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ALTERNATIVE METHOD OF FISCAL STABILITY ASSESSMENT

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Purpose: The purpose of this article is to propose an alternative method for analyzing the fiscal stability presented by the stability of the general government debt-to-GDP ratio. This presented method based on a model that takes into account different fiscal rules and we compare this method with classical methods used by institutions, with particular emphasis on the methods used by the European Commission.
Design/methodology/approach: The article compares selected classical methods for assessing stability—stability indicators and Debt Sustainability Analysis (DSA) used by the European Commission—with the proposed alternative method of assessing the local stability of the debt-to-GDP ratio using a model that describes an open economy. This model consists of three equations: the multiplier equation, the law of motion for debt and the fiscal rule incorporating various fiscal variables.
Findings: Using the proposed alternative method for assessment of fiscal stability, it can be noted that replacing the general government debt/GDP ratio that take into account in the convergence criteria with another instrument in the fiscal rule, we may obtain different results regarding local debt stability.
Practical implications: The presented alternative method of fiscal stability assessment aims to attract the attention of institutions and entities analyzing debt stability to the importance of fiscal rules and the type of fiscal instrument in the analysis of fiscal stability.
Originality/value: In the classical methods of fiscal stability assessment used by researchers and by various institutions, with particular emphasis on the European Commission, there is a lack of analyses of the impact of the instrument included in fiscal rule on fiscal stability represented by the stability of the debt/GDP ratio. The proposed alternative method of fiscal stability assessment fills this research gap. This added value of this article is addressed to institutions that study the fiscal stability. The proposed alternative method may be considered by the European Commission, the IMF, the Fiscal Council, and the government.
Keywords: fiscal stability, targeting rule, stability indicators, general government debt to GDP ratio.
Category of the paper: Research paper.

1. Introduction

There are many methods for assessing fiscal stability used by international institutions, such as the European Commission and the International Monetary Fund, as well as by national institutions. The European Commission presents the results of fiscal stability analyses in the reports: Debt Sustainability Monitor, e.g., *Debt Sustainability Monitor 2022* (Directorate-General for Economic and Financial Affairs, 2022) and *Debt Sustainability Monitor 2023* (Directorate-General for Economic and Financial Affairs, 2023). The International Monetary Fund publishes the results of fiscal policy analyses and its impact on economic stability in the Fiscal Monitor (International Monetary Fund. (n.d.)). Taking notice of fiscal risks, the IMF also presents fiscal stability in various countries as well as information on financial stability in the world and in individual regions in the reports such as: World Economic Outlook (WEO) (International Monetary Fund. (n.d.)), Global Financial Stability Report (GFSR) (International Monetary Fund. (n.d.)) i Regional Economic Outlook (International Monetary Fund. (n.d.)). Moreover, all European Union Member States outside the euro area are obliged to prepare the Convergence Programme and update it annually. This is part of the budgetary surveillance process in the European Union. The programme is prepared in accordance with the guidelines for the stability and convergence programme of the EU Member States. In Poland, this programme is part of the Multiannual State Financial Plan (Ministry of Finance (n.d.)) prepared on the basis of the Public Finance Act. The annual update of the Convergence Programme includes a forecast of basic macroeconomic and fiscal variables for the next three years. This document also presents the main objectives of the government's economic policy and actions to achieve them.

The results of fiscal stability analyses are also presented in numerous scientific studies (see e.g. Marín-Rodríguez et al., 2023; Baharumshah et al., 2017; Hansen, Imrohoroglu, 2023; Wyplosz, 2011).

Taking into account the Article 5 of the Directive of the Council of the European Union (Council Directive 2011/85/EU of 8 November 2011 on requirements for budgetary frameworks of the Member States), according to which the Member States are obliged to apply their specific numerical fiscal rules, many authors analyse the rule-based fiscal policy and the fiscal stability and the sustainability of the general government debt (see e.g. Heimberger, 2023; Kopits, Symansky, 1998). The stability analysis is particularly important because the rules-based decision-making approach allows for enhancing prudence and objectivity in the implementation of fiscal and monetary policy (see e.g. Barbier-Gauchard et al., 2021; Wieland, 1996).

However, in exceptional situations it is possible to activate the general escape clause and suspend the application of fiscal rules in European Union countries. In 2020, due to the significant economic slowdown across the EU caused by the pandemic, the Ecofin Council

approved a temporary deviation in the budgetary policies of EU member states from the EU Council recommendations regarding budgetary policy, provided that this deviation does not threaten the medium-term stability of public finances. Taking into account the general escape clause activated by the European Commission and the escape clause for the stabilising expenditure rule, the stabilising expenditure rule was suspended in Poland in 2020. This allowed for the implementation of measures to minimize the negative effects of the crisis and to increase spending necessary to support healthcare systems, the population and the economy. However, despite the possibility of suspending fiscal rules in various exceptional situations, such as the pandemic, the energy and gas crises in Europe, the economic slowdown, and increasing inflation, it is still important to ensure stable public finances while also taking into account the economic growth and price stability.

When analyzing the stability of the general government debt to GDP ratio, it takes into account the fiscal targeting rules (see e.g. Reicher, 2014). The importance of general government debt and he significance of growth and of productivity were studied by Afonso and Jalles (2013) and Auerbach and Gorodnichenko (2012).

If fiscal policy has a multiplier effect, for example due to distortionary taxes or Keynesian consumption behaviour, a trade-off between debt stability and stability of output or inflation is likely. The presence of distortionary taxation may affect the interaction between monetary and fiscal policy rules in terms of stability. The significance of fiscal rules and the fiscal multiplier has been studied from various perspectives by many researchers (see e.g., Barnichon et al., 2022; Canzoneri et al., 2016; Caselli, Wingender, 2021; Corsetti et al., 2016; Debrun, Jonung, 2019; Przybylska-Mazur, 2016; Woodford, 2011).

However, new exceptional situations and the lack of global stability highlight the need to modify previously considered fiscal instruments and the need to analyze the impact of the type of fiscal instrument on the stability of variables such as debt and output.

The purpose of this article is to propose an alternative method for analyzing the stability of the general government debt-to-GDP ratio based on a model that incorporates different fiscal rules as well as to compare this method with classical methods used by institutions with particular emphasis on the methods used by the European Commission.

The presented paper fills a research gap by comparing various methods of assessing fiscal stability, with particular emphasis on the proposed alternative approach. Previous studies have not analyzed the impact of fiscal instruments on the stability of general government debt. The findings presented in this paper fill this research gap.

2. Methods

Among the methods of fiscal stability assessment, we can distinguish the alternative method presented in the article, as well as the methods previously used by various institutions, which we will refer to below as classical methods. In the subsection on classical methods, a brief overview is provided of the fundamental approaches used by the European Commission to assess the stability of the general government sector.

Taking into account the existence of different definitions of fiscal stability used by various institutions, it is necessary to provide a definition of fiscal stability before analyzing this problem.

2.1. Classical methods of fiscal stability assessment

The most commonly used definition of fiscal stability by various institutions is based on the concept of solvency, understood as the government's ability to settle future liabilities. The formal condition for solvency is derived from the government's intertemporal budget constraint. The definitions and principles of fiscal stability used by the European Commission are included in the Stability and Growth Pact.

The European Commission defines fiscal stability in the context of ensuring sound public finances, which are essential for long-term economic growth and stability.

In defining fiscal stability, the European Commission takes into account:

- budget balance, which is achieved when the general government deficit-to-GDP ratio does not exceed 3%;
- general government debt - Member States should maintain the government debt-to-GDP ratio below 60%,
- sustainable fiscal development, which includes the government's ability to finance its current obligations and future expenditures, such as pensions and healthcare, without excessive borrowing,
- risk identification and management – identifying potential fiscal risks, such as economic fluctuations, financial crises and off-balance-sheet liabilities, and introducing appropriate preventive measures,
- efficiency of expenditure – general government expenditure should be efficient and contribute to economic growth and improvement of citizens' quality of life.

Thus, the European Commission defines fiscal stability as a state in which general government finances are managed in a sustainable, predictable and transparent manner, including budget balance, control of general government debt and effective management of fiscal risk. The goal is to ensure the long-term economic and financial stability of the European Union Member States.

When assessing the stability of the general government sector, the European Commission takes into account different time horizons using fiscal stability indicators: the indicator S_0 in the short-term analysis, the indicator S_1 in the medium-term analysis and the indicator S_2 in the long-term analysis. When analyzing the stability of the general government sector, the European Commission also uses deterministic debt level projections for a ten-year horizon and stochastic debt projections for a five-year horizon.

The indicator S_0 is a composite indicator of fiscal stress. This indicator is a binary indicator that allows for identifying the risk of potential fiscal stress in the next year, based on fiscal and structural variables that have proven to be effective in detecting situations of impending fiscal stress in the past. The indicator S_0, which is an early warning indicator, requires setting endogenous critical risk thresholds for individual variables on the basis of which the composite fiscal stress indicator is calculated. This process aims to minimize the sum of the number of fiscal stress signals sent ahead of no-fiscal-stress episodes (false positive signals – type-I error) and the number of no-fiscal-stress signals sent ahead of fiscal stress episodes (false negative signals – type-II error). That maximizes the signaling power of the indicator. The indicator S_0 is calculated as a weighted share of variables that have reached their critical thresholds, with weights given by their signaling power. The higher the share of individual variables whose values are greater than or equal to their specified threshold, the higher the value of the indicator S_0. This indicator is a measure of overall short-term risks to fiscal stability. High values of this indicator signal an increase in overall stability risks.

The S_1 and S_2 indicators are fiscal gap indicators that provide information on the size of the necessary adjustment in the primary structural balance in order to satisfy the intertemporal budget constraint with the imposed transversality condition, which ensures that the debt cannot be financed according to the financial pyramid scheme in the medium-term and long-term horizons, respectively. The higher the value of the S_1 and S_2 indicators, the greater the fiscal risk and therefore the need for greater fiscal adjustment.

The indicator S_1 also provides information on medium-term fiscal challenges by measuring the consolidation effort that would be needed to reduce the general government debt-to-GDP ratio to 60%. It should be noted that for countries with an initial general government debt-to-GDP ratio below 60%, including Poland, the component related to the necessary adjustment is negative.

Since it is widely considered that fiscal policy is sustainable in the long run if the present value of future primary balances equals the current level of debt, this is equivalent to satisfying the government's intertemporal budget constraint.

The indicator S_2 defines the immediate and one-time permanent fiscal adjustment, i.e., the initial fiscal effort needed to stabilize the general government debt-to-GDP ratio in the long term, using the projections from the Ageing Report regarding expenditures on pensions, healthcare, long-term care, and education. This fiscal gap indicator determines the overall long-term risk classification. If the value of the indicator is less than 2, it can be stated that there is

a low level of risk in the long term. If the value of the indicator is in the interval [2, 6], then there is medium risk, while the value greater than 6 indicates a high level of risk.

The European Commission also assesses long-term risk using Debt Sustainability Analysis (DSA) calculating both deterministic and stochastic debt level projections.

When using indicators to assess stability, one can see the problem that the indicators are subject to high uncertainty because they strongly depend on the initial assumptions, including the structural balance. Uncertainty regarding the indicators is also related to frequent revisions of potential GDP estimates and the output gap, as well as to changes in interest rates. Therefore, the European Commission is carrying out a sensitivity analysis to changes in the initial budgetary position and a sensitivity analysis to changes in the costs of aging. Furthermore, to take into account uncertainty related to macroeconomic conditions, stochastic debt projections are used in the assessment of fiscal stability.

2.2. Alternative method of fiscal stability assessment

In the article, an alternative method for assessing fiscal stability is proposed. This method is based on an open economy model consisting of three equations: the multiplier equation, which links the primary surplus to the output gap, a first-order approximation to the law of motion for the general government debt and a fiscal rule.

In assessing fiscal stability, the government debt-to-GDP ratio was studied. The definition of stability used in the analyses is as follows: stability is understood as a state in which the considered variable leads to the fulfillment of the law of motion in a non-explosive manner. In addition, we can note that two types of fiscal stability exist: global stability and local stability, which are defined as follows:

We say that the solution X_t of the law of motion is globally stable if and only if $\lim_{T\to\infty} \theta^T X_T = 0$ for every θ, such that $|\theta| < 1$.

However assuming that x_t is a local linear approximation of the sequence $X_t - \bar{X}$ for some $\bar{X}$, we say that the sequence $(X_t)_t$ is locally stable if and only if the solution x_t of the law of motion satisfies the following condition $\lim_{T\to\infty} \theta^T x_T = 0$ for every θ, such that $|\theta| < 1$.

The small open economy model used to assess fiscal stability includes consumers, producers, and the government. The model used for the analysis is based on the assumptions that the economy is open, taxation is distortionary, and consumers have access to a complete set of financial assets. However, they cannot hedge against the labor supply decisions. Additionally, it is assumed that prices, global interest rates, and global economic conditions are given.

We assume that consumers determine the optimal values of consumption C_t and labor expressed in the number of working hours H_t in period *t* by solving the following problem:

$$E_t \sum_{\tau=0}^{\infty} \delta^{\tau} \cdot [\ln(C_{t+\tau}) - \frac{\varphi H_{t+\tau}^{1+\frac{1}{a}}}{1+\frac{1}{a}} - \lambda_{t+\tau}(C_{t+\tau} + P_{t+\tau}^{T} \cdot A_{t+\tau} - P_{t-1+\tau}^{T} \cdot A_{t-1+\tau} - \\ - W_{t+\tau}H_{t+\tau}(1 - T_{t+\tau} + V_{t+\tau}) + \varphi_{t+\tau})] \rightarrow max \quad (1)$$

where:

E_t – expected value in period *t*,

$C_{t+\tau}$ – consumption value in period $t + \tau$,

$H_{t+\tau}$ - number of working hours in period $t + \tau$,

$P_{t+\tau}^{T}$ – transpose of the asset prices vector in period $t + \tau$,

$P_{t-1+\tau}^{T}$ – transpose of the asset prices vector in period $t - 1 + \tau$,

$A_{t+\tau}$ – vector of asset quantities in period $t + \tau$,

$A_{t-1+\tau}$ – vector of asset quantities in period $t - 1 + \tau$,

$W_{t+\tau}$ – gross remuneration per hour in period $t + \tau$,

$T_{t+\tau}$ – tax rate in pariod $t + \tau$,

$V_{t+\tau}$ – share of the tax-exempt part in labor income in period $t + \tau$,

$\varphi_{t+\tau}$ – income exempt from taxation in period $t + \tau$ paid not by the employer including, among others, income from various government programs,

δ – discount factor,

$\lambda_{t+\tau}$ – Lagrange multiplier in period $t + \tau$,

φ, a – parameters.

We assume that producers produce in each period *t* according to a linear production function $Y_t = Z_t \cdot H_t$ maximizing profit, where Y_t is output in period *t*, Z_t is productivity rate in period *t* and H_t is number of working hours in period *t*.

In addition, we assume that the government takes into account the law of motion for the general government debt B_t in period *t*:

$$B_t = \frac{1+ i_{t-1}}{1+\pi_t} \Gamma\left(\frac{B_{t-1}}{\bar{Y}_{t-1}}\right) B_{t-1} - S_t \quad (2)$$

where:

$\Gamma\left(\frac{B_{t-1}}{\bar{Y}_{t-1}}\right)$ is a function representing the risk of default on the general government debt,

B_t represents the general government debt in period *t*,

B_{t-1} represents the general government debt in period *t* – 1,

$\bar{Y}_{t-1}$ represents the potential GDP in period *t* – 1,

i_{t-1} represents the nominal interest rate in period *t* – 1,

π_t represents the inflation rate in period *t*,

S_t represents the budget balance, $S_t = T_t Y_t - G_t$,

Y_t represents the GDP in period *t*,

T_t represents the tax rate in period *t*,

G_t represents the general government revenues in period *t*.

The above model characterizing the open economy can be written in a reduced form using the following three equations:

- the multiplier equation that relates the primary surplus to the output gap:

$$y_t = -\frac{a}{1-\bar{T}-a\bar{T}}\,(s_t - v_t) \tag{3}$$

or equivalently

$$y_t = y_t^* - m \cdot s_t \tag{4}$$

for the multiplier $m = \frac{a}{1-\bar{T}-a\bar{T}}$ and the output gap correction factor $y_t^* = m \cdot v_t$ where $y_t = \frac{Y_t-\bar{Y}_t}{\bar{Y}_t}$ is the output gap defined as the relative deviation of GDP Y_t from potential GDP $\bar{Y}_t$, $s_t = \frac{S_t-\bar{S}_t}{\bar{Y}_t}$ is the ratio of the deviation of the budget balance S_t from the trend $\bar{S}_t$ to the potential GDP, $\bar{T}$ represents the tax trend and $v_t = V_t$ is the absolute deviation of the work gap from the trend;

- the first-order approximation for the law of motion for the general government debt:
  Assuming that the first-order approximation for the law of motion for the general government debt $\Gamma\left(\frac{B_{t-1}}{\bar{Y}_{t-1}}\right) = e^{c_t^* + c\cdot\frac{B_{t-1}}{\bar{Y}_{t-1}}}$ is of the following form

$$b_t = \frac{1+i_{t-1}}{1+g_t}(1+c\cdot b)\,b_{t-1} + \frac{1+i_{t-1}}{1+g_t}\,b\,c_t^* - s_t \tag{5}$$

  where:
  $b_t = \frac{B_t}{\bar{Y}_t} - b$ is the deviation of the general government debt-to-potential GDP ratio from the reference value b,
  c_t^* – the coefficient influencing the rate of change of the general government debt-to-potential GDP ratio in period *t*,
  c – the coefficient influencing the rate of change of the general government debt-to-potential GDP ratio and g_t represents the economic growth rate in period *t*;

- fiscal rule, which is an instrument limiting the scope of fiscal policy; this rule takes the form of quantitative limits concerning primarily:
  – the permissible budget balance,
  – the general government debt,
  – the growth or level of budget expenditure.

This equation is a fiscal rule specified by the fscal policymaker, which sets b_t or s_t as a function of other variables. Depending on the type of fiscal rule taken into account, we can consider different fiscal systems.

Below, we present the results of the analysis of the general government debt stability under different fiscal systems, which involves adopting various fiscal rules, i.e., taking into account the quantitative limits of fiscal instruments.

2.2.1. Fiscal rule taking into account the debt-to-GDP ratio

Applying the fiscal targeting rule that takes into account the general government debt-to-GDP ratio, we aim to achieve the exogenous target B_t^*. The target can be written as $B_t^* = \frac{B_t}{Y_t}$.

Assuming that the target deviation $b_t^* = B_t^* - b$ from the established value *b* satisfies the equation

$$b_t^* = b_t - b\, y_t \tag{6}$$

we can write the law of motion for b_t^* in the following form:

$$b_t^* = \frac{1 + i_{t-1}}{1 + g_t}(1 + c \cdot b)\, b_{t-1}^* + \frac{1 + i_{t-1}}{1 + g_t}(1 + c \cdot b) b\, y_{t-1} + \\ + \frac{1 + i_{t-1}}{1 + g_t} b\, c_t^* - b\, y_t - s_t \tag{7}$$

Thus, considering the exogenous, locally stable sequence $(b_t^*)_t$, which is not identically zero, and the model consisting of equations (4), (7), (6), the sequence$(b_t)_t$ is locally stable at *b* if and only if $\left| \frac{-m \frac{1+i_{t-1}}{1+g_t}(1+c \cdot b) b}{1 - m \cdot b} \right| < 1$ or equivalently, when $m \cdot b < \frac{1}{\frac{1+i_{t-1}}{1+g_t}(1+c \cdot b)+1}$.

2.2.2. Fiscal rule taking into account the debt-to-potential GDP ratio

In the fiscal rule taking into account the general government debt-to-potential GDP ratio, the debt level is of particular importance due to the predetermined level of potential GDP. Applying the fiscal targeting rule that takes into account the general government debt-to-potential GDP ratio, the aim is to achieve the exogenous target B_t^{**}. Therefore, the target can be written as follows: $B_t^{**} = \frac{B_t}{\bar{Y}_t}$.

To analyze the local stability, we assume that the target deviation $b_t^{**} = B_t^{**} - b$ from the established value *b* satisfies the equation

$$b_t^{**} = b_t \tag{8}$$

Then, the law of motion for b_t^{**} is of the following form:

$$b_t^{**} = \frac{1 + i_{t-1}}{1 + g_t}(1 + c \cdot b)\, b_{t-1}^{**} + \frac{1 + i_{t-1}}{1 + g_t} b\, c_t^* - s_t \tag{9}$$

Thus, taking into account the exogenous, locally stable sequence $(b_t^{**})_t$, which is not identically zero, and the model consisting of equations (4), (9), (8), the sequence $(b_t)_t$ is always locally stable.

The above remark suggests that removing GDP from the fiscal rule and replacing this indicator with potential GDP can help ensure stability.

2.2.3. Fiscal rule taking into account the total balance-to-potential GDP ratio

Stability analysis based on a model that includes the balance or deficit instead of the debt in a fiscal rule is also particularly important, because European Union member states are

required to comply with requirements for general government debt as well as general government deficit.

In the fiscal rule taking into account the total balance-to-potential GDP ratio, the level of the total balance is particularly important due to the predetermined level of potential GDP.

When the total balance is negative, we have a total deficit, and we consider a fiscal rule that takes into account the total deficit-to-potential GDP ratio instead of a fiscal rule that considers the total balance-to-potential GDP ratio.

Applying the fiscal targeting rule that includes the total balance-to-potential GDP ratio, the fiscal instrument considered is the indicator S_t^{**}, which represents the total balance-to-potential GDP ratio.

This indicator satisfies the following equation:

$$S_t^{**} = \frac{S_t - \left(\frac{1 + i_{t-1}}{1 + \pi_t} \Gamma\left(\frac{B_{t-1}}{\bar{Y}_{t-1}}\right) - 1\right) B_{t-1}}{\bar{Y}_t} \tag{10}$$

To analyze local stability, we use the law of motion for s_t^{**} in the model. Therefore, we consider the deviation of the total budget balance from the trend in the following form:

$$s_t^{**} = s_t - \frac{i_{t-1}}{1 + g_t} b_{t-1} - \frac{1 + i_{t-1}}{1 + g_t}(c \cdot b\, b_{t-1} + bc_t^*) \tag{11}$$

Taking into account the law of motion for debt (5), we obtain that the general government debt must satisfy the following equation:

$$b_t = \frac{1}{1 + g_t} b_{t-1} - s_t^{**} \tag{12}$$

Thus, given the exogenous, locally stable sequence $(s_t^{**})_t$, which is not identically zero, and the model consisting of equations (4), (12), (11), the sequence $(b_t)_t$ is always locally stable if and only if the nominal growth rate $g_t > 0$.

This implies that setting the total deficit as the target leads to a stable debt path when the nominal growth rate g_t is positive

2.2.4. Fiscal rule taking into account the primary balance-to-potential GDP ratio

If the primary balance is negative, then we have a primary deficit and we refer to a fiscal rule that takes into account the primary deficit instead of a fiscal rule that takes into account the primary balance.

Applying the fiscal targeting rule taking into account the primary balance-to-potential GDP ratio, we take into account the primary balance indicator S_t^* relative to potential GDP $\bar{Y}_t$.

Analyzing the local stability, we assume that the deviation $s_t^* = \frac{S_t^* - \bar{S}_t^*}{\bar{Y}_t}$ of the primary balance indicator S_t^* from the trend of the primary balance $\bar{S}_t^*$ to the potential GDP $\bar{Y}_t$ satisfies the equation:

$$s_t^* = s_t \tag{13}$$

Then the law of motion for b_t is of the following form:

$$b_t = \frac{1 + i_{t-1}}{1 + g_t}(1 + c \cdot b)b_{t-1} + \frac{1 + i_{t-1}}{1 + g_t} b\, c_t^* - s_t^* \tag{14}$$

Thus, considering the exogenous, locally stable sequence $(s_t^*)_t$ which is not identically zero and the model consisting of equations (4), (14), (13), the sequence $(b_t)_t$ is always locally unstable.

Therefore, setting the primary deficit as a target may lead to serious problems with the stability of the general government debt, and the government may be forced to use inflation to reduce part of the debt.

3. Results

The empirical analysis focuses on studying fiscal stability in Poland. Below, we present the results of fiscal stability in Poland in different time horizons presented by the European Commission, as well as the results of the method proposed in the article.

3.1. Classical methods – European Commission's results for Poland

The analysis conducted in this subsection are based on debt projections and stability indicators developed by the European Commission for Poland and published in the European Commission's latest report - Debt Sustainability Monitor 2023 (Institutional Paper, No. 271, March 2024).

The table below presents the deterministic projection of general government debt-to-GDP ratio for baseline scenario in Poland.

Table 1.
Deterministic projection of general government debt-to-GDP ratio for baseline scenario in Poland

Year	general government debt-to-GDP ratio projection for baseline scenario	Year	general government debt-to-GDP ratio projection for baseline scenario
2021	53,6	2028	62,2
2022	49,3	2029	64,5
2023	50,9	2030	67
2024	54,4	2031	69,4
2025	56,5	2032	71,9
2026	58,1	2033	74,4
2027	60	2034	77,1

Source: Debt Sustainability Monitor 2023 (European Commission, Institutional Paper, No. 271, March 2024).

Moreover, the European Commission publication shows that the debt sustainability analysis (DSA) consists in a set of deterministic projections based on various scenarios. The deterministic projections of debt to GDP ratio for 2034 are: the baseline scenario 77,1%, the historical structural primary balance (SPB) scenario 78,8%, the lower SPB scenario 84,5%, the adverse interest-growth rate differential (r-g) scenario 82,8% and the financial stress scenario 77,6%. The risk level is determined as medium in all scenarios.

However, based on the stochastic projection, the probability of debt-to-GDP ratio exceeding the 2023 level in 2028, is 0,95 and the difference between 90th and 10th percentiles of this ratio is 19,5%. Therefore the risk is determined as low.

The total indicator S_0 for Poland in 2023 calculated by the European Commission is 0.39, which allows to determine a low level of fiscal instability risk in Poland in the short-term horizon. According to the European Commission's analyses in 2023 the indicator S_1 equal to 3,2% of GDP, signals a medium fiscal risk in Poland in the medium-term horizon. Poland belongs to the group of EU member states considered to be at medium risk, as an overall correction of 2-6 percentage points of GDP would be needed to bring the rising general government debt back to 60% of GDP by 2070. The medium-term risk of fiscal instability in Poland is assessed as medium. However, debt is expected to continue rising in the medium term, with the debt-to-GDP ratio exceeding 60%.

For Poland, the indicator S_1 equals 3,2% of GDP and this indicator measures the permanent fiscal effort needed in 2025 to bring the debt-to-GDP to 60% by 2070. The indicator S_1 for Poland is composed of 0,8 percentage points of GDP to absorb the budgetary impact of rising ageing costs, 2,5 percentage points to close the gap between the 2024 structural primary balance and the debt-stabilising structural primary balance. The third component is the debt requirement and is equals to -0,1 percentage points. This component is related to the distance of the current debt-to-GDP ratio to the 60% reference value in 2070. Moreover, in 2023 the total indicator in the medium-term horizon increased compared to 2022. In 2022, this indicator was equal to 2,8, while in 2023, the indicator S_1 for Poland was equal to 3,2.

Using the indicator S_2 to assess fiscal stability, the European Commission stated that in 2023 this baseline overall index for Poland is 3,8 percentage points of GDP, of which initial budgetary position equals 2,7 percentage points of GDP and aging costs are 1,1 percentage points of GDP. For comparison, this overall index for Poland was equal to 3,7 percentage points of GDP in 2022. According to the European Commission's analysis, the indicator S_2 suggests that Poland is at overall medium long-term risk to fiscal stability.

Thus, Poland belongs to the group of EU member states exposed to medium risk, as the overall correction needed to stabilize the debt in the long term is between 2 and 6 8 percentage points of GDP.

3.2. Alternative method - results for Poland

Since one of the methods of assessing fiscal stability presented in this article incorporates a fiscal rule into the analysis, the results of analyses carried out for Poland based on this method are shown below. The theoretical analysis shows that when we take into account the values of the general government debt-to-potential GDP ratio in the fiscal rule, the sequence of the general government debt-to-GDP ratio $(b_t)_t$ is always locally stable. However, when taking into account the values of the general government primary balance-to-potential GDP ratio in the fiscal rule, the sequence of the general government debt-to-GDP ratio $(b_t)_t$ is always locally unstable. Thus, it remains to analyze fiscal stability when we include either the general government debt-to-GDP ratio or the general government total balance-to-potential GDP ratio in the fiscal rule.

For the analysis we took into account annual data for Poland from the period 2003-2023, including GDP (in PLN million) (Central Statistical Office, www.stat.gov.pl), GDP dynamics (Central Statistical Office, www.stat.gov.pl), general government balance (in PLN million) (Eurostat, https://ec.europa.eu/eurostat/data/database), general government debt (in PLN million) (Eurostat, https://ec.europa.eu/eurostat/data/database), general government debt-to-GDP ratio (Eurostat, https://ec.europa.eu/eurostat/data/database) and the reference rate (average annual value calculated on the basis of NBP data, www.nbp.pl). We assumed $b = 0{,}6$ (the limit for the general government debt-to-GDP ratio of 60%). The parameter c was set as the average relative change in the reference rate. In addition, the values of potential GDP and the trend balance were calculated using the Hodrick-Prescott filter. The obtained results are presented in the tables below.

In Table 2, we present the results of fiscal stability analyses for Poland in the years 2003-2023 when we include the general government total balance-to-potential GDP ratio in the fiscal rule.

Table 2.
Coefficient values used to assess the stability of the general government debt based on the fiscal targeting rule taking into account the general government total balance-to-potential GDP

Year	Coefficient values	Stability of general government debt	Year	Coefficient values	Stability of general government debt
2003	0,039	stable	2014	0,039	stable
2004	0,053	stable	2015	0,044	stable
2005	0,036	stable	2016	0,03	stable
2006	0,062	stable	2017	0,052	stable
2007	0,068	stable	2018	0,062	stable
2008	0,051	stable	2019	0,046	stable
2009	0,017	stable	2020	-0,02	unstable
2010	0,032	stable	2021	0,069	stable
2011	0,053	stable	2022	0,053	stable
2012	0,015	stable	2023	0,001	stable
2013	0,007	stable			

Source: Own calculations.

In Table 3, we present the results of fiscal stability analyses for Poland in the years 2003-2023 when we incorporate the general government debt-to-GDP ratio in the fiscal rule.

Table 3.
Coefficient values used to assess the stability of the general government debt based on the fiscal targeting rule taking into account the general government debt to GDP ratio

Year	Coefficient values	Stability of general government debt	Year	Coefficient values	Stability of general government debt
2003	2,184	unstable	2014	2,073	unstable
2004	2,098	unstable	2015	2,052	unstable
2005	2,138	unstable	2016	2,064	unstable
2006	2,062	unstable	2017	2,019	unstable
2007	2,039	unstable	2018	2,000	unstable
2008	2,080	unstable	2019	2,031	unstable
2009	2,175	unstable	2020	2,167	unstable
2010	2,102	unstable	2021	1,966	unstable
2011	2,057	unstable	2022	1,995	unstable
2012	2,149	unstable	2023	2,202	unstable
2013	2,174	unstable			

Source: Own calculations.

4. Discussion

The debt stability analyses prepared by the European Commission show a low level of fiscal instability risk in Poland in the short term. However the indicators S_1 and S_2 signal medium fiscal risk in Poland in the medium-term and long-term horizons.

The calculated deterministic projections of the general government debt-to-GDP ratio for the baseline scenario in Poland indicate an upward trend of this ratio in Poland and exceeding the established reference value of this indicator, i.e. 60%, in 2028.

Moreover, the calculated projections by the European Commission for the general government debt-to-GDP ratio for alternative scenarios—the historical structural primary balance (SPB) scenario, the lower SPB scenario, the adverse interest-growth rate differential (r-g) scenario, and the financial stress scenario—also show that the general government debt-to-GDP ratio will exceed 60% in Poland Therefore, Poland belongs to the group of countries exposed to medium risk, and an overall correction is required to stabilize the debt in the long-term horizon. This correction of the general government debt-to-GDP ratio is equal to between 2 and 6 percentage points.

It should be noted that the DSA methodology used by the European Commission takes into account the revised fiscal rules in the new EU economic governance framework.

Therefore, using the proposed alternative method of assessing fiscal stability, represented by the stability of the general government debt-to-GDP ratio and based on a model that

incorporates different fiscal rules, we noted that the type of fiscal instrument included in the fiscal rule has an impact on the result regarding the stability of the debt-to-GDP ratio.

If we include the debt-to-potential GDP ratio in the fiscal rule, then the sequence $(b_t)_t$ of the general government debt-to-GDP ratio is always locally stable, i.e. also locally stable in Poland throughout the entire analyzed period 2002-2023.

If we take into account the primary balance-to-potential GDP in the fiscal rule, then the sequence $(b_t)_t$ of the general government debt-to-GDP ratio is always locally unstable, including throughout the entire analyzed period of 2002-2023 in Poland.

If we take into account the total balance-to-potential GDP ratio in the fiscal rule, then the sequence $(b_t)_t$ of the general government debt-to-GDP ratio was stable in Poland during the analyzed period of 2003-2023, except for 2020, when the SARS-CoV-2 coronavirus pandemic began and support programs were implemented, including programs counteracting or limiting the negative economic effects related to the announced lockdown.

However, based on empirical analysis, we can state that taking into account the debt-to-GDP ratio in the fiscal rule, the sequence $(b_t)_t$of the general government debt-to-GDP ratio was locally unstable in Poland throughout the entire period of 2003-2023.

Taking into account the stability results obtained from the presented alternative method of assessing fiscal stability, institutions such as the European Commission or the IMF can extend the analysis of fiscal stability for individual countries. In addition to macroeconomic indicators such as the general government debt-to-GDP ratio and the general government deficit-to-GDP ratio and the fixed reference values of 60% for the debt-to-GDP ratio and 3% for the deficit-to-GDP ratio, these institutions may also take into account rules including the debt-to-potential GDP ratio or the total balance-to-potential GDP ratio or the primary balance-to-potential GDP ratio when assessing fiscal stability.This approach enables a comprehensive assessment of a country's fiscal stability

Relating the findings in this article to those of other authors, it can be stated that the reports on fiscal stability published by the European Commission and the International Monetary Fund do not analyze the impact of the type of fiscal rule on the stability of the general government debt. The debt sustainability analysis (DSA) in the European Commission's reports considers the impact of aging-related costs on debt stability and presents various fiscal sustainability scenarios, such as 'historical structural primary balance (SPB)', 'lower SPB', 'adverse interest rate-growth differential (r-g)', and 'financial stress'. The S_1 indicator also incorporates for future aging costs and the debt anchor in EU fiscal regulations.

Marín-Rodríguez et al. (2023) provide an overview of fiscal sustainability research methodologies, highlighting an evolving shift towards interdisciplinary approaches that encompass environmental, social, and political factors. They also identify three emerging trends in fiscal sustainability research: the relationship between fiscal sustainability and economic growth, the methodologies and models for assessing fiscal sustainability, and demographic concerns and their impact on fiscal sustainability. Baharumshah et al. (2017) proposed

a Markov-switching model to assess the sustainability of fiscal policy. Hansen and Imrohoroglu (2023) consider the fiscal implications of an aging population in Japan. Heimberger (2023) assessed the European Commission's reform orientations with regard to using debt sustainability analysis (DSA) as an anchor in EU fiscal rules.

A theoretical discussion of fiscal targeting rules and macroeconomic stability under distortionary taxation, particularly in a small open economy, was conducted by Reicher (2014). He showed that the interaction between the fiscal rule and output can influence whether fiscal policy is stabilizing or passive in equilibrium. The theoretical findings on the stability of general government debt presented in this article, based on the proposed model, align with the findings reported by Reicher (2014).

The research findings presented in this article aim not only to compare the proposed alternative method for assessing stability with classical methods used for assessing fiscal stability but also to highlight the fact that the assessment of fiscal stability can depend on the type of fiscal rule applied.

5. Summary

In this article, we presented the results of a study on fiscal stability analyzed on the basis of the general government debt-to-GDP ratio, taking into account the fiscal rules that incorporate different fiscal instruments such as general government debt-to-GDP ratio, general government debt-to-potential GDP ratio, general government total balance-to-potential GDP ratio and general government primary balance-to-potential GDP ratio. In the article, we presented also the classical methods of assessing general government debt stability, focusing on the methods used by the European Commission for short-term, medium-term and long-term horizons. The results obtained based on the proposed alternative method were compared with the debt stability assessment for Poland made by the European Commission. By performing the empirical analysis based on the proposed alternative method of assessing stability, the local stability of the general government debt-to-GDP ratio in Poland during the period 2003-2023 was studied.

Using the proposed alternative method to assess fiscal stability, the analysis indicated that the assessment of the local stability of the general government debt-to-GDP ratio significantly depends on the type of variable included in the fiscal rule. Moreover, it can be state that removing GDP from the fiscal rule and replacing this indicator with potential GDP can help ensure stability. It has also been noted that adopting the primary balance as a target can result in serious problems with the stability of the general government debt.

Furthermore, we can conclude that taking into account the total balance-to-potential GDP in the fiscal rule leads to stable debt paths. Additionally, the fiscal rule incorporating the total balance-to-potential GDP can be used to identify negative nominal economic growth rates and extraordinary situations

Since Article 5 of the Council of the European Union Directive (Council Directive 2011/85/EU of 8 November 2011 on requirements for budgetary frameworks of the Member States) obliges member states to apply country-specific numerical fiscal rules without specifying which particular rules should be used, it is challenging to discuss in this article the priority of applying a specific type of fiscal rule when assessing the stability of the general government debt-to-GDP ratio. However, considering the practical aspects related to the selection of fiscal rules, it is advisable to adopt a comprehensive approach to the debt stability problem by incorporating various fiscal variables and, consequently, different types of fiscal rules.

However, in the context of stability, the application of a fiscal rule based on the primary balance-to-potential GDP ratio appears less favorable, as it inevitably leads to local instability of the general government debt-to-GDP ratio. To demonstrate the local stability of the general government debt-to-GDP ratio, a fiscal rule based on the debt-to-potential GDP ratio should be applied. However, to make debt stability dependent primarily on the nominal growth rate or the interest rate or the tax trend or the rate of change of the general government debt-to-potential GDP ratio or the reference value of general government debt-to-GDP ratio, a fiscal rule taking into account the total balance to potential GDP or a fiscal rule taking into account the debt to GDP ratio should be considered.

In conclusion, it is worth emphasizing that replacing the commonly used instrument, such as the general government debt-to-GDP ratio, with another fiscal instrument may yield different results regarding local debt stability. In further studies, the obtained results will be verified for other European Union member states.

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