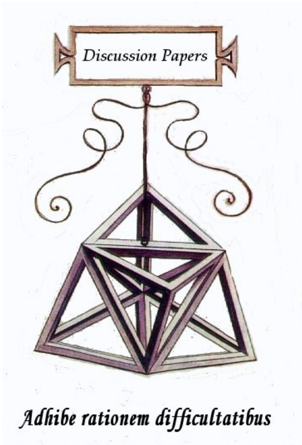
Discussion papers
E-papers of the Department of Economics e Management – University di Pisa



Giovanni Carnazza, Emilio Carnevali

Days of future past? The reform of the European fiscal framework, the (enduring) role of the structural balance and the pro-cyclical bias of potential GDP endogeneity

Discussion paper n. 306

2024

Discussion paper n. 306, presented: **April 2024**

Authors' address/Indirizzo degli autori:

Giovanni Carnazza — University of Pisa - Department of Economics and Management, Via Cosimo Ridolfi 10, 56124 Pisa - Italy. E-mail: giovanni.carnazza@unipi.it

Emilio Carnevali — Northumbria University - Accounting and Financial Management - Falconer Street, Newcastle upon Tyne NE1 2SW - United Kingdom. E-mail: emilio.carnevali@northumbria.ac.uk

Please cite as:/Si prega di citare come:

Giovanni Carnazza, Emilio Carnevali (2024), "Days of future past? The reform of the European fiscal framework, the (enduring) role of the structural balance and the pro-cyclical bias of potential GDP endogeneity", Discussion Papers, Department of Economics and Management – University of Pisa, n. 306 (http://www.ec.unipi.it/ricerca/discussion-papers).

Discussion Papers Series contact: pietro.battiston@unipi.it

Discussion paper

n. 306

Giovanni Carnazza, Emilio Carnevali

Days of future past? The reform of the European fiscal framework, the (enduring) role of the structural balance and the pro-cyclical bias of potential GDP endogeneity

Abstract

The European fiscal framework has recently been reformed, yet the concept of structural balance still plays a crucial role within it. This paper proposes a multidimensional approach to scrutinize the pro-cyclical tendencies embedded in European economic policies arising from the European Commission's calculation methodology of potential output and structural balance. Initially, a theoretical model shows the vicious cycle dynamic that characterises the fiscal adjustment process during a recession when potential output is dependent on actual output. Subsequently, numerical simulations juxtapose this dynamic with a counterfactual scenario where potential output is only influenced by long-term supply factors. Finally, employing dynamic panel data analysis covering 26 EU countries from 1995 to 2023, on an annual basis, empirical evidence is presented to show the pro-cyclical nature of fiscal policies adopted by European governments. Importantly, these estimates facilitate the isolation of the proportion of the pro-cyclical effect attributed solely to the bias stemming from the endogeneity of potential GDP.

Keywords: European fiscal framework; fiscal (pro-)cyclicality; (endogenous) output gap; structural balance; pro-cyclical bias

JEL CLassification: C51; E32; E62; H62

Days of future past?
The reform of the European fiscal framework, the (enduring) role of the structural balance and the pro-cyclical bias of potential GDP endogeneity

Giovanni Carnazza (*corresponding author*) [(*)]

Emilio Carnevali [(**)]

Abstract

The European fiscal framework has recently been reformed, yet the concept of structural balance still plays a crucial role within it. This paper proposes a multidimensional approach to scrutinize the pro-cyclical tendencies embedded in European economic policies arising from the European Commission's calculation methodology of potential output and structural balance. Initially, a theoretical model shows the vicious cycle dynamic that characterises the fiscal adjustment process during a recession when potential output is dependent on actual output. Subsequently, numerical simulations juxtapose this dynamic with a counterfactual scenario where potential output is only influenced by long-term supply factors. Finally, employing dynamic panel data analysis covering 26 EU countries from 1995 to 2023, on an annual basis, empirical evidence is presented to show the pro-cyclical nature of fiscal policies adopted by European governments. Importantly, these estimates facilitate the isolation of the proportion of the pro-cyclical effect attributed solely to the bias stemming from the endogeneity of potential GDP.

Keywords: European fiscal framework; fiscal (pro-)cyclicality; (endogenous) output gap; structural balance; pro-cyclical bias.

JEL Classification: C51; E32; E62; H62

Conflict of interest: The authors declare no ethical issues or conflicts of interest in this research.

[(*)] University of Pisa, Department of Economics and Management
E-mail: giovanni.carnazza@unipi.it
ORCID iD: 0000-0002-7719-358X
[(**)] Northumbria University, Department of Accounting and Financial Management
E-mail: emilio.carnevali@northumbria.ac.uk
ORCID iD: 0000-0002-6551-9183

1. Introduction

The “*whatever it takes*” statement by the then president of the European Central Bank Mario Draghi (2012) has become one of the most famous in the recent history of central banking. At the time, the eurozone was facing an existential crisis. Many have credited this sentence with saving the single currency from implosion. By contrast, Draghi’s appraisal of the European fiscal framework, as outlined in an article published in *The Economist* in September 2023 (Draghi 2023), has garnered considerably less attention. In the article, Draghi argues that European fiscal rules do not allow to ensure the credibility of public finances in the medium-term or to react to unexpected shocks, leading to pro-cyclical fiscal outcomes. If left unaddressed, the issue of fiscal pro-cyclicality could present another existential threat to the eurozone in the future, given the *de facto* loss of national discretionary fiscal policies in mitigating business cycle fluctuations after the loss of the monetary and the exchange rate policies.

Our primary research question concerns precisely the phenomenon of fiscal pro-cyclicality and, in particular, its determinants. In our view, the methodology for calculating potential GDP, which is empirically significantly influenced by actual GDP realisations, is one of the most important reasons behind this pro-cyclical behaviour, alongside the overall European fiscal framework. Although the issue of fiscal pro-cyclicality in Europe has been studied extensively (see, among others, Larch et al., 2021; Aldama and Creel, 2022; Gootjes and de Haan, 2022; Carnazza et al., 2023), our paper presents a robust theoretical explanation of this endogenous pro-cyclical distortion in Section 3. Additionally, we provide a quantitative estimation of the size of the distortion in Section 4. To the best of our knowledge, this is the first attempt to provide a formal theoretical explanation and a quantitative estimate of this specific bias in the literature.

The notion that the European fiscal rules promote pro-cyclical fiscal policies may seem counterintuitive. In theory, if countries comply with the structural budget balance target, their discretionary fiscal policy should be completely a-cyclical, while automatic stabilisers would operate in full to offset fluctuations in the business cycle (Eyraud and Wu, 2015; Eyraud et al., 2017).

However, this theoretical fiscal room for manoeuvre is practically limited by at least two factors: on the one hand, the need to comply with other fiscal constraints, such as reducing the debt-to-GDP ratio; on the other hand, the significant dependence of potential GDP on the business cycle.

In Section 3.1, we provide a graphical illustration demonstrating how the methodology employed by the European Commission to calculate potential GDP significantly curtails the effectiveness of automatic stabilisers. In Section 3.2, we use a macroeconomic dynamic model and numerical simulations to test our theoretical argument. We contrast the model's response to an exogenous shock under two different conditions: one where potential output is influenced by actual output – in line with the current European methodology – and another with potential output is exogenous. As expected, our findings reveal that the crisis is more severe and the recovery slower when potential output is endogenous.

Finally, Section 4 introduces two dynamic panel data models considering the 26 countries of the European Union (EU) from 1995 to 2023 on an annual basis.[1] The first model assesses fiscal pro-cyclicality through real-time data. Therefore, it automatically incorporates the distortion due to the endogeneity of potential GDP. The second model neutralises this bias by robustly estimating a potential GDP fully exogenous to the business cycle. We test the exogeneity of potential GDP against 29 past realisations of the *NAWRU* to make sure that the results of second model do not depend in any way on the initial value of the *NAWRU*, but only on the assumption that it is constant. The comparison of the fiscal cyclicality coefficients of the two models makes it possible to quantify the pro-cyclical effect specifically attributable the potential GDP calculation methodology.

The sections described above, namely Sections 3 and 4, are preceded by a contextualization of our research questions: in Section 2, we offer a comprehensive overview of the European fiscal framework, tracing its evolution from the original rules established in the Maastricht Treaty to the contemporary challenges faced. Section 2.1 explores the historical development of fiscal regulations,

[1] We exclude Luxembourg due to data problems that do not allow the calculation of potential GDP on the basis of the production function.

highlighting interesting shifts in policy approaches; Section 2.2 focuses on the critical role of the structural balance concept, officially introduced in 2005; finally, in Section 2.3, we critically evaluate recent reform efforts concerning the Stability and Growth Pact (SGP), examining why the new rules have not adequately addressed the systemic problems inherent in the previous framework. In doing so, we draw an important parallel between the old concept of structural balance and the new concept of net expenditure, underscoring their strong similarities.

2. The European fiscal framework and its recent reform: Days of future past?

2.1 The historical origins of the European fiscal framework

The idea of sound finance (or fiscal rectitude) has been at the core of the European Monetary Union (EMU) project since the very beginning. The Maastricht Treaty, signed in 1992, set the path toward the single currency through a series of criteria that the EMU member states had to satisfy to join the club. Among them were the famous thresholds of 3% of GDP for the government budget deficit and 60% of GDP for the government debt. The 60% figure was, at the time, the average debt-to-GDP ratio of European countries.

The exact origin of the deficit figure (3%) is still debated. Some versions of the story credit the idea that it was a purely arbitrary number. Guy Abeille, an official of the French Treasury during François Mitterand's Presidency, stated that the number was chosen because it was simple, elegant, and "*made us think of the holy trinity*" (Abeille, 2012). Subsequently, the figure would move from the French budget documents to the European treaties. Others identified more rigorous origins. De Grauwe (2020) posits that the 3% parameter most likely derived from the well-known formula for the stabilisation of public debt. Given the average debt-to-GDP ratio of European countries at 60%, and assuming a nominal annual GDP growth of 5%, the formula works as follows:

$$g \cdot b = d \rightarrow 0.60 \cdot 0.05 = 0.03 \tag{1}$$

where g is the nominal GDP rate of growth, b is the debt-to-GDP ratio, and d is the stabilising deficit-to-GDP ratio. Buiter et al. (1993) use the same formula, with an identical assumption on nominal annual growth, but seem to suggest an inverted direction of causality. First comes the 3% threshold, which corresponds to the average public investment of EC countries as a share of GDP in the period 1974-91. The 3% limit would be met if current expenditure is covered by current revenues and public investment is funded through borrowing (this was apparently advocated as an implicit "golden rule" by the German negotiators, according to Buiter et al., 1993). Then comes the debt-to-GDP ratio that is compatible with a stable state solution given the chosen deficit-to-GDP threshold.

Even before the introduction of the euro (1999), pressures mounted to make the fiscal rules more rigid, as the two aforementioned parameters did not seem strict enough. The German government, in particular, pushed for a more hawkish approach to public finance to be embedded in the European fiscal framework (Estella, 2023). This resulted in the SGP, signed in Amsterdam in 1997, which introduced "*the medium-term budgetary objective of positions close to balance or in surplus*" (European Council, 1997, p.2). The meaning of the vague expression "*medium-term*" was clarified in the Council Regulation 1466/971: the medium-term had to be considered equal to "*three years*".

In 2005, the SGP underwent reform. It could be argued that the reform process was a response to challenges faced by the French and German economies in adhering to the old rules, rather than a comprehensive reassessment of the implications of the old framework in light of sound empirical evidence and rigorous theoretical arguments. Nevertheless, the outcome was the introduction of greater flexibility into the European fiscal rules. In particular, (i) differentiated Medium-Term budgetary Objectives (MTO) for each member state were introduced; (ii) these objectives "*shall be specified within a defined range between –1% of GDP and balance or surplus*[2]*, in cyclically-adjusted terms, net of one-off and temporary measures*" (European Council, 2005); (iii) each member state

[2] Within this range, the MTO was clearly more restrictive for countries whose public debt ratio was significantly above 60% of GDP (for example, before the suspension of the European fiscal framework due to the outbreak of the pandemic in 2020, the Italian MTO had been set at +0.5% of GDP, being also subject to the debt reduction benchmark).

should achieve its MTO through an "*annual improvement of its cyclically-adjusted balance, net of one-off and other temporary measures (...) with 0.5% of GDP as a benchmark*" (European Council, 2005).

For the first time, European legislation officially incorporated an explicit reference to a cyclically-adjusted measure of the budget balance, although since 2002 the European Commission had proposed an interpretation of the medium-run "*close to balance or in surplus*" objective as "*defined in underlying terms throughout the economic cycle, i.e., net of transitory effects and especially the effects of cyclical fluctuations on budgets*" (Commission of the European Communities, 2002).

The Great Financial Crisis of 2007–2008, followed by the European Sovereign Debt Crisis, prompted another revaluation of European fiscal rules, resulting in a shift in the opposite direction compared to the earlier round of reform – this time towards more rigidity. The Treaty on Stability, Coordination and Governance in the Economic and Monetary Union, also known as Fiscal Compact[3], reiterated the original commitment featured in the SGP of a budgetary position "*balanced or in surplus*". The target could be deemed respected if the cyclically adjusted deficit did not exceed -0.5% of GDP (-1% for countries with a debt-to-GDP ratio significantly below 60%). The Treaty also stated that these budgetary rules "*shall take effect in the national law of the Contracting Parties at the latest one year after the entry into force of this Treaty through provisions of binding force and permanent character, preferably constitutional*" (Treaty on Stability, Coordination and Governance in the Economic and Monetary Union, 2012). The last point is particularly important if we consider that the recent reform of the SGP (that will be analysed below – Paragraph 2.3) has moved the lower limit of the cyclically-adjusted deficit. The new – slightly more generous – threshold is theoretically irrelevant if a country had already introduced a stricter balanced budget rule in its primary legislation or Constitution.

[3] Strictly speaking, the Fiscal Compact constitutes only Title III of the Treaty. However, over the following years, the entire Treaty has come to be colloquially known as the Fiscal Compact. For the sake of convenience, we will adopt this denomination.

With the outbreak of the Covid-19 pandemic, the application of the European fiscal framework was suspended. The general escape clause was invoked by European finance ministers on 23 March 2020 (European Council, 2020). Although the rules were initially expected to be reinstated in 2023, the Russian invasion of Ukraine prompted European leaders to postpone the renewed enforcement to 2024.

2.2 The role of the structural balance

The notion of cyclically-adjusted balance net of one-off and other temporary measures in the European legislation corresponds to the definition of structural balance. The latter can be derived by splitting the nominal budget balance (BB) into three different components: first, the cyclical component of the budget balance (CC), that represents the automatic stabilisers' functioning; secondly, the structural balance (SB), which is considered the proper medium-term discretionary fiscal orientation; finally, the one-off and other temporary measures ($Temp$), which are considered exceptional measures in the face of exceptional events and therefore of little relevance to the fiscal sustainability of a country. Formally,

$$BB = CC + SB + Temp \tag{2}$$

$$SB = BB - CC - Temp = CAB - Temp \tag{3}$$

For the sake of simplicity, since the one-off and other temporary measures tend to be very modest, we can realistically assume in advance that the $Temp$ component is equal to 0, implying the equality between CAB and SB:

$$SB = CAB = BB - CC \tag{4}$$

The estimation of the CC component is based on two elements: on the one hand, the cyclical adjustment parameter (ε) in the (new) form of a semi-elasticity, which measures the reaction of the budget balance to the business cycle (Mourre et al., 2019); on the other hand, the output gap (OG), which is equal to the distance between actual GDP (Y) and potential GDP (Y^*) expressed in terms of potential GDP. Formally,

$$CC = \varepsilon \cdot OG = \varepsilon \cdot \frac{Y - Y^*}{Y} \tag{5}$$

where OG captures the alternating phases of the business cycle: positive and negative values correspond to the expansionary and recessionary phases respectively.

When the structural balance is required to be equal to zero, equation (3) implies that the nominal budget balance (BB) should coincide with the cyclical balance (CC). Formally,

$$SB = 0 \ \rightarrow BB = CC \tag{6}$$

The application of this approach seeks to concurrently pursue two objectives that are traditionally perceived as mutually exclusive: on the one hand, fiscal responsibility, setting a formal limit to guarantee the sustainability of public finances; on the other hand, the utilisation of fiscal policy to mitigate cyclical fluctuations, enabling the activation of the automatic stabilisers without affecting at the same time the structural balanced budget. From this perspective, the European structural balance approach appears to echo the spirit of the original proposal by the Swedish economist Gunnar Myrdal. Writing at the end of the 1930s, Myrdal observed that the positive effects of deficit spending during a recession could be curtailed, or even reversed, by the adverse reaction of business confidence due to the deterioration of public finance (Myrdal, 1939). A rule that allowed – and compelled – the government to balance the budget over the entire economic cycle, rather than every single year, would have helped deploy countercyclical fiscal policies in times of crisis, while simultaneously reassuring advocates of sound finance regarding the medium-term sustainability of the government's economic policy.

A complete history of the concept of structural balance and its applications in economic theory and fiscal policy falls beyond the remit of the present study (see, for example, Constantini, 2015).

What we would like to emphasise here is that the relative success of the measure throughout the years lay in its promise to permit a certain degree of Keynesian fiscal intervention, all while incorporating public finance accounting into a broader medium-term framework. The use of the concept of "*full employment balance*" by Kennedy's Council of Economic Advisers at the beginning of the 1960s, for instance, provided theoretical coverage for quite an aggressive fiscal stance. However, the European Union' legislation has applied the concept of structural balance in a peculiar manner. Firstly, countercyclical fiscal policy is expected to primarily rely on the action of automatic stabilisers, as discretionary fiscal policy is virtually precluded. Secondly, the calculation of potential output is not linked to any socially optimal goal or exogenous measure of high or full employment, but rather to a far more complex notion of NAWRU (i.e. the non-accelerating wage rate of unemployment) (see Section 3.1). The combination of the first element with the theoretical and empirical challenges posed by the second has resulted in a fiscal framework that has often operated, as we will demonstrate below, in a pro-cyclical direction.

2.3 The recent reform

After a long period of negotiation, in December 2023 European leaders agreed for a reform of the SGP in order to simplify the EU governance framework by using a single operational indicator, the so-called net expenditure (European Commission, 2023). The new framework is far from simple, but its extensive description is outside our scope. Here, it is sufficient to point out the profound similarity between the previous concept of structural balance (once it is calculated net of interest expenditure) and this new indicator. Omitting some irrelevant items, the net expenditure measure (G_{net}) is defined as "*government expenditure net of interest expenditure* ($G_{primary}$)*, discretionary revenue measures* ($T_{structural} = T - T_{cyclical}$)*, cyclical elements of unemployment benefit expenditure*, *and one-offs and other temporary measures* ($Temp$)" (European Council, 2023). Assuming that the cyclical component of expenditure is fully absorbed by the unemployment benefits ($G_{cyclical}$) and continuing to ignore the $Temp$ component,

$$G_{net} = G_{primary} - T_{structural} - G_{cyclical} \tag{7}$$

$$G_{net} = G_{primary} - \left(T - T_{cyclical}\right) - G_{cyclical} \tag{8}$$

$$G_{net} = \left(G_{primary} - G_{cyclical}\right) - \left(T - T_{cyclical}\right) \tag{9}$$

The structural primary balance (SPB), or cyclically-adjusted primary balance ($CAPB$), can be obtained from Equation 3 once the interest expenditure (Int) is taken into account:

$$SPB = CAPB = BB - Int - CC = \; PB - CC \tag{10}$$

where PB is the primary balance. Equation 10 can then be developed as follows:

$$SPB = CAPB = PB - CC = T - G_{primary} - \left(T_{cyclical} - G_{cyclical}\right) \tag{11}$$

$$-SPB = -CAPB = \left(G_{primary} - G_{cyclical}\right) - \left(T - T_{cyclical}\right) \tag{12}$$

We can then conclude that G_{net} is nothing but the structural balance net of interest expenditure:

$$G_{net} = -CAPB = -SPB \tag{13}$$

At first glance, the fact that G_{net} excludes interest expenditure – as opposed to the structural balance – might seem to be an advantage for countries with high interest expenditure, such as Italy. Actually, the formal exclusion or inclusion of interest expenditure becomes irrelevant, given the underlying objective of the new indicator, namely the progressive reduction of the debt-to-GDP ratio[4]: since interest expenditure, by definition, fuels the growth of the debt-to-GDP ratio, the new indicator must necessarily take it into account.

[4] According to the new "*debt sustainability safeguard*", the debt-to-GDP ratio must decrease by a minimum annual average amount of 1% (for countries whose debt-to-GDP ratio exceeds 90%) or 0.5% (for countries whose debt-to-GDP ratio remains between 60% and 90%).

The importance of interest expenditure in fuelling public debt can be fully appreciated with the case of Italy. Taking 1995 as the reference year, we estimate the debt evolution ($debt$) by removing each year the increase resulting from interest expenditure:

$$netdebt_t = debt_{t-1} + SFadj_t - BB_t - interest_t \tag{14}$$

where $netdebt$ is the debt net of interest, $SFadj$ the stock-flow adjustment (explaining the difference between the change in government debt and the government deficit/surplus for a given period)[5], BB the budget balance ($BB > 0$ defines surpluses, while $BB < 0$ defines deficits), and $interest$ the interest expenditure.[6] Without the influence of interest expenditure, thanks to the high primary surpluses, the Italian public debt would have fallen sharply, decreasing by approximately 500 billion euros (Figure 1).

Back to the concept of net expenditure, the new reform would depart from the past if and only if it excluded interest expenditure not only from the new indicator, but also from the calculation of the debt-to-GDP ratio. On the contrary, its inclusion in the dynamics of this ratio makes the way we treat interest expenditure in G_{net} irrelevant.

[Figure 1]

Setting aside the analogy between the old indicator (i.e. the structural balance) and the new indicator (i.e. net expenditure), the long and sometimes tense negotiation among member states led to the inclusion – -upon request of the German government – of additional sound finance safeguards in the reformed SGP. As a result, the old benchmark remains among the objectives to be achieved. The "*deficit resilience safeguard*" prescribes a "*common resilience margin in structural terms of 1.5% of GDP*" (Council of the European Union, 2023a).

---

[5] Conceptually, the $SFadj$ can be broken down into the following categories: net acquisition of financial assets, debt adjustment effects and statistical discrepancies.

[6] All the variables are expressed in current values.

3. Modelling the short-run vicious cycle: The (endogenous) fiscal policy reaction

3.1 A theoretical proposal

As we have explained in Section 2.2, the use of the structural balance measure aims to guarantee a certain degree of counter-cyclical fiscal policy while also maintaining the public budget within a medium-term equilibrium safeguard. The problem with this apparently win-win situation lies in the methodology used to calculate the cyclical component (CC). By definition, this calculation implies the measurement of the cyclical fluctuations of the GDP (OG), which in turn requires the estimation of potential GDP (Y^*). The latter can be defined as the level of production/income an economic system would achieve on the basis of available production factors without creating inflationary pressure. The European Commission estimates Y^* through a Cobb-Douglas production function with constant returns to scale (Equation 15), which is a combination of potential labour (L^*), stock of capital (K), and potential total factor productivity (TFP^*), which captures the technological level of a production system.[7] Formally,

$$Y_t^* = L_t^{*\alpha} \cdot K_t^{1-\alpha} \cdot TFP_t^* \tag{15}$$

where α and $(1-\alpha)$ are the output elasticities of labour and capital. Under the hypotheses of constant returns to scale and perfect competition, the latter can be estimated from the observed wage and profit shares. Conventional mean values of 0.65 and 0.35 respectively are imposed on the estimation procedures for all countries. Potential labour is defined as follows:

$$L_t^* = Parts_t \cdot Popw_t \cdot (1 - NAWRU_t) \cdot h_t \tag{16}$$

where $Parts$ represents the structural component of the labour force participation rate (smoothed participation rate), $Popw$ is the working-age population in age 15-74 (population of working age), h is the structural component of the per-employee hours worked (trend, average hours worked), and

[7] For a detailed presentation of the model, see Havik et al. (2014).

$NAWRU$ is the non-accelerating wage rate of unemployment (structural unemployment), i.e. the unemployment rate compatible with stable wage inflation.

The $NAWRU$ is an unobservable variable, which is virtually derived from a simple interpolation of the actual observations of the unemployment rate, as pointed out by several authors and recognised by the European Commission itself (Fantacone et al., 2015; Orlandi et al., 2018; Carnazza et al., 2021). The $NAWRU$, and consequently the potential output and the output gap, is therefore extremely dependent on the business cycle. This has significant implications for the effectiveness of fiscal policy during a downturn, especially when considering that the European fiscal rules discourage the application of discretionary fiscal measures.

When a country enters a recession, the subsequent increase in the unemployment rate tends to increase the $NAWRU$. This results in a reduction of the potential labour contribution to potential GDP, and consequently in a narrowing of the output gap, which quantifies the deviation allowed in the structural balance. To comply with the balanced budget principle underlying the structural balance approach[8], the country in question must therefore implement a restrictive discretionary fiscal policy. At the beginning of a recessionary phase of the economic cycle, the country can consequently be forced to reduce spending and/or increase revenues. The vicious circle is then set in motion: the restrictive fiscal policy increases the decline in GDP, leading, through the $NAWRU$ mechanism, to a further narrowing of the output gap and forcing an even more recessive manoeuvre.

Formally, this reasoning can be graphically translated into Figure 2. Point A represents the starting point of country i, where actual and potential GDP coincide ($Y_{t_0} = Y_1^*$). For the sake of simplicity, we assume that in t_0 the structural balance is equal to 0 ($SB = CAB = 0$), implying the equivalence between the nominal budget balance and its cyclical component ($BB = CC$) (see Equation 4). In the subsequent period (t_1), we suppose the economy goes into recession: in point B, actual GDP is well

[8] We maintain the 0% target of the MTO since this objective has guided fiscal policy until 2019. However, the logic of the argument remains unchanged if another target is chosen, such as the current -1.5% benchmark introduced by the reform of the SGP (see Section 2.3). The target chosen should represent both the initial equilibrium of the economy and the point to which the policy maker aims to return after the occurrence of a negative shock.

below potential GDP (Y_1^*) and the related output gap would be negative (e.g. -5%). If we assume for simplicity that the semi-elasticity parameter of the budget balance is equal to 1 ($\varepsilon = 1$), then the cyclical component of the budget balance (CC) would coincide exactly with the output gap (OG) (i.e., $OG_1 = CC_1 = BB$). Consequently, no corrective fiscal policy would be implemented to maintain the structural balance at 0 (by definition, $SB = 0$). Automatic stabilisers would then seem free to act. However, when the economy enters a recession, potential GDP decreases from Y_1^* to Y_2^* due to the endogenous relationship between $NAWRU$ and the actual unemployment rate. The recorded output gap may not be 5%, as initially assumed, but, for instance, 3%. The 5% budget deficit is not then entirely offset by automatic stabilisers. In other words, being $OG_2 = CC_2 = -3\%$, and assuming the semi-elasticity parameter – as is traditionally done – as constant, fiscal policy must adopt a restrictive stance through corrective measures equivalent to 2% of GDP. Only in this way, country i can comply with the MTO.

A recession triggered by exogenous factors now becomes fuelled by the same restrictive fiscal policies required to achieve the zero-structural budget balance. The new restrictive policy implemented during a recessionary phase (pro-cyclical fiscal behaviour) exacerbates the recession by shifting the economy from point B to point C. In this situation, we can again assume that the initial budget deficit is fully absorbed by the operation of automatic stabilisers (i.e., $OG_3 = CC_3 = BB$). However, the worsening of the recessionary phase pushes potential GDP downwards ($Y_2^* \rightarrow Y_3^*$), resulting in a lower observed output gap ($OG_3 \rightarrow OG_4$). This implies that, in order to adhere to the structural budget balance rule, the government needs to implement new restrictive measures, reinstating the previous dynamics. Figure 3 summarises all of this through a conceptual diagram.

[Figure 2]

[Figure 3]

3.2 A model-simulation approach

The dynamics of the vicious cycle described in Section 3.1 can be further clarified through numerical simulations. The model we use is a development of the so-called SIM model presented in Godley and Lavoie (2012), which is particularly convenient for the experiment we would like to carry out (see full list of variables, parameters and equations in the Appendix).[9] Within a discrete time framework, it assumes that output in time t (Y_t) is demand-driven in the short-run. In the long-run, actual output is anchored to a steady-state potential level (Y^*_{long}) equal to 100 units. Consequently, this value represents both the starting point figure for actual and potential output and their final value when all the cyclical fluctuations have been reabsorbed by the system. The steady-state framework[10] that characterises the original SIM model makes more transparent the short-run dynamics we would like to investigate.

In the SIM model the demand for consumption goods by the household sector (C_{d_t}) is given by the following equation:

$$C_{d_t} = \alpha_1 Y_{d_t} + \alpha_2 H_{h_{t-1}} \tag{17}$$

where α_1 represents the propensity to consume out of income, α_2 denotes the propensity to consume out of the previous period's wealth – which is given by $H_{h_{t-1}}$, or the stock of money, in the "simplified world" of the model – and Y_{d_t} stands for disposable income. The inclusion of $H_{h_{t-1}}$ in the consumption function facilitates the convergence of consumption and, consequently, total demand toward a steady-state value. This occurs once the level of saving diminishes to zero, leading to the cessation of accumulation in household wealth.

Actual output (Y_t) is simply given by the sum of the supply of consumption goods (C_{s_t}), that is equal to the demand expressed by Equation 16, and the supply of goods purchased by the government

[9] The EViews code of the model is available upon request.

[10] Implicitly, we are assuming a rate of growth of potential output equal to 0.

(G_{s_t}). Being the model purely demand-driven in the short-run, G_{s_t} is equal to G_{d_t}. The latter represents the exogenous government demand for goods, which we treat as fixed throughout our simulations. There is no fixed capital investments or foreign sector in the economy. The system is a pure labour economy where production is carried out by labour alone. All revenues from sales accrue to workers in the form of salaries. Hence, disposable income is equal to:

$$Y_{d_t} = N_{d_t}W - Tax_t \tag{18}$$

where N_{d_t} represents the demand for labour (even in the labour market, the supply simply follows the demand), W stands for the wage rate[11], and Tax_t denotes net taxes (taxes paid minus government transfers received by consumers). Net taxes are simply a proportion of total income:

$$Tax_t = \theta_t(N_{d_t}W) \tag{19}$$

When actual output (Y_t) equals potential output (Y_t^*), no government transfers (e.g. unemployment benefits) are assumed to take place. However, if $Y_t < Y_t^*$ the level of government transfers increases. In other words, the variable θ_t, which captures the average net tax rate, is a function of the output gap:

$$\theta_t = t_{base} + pos_{OG_t} \cdot sen_{OG} \cdot OG_t \tag{20}$$

where t_{base} is the standard tax rate[12], OG_t is the output gap, and pos_{OGt} is a parameter that takes the value of 1 if the output gap is negative and 0 otherwise (it ensures that no extra-contractionary fiscal policy is carried out if output is above potential). sen_{OG} represents the sensitivity of the automatic

[11] For the sake of simplicity, we treat the wage rate as constant in the model; hence, the absence of the time subscript in the variable representing it.
[12] The simulations below assume a standard tax rate of 20%.

stabilisers to the output gap. Obviously, it is an institutional variable that depends on the robustness and generosity of the welfare system in a particular country.[13]

Potential output (Y_t^*) can be modelled in two ways. A first version of the model (Model 1) assumes potential output as constant and equal to its long-term value:

$$Y_t^* = Y_{long}^* \tag{21}$$

A second version of the model (Model 2) assumes that potential output can be affected by the actual unemployment rate (or, equivalently, by the actual employment rate[14]), in accordance with the dynamics incorporated in the European fiscal framework (where actual unemployment affects the NAWRU and this, in turn, affects potential output). More precisely, in the second version of the model, potential output is given by the following equation:

$$Y_t^* = \lambda_1 Y_{long}^* + \lambda_2 \, lab_{max}(1 - unp) + \lambda_3 Y_{t-1}^* \tag{21 bis}$$

where lab_{max} is the labour force[15], unp_t is the unemployment rate (hence $1 - unp_t$ is the employment rate), and Y_{t-1}^* is the potential output of the previous period. λ_1, λ_2 and λ_3 are the parameters-weights that capture the sensitivity of current potential output to each variable (we assume $\lambda_1 + \lambda_2 + \lambda_3 = 1$). Intuitively, the higher is λ_1, the smaller is the reduction of potential output during a recession, the higher is the λ_2, the higher is the impact of current unemployment on current potential output, the higher is λ_3 the slower will be the impact of the business cycle on the current value of potential output.[16]

---

[13] For convenience, we set this parameter to 0.5 in our simulations.

[14] The model makes no distinction between the labour force and the working age population.

[15] We assume the labour force as fixed. In this case, it can be defined as the availability of working age people in a particular economy.

[16] The specific values applied to these parameters are provided in the appendix (together with the values of the other parameters of the model). However, sensitivity checks have been carried out. The results of the simulations are quite robust to different values of the parameters within a reasonable range.

Figure 4 shows what happens to actual and potential output when the latter is assumed to remain constant during a downturn (Model 1 in Figure 4a, $Y_t^* = Y_{long}^*$). In the year 2011 (symbolically representing the beginning of the European sovereign debt crisis), a recession is triggered by a shock in consumer confidence captured by a step change in α_1 (from 0.6 to 0.5).

With constant potential output and net taxes proportional to the output gap, the downturn is less severe, and the recovery is faster than in a situation where there are no automatic stabilisers. This case is depicted in Figure 4b. Formally, the absence of automatic stabilisers can be easily modelled by transforming Equation 18 as follows:

$$\theta_t = t_{base} \qquad \text{(20 bis)}$$

As evident from the comparison of the previous two scenarios, the operation of automatic stabilisers makes the recession both less severe and more short-lived.

However, the counter-cyclical effects of the automatic stabilisers are reduced if potential output is endogenised and becomes sensitive to changes in actual output. Figure 4c illustrates that potential output decreases along with actual output (Model 2). Although θ is back as an endogenous variable in the third scenario of our simulations (it follows Equation 18 in its original form), the variable on which it depends (output gap) is smaller (in absolute terms) than in the first scenario due to the drop in potential output. Consequently, net taxes are higher in this scenario, as government transfers are smaller. Using the terminology of the European fiscal framework, the room for manoeuvre of the automatic stabilisers is limited by a smaller cyclical component of government balance's deficit.

The result is clear: the recession is deeper and more long-lived than in scenario 1. Scenario 3 approximates the dynamics of Southern European countries during the years of the sovereign debt crisis. Scenario 1 approximates a counterfactual case, i.e., what would have happened if the pro-cyclicality element had been eliminated.

[Figure 4]

4. Econometric analysis

4.1 Exogenous potential GDP vs endogenous potential GDP

When studying the relationship between the budget balance and the business cycle from an empirical perspective, we must address the potential problem of reverse causality: while fiscal policy may be influenced by the business cycle, the business cycle may also be affected by fiscal policy.[17] Theoretically, it should be noted that the prevailing literature interprets the business cycle and potential GDP as two clearly distinct phenomena, driven by differentiated factors: the former by demand factors (such as fiscal policy) and the latter by supply factors (Palumbo, 2015). However, the previous sections have shown how the reality may be characterised by a dangerous vicious cycle due to the endogenous nature of potential GDP in relation to actual GDP realisations. Demand factors do not only influence the business cycle but also potential GDP. The reciprocity between the budget balance and the business cycle can then be summarised in two transmission channels. Fiscal policy can influence the business cycle directly by (i) affecting the cyclical component of GDP and indirectly by (ii) influencing potential GDP.

While the first transmission channel is grounded in established economic theory and is commonly recognized in the literature of the field, the second channel is rarely discussed or even acknowledged. However, it is the second channel that presents the most difficult challenges from an econometric perspective. As we have seen, the production function approach at the centre of the European Commission's methodology makes potential GDP dependent on the potential contribution of labour (L^* in Eq. 15), which, in turn, is influenced by the *NAWRU* (Eq. 16); since this unobservable variable is affected by the actual realisations of the unemployment rate, it is not possible to directly eliminate the second transmission channel of reverse causality.

We address this problem by introducing a method to estimate an exogenous measure of potential GDP. In this way, the value of the output gap can be calculated to estimate a business cycle in which

[17] For a formal discussion of the problem of reverse causality and its consequences, see Rigobón (2004) and Jaimovich and Panizza (2007).

fiscal policy affects only the evolution of the cyclical component of GDP (channel i) without any indirect effect on potential GDP (channel ii).

Relying on the data provided by the European Commission regarding the individual variables of the production function (Eq. 15 and 16) and recognising the variability of the *NAWRU* as the main link between the business cycle and potential GDP, we estimate an exogenous version of potential GDP considering constant values of the *NAWRU*. More precisely, keeping all other factors unchanged, for each country we estimate as many potential GDP as the *NAWRU* estimates from 1995 to 2023, replacing the time-varying *NAWRU* with the corresponding constant value for a certain year.[18] In other words, there will be 29 potential GDP series (one per year), each based on the corresponding constant value of the *NAWRU*. Our aim is to show how the empirical results associated with imposing a constant NAWRU do not depend on its starting value.

To assess the fiscal policy stance, the economic literature traditionally focuses on the last *ex-post* estimate of the output gap. This choice has at least two shortcomings: on the one hand, the *ex-post* output gap does not embed the progressive revisions of the *NAWRU* and thus the endogenous bias we want to estimate; on the other hand, fiscal policy decisions were taken based on the output gap officially recorded and communicated to national governments at the time, which may have diverged from the current assessment. For this reason, we take for each autumn forecast of the European Commission the contemporary value of the *NAWRU* in the corresponding year, creating a real-time variable for potential GDP and then for the output gap.[19] This real-time measure of the business cycle (i.e., OG_{end}) allows to match the timing of the fiscal decision with the level of the output gap observed in the past, taking into account the endogenous revision of the *NAWRU* on potential GDP.[20]

[18] All production function values, including those of the *NAWRU*, are based on the autumn 2023 forecast by the European Commission.

[19] Since autumn 2002, potential GDP and the underlying variables are estimated by the European Commission in spring and autumn. We take autumn as benchmark in order to have one additional observation. In any case, results with spring estimates are robust and are available upon request.

[20] In the Appendix, taking Italy as a benchmark, Table A1 shows how the two output gap measures have been estimated from different NAWRU values, while Figure A1 compares real-time and *ex-post* (2023) values.

4.2 Dynamic panel data analysis: Data and methodology

Our empirical analysis is based on the 26 countries belonging to the European Union observed over the period 1995-2023 on an annual basis.[21] Our econometric specification can be expressed as a dynamic panel data model, where discretionary fiscal decisions ($CAPB$) are mainly explained by the cyclical conditions (OG):

$$CAPB_{i,t} = \beta_0 + \beta_1 CAPB_{i,t-1} + \beta_2 OG_{i,t} + \boldsymbol{\alpha' control} + \boldsymbol{u_{i,t}} \tag{21}$$

where $CAPB$ represents the cyclically-adjusted primary balance (interest expenditure is normally excluded from this kind of analysis as it is not under the direct control of the policy-makers). Positive values of the budget balance indicate a surplus, and negative values a deficit. The sign of the coefficient associated with the output gap (β_2) captures the cyclical reaction of fiscal policy: if β_2 is negative, this implies a pro-cyclical reaction of fiscal policy, while a positive value indicates counter-cyclicality. We include a lag of the dependent variable ($CAPB_{i,t-1}$) as we expect persistence, possibly resulting from progressive convergence to a target budget (Galí and Perotti, 2003). Our model also includes a vector of demographic, trade, fiscal and macroeconomic control variables ($\boldsymbol{control}$), as highlighted in the literature (see, among others, Lane, 2003; Raess and Pontusson, 2015; Mauro et al., 2015; Jalles, 2018; Gootjes and de Haan, 2022; Carnazza et al., 2023): demographic control variables include age dependency ($AD_{i,t}$) and the population growth rate ($pop\_growth_{i,t}$); trade control variables include the degree of openness ($open_{i,t}$) and the terms of trade ($ToT_{i,t}$); the fiscal control variable consist of the lag of the debt-to-GDP ratio ($debtGDP_{i,t-1}$), as a high debt makes contractionary fiscal policies more likely (Eyraud et al., 2017); macroeconomic control variables include the lag of the nominal interest rate ($IR_{i,t-1}$), the unemployment rate ($UR_{i,t-1}$), and the GDP deflator growth rate ($inflationGDP_{i,t-1}$).[22] Finally, $\boldsymbol{u_{i,t}}$ includes country-fixed effects (γ_i) (to control

[21] See footnote 1.

[22] The lag operator has been applied to those control variables that may suffer from the problem of reverse causality with respect to the budget balance. In any case, results are robust to the non-application of the lag and are available upon request.

for unobserved time-invariant country characteristics), time-fixed effects (λ_t) (to deal with possible exogenous shocks common to all countries in a specific year), a dummy variable taking into account whether and when a country joined the single currency area ($\tau_{i,t}$), and the error component ($\varepsilon_{i,t}$).[23]

As anticipated in section 4.1, we will test two dynamic panel data models: the first one will be a real-time model that incorporates the effect of the endogenous bias of potential GDP on fiscal cyclicality; the second one will be an exogenous model that adjusts for this bias by imposing a potential GDP that is completely exogenous to the business cycle. The latter will be estimated a number of times corresponding to the constant $NAWRU$ values used for estimating exogenous potential GDP (i.e. 29).

Consequently, the specification of our dependent variable $CAPB_{i,t}$ will change depending on the definition of the output gap applied. Formally, considering one-off and other temporary measures ($Temp$) and the country-specific semi-elasticity estimates (ε) provided in Mourre et al. (2019), we can expand the general definition of the $CAPB$ (Eq. 22) to develop its two endogenous (real-time) (Eq. 23) and exogenous versions (Eq. 24). For each country i and for each year t,

$$CAPB_{i,t} = SPB_{i,t} + Temp_{i,t} = PB_{i,t} - CC_{i,t} + Temp_{i,t} = PB_{i,t} - \varepsilon \cdot OG_{i,t} + Temp_{i,t} \quad (22)$$

$$CAPB_{end_{i,t}} = PB_{i,t} - \varepsilon \cdot OG_{end_{i,t}} + Temp_{i,t} \quad (23)$$

$$CAPB_{ex(j)_{i,t}} = PB_{i,t} - \varepsilon \cdot OG_{ex(j)_{i,t}} + Temp_{i,t} \text{ where } j = 1995, \dots, 2023 \quad (24)$$

where the subscript 'end' stands for $endogenous$, denoting those variables characterised by potential GDP moving with the business cycle, while the subscript '$ex(j)$' stands for $exogenous$, denoting those variables characterised by potential GDP independent of actual GDP realisations (j runs from 1995 to 2023 defining the reference year of the constant value of the $NAWRU$ over time). Given the two specifications of the dependent variable, Eq. 21 can be rewritten as follows:

[23] All descriptive statistics and sources are given in Table A2 in the Appendix.

$$CAPB_{end_{i,t}} = \beta_0^{end} + \beta_1^{end} CAPB_{end_{i,t-1}} + \sum_{h=1}^{3} \beta_2^{end_h} OG_{i,t}^{end_h} + \boldsymbol{\alpha}_{\boldsymbol{end}}' \boldsymbol{control} + \boldsymbol{u}_{\boldsymbol{i,t}}^{\boldsymbol{end}} \quad (25)$$

$$CAPB_{ex(j)_{i,t}} = \beta_0^{ex(j)} + \beta_1^{ex(j)} CAPB_{ex(j)_{i,t-1}} + \sum_{h=1}^{3} \beta_2^{ex(j)_h} OG_{i,t}^{ex(j)_h} + \boldsymbol{\alpha}_{\boldsymbol{ex(j)}}' \boldsymbol{control} + \boldsymbol{u}_{\boldsymbol{i,t}}^{\boldsymbol{ex(j)}} \quad (26)$$

Since real-time estimates of the output gap by the European Commission start from 2002 and the European fiscal framework has been suspended from 2020 due to the Covid-19 health crisis (see Section 2.1), we introduce two structural time breaks applied to the output gap (i.e., 2002 and 2020). Accordingly, the output gap variable has then been split into three time series identified by the value of the superscript h: $h = 1$ refers to the period from 1995 to 2001; $h = 2$ refers to the period from 2002 to 2019; $h = 3$ refers to the period from 2020 to 2023. The objective is twofold: first, to allow a consistent comparison between the coefficients estimated in the two models ($\beta_2^{end_2}$ vs $\beta_2^{ex(j)_2}$); second, to understand whether there has been a change in fiscal (pro-)cyclicality in recent years.

From a methodological perspective, by developing two different specifications of the dependent variable $CAPB_{i,t}$ we have only dealt with one of the two aspects of the reverse causality problem, namely whether fiscal policy could affect potential GDP through its impact on the business cycle. The transmission channel between fiscal policy and the cyclical component of GDP (channel i) still needs to be properly addressed. That is why we will rely on the Arellano-Bond (AB) specification – which uses the conventionally derived variance estimator for the Generalised Method of Moments (GMM) (Arellano and Bond, 1991) – as our main estimator. In this methodological framework, in line with the prevailing literature, the potential endogeneity of the output gap is considered by using its own lags as instruments.[24]

[24] For robustness, estimates have also been performed with FE (Fixed Effects with robust standard errors) and GLS (Generalised Least Squares controlling for panel-specific AR1 autocorrelation structure and heteroskedastic and correlated error structure) estimators. Results are robust and available upon request.

4.3 Results: Finding the pro-cyclical bias

Table 1 compares the fiscal cyclicality coefficients of the endogenous and the exogenous model in the three sub-periods ($\sum_{h=1}^{3} \beta_2^{end_h}$ *vs* $\sum_{h=1}^{3} \beta_2^{ex(j)_h}$). As anticipated, the exogenous approach features 29 different coefficients, as many as the constant NAWRU values used for estimating potential GDP ($j = 1995, \dots, 2023$). In this way, we show how the sign and the size of the corresponding coefficient with exogenous potential GDP is virtually independent of the initial value of the *NAWRU*. Considering only the period 2002-2019, the real-time approach, which incorporates the pro-cyclical bias due to the endogeneity of potential GDP with respect to the business cycle, shows a strong and significant pro-cyclicality ($\beta_2^{end_2} = -0.274$). When we estimate fiscal cyclicality through a model that neutralises the endogenous bias of potential GDP, the pro-cyclicality coefficient is still significant, but its value is markedly smaller in absolute terms. In order to derive a single value for comparisons, we estimate the average of these 29 coefficients: $\sum_{j=1995}^{2023} \beta_2^{ex(j)_2}/29 = \beta_2^{ex(avg)_2} = -0.184$. The difference between these two coefficients ($\beta_2^{end_2}$ and $\beta_2^{ex(avg)_2}$) quantifies the pro-cyclical bias attributable to the European Commission's methodology for calculating potential GDP: roughly one third of the estimated total pro-cyclicality in real-time stems from the use of a potential GDP measure that is influenced by the actual fluctuations in the unemployment rate. This result highlights how discretionary fiscal policy has been distorted in a strongly pro-cyclical direction by the high variability of potential GDP: if potential GDP had been truly exogenous as assumed by the underlying economic theory, the pro-cyclical behaviour in the pursuit of a balanced structural budget would have been much less pronounced. Indeed, the fiscal effort to increase the surplus or decrease the deficit by 0.274% is reduced by about 100 basis point against a 1% recession in the exogenous output gap model.

Two additional aspects of this analysis are worth noting. The pro-cyclicality is much less pronounced in the first sub-period ($\beta_2^{ex(avg)_1} = -0.122$), when the European fiscal framework had not embraced the structural balanced budget rule yet (and thus the endogenous calculation of potential GDP. See Section 2.1); on the other hand, fiscal pro-cyclicality disappears completely from 2020 onwards, when the European fiscal rules were suspended to deal with the covid-19 health crisis. Although these results should be treated with caution, given the lack of comparison with real-time data in the first case and the limited number of observations in the second, they provide an important indication on the pro-cyclical distortion of the European fiscal framework. As already emphasized, this pro-cyclical bias is attributable to the necessity of adhering to numerous fiscal rules and the endogeneity of the potential GDP calculation methodology. Our analysis has quantified the specific contribution of the latter factor.

[Table 1]

The previous results are even more pronounced when we consider a sub-sample of those eurozone countries that have experienced the most severe economic recessions, namely the country that were once designated with the derogatory acronym PIIGS (Portugal, Italy, Ireland, Greece and Spain) (Table 2). Considering the second sub-period, the difference between the pro-cyclicality coefficient of the endogenous approach ($\beta_{2_{PIIGS}}^{end_2} = -0.489$) and the average coefficient of the exogenous approach ($\beta_{2_{PIIGS}}^{ex(avg)_2} = -0.255$) is even more significant.

It is also possible to estimate the "unnecessary restriction" that a country could have avoided if the endogenous distortion of potential GDP had been neutralized. In this regard, taking Italy as an example, Figure 5 calculates the endogenous and exogenous (pro-cyclical) fiscal reaction to a 1% recession over the period considered (the result is then multiplied by total real GDP in order to quantify the fiscal effort required in absolute terms). The pro-cyclical bias due to the endogeneity of potential GDP is about 4 billion euros for each percentage point of recession. This means that, in the most severe years of the economic crisis, when the real-time output gap exceeded -4% (i.e., 2009, 2013 and 2014), the additional fiscal effort required in each year was around 16 billion euros. This was the size of the "unnecessary" fiscal contraction due to a methodological problem.

[Table 2]

[Figure 5]

5. Conclusions and policy implications

The analysis developed in this paper illustrates, from theoretical, numerical, and empirical perspectives, why the European fiscal framework has not allowed fiscal policy to operate as intended by theory, leaving (at least) the automatic stabilisers free to operate. The pro-cyclical behaviour of fiscal policy is confirmed and, for the first time, we have estimated the pro-cyclical bias due to the European Commission's specific methodology for calculating potential GDP. More importantly, our work shows why, despite the recent reform of the SGP, the problems we have examined could reappear in the future. We consider this type of analysis particularly relevant given the fact that the reformed version of the SGP will only gradually be implemented over the coming years. The years 2025, 2026, and 2027 have been defined as a "*transitory period*" (Council of the European Union 2023b) during which the requirements linked to the deficit-based Excessive Deficit Procedure will be applied with some flexibility. Flexibility is necessary due to the need for many countries to complete their Next Generation EU recovery plans. Hence, it may prove challenging in the near future to empirically assess the long-term effects of the recent reform, especially for high-debt countries that significantly benefited from the European post-pandemic funding facilities.

If one aligns with the historical stance of the European fiscal framework – which dictates that economic shocks should primarily be managed through a combination of monetary policy and automatic stabilisers, and prescribes a very limited role of active and discretionary fiscal policy at a national level – the most direct approach to address the dysfunctions of the current framework is to reduce the endogeneity of the *NAWRU* and potential output with respect to the economic cycle. This problem has been explicitly recognised by economists within the European Commission itself in the past (see, for instance, Havik et al., 2014). We believe that greater efforts to reduce the cyclical nature of potential output could create significant fiscal manoeuvring room for national governments, which could contribute to making European economies far more resilient in the face of economic shocks (the pro-cyclical bias due to the endogeneity of potential output could even be fully overcome by introducing a stable estimate of the *NAWRU* over time regardless of the initial value considered). In this regard, our paper presents a clear quantification of the pro-cyclical distortion specifically attributable to the current methodology used to calculate potential output. We hope this can foster the debate for future improvements in the methodology.

An important objection to this approach relates to the notion of hysteresis, which could provide sound theoretical arguments justifying the actual dependency of potential output on cyclical fluctuations: negative aggregate demand shocks can affect potential output (Blanchard and Summers, 1986; Carlin and Soskice, 1990). In other words, workers who become unemployed tend to lose their skills and networks, thereby diminishing their employability in the future, resulting in a contraction of the labour force.

At least two arguments can be made in favour of the ideas underlying our analysis. First, if the hysteresis holds true, then discretionary fiscal policy should not be ruled out to minimise the contraction of production in times of crisis and therefore limit the hysteresis effect[25] or to exploit the same effect in a positive way: aggressive fiscal policies, even when the economy does not present a negative output gap, could have a positive effect on potential output (e.g. labour shortages could force firms to implement training programs and therefore attract more people into the labour force). Secondly, the economic theory underlying the concepts of the natural rate of unemployment and the *NAWRU* in no way predicts such sudden and significant fluctuations in their values. Thus, the necessity for a new methodology to mitigate such variations remains pertinent.

Surely, the recognition of an active role of fiscal policy is much less technical and more political than a mere amendment to the methodology of calculating the NAWRU and the output gap. It would come with substantial political implications and challenges. In a monetary union, counter-cyclical fiscal policy is better conducted at a federal level. That is why this more radical approach points towards the formation of a real fiscal and budgetary union. The issuance of Eurobonds and the creation of the Next Generation EU recovery plans during the Covid-19 pandemic seemed to

[25] See Ball (1997)'s comparison between the US and other OECD countries on the link between counter-cyclical policies and the stability of the *NAIRU* (i.e., the old definition of the *NAWRU* based on inflation rather than wage inflation).

represent a first, important step in the direction of European federalism. Since then, this force for change has lost momentum. However, the success of the European project may truly depend on how we, as Europeans, collectively overcome these huge challenges.

References

Abeille, G. (2012). 3% de deficit: “Le chiffre est n’e sur un coin de table”. *Le Parisien*. 28 September.

Aldama, P., & Creel, J. (2022). Real-time fiscal policy responses in the OECD from 1997 to 2018: Procyclical but sustainable? European Journal of Political Economy, 73, 102135.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The review of economic studies, 58(2), 277-297.

Ball, L. M. (1997). Disinflation and the NAIRU. In Reducing inflation: Motivation and strategy (pp. 167-194). University of Chicago Press.

Blanchard, O. J., & Summers, L. H. (1986). Hysteresis and the European unemployment problem. NBER macroeconomics annual, 1, 15-78.

Buiter, W., Corsetti, G., & Roubini, N. (1993). Excessive deficits: sense and nonsense in the Treaty of Maastricht. Economic policy, 8(16), 57-100.

Carlin, W., & Soskice, D. (1990). Macroeconomics and the wage bargain (Vol. 3). Oxford: Oxford University Press.

Carnazza, G. (2023). Ex-post and real-time estimations of the output gap: A new assessment of fiscal procyclicality in the eurozone, The Journal of Economic Asymmetries, 28, e00332.

Carnazza, G., Fontanari, C., Liberati, P., & Palumbo, A. (2021). From Potential GDP to Structural Balance: A Theoretical Reassessment and New Evidence for Italy. Review of Political Economy, 35(2), 510-540.

Carnazza, G., Liberati, P., & Sacchi, A. (2023). Does politics matter? A comparative assessment of discretionary fiscal policies in the euro area. European Journal of Political Economy, 102435.

Council of the European Union (2023a) Proposal for a Regulation of the European Parliament and of the council on the effective coordination of economic policies and multilateral budgetary surveillance and repealing Council Regulation (EC) No 1466/97. 20 December.

Council of the European Union (2023b). Proposal for a COUNCIL REGULATION amending Regulation (EC) No 1467/97 on speeding up and clarifying the implementation of the excessive deficit procedure. 20 December.

De Grauwe, P. (2020). Economics of the monetary union. Oxford University Press, USA.

Draghi, M. (2012). Speech at the Global Investment Conference. 26 July.

Draghi, M. (2023). Mario Draghi on the path to fiscal union in the euro zone. The Economist, 6 September.

Eyraud, L., & Wu, M. T. (2015). Playing by the rules: Reforming fiscal governance in Europe. International Monetary Fund.

Eyraud, L., Gaspar, V., & Poghosyan, M. T. (2017). Fiscal politics in the euro area. International Monetary Fund.

Estella, A. (2023). EU fiscal coordination: past and present. In A. Hinarejos & R. Schütze (Eds.): EU fiscal federalism past and present. Oxford University Press.

Commission of the European Communities (2002) Communication from the Commission to Council and the European Parliament: Strengthening the Coordination of Budgetary Policies. 27 November.

European Commission (2023). Proposal for a regulation of the European parliament and of the council on the effective coordination of economic policies and multilateral budgetary surveillance and repealing council regulation (EC) no 1466/97. 20 December.

European Council (1997). Resolution of the European Council on the Stability and Growth Pact. Official Journal of the European Communities, Vol. C 236, No. 1.

European Council (2005). Council Regulation (EC) No 1055/2005 of 27 June 2005 amending Regulation (EC) No 1466/97 on the strengthening of the surveillance of budgetary positions and the surveillance and coordination of economic policies. Official Journal of the European Communities, Vol. C 236, No. 1.

European Council (2020). Statement of EU ministers of finance on the Stability and Growth Pact in light of the COVID-19 crisis. 23 March.

European Council (2023). Proposal for a regulation of the European Parliament and of the Council on the effective coordination of economic policies and multilateral budgetary surveillance and repealing council regulation (EC) no 1466/97.

Fantacone, S., Garalova, P. G., & Milani, C. (2015). Structural budget balance and fiscal policy: the limits of the European approach. Yildiz Social Science Review, 1(2), 19-34.

Galí, J., & Perotti, R. (2003). Fiscal policy and monetary integration in Europe. Economic policy, 18(37), 533-572.

Godley, W., & Lavoie, M. (2012). Monetary economics: an integrated approach to credit, money, income, production and wealth. Palgrave Macmillan.

Gootjes, B., & de Haan, J. (2022). Procyclicality of fiscal policy in European Union countries. Journal of International Money and Finance, 120, 102276.

Havik, K., Mc Morrow, K., Orlandi, F., Planas, C., Raciborski, R., Röger, W., Rossi, A., Thum-Thysen, A. & Vandermeulen, V. (2014). The production function methodology for calculating potential growth rates & output gaps (No. 535). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Jalles, J. T. (2018). Fiscal rules and fiscal counter-cyclicality. Economics Letters, 170, 159-162.

Lane, P. R. (2003). The cyclical behaviour of fiscal policy: evidence from the OECD. Journal of Public economics, 87(12), 2661-2675.

Larch, M., Orseau, E., & Van Der Wielen, W. (2021). Do EU fiscal rules support or hinder counter-cyclical fiscal policy?. Journal of International Money and Finance, 112, 102328.

Mauro, P., Romeu, R., Binder, A., & Zaman, A. (2015). A modern history of fiscal prudence and profligacy. Journal of Monetary Economics, 76, 55-70.

Mourre, G., Poissonier, A., & Lausegger, M. (2019). The semi-elasticity underlying the cyclically-adjusted budget balance: An update and further analysis, European Economic Discussion Paper, 98.

Orlandi, F., Roeger, W., & Thum-Thysen, A. (2018). The return of the European wage Phillips curve. European Economy Discussion Paper, 85.

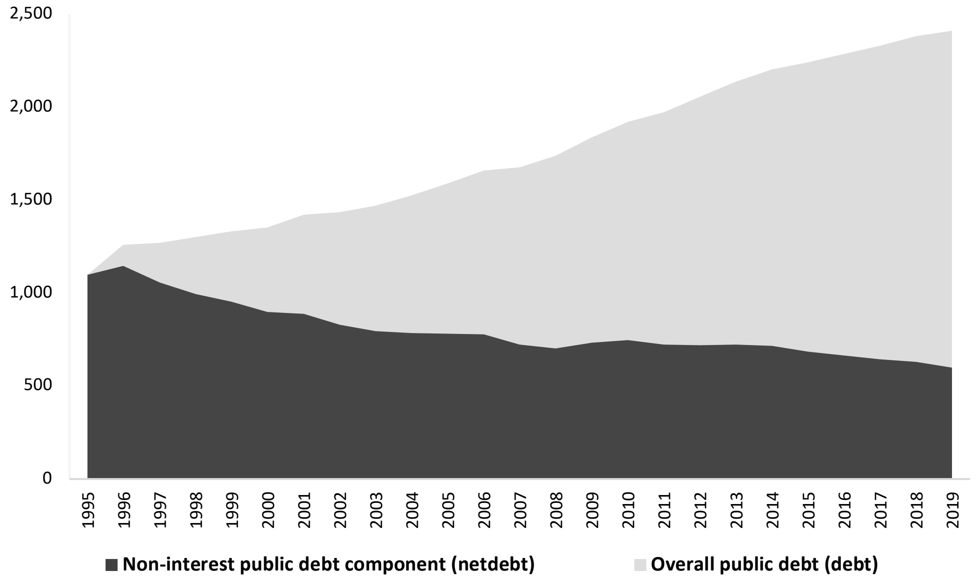
Palumbo, A. (2015). Studying growth in the modern classical approach: Theoretical and empirical implications for the analysis of potential output, Review of Political Economy, 282-307.

Raess, D., & Pontusson, J. (2015). The politics of fiscal policy during economic downturns, 1981–2010. European Journal of Political Research, 54(1), 1-22.

Treaty on Stability, Coordination and Governance in the Economic and Monetary Union (2012).

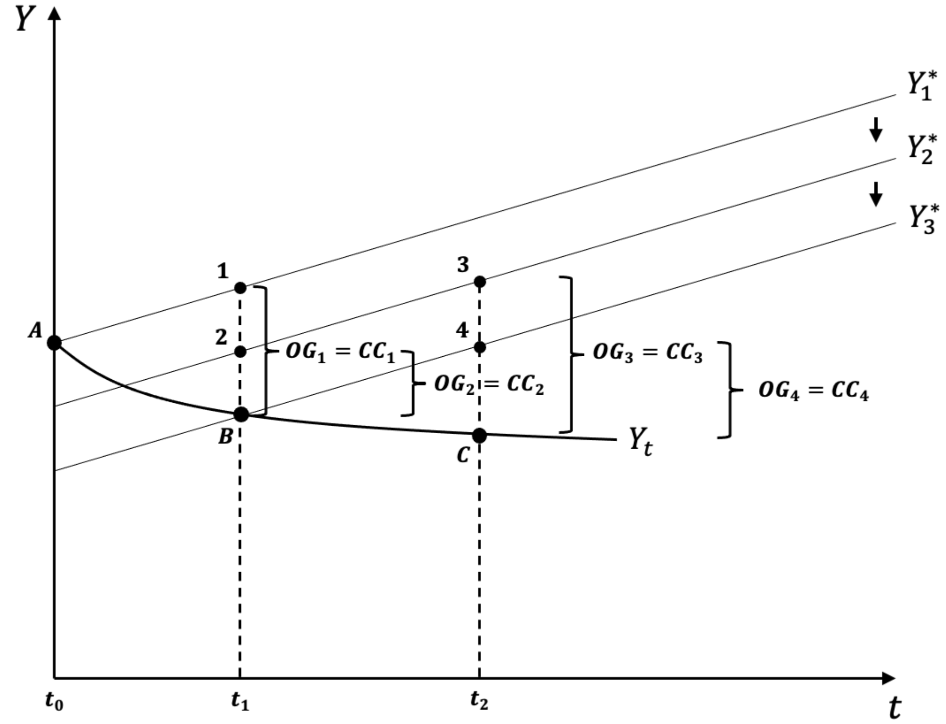
Figures and Tables

Figure 1 – Italian public debt with and without interest expenditure (billion euros)



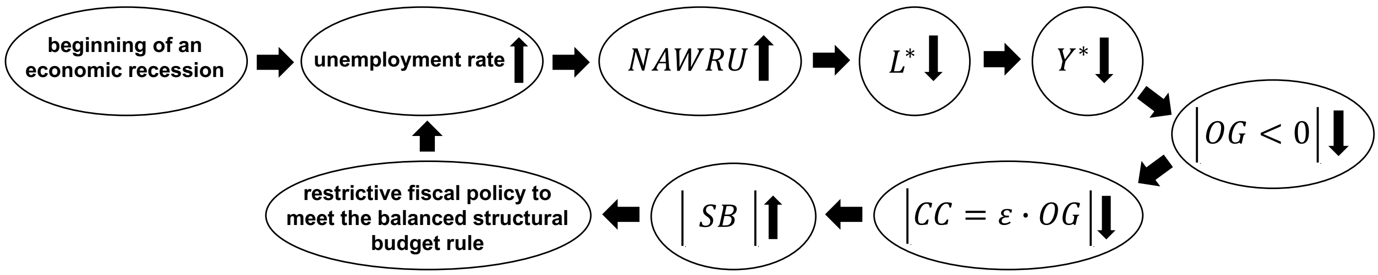
Note: *netdebt* represents the debt evolution by removing each year the increase resulting from interest expenditure. On the contrary, *debt* represents the actual evolution of the Italian public debt over time.
Source: own calculation on AMECO (2023 autumn forecast) data

Figure 2 – The pro-cyclical (endogenous) behaviour of fiscal policy during a recession



Note: point *A* represents the starting point, where actual and potential GDP coincide. We suppose that the economy enters a recession and simulate the fiscal corrections necessary to meet the MTO. The continuous downward revisions of potential (endogenous) GDP leads to a vicious cycle between corrective fiscal manoeuvres and a worsening of the recession.

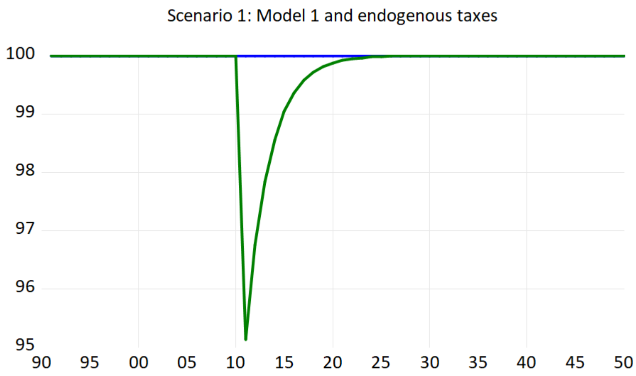
Figure 3 – The vicious cycle of fiscal pro-cyclicality



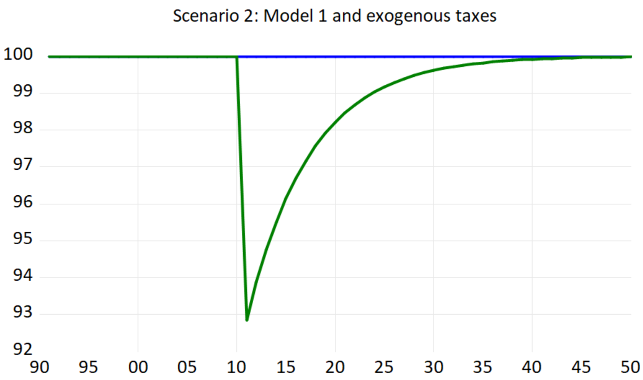
Note: the vicious cycle of fiscal pro-cyclicality triggered by exogenous factors and fuelled by the aim of complying with the European fiscal framework and by the endogeneity of potential GDP is graphically presented.

Figure 4 – Actual and potential output in an exogenous and endogenous potential output model

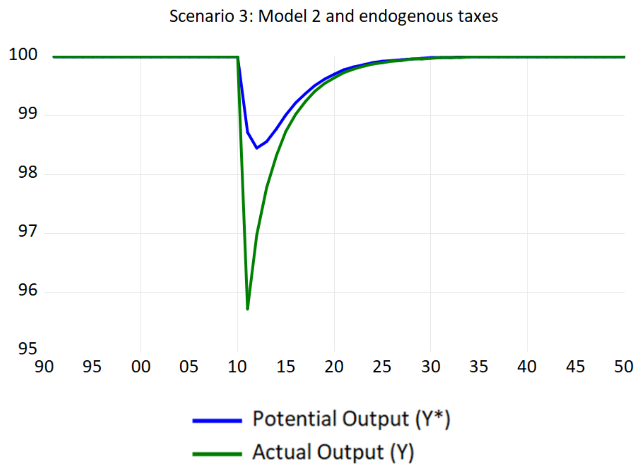
(a) exogenous potential output: θ endogenous



(b) exogenous potential output: θ fixed



(c) endogenous potential output: θ endogenous



Note: panel (a) shows the effect of a 10% drop in the propensity to consume out of income when potential output is assumed exogenous. Panel (b) presents the effect of the same shock assuming no automatic stabilisers are deployed. In panel (c), an identical shock is tested in a model with automatic stabilisers, but with an endogenous measure of potential output.

Table 1 – Fiscal cyclicality in the EU-26

Main regressor		***OGend vs OGex(j)*** *where j = 1995, … , 2023*		
Sub-period		*1995-2001*	*2002-2019*	*2020-2023*
Dependent variable (Eq. 24)		***CAPBend***		
Endogenous approach			-0.274 ***	0.119
Dependent variable (Eq. 25)		***CAPBex(j)*** *where j = 1995, … , 2023*		
Exogenous approach with constant NAWRU	1995	-0.129 *	-0.169 ***	-0.035
	1996	-0.128	-0.172 ***	-0.048
	1997	-0.126	-0.173 ***	-0.062
	1998	-0.128	-0.175 ***	-0.077
	1999	-0.132	-0.176 ***	-0.089
	2000	-0.136	-0.176 ***	-0.098
	2001	-0.139	-0.176 ***	-0.102
	2002	-0.140	-0.176 ***	-0.102
	2003	-0.146	-0.176 ***	-0.098
	2004	-0.151 *	-0.177 ***	-0.090
	2005	-0.156 *	-0.180 ***	-0.082
	2006	-0.162 **	-0.183 ***	-0.067
	2007	-0.164 **	-0.187 ***	-0.051
	2008	-0.161 **	-0.188 ***	-0.034
	2009	-0.162 **	-0.187 ***	-0.027
	2010	-0.157 **	-0.186 ***	-0.020
	2011	-0.155 **	-0.186 ***	-0.008
	2012	-0.159 **	-0.184 ***	-0.008
	2013	-0.161 ***	-0.184 ***	-0.003
	2014	-0.164 ***	-0.186 ***	0.004
	2015	-0.169 ***	-0.190 ***	0.015
	2016	-0.175 ***	-0.193 ***	0.021
	2017	-0.179 ***	-0.195 ***	0.026
	2018	-0.184 ***	-0.195 ***	0.028
	2019	-0.186 ***	-0.194 ***	0.030
	2020	-0.190 ***	-0.194 ***	0.032
	2021	-0.190 ***	-0.191 ***	0.026
	2022	-0.190 ***	-0.190 ***	0.025
	2023	-0.191 ***	-0.189 ***	0.020
(exogenous) Average		-0.122	-0.184	0.000
(exogenous) Std Dev		0.078	0.008	0.000

Note: ***, **, * denote significance at 1%, 5% and 10% level, respectively. For the calculation of the arithmetic mean, if a coefficient is not statistically significant, a value of 0 is considered. According to Eq. 25 and 26, all models include the constant, the lag of the dependent variable and demographic, trade, fiscal and macroeconomic controls. Country-fixed effects, year-fixed effects and a dummy variable controlling whether and when a country has joined the EMU are also included. Luxembourg is not considered due to data problems that do not allow for the calculation of potential GDP on the basis of the production function. The AB estimator uses the conventionally derived variance estimator for GMM estimation (the output gap has been considered endogenous regressor with a maximum of three lags to be used as instruments). The endogenous approach has 26 countries and 479 observations, while the exogenous approach 26 countries and 659 observations.

Table 2 – Fiscal cyclicality in PIIGS countries

Main regressor		***OGend vs OGex(j)*** *where j = 1995, … , 2023*		
Sub-period		*1995-2001*	*2002-2019*	*2020-2023*
Dependent variable (Eq. 24)		***CAPBend***		
Endogenous approach			-0.489 ***	0.316
Dependent variable (Eq. 25)		***CAPBex(j)*** *where j = 1995, … , 2023*		
Exogenous approach with constant NAWRU	1995	-0.616 **	-0.262 **	0.121
	1996	-0.610 *	-0.257 **	0.145
	1997	-0.591 *	-0.252 **	0.174
	1998	-0.538	-0.246 **	0.209
	1999	-0.497	-0.244 **	0.245
	2000	-0.452	-0.241 **	0.269
	2001	-0.455	-0.243 **	0.290
	2002	-0.449	-0.242 **	0.297
	2003	-0.483	-0.240 **	0.281
	2004	-0.501	-0.244 **	0.281
	2005	-0.544	-0.244 **	0.243
	2006	-0.574 *	-0.251 **	0.219
	2007	-0.594 *	-0.259 **	0.179
	2008	-0.623 **	-0.264 **	0.138
	2009	-0.640 **	-0.268 **	0.093
	2010	-0.629 **	-0.272 **	0.054
	2011	-0.609 **	-0.275 **	0.032
	2012	-0.612 **	-0.272 **	0.020
	2013	-0.620 **	-0.268 **	0.025
	2014	-0.637 **	-0.265 **	0.050
	2015	-0.636 **	-0.263 **	0.084
	2016	-0.635 **	-0.258 **	0.130
	2017	-0.622 *	-0.255 **	0.182
	2018	-0.588 *	-0.252 **	0.231
	2019	-0.556	-0.251 **	0.258
	2020	-0.514	-0.254 **	0.293
	2021	-0.501	-0.245 **	0.272
	2022	-0.484	-0.250 **	0.286
	2023	-0.486	-0.248 **	0.273
(exogenous) Average		-0.339	-0.255	0.000
(exogenous) Std Dev		0.311	0.010	0.000

Note: ***, **, * denote significance at 1%, 5% and 10% level, respectively. For the calculation of the arithmetic mean, if a coefficient is not statistically significant, a value of 0 is considered. According to Eq. 25 and 26, all models include the constant, the lag of the dependent variable and demographic, trade, fiscal and macroeconomic controls. Country-fixed effects, year-fixed effects and a dummy variable controlling whether and when a country has joined the EMU are also included. Luxembourg is not considered due to data problems that do not allow for the calculation of potential GDP on the basis of the production function. The AB estimator uses the conventionally derived variance estimator for GMM estimation (the output gap has been considered endogenous regressor with a maximum of three lags to be used as instruments). The endogenous approach has 5 countries and 100 observations, while the exogenous approach 5 countries and 130 observations.

Figure 5 – Pro-cyclical bias in Italy against a recession of 1% (billion euros)

Note: the endogenous reaction of fiscal policy is based on real-time estimates of the *NAWRU* and incorporates the pro-cyclical bias resulting from the endogeneity of potential GDP. On the contrary, the exogenous reaction of fiscal policy is estimated by assuming a constant *NAWRU* over the entire period under consideration, which ensures the independence of potential GDP from actual GDP realisations. In this regard, the value reported in brackets is the arithmetic average of the 29 *ex-post NAWRU* estimated by the European Commission from 1995 to 2023 (autumn forecasts).

Appendix

A.1 Equations of the model used for the simulations (Section 3.2)

$$C_{s_t} = C_{d_t} \quad \text{(A1)}$$

$$G_{s_t} = G_{d_t} \quad \text{(A2)}$$

$$Tax_t = \theta_t(N_{d_t}W) \quad \text{(A3)}$$

$$N_{s_t} = N_{d_t} \quad \text{(A4)}$$

$$Y_{d_t} = N_{d_t}W - Tax_t \quad \text{(A5)}$$

$$C_{d_t} = \alpha_1 Y_{d_t} + \alpha_2 H_{h_{t-1}} \quad \text{(A6)}$$

$$H_{s_t} = H_{s_{t-1}} + G_{s_t} - Tax_t \quad \text{(A7)}$$

$$H_{h_t} = H_{h_{t-1}} + Y_{d_t} - C_{d_t} \quad \text{(A8)}$$

$$Y_t = C_{s_t} + G_{s_t} \quad \text{(A9)}$$

$$N_{d_t} = \frac{Y_t}{W} \quad \text{(A10)}$$

$$Debt_t = \frac{H_{s_t}}{Y_t} \quad \text{(A11)}$$

$$OG_t = \frac{Y_t - Y_t^*}{Y_t^*} \quad \text{(A12)}$$

$$pos_{OGt} = 1\ if\ OG < 0, otherwise\ \ pos_{OGt} = 0 \quad \text{(A13)}$$

$$\theta_t = t_{base} + pos_{OG_t} \cdot sen_{OG} \cdot OG_t \quad \text{(A14)}$$

$$unp_t = 1 - (\frac{N_{d_t}}{lab_{max}}) \quad \text{(A15)}$$

$$Y_t^* = Y_{long}^* \text{ (Model 1)}$$ (A16) Model 1

$$Y_t^* = \lambda_1 Y_{long}^* + \lambda_2 \, lab_{max}(1 - unp_t) + \lambda_3 Y_{t-1}^* \text{ (Model 2)}$$ (A17) Model 2

A.2 Variables and parameters of the model used for the simulations (Section 3.2)

Variable	Symbol	**Value** (for parameters and exogenous variables)	**Initial value** (for endogenous variables)
Consumption goods demand by households	C_d		*80*
Consumption goods supply	C_s		*80*
Goods demanded by government	G_d	*20*	
Government goods supply	G_s		*20*
Cash money held by households	H_h		*80*
Cash money supplied by government	H_s		*80*
Demand for labour	N_d		*100*
Supply of labour	N_s		*100*
Taxes	Tax		*20*
Tax rate	θ		*0.2*
Income = GDP (Actual)	Y		*100*
Disposable income of households	Y_d		*80*
Debt-to-GDP ratio	$Debt$		*0.8*
Potential Output (Current)	Y^*		*100*
Long run Potential Output	Y^*_{long}	*100*	
Output Gap	OG		*0*
Unemployment rate	unp		*0*
Output below potential indicator	pos_{OG}		*0*
Standard base rate	t_{base}	*0.2*	
Wage rate	W	*1*	

Sensitivity of tax rate to output gap	sen_{OG}	*1*	
Propensity to consume out of income	α_1	*0.6*	
Propensity to consume out of wealth	α_2	*0.4*	
First parameter of potential output	λ_1	*0.2*	
Second parameter of potential output	λ_2	*0.3*	
Third parameter of potential output	λ_3	*0.5*	
Labour force	lab_{max}	*100*	

Table A1 – Revisions in the Italian *NAWRU* estimates (autumn forecast)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Δ
1995																						**9.5**	
1996																						**9.6**	
1997																						**9.6**	
1998																						**9.7**	
1999																						**9.6**	
2000																						**9.5**	
2001																						**9.3**	
2002	9.2																					**9.3**	0.1
2003		9.1																				**9.4**	0.3
2004			8.4																			**9.3**	0.9
2005				7.9																		**9.4**	1.5
2006					7.5																	**9.1**	1.6
2007						6.2																**8.9**	2.6
2008							7.2															**9.1**	1.9
2009								7.9														**9.3**	1.4
2010									7.7													**9.4**	1.7
2011										7.5												**8.9**	1.4
2012											9.7											**9.5**	-0.2
2013												10.3										**9.8**	-0.5
2014													10.7									**9.9**	-0.8
2015														10.7								**9.5**	-1.3
2016															10.5							**9.5**	-1.0
2017																10.3						**9.5**	-0.7
2018																	9.8					**9.5**	-0.3
2019																		9.8				**9.5**	-0.4
2020																			9.5			**9.1**	-0.4
2021																				9.7		**9.7**	0.0
2022																					9.1	**9.2**	0.1
2023																						**9.2**	0.0

Note: the dark-grey areas summarise the estimation of the real-time *NAWRU* variable, while the column concerning 2023 indicates the last *ex-post* estimate of the NAWRU. The last column (Δ) reports the difference between the two variables. The real-time *NAWRU* has been used to estimate an endogenous version of potential GDP considering the feedback effect of the business cycle. Each *ex-post* value in the 2023 column has been used to estimate an exogenous potential GDP, independent of the actual realisations of the unemployment rate. In this way, we estimate 29 potential GDP series (one per year), each based on the corresponding constant value of the *NAWRU*.
Source: authors' elaborations on AMECO – current (2023) and past autumn forecasts – data

Figure A1 – Real-time *vs ex-post* estimates of the Italian *NAWRU*

Source: authors' elaborations on AMECO – current (2023) and past autumn forecasts – data

Table A2 – Descriptive statistics: Dynamic panel data analysis (Section 4)

(a) Dependent variables

Category	Variable	Definition	Obs.	Mean	Std Dev	Source
Dependent variables	*CAPBend*	Endogenous approach - real-time NAWRU	531	-0.34	2.89	AMECO (2023 and past autumn forecasts)
	CAPBex(1995)	Exogenous approach - constant NAWRU 1995	754	-0.47	3.22	AMECO (autumn 2023 forecast)
	CAPBex(1996)	Exogenous approach - constant NAWRU 1996	754	-0.51	3.22	AMECO (autumn 2023 forecast)
	CAPBex(1997)	Exogenous approach - constant NAWRU 1997	754	-0.52	3.24	AMECO (autumn 2023 forecast)
	CAPBex(1998)	Exogenous approach - constant NAWRU 1998	754	-0.49	3.27	AMECO (autumn 2023 forecast)
	CAPBex(1999)	Exogenous approach - constant NAWRU 1999	754	-0.47	3.31	AMECO (autumn 2023 forecast)
	CAPBex(2000)	Exogenous approach - constant NAWRU 2000	754	-0.44	3.33	AMECO (autumn 2023 forecast)
	CAPBex(2001)	Exogenous approach - constant NAWRU 2001	754	-0.38	3.35	AMECO (autumn 2023 forecast)
	CAPBex(2002)	Exogenous approach - constant NAWRU 2002	754	-0.35	3.35	AMECO (autumn 2023 forecast)
	CAPBex(2003)	Exogenous approach - constant NAWRU 2003	754	-0.32	3.33	AMECO (autumn 2023 forecast)
	CAPBex(2004)	Exogenous approach - constant NAWRU 2004	754	-0.29	3.33	AMECO (autumn 2023 forecast)
	CAPBex(2005)	Exogenous approach - constant NAWRU 2005	754	-0.26	3.31	AMECO (autumn 2023 forecast)
	CAPBex(2006)	Exogenous approach - constant NAWRU 2006	754	-0.23	3.29	AMECO (autumn 2023 forecast)
	CAPBex(2007)	Exogenous approach - constant NAWRU 2007	754	-0.21	3.27	AMECO (autumn 2023 forecast)
	CAPBex(2008)	Exogenous approach - constant NAWRU 2008	754	-0.21	3.25	AMECO (autumn 2023 forecast)
	CAPBex(2009)	Exogenous approach - constant NAWRU 2009	754	-0.38	3.27	AMECO (autumn 2023 forecast)
	CAPBex(2010)	Exogenous approach - constant NAWRU 2010	754	-0.45	3.28	AMECO (autumn 2023 forecast)
	CAPBex(2011)	Exogenous approach - constant NAWRU 2011	754	-0.43	3.29	AMECO (autumn 2023 forecast)
	CAPBex(2012)	Exogenous approach - constant NAWRU 2012	754	-0.48	3.29	AMECO (autumn 2023 forecast)
	CAPBex(2013)	Exogenous approach - constant NAWRU 2013	754	-0.46	3.27	AMECO (autumn 2023 forecast)
	CAPBex(2014)	Exogenous approach - constant NAWRU 2014	754	-0.35	3.24	AMECO (autumn 2023 forecast)
	CAPBex(2015)	Exogenous approach - constant NAWRU 2015	754	-0.21	3.21	AMECO (autumn 2023 forecast)
	CAPBex(2016)	Exogenous approach - constant NAWRU 2016	754	-0.06	3.18	AMECO (autumn 2023 forecast)
	CAPBex(2017)	Exogenous approach - constant NAWRU 2017	754	0.10	3.16	AMECO (autumn 2023 forecast)
	CAPBex(2018)	Exogenous approach - constant NAWRU 2018	754	0.25	3.14	AMECO (autumn 2023 forecast)
	CAPBex(2019)	Exogenous approach - constant NAWRU 2019	754	0.38	3.13	AMECO (autumn 2023 forecast)
	CAPBex(2020)	Exogenous approach - constant NAWRU 2020	754	0.43	3.13	AMECO (autumn 2023 forecast)
	CAPBex(2021)	Exogenous approach - constant NAWRU 2021	754	0.52	3.12	AMECO (autumn 2023 forecast)
	CAPBex(2022)	Exogenous approach - constant NAWRU 2022	754	0.63	3.12	AMECO (autumn 2023 forecast)
	CAPBex(2023)	Exogenous approach - constant NAWRU 2023	754	0.67	3.12	AMECO (autumn 2023 forecast)

(b) Main regressors

Category	Variable	Definition	Obs.	Mean	Std Dev	Source
Main regressors	*OGend*	Endogenous approach - real-time NAWRU	531	-0.62	3.12	AMECO (2023 and past autumn forecasts)
	OGex(1995)	Exogenous approach - constant NAWRU 1995	754	0.26	4.22	AMECO (autumn 2023 forecast)
	OGex(1996)	Exogenous approach - constant NAWRU 1996	754	0.38	4.20	AMECO (autumn 2023 forecast)
	OGex(1997)	Exogenous approach - constant NAWRU 1997	754	0.42	4.20	AMECO (autumn 2023 forecast)
	OGex(1998)	Exogenous approach - constant NAWRU 1998	754	0.41	4.22	AMECO (autumn 2023 forecast)
	OGex(1999)	Exogenous approach - constant NAWRU 1999	754	0.40	4.26	AMECO (autumn 2023 forecast)
	OGex(2000)	Exogenous approach - constant NAWRU 2000	754	0.34	4.29	AMECO (autumn 2023 forecast)
	OGex(2001)	Exogenous approach - constant NAWRU 2001	754	0.24	4.29	AMECO (autumn 2023 forecast)
	OGex(2002)	Exogenous approach - constant NAWRU 2002	754	0.15	4.25	AMECO (autumn 2023 forecast)
	OGex(2003)	Exogenous approach - constant NAWRU 2003	754	0.08	4.18	AMECO (autumn 2023 forecast)
	OGex(2004)	Exogenous approach - constant NAWRU 2004	754	-0.02	4.09	AMECO (autumn 2023 forecast)
	OGex(2005)	Exogenous approach - constant NAWRU 2005	754	-0.12	4.02	AMECO (autumn 2023 forecast)
	OGex(2006)	Exogenous approach - constant NAWRU 2006	754	-0.21	3.97	AMECO (autumn 2023 forecast)
	OGex(2007)	Exogenous approach - constant NAWRU 2007	754	-0.28	3.93	AMECO (autumn 2023 forecast)
	OGex(2008)	Exogenous approach - constant NAWRU 2008	754	-0.31	3.92	AMECO (autumn 2023 forecast)
	OGex(2009)	Exogenous approach - constant NAWRU 2009	754	0.05	3.96	AMECO (autumn 2023 forecast)
	OGex(2010)	Exogenous approach - constant NAWRU 2010	754	0.21	4.00	AMECO (autumn 2023 forecast)
	OGex(2011)	Exogenous approach - constant NAWRU 2011	754	0.17	4.04	AMECO (autumn 2023 forecast)
	OGex(2012)	Exogenous approach - constant NAWRU 2012	754	0.29	4.08	AMECO (autumn 2023 forecast)
	OGex(2013)	Exogenous approach - constant NAWRU 2013	754	0.24	4.07	AMECO (autumn 2023 forecast)
	OGex(2014)	Exogenous approach - constant NAWRU 2014	754	-0.02	4.01	AMECO (autumn 2023 forecast)
	OGex(2015)	Exogenous approach - constant NAWRU 2015	754	-0.34	3.95	AMECO (autumn 2023 forecast)
	OGex(2016)	Exogenous approach - constant NAWRU 2016	754	-0.68	3.92	AMECO (autumn 2023 forecast)
	OGex(2017)	Exogenous approach - constant NAWRU 2017	754	-1.02	3.90	AMECO (autumn 2023 forecast)
	OGex(2018)	Exogenous approach - constant NAWRU 2018	754	-1.34	3.90	AMECO (autumn 2023 forecast)
	OGex(2019)	Exogenous approach - constant NAWRU 2019	754	-1.62	3.92	AMECO (autumn 2023 forecast)
	OGex(2020)	Exogenous approach - constant NAWRU 2020	754	-1.72	3.92	AMECO (autumn 2023 forecast)
	OGex(2021)	Exogenous approach - constant NAWRU 2021	754	-1.92	3.95	AMECO (autumn 2023 forecast)
	OGex(2022)	Exogenous approach - constant NAWRU 2022	754	-2.15	3.96	AMECO (autumn 2023 forecast)
	OGex(2023)	Exogenous approach - constant NAWRU 2023	754	-2.21	3.98	AMECO (autumn 2023 forecast)

(c) Control variables

Category	Variable	Definition	Obs.	Mean	Std Dev	Source
Demographic controls	*AD*	Age dependency (1st variant)	748	50.11	4.62	Eurostat
	pop_growth	Population growth rate	728	0.16	0.89	Eurostat
Fiscal control	*debtGDP*	Debt-to-GDP ratio	747	60.21	34.65	AMECO (autumn 2023 forecast)
Macroeconomic controls	*IR*	Implicit nominal interest rate	721	4.64	3.95	AMECO (autumn 2023 forecast)
	inflationGDP	GDP deflator growth rate	723	3.03	4.51	Eurostat
	UR	Unemployment rate	747	8.86	4.27	AMECO (autumn 2023 forecast)
Trade controls	*open*	Openness	754	110.29	52.04	AMECO (autumn 2023 forecast)
	ToT	Terms of trade	754	98.33	7.04	AMECO (autumn 2023 forecast)