532)	(0.355)	(0.522)	(0.332)
Spend	0.432***	0.221**	0.410***	0.279***	0.235***	0.246***
	(0.101)	(0.099)	(0.102)	(0.100)	(0.050)	(0.041)
Inf			0.029	−0.339**	0.116	−0.275*
			(0.150)	(0.157)	(0.149)	(0.150)
Intt_{-1}			−0.011	−0.015	−0.026	−0.012
			(0.070)	(0.067)	(0.069)	(0.063)
REERt_{-1}			−0.058**	0.023	−0.033	0.0327**
			(0.027)	(0.014)	(0.027)	(0.013)
N	253	253	253	253	253	253
Adj. R^2	0.239	0.323	0.245	0.341	0.263	0.407
1st stage *F*-statistic	79.378	71.163	79.378	71.163		
Multiplier	1.87	0.96	1.77	1.2	1.02	1.06

Note: ***, ** and * denote statistical significance at the 1% or lower, 5% and 10% level, respectively. Standard errors are presented in brackets. GDP, Pop and Spend are in growth rates (first-difference of logs).

different from 0 (Bound, Jaeger, and Baker 1995). Usually, an instrument is considered to be valid if the first-stage *F*-statistic is at le ast 10, which is the case in this exercise, as shown in the next section.

Results and discussion

In line with the relevant literature, we use Random Effects (RE) TSLS and Fixed Effects (FE) TSLS estimators, in order to account for specific country-related impacts in the latter model. In Equations (1) and (2), we control only for population growth and lagged GDP growth. Equations (3) and (4) add other control variables. Table 3 summarizes the main results of these estimations and compares them to pooled and FE OLS regressions, which do not take endogeneity into account.

Previous GDP growth is found to be statistically significant in all estimations, possibly signaling the presence of hysteresis. The (negative) impact of inflation and population growth is only statistically significant under RE TSLS and the (negative) impact of an increase in the real effective exchange rate is only statistically significant under FE TSLS, while the effect of the interest rate appears to be statistically insignificant in both cases.

Spend is found to be statistically significant in all regressions, at least at the 5% level (in fact, statistical significance is ensured at the 1% level in all regressions but one). Under FE, the coefficient of government spending is lower once we control for inflation, the interest rate and the real effective exchange rate. Since we are using growth rates, the coefficient of *Spend* is an elasticity: to get the value of the multiplier, it is necessary to multiply

the value of the coefficient by the average ratio of GDP-to-Spend over this period (which, in this sample, is around 4,324)[2]. The public spending multiplier is large in both estimations (1.87 in Regression (1) and 1.77 in Regression (3)), while its value is lower in RE TSLS regressions. However, the performed Hausman specification test, which detects endogenous regressors and misspecification issues, suggests that the FE model is the preferred one. Multiplier values are essentially in line with previous studies, such as Qazizada and Stockhammer (2015), and suggest a considerable positive impact of public investment and final consumption on economic growth in the short-run (1-year period).

These results should be carefully interpreted. It is important to bear in mind that regression analysis is an imperfect way of assessing the links between macroeconomic variables. Lawson (1997) criticizes econometric methods for requiring a closed-system representation of the economy in order to allow for the inference of direct causal relations between two variables, despite the fact that real-world economies are complex systems. Even when using methods that do not impose *a priori* restrictions on the estimated coefficients—such as in the TSLS approach—, which are arguably more adequate in the search for realistic relationships between variables, there are still problematic aspects due to the researcher's inability to perform experimental controls (Martins 2016). Nevertheless, despite its inherent limitations, we may interpret the obtained value as an approximation of the average impact of government spending on the Eurozone economy's growth during the historical period under analysis, providing a hint on how government spending may affect economic activity over the next years. The multiplier is found to be positive and larger than 1, which supports the heterodox view on fiscal policy. Furthermore, it is important to note that while public investment has positive effects on the short-term, it also provides longer-term structural benefits to the economy. Exploring these links is the purpose of the next section.

Implications for future policymaking in Portugal

In this section, we critically analyze the Portuguese government's macroeconomic projections for the 2021–2025 period and draw an alternative scenario for fiscal expansion, using the multiplier estimated in section 4. The Stability Program 2021–2025 presented by the government to the European Commission sheds some light on the executive's plans for public investment in the coming years. Public GFCF is projected to increase from 2.6% of GDP in 2021 to 3.6% in 2023 and 2024. From 2022 onwards, the program projects a "strong economic recovery based on public investment […] and other measures designed to stimulate the economy in order to

Table 4. Portuguese government's macroeconomic projections for the 2021–2025 period (baseline scenario).

	2021	2022	2023	2024	2025
Real GDP growth rate (%)	4	4.9	2.8	2.4	2.2
Budget balance (%GDP)	−4.5	−3.2	−2.2	−1.6	−1.1
Total revenue (%GDP)	43.6	42.2	42.2	42	41.9
Total expenditure (%GDP)	48.1	45.4	44.4	43.6	43
Public Investment (%GDP)	2.6	3.3	3.6	3.6	3.5
Debt-to-GDP ratio	128	123	120.7	117.1	114.3

Source: Stability Program 2021–2025.

allow for a robust initial impulse with higher and longer lasting multiplier effects" (Ministério das Finanças 2021, 29). This increase will take place in the context of the EU's Recovery and Resilience Fund (RRF), under which Portugal will receive some €14 billion on grants to complement national fiscal measures.

However, the focus of macroeconomic policy is still on reducing the fiscal deficit: more specifically, from −5.7% of GDP in 2020 to −1.1% in 2025, in a considerable effort to rebalance the country's budget (see Table 4, below). This strategy may be understood as being aligned with the European Commission's agenda, according to which fiscal support measures must be "gradually withdrawn" in view of achieving "prudent medium-term fiscal positions" (Dombrovskis 2021, 1). In this sense, the government seems to be relying on the RRF to replace the necessary domestic investment effort while achieving a significant reduction in the budget deficit. This strategy undermines the actual nature of the RRF, which was officially announced as a complement to—and not a replacement of—national investments, and represents a renewed focus on the sound finance approach to macroeconomic policy.

It is important to note that, of all types of government expenditure, public investment is able to generate the greater benefits. In one of its latest *Fiscal Monitors*, the IMF has actually estimated a public investment multiplier of 2.7 after 2 years and recognized that it also had positive impacts on private investment and employment (IMF 2020). There are several reasons for this outcome. Firstly, raising public investment constitutes a way of stimulating aggregate demand: investment in new public works or in the maintenance of existing public facilities is translated into higher rates of capacity utilization and, consequently, lower rates of unemployment/underemployment, which are in turn associated with higher tax revenues and lower government transfers. Secondly, some types of public investment (for example, on infrastructure such as transport facilities—roads, railways, airports—, power-generating facilities or communication systems) crowd-in private investment and stimulate R&D expenditure, due to their procyclical nature and their reliance on expectations about the future demand

growth (Deleidi and Mazzucato 2019). In doing so, they raise the economy's capital stock and boost its productive capacity (Abiad, Furceri, and Topalova 2015).

Furthermore, the negative effects of investment restriction are well documented: the presence of hysteresis effects of fiscal policy means that restricting public investment has permanent negative effects on both total and potential GDP (Fatás and Summers 2018). In the short-run, cuts in public investment unnecessarily restrict economic activity and prevent the economy from reaching its productive potential. Lower GDP growth may, in turn, mislead policymakers into thinking that the economy needs further fiscal adjustment; in addition, lower employment may leave permanent scars in the labor market and harm productivity. Over the long-run, this policy stance is translated into under-funded public services and a slower pace of capital accumulation in the public sector, thus lowering potential growth and hampering the process of economic development. In line with this view, Heimberger (2016) and Stockhammer, Qazizada, and Gechert (2019) provide evidence for the negative impact of fiscal consolidations in output growth, arguing that the austerity measures adopted by Eurozone periphery countries after the GFC have been responsible for the double-dip recession in this area, while Botta and Tippet (2021) link fiscal contractions and the longer-term stagnation trend in the Eurozone periphery.

In this section, we draw an alternative policy path in which the government begins by setting an annual target for real GDP growth and then adapts the level of public spending accordingly. In this scenario, the 2021 government's projections are assumed to hold and the growth target in subsequent years is set to exceed the Stability Program's projections: 6% in 2022, 4% in 2022 and 3% in 2024 and 2025. Then, the government sets its fiscal stance in order to reach this growth target by adjusting the level of public investment. In line with recent analyses of macroeconomic projections, such as Uxó, Álvarez, and Febrero (2018), we calculate the deviations from the baseline scenario using some Keynesian arithmetic.

GDP responds to changes in fiscal policy as follows[3]:

$$\Delta Y = \alpha_e\left(\Delta E^d + \varphi_e \Delta Y\right) - \beta_T(\Delta T^d + \varphi_T \Delta Y) \tag{4}$$

Where Δ denotes a change in a specific nominal variable relative to the baseline scenario, Y is GDP, E is the total public expenditure, T is the total public revenue, α_e is the public expenditure multiplier and $\beta\tau$ is the revenue multiplier. The superscripts c and d denote "cyclical" and "discretionary," respectively. In addition, ϕ_e denotes the sensitivity of total expenditure to total output and $\varphi\tau$ denotes the sensitivity of total revenue to total output (in order to account for the working of automatic stabilizers). The GDP deflator, apparent labor productivity and the rate of population growth are assumed to

follow the path envisaged in the baseline scenario, as well as the implicit interest rate on public debt. It is possible to derive an equation for the impact of government's discretionary fiscal decisions:

$$\Delta Y = \frac{\alpha_e}{1 - \alpha_e \varphi_e + \beta_T \varphi_T} \Delta E^d - \frac{\beta^T}{1 - \alpha_e \varphi_e + \beta_T \varphi_T} \Delta T^d \quad (5)$$

Variations in government spending and subsequent variations in GDP also influence the total public revenues according to its cyclical sensitivity:

$$\Delta T = \Delta T^d + \varphi_T \Delta Y \quad (6)$$

Finally, the consequent changes in the public balance (*PB*) can be represented as follows:

$$\Delta PB = \left[1 - (\varphi_e - \varphi_e) \frac{\beta_T}{1 - \alpha_e \varphi_e + \beta_T \varphi_T}\right] \Delta T^d + \left[1 - (\varphi_T - \varphi_e) \frac{\alpha_e}{1 - \alpha_e \varphi_e + \beta_T \varphi_T}\right] \Delta E^d - i.\Delta D_{t-1} \quad (7)$$

where i is the interest rate on public debt and ΔD_{t-1} is the deviation of previous year's public debt from the baseline assumption. This segment of Equation (7) allows us to take into account the impact of a debt-financed fiscal stimulus. Derivations are presented in Appendix 4.

In order to carry out this exercise, it is necessary to know the values of public expenditure and revenue multipliers ($\alpha\square$ and β_T), as well as their cyclical sensitivity to changes in total output ($\varphi\square$ and φ_T). We use the previously estimated public spending multiplier (1.77) and assume a value of 0.25 for the revenue mutliplier, which is a moderate assumption based on the empirical literature (Batini, Eyraud, and Weber 2014; Gechert and Rannenberg 2018). The values for cyclical sensitivities are taken from the European Commission's estimates for Portugal: −0.04 for the public expenditure cyclical sensitivity, and 0.41 for the public revenue one (Mourre et al. 2013, Table 2.4.; the respective semi-elasticities have been revised by Mourre, Poissonnier, and Lausegger (2019) and have not changed significantly).

Using these values, the equations for the Portuguese economy become:

$$\Delta Y = 1,51\Delta E^d - 0,21\Delta T^d \quad (8)$$

$$\Delta T = \Delta T^d + 0,41\Delta Y \quad (9)$$

$$\Delta PB = 0,91\Delta T^d - 0,32\Delta E^d - i.\Delta D_{t-1} \quad (10)$$

In this exercise, the government adjusts the level of public spending (i.e. investment) without changing taxes ($\Delta T^d = 0$). Table 5 summarizes the evolution of the main macroeconomic variables in the alternative scenario.

Table 5. Description, value and source of parameters used in the calculations.

Parameter	Description	Value	Source
Public expenditure multiplier (α_e)	The effect of a unit change in public expenditure on GDP	1.77	Own calculations (see section 4)
Public revenue multiplier ($\beta\tau$)	The effect of a unit change in public revenue on GDP	0.25	Batini, Eyraud, and Weber 2014; Gechert and Rannenberg 2018
Public expenditure cyclical sensitivity (φ_e)	Change in public expenditure in response to a unit change in GDP	−0.04	European Commission (Mourre et al. 2013)
Public revenue cyclical sensitivity ($\varphi\tau$)	Change in public revenue in response to a unit change in GDP	0.41	European Commission (Mourre et al. 2013)

There are four main conclusions from this alternative projection:

- Firstly, public investment grows by 3 p.p. by the end of 2025 (relative to 2021), while in the baseline scenario it is projected to grow only by around 1 p.p.[4];
- Secondly, the economy grows at greater annual rates from 2022 onwards, which should be expected to lower both the unemployment and under-employment rates;
- Thirdly, the increase in public investment has a moderate impact on public deficit, which follows a similar downward trajectory in the two scenarios (in both cases, it becomes lower than the −3% EU threshold by 2023);
- Finally, the public debt-to-GDP ratio declines at a faster rate in the alternative scenario, reaching 113% of GDP by 2025, while the Government projects it to decline to 114.3% in its calculations. The evolution of these indicators is displayed in Figures 3–6.

This conclusion can be linked with Equation (2): when the fiscal multiplier is sufficiently large, the growth-enhancing effects of promoting public spending offset its initial financing cost. The "snowball effect"—resulting from higher GDP growth—is larger than the change in the country's public balance—resulting from the initial financing cost –, in absolute terms. The exercise carried out in this section shows that debt sustainability is compatible with a more expansive fiscal stance by the Portuguese government.

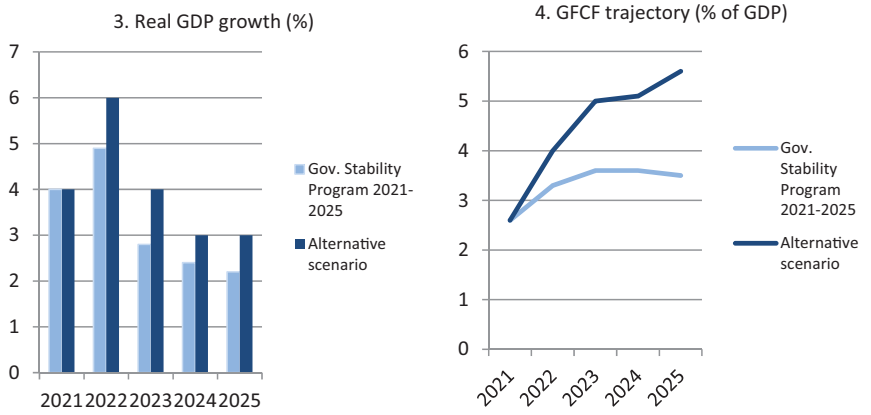
Despite the favorable outlook, the Portuguese economy's external constraint could raise doubts about the effectiveness of the alternative scenario. The boost to aggregate demand and GDP growth is expected to be translated into higher imports, due to the nature of public investment and the imports required by this effort. Since the turn of the twenty-first century, the country's external dependence has been reflected in an ever-growing external debt, a trajectory which was made possible by the Eurozone architecture and was at the roots of the previous crisis (Barradas et al. 2018). However, the positive impact of increased growth may offset the negative

Table 6. Alternative macroeconomic projections for the 2021–2025 period, based on a more expansive fiscal policy.

	2021	2022	2023	2024	2025
Real GDP growth rate (%)	4	6	4	3	3
Budget balance (%GDP), PB/Y	−4.5	−3.4	−2.7	−2.1	−1.8
Total revenue (%GDP), T/Y	43.6	41.1	39.5	38.9	38.5
Total expenditure (%GDP), E/Y	48.1	45.6	44.8	44.2	43.7
Public Investment (%GDP)	2.6	4	5	5.1	5.6
Debt-to-GDP ratio	128	122.7	119	116.2	113

Source. The values for 2021 are taken from the Stability Program 2021–2025, while the rest are the result of own calculations.

Note. The values for public investment are derived by the sum of each years GFCF projections from the baseline scenario with the additional public spending approved by the government in the alternative scenario.

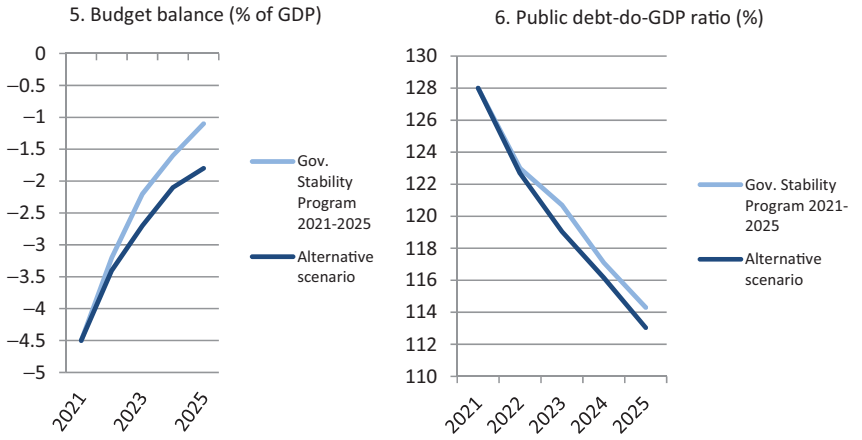


Figures 3 and 4. Comparison of baseline and alternative scenarios: real GDP growth (%) and GFCF trajectory (% of GDP), respectively. *Source*: Stability Program 2021–2025 and own calculations.

evolution of the external debt stock. We can formulate the evolution of the external debt-to-GDP ratio as:

$$\left(\frac{IIP}{GDP}\right)\mathrm{t} = \frac{\left(\frac{IIP}{GDP}\right)_{\mathrm{t}-1}}{(1+g)} + EB \tag{11}$$

Where *IIP* denotes the country's International Investment Position, g is the nominal growth rate and *EB* is the external balance (current account plus capital account). The Portuguese government assumes an external balance surplus of 2.1% of GDP in 2021 and projects it to be even larger during the next years (3.4% in 2022 and 2023, 2.9% in 2024 and 2.5% in 2025). Portugal's IIP was −105.4% of GDP in 2020. Assuming that the government's EB and GDP growth projections for 2021 hold, it will be slightly lower by the end of this year (around −100% of GDP). The Stability Program 2021–2025 does not present estimates for the country's external indebtedness over this period, but we can deliver our own projections for the alternative scenario. For this exercise, we need to take into account the impact of imports on the external balance. Estimates for the income-



Figures 5 and 6. Comparison of baseline and alternative scenarios: budget balance and public debt-to-GDP ratio, respectively. *Source:* Stability Program 2021–2025 and own calculations.

elasticity of imports for the Portuguese economy range between 2 and 2.6 (Soukiazis, Cerqueira, and Antunes 2013; Soukiazis and Antunes 2011; OECD, 2010). If we use a value of 2.5 for this elasticity in the alternative scenario (which is a considerably large value), and assume that exports grow at the annual rate projected by the government, the country's external balance turns negative in 2023 and reaches −5.5% by 2025. However, the boost to GDP growth from a more expansive fiscal policy is capable of off-setting this negative impact on external indebtedness, and Portugal's IIP falls to −81% of GDP by 2025. This outcome suggests that the external constraint should not halt the adoption of a more expansive fiscal stance, particularly if public investment is managed according to import-substitution criteria and in order to promote domestic industrial development (Hein and Martschin 2020). The overall picture appears to support the idea that public debt sustainability is not only compatible with, but actually improved by a more expansive fiscal policy.

Conclusion

More than a decade ago, the onset of the GFC has sparked the debate on fiscal policy and its role in macroeconomic stabilization. The COVID-19 crisis and the unprecedented level of fiscal support measures adopted by governments all around the globe have fueled this debate further. However, while the short-term stabilizing role of fiscal policy has by now been acknowledged by most economists and international institutions, the same cannot be said for its longer-term function in the economic development process. As a result, appeals by international institutions for governments to embrace an active fiscal policy and promote public investment in order to foster the economic recovery have been coupled with warnings about

the need for medium-term fiscal sustainability, which is often interpreted as a requirement to scale back these measures and focus on closing budget deficits so that public debt does not go off the rails (particularly in highly indebted economies, such as the Portuguese one).

In this paper, we argue that the sound finance approach is flawed and that public debt sustainability is not only compatible with, but actually improved by an expansionary fiscal stance in the present context. Using a TSLS method, the public spending multiplier for a panel of 11 Eurozone economies is estimated to be positive and close to 1.8, suggesting that the positive impacts of public investment on economic activity and aggregate income more than offset its initial negative impact on debt. Building on this finding, the Portuguese government's plans for the next 5 years are critically assessed and compared with an alternative scenario in which public investment is assigned a greater role, with positive effects on growth, economic activity and the public debt-to-GDP ratio.

Some limitations of this research are worth mentioning. Firstly, the econometric estimation of the fiscal multiplier for a panel of Eurozone countries provides an indicator of the average impact of public spending in these economies, but not a specific measure for the Portuguese one. Secondly, this paper does not include an assessment of whether the value of the multiplier changes with the economy's rate of capacity utilization or the stage of industrial development. This could be an avenue for further research. Furthermore, the 2021–2025 alternative projections presented in the last section are dependent on some of the Portuguese government's assumptions about the evolution of both the domestic and global economy, as well as on the values of multipliers and cyclical elasticities. The exercise should be understood as an approximate estimate of the evolution of the Portuguese economy under a more expansive fiscal policy (and not as an error-free prediction). Nevertheless, we can derive relevant implications for policymakers. The most important conclusion of this paper is that the sustainability of public finances is compatible with an expansionary fiscal stance. As Skidelski and Gasperin (2021, 22) put it:

> The trauma of the ongoing crisis will not be overcome if fiscal policy is set to turn 'orthodox' – that is, cease to exist as a macroeconomic tool. It is important for governments to understand that fiscal policy is for 'normal' times.

Instead of focusing on closing the budget deficit, the Portuguese government (and the rest of the Eurozone) should focus on managing aggregate demand and promoting public investment in order to foster a socially and environmentally sustainable recovery from the pandemic shock, thus allowing societies to face the risks posed by a changing demographic landscape and the ongoing climate crisis. If this goal is achieved, the evolution of the public debt-to-GDP ratio should not be much of a concern.

Notes

1. We chose to estimate the joint impact of the general government's final consumption expenditure and gross fixed capital formation, so as to include not only investment expenditure, but also expenditure in the production of the public sector's final goods and services. This excludes automatic stabilizers and other types of expenditure, such as bank rescue packages, in order to provide a measure of the government's impact on real economic activity.
2. Denoting GDP as Y, government spending as S and the multiplier as m, we can obtain the value of the multiplier as follows: $\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \frac{m\ (S_t - S_{t-1})}{S_{t-1}} \iff \Delta Y_t = m\frac{\Delta S_t}{S_{t-1}}(Y_{t-1})$, meaning $\frac{\Delta Y_t}{\Delta S_t} \cong m * (\frac{Y}{S})$.
3. See Annex 4 for the derivation of equations used in this section.
4. The fiscal multiplier used in this paper only captures the short-term impact of public investment (over a 1-year period). It does not capture the long-term positive effects of this instrument on growth, which suggests that its impact on economic growth on a 5-year period should be higher.

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Appendix

A1. Data definition and source

Variable	Definition	Source
1. GDP	Real GDP Growth Rate	AMECO
2. GFCF	Real Gross Fixed Capital Formation, General Government	AMECO
3. FCE	Real Final Consumption Expenditure, General Government	AMECO
4. Spend	Real Government Spending Growth Rate = GFCF + FCE	AMECO
5. Pop	Population Growth Rate	AMECO
6. Inf	CPI-based Inflation Rate	AMECO
7. Int	Long-Term Real Interest Rate	AMECO
8. REER	Real Effective Exchange Rate	AMECO

A2. Descriptive statistics

	GDP	GDP_1	Spend	Spend_1	Pop_1	Inf	Int_1	REER_1
N	253	253	253	253	253	253	253	253
Mean	0.019	0.019	0.018	0.018	0.004	0.018	0.024	1.046
Median	0.018	0.019	0.019	0.019	0.004	0.018	0.021	1.017
Min.	−0.107	−0.107	−0.165	−0.165	−0.007	−0.017	−0.060	0.843
Max.	0.225	0.225	0.127	0.127	0.030	0.052	0.228	1.717
Std. Dev.	0.030	0.030	0.039	0.039	0.005	0.012	0.029	0.118
1st Q	0.008	0.008	0.004	0.004	0.002	0.010	0.007	0.989
3rd Q	0.034	0.035	0.038	0.039	0.006	0.025	0.035	1.057
Skewness	0.642	0.611	−1.257	−1.251	1.403	0.055	2.288	2.556
Kurtosis	9.616	9.397	5.375	5.265	4.238	0.272	11.553	8.600

A3. Correlation matrix

	GDP	GDP_1	Spend	Spend_1	Pop_1	Inf	Int_1	REER_1
GDP	1	0.536	0.464	0.375	0.165	0.089	−0.226	0.015
GDP_1	0.536	1	0.519	0.463	0.306	0.281	−0.421	−0.072
Spend	0.464	0.519	1	0.526	0.350	0.180	−0.380	−0.101
Spend_1	0.375	0.463	0.526	1	0.453	0.292	−0.423	0.010
Pop_1	0.165	0.306	0.350	0.453	1	0.306	−0.371	0.466
Inf	0.089	0.281	0.180	0.292	0.306	1	−0.210	−0.077
Int_1	−0.226	−0.421	−0.380	−0.423	−0.371	−0.210	1	0.165
REER_1	0.015	−0.072	−0.101	0.010	0.466	−0.077	0.165	1

A4. Derivation of equations used in section 5

Equation 4:

$$\Delta Y = \alpha_e \Delta E - \beta_T \Delta T \iff \Delta Y = \alpha_e(\Delta E^d + \Delta E^c) - \beta_T(\Delta T^d + \Delta T^c) \iff$$
$$\iff \Delta Y = \alpha_e(\Delta E^d + \varphi_e \Delta Y) - \beta_T(\Delta T^d + \varphi_T \Delta Y)$$

Equation 7:

$$\Delta PB = (\Delta T^d - \Delta E^d) + (\Delta T^c - \Delta E^c) - i.\Delta D_{t-1} \iff$$
$$\Delta PB = (\Delta T^d - \Delta E^d) + (\varphi_T - \varphi_e)\Delta Y - i.\Delta D_{t-1} \iff$$
$$\iff \Delta PB = \left[1 - (\varphi_T - \varphi_e)\frac{\beta_T}{1 - \alpha_e\varphi_e + \beta_T\varphi_T}\right]\Delta T^d$$
$$+ \left[1 - (\varphi_T - \varphi_e)\frac{\alpha_e}{1 - \alpha_e\varphi_e + \beta_T\varphi_T}\right]\Delta E^d - i.\Delta D_{t-1}$$