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Fiscal Policy and Business Cycles: Exploring the Relationship for Portugal

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Abstract

The evaluation of government's macroeconomic stabilisation function highlight the importance of countercyclical fiscal policy in mitigating the adverse effects of economic fluctuations, and the literature identifies various factors influencing fiscal policy cyclicality, such as political distortions, credit market imperfections, and fiscal rules.

We first assess the cyclicality of Portugal's discretionary fiscal policy, relying on the estimation of the cyclically adjusted primary balance and the output gap, using univariate and multivariate methods. Despite some shortcomings, the HP and BK filters perform better. Furthermore, the production function approach, in particular the Cobb-Douglas function, is employed to estimate potential output. The cyclically adjusted primary balance for Portugal is calculated, using the new methodology of the European System of Central Banks.

Our analysis uncovers several significant insights for the 27 EU member states. Firstly, it indicates that more favourable economic conditions are linked to a decrease in the cyclically adjusted primary balance, signifying a more procyclical fiscal policy. Additionally, there is some evidence to suggest that financial development has a positive impact on fiscal performance. Furthermore, corruption appears to exert a negative influence on countercyclicality, while the influence of fiscal rules framework is generally insignificant. However, Eurozone membership is found to result in more stringent fiscal policies.

Our primary focus in this analysis is on the determinants of discretionary fiscal policy in Portugal. The analysis shows a countercyclical fiscal policy. Notably, the study underscores the significant roles played by financial factors and EMU membership in enhancing fiscal discipline in Portugal. In addition, since Portugal is a country that has recently showed persistent fiscal deficits and accumulated public debt and also has an ageing population, the debt-to-GDP ratio and the age dependency ratio influence the policymakers' behaviour, respectively, improving and deteriorating fiscal performance.

JEL codes: C33, E32, E62, H62

Keywords: macroeconomic stabilisation, fiscal policy, business cycles, corruption, credit markets imperfections, fiscal rules

Resumo

A avaliação da função de estabilização macroeconómica do governo sublinha a importância da política orçamental contra cíclica para atenuar os efeitos adversos das flutuações económicas, e a literatura identifica vários fatores que influenciam a ciclicidade da política orçamental, como as distorções políticas, as imperfeições do mercado de crédito e as regras orçamentais. O enfoque passa por avaliar a ciclicidade da política orçamental discricionária de Portugal, com base na estimativa do saldo primário ajustado pelo ciclo e do hiato do produto, utilizando métodos univariados e multivariados. Apesar de algumas deficiências, os filtros HP e BK apresentam melhores resultados. Além disso, a abordagem da função de produção, em particular a função Cobb-Douglas, é empregue para estimar o produto potencial e é calculado o saldo primário ajustado do ciclo para Portugal, utilizando a nova metodologia do Sistema Europeu de Bancos Centrais.

A nossa análise revela várias conclusões importantes para os 27 Estados-Membros da UE. Em primeiro lugar, indica que condições económicas mais favoráveis estão associadas a uma diminuição do saldo primário ajustado ciclicamente, o que significa uma política orçamental mais pró-cíclica. Além disso, existem alguns elementos que sugerem que o desenvolvimento financeiro tem um impacto positivo no desempenho orçamental. Adicionalmente, a corrupção parece exercer uma influência negativa na contraciclicidade, enquanto a influência do quadro de regras orçamentais é geralmente insignificante. Contudo, a adesão à zona euro resulta em políticas orçamentais mais rígidas.

A análise em foco revela uma política orçamental portuguesa contra cíclica. Em particular, o estudo sublinha o papel significativo desempenhado pelos fatores financeiros e pela adesão à UEM no reforço da disciplina orçamental em Portugal. Além disso, uma vez que Portugal é um país que apresentou recentemente défices orçamentais persistentes (e acumulou dívida pública) e que também tem uma população muito idosa, o rácio da dívida em relação ao PIB e o rácio de dependência total influenciam o comportamento dos decisores políticos, respetivamente, melhorando e deteriorando o desempenho orçamental.

Códigos JEL*:* C33, E32, E62, H62

Palavras-chave: estabilização macroeconómica, política orçamental, ciclos económicos, corrupção, imperfeições no mercado de crédito, regras orçamentais

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1. Introduction

In 1992, some European Union (EU) member states reunited to sign the Maastricht Treaty, which initiated a new era with the creation of the Economic and Monetary Union (EMU). In practice, the EMU began in 1999 with irreversible fixation of the exchange rates for the eleven initial participant currencies, as well as the implementation of a single monetary policy overseen by a supranational independent central bank – the European Central Bank. Hence, each country that belongs to the EMU is unable to conduct an autonomous monetary policy (using interest rates or the money stock as instruments) and cannot use the exchange rate policy to smooth business cycles. Therefore, the only macroeconomic policy available at the national level to stabilise the economy is fiscal policy and it is conducted independently by each national government in the EMU.

Fiscal policy is used by governments to carry out three economic functions: allocation, redistribution (both microeconomic in nature) and macroeconomic stabilisation. The latter function seeks to reduce the amplitude and duration of business cycles both in economic expansion and contraction times (Musgrave, 1959).

The macroeconomic stabilisation function is crucial for analysing the behaviour of business cycles. Within this function, the government role includes providing the conditions that enable automatic stabilisers to buffer the effect of demand shocks, using countercyclical discretionary policies to stabilise output around its natural level and planning expenditure to keep the public debt at a sustainable level. The conduction of fiscal policy is particularly significant in the case of a zero lower bound (Fatás & Mihov, 2012) when the effectiveness of the monetary policy is reduced, as seen in Europe following the 2011-2013 sovereign debt crisis. However, according to Blanchard et al. (2021), the framework of fiscal rules established in the European context is becoming increasingly complex, influencing national fiscal policy conduct. As a result of the existing fiscal rules, countries in the EMU face a duality in that they must strive for economic stability and fiscal sustainability.

This is the framework that applies to Portugal as an EMU founding member. It is well known that Portugal has had persistent fiscal deficits throughout its democratic period (except for 2019), and, therefore, high levels of public debt. It is, however, important to assess whether this performance is consistent with the absence of countercyclical fiscal policy. Furthermore, we intend to determine whether, given the institutional framework to which Portugal is subject, policymakers' actions in adopting countercyclical measures have been conditioned by concerns about the sustainability of public accounts, particularly within the increasingly dense context of fiscal rules. On the other hand, persistent fiscal deficits in Portugal, like in any other country, need to be funded, and typically funding fiscal deficits involves borrowing money through the issuance of government bonds or other debt instruments. However, not everything is perfect, as Portugal's debt-to-GDP ratio has been higher than the Maastricht Treaty's threshold since 2003 and, as a result of the global financial crisis and the sovereign crisis that has afflicted some European countries (including Portugal), the financing of large public debts by national or international entities has become more difficult due to countries' high default risk.

Furthermore, policymakers' actions in enacting procyclical measures can be shaped by political factors. For example, in a polarised government, some decisionmakers, following their self-interested behaviour, compete for their preferred expenditure category and do not fully internalise the tax burden associated with it, resulting in excessive spending, leading to a more corruptive economy. Hence, it is essential for countries to strike a balance between funding fiscal deficits and maintaining economic stability because excessive borrowing can lead to unsustainable levels of debt, while excessive strictness measures can hinder economic growth and social development. Therefore, sustainable fiscal policies often involve a combination of responsible management of public finances, borrowing, and structural reforms.

Thus, the aim of this dissertation is to add to the literature on the Portuguese economy by providing an updated, comprehensive, and rigorous analysis of the relationship between discretionary fiscal policy and the business cycle. Thereby, the following research questions will be addressed: (i) Does the Portuguese empirical evidence support the normative view of a countercyclical fiscal policy? (ii) Have corruption, credit markets imperfections, and fiscal rules limited fiscal policy's ability to stabilise the 27 EU economies, and in particular, the Portuguese economy?

To answer these questions, we will use data from the new national accounts "Long time series for the Portuguese Economy" which were released by Instituto Nacional de Estatística (INE) and Banco de Portugal in December 2021, and span from 1947 to 2022. This is relevant because most empirical studies on the subject suffer from an absence of harmonised data to measure fiscal policy's countercyclical behaviour and a lack of long observation periods, indicating a need for new evidence, specifically for Portugal. This first step has the goal of reproducing the output gap using statistical methods and the production function approach used by Almeida and Félix (2006) for the Portuguese economy from 1970 to 2020. Also, we calculate the Portuguese cyclically adjusted primary balance using an adaptation of the methodology provided by Braz et al. (2019), with an extension of the analysis period, covering the years from 1970 to 2020.

Furthermore, due to the Covid-19 crisis and the need to protect households and firms while increasing demand, governments have been willing to accept a significant increase in public debt level, as is the case of EMU members, and this was made possible because the European Commission (EC) suspended the Stability and Growth Pact by activating the general escape clause (Blanchard et al., 2021), allowing members states to provide as much assistance as needed. Thus, a second step is a quantitative analysis to assess the impact of corruption, credit markets imperfections, and fiscal rules on the conduct of fiscal policy in the EU member states, using panel data and including as variables of interest the Corruption Perception Index, two variables to measure credit markets imperfections – the Chi-Ito Financial Openness Index and the International Monetary Fund Financial Development Index –, and the EC Fiscal Rules Index.

The dissertation begins with the literature review on the relationship between fiscal policy and business cycles, supported by an analysis of the normative and the positive perspectives. Section 3 critically debates the methods for assessing the stance of fiscal policy, providing empirical evidence for the Portuguese case. In a subsequent stage, a quantitative analysis is conducted using indicators to measure the impact of political distortions, credit markets imperfections and fiscal rules on the performance of EU countries fiscal policy with particular focus on the Portuguese case. Finally, the major conclusions and limitations with a view on future developments are presented.

2. Fiscal policy and business cycles

In this section, the relevant economic literature in terms of appropriateness of conducting a countercyclical fiscal policy is reviewed. However, some empirical literature concludes that both developed and developing countries often carry procyclical fiscal policy, and the final subsection discusses the reasons for this policymakers' behaviour.

2.1. Fiscal policy's stabilisation function

Governments play a variety of roles by allocating resources, redistributing income, and influencing the level of the economic activity. The performance of policymakers has been viewed by two perspectives. On the one hand, the normative approach establishes guidelines, principles, or norms for welfare-enhancing public sector intervention in the economy attempting to define what the government should do to correct market imperfections and supplement the market to promote social welfare (Musgrave, 1959). On the other hand, the positive approach describes and analyses what the government does, aiming to explain how the behaviour of self-interested individual citizens, organised interest groups, politicians, and government employees – who interact with one another in a variety of nonmarket political institutions – shapes the scope and form of public action (Cordes, 1997).

The normative ultimate goal of the government is to maximise social welfare, which Musgrave (1959) believes can be accomplished through the use of three economic functions: allocation, redistribution, and stabilisation. The former is a strategy used by governments to address potential market failures such as externalities, imperfect competition, the provision of goods or services that are not efficiently provided by the private sector, and information asymmetries. The next function is income redistribution and the provision of essential and merit goods to promote equity in the society. In turn, the macroeconomic stabilisation function, which aims to reduce the amplitude and duration of the business cycle, is important because it keeps the economy from overheating, which can lead to accelerated inflation, and avoids deep contractions with periods of high unemployment.

This last function is critical for analysing the behaviour of business cycles. The government role includes providing automatic stabilisers to buffer the effect of demand shocks, using fiscal policy to stabilise output around its natural level, and planning public expenditure to keep the public debt at a manageable level. The automatic stabilisers are defined as the involuntary reaction to the economic situation of some instruments available to governments, such as taxes and unemployment benefits, which means that some fiscal tools react to the cyclical situation endogenously (without direct the intervention of policymakers) reducing the volatility and persistence of cyclical fluctuations. According to Fatás and Mihov (2012), in countries such as Germany and Portugal, during the period between 1960 and 2010, all of the countercyclical behaviour of the budget balance was due to automatic stabilisers. However, automatic stabilisers may not establish countercyclical behaviour on their own, necessitating policymakers' intervention through discretionary fiscal policy. The United States of America (USA) is an example of this, because the countercyclical discretionary policy was nearly as large as automatic stabilizers between 1960 and 2010 (Fatás & Mihov, 2012). Hence, discretionary fiscal policy complements the role of automatic stabilisers in macroeconomic stabilisation.

Indeed, the goal of fiscal policymakers is to reduce the amplitude and duration of business cycles: when a negative demand shock affects an economy, it usually leads to a contraction (downward of the business cycle), so that governments should conduct an expansionary fiscal policy – lower taxes, higher spending, so lower balances – and when the economy is expanding (upward of the business cycle), the inverse should happen (Fatás & Mihov, 2012). Hence, fiscal policy should be countercyclical.

The downward of the business cycle can cause social costs, such as bankruptcies of financial or nonfinancial institutions, unemployment, loss of living standards and social imbalances. Also, the upward of the business cycle can cause cost for the society, like inflationary pressures on prices and overemployment. Hence, both parts of the business cycle can have long-term effects on the production capacity because the economy can no longer meet consumers demand, and so, the notion that the business cycle upward trend is optimal for a country's economy is wrong.

Many authors began to investigate the costs of business cycles, focusing on the welfare losses for the population in an economy, because the short-run economic volatility can have serious consequences for households, businesses, and governments. Lucas (1989) presented a seminal study on the cost of business cycles that focuses on the effect of fluctuations in the amount of goods and services that people get to consume, that is, how much will the economic fluctuations impact private consumption. The author estimates that the welfare costs of consumption fluctuations are very small for USA post-war years. However, some authors, like Dolmas (1998), Imrohoroglu (1989) and Jordà et al. (2020), attempted to change the preferences hypotheses and other modelling assumptions, resulting in much higher welfare costs. Nonetheless, some other research, such as Otrok (2001), conclude for low welfare costs.

In any case, the aim of the calculation of the costs of business cycles is to demonstrate that, if these results are a good approximation of the reality, government intervention with well-designed policies to prevent financial crises and mitigate large fluctuations of business cycles would allow for substantial gains in the economic welfare.

2.2. The normative and positive perspectives

Conventional economic wisdom holds that fiscal policy should be countercyclical, which is supported by Keynesian and Neoclassical views of fiscal policy. In a contraction, the former view allows for the appearance of budget deficits by issuing more public debt and reducing tax hikes to stimulate aggregate demand, whereas in a boom, it should do the opposite – in both cases, benefiting from automatic stabilisers and discretionary fiscal policies (Keynes, 2010). The Neoclassical view does not address all aspects of government expenditure, but optimal taxation is central to the analysis. Barro (1979), for example, provided a "tax smoothing" hypothesis in which countercyclical measures are used to smooth out tax burden over time. This hypothesis can help stabilise the economy because government expenditures tend to rise during economic downturns, and instead of dramatically raising taxes during these periods – which could further dampen economic activity – the government should borrow to finance the increased spending. Conversely, during expansion times, when government spending is lower, the government should run budget surpluses and use the excess funds to pay down debt incurred during the downturn. This stability can lead to more predictable economic conditions, boosting consumer and business confidence, encouraging investment and spending, as well as avoiding procyclical fiscal policies that exacerbate economic fluctuations.

However, in many countries, countercyclical fiscal policy does not always occur, giving more focus to the positive perspective. Gavin and Perotti (1997) developed a seminal work on procyclical behaviour that does not conform to either Keynesian or Barro prescriptions by analysing data from central and local governments, as well as data from nonfinancial public firms in 13 Latin American countries and industrial countries. In this manner, the authors show that, for the case of Latin American, public expenditure is procyclical, particularly during contractions. Following this study, numerous empirical studies concluded that most countries outside of Latin America adopted procyclical fiscal policies. These empirical works have identified three main causes of such procyclicality: (i) political distortions, like Alesina et al. (2008), Alesina and Passalacqua (2015) and Heimberger (2022); (ii) imperfection in international credit markets, such as Gavin and Perotti (1997), and (iii) fiscal rules as for example, Attinasi et al. (2019), Coeuré and Pisani-Ferry (2005) and Larch et al. (2021).

2.2.1. Political distortions

Alesina et al. (2008) conclude that procyclical policymaking is the result of government failures rather than market failures. The authors believe that voters face corrupt governments that can appropriate a portion of tax revenues for political rents, and by regressing budget surplus or the government consumption (scaled to GDP) with output gap and a corruption measure as explanatory variables, Alesina et al. (2008) discover that, for developing countries, the more corrupt the government, the more likely fiscal policy is procyclical.

Examining the correlation between corruption and fiscal countercyclicality, Jalles et al. (2023) explore how this variable can impact a government's ability to respond effectively to economic shocks. Corruption introduces distortions into economic decision-making processes, potentially impairing a government's capacity to make necessary adjustments during periods of economic turbulence. This, in turn, weakens the effectiveness of fiscal policy in maintaining stable fiscal balances throughout economic cycles. In their comprehensive analysis spanning the years 1980 to 2021 across a diverse range of advanced, emerging market, and developing economies, the researchers utilize the World Bank Corruption index. The study finds that, on the whole, this index lacks statistical significance in explaining fiscal countercyclicality within this broad group of economies. However, the scenario changes when focusing specifically on advanced economies. Here, a notable and statistically significant positive coefficient emerges. This signifies that corruption within advanced economies can act as an obstacle, complicating the feasibility of implementing effective countercyclical policies.

Beyond corruption, other authors tackle different political distortion that can cause a procyclical fiscal policy. Krogstrup and Wyplosz (2010) conclude that one of the sources of deficit bias in an economy is a common pool problem, which occurs when multiple government decisionmakers compete for their preferred public goods, resulting in a current and a future tax burden required to pay for those goods. According to Alesina and

Passalacqua (2015), rational and forward-looking agents do not fully internalise the tax burden of spending decisions, and if a government benefits some districts more than others, this will lead to "excessive spending" in the latter districts. In other words, when governments allocate expenditure disproportionately to certain districts without fully accounting for the tax burden, they may inadvertently encourage "excessive spending" in those districts because residents may be unaware of the true costs they will have to bear through taxes, resulting in inefficient resource allocation and economic imbalances between districts.

Akai and Goto (2022), which study municipal mergers and their effects on public debt, also find a fiscal common pool problem. Municipal mergers incentivize municipalities to issue more debt just before the merger because the debt of each municipality will be shared after the merger, so that there are incentives to increase the value of debt before the municipality's consolidation – the marginal cost of debt prior to the merger is low. Although local governments receive their funding from an upper level government – for example, in Denmark, Finland, Germany, Ireland, Sweden, and the USA – they can also collect taxes and borrow debt independently of state's fiscal base (Hendrick & Shi, 2020); therefore, municipal mergers can affect the state government's fiscal policy because they will lead to additional debt issued by local governments.

Similar to these authors, Lane (2003) presented evidence on the impact of political distortion on fiscal cyclicality for OECD countries, focusing on the "voracity effect" – a different measure from the one of Alesina et al. (2008) – which states that during an expansion period, the intensity of fiscal competition among government levels increases, causing public expenditure to grow more than proportionally relative to income growth, whereas a contraction period chills fiscal competition. The author measured political distortion using an index of "veto points in the political system and the distribution of preferences across and within the different branches of the government" (p. 6), and Lane (2003) concludes from a cross-sectional analysis for OCDE countries that the political distortion variable has a procyclical influence in government consumption, the ratio of primary surplus to GDP and wages in the public sector, but this effect is only significant for government consumption.

Another source of political distortion is rent seeking. The self-interested politician understands that voters will remove him/her from the government if the politician is perceived to be extracting rents. However, voters do not have a commitment to the incumbent politician, that is, even if the politician does not extract rents – or if he/she extracts rents but are not perceived to the voters – these voters may or may not re-elect the politician. As a result, regardless of where the country's economy is in the business cycle, the incumbent politician must set fiscal policies such that define a sufficiently low level of taxation and/or a sufficiently high level of public expenditure to have some chances to remain in office in the following period (Alesina & Passalacqua, 2015).

Heimberger (2022) concludes that elections have a stronger impact for a Eurozone sample as a measure of political distortion. Aldama and Creel (2022), using real-time data to measure fiscal policy responses in OECD countries, conclude that election years have no significant impact on discretionary fiscal stance. Alesina and Passalacqua (2015) conclude that the higher the level of debt chosen by the government, the lower is the probability of re-election of the current government, and governments may incur additional debt if they believe they have a good chance of re-election.

Ilzetzki (2011) investigates the impact of political polarisation (increased disagreement between successive governments, that is, political friction) and the likelihood of re-election of the current government on fiscal policies. The author concludes that when the incumbent is unsure of whether its successor will prioritise the same interests – which occurs only if the likelihood of a turnover is positive – and there is uncertainty about the re-election outcome, the desire to capture rents for the benefit of its own constituency induces governments to save less and spend more when more tax revenue is available, resulting in procyclical fiscal policies (upturn of the business cycle). On the other hand, when there are agreements between the incumbent government and the opposition, the economy can benefit from countercyclical fiscal policies even when there is a chance that an opposing faction will seize power in the future.

2.2.2. Credit markets imperfections

International credit markets imperfections may lead to more procyclical fiscal policy in some countries. The seminal study by Gavin and Perotti (1997) concludes that the procyclicality of fiscal policy, particularly in Latin American contraction times, is due to the total or partial loss of access to international credit markets, using each Latin American country's share of exports of goods and services to capture the effect of emergency credit. This borrowing constraints stem from investors' fears that a fiscal deficit will become unmanageable, resulting in default. Additionally, fiscal policymakers may lose confidence in their ability to manage the situation, which make obtaining credit more difficult, because investors may doubt the government's ability to implement effective fiscal policies to address economic challenges – "precarious creditworthiness" (Gavin & Perotti, 1997, p. 31).

Talvi and Végh (2005) find that output is positively and significantly correlated with government consumption in both developing and industrial countries (except for the G7 countries), and the authors' model concludes that this correlation is not the result of credit rationing by international credit markets during contraction times. Rather, the government's inability to generate large budget surpluses during periods of expansion results in less borrowing during periods of contraction relative to the amount of borrowing that would have occurred without political distortions. Alesina et al. (2008) hold the same view, assuming that the cyclicity of the business cycles is not due to market failures, because the coefficients for developing and industrial countries remained similar before and after the 1982 Mexican debt crisis, as concerns about default and creditworthiness became an issue primarily after that crisis.

In bad times, governments are forced to cut expenditures and raise taxes due to a lack of access to (international or domestic) credit markets, whereas in good times, political pressures for additional spending are difficult to resist. Using indicators of financial development such as the ratio of private credit to GDP and the International Monetary Fund (IMF) Financial Development Index, Haan and Gootjes (2023) conclude that procyclical fiscal policies are frequently used by governments that have a harder time financing budget deficits. In similar vein, Frankel et al. (2013) concentrate on the institutional quality (IQ) using an index that consists of four normalised variables: investment profile, corruption, law and order, and bureaucratic quality. Since their average index value of 0.79 considers acyclical fiscal policy, and "the higher (lower) the IQ in a country, the more countercyclical (procyclical) is fiscal policy" (p. 5), the authors conclude for Portugal that the fiscal policy is procyclical (the average IQ index between 1984 and 2008 is 0.74).

Ilzetzki (2011) investigates the credit markets imperfections using the government borrowing constraints, incorporating a debt limit parameter in his model. When borrowing constraints are combined with political friction, the author concludes that borrowing constraints – simulating the model with different levels of debt limits – leads to procyclical fiscal policies. Hence, while borrowing constraints may contribute to the procyclical nature of fiscal policies to some extent, other factors such as political friction may also play a substantial role in influencing fiscal policy decisions throughout the business cycle.

2.2.3. Fiscal rules

The EU's economic governance is unusual: while monetary policy is controlled by a supranational independent central bank, fiscal policy is still managed independently by national governments. This institutional structure creates a constant bias towards large deficits and debt accumulation because, in addition to the deficit bias present in all economies, an economy that is part of a monetary union and still has control over its fiscal policy has more incentives to run large deficits because an excessive deficit in a single country does not raise the union's interest rate or cause a change in exchange rates, implying that there is no market feedback to contrive.

As a result, to coordinate fiscal policies, achieve robust public finances and sustainable debt levels, and boost citizens' and markets' confidence in the euro, the Maastricht Treaty enshrined two reference values: a 3% cap of GDP on public deficit and a 60% debt-to-GDP target. Alongside these facts, there is a "no bailout clause" that prohibits "the European Union or a member state from "assuming the commitments" of other governments, and the Eurosystem (…) from "purchasing directly" the debt instruments of a government" (Bilbiie et al., 2021, p. 1), which is only possible in the secondary market when a market price has been formed.

Then, in 1997, the Stability Growth Pact (SGP) was implemented to govern the fiscal coordination of member states, and it was built around those two reference values while also stating that member states should aim for a balanced budget over the cycle, allowing countercyclical policy to be implemented up to the 3% limit. The idea behind the SGP's design was that a fiscal framework coupled with capital markets would exert pressure on member states to pursue sound public finances (Bilbiie et al., 2021).

Nonetheless, following the creation of the SGP, some countries encountered difficulties in pursuing a countercyclical fiscal policy to create some fiscal space, prompting the first reform of the SGP in 2005 to formally maintain the rules while eroding them at the same time. Additionally, the "Six-Pack" reform was implemented in 2011, as was the "Two-Pack" in 2013, and with all these reforms, the SGP gained flexibility but also complexity (Bénétrix & Lane, 2013). Therefore, fiscal rules are the third factor that influences the cyclicality of fiscal policy.

Larch et al. (2021) and Coeuré and Pisani-Ferry (2005) conclude that deviations from fiscal rules and the accumulation of government debt leads to a procyclical fiscal policy. Similarly, Attinasi et al. (2019) conclude that discretionary fiscal policy does not deliver economic stabilisation when fiscal policymakers are concerned about the sustainability of public debt, particularly in countries with debt-to-GDP ratios above 60% (the benchmark set by the SGP). However, Aldama and Creel (2022) conclude that fiscal rules have no effect on fiscal decisions and Alqaralleh (2020) claims that the parameters of the fiscal rules appear to preserve the countercyclical behaviour of fiscal policy for United Kingdom, USA and Canada.

3. How to assess the nature of discretionary fiscal policy?

The basic requirement behind determining whether fiscal policy is countercyclical or not is to measure the business cycle and the appropriate fiscal policy aggregate. The output gap is traditionally used to measure the business cycle, and the primary structural balance is usually used to measure discretionary fiscal policy. The next subsection addresses the methodology behind the measurement of the output gap. The following subsection discusses the use of the primary structural balance, followed by the combination of both steps to assess the nature of discretionary fiscal policy for the Portuguese economy for the period from 1970 to 2020.

3.1. Business cycle: how to compute the output gap?

The business cycle is a series of fluctuations in Gross Domestic Product (GDP) around its long-term growth rate (output gap) that explains how the economic activity expands and contracts over time. The estimation of the output gap is important because not only it is used by central banks when using the Taylor Rule to set the nominal interest rates, but also – and most importantly for this topic – it is used for fiscal consolidation purposes as a requirement to estimate cyclically adjusted budget balances (Alvarez & Gomez-Loscos, 2018; Balan & Vlad, 2018). As the output gap relates an observed variable (real output) to an unobserved variable (potential output), we first must estimate the potential output.

Long-term growth rate can be based on two different approaches: potential output and natural output. The former is a supply concept, a measure of the production capacity; that is, it is the level of real GDP that could be achieved if all the factors of production were efficiently used (Balan & Vlad, 2018). Finally, natural output is reached when the labour market balances the capital markets; that is, it is the level of real output at which the inflation rate remains constant, with price increases having no tendency to accelerate or decelerate (Okun, 1962) and is typically associated with flexible prices and wages (Alvarez & Gomez-Loscos, 2018).

We favour the potential output over the natural output because the latter is the level that would prevail in imperfectly competitive markets, with flexible prices and wages; thus, natural output will be extremely volatile, due to the very high variability of wages, that is, the labour supply curve is much steeper with flexible wages than with sticky wages (Justiniano & Primiceri, 2008).

Potential output cannot be calculated directly from statistical data, but its estimation is critical because it allows for the correct dimensioning of the macroeconomic policies and a deeper understanding of how the economy works (Balan & Vlad, 2018). There are two ways to estimate potential output: univariate methods and multivariate methods. The former, also known as statistical methods, estimate trend output based on actual output, using past GDP values to provide an accurate picture of the current and future values of potential GDP (Balan & Vlad, 2018). The multivariate methods, also known as structural methods, estimate the current value of potential GDP based on past GDP values, but they also include useful information on other variables based on the economic theory, such as potential productivity, potential employment, and capital stock (Alvarez & Gomez-Loscos, 2018). It is important to note that different methods may yield quantitatively different estimates of potential output (Botas et al., 1998).

3.1.1. Univariate methods/Statistical methods

In macroeconomic series, we can try to isolate a trend component (τ), which accounts for long-term growth, and a cyclical component (c), which accounts for short-term deviations from the trend. Trend output is the smoothed, long-term average level of the actual output series over time and it is normally obtained by using statistical methods, such as the Hodrick-Prescott (HP) filter or the Hamilton filter (Alvarez & Gomez-Loscos, 2018). These methods use techniques for treating time series that identify the concept of potential output with the trend component of a time series, thereby removing seasonal, cyclical, and erratic components. What constitutes the trend and the cycle, on the other hand, depends on the problem formulation, the analytic objectives, and data availability. Some and, to our knowledge, the most commonly used filters that can generate these components are discussed below.

The HP filter is one of the easiest methods used by economists to predict the tendency of macroeconomic variables. The main idea behind the estimation of the trend component of GDP is that this component varies smoothly over time. Therefore, the trend component is estimated using weighted moving averages calculated from past and future values of observed output, with years close to the one for which potential output is being calculated receiving a higher weight (Botas et al., 1998). The filter identifies the trend component by minimizing the next function:

$$\min_{\tau_t} \sum_{t=1}^{T} (y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \quad (3.1.)$$

where T is the number of years available in the statistical series, y_t is the real output for each year (t), τ_{t+1}, τ_t, and τ_{t-1} are the trend component of the future, current, and past years. The smoothing parameter, λ, is a positive number which penalises variability in the growth component series. The larger the value of λ, the smoother is the solution series (Hodrick & Prescott, 1997). Once the trend component is estimated, the cycle component can be calculated as the difference between the observed data and the trend: $c_t = y_t - \tau_t$.

This filter has the advantages of providing a simple technique for achieving the potential output, of providing a consistent framework that can be applied to different countries in a timely manner (Alvarez & Gomez-Loscos, 2018), and of ensuring that the output gap is stationary (Botas et al., 1998).

Nevertheless, there are numerous disadvantages of using an HP filter. Hamilton (2018) identifies three issues with the HP filter. The first issue is related to the smoothing parameter, as Hodrick and Prescott (1997) provided a probability model to achieve the "perfect" value of λ, suggesting a λ of 16 000 for quarterly data. However, this value may not be entirely correct; the idea of selecting a value rather than an estimate from the data is counterproductive because when the smoothness penalty tends to zero, the trend component is simply the series of actual GDP, and when λ tends to infinity, the procedure amounts to a regression on a linear time trend (Alvarez & Gomez-Loscos, 2018; Balan & Vlad, 2018; Hamilton, 2018). Some authors, such as Baxter and King (1999) and Christiano and Fitzgerald (2003), concluded that the HP filter is only "perfect" for quarterly data because the value of the smoothing parameter for annual data varies in the literature: some authors assume $\lambda=100$, Botas et al. (1998) assume $\lambda=30$, and Baxter and King (1999) assume $\lambda=10$[1]. It is worth noting that this discretionary choice only affects the amplitude of the business cycle, leaving the potential output growth in each cycle and the turning points of each business cycle unchanged (Almeida & Félix, 2006).

[1] The "HELP" tool in MATLAB suggests $\lambda=6.25$ for annual data.

The second problem pertains to the inherent values of the data used for calculating the trend component of a specific year (τ_t). As demonstrated by Hamilton (2018), the filtered values towards the end of the dataset diverge notably from those in the middle because "making use of unknowable future values (…) [will] impose patterns that are not a feature of the data-generating process and could not be recognized in real time" (p. 9). In essence, incorporating forecasting data introduces bias to the trend component (τ_t). To solve this problem, an alternative approach involves utilizing the "one-sided" HP filter, which only relies on current and previous values to predict the trend component (τ_t), so that this alternative does not revise its outputs when new data becomes available.

Alongside these facts, an additional concern arises from the HP filter's tendency to generate artificial cycles within the series, introducing cyclical patterns that were absent in the original data. The default "two-sided" filter, usually applied to historical data, computes outputs using future values of the input series, leading to out-of-the-ordinary outcomes that are unsuitable for predictive purposes.

Given these limitations, Hamilton (2018) proposed an alternative methodology. The trend component is defined by the author as the value that we would expect for the original data at date t based on its behaviour up to date t-*h*. This was formalised by performing an OLS regression of the observed variable y_t on a constant, the realisation *h* periods ago, y_{t-h}, and *p*-1 additional lags: $y_{t-h-1}, \ldots, y_{t-h-(p-1)}$. The author suggests *h*=8 quarters and *p*=4 lags for quarterly data because the filter "is taking out both the long-run trend as well as any strictly seasonal components" (p. 16).

$$y_t = \beta_0 + \beta_1 y_{t-8} + \beta_2 y_{t-9} + \beta_3 y_{t-10} + \beta_4 y_{t-11} + v_t \quad (3.2.)$$

For annual data, Hamilton (2018) assumes that "if we are interested in business cycles, a 2-year horizon should be the standard benchmark." (p.18), so we have a *h*=2 and *p*=1.

$$y_t = \beta_0 + \beta_1 y_{t-2} + v_t \quad (3.3.)$$

The fitted values and residuals from this linear regression correspond to the estimated Hamilton trend and cycle, so $\tau_t=\hat{y}_t$ and $c_t=\hat{v}_t$ (Moura, 2022).

The Hamilton filter[2] outperforms the HP filter in that it can predict the cycle component using only past values of the macroeconomic variable, avoiding spurious cycles (Hamilton, 2018). Additionally, the Hamilton filter produces consistent estimates at sample's boundaries. On the other hand, the Hamilton filter has drawbacks. First, the filter, like the HP filter, is based on a rather arbitrary choice for the forecast horizon (h), just as the HP filter depends on the smoothing parameter (λ), thus failing to correct the first problem discussed above for the HP filter (Moura, 2022). Second, Moura (2022) claims that the Hamilton cycles are twice as volatile and have greater persistence as the HP cycles, and the Hamilton trend component is not as smooth as the HP trend component because the Hamilton filter does not use future information. Hence, the author concludes that the HP and Hamilton filters should be used in tandem tool for business cycle analysis.

The HP filter is classified as a "high-pass" filter because it removes low-frequency cycles while preserving high-frequency volatility. A "band-pass" filter is another statistical method that passes through components of the time series within a specified band of frequencies while removing components at higher and lower frequencies (Alvarez & Gomez-Loscos, 2018; Baxter & King, 1999; Christiano & Fitzgerald, 2003). So, as GDP time series have little power at high frequencies, applying the HP filter results in only minor increases in the volatility of the filtered time series. However, "band-pass" filters are more appropriated for inflation rate series because this macroeconomic variable has significant high-frequency variation.

The filter developed by Baxter and King (1999) is an example of a "band-pass" filter. The Baxter and King (BK) filter's goal is to create a linear symmetric filter that eliminates very slow moving (trend) and very high frequency (irregular) components while retaining intermediate (business cycle) components. Aside from the data itself, the author assumes that we only need a truncation point (K – maximum lag length), a lower (p – shortest cycle length passed by the filter) and an upper (q – longest cycle length passed by the filter) cut-off frequency. The process for obtaining the values is much more complicated than with the HP or Hamilton filters, but the BK filter has the following advantage over the HP filter: it tends to be more robust to structural breaks or changes in the underlying data generating process

[2] As an alternative to the HP filter, Hamilton (2018) proposes a regression filter. However, the Hamilton filter is not a band pass filter.

whereas in the HP filter can be problematic, leading to less accurate trend estimates. Baxter and King (1999) assume that the quarterly values (K=12; p=6; q=32) can be divided by four to obtain the values for annual data, but because the shortest cycle length will not be an integer, the authors adopted a round number (K=3; p=2; q=8). As a result, when the sampling frequency changes, it is simple to modify the filter construction.

The BK filter, on the other hand, is not without flaws. The concern is about the truncation point: what should the value of K be? An increased truncation point value produces an improved approximation to the ideal filter, but much more loss of observations, because "if we choose an approximating moving average with maximum lag length K, implementing the filter means that we lose 2K observations" (Baxter & King, 1999, p. 579) – K at the end of the data and K at the beginning. However, if the maximum lag length is very short, we may encounter issues near cut-off frequencies such as leakage, which occurs when the filter passes through frequencies that were intended to be suppressed and mixes them with those intended to be retained. Baxter and King (1999) studied different values of K and concluded that for values equal to or greater than 12, the BK filter produces a good approximation of a "band-pass" filter.

Christiano and Fitzgerald (2003)'s filter (CF) is a similar example of a "band-pass" filter to the BK filter for extracting middle frequency business cycles. The aim is to determine whether the change in output reflects a shift in trend (lower frequency component of the data) or is simply a transitory blip (part of the high frequency component). The distinctions between the BK and CF filters are primarily technical (each optimises a different objective function), rather than functional (both filters specify lower and upper cut-off periods for the cycle). The CF filter generates an asymmetric time varying moving average filter, which allows the data to be smoothed and the trend component extracted. The advantages over BK filter are that it uses all available data to estimate the trend component of the macroeconomic variable, and it produces better results in real-time analysis. On the other hand, the CF filter displays an asymmetric trait, which means that the weight of past and future observations in generating the trend component for a specific year could diverge. As a result, there could be a tendency for the filtered output to experience a phase shift towards the end of the dataset. This implies that the temporal alignment of specific characteristics in the filtered output might not perfectly match the timing of corresponding events in the original data. In this case, due to the uneven emphasis on past and future observations, the filtered trend component might exhibit a displacement or shift in its position relative to the original data.

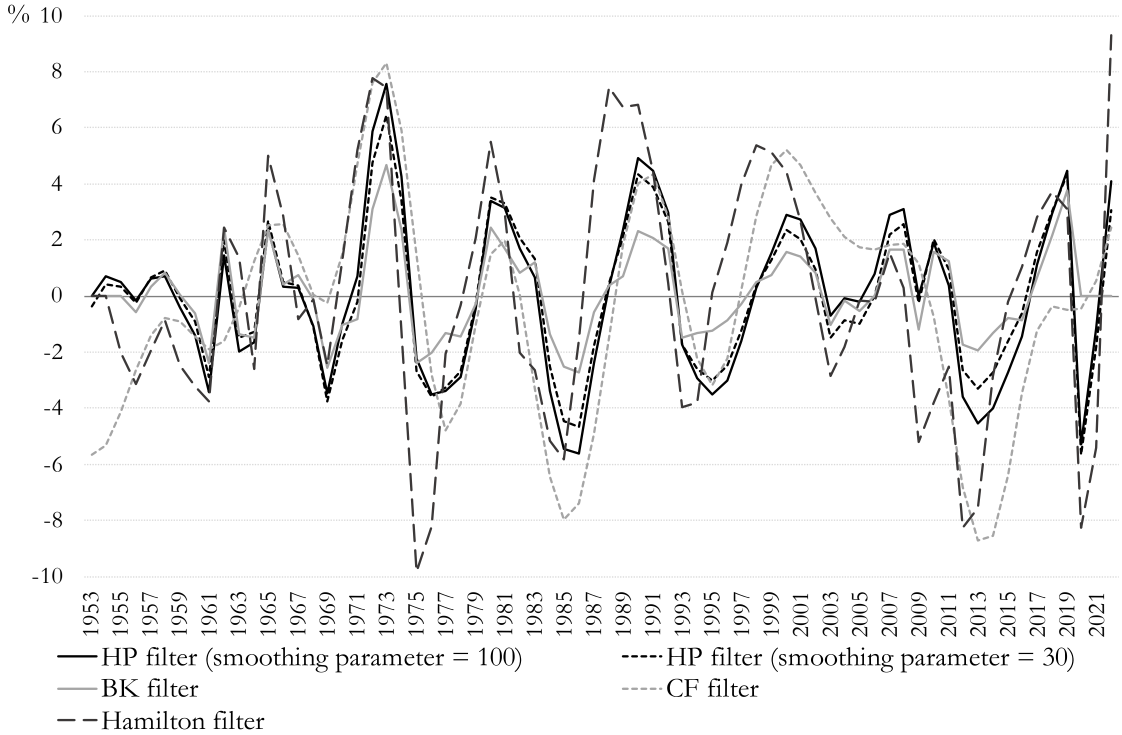
In any case, the primary objective of these filters is to show that if these results are a good approximation of the potential output, we can achieve it using only effective GDP data. However, as previously stated, there is no such thing as a "perfect" filter because all the filters have flaws.

Following the presentation of the statistical methods theory, the goal is to attempt to replicate these filters for the data available from the new national accounts "Long time series for the Portuguese Economy" released in 2021 by INE and Banco de Portugal that currently span from 1947 to 2022. Moreover, since GDP data is only available from 1953 onwards, the analysis will cover the 1953-2022 period. Since the GDP values are available in nominal terms, they were converted to real GDP using the implicit GDP deflators available for the period 1953 to 2022. In line with Hodrick and Prescott (1997), we used the natural logarithms of the real GDP for all filters to calculate the trend and the cycle components[3].

Figure 1 depicts the output gap, using the statistical methods described above, showing the benefits and the drawbacks of each filter, as well as the turning points – most of which are in the same year. We can see that the output gap fluctuations of the HP filter and the BK filter are similar. As for the HP filter, the amplitude of the business cycle is smaller with the smaller smoothing parameter (λ=30), as expected. Given the asymmetric nature of the CF filter's weights for past and future observations, the CF filter is the only filter that provides a negative output gap for the Portuguese economy from 2017 to 2019. The Hamilton filter has a more volatile business cycle, which confirms Moura's (2022) criticism; this behaviour is due to the fact that the Hamilton filter only uses the past data to estimate the potential output. Overall, the filters that seem to perform better are HP and BK, despite the problem at the extremes of the series.

[3] Since we use the logarithm to replicate the filters for our analysis, change in the growth component corresponds to a growth rate.

Figure 1 – Statistical methods: output gap of Portuguese economy, 1953-2022



Source: INE and Banco de Portugal, "Long time series for the Portuguese Economy" (retrieved on April 26, 2023), and own calculations.

Note: Annex 1 contains MATLAB code that reproduces the data used to create this figure.

The Portuguese business cycles have a smaller amplitude and shorter durations in the 1950s and 1960s, but they have a much larger amplitude and a much longer duration in the following decades (7 years in the 1970s; 10 years in the 1980s and 1990s). When Portugal joined the EEC in 1986, the output gap was negative but in a turning point, indicating that the association with the EEC was beneficial. The business cycle was already in an ascending phase when Portugal joined the EMU, with a turning point in 2000. The contraction in 2009 was caused by the global financial crisis, and the contraction in 2011-2013 was caused by the sovereign debt crisis, which resulted in a negative output gap as predicted. The abnormal behaviour at the end of the series is due to the Covid-19 pandemic in which the economy was completely halted due to the 2020 outbreak of a new global virus.

3.1.2. Multivariate methods/Structural methods

The main limitation of univariate methods is that they are merely statistical procedures that do not consider any potential structural constraints in the economy, specifically the higher or lower availability of production factors. Thus, the potential output projected by any of the preceding methods may be inconsistent with changes in productivity, employment, and capital stock. Therefore, multivariate methods attempt to overcome these difficulties by considering the availability of inputs.

The most well-known structural method is the production function approach. As a result of this method, potential output reflects the trend productivity and a level of capital utilisation consistent with the past, as well as a level of labour utilisation consistent with the absence of inflationary pressures which is generally associated with the concept of the natural rate of unemployment (Botas et al., 1998). The two-factor Cobb-Douglas function is commonly used in the production function approach. This method assumes perfect competition and that the elasticity of substitution between the factors underlying such a function is not only constant, but also unitary. We use this production function in the Cobb-Douglas form:

$$Y_t = A_t\, L_t^{\alpha}\, K_t^{1-\alpha}, \text{ with } \alpha \in \,]0, 1[\qquad (3.4.)$$

where Y_t represents the real output, A_t the total factor productivity (TFP), L_t the quantity of labour input, K_t the real capital stock and α the structural parameter, addressed normally as the elasticity of substitution between the factors. This structural parameter (α) can be obtained by calculating the average share of labour returns in Gross Value Added (GVA) (Almeida & Félix, 2006). To be more rigorous, we will address α as the average share of labour returns in the total returns of the factors, excluding the taxes and the subsidies included in the GVA so that these aggregates do not influence the elasticity of substitution between the factors.

In the literature, it is common to assume that the real capital stock is a good approximation to the potential capital stock, given that there is no significant deviation from its long-term equilibrium values, hence, $K_t^* = K_t$ (Almeida & Félix, 2006). The potential employment (L_t^*) is challenging to precisely delineate, as it pertains to an economic scenario wherein nearly all individuals ready and capable of working can attain employment. Essentially, under conditions of full employment, the level of unemployment is minimal, and the majority of job seekers can successfully obtain positions. So, L_t^* is calculated using the total labour force and the natural unemployment rate (u_t^*). Normally, in the literature, this natural unemployment rate corresponds to the Non-Accelerating Inflation Rate Unemployment (NAIRU), but we apply the HP filter (λ=30) to the observed unemployment rate and the u_t^* is the trend of the unemployment rate. Therefore, the potential employment is given by L_t^* = labour force × (1 - u_t^*). The TFP is the residual of the Cobb-Douglas function (Solow's residual), that is, $A_t = \frac{Y_t}{L_t^{\alpha} K_t^{1-\alpha}}$, and to achieve the potential value of TFP the HP filter (λ=30) is applied (Almeida & Félix, 2006).

Once A_t^*, L_t^*, K_t^* and α are known, the potential output can be calculated:

$$Y_t^* = A_t^* \, (L_t^*)^{\alpha} (K_t^*)^{1-\alpha}, \text{ with } \alpha \in \,]0, 1[\qquad (3.5.)$$

This production function can provide a comprehensive and consistent assessment of the economic outlook, and it enables explicit accounting for growth in terms of TFP, labour and capital. Also, when compared to other structural methods, it allows for growth accounting exercises, which express potential output growth as a function of each of its determinants. However, the assumptions considered by this method may not fully correspond to the reality; for example, the assumption of perfect competition does not seem to hold in real world economies. Also, this structural method is not fault free because it uses statistical methods to estimate the trend of the inputs as these are not straightforward to obtain (Almeida & Félix, 2006; Alvarez & Gomez-Loscos, 2018; Botas et al., 1998).

Some considerations should be made before presenting the results. Firstly, the capital stock used within the framework of Cobb-Douglas function corresponds to the total value of fixed assets accessible for utilization as a production factor during a specific period within the national territory. Consequently, this excludes inventories and objects of value – as accounted for in the Investment (Gross Fixed Capital Formation) category – since they do not contribute to the production process. The determination of the net fixed capital stock in the "Long time series for the Portuguese Economy" is calculated using the perpetual inventory method, which accounts for successive accumulations of fixed capital investment based on assumptions about its useful lifespan, as well as depreciation methodology. The net fixed capital stock, like GDP, is presented in nominal terms, but it has been converted into real capital stock through the application of fixed capital stock deflators available from 1970 to 2020. Our calculation of the output gap under the production function approach covers the period from 1970 to 2020, primarily because the capital stock dataset is only accessible for this time span.

Figure 2 – Production function approach: output gap of Portuguese economy, 1970-2020

Source: INE and Banco de Portugal, "Long time series for the Portuguese Economy" (retrieved on April 26, 2023), and own calculations.

Figure 2 shows that the output gap fluctuations according to the production function approach yields similar results to the statistical methods between the 1970s to the 2000s, by looking at the values of the contraction and expansion turning points while considering an interval for potential errors. Different from statistical methods, in the 2000 era, the production function approach places the output gap roughly close to zero, but during the global financial crisis and to a greater extent during the sovereign debt crisis, there was a negative output gap, as was expected. The sudden decline in the output gap was brought on by the Covid-19 pandemic in 2020.

3.2. Cyclically adjusted primary balance

After measuring the output gap of the Portuguese economy, the structural primary balance is needed to assess the impact of the Portuguese discretionary fiscal policy. This variable is the budget balance – excluding the interest payments on public debt – that would have been achieved if the economy had been operating at full capacity and there had been no temporary one-off measures.

The budget balance of a government's economy in each period is represented by the difference between the total government revenue and the total government expenditure. The total government revenue and expenditure include current (e.g.: taxes on income and wealth, expenditure on hospital equipment, public employees' compensation, social benefits) and capital categories (e.g.: public investment, capital transfers). When the budget balance is positive, there is a budget surplus and a financing capacity, that is, the country's government has the capacity to lend some money to other economic agents that do not have sufficient money to meet their obligations. When the difference is negative, there is a budget deficit, which corresponds to a financing need. Hence, the budget balance is one of the most relevant indicators to assess the financial health of the government. However, if an economy has significant and persistent fiscal imbalances this may lead to the accumulation of budget deficits which, in turn, leads to an increase in public debt. Some policymakers consider the primary balance (PB_t), which is the difference between the total government revenue and the primary expenditure, the latter being the total government expenditure excluding the interest payments on public debt, given by[4]:

$$PB_t = R_t - E_t - i\,D_{t-1} \quad (3.6.)$$

where R_t is the total government revenue, E_t the total government expenditure, i denotes the nominal interest rate on public debt, and D_{t-1} is the public debt, that is, the accumulation of budget deficits and their financing (and eventual stock-flow adjustments), therefore, iD_{t-1} is the interest on public debt spending. Given that interest payments are predetermined by the size of prior deficits and the value of the interest rates is not determined by the country's policymakers, the exclusion of interest payments from the expenditure can be said to provide an indicator of current fiscal effort.

The primary balance includes the behaviour of the automatic stabilisers, that is, the cyclical effects that "automatically" influence the balance without any policymakers' direct intervention. Therefore, to assess the impact of the policymakers' intervention, it is necessary to remove from the primary balance the revenue and expenditure items that are most likely influenced by the business cycle. There are various methods to estimate the cyclically adjusted primary balance (CAPB) – the Organisation for Economic Cooperation and Development

[4] All variables are in nominal values and given in percentage of nominal GDP.

(OECD), the EC, the IMF, and the European System of Central Banks (ESCB) methodologies.

The old ESCB methodology estimates the CAPB based on the deviation of revenue and expenditure categories from their trends, using the HP filter. The main advantage of the above methodologies over the old ESCB methodology is that they allow for a structural interpretation of labour, capital, and total factor productivity contributions to GDP. In these cases, the cyclical component is calculated using concepts derived from standard economic theory and country-specific information on the economy's structure (Farrugia, 2014). This is only possible with a methodology that estimates the output gap in an aggregate form, which the disaggregated ESCB approach does not.

The new ESCB methodology estimates the cyclically adjusted balance through an aggregate procedure that uses a cyclical component defined by the multiplication of a semi-elasticity (ε) and the output gap (OG_t) based on the production function method (Braz et al., 2019). Hence, the CAPB is given by equation (3.7.).

$$CAPB_t = PB_t - \varepsilon \times OG_t \quad (3.7.)$$

Since the semi-elasticity corrects for the effect of the business cycle in both the numerator and the denominator, the $CAPB_t$ should be interpreted as the ratio of the cyclically adjusted primary balance to potential nominal GDP. The semi-elasticity can be divided into the revenue semi-elasticity (ε^R) and the expenditure semi-elasticity (ε^E). Additionally, each of these semi-elasticities can be defined by the product between a budget elasticity vis-à-vis the macroeconomic base (η^{RB} and η^{EB}, measuring respectively the sensitivity of revenue and expenditure items to changes in the associated macroeconomic bases) and a macroeconomic base elasticity vis-à-vis GDP (η^{BY}, measuring the sensitivity of each macroeconomic base to changes in the GDP). Therefore, the semi-elasticity (ε) is given by (Braz et al., 2019):

$$\varepsilon = \varepsilon^R - \varepsilon^E = (\eta^{RB}\eta^{BY} - 1) \times \bar{r} - (\eta^{EB}\eta^{BY} - 1) \times \bar{e} \quad (3.8.)$$

where $\bar{r}$ and $\bar{e}$ are the 10-year averages of revenue and expenditure shares on GDP.

According to Braz et al. (2019), four revenue categories are affected by the business cycle: direct taxes paid by households (which are broken down into personal income tax and other current taxes), direct taxes paid by corporations, taxes on production and imports (which are divided into the Value Added Tax, VAT, and other indirect taxes), and social contributions. The only category on the expenditure side that is impacted by the business cycle are unemployment benefits. For the remaining non-cyclical revenue and expenditure categories, the contribution to aggregate semi-elasticity stems only from a denominator effect since the elasticities of the macroeconomic bases to GDP (η^{BY}) are assumed to be zero.

The semi-elasticity (ε) is calculated using an estimation of the elasticities of macroeconomic bases to GDP (η^{BY}) based on the Portuguese national accounts long time series. The fiscal data are primarily derived from the official national accounts, as well as detailed tax reporting ("national tax lists"), based on a questionnaire sent to Eurostat by each member state that contains detailed information on taxes and social contributions on the basis of national classifications. We consider the total amount of social benefits as the unemployment benefits, because for the time span used the total public expenditure per function (COFOG) for Portugal is only available from 1995 onwards.

3.2.1. Macroeconomic base's elasticity vis-à-vis GDP

For each relevant macroeconomic base, the elasticity to GDP (η^{BY}) is estimated using a standard regression specified in logarithm differences to account for non-stationarity. Within the choice of the appropriate macroeconomic base for each fiscal variable, alternatives for some taxes have been proposed. These recommendations represent a harmonised solution that is particularly useful in cases of unavailability of data or lack of explanatory power of some less standardised macroeconomic bases.

As an alternative to Braz et al. (2019), we assumed that the personal income tax is solely levied on labour income, which is a simple but reasonable assumption given that the majority of the value of the personal income tax is derived from labour income; therefore, we use the employees returns working in the national territory as the macroeconomic base for the individual income tax (Braz et al., 2019). For direct taxes paid by corporations, the effective tax base is the net income generated from business activities, and thus the revenue elasticity with respect to this base is one. However, due to a data shortage, Braz et al. (2019) opted to employ the total economy's gross operating surplus and mixed income as an alternative base, which is the suggested *proxy* for the effective base and is used in this estimation.

In the case of VAT and other taxes on products (except stamp taxes), the household (private) consumption was kept as the reference base. As outlined by Braz et al. (2019), in the case of Portugal, for example, the suggested effective base for stamp duties – residential investment – proves inadequate. "In fact, this base contributes only a negligible amount to stamp tax collection, which is primarily derived from commercial and financial transactions" (p. 27). Therefore, we adopt the nominal GDP, given that its trajectory closely mirrors that of the effective base. The net social contributions use the employees returns as the macroeconomic base. For the only expenditure variable that is assumed to be influenced by the business cycle – the unemployment benefits –, the macroeconomic base is the number of unemployed people in the national territory. Finally, "other current taxes paid by households" and "other indirect taxes on production" are regarded as non-cyclical.

3.2.2. Categories' elasticity vis-à-vis the macroeconomic base

The elasticities resulting from tax variables and macroeconomic bases are commonly referred to as "structural elasticities", which implies a unitary elasticity in most cases, except for progressive taxes such as the personal income tax or, in some countries, social contributions. According to Braz et al. (2019), taxes in Portugal are essentially proportional, and therefore, unitary elasticities were assumed. The following are the only exceptions: personal income tax (η^{RB}=1.07); direct taxes on corporations (η^{RB}=1.95); VAT on household final consumption (η^{RB}=1.26); and stamp taxes (η^{RB}=2.27).

Given its progressive nature, the elasticity of the personal income tax should ideally consider tax legislation. Since the necessary data were not available, the OECD-calibrated elasticities were used by Braz et al. (2019), and also in our analysis. Since the macroeconomic base of direct taxes paid by corporations is a *proxy*, the category's elasticity against the base was adjusted by the ratio of the elasticities of the bases (effective and *proxy*) to GDP, ensuring that the contribution of this revenue item to the semi-elasticity of the balance is unaffected by the alternative choice.

In the case of VAT, different rates are applied to the consumption of various types of goods and services. To capture the effects of changes in the composition of household consumption over the business cycle, an elasticity greater than one was assumed in this case. Regarding the stamp taxes, due to the inexistence of an appropriate effective base, it was necessary to assume a non-unitary elasticity against the base, despite the various existing rates.

It should be noted that the calculation of tax semi-elasticities in the new ESCB cyclical adjustment methodology takes two types of time lags into account: the so-called collection lag, which is related to tax codes and how collection is defined (relevant when taxes are levied on aggregates relating to the previous year); and the so-called cyclical lag, which stems from a lagged response of the macroeconomic bases to cyclical fluctuations. In the case of Portugal, only the cyclical lag is considered. The main taxes collected with lags in the Portuguese tax system are corporate income tax and personal income tax. As stated by Braz et al. (2019), data shows that its magnitude has been highly volatile in recent years, making it more difficult to calculate an appropriate "average" collection lag for the time period under consideration. Nevertheless, our analysis does not consider any of the time lags of the new ESCB cyclical adjustment methodology. In Table 1, we present the results of the semi-elasticity (ε) using equation (3.8.).

The semi-elasticity of revenue is roughly zero (-0.08), reflecting the high sensitivity of the tax revenue to the cycle. As a result, revenue as a ratio to GDP remains relatively constant over the cycle, because the small magnitude of the revenue ratio's semi-elasticity implies that its cyclical component is also negligible. On the contrary, the expenditure side is considered to clearly respond to cyclical developments, as a result, the semi-elasticity is significant and negative (-0.47), reflecting the expenditure-to-GDP ratio's counter-cyclical behaviour. Accordingly, the semi-elasticities of revenue and expenditure result in a semi-elasticity (ε) of 0.39 (lower right corner of Table 1). According to estimates, a 1 percentage point (p.p.) increase (or decrease) in the output gap results in a corresponding improvement (or deterioration) of 0.39 p.p. in the primary balance-to-GDP ratio.

Excluding temporary or one-off measures from the cyclically adjusted primary balance is the ultimate step in analysing the structural primary balance. Temporary measures are intended to provide a short-term solution or response and typically refer to specific interventions implemented on a temporary or one-time basis to address a specific issue. One-off measures can be implemented quickly to address immediate challenges, but they may not contribute to long-term improvement or deterioration. The approach to one-off measures in European countries tend to be subjective, relying on expert judgement on a case-by-case basis. These assessments are guided by a set of principles established by EC in order to enhance transparency in the criteria applied for fiscal oversight (Joumard et al., 2008).

Table 1 – Calculations of the aggregate semi-elasticity of the budget balance

Category	Weight on GDP	Macroeconomic base	Macroeconomic base's elasticity vis-à-vis GDP	Categories' elasticity vis-à-vis the macroeconomic base	Semi-elasticity
i, j	$\bar{r}_i$, $\bar{e}_j$	B	η^{BY}	η^{RB}, η^{EB}	ε
Current taxes on income wealth	**10.31%**				-0.01
Individual income tax	6.98%	Employees returns working in the national territory	0.88	1.07	0.00
Corporate income tax	2.90%	Gross operating surplus + gross mixed income	0.57***	1.95	0.00
Other current revenues	0.43%	Non-cyclical/potential output	0.00	1.00	0.00
Taxes on production and imports	**14.84%**				0.01
VAT	8.63%	Private consumption	0.92**	1.26	0.01
Other taxes on products (except stamp taxes)	3.94%	Private consumption	0.92**	1.00	0.00
Stamp taxes	0.74%	Observed output	1.00	2.27	0.01
Other taxes on production	1.53%	Non-cyclical/potential output	0.00	1.00	-0.02
Net social contributions	**11.98%**	Employees returns working in the national territory	0.88	1.00	-0.01
Other non-cyclical revenues	**6.66%**		0.00	0.00	-0.07
Total revenue(1)	**43.79%**				**-0.08**
Social benefits	19.18%	Number of unemployed	0.00***	1.00	-0.19
Other non-cyclical expenditure	27.58%				-0.28
Total expenditure(2)	**46.76%**				**-0.47**
Total budget(3) = (1) – (2)					**0.39**

Note: ***p-value < 0.01, **p-value < 0.05, *p-value < 0.1.
Source: INE and Banco de Portugal, "Long time series for the Portuguese Economy" (retrieved on April 26, 2023), and own calculations.

3.2.3. CAPB versus output gap

The one-off measures were not implemented in our analysis because the EC's AMECO database series only begins in 2010, resulting in a loss of more than a half of the sample for the Portuguese economy.

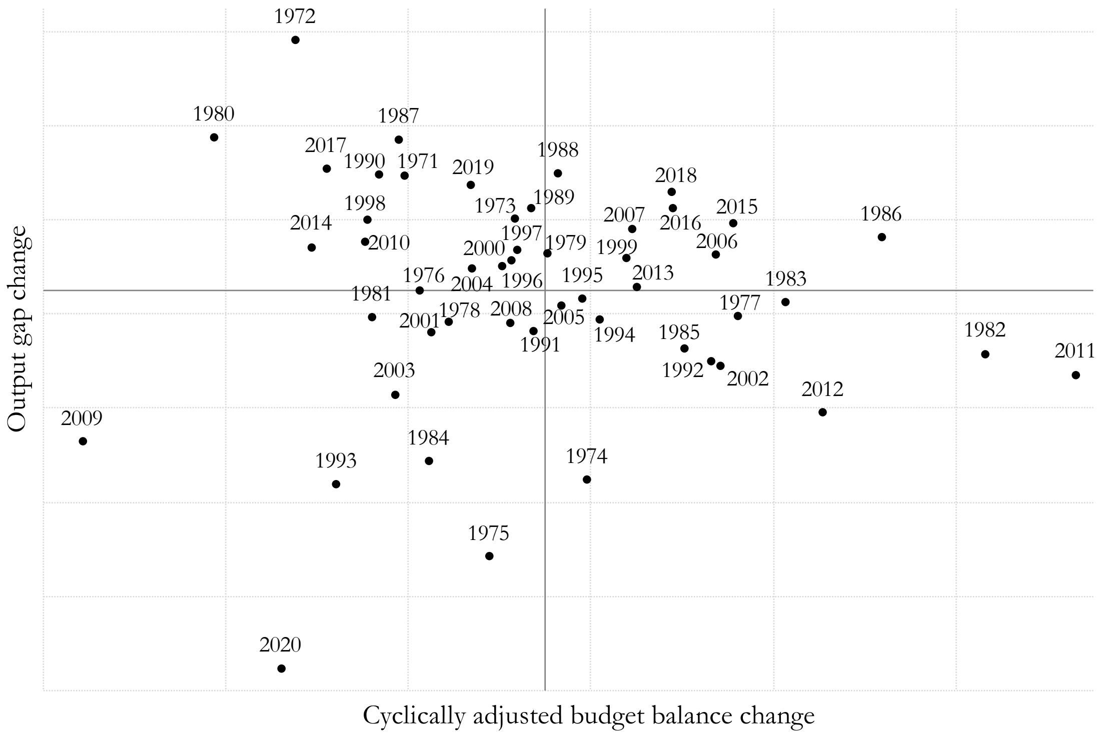
The difference in the CAPB between two consecutive years reflects the discretionary nature of fiscal policy. Therefore, a positive (negative) change of the CAPB indicates that discretionary fiscal policy is contractionary (expansionary), whereas a null change indicates that discretionary fiscal policy is absent. Figure 3 depicts a scatter plot with the horizontal axis displaying the output gap change (ΔOG) calculated using the production function approach in subsection 3.1., and the vertical axis displaying the cyclically adjusted primary balance change (ΔCAPB). We can categorise the Portuguese economy into four categories by dividing the scatter plot into four quadrants along the zero axes.

- ΔOG > *0 and* ΔCAPB > *0:* In this case, we are in the first quadrant (top-right), with a positive variation of the OG and the CAPB, indicating that the Portuguese economy is expanding while discretionary fiscal policy is contracting. Hence, we have a fiscal policy that is countercyclical. Portugal, for example, escaped the procyclicality trap in 1986 (when it joined the EEC), 1999 (when it joined the eurozone), and 2013 (after the sovereign debt crisis).
- ΔOG < *0 and* ΔCAPB > *0:* In this case, we are in the second quadrant (top-left), with a negative change of the OG and a positive change of the CAPB, indicating that the Portuguese economy is contracting while discretionary fiscal policy is contracting. Thus, we have a fiscal policy that is procyclical. Portugal, for example, implemented a procyclical fiscal policy in 1973 (the first oil shock that resulted in international monetary system deregulation), 1980 (following the second oil shock), 1997 and 1998 (prior to EMU membership), and 2019 (a period of fiscal consolidation prior to the pandemic).
- ΔOG < *0 and* ΔCAPB < *0:* In this case, we are in the third quadrant (bottom-left), with a negative variation of the OG and the CAPB, indicating that the Portuguese economy is contracting while discretionary fiscal policy is expanding. As a result, we have a fiscal policy that is countercyclical. Portugal, for example, avoid procyclicality in 1975 (following the April 25th Revolution), 2008 and 2009

(following the global financial crisis), and 2020 (when a new global virus appeared, and a significant fiscal support was needed).

- ΔOG > *0 and* ΔCAPB < *0:* In this case, we are in the fourth quadrant (bottom-right), with a positive change of the OG and a negative change of the CAPB, indicating that the Portuguese economy is expanding while discretionary fiscal policy is expanding. Accordingly, we have a procyclical fiscal policy. Portugal, for example, adopted a procyclical fiscal policy in 1974 (year of the April 25th Revolution), as well as in 2011 and 2012 (the years of the sovereign debt crisis and international support requiring fiscal consolidation).

Figure 3 – Stance of the Portuguese fiscal policy, 1970-2020



Source: INE and Banco de Portugal, "Long time series for the Portuguese Economy" (retrieved on April 26, 2023); Eurostat, "National tax lists" (retrieved on April 21, 2023); and own calculations.

4. Extending the scope to include the 27 European Union member states: an econometric analysis

The final stage in our empirical approach to assessing fiscal policy stance involves conducting econometric estimations of a model that captures the primary patterns and drivers of fiscal cyclicality. This application holds significant value as it enables us to gain insights into the factors contributing to the recognition of procyclical fiscal policies in select EU countries. Within the context of the existing literature on this topic, this stage assumes particular importance as it incorporates variables of interest such as the Corruption Perception Index, two alternative variables to measure credit markets imperfections – the Chinn-Ito Financial Openness Index, and the IMF Financial Development Index –, and the EC Fiscal Rules Index, for the 27 EU countries covering the 1995-2020 period.

The subsequent sections of this discussion are structured as follows: Section 4.1 outlines the model specification, Section 4.2 elaborates on the estimation strategy, and Section 4.3 interprets the baseline results. Finally, in Section 4.4, we delve into the analysis of Portugal's discretionary fiscal policy.

4.1. Model specification

Given the objective of characterising the discretionary fiscal policy within the EU context, we have assembled a sample consisting of all 27 EU countries[5], with regard to the period between 1995 and 2020. The selection of this timeframe is driven by data limitations related to the dependent variables, specifically, the cyclically adjusted primary balance both in its level and its change, whose values have only been published by the EC's AMECO database since 1995.

Panel data is defined as the analysis of multiple units (countries) over various time periods (years). Its application is advantageous because it allows for a more consistent description of the data and the average behaviour of fiscal policy, as well as it enables the control of inherent heterogeneity among different countries and years, which might not be adequately captured otherwise, and allowing for the identification of more accurate effects

[5] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden.

(Fatás & Mihov, 2012; Verbeek, 2017). However, panel data analysis involves more complex models and techniques that require a higher level of statistical knowledge and expertise to correctly implemented.

Regarding the construction of our model, we selected a set of variables that we anticipated could potentially explain the procyclical nature of fiscal policy in EU countries over time. This selection was made in accordance with the context presented in the preceding sections, and it led to the development of the following baseline specification:

$$CAPB_{i,t} = \beta_1 + \beta_2 OG_{i,t} + \beta_3 OG_{i,t} \times X_{i,t} + \beta_4 Z_{i,t} + \varepsilon_{i,t} \qquad (4.1.)$$

$$\Delta CAPB_{i,t} = \eta_1 + \eta_2 OG_{i,t} + \eta_3 OG_{i,t} \times X_{i,t} + \eta_4 Z_{i,t} + \varepsilon_{i,t} \qquad (4.2.)$$

where i=1, …, 27 and t= 1995, …, 2020.

The dependent variable of equation (4.1.) is the level of Cyclically Adjusted Primary Balance (CAPB) in percentage of GDP for each of the 27 EU countries from 1995 to 2022. This variable indicates whether a government is running a discretionary surplus or a deficit in a given year. It was not obtained directly from the EC's AMECO database; rather, it was calculated using total revenue and total expenditure, excluding interest payments, adjusted for the cycle component (both in percentage of GDP). Hence, the CAPB is the difference between these two EC's AMECO variables. A surplus in CAPB means that government revenue exceed expenditure (excluding interest payments) adjusted by the cycle component, while a deficit means the opposite[6].

The dependent variable in equation (4.2.), ΔCAPB, represents the cyclically adjusted primary balance in percentage of GDP change, that is, the discretionary fiscal policy behaviour. A positive sign corresponds to a restrictive discretionary fiscal policy, whereas a negative sign indicates an expansionary discretionary fiscal policy. The dependent variable is the change in the CAPB between two consecutive years.

We inspired our analysis in the Fatás and Mihov (2012)'s article. Therefore, we employed distinct dependent variables because it is crucial to differentiate between the level and the change of the CAPB when evaluating procyclical fiscal policies. This distinction aids in determining whether fiscal policies are promoting economic stability or exacerbating

[6] The one-off measures were not implemented in our analysis because the EC's AMECO database series only begins in 2010.

business cycles. A procyclical fiscal stance that solely prioritises budget balance without regard for the economic background can result in undesirable consequences, such as worsening economic volatility or hindering economic recovery during a downturn. Hence, policymakers should meticulously evaluate the timing and scale of fiscal policy changes to effectively pursue their objectives of economic stabilisation (Fatás & Mihov, 2012).

As explanatory variables, we begin with the inclusion of OG, the output gap expressed as a percentage of GDP. This variable is commonly employed in the literature to gauge the impact of the business cycle on fiscal policy. If it demonstrates statistical significance, we will then explore the intriguing question of whether discretionary fiscal policy has exhibited a countercyclical or procyclical pattern. This inquiry is particularly pertinent in the context where fiscal policy conduct in advanced economies has notably displayed procyclical tendencies in recent decades (Alesina et al., 2008; Attinasi et al., 2019; Fatás & Mihov, 2012).

Within the extensive body of the literature, three primary factors ($X_{i,t}$) exert substantial influence on fiscal policy and its cyclical dynamics: political distortions (Alesina et al., 2008; Heimberger, 2022; Lane, 2003), imperfection in international credit markets (Gavin & Perotti, 1997; Ilzetzki, 2011), and fiscal rules (Attinasi et al., 2019; Larch et al., 2021).

For gauging political distortions, we chose to employ the Corruption Perception Index (CPI) provided by the Transparency International. This index fuses information from various sources, reflecting the perceptions of corruption levels within the public sector by business professionals and country specialists. Transparency International's CPI employs a scale ranging from 0 (highly corrupt) to 100 (very clean). Consequently, we expect that nations characterized by lower corruption will demonstrate an improved performance in discretionary fiscal policy.

Afterwards, we selected specific variables that intend to depict the stability of countries access to financial markets. In this regard, we opted for two financial variables due to the challenging nature of measurement (Haan & Gootjes, 2023): the Chinn-Ito Index (KAOPEN), and the IMF Financial Development Index (FDI). The Chinn-Ito Index (KAOPEN) gauges the openness of cross-border financial transactions, aiming to encompass both the extent and intensity of capital controls. This index's range spans from 0 to 100, where a higher value indicates fewer restrictions on capital movement (Chinn & Ito, 2008). We anticipate that countries with less constrained capital accounts will exhibit enhanced fiscal policy performance.

Secondly, we chose to incorporate the IMF Financial Development Index (FDI), which provides a ranking of countries based on the depth (size and liquidity), access (availability financial services to individuals and companies), and efficiency (capacity of institutions to offer financially sustainable services at low cost and the vibrancy of capital markets) of their financial institutions and financial markets. This index takes into account the intricated and multi-faceted nature of financial development, offering a more comprehensive perspective compared to other variables employed as *proxies* for financial development, such as the ratio of private credit to GDP used by Haan and Gootjes (2023). The objective is to explore whether a more stringent financial landscape exerts influence over fiscal policy, and discover if this effect is correlated with deficits increases (which appears to be a more plausible scenario) or with a reduction in deficits (Svirydzenka, 2016).

Subsequently, and following our literature review, the focus shifted towards collecting variables that depict the fiscal framework of various countries. In pursuit of this objective, we initiated the process by opting for the EC's Fiscal Rules Index (FRI). This index evaluates a wide array of facets that define the robustness of fiscal regulations within each EU member state. These rules comprise the arrangements, procedures and institutions governing the planning and implementation of fiscal policies. The aim is to investigate whether a stricter fiscal environment holds sway over fiscal policy and if it does, whether such influence is linked to a decrease in deficits (which seems more probable) or to events that increase deficits.

As an alternative to the Fiscal Rules Index variable, we introduced a dummy variable indicating membership in the European Monetary Union (EMU). This inclusion enables us to investigate a significant question: whether the entry in the EMU by European countries led to a reduction in creative accounting practices, possibly due to their commitment to a more stringent fiscal policy framework. It is anticipated that this variable will contribute to a less procyclical discretionary fiscal policy.

Additionally, we include a vector with control variables. One of the control variables in our analysis is the square of the output gap (OG2). We include this variable to assess the level of volatility within the business cycle, specifically to gauge whether the severity of economic contractions and expansions influences the behaviour of fiscal policy. The expected, if the coefficient associated with OG2 is statistically significant, is that the deeper the contraction/expansion, the more countercyclical the discretionary fiscal policy should be.

The second control variable is the inflation rate (INFLATION). It serves as a *proxy* for macroeconomic stability, with the anticipation of lower rates in more stable countries (Jalles et al., 2023). High inflation implies more economic instability and in order to stimulate the economy, public spending has to be reduced; But, at the same time, the prices rise which increases the value of transactions generating additional revenue. Consequently, the overall impact remains uncertain. An instance of utilizing the inflation rate within empirical research can be observed in the work of Fatás and Mihov (2012), where they ascertain that the responsiveness of fiscal policy to cyclical fluctuations was relatively more pronounced in the period following 1990, characterized by low and consistent inflation rates across most countries.

The next control variable has not been used in any empirical analysis, as far as we know. The age dependency ratio (AGE_DEP) pertains to the proportion of dependents – individuals below 15 years and those above 64 years – relative to the working-age population falling between 15 and 64 years. Data is presented as the proportion of dependents per 100 working-age individuals and exported from Eurostat. This variable serves as an explanatory factor due to the concentration of expenditure on dependent individuals, including items like healthcare, education, and pension payments, contrasted with the bulk of revenue stemming from the labour force. Consequently, this variable can be construed as follows: holding all other factors constant, an elevation in the age dependency ratio triggers a negative influence on the budget balance, but its reaction to the business cycle is uncertain.

As much of the literature use, we used the general government gross debt ratio to GDP lagged one period (DEBT_LAG1), exported from AMECO Database. This variable encompasses the total debt of a government, including all its levels and entities (central, regional or state, and local governments). It comprises various types of debt, including government bonds, loans, and other financial obligations. This comprehensive approach enables analysts to evaluate fiscal sustainability trends and potential implications for economic stability and policy decisions.

For the last control variable, we have a dummy that signals the occurrence of legislative elections (ELECTIONS) retrieved from the Comparative Political Dataset and for the 2022 year we used the website "Parties and Elections in Europe". Normally, during election years or leading up to an election, politicians may be more inclined to implement fiscal policies that provide short-term economic benefits to gain voter support, which can include tax cuts or increased government spending on popular programs. Hence, if significant, in years of elections, the government will typically resort to deficit-increasing measures (Heimberger, 2022).

Table 2 summarises the descriptive statistics of both the dependent and explanatory variables included in our specifications. Since most of the variables, such as financial variables, do not have observations that cover the entire reference period for every country, we are in the presence of an unbalanced panel.

One remarkable observation pertains to the minimum and maximum values of ΔCAPB, both of which are associated with consecutive years in Ireland. To illustrate, in 2010, the Irish government took significant measures to infuse capital into its banking sector, specifically addressing substantial losses incurred by institutions like the Bank of Ireland (which was under state ownership), the Allied Irish Bank (nationalised in 2010) and the Irish Nationwide Building Society (which was subsequently dissolved in 2011). The receipt of financial support from collaborative partners was contingent upon swift actions aimed at rectifying Ireland's financial sector, establishing a sustainable path for public finances, and implementing a comprehensive set of structural reforms (Directorate-General for Economic and Financial Affairs, 2011).

The peak value in the inflation variable is associated with Bulgaria in 1997, marking the height of the hyperinflationary period of 1996/1997. This crisis unfolded during a period of profound uncertainty, as Bulgaria grappled with a substantial economic and political crisis. The inflationary aspect of the monetary crisis was resolved with the implementation of a currency board, an official monetary regime that embraced the use of foreign currencies (in this case the German mark) to restore trust and stability to the national currency, resulting in the stability of the inflation rate in the next years[7].

[7] This information consulted in https://sofiaglobe.com/2018/12/27/winter-of-change-bulgaria-and-the-crisis-of-1996-97/, which was last accessed on September 2, 2023.

Table 2 – Descriptive statistics of the dependent and explanatory variables

	Obs.	Mean	Std. dev.	Maximum	Minimum
CAPB	743	-0.02	3.06	10.30	-27.80
				(Greece, 2016)	(Ireland, 2010)
ΔCAPB	720	-0.06	2.25	18.30	-18.80
				(Ireland, 2011)	(Ireland, 2010)
OG	743	-0.37	3.36	13.80	-18.30
				(Bulgaria, 1996)	(Greece, 2012)
CPI	709	63.07	17.88	100	26
				(Denmark, 1998, 1999; Finland, 2000)	(Romania, 2002)
KAOPEN	669	86.11	24.98	100	0
				–	(Romania, 1995)
FDI	702	52.81	20.06	90.18	9.18
				(Spain, 2017)	(Lithuania, 1995)
FRI	756	0.21	1.02	2.82	-1.02
				–	–
OG2	743	11.38	30.11	334.89	0.00
				(Greece, 2012)	–
INFLATION	756	5.39	39.42	1058.37	-4.48
				(Bulgaria, 1997)	(Ireland, 2009)
AGE_DEP	750	49.78	4.48	62.50	38.60
				(France, 2022)	(Slovakia, 2009)
DEBT_LAG1	734	58.76	34.82	212.39	3.77
				(Greece, 2021)	(Estonia, 2008)
ELECTIONS	756	0.26	0.44	1.00	0.00
				–	–

Note: In the year 2022, no observations were available for the FRI variable. However, to minimize the impact on degrees of freedom, we adopted the assumption that these values remained consistent with those of 2021, considering the relative rigidity of fiscal rules within the EU context.

4.2. Estimation strategy

Before presenting the estimation outcomes, we explain the options made regarding the specification of cross-section and period effects, as well as the treatment of the endogeneity of some independent variables.

4.2.1. Random effects or fixed effects?

When deciding between the fixed-effects (FE) and random-effects (RE) estimators, the use of panel data raises crucial considerations in our estimation strategy, particularly in determining the appropriate specification for cross-sectional and temporal effects. The Hausman test compares the FE and the RE estimators to formally assess this choice. In this test, the null hypothesis (H_0), posits that the RE estimator is more efficient than the FE estimator (although both are consistent), under the assumption that the regressors are uncorrelated with the individual (or temporal) effects. Conversely, in the alternative scenario (H_1), the regressors are consider correlated with the individual (or temporal) effects, indicating that the RE estimator is no longer consistent, and the FE estimator becomes more suitable (Verbeek, 2017).

As show in Annex 4, when performing the Hausman test on the Ordinary Least Squares (OLS) estimates of the specification without variables of interest, it is suggested that the FE estimator is preferable for cross-section and period effects. Therefore, we will implement fixed effects in the individual and temporal dimension, independently of the dependent variable.

Despite the fact the Hausman test suggested the inclusion of both fixed effects estimator, we ran the redundant two-way FE tests to verify fixed effects appropriateness in either dimension or both. The results (Annex 5) reveal that cross-sectional fixed effects are not redundant (we can reject the null hypothesis for a p-value of 0.01), as well as the period fixed effects when the dependent variable is the level of cyclically adjusted primary balance. However, when using the CAPB change as the dependent variable, the cross-sectional fixed effects are found to be redundant, while the period fixed effects remain necessary.

Hence, it is recommended that we incorporate both country and year fixed effects when estimating the econometric model for both dependent variables, even though the redundant fixed effects test suggests that fixed effects in the cross-sectional dimension are not necessary for ΔCAPB, allowing for the comparability of different specifications.

4.2.2. Is the variation of output gap endogenous?

We acknowledge that there may be a reciprocal relationship between fiscal policy performance and output. This reverse causality introduces endogeneity concerns into the output gap (OG): the error term is likely to exhibit positive correlation with the independent variable if exogenous fiscal shocks influence both fiscal policy and the economic activity. This correlation potentially introduces an upward bias in the OLS estimates for the output gap coefficient.

To tackle this problem, we propose a solution in the form of a Two-Stage Least Squares (TSLS) estimation. The initial step involves identifying suitable instrumental variables (IVs) for the potentially endogenous variable. For a variable to qualify as an IV, it must satisfy two conditions: relevance and exogeneity. Relevance indicates that the variable serves as a suitable proxy for the endogenous variable, resulting in a non-zero covariance between them. Exogeneity, on the other hand, requires that the potential IV is not correlated with the residuals of the structural equation, indicating a zero covariance with these residuals (Verbeek, 2017). To mitigate endogeneity concerns, we employ an instrumental variable approach for analysing the cyclical behaviour of discretionary fiscal policy. In this context, we use the lag of a country's own output gap as our instrument for the OG (Fatás & Mihov, 2012; Heimberger, 2022).

As demonstrated in Annex 6, we conducted an evaluation of the performance of the lag of each country's output gap (OG_LAG1) as an instrument for the output gap (OG). Our analysis confirmed that it is a relevant IV[8], and that OG is exogenous (as well as the IV) when the dependent variable is the level of CAPB. This allows us to address the inherent endogeneity in the relationship between OG and CAPB. Nonetheless, when we use CAPB change as a dependent variable, OG_LAG1 did not meet the requisites of relevance and exogeneity, indicating that OG is indeed endogenous concerning ΔCAPB. Therefore, we will employ the two-stage least square approach when the dependent variable is the level of CAPB.

Furthermore, our choice of fixed effects (FE) estimation was confirmed through a Hausman test, as displayed in Annex 4. Although the test does not distinguish between FE or RE for period effects for the TSLS estimates, it possibly indicates a positive RE variance estimator. Given this and considering the trade-off between robustness (FE) and efficiency (RE) regarding period effect specification, we opted for FE due to the outlined reasons. For

[8] It is important to note that the observations for OG_LAG1 are already present in our database (including values related to the output gap of 1994) rather than being generated by the econometric software. Therefore, the utilization of this instrumental variable should not result in any reduction in degrees of freedom.

sectional effects, the Hausman test confirms that FE is the most efficient one. Lastly, we acknowledge that redundant two-way FE tests are unavailable for TSLS estimations. Despite this limitation, considering the results obtained in comparison to OLS estimates, we maintain the decision to incorporate both sectional and period fixed effects, allowing for the comparability of different specifications in terms of the variables included.

4.3. Result analysis

In line with the previously outlined assumptions and selecting *White diagonal* robust estimators to account for the potential presence of cross-section and period heteroscedasticity, we have generated the estimation results displayed in Tables 3 and 4. We will start our analysis by evaluating how the budget balance responds to economic cycles. Upon examining the coefficients related to the output gap in both tables, we observe a consistent negative and statistically significant relationship[9], except for specification (3.a.). Therefore, we can infer that, assuming that all other factors remain constant, more favourable economic conditions tend to result in a reduction in the cyclically adjusted primary budget balance (CAPB) as shown in Table 3. Such implies that discretionary fiscal policy is expansionist, as indicated in Table 4.

Among the control variables, two consistently significant factors across both tables are the general government gross debt ratio to GDP lagged one period (DEBT_LAG1) and the election dummy variable (ELECTIONS). The significance of the DEBT_LAG1 variable suggests that, all else being equal, an increase in public debt as a percentage of GDP tends to be positively associated with a deficit-reducing cyclically adjusted primary balance, revealing the need to improve the fiscal performance in face of debt accumulation. Secondly, the election dummy variable exhibits a negative relationship with a country's CAPB, indicating that the occurrence of legislative elections typically leads to a stronger expansionary bias in fiscal policy, *ceteris paribus*.

The age dependency ratio (AGE_DEP) is only significant for the CAPB level. Given the negative coefficient associated with this variable, we can interpret it as follows: an increase in the age dependency ratio results in a more pronounced expansionary fiscal policy,

[9] Since there is a square of OG as a control variable, the analysis of the OG coefficient should consider the coefficient associated with OG2. However, the specifications show that the OG2 coefficients is insignificant in most cases, so we will not consider its influence on the budget balance's reaction to the cycle.

assuming all other factors remain constant. In Table 3, the inflation rate variable (INFLATION) shows positive and significant coefficients across three specifications. This suggests that when inflation is high, it tends to contribute to economic instability, prompting decreased public spending to stimulate the economy. However, simultaneously, high inflation leads to rising prices, which in turn increases the value of transactions, generating additional revenue. All else being equal, in this scenario, fiscal policy is expected to become more restrictive.

The variables of interest (CPI, KAOPEN, FDI, FRI and EMU) where incorporated individually, in interaction with the business cycle, to understand their influence on the cyclically adjusted primary balance in accordance with the economic context. In specification 2 of both tables, we decided to capture the influence of countries' fiscal transparency, using the Corruption Perception Index (CPI). As for Table 3, *ceteris paribus*, when a favourable economic environment prevails, a lower level of corruption (indicated by a higher CPI) is associated with a reduced expansionary bias and a greater degree of countercyclicality (with a significant p-value of 1%). However, in Table 4, the incorporation of the CPI did not produce any changes in the baseline results.

The first financial alternative (KAOPEN) is insignificant for both tables, which might be attributed to the fact that the analysis comprises 27 EU countries, primarily consisting of developed nations that generally possess strong financial openness, facilitating access to markets. On the other hand, the second financial variable (FDI) reveals that, assuming all other factors constant, in the presence of more favourable economic conditions, countries with more developed markets tend to adopt a more countercyclical fiscal policy – with a positive and significant interaction coefficient at the 1% significance level in Table 3. However, the inclusion of these two financial variables are not significant in Table 4.

The Fiscal Rules Index (FRI) does not demonstrate statistical significance in elucidating the patterns of discretionary fiscal policy across different countries and time periods (it is the same result as in Aldama and Creel, 2022). This could be due to common fiscal framework of EU members states that does not allow for enough variability among countries. In an alternative specification (4.b.), we replaced the Fiscal Rules Index variable (FRI) with a dummy variable for EMU membership, which proves to be both statistically significant and positive in both tables. Consequently, it can be inferred that countries within the euro zone tend to pursue more restrictive fiscal policies, indicative of an inclination towards greater countercyclicality in their fiscal policy approach.

In conclusion, more favourable economic conditions are associated with a reduction in CAPB, indicating a more procyclical fiscal policy, while higher public debt and election periods tend to have deficit-reducing and expansionary effects, respectively. The age dependency ratio influences fiscal policy, with higher ratios leading to lower cyclically adjusted primary balance. Inflation rates affect fiscal policy, with high inflation prompting increased budget balances. That is evidence that financial development has a positive impact on fiscal performance, while the corruption level deters the countercyclical fiscal response to the economic cycle. The Fiscal Rules Index (FRI) is generally insignificant, but the Eurozone membership (EMU) is found to lead to more restrictive fiscal policies. Overall, our results are more significant for the cyclically adjusted primary balance in level than for its change.

Table 3 – Estimation results of CAPB (in % GDP)

	(1)	(2)	(3.a)	(3.b)	(4.a)	(4.b)
INTERCEPT	3.9962	2.1718	5.7261	3.4398	3.9428	3.7490
	(1.9123)	(1.9725)	(2.7121)	(2.2462)	(1.9054)	(1.9382)
OG	**-0.2008***	**-1.3534***	-0.3017	**-0.8101***	**-0.2135***	**-0.4574***
	(0.0776)	**(0.2914)**	(0.2315)	**(0.1753)**	**(0.0826)**	**(0.0837)**
OG×CPI		**0.0194***				
		(0.0052)				
OG×KAOPEN			0.0005			
			(0.0028)			
OG×FDI				**0.0124***		
				(0.0039)		
OG×FRI					0.0601	
					(0.0770)	
OG×EMU						**0.5589***
						(0.1686)
OG2	0.0038	**-0.0121**	0.0002	0.0075	0.0040	**0.0168**
	(0.0553)	**(0.0060)**	(0.0006)	(0.0064)	(0.0053)	**(0.0077)**
INFLATION	0.0412	**0.0788**	0.0439	**0.0599***	0.0427	**0.0734**
	(0.0304)	**(0.0384)**	(0.0325)	**(0.0352)**	(0.0302)	**(0.0333)**
AGE_DEP	**-0.1315***	**-0.0836**	**-0.1700***	**-0.1219***	**-0.1296***	**-0.1355***
	(0.0373)	**(0.0389)**	**(0.0543)**	**(0.0440)**	**(0.0370)**	**(0.0376)**
DEBT_LAG1	**0.0398***	**0.0311***	**0.0430***	**0.0431***	**0.0393***	**0.0452***
	(0.0068)	**(0.0071)**	**(0.0076)**	**(0.0075)**	**(0.0069)**	**(0.0070)**
ELECTIONS	**-0.3296***	**-0.3099***	-0.3101	**-0.3712***	**-0.3272***	**-0.3704**
	(0.1778)	**(0.1814)**	(0.1945)	**(0.1937)**	**(0.1764)**	**(0.1854)**
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	721	698	642	667	721	721
Adjusted R^2	0.4438	0.4444	0.4353	0.4337	0.4434	0.4349
p-value (F-statistic)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: ***p-value < 0.01, **p-value < 0.05, *p-value < 0.1. Robust standard errors are reported in parentheses. *EViews* estimation outputs can be consulted in Annex 8.

Table 4 – Estimation results of CAPB (in % GDP) change

	(1)	(2)	(3.a)	(3.b)	(4.a)	(4.b)
INTERCEPT	-0.6108	-0.5961	-0.6493	-1.2896	-0.6535	-0.6787
	(1.6152)	(1.6751)	(2.1114)	(1.7984)	(1.6214)	(1.6082)
OG	**-0.1188*** **	**-0.2747** **	0.0805	**-0.1821***	**-0.1238*** **	**-0.1757*** **
	(0.0393)	**(0.1200)**	(0.1819)	**(0.0946)**	**(0.0413)**	**(0.0451)**
OG×CPI		0.0024				
		(0.0022)				
OG×KAOPEN			-0.0023			
			(0.0019)			
OG×FDI				0.0014		
				(0.0018)		
OG×FRI					0.0391	
					(0.0466)	
OG×EMU						**0.1417***
						(0.0724)
OG2	-0.0015	-0.0041	-0.0028	-0.0013	-0.0012	0.0022
	(0.0063)	(0.0063)	(0.0065)	(0.0066)	(0.0063)	(0.0066)
INFLATION	-0.0027	0.0328	-0.0132	-0.0121	-0.0019	0.0052
	(0.0326)	(0.0358)	(0.0341)	(0.0346)	(0.0327)	(0.0331)
AGE_DEP	-0.0048	-0.0040	-0.0085	0.0063	-0.0034	-0.0058
	(0.0326)	(0.0337)	(0.0436)	(0.0367)	0.0328	(0.0327)
DEBT_LAG1	**0.0147** **	0.0118	**0.0184** **	**0.0170** **	**0.01439** **	**0.0162** **
	(0.0071)	(0.0073)	**(0.0083)**	**(0.0081)**	**(0.0071)**	**(0.0071)**
ELECTIONS	**-0.4005** **	**-0.3032***	**-0.4367** **	**-0.4249** **	**-0.3998** **	**-0.4121** **
	(0.1769)	**(0.1751)**	**(0.1948)**	**(0.1882)**	**(0.1761)**	**(0.1774)**
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	711	688	632	657	711	711
Adjusted R^2	0.1153	0.1364	0.1098	0.1128	0.1160	0.1221
p-value (F-statistic)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: ***p-value < 0.01, **p-value < 0.05, *p-value < 0.1. Robust standard errors in parentheses. *EViews* estimation outputs can be consulted in Annex 8.

4.4. An example in focus: which factors influence Portugal's fiscal policy stance?

Our aim is to identify the main factors that influence the Portuguese fiscal cyclicality. In this subsection, we reproduce the equations used for the 27 EU countries but using only data for Portugal. Therefore, we will reproduce the following equations:

$$CAPB_t = \beta_1 + \beta_2 OG_t + \beta_3 OG_t \times X_t + \beta_4 Z_t + \varepsilon_t \quad (4.3.)$$

$$\Delta CAPB_t = \eta_1 + \eta_2 OG_t + \eta_3 OG_t \times X_t + \eta_4 Z_t + \varepsilon_t \quad (4.4.)$$

where t=1995, …, 2020.

Since we are in presence of time series, we need to know if the data has a heteroskedastic problem. Such problem refers to a condition in which the variance of the residual term in a regression model varies widely. If this is true, it may vary in a systematic way, and there may be some factor that can explain this. The White test and the Breusch-Pagan test can be used to assess the presence of heteroskedasticity. The White test is more generic and uses the square of each variable and their interactions to test nonlinear forms of heteroskedasticity, whereas the Breusch-Pagan test checks for the linear form of heteroskedasticity. Specifically, under the null hypothesis (H_0), the variance of the residual term in a regression model is constant, i.e., there is homoskedasticity. In the alternative scenario (H_1), the variance of the error term varies, and therefore, there is heteroskedasticity (Verbeek, 2017). As we can observe in Annex 7, the Breusch-Pagan test, for both dependent variables, shows that we cannot reject H_0, and so the time series is homoscedastic. The same can be proved by the White test (that could only be produced for the CAPB dependent variable).

Time series are likely to have autocorrelation problems. Autocorrelation (or serial correlation) is the phenomenon where adjacent observations are correlated i.e., the previous value has an impact on the next value. This leads to problems in statistical analysis as the assumption of independence of values is violated. The Durbin-Watson statistic and the Breusch-Godfrey test can be used to assess the presence of autocorrelation. The Durbin-Watson value ranges from 0 to 4, with a value of 2 indicating zero autocorrelation, values below 2 mean that there is positive autocorrelation and above 2 indicate negative autocorrelation. The Breusch-Godfrey's null hypothesis is that there is no serial correlation of any order up to p. For annual data, Verbeek (2017) suggests the use of the first or second lags of the residuals. As we can observe in Annex 7, the Breusch-Godfrey test, for the CAPB dependent variable, shows that we can reject H_0, and so the time series has autocorrelation, but for the ΔCAPB there is no autocorrelation problem. In specification 1 of CAPB as the dependent variable, we can see that in Annex 10 the Durbin-Watson statistic is below 2, and therefore the autocorrelation is positive.

We also test if the OG variable could have any endogeneity problem, but for both dependent variables the p-value of J-statistic is higher than 5%, and so the OG variable is exogenous. However, we prove that the OG_LAG1 is a strong instrument because the Cragg-Donald F-statistic is higher than 10.

We will not discuss the coefficients obtained in equation (4.4.) because, as seen in Annex 9, none of the variables of interest is statistically significant, and so we will only analyse the variables of interest corresponding to equation (4.3.). In specification 1 (Table 5), we observe a positive and statistically significant[10] coefficient associated with the Portuguese output gap (for a p-value of 1%), which contrasts with the findings in Table 3. This suggests that, assuming all other factors constant, more favourable economic conditions tend to lead to an expansion in the cyclically adjusted primary budget balance, implying that fiscal policy is countercyclical.

Among the control variables (Z_t), two factors exhibit statistical significance: the debt-to-GDP ratio lagged one period (DEBT_LAG1) and the age dependency ratio (AGE_DEP). The coefficient for the DEBT_LAG1 variable implies that, holding all else constant, an increase in Portuguese public debt as a percentage of GDP is positively associated with a restrictive discretionary fiscal policy. The age dependency ratio (AGE_DEP) displays a negative coefficient, indicating that an increase in the age dependency ratio leads to an expansionary fiscal effect, *ceteris paribus*. The remaining control variables (OG2, INFLATION and ELECTIONS) are not significant (Table 5).

Similar to our analysis across the 27 EU member states, we individually incorporated the variables of interest (CPI, KAOPEN, FDI, FRI and EMU) in interaction with the business cycle. In specification 2, the corruption variable (CPI) is not significant. Such outcome may arise because this variable compares numerous countries, assessing corruption

[10] See footnote 9.

perceptions within the public sector by business professionals and country specialists, which may not be suitable for a single country analysis.

The first financial alternative (KAOPEN) reveals a positive and statistically significant coefficient (at 5% significant level). Thus, in the presence of more favourable economic conditions, Portugal, with easier access to markets, tends to adopt a more countercyclical fiscal policy, assuming that all other factors remain constant. Similarly, the second financial variable (FDI) reveals that, all else being equal, more developed Portuguese markets tend to be associated to a more countercyclical fiscal policy – with a positive and significant interaction coefficient at the 10% significance level (Table 5).

In specification 4.b., we replaced the Fiscal Rules Index variable (FRI), which is not significant, with the dummy variable EMU, which proves to be statistically significant and positive. Hence, it can be inferred that since Portugal entered the EMU, the policymakers in Portugal tend to pursue more restrictive fiscal policies, indicating a leaning towards greater countercyclicality in discretionary fiscal policy. The FRI variable is not significant, possibly due to the criteria used to establish the fiscal rules index.

In summary, the Portuguese fiscal policy stance is deeply influenced by the financial openness, the financial development and the EMU membership producing more countercyclical fiscal policies since 1999, when Portugal enter the euro zone. In addition, since Portugal is a country that has showed persistent fiscal deficits and accumulated public debt and also has an ageing population, the debt-to-GDP ratio and the age dependency ratio influence the policymakers' behaviour, respectively, improving and deteriorating fiscal performance.

Table 5 – Estimation of CAPB (in % GDP) for the Portuguese economy

	(1)	(2)	(3.a)	(3.b)	(4.a)	(4.b)
INTERCEPT	16.1295	15.7500	12.6188	18.5880	16.4401	17.3598
	(9.9386)	(10.0260)	(12.7310)	(14.2991)	(9.6863)	(10.4128)
OG	**0.4045*** **	2.7022	**-22.7213** **	-4.5182	0.4598	-1.1070
	(0.2238)	(6.8849)	**(8.0504)**	(2.6398)	(0.2763)	(0.6894)
OG×CPI		-0.0365				
		(0.1065)				
OG×KAOPEN			**0.2324** **			
			(0.0821)			
OG×FDI				**0.0741***		
				(0.0391)		
OG×FRI					-0.0966	
					(0.0960)	
OG×EMU						**1.6080** **
						(0.7331)
OG2	0.1272	0.1355	0.1421	0.1145	0.1122	0.1400
	(0.0784)	(0.0974)	(0.0892)	(0.0883)	(0.0750)	(0.0825)
INFLATION	0.4905	0.4638	0.6009	0.4815	0.5058	0.4442
	(0.2959)	(0.2711)	(0.4001)	(0.4976)	(0.3020)	(0.2667)
AGE_DEP	**-0.5002***	**-0.4876***	-0.4445	**-0.5711***	**-0.5100** **	**-0.5231***
	(0.2446)	**(0.2409)**	(0.2834)	**(0.3151)**	**0.2384**	**(0.2552)**
DEBT_LAG1	**0.0812*** **	**0.0787*** **	**0.0850*** **	**0.0938*** **	**0.0833*** **	**0.0826*** **
	(0.0218)	**(0.0202)**	**(0.0205)**	**(0.0246)**	**(0.0209)**	**(0.0223)**
ELECTIONS	-0.0723	0.0053	-0.1732	0.2796	0.0384	-0.3523
	(0.5720)	(0.5927)	(0.6855)	(0.5767)	(0.5069)	(0.6045)
Observations	28	28	26	26	28	28
R^2	0.3718	0.3749	0.4511	0.4282	0.3811	0.4253
p-value (F-statistic)	0.1006	0.1627	0.0952	0.1244	0.1519	0.0896

Note: ***p-value < 0.01, **p-value < 0.05, *p-value < 0.1. Robust standard errors in parentheses. *EViews* estimation outputs can be consulted in Annex 7.

5. Conclusion

Governments perform multiple roles in the economy, and their performance is evaluated from two perspectives: the normative approach and the positive approach. The government's ultimate normative goal is to maximize social welfare, achieved through three economic functions: allocation, redistribution, and stabilisation. The relevant one for our work is the stabilisation function, that aims to moderate the business cycle's impact, preventing overheating and deep contractions. Fiscal policymakers should strive to reduce the amplitude and duration of business cycles by employing countercyclical fiscal policy and mitigating social costs and welfare losses associated with both phases of the business cycle.

According to the relevant literature, several factors influence the cyclicality of fiscal policy: political distortions, such as corruption, common pool problems, rent-seeking behaviour, and political friction (Alesina et al., 2008; Jalles et al., 2023); credit market imperfections which may further exacerbate procyclicality, especially in situations where access to international credit markets becomes constrained during economic downturns, as discussed by Gavin and Perotti (1997) and others authors; and, fiscal rules, which, while designed to promote sound public finances, can inadvertently lead to procyclicality, with deviations from these rules and concerns about debt sustainability affecting fiscal policy decisions (Coeuré & Pisani-Ferry, 2005; Larch et al., 2021). Overall, the cyclicality of fiscal policy is shaped by a complex interplay of these factors, with each contributing to the observed patterns in different ways across countries and time.

We first start to analyse the Portuguese discretionary fiscal policy. The output gap depends on potential output, which can be estimated using univariate and multivariate methods. The first methods involve various filters used to separate the trend and the cyclical components in macroeconomic time series: HP filter; Hamilton filter and band-pass filters, such as the BK filter and the CF filter. Despite some shortcomings, the HP and BK filters are noted as performing relatively well in this context.

The multivariate methods for estimating potential output follow a production function approach, usually a Cobb-Douglas function. We estimate the Portuguese cyclically adjusted primary balance based on revenue and expenditure categories influenced by the business cycle, providing details on how elasticities are, in turn, estimated for different tax and expenditure items. Overall, it is estimated that an increase (reduction) of 1 p.p. in the output gap induces an improvement (deterioration) of 0.39 p.p. in the primary balance as GDP ratio, suggesting that in the period under analysis the fiscal policy in Portugal has been, on average, countercyclical.

We next detail the relationship between Portugal's discretionary fiscal policy and its economic cycles, using changes in the cyclically adjusted primary balance and in the output gap as key indicators. This passage provides historical examples of when Portugal's fiscal policy exhibited procyclical and countercyclical fiscal policy, emphasizing the importance of understanding the discretionary nature of fiscal policy in response to economic conditions.

To address the potential causes of the discretionary fiscal policy, we expand firstly our analysis for the 27 EU countries. The panel data evaluates the impact of economic cycles, public debt, election periods, age dependency, inflation, and several financial and corruption variables on fiscal policy. We find that more favourable economic conditions are associated with a reduction in the cyclically adjusted primary balance, indicating a more procyclical fiscal policy, and some evidence that financial development enhanced fiscal performance. There is evidence that corruption influences countercyclicality negatively and that the fiscal rules framework is generally insignificant, but the Eurozone membership is found to lead to more restrictive fiscal policies. The focus of our analysis is the causes of Portuguese discretionary fiscal policy, and several important findings emerge. Notably, it reveals a countercyclical fiscal policy as suggested by the production function multivariate approach. Particularly, the study suggests that financial factors and EMU membership have been pivotal in enhancing Portuguese fiscal discipline.

We identify a primary limitation in our analysis, which pertains to the data regarding the discretionary fiscal policy. Despite having multiple variables to gauge the significance of three crucial factors, the available dataset lacks coverage for periods preceding 1995, to measure the causes for the Portuguese time series. Furthermore, assessing access to imperfect financial markets presents challenges due to the volatile and frequently updated nature of financial variables, such as the Chinn-Ito index, which undergoes annual changes in its index values. From our perspective, future help to navigation will have to do with improvements in terms of data availability and transparency, namely providing data for the most recent years (2021 and 2022) and for period prior to 1995.

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Annexes

Annex 1 – MATLAB code

```
% Import from calculations the excel file "Own calculations. xlxs"
% After choose the "Year", "GDP (real)" and "LN GDP (real)" column of the sheet
% "Statistical methods" (without the header)
% NOTE: should choose in output type: "column vectors"; creating 3 variables

% Now apply the HP filter on LN GDP to obtain the trend and cyclical compenent of GDP
% We choose the smoothing parameter to be 100 for yearly data, but Braz et
% al. (2019) use the smoothing parameter to be equal to 30 (the authors
% consider a duration of 8 years for the business cycle)

[HPTrend100, HPCycle100] = hpfilter(LNGDP,Smoothing = 100);
HPCycle100 = HPCycle100 * 100;
[HPTrend30, HPCycle30] = hpfilter(LNGDP, Smoothing = 30);
HPCycle30 = HPCycle30 * 100;

% Now apply the Hamilton filter on LN GDP to obtain the trend and cyclical compenent↙
of GDP

[HTrend, HCycle] = hfilter(LNGDP, LeadLength = 2, LagLength = 1);
HCycle = HCycle * 100;

% Now apply the BK filter on LN GDP to obtain the trend and cyclical compenent of GDP
% (the parameters are provided by "help bkfilter")

[BKTrend, BKCycle] = bkfilter(LNGDP,LowerCutoff = 2,UpperCutoff = 8, LagLength = 3);
BKCycle = BKCycle * 100;

% Now apply the CF filter on LN GDP to obtain the trend and cyclical compenent of GDP
% ("Drift = true" because when a series is trending, cffilter must estimate an
% additional drift parameter)

[CFTrend, CFCycle] = cffilter(LNGDP);
CFCycle = CFCycle * 100;
```

Annex 2 – Detail of the variables used in the econometric study

Variable	Description	Source
CAPB	Total general government revenue net of total general government expenditure (excluding interest payments), in % of GDP	AMECO Database[a]
ΔCAPB	Difference between two consecutive years of total general government revenue net of total general government expenditure (excluding interest payments), in % of GDP	AMECO Database
OG	Gap between actual and potential gross domestic product, in % of GDP	AMECO Database
OG_LAG1	OG lagged by one year	AMECO Database
CPI	*Corruption Perception Index* expressed between 0 and 100 (where 100 corresponds to the minimum level of perceived corruption)	Transparency International[b]
KAOPEN	*Chinn-Ito Index* expressed between 0 and 100 (where 100 corresponds to the maximum level of financial openness)	Chinn and Ito (2006)
FDI	*Financial Development Index* expressed as an integer between 0 and 100 (where 100 corresponds to the maximum level of financial development)	IMF[c]
FRI	*Fiscal Rules Index*, it evaluates a wide array of facets that define the robustness of fiscal regulations within each EU member state	EC[d]
EMU	Dummy variable that assumes the value "1" if the country was an EMU member in year t and "0" otherwise	EU[e]
OG2	Square of the gap between actual and potential gross domestic product, in % of GDP	AMECO Database

Variable	Description	Source
INFLATION	Inflation rate at consumer prices, in percentage	World Bank[f]
AGE_DEP	*Age dependency ratio*, it represents the proportion of dependents – individuals below 15 years and those above 64 years – relative to the working-age population falling between 15 and 64 years	Eurostat[g]
DEBT_LAG1	Total gross debt outstanding at the end of year t-1, in % of GDP	AMECO Database
ELECTIONS	Dummy variable that assumes the value "1" if parliamentary elections took place in year t and "0" otherwise	Comparative Political Dataset[h]; Parties and Elections in Europe[i]

Notes: Each of the following sources was last accessed on July 24, 2023.

[a] AMECO Database (https://economy-finance.ec.europa.eu/economic-research-and-databases/economic-databases/ameco-database_en);

[b] Transparency International (https://www.transparency.org/en/cpi/2022);

[c] International Monetary Fund: Financial Development Database (https://data.imf.org/?sk=f8032e80-b36c-43b1-ac26-493c5b1cd33b);

[d] European Commission: Fiscal Rules Database (https://data.europa.eu/data/datasets/fiscal-rules-database?locale=pt);

[e] European Union (https://european-union.europa.eu/institutions-law-budget/euro/countries-using-euro_en);

[f] World Bank (https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?end=2022&locations=AT-BE-BG-HR-CY-CZ-DK-EE-FI-FR-DE-GR-HU-IE-IT-LV-LT-LU-MT-NL-PL-PT-RO-SK-SI-ES-SE&start=1995);

[g] Eurostat (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:Estrutura_populacional_e_envelhecimento&oldid=364975);

[h] Comparative Political Dataset (https://www.cpds-data.org/); [i] Parties and Elections in Europe (http://www.parties-and-elections.eu/countries.html).

Annex 3 – Correlation matrix of the variables used in the econometric study

	CAPB	ΔCAPB	OG	CPI	KAOPEN	FDI	FRI	…
CAPB	1	0.367	-0.099	0.284	0.106	0.211	0.083	
ΔCAPB		1	-0.078	0.005	-0.021	-0.009	-0.051	
OG			1	0.089	-0.003	-0.032	-0.093	
CPI				1	0.470	**0.645**	0.206	
KAOPEN					1	0.458	0.319	
FDI						1	0.177	
FRI							1	
…								

	…	EMU	OG2	INFLATION	AGE_DEP	DEBT_LAG1	ELECTIONS	OG_LAG1
CAPB		0.036	0.088	0.096	0.141	0.234	-0.052	-0.156
ΔCAPB		-0.047	0.029	0.097	-0.019	0.072	-0.061	-0.081
OG		-0.101	-0.440	0.023	-0.134	-0.315	0.024	**0.645**
CPI		0.305	-0.183	-0.240	0.321	-0.058	-0.030	0.070
KAOPEN		0.406	0.023	-0.184	0.287	0.129	-0.003	0.026
FDI		**0.508**	-0.053	-0.084	0.289	0.410	-0.020	-0.013
FRI		0.303	-0.013	-0.082	0.464	0.115	0.012	-0.129
EMU		1	0.052	-0.082	0.189	0.386	-0.001	-0.081
OG2			1	0.006	0.022	0.238	0.002	-0.296
INFLATION				1	-0.028	-0.221	0.054	0.181
AGE_DEP					1	0.325	0.005	-0.181
DEBT_LAG1						1	-0.003	-0.395
ELECTIONS							1	-0.011
OG_LAG1								1

Annex 4 – Hausman test

1) OLS estimates

The equations used are without the explanatory variable for simplicity. Regarding the OLS estimates, the Hausman test results show that we can reject H_0 for cross-section effects (p-value smaller than 1%). However, when the dependent variable is ΔCAPB the Hausman test warns that "estimated cross-section random effects variance is zero", that is the GLS estimates are equal to the OLS estimates. The FE estimator is preferable for period effects (we do reject H_0 with a p-value of 0.01).

Hausman test (OLS estimates)

Correlated Random Effects - Hausman Test
Equation: EQ01
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	35.182490	6	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
OG	0.023469	0.013588	0.000019	0.0242
OG2	0.005763	0.005568	0.000001	0.7948
INFLATION	0.022018	-0.002181	0.000034	0.0000
AGE_DEP	-0.154779	-0.088593	0.000163	0.0000
DEBT_LAG1	0.050394	0.035336	0.000015	0.0001
ELECTIONS	-0.351683	-0.370035	0.000062	0.0197

Correlated Random Effects - Hausman Test
Equation: EQ01
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	30.149672	6	0.0000

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
OG	-0.220263	-0.138585	0.000434	0.0001
OG2	-0.000678	0.001405	0.000001	0.0536
INFLATION	-0.086108	-0.077033	0.000156	0.4675
AGE_DEP	0.101412	0.087276	0.000063	0.0746
DEBT_LAG1	0.010835	0.012400	0.000000	0.0010
ELECTIONS	-0.415280	-0.407500	0.000379	0.6894

Correlated Random Effects - Hausman Test
Equation: EQ01_VAR
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	22.265850	6	0.0011

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
OG	-0.045327	-0.061365	0.000053	0.0280
OG2	-0.002957	-0.002445	0.000002	0.7349
INFLATION	0.074205	0.049483	0.000122	0.0250
AGE_DEP	-0.088435	-0.024729	0.000443	0.0025
DEBT_LAG1	0.028303	0.005413	0.000027	0.0000
ELECTIONS	-0.281110	-0.301168	0.000255	0.2093

Correlated Random Effects - Hausman Test
Equation: EQ01_VAR
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	71.836504	6	0.0000

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
OG	-0.123887	-0.070792	0.000609	0.0314
OG2	-0.001320	-0.001890	0.000002	0.6617
INFLATION	-0.008767	0.039056	0.000231	0.0016
AGE_DEP	-0.005834	-0.019350	0.000100	0.1767
DEBT_LAG1	-0.000028	0.004064	0.000000	0.0000
ELECTIONS	-0.416068	-0.330084	0.000674	0.0009

2) TSLS estimates

The two-stage least squares show that we can reject the null hypothesis for cross-section effects, but for period effects the Hausman test cannot distinguish between RE and FE estimator.

Hausman test (TSLS estimates)

Correlated Random Effects - Hausman Test
Equation: EQ01
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	45.317390	6	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
OG	-0.077399	-0.120820	0.000231	0.0043
OG2	0.001010	-0.000893	0.000001	0.0290
INFLATION	0.034547	0.015139	0.000044	0.0036
AGE_DEP	-0.156793	-0.090126	0.000182	0.0000
DEBT_LAG1	0.046579	0.030989	0.000019	0.0003
ELECTIONS	-0.317933	-0.332371	0.000249	0.3606

Correlated Random Effects - Hausman Test
Equation: EQ01
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	0.000000	6	1.0000

* Period test variance is invalid. Hausman statistic set to zero.

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
OG	-0.258716	-0.236766	0.000308	0.2113
OG2	-0.002168	-0.002426	0.000001	0.7487
INFLATION	-0.088576	-0.077333	0.000101	0.2634
AGE_DEP	0.103003	0.092462	0.000043	0.1060
DEBT_LAG1	0.009544	0.010233	0.000000	0.0724
ELECTIONS	-0.437336	-0.424593	0.000317	0.4741

Annex 5 – Redundant Two-Way Fixed Effects test

The equations utilized in these tests have been simplified by excluding the explanatory variable for the sake of simplicity. Additionally, the left-side outlier corresponds to the equation with CAPB as the dependent variable, while the right-side outlier represents the equation with ΔCAPB as the dependent variable. The redundant two-way fixed effects tests are designed to evaluate the collective significance of OLS cross-section and period fixed effects estimates. In essence, they must decide between a null hypothesis (H_0) wherein these effects are deemed redundant, suggesting their exclusion, and an alternative hypothesis (H_1) positing that they are not redundant and should be retained when estimating the econometric model.

The *EViews* output presents three distinct pairs of tests. The first pair ("Cross-section F" and "Cross-section Chi-square") assesses the comparison between a restricted specification featuring only period fixed effects and an unrestricted specification including both cross-section and period fixed effects. Based on the obtained p-values, we can reject the idea that cross-section fixed effects are redundant when the dependent variable is CAPB, but we cannot reject H_0 when we use ΔCAPB. The reasoning for the second set ("Period F" and "Period Chi-square") follows a similar rationale, but in this case, it involves a restricted specification with only cross-section fixed effects; in this instance, we can reject the notion that period fixed effects are redundant in CAPB and ΔCAPB (for a p-value of 0.01). Finally, the final pair ("Cross-section/Period F" and "Cross-section/Period Chi-square") examines a restricted specification without fixed type of fixed effects; given the previous findings, it is not surprising that we can reject the redundancy of joint cross-section and period fixed effects for CAPB and ΔCAPB (for a p-value of 0.01), this could be due to temporal effects only, sectional effects only, or both at the same time.

As a result, the redundant two-way fixed effects tests recommend that we estimate our model with both fixed effects in the individual and temporal dimension when the dependent variable is CAPB, but we only estimate our model with fixed effects in the temporal dimension when we use ΔCAPB.

Redundant Fixed Effect tests' output

Redundant Fixed Effects Tests
Equation: EQ01
Test cross-section and period fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	11.008684	(26,666)	0.0000
Cross-section Chi-square	259.554068	26	0.0000
Period F	8.302286	(27,666)	0.0000
Period Chi-square	210.622389	27	0.0000
Cross-Section/Period F	10.363422	(53,666)	0.0000
Cross-Section/Period Chi-square	436.634398	53	0.0000

Redundant Fixed Effects Tests
Equation: EQ01_VAR
Test cross-section and period fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.408566	(26,651)	0.9964
Cross-section Chi-square	11.508138	26	0.9936
Period F	3.981006	(27,651)	0.0000
Period Chi-square	108.652345	27	0.0000
Cross-Section/Period F	2.539928	(53,651)	0.0000
Cross-Section/Period Chi-square	133.638658	53	0.0000

Annex 6 – Endogeneity test

1) For the 27 EU countries

We used the methos suggested by Verbeek (2017) because we were concerned that the output gap (OG) could be endogenous in relation to the dependent variable (CAPB or ΔCAPB). We will use Instrumental Variable's (IV) estimation to determine whether endogeneity exists and whether it is possible to control for it.

The procedure commences with the estimation of reduced-form equations, wherein OG alternately serves as the dependent variable in these supplementary regressions. In contrast, the independent variables will comprise the components of the structural equation, excluding the explanatory variables for the sake of simplicity, while including additional instrumental variables (IVs). As an illustration, in the equation involving OG, we will utilize the output gap lagged by one period (OG_LAG1). Thus, we have formulated the reduced-form equation as follows.

$$OG_{i,t} = \delta_1 + \delta_2 OG\_LAG1_{i,t} + \delta_3 OG2_{i,t} + \delta_4 INFLATION_{i,t} + \delta_5 AGE\_DEP_{i,t} + \delta_6 DEBT\_LAG1_{i,t} + \delta_7 ELECTIONS_{i,t} + \varepsilon_{i,t} \quad \text{(A3.1.)}$$

Based on the estimation outputs relative to equation (A3.1.)[11], we can confirm that

[11] Based on the findings from the Hausman and Redundant Fixed Effects tests, we opt for the inclusion of both cross-section and period fixed effects in our estimations. Additionally, we employ *White diagonal* robust estimators to account for potential heteroscedasticity across cross-sections and periods.

OG_LAG1 is a relevant instrument, as it has high correlation with OG because the F-statistic on the first stage regression is above 10 – so we can move forward with the assumption that the instrument is sufficiently strong and relevant.

Estimation output of equation (A3.1.)

Dependent Variable: OG
Method: Panel Least Squares
Date: 09/06/23 Time: 10:24
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 721
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.625781	1.345846	0.464972	0.6421
OG_LAG1	0.615823	0.044151	13.94802	0.0000
OG2	-0.027162	0.005199	-5.224100	0.0000
INFLATION	0.001990	0.026843	0.074149	0.9409
AGE_DEP	-0.015586	0.027003	-0.577181	0.5640
DEBT_LAG1	0.005223	0.004946	1.055938	0.2914
ELECTIONS	0.168149	0.130246	1.291013	0.1972

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.804018	Mean dependent var	-0.377115
Adjusted R-squared	0.786524	S.D. dependent var	3.331515
S.E. of regression	1.539274	Akaike info criterion	3.780049
Sum squared resid	1566.149	Schwarz criterion	4.161239
Log likelihood	-1302.708	Hannan-Quinn criter.	3.927200
F-statistic	45.96187	Durbin-Watson stat	1.543647
Prob(F-statistic)	0.000000		

The second step, following the approach recommended by Verbeek (2017), involves extracting the residuals from the reduced-form equations and incorporating them into the equations mentioned earlier, which encompass the potentially endogenous variable. If these residuals demonstrate statistical significance, it will imply that the variable in question is, or at the very least continues to be, endogenous. This rationale prompted us to formulate two supplementary auxiliary regressions.

$$CAPB_{i,t} = \tau_1 + \tau_2 OG_{i,t} + \tau_3 Z_{i,t} + \tau_4 RESID01_{i,t} + \varepsilon_{i,t} \quad \text{(A3.2.1.)}$$

$$\Delta CAPB_{i,t} = \theta_1 + \theta_2 OG_{i,t} + \theta_3 Z_{i,t} + \theta_4 RESID01_{i,t} + \varepsilon_{i,t} \quad \text{(A3.2.2.)}$$

RESID01 are the residuals of equation A3.1. used for the two dependent variables.

The p-values associated with the t-statistics of RESID01 must then be examined. The null hypothesis (H_0) posits that the coefficient of the residuals is equal to zero, suggesting that the variable we suspected to be endogenous is, in fact, exogenous, as is the instrumental variable employed. Conversely, the alternative hypothesis (H_1) contends that the coefficient of the residuals differs from zero, indicating that the variable we suspected to be endogenous is indeed endogenous, and the instrumental variable fails to meet the criterion of exogeneity.

In light of this, we cannot reject H_0 for equation (A3.2.1.), indicating that OG is exogenous with regard to CAPB, only possible because the OG_LAG1 is exogenous. However, the instrument variable fails to meet the requisite of exogeneity with regard to ΔCAPB (for a p-value of 1%), so the OG is still endogenous.

Estimation output of equation (A3.2.1.)

Dependent Variable: CAPB
Method: Panel Least Squares
Date: 09/08/23 Time: 10:25
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 705
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.098241	1.847732	2.759189	0.0060
OG	-0.174764	0.080199	-2.179139	0.0297
OG2	0.005054	0.005395	0.936653	0.3493
INFLATION	0.033390	0.030262	1.103359	0.2703
AGE DEP	-0.159111	0.036200	-4.395276	0.0000
DEBT_LAG1	0.044712	0.007100	6.297368	0.0000
ELECTIONS	-0.377435	0.177680	-2.124237	0.0340
RESID01	0.008538	0.105595	0.080859	0.9356

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.499740	Mean dependent var	-0.061844
Adjusted R-squared	0.453132	S.D. dependent var	3.063667
S.E. of regression	2.265597	Akaike info criterion	4.556104
Sum squared resid	3305.607	Schwarz criterion	4.950501
Log likelihood	-1545.027	Hannan-Quinn criter.	4.708512
F-statistic	10.72220	Durbin-Watson stat	0.808790
Prob(F-statistic)	0.000000		

Estimation output of equation (A3.2.2.)

Dependent Variable: VAR CAPB
Method: Panel Least Squares
Date: 09/08/23 Time: 10:58
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 711
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.763005	1.593948	-1.106062	0.2691
OG	0.189039	0.070710	2.673428	0.0077
OG2	0.012219	0.005711	2.139551	0.0328
INFLATION	-0.017932	0.031278	-0.573308	0.5666
AGE DEP	0.009495	0.032144	0.295387	0.7678
DEBT_LAG1	0.022356	0.006842	3.267660	0.0011
ELECTIONS	-0.433187	0.171543	-2.525244	0.0118
RESID01	-0.529371	0.100239	-5.281104	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.239975	Mean dependent var	-0.067792
Adjusted R-squared	0.169819	S.D. dependent var	2.245406
S.E. of regression	2.045886	Akaike info criterion	4.351428
Sum squared resid	2720.672	Schwarz criterion	4.743224
Log likelihood	-1485.933	Hannan-Quinn criter.	4.502771
F-statistic	3.420579	Durbin-Watson stat	2.553218
Prob(F-statistic)	0.000000		

2) For Portuguese economy

We prove that the OG_LAG1 is a strong instrument because the Cragg-Donald F-stat is bigger than 10. And the OG is endogenous because the p-value of the endogeneity test for both dependent variable is bigger than 5%.

Weak Instrument test

Cragg-Donald F-stat: 21.65758

Stock-Yogo bias critical values not available for models with less than 3 instruments.

Stock-Yogo critical values (size):

10%	16.38
15%	8.96
20%	6.66
25%	5.53

Moment selection criteria:

SIC-based:	1.88E-39
HQIC-based:	1.88E-39
Relevant MSC:	-7.712257

Output of the endogeneity test

Estimation output of CAPB

Endogeneity Test
Equation: EQ01
Endogenous variables to treat as exogenous: OG
Specification: CAPB C OG OG2 INFLATION AGE DEP DEBT LAG1 ELECTIONS
Instrument specification: C OG LAG1 OG2 INFLATION AGE DEP DEBT_LAG1 ELECTIONS
Null hypothesis: OG are exogenous

	Value	df	Probability
Difference in J-stats	0.023506	1	0.8781

J-statistic summary:

	Value
Restricted J-statistic	0.023506
Unrestricted J-statistic	1.08E-37

Estimation output of ΔCAPB

Endogeneity Test
Equation: EQ03
Endogenous variables to treat as exogenous: OG OG*OG
Specification: VAR CAPB C OG OG*OG INFLATION AGE DEP DEBT_LAG1 ELECTIONS
Instrument specification: C OG LAG1 OG LAG1*OG LAG1 INFLATION AGE_DEP DEBT_LAG1 ELECTIONS
Null hypothesis: OG OG*OG are exogenous

	Value	df	Probability
Difference in J-stats	1.083631	2	0.5817

J-statistic summary:

	Value
Restricted J-statistic	1.083631
Unrestricted J-statistic	1.85E-37

Annex 7 – Heteroskedasticity and autocorrelation tests

1) Heteroskedasticity test

CAPB

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.349225	Prob. F(6,21)	0.9024
Obs*R-squared	2.540331	Prob. Chi-Square(6)	0.8639
Scaled explained SS	4.411058	Prob. Chi-Square(6)	0.6212

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/11/23 Time: 15:51
Sample: 1995 2022
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-27.54630	83.13549	-0.331342	0.7437
OG	-0.999846	1.232468	-0.811255	0.4263
OG2	-0.461754	0.349957	-1.319459	0.2012
INFLATION	-0.804255	1.290722	-0.623105	0.5399
AGE_DEP	0.779179	1.943871	0.400839	0.6926
DEBT_LAG1	-0.052765	0.170750	-0.309018	0.7604
ELECTIONS	-1.797719	3.909243	-0.459864	0.6503

R-squared	0.090726	Mean dependent var	3.350881
Adjusted R-squared	-0.169066	S.D. dependent var	8.478834
S.E. of regression	9.167601	Akaike info criterion	7.481546
Sum squared resid	1764.943	Schwarz criterion	7.814597
Log likelihood	-97.74165	Hannan-Quinn criter.	7.583363
F-statistic	0.349225	Durbin-Watson stat	1.727377
Prob(F-statistic)	0.902375		

ΔCAPB

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.453920	Prob. F(6,20)	0.2440
Obs*R-squared	8.200076	Prob. Chi-Square(6)	0.2238
Scaled explained SS	3.060647	Prob. Chi-Square(6)	0.8012

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/11/23 Time: 16:44
Sample: 1996 2022
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-23.11558	27.52322	-0.839857	0.4109
OG	-0.367244	0.409257	-0.897342	0.3802
OG2	-0.191862	0.115440	-1.662008	0.1121
INFLATION	0.044317	0.432412	0.102488	0.9194
AGE_DEP	0.486484	0.643322	0.756206	0.4583
DEBT_LAG1	0.017075	0.056339	0.303071	0.7650
ELECTIONS	0.175017	1.342135	0.130402	0.8976

R-squared	0.303707	Mean dependent var	2.674154
Adjusted R-squared	0.094818	S.D. dependent var	3.178543
S.E. of regression	3.024099	Akaike info criterion	5.269517
Sum squared resid	182.9035	Schwarz criterion	5.605475
Log likelihood	-64.13848	Hannan-Quinn criter.	5.369415
F-statistic	1.453920	Durbin-Watson stat	2.728544
Prob(F-statistic)	0.244033		

CAPB

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	2.241985	Prob. F(24,3)	0.2777
Obs*R-squared	26.52133	Prob. Chi-Square(24)	0.3273
Scaled explained SS	46.05192	Prob. Chi-Square(24)	0.0044

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/11/23 Time: 15:54
Sample: 1995 2022
Included observations: 28
Collinear test regressors dropped from specification

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13950.79	52691.89	-0.264762	0.8083
OG^2	133.7742	52.36388	2.554703	0.0836
OG2*OG	-1.627151	1.374854	-1.183508	0.3218
OG*INFLATION	11.36890	4.107098	2.768109	0.0697
OG*AGE_DEP	0.653911	16.98825	0.038492	0.9717
OG*DEBT LAG1	0.043023	1.604654	0.026811	0.9803
OG*ELECTIONS	13.22273	4.345596	3.042788	0.0557
OG	-62.04206	725.7418	-0.085488	0.9373
OG2*INFLATION	1.605492	1.658233	0.968194	0.4044
OG2*AGE DEP	-2.690644	1.298369	-2.072327	0.1300
OG2*DEBT_LAG1	-0.005344	0.209047	-0.025561	0.9812
OG2*ELECTIONS	-2.071073	4.719686	-0.438816	0.6905
INFLATION^2	-4.356722	2.562974	-1.699870	0.1877
INFLATION*AGE_DEP	1.938381	7.875823	0.246118	0.8215
INFLATION*DEBT_LAG1	-1.176213	0.607839	-1.935072	0.1484
INFLATION*ELECTIONS	12.81783	9.389585	1.365111	0.2656
INFLATION	13.79678	343.9627	0.040111	0.9705
AGE_DEP^2	-10.49137	29.02105	-0.361509	0.7417
AGE DEP*DEBT LAG1	3.312873	5.356059	0.618528	0.5800
AGE_DEP*ELECTIONS	12.99770	12.36719	1.050982	0.3705
AGE_DEP	764.4721	2476.220	0.308725	0.7777
DEBT LAG1^2	-0.242760	0.230555	-1.052938	0.3697
DEBT_LAG1*ELECTIO	0.276400	0.634595	0.435553	0.6926
DEBT_LAG1	-121.6655	231.4852	-0.525586	0.6355
ELECTIONS^2	-657.9513	579.5260	-1.135327	0.3387

R-squared	0.947190	Mean dependent var	3.350881
Adjusted R-squared	0.524712	S.D. dependent var	8.478834
S.E. of regression	5.845405	Akaike info criterion	5.921311
Sum squared resid	102.5063	Schwarz criterion	7.110779
Log likelihood	-57.89835	Hannan-Quinn criter.	6.284943
F-statistic	2.241985	Durbin-Watson stat	2.826389
Prob(F-statistic)	0.277664		

2) Autocorrelation test

CAPB(LAG1)

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	6.123986	Prob. F(1,20)	0.0224
Obs*R-squared	6.563761	Prob. Chi-Square(1)	0.0104

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 08/11/23 Time: 16:03
Sample: 1995 2022
Included observations: 28
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.42521	18.89360	1.028137	0.3162
OG	-0.036960	0.255214	-0.144820	0.8863
OG2	0.035912	0.073784	0.486719	0.6317
INFLATION	0.214314	0.280521	0.763984	0.4538
AGE DEP	-0.473252	0.445023	-1.063433	0.3003
DEBT LAG1	0.040900	0.038975	1.049389	0.3065
ELECTIONS	1.015584	0.906355	1.120514	0.2758
RESID(-1)	0.604202	0.244155	2.474669	0.0224

R-squared	0.234420	Mean dependent var	1.28E-15
Adjusted R-squared	-0.033533	S.D. dependent var	1.864132
S.E. of regression	1.895129	Akaike info criterion	4.351407
Sum squared resid	71.83028	Schwarz criterion	4.732037
Log likelihood	-52.91970	Hannan-Quinn criter.	4.467770
F-statistic	0.874855	Durbin-Watson stat	1.958943
Prob(F-statistic)	0.542900		

ΔCAPB (LAG1)

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.711681	Prob. F(1,19)	0.4094
Obs*R-squared	0.974822	Prob. Chi-Square(1)	0.3235

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 08/11/23 Time: 16:45
Sample: 1996 2022
Included observations: 27
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.686870	17.53313	-0.096210	0.9244
OG	0.031300	0.261652	0.119624	0.9060
OG2	0.012604	0.074571	0.169024	0.8676
INFLATION	0.049206	0.279809	0.175855	0.8623
AGE DEP	0.034506	0.409191	0.084327	0.9337
DEBT LAG1	-0.001792	0.035719	-0.050170	0.9605
ELECTIONS	-0.151528	0.868186	-0.174534	0.8633
RESID(-1)	-0.222132	0.263310	-0.843612	0.4094

R-squared	0.036105	Mean dependent var	-5.89E-15
Adjusted R-squared	-0.319015	S.D. dependent var	1.666435
S.E. of regression	1.913874	Akaike info criterion	4.377330
Sum squared resid	69.59534	Schwarz criterion	4.761282
Log likelihood	-51.09396	Hannan-Quinn criter.	4.491499
F-statistic	0.101669	Durbin-Watson stat	2.026106
Prob(F-statistic)	0.997573		

CAPB (LAG2)

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	2.909058	Prob. F(2,19)	0.0790
Obs*R-squared	6.564045	Prob. Chi-Square(2)	0.0376

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 08/11/23 Time: 16:04
Sample: 1995 2022
Included observations: 28
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.60192	22.35282	0.876933	0.3915
OG	-0.037249	0.262475	-0.141916	0.8886
OG2	0.036350	0.080564	0.451192	0.6570
INFLATION	0.217230	0.341428	0.636240	0.5322
AGE_DEP	-0.477630	0.533393	-0.895456	0.3817
DEBT_LAG1	0.041316	0.047786	0.864600	0.3980
ELECTIONS	1.016754	0.932811	1.089989	0.2893
RESID(-1)	0.603619	0.253179	2.384158	0.0277
RESID(-2)	0.004769	0.300435	0.015875	0.9875

R-squared	0.234430	Mean dependent var	1.28E-15
Adjusted R-squared	-0.087915	S.D. dependent var	1.864132
S.E. of regression	1.944348	Akaike info criterion	4.422823
Sum squared resid	71.82933	Schwarz criterion	4.851031
Log likelihood	-52.91952	Hannan-Quinn criter.	4.553730
F-statistic	0.727264	Durbin-Watson stat	1.958434
Prob(F-statistic)	0.666423		

ΔCAPB (LAG2)

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.708361	Prob. F(2,18)	0.2093
Obs*R-squared	4.307452	Prob. Chi-Square(2)	0.1161

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 08/11/23 Time: 16:46
Sample: 1996 2022
Included observations: 27
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-10.27685	17.63093	-0.582887	0.5672
OG	-0.007084	0.252129	-0.028095	0.9779
OG2	0.025683	0.071992	0.356753	0.7254
INFLATION	-0.010033	0.270901	-0.037036	0.9709
AGE_DEP	0.241143	0.412626	0.584411	0.5662
DEBT_LAG1	-0.021436	0.036335	-0.589951	0.5626
ELECTIONS	-0.643054	0.886078	-0.725731	0.4773
RESID(-1)	-0.328679	0.260973	-1.259436	0.2240
RESID(-2)	-0.454478	0.279528	-1.625879	0.1214

R-squared	0.159535	Mean dependent var	-5.89E-15
Adjusted R-squared	-0.214005	S.D. dependent var	1.666435
S.E. of regression	1.836110	Akaike info criterion	4.314377
Sum squared resid	60.68337	Schwarz criterion	4.746322
Log likelihood	-49.24408	Hannan-Quinn criter.	4.442817
F-statistic	0.427090	Durbin-Watson stat	2.102097
Prob(F-statistic)	0.889564		

Annex 8 – *Eviews* estimation outputs for 27 EU countries

CAPB

Specification (1)

Dependent Variable: CAPB
Method: Panel Two-Stage Least Squares
Date: 09/08/23 Time: 10:25
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 721
White diagonal standard errors & covariance (d.f. corrected)
Instrument specification: C OG_LAG1 OG2 INFLATION AGE_DEP DEBT_LAG1 ELECTIONS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.996227	1.912263	2.089789	0.0370
OG	-0.200763	0.077610	-2.586812	0.0099
OG2	0.003823	0.005310	0.719868	0.4719
INFLATION	0.041226	0.030433	1.354649	0.1760
AGE_DEP	-0.131488	0.037275	-3.527523	0.0004
DEBT_LAG1	0.039784	0.006785	5.863677	0.0000
ELECTIONS	-0.329555	0.177770	-1.853829	0.0642

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.489340	Mean dependent var	-0.037587
Adjusted R-squared	0.443759	S.D. dependent var	3.061053
S.E. of regression	2.282982	Sum squared resid	3445.135
F-statistic	10.48602	Durbin-Watson stat	0.789047
Prob(F-statistic)	0.000000	Second-Stage SSR	3484.783
Instrument rank	60		

Specification (2)

Dependent Variable: CAPB
Method: Panel Two-Stage Least Squares
Date: 09/08/23 Time: 10:26
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 698
White diagonal standard errors & covariance (d.f. corrected)
Instrument specification: C OG_LAG1 OG_LAG1*CPI OG2 INFLATION AGE_DEP DEBT_LAG1 ELECTIONS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.171780	1.972542	1.101006	0.2713
OG	-1.353378	0.291412	-4.644215	0.0000
OG*CPI	0.019410	0.005234	3.708456	0.0002
OG2	-0.012086	0.005957	-2.028978	0.0429
INFLATION	0.078831	0.038405	2.052605	0.0405
AGE_DEP	-0.083583	0.038865	-2.150587	0.0319
DEBT_LAG1	0.031075	0.007095	4.380082	0.0000
ELECTIONS	-0.309933	0.181427	-1.708310	0.0881

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.492182	Mean dependent var	0.026504
Adjusted R-squared	0.444350	S.D. dependent var	3.026554
S.E. of regression	2.256051	Sum squared resid	3242.182
F-statistic	11.99599	Durbin-Watson stat	0.912593
Prob(F-statistic)	0.000000	Second-Stage SSR	2997.548
Instrument rank	61		

ΔCAPB

Specification (1)

Dependent Variable: VAR_CAPB
Method: Panel Least Squares
Date: 09/08/23 Time: 10:58
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 711
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.610817	1.615181	-0.378172	0.7054
OG	-0.118790	0.039334	-3.020028	0.0026
OG2	-0.001505	0.006306	-0.238673	0.8114
INFLATION	-0.002748	0.032618	-0.084258	0.9329
AGE_DEP	-0.004775	0.032639	-0.146282	0.8837
DEBT_LAG1	0.014670	0.007051	2.080541	0.0379
ELECTIONS	-0.400458	0.176860	-2.264271	0.0239

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.188820	Mean dependent var	-0.067792
Adjusted R-squared	0.115302	S.D. dependent var	2.245406
S.E. of regression	2.111992	Akaike info criterion	4.413754
Sum squared resid	2903.793	Schwarz criterion	4.799127
Log likelihood	-1509.090	Hannan-Quinn criter.	4.562616
F-statistic	2.568376	Durbin-Watson stat	2.479765
Prob(F-statistic)	0.000000		

Specification (2)

Dependent Variable: VAR_CAPB
Method: Panel Least Squares
Date: 09/08/23 Time: 10:59
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 688
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.596126	1.675072	-0.355881	0.7220
OG	-0.274691	0.120034	-2.288440	0.0224
OG*CPI	0.002404	0.002192	1.096787	0.2732
OG2	-0.004062	0.006293	-0.645553	0.5188
INFLATION	0.032770	0.035816	0.914964	0.3606
AGE_DEP	-0.003979	0.033675	-0.118157	0.9060
DEBT_LAG1	0.011822	0.007343	1.609998	0.1079
ELECTIONS	-0.303166	0.175078	-1.731600	0.0838

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.211804	Mean dependent var	-0.060029
Adjusted R-squared	0.136378	S.D. dependent var	2.203646
S.E. of regression	2.047876	Akaike info criterion	4.355967
Sum squared resid	2629.511	Schwarz criterion	4.757945
Log likelihood	-1437.453	Hannan-Quinn criter.	4.511479
F-statistic	2.808115	Durbin-Watson stat	2.487344
Prob(F-statistic)	0.000000		

Specification (3.a)

Dependent Variable: CAPB
Method: Panel Two-Stage Least Squares
Date: 09/08/23 Time: 10:27
Sample (adjusted): 1995 2020
Periods included: 26
Cross-sections included: 26
Total panel (unbalanced) observations: 642
White diagonal standard errors & covariance (d.f. corrected)
Instrument specification: C OG_LAG1 OG_LAG1*KAOPEN OG2 INFLATI AGE_DEP DEBT_LAG1 ELECTIONS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.726053	2.712076	2.111318	0.0352
OG	-0.301711	0.231510	-1.303234	0.1930
OG*KAOPEN	0.000529	0.002781	0.190198	0.8492
OG2	0.000246	0.005516	0.044652	0.9644
INFLATION	0.043908	0.032520	1.350199	0.1775
AGE_DEP	-0.169958	0.054346	-3.127323	0.0019
DEBT_LAG1	0.042959	0.007610	5.644706	0.0000
ELECTIONS	-0.310096	0.194451	-1.594727	0.1113

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.485539	Mean dependent var	0.028193
Adjusted R-squared	0.435327	S.D. dependent var	3.086547
S.E. of regression	2.319378	Sum squared resid	3141.636
F-statistic	9.506476	Durbin-Watson stat	0.819860
Prob(F-statistic)	0.000000	Second-Stage SSR	3167.588
Instrument rank	58		

Specification (3.a)

Dependent Variable: VAR_CAPB
Method: Panel Least Squares
Date: 09/08/23 Time: 10:59
Sample (adjusted): 1995 2020
Periods included: 26
Cross-sections included: 26
Total panel (unbalanced) observations: 632
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.649339	2.111405	-0.307539	0.7585
OG	0.080501	0.181891	0.442578	0.6582
OG*KAOPEN	-0.002326	0.001922	-1.210175	0.2267
OG2	-0.002837	0.006451	-0.439740	0.6603
INFLATION	-0.013206	0.034131	-0.386929	0.6990
AGE_DEP	-0.008487	0.043570	-0.194791	0.8456
DEBT_LAG1	0.018384	0.008298	2.215355	0.0271
ELECTIONS	-0.436723	0.194809	-2.241797	0.0254

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.190201	Mean dependent var	-0.114399
Adjusted R-squared	0.109786	S.D. dependent var	2.311735
S.E. of regression	2.181149	Akaike info criterion	4.484865
Sum squared resid	2730.754	Schwarz criterion	4.893149
Log likelihood	-1359.217	Hannan-Quinn criter.	4.643430
F-statistic	2.365231	Durbin-Watson stat	2.487617
Prob(F-statistic)	0.000000		

Specification (3.b)

Dependent Variable: CAPB
Method: Panel Two-Stage Least Squares
Date: 09/08/23 Time: 10:27
Sample (adjusted): 1995 2020
Periods included: 26
Cross-sections included: 27
Total panel (unbalanced) observations: 667
White diagonal standard errors & covariance (d.f. corrected)
Instrument specification: C OG_LAG1 OG_LAG1*FDI OG2 INFLATION AGE_DEP DEBT_LAG1 ELECTIONS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.439812	2.246224	1.531376	0.1262
OG	-0.810108	0.175258	-4.622375	0.0000
OG*FDI	0.012376	0.003931	3.148406	0.0017
OG2	0.007450	0.006403	1.163411	0.2451
INFLATION	0.059856	0.035185	1.701187	0.0894
AGE_DEP	-0.121869	0.044025	-2.768168	0.0058
DEBT_LAG1	0.043103	0.007546	5.712027	0.0000
ELECTIONS	-0.371229	0.193692	-1.916590	0.0558

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.483054	Mean dependent var	0.105547
Adjusted R-squared	0.433740	S.D. dependent var	3.066977
S.E. of regression	2.307908	Sum squared resid	3238.475
F-statistic	10.67028	Durbin-Watson stat	0.898960
Prob(F-statistic)	0.000000	Second-Stage SSR	3104.546
Instrument rank	59		

Specification (3.b)

Dependent Variable: VAR_CAPB
Method: Panel Least Squares
Date: 09/08/23 Time: 10:59
Sample (adjusted): 1995 2020
Periods included: 26
Cross-sections included: 27
Total panel (unbalanced) observations: 657
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.289593	1.798379	-0.717086	0.4736
OG	-0.182067	0.094611	-1.924383	0.0548
OG*FDI	0.001355	0.001793	0.755741	0.4501
OG2	-0.001324	0.006642	-0.199281	0.8421
INFLATION	-0.012079	0.034555	-0.349562	0.7268
AGE_DEP	0.006287	0.036662	0.171492	0.8639
DEBT_LAG1	0.016961	0.008131	2.085948	0.0374
ELECTIONS	-0.424910	0.188244	-2.257227	0.0244

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.191212	Mean dependent var	-0.118265
Adjusted R-squared	0.112768	S.D. dependent var	2.284999
S.E. of regression	2.152309	Akaike info criterion	4.456470
Sum squared resid	2770.195	Schwarz criterion	4.859474
Log likelihood	-1404.951	Hannan-Quinn criter.	4.612709
F-statistic	2.437558	Durbin-Watson stat	2.485498
Prob(F-statistic)	0.000000		

Specification (4.a)

Dependent Variable: CAPB
Method: Panel Two-Stage Least Squares
Date: 09/08/23 Time: 10:28
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 721
White diagonal standard errors & covariance (d.f. corrected)
Instrument specification: C OG LAG1 OG LAG1*FRI OG2 INFLATION AGE DEP DEBT LAG1 ELECTIONS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.942755	1.905378	2.069277	0.0389
OG	-0.213498	0.082576	-2.585481	0.0099
OG*FRI	0.060104	0.076983	0.780750	0.4352
OG2	0.004041	0.005319	0.759754	0.4477
INFLATION	0.042738	0.030237	1.413442	0.1580
AGE_DEP	-0.129602	0.036988	-3.503869	0.0005
DEBT_LAG1	0.039298	0.006867	5.722545	0.0000
ELECTIONS	-0.327249	0.176431	-1.854827	0.0641

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.489739	Mean dependent var	-0.037587
Adjusted R-squared	0.443352	S.D. dependent var	3.061053
S.E. of regression	2.283816	Sum squared resid	3442.438
F-statistic	10.35735	Durbin-Watson stat	0.791116
Prob(F-statistic)	0.000000	Second-Stage SSR	3474.717
Instrument rank	61		

Specification (4.a)

Dependent Variable: VAR_CAPB
Method: Panel Least Squares
Date: 09/08/23 Time: 10:59
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 711
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.653540	1.621367	-0.403079	0.6870
OG	-0.123845	0.041263	-3.001371	0.0028
OG*FRI	0.039068	0.046612	0.838168	0.4022
OG2	-0.001207	0.006345	-0.190190	0.8492
INFLATION	-0.001876	0.032680	-0.057418	0.9542
AGE_DEP	-0.003424	0.032836	-0.104262	0.9170
DEBT_LAG1	0.014386	0.007052	2.039841	0.0418
ELECTIONS	-0.399788	0.176052	-2.270850	0.0235

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.190713	Mean dependent var	-0.067792
Adjusted R-squared	0.116010	S.D. dependent var	2.245406
S.E. of regression	2.111148	Akaike info criterion	4.414230
Sum squared resid	2897.014	Schwarz criterion	4.806026
Log likelihood	-1508.259	Hannan-Quinn criter.	4.565573
F-statistic	2.552939	Durbin-Watson stat	2.482099
Prob(F-statistic)	0.000000		

Specification (4.b)

Dependent Variable: CAPB
Method: Panel Two-Stage Least Squares
Date: 09/08/23 Time: 10:28
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 721
White diagonal standard errors & covariance (d.f. corrected)
Instrument specification: C OG LAG1 OG LAG1*EMU OG2 INFLATION AGE DEP DEBT LAG1 ELECTIONS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.748963	1.938222	1.934228	0.0535
OG	-0.457412	0.083722	-5.463492	0.0000
OG*EMU	0.558941	0.168632	3.314561	0.0010
OG2	0.016842	0.007749	2.173545	0.0301
INFLATION	0.073353	0.033342	2.200036	0.0282
AGE_DEP	-0.135475	0.037595	-3.603555	0.0003
DEBT_LAG1	0.045203	0.006987	6.469491	0.0000
ELECTIONS	-0.370424	0.185375	-1.998235	0.0461

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.482032	Mean dependent var	-0.037587
Adjusted R-squared	0.434944	S.D. dependent var	3.061053
S.E. of regression	2.300999	Sum squared resid	3494.434
F-statistic	11.09541	Durbin-Watson stat	0.872272
Prob(F-statistic)	0.000000	Second-Stage SSR	3358.650
Instrument rank	61		

Specification (4.b)

Dependent Variable: VAR_CAPB
Method: Panel Least Squares
Date: 09/08/23 Time: 11:00
Sample: 1995 2022
Periods included: 28
Cross-sections included: 27
Total panel (unbalanced) observations: 711
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.678735	1.608240	-0.422036	0.6731
OG	-0.175690	0.045102	-3.895376	0.0001
OG*EMU	0.141672	0.072351	1.958121	0.0506
OG2	0.002163	0.006646	0.325412	0.7450
INFLATION	0.005171	0.033138	0.156047	0.8760
AGE_DEP	-0.005806	0.032667	-0.177717	0.8590
DEBT_LAG1	0.016169	0.007050	2.293382	0.0221
ELECTIONS	-0.412141	0.177435	-2.322771	0.0205

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.196253	Mean dependent var	-0.067792
Adjusted R-squared	0.122061	S.D. dependent var	2.245406
S.E. of regression	2.103909	Akaike info criterion	4.407361
Sum squared resid	2877.182	Schwarz criterion	4.799157
Log likelihood	-1505.817	Hannan-Quinn criter.	4.558704
F-statistic	2.645208	Durbin-Watson stat	2.495483
Prob(F-statistic)	0.000000		

Annex 9 – Estimation of CAPB (in % GDP) change for the Portuguese economy

	(1)	(2)	(3.a)	(3.b)	(4.a)	(4.b)
INTERCEPT	38.8329	38.4778	5.9156	10.4757	38.8907	40.2918
	(17.29)	(17.8279)	(19.1202)	(19.5884)	(17.7374)	(17.6803)
OG	0.1031	1.4581	8.5177	-2.9365	0.1163***	-0.7719
	(0.2571)	(7.2746)	(43.7414)	(3.5829)	(0.2798)	(1.3503)
OG×CPI		-0.0215				
		(0.1153)				
OG×KAOPEN			-0.0850			
			(0.4376)			
OG×FDI				0.0439		
				(0.0532)		
OG×FRI					-0.0226	
					(0.1601)	
OG×EMU						0.9145
						(1.3848)
OG2	0.0881	0.0930	0.0600	0.0484	0.0846	0.0954
	(0.0725)	(0.0788)	(0.0628)	(0.0634)	(0.0784)	(0.0744)
INFLATION	**0.7610****	**0.7410****	**1.6750*****	**1.5294*****	**0.7641****	**0.7592****
	(0.2717)	**(0.2984)**	**(0.3207)**	**(0.3596)**	**(0.2795)**	**(0.2756)**
AGE_DEP	**-0.9794****	**-0.9691**	-0.3400	-0.4354	**-0.9814****	**-1.0093**
	(0.4042)	**(0.4180)**	(0.4229)	(0.4312)	**0.4147**	**(0.4125)**
DEBT_LAG1	**0.0970****	**0.0954**	**0.0819****	**0.0884****	**0.0974****	**0.0982****
	(0.0354)	**0.0372**	**(0.0302)**	**(0.0306)**	**(0.0365)**	**(0.0360)**
ELECTIONS	1.2709	1.2956	**1.9336****	**2.1001****	1.2944	1.2324
	(0.8433)	(0.8745)	**(0.6974)**	**(0.7024)**	(0.8806)	(0.8574)
Observations	27	27	25	25	27	27
R^2	0.3751	0.3763	0.5357	0.5526	0.3758	0.3892
P-value (F-statistic)	0.1134	0.1851	0.0033	0.0025	0.1860	0.1618

Note: ***p-value < 0.01, **p-value < 0.05, *p-value < 0.1. Standard errors in parentheses. *EViews* estimation outputs can be consulted in Annex 10.

Annex 10 – *Eviews* estimation outputs for Portuguese economy

CAPB

Specification (1)

Dependent Variable: CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:53
Sample: 1995 2022
Included observations: 28
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	16.12947	9.938602	1.622911	0.1195
OG	0.404533	0.223845	1.807200	0.0851
OG2	0.127164	0.078436	1.621244	0.1199
INFLATION	0.490513	0.295913	1.657625	0.1123
AGE_DEP	-0.500167	0.244609	-2.044766	0.0536
DEBT_LAG1	0.081196	0.021809	3.723109	0.0013
ELECTIONS	-0.072302	0.571989	-0.126405	0.9006

R-squared	0.371766	Mean dependent var	-0.639286
Adjusted R-squared	0.192271	S.D. dependent var	2.351885
S.E. of regression	2.113727	Akaike info criterion	4.547100
Sum squared resid	93.82466	Schwarz criterion	4.880151
Log likelihood	-56.65940	Hannan-Quinn criter.	4.648917
F-statistic	2.071177	Durbin-Watson stat	1.134906
Prob(F-statistic)	0.100559	Wald F-statistic	4.840463
Prob(Wald F-statistic)	0.003009		

Specification (2)

Dependent Variable: CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:53
Sample: 1995 2022
Included observations: 28
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.74997	10.02603	1.570909	0.1319
OG	2.702202	6.884874	0.392484	0.6989
CPI*OG	-0.036506	0.106543	-0.342638	0.7354
OG2	0.135458	0.097382	1.390996	0.1795
INFLATION	0.463808	0.271053	1.711131	0.1025
AGE_DEP	-0.487558	0.240885	-2.024029	0.0565
DEBT_LAG1	0.078703	0.020228	3.890866	0.0009
ELECTIONS	0.005300	0.592688	0.008943	0.9930

R-squared	0.374875	Mean dependent var	-0.639286
Adjusted R-squared	0.156081	S.D. dependent var	2.351885
S.E. of regression	2.160561	Akaike info criterion	4.613569
Sum squared resid	93.36047	Schwarz criterion	4.994199
Log likelihood	-56.58997	Hannan-Quinn criter.	4.729932
F-statistic	1.713368	Durbin-Watson stat	1.169317
Prob(F-statistic)	0.162691	Wald F-statistic	7.424646
Prob(Wald F-statistic)	0.000188		

ΔCAPB

Specification (1)

Dependent Variable: VAR_CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:51
Sample (adjusted): 1996 2022
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	38.83289	17.29272	2.245621	0.0362
OG	0.103093	0.257135	0.400930	0.6927
OG2	0.088093	0.072530	1.214566	0.2387
INFLATION	0.761005	0.271683	2.801081	0.0110
AGE_DEP	-0.979399	0.404197	-2.423076	0.0250
DEBT_LAG1	0.096950	0.035398	2.738877	0.0127
ELECTIONS	1.270860	0.843258	1.507083	0.1474

R-squared	0.375142	Mean dependent var	-0.003704
Adjusted R-squared	0.187684	S.D. dependent var	2.108131
S.E. of regression	1.900029	Akaike info criterion	4.340029
Sum squared resid	72.20217	Schwarz criterion	4.675986
Log likelihood	-51.59039	Hannan-Quinn criter.	4.439927
F-statistic	2.001208	Durbin-Watson stat	2.215730
Prob(F-statistic)	0.113354		

Specification (2)

Dependent Variable: VAR_CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:50
Sample (adjusted): 1996 2022
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	38.47780	17.82785	2.158298	0.0439
OG	1.458108	7.274633	0.200437	0.8433
CPI*OG	-0.021487	0.115279	-0.186388	0.8541
OG2	0.092978	0.078832	1.179452	0.2528
INFLATION	0.741033	0.298390	2.483436	0.0225
AGE_DEP	-0.969051	0.418022	-2.318181	0.0317
DEBT_LAG1	0.095411	0.037211	2.564077	0.0190
ELECTIONS	1.295573	0.874484	1.481528	0.1549

R-squared	0.376282	Mean dependent var	-0.003704
Adjusted R-squared	0.146491	S.D. dependent var	2.108131
S.E. of regression	1.947608	Akaike info criterion	4.412276
Sum squared resid	72.07039	Schwarz criterion	4.796228
Log likelihood	-51.56573	Hannan-Quinn criter.	4.526445
F-statistic	1.637497	Durbin-Watson stat	2.257618
Prob(F-statistic)	0.185108		

Specification (3.a)

Dependent Variable: CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:53
Sample (adjusted): 1995 2020
Included observations: 26 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.61876	12.73100	0.991184	0.3347
OG	-22.72133	8.050431	-2.822375	0.0113
KAOPEN*OG	0.232380	0.082084	2.830995	0.0111
OG2	0.142139	0.089153	1.594320	0.1283
INFLATION	0.600910	0.400127	1.501799	0.1505
AGE_DEP	-0.444494	0.283400	-1.568433	0.1342
DEBT_LAG1	0.084985	0.020495	4.146566	0.0006
ELECTIONS	-0.173237	0.685517	-0.252710	0.8034

R-squared	0.451120	Mean dependent var	-0.776923
Adjusted R-squared	0.237667	S.D. dependent var	2.386011
S.E. of regression	2.083266	Akaike info criterion	4.553411
Sum squared resid	78.11994	Schwarz criterion	4.940517
Log likelihood	-51.19434	Hannan-Quinn criter.	4.664883
F-statistic	2.113438	Durbin-Watson stat	1.350376
Prob(F-statistic)	0.095174	Wald F-statistic	6.159310
Prob(Wald F-statistic)	0.000878		

Specification (3.a)

Dependent Variable: VAR_CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:51
Sample (adjusted): 1996 2020
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.915553	19.12027	0.309386	0.7608
OG	8.517715	43.74143	0.194729	0.8479
KAOPEN*OG	-0.085039	0.437579	-0.194339	0.8482
OG2	0.060026	0.062830	0.955373	0.3528
INFLATION	1.675028	0.320675	5.223441	0.0001
AGE_DEP	-0.340049	0.422900	-0.804088	0.4324
DEBT_LAG1	0.081886	0.030161	2.714982	0.0147
ELECTIONS	1.933586	0.697436	2.772422	0.0130

R-squared	0.671088	Mean dependent var	-0.012000
Adjusted R-squared	0.535653	S.D. dependent var	2.187144
S.E. of regression	1.490386	Akaike info criterion	3.890285
Sum squared resid	37.76125	Schwarz criterion	4.280325
Log likelihood	-40.62856	Hannan-Quinn criter.	3.998465
F-statistic	4.955070	Durbin-Watson stat	2.845127
Prob(F-statistic)	0.003321		

Specification (3.b)

Dependent Variable: CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:54
Sample (adjusted): 1995 2020
Included observations: 26 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.58800	14.29913	1.299939	0.2100
OG	-4.518171	2.639820	-1.711545	0.1042
FDI*OG	0.074121	0.039074	1.896963	0.0740
OG2	0.114473	0.088325	1.296051	0.2113
INFLATION	0.481518	0.497594	0.967694	0.3460
AGE_DEP	-0.571107	0.315082	-1.812565	0.0866
DEBT_LAG1	0.093785	0.024624	3.808690	0.0013
ELECTIONS	0.279624	0.576696	0.484873	0.6336

R-squared	0.428152	Mean dependent var	-0.776923
Adjusted R-squared	0.205767	S.D. dependent var	2.386011
S.E. of regression	2.126406	Akaike info criterion	4.594404
Sum squared resid	81.38888	Schwarz criterion	4.981510
Log likelihood	-51.72725	Hannan-Quinn criter.	4.705877
F-statistic	1.925273	Durbin-Watson stat	1.178493
Prob(F-statistic)	0.124421	Wald F-statistic	5.961246
Prob(Wald F-statistic)	0.001058		

Specification (3.b)

Dependent Variable: VAR_CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:51
Sample (adjusted): 1996 2020
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.47565	19.58840	0.534788	0.5997
OG	-2.936531	3.582930	-0.819589	0.4238
FDI*OG	0.043899	0.053151	0.825933	0.4203
OG2	0.048380	0.063352	0.763669	0.4555
INFLATION	1.529417	0.359603	4.253070	0.0005
AGE_DEP	-0.435416	0.431178	-1.009828	0.3267
DEBT_LAG1	0.088368	0.030551	2.892448	0.0101
ELECTIONS	2.100111	0.702421	2.989816	0.0082

R-squared	0.683074	Mean dependent var	-0.012000
Adjusted R-squared	0.552575	S.D. dependent var	2.187144
S.E. of regression	1.462977	Akaike info criterion	3.853161
Sum squared resid	36.38510	Schwarz criterion	4.243201
Log likelihood	-40.16451	Hannan-Quinn criter.	3.961341
F-statistic	5.234332	Durbin-Watson stat	2.940432
Prob(F-statistic)	0.002515		

Specification (4.a)

Dependent Variable: CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:55
Sample: 1995 2022
Included observations: 28
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	16.44007	9.686312	1.697248	0.1052
OG	0.459825	0.276346	1.663944	0.1117
FRI*OG	-0.096642	0.095954	-1.007167	0.3259
OG2	0.112153	0.074981	1.495754	0.1503
INFLATION	0.505777	0.302032	1.674580	0.1096
AGE_DEP	-0.510029	0.238445	-2.138977	0.0450
DEBT_LAG1	0.083291	0.020929	3.979638	0.0007
ELECTIONS	0.038417	0.506932	0.075783	0.9403

R-squared	0.381069	Mean dependent var	-0.639286
Adjusted R-squared	0.164444	S.D. dependent var	2.351885
S.E. of regression	2.149829	Akaike info criterion	4.603610
Sum squared resid	92.43530	Schwarz criterion	4.984240
Log likelihood	-56.45054	Hannan-Quinn criter.	4.719972
F-statistic	1.759114	Durbin-Watson stat	1.145276
Prob(F-statistic)	0.151932	Wald F-statistic	6.719193
Prob(Wald F-statistic)	0.000360		

Specification (4.a)

Dependent Variable: VAR_CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:52
Sample (adjusted): 1996 2022
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	38.89067	17.73740	2.192580	0.0410
OG	0.116316	0.279840	0.415652	0.6823
FRI*OG	-0.022591	0.160134	-0.141075	0.8893
OG2	0.084584	0.078424	1.078552	0.2943
INFLATION	0.764094	0.279454	2.734241	0.0132
AGE_DEP	-0.981375	0.414716	-2.366375	0.0287
DEBT_LAG1	0.097431	0.036458	2.672397	0.0151
ELECTIONS	1.294382	0.880640	1.469820	0.1580

R-squared	0.375795	Mean dependent var	-0.003704
Adjusted R-squared	0.145825	S.D. dependent var	2.108131
S.E. of regression	1.948368	Akaike info criterion	4.413056
Sum squared resid	72.12662	Schwarz criterion	4.797008
Log likelihood	-51.57625	Hannan-Quinn criter.	4.527225
F-statistic	1.634105	Durbin-Watson stat	2.186537
Prob(F-statistic)	0.186033		

Specification (4.b)

Dependent Variable: CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:54
Sample: 1995 2022
Included observations: 28
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17.35980	10.41284	1.667153	0.1111
OG	-1.107045	0.689438	-1.605721	0.1240
EMU*OG	1.608018	0.733129	2.193361	0.0403
OG2	0.140023	0.082450	1.698289	0.1050
INFLATION	0.444169	0.266710	1.665362	0.1114
AGE_DEP	-0.523095	0.255229	-2.049510	0.0538
DEBT_LAG1	0.082610	0.022340	3.697768	0.0014
ELECTIONS	-0.352309	0.604539	-0.582773	0.5666

R-squared	0.425267	Mean dependent var	-0.639286
Adjusted R-squared	0.224110	S.D. dependent var	2.351885
S.E. of regression	2.071649	Akaike info criterion	4.529523
Sum squared resid	85.83460	Schwarz criterion	4.910153
Log likelihood	-55.41333	Hannan-Quinn criter.	4.645886
F-statistic	2.114105	Durbin-Watson stat	1.242710
Prob(F-statistic)	0.089571	Wald F-statistic	4.683271
Prob(Wald F-statistic)	0.003024		

Specification (4.b)

Dependent Variable: VAR_CAPB
Method: Least Squares
Date: 08/11/23 Time: 16:52
Sample (adjusted): 1996 2022
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	40.29181	17.68032	2.278907	0.0344
OG	-0.771851	1.350289	-0.571619	0.5743
EMU*OG	0.914537	1.384809	0.660407	0.5169
OG2	0.095382	0.074398	1.282052	0.2152
INFLATION	0.759167	0.275609	2.754504	0.0126
AGE_DEP	-1.009309	0.412512	-2.446741	0.0243
DEBT_LAG1	0.098161	0.035954	2.730171	0.0133
ELECTIONS	1.232425	0.857380	1.437431	0.1669

R-squared	0.389163	Mean dependent var	-0.003704
Adjusted R-squared	0.164118	S.D. dependent var	2.108131
S.E. of regression	1.927392	Akaike info criterion	4.391408
Sum squared resid	70.58199	Schwarz criterion	4.775359
Log likelihood	-51.28400	Hannan-Quinn criter.	4.505577
F-statistic	1.729266	Durbin-Watson stat	2.215758
Prob(F-statistic)	0.161750		