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ESTIMATION OF THE CYCLICALLY ADJUSTED BUDGET BALANCE – AGGREGATED AND DISAGGREGATED METHOD

Abstract. *Budget deficit is one of the most important macroeconomic problems which has been debated in academic and political platform since 1970s. Monetary and tax authorities, if different, may engage in non-cooperative behavior. The behavior of the fiscal authority may affect the monetary authority's ability to achieve its inflation target. The aim of our paper was to see if the fiscal policy in Romania was pro-cyclical. In order to this, we analyzed the cyclically adjusted structural budget balance and came with the conclusion that the fiscal policy is in fact pro-cyclical because the curve of fiscal impulses follows the trend of excess demand.*

Keywords*: Budget balance, Pro-cyclical, Fiscal policy, Monetary policy.*

JEL Classification : E52, E58, E62, E63, E17

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1. Introduction

The cash budget deficit target for 2020 was estimated at 3.59% of GDP, and the ESA deficit to 3.58% of GDP, which will reach 1.94% of GDP in 2023, thus complying with the provisions of European regulations.

It should be noted that the practice in the period 2016-2019 of a pronounced expansionist policy, with circumvention of the rules established by the TSCG and the LRFB, and which involved abandoning the structural deficit target, determined the EC to maintain the decision to place Romania in the EDP even in the context of the event COVID-19 pandemic on the grounds that the violation of European tax rules, being prior pandemic, not due to it.

In fact, in its opinions on the draft budget for 2020 and the Fiscal-Budgetary Strategy 2019-2021, the Fiscal Council considered that the proposed budgetary targets reflect the lack of commitment of any structural adjustments in 2019-2020, the deviation from the medium-term objective continuing to place at a high level (about 2 pp of GDP).

It should be noted that, in the context of the declaration of the COVID-19 pandemic, from March 2020, the fiscal rules are suspended in order to allow the automatic stabilizers to operate and to allow the taking of measures to halt and combat the economic effects of the pandemic, the EC forwarded the April 6th, 2020 an address confirming the launch of the EDP by virtue of the fact that tax violations transposed by the LRFB and at national level - predate the pandemic, not being determined by this one. Thus, the reporting deadline of 15 September 2020 is maintained, stating that in the evaluation of effective actions in response to the EC Recommendation, will consider the economic impact and COVID-19 pandemic and the implications of activating the Stability Pact waiver clause and growth (PSC).

Most of the underdeveloped or emerging economies were forced to reach for aggressive/restrictive packages for fiscal consolidation, as a consequence of a decrease in the financing capacity, and, at the same time, the existence of major imbalances caused by adopting pro-cyclical fiscal policies in the economic expansion/boom period.

Same thing can be found in Romania, just as in many other countries, the main consequence of the **pro-cyclical** fiscal policy adopted in the period of economic expansion until 2008 was an overheating of the economy, which deepened the destabilizing of budget balances. This pro-cyclical character of the fiscal policies adopted by the decision makers also has another negative role, as it annuls the role and effect of the **automatic stabilizers**, meant to naturally balance the economy.

2. Literature Review

The influence of fiscal policy on price determination can be better observed in fiscal dominance regimes, like the case of Romania.
A fundamental article for dealing with fiscal indicators related to the business cycle, is that of Olivier Blanchard (1990).

Paul van den Noord (2000) argues in his article Van den Noord, P. (2000) "The Size and Role of Automatic Stabilizers in the 1990s and Beyond" by introducing an effect of "hysteresis" at unemployment level (the size of unemployment also depends on these alternations that the previous system went through).

Authors Kopits and Craig (1998) and more recently Koen, V. and P. van den Noord (2005), support this theory that the existence of a numerical threshold, in terms of the budget deficit, stimulates the use of temporary fiscal measures.

In the literature we can distinguish ***four methodologies*** used by the main international organizations, for determining the cyclically adjusted fiscal deficit. Three methodologies which largely follow the same standard procedure, which are proposed and used by the International Monetary Fund ***(IMF),*** the European Commission ***(EC)*** and by The Organization for Economic Cooperation and Development ***(OECD).*** Another methodology is the one developed and used by the European Central Bank ***(ECB).***

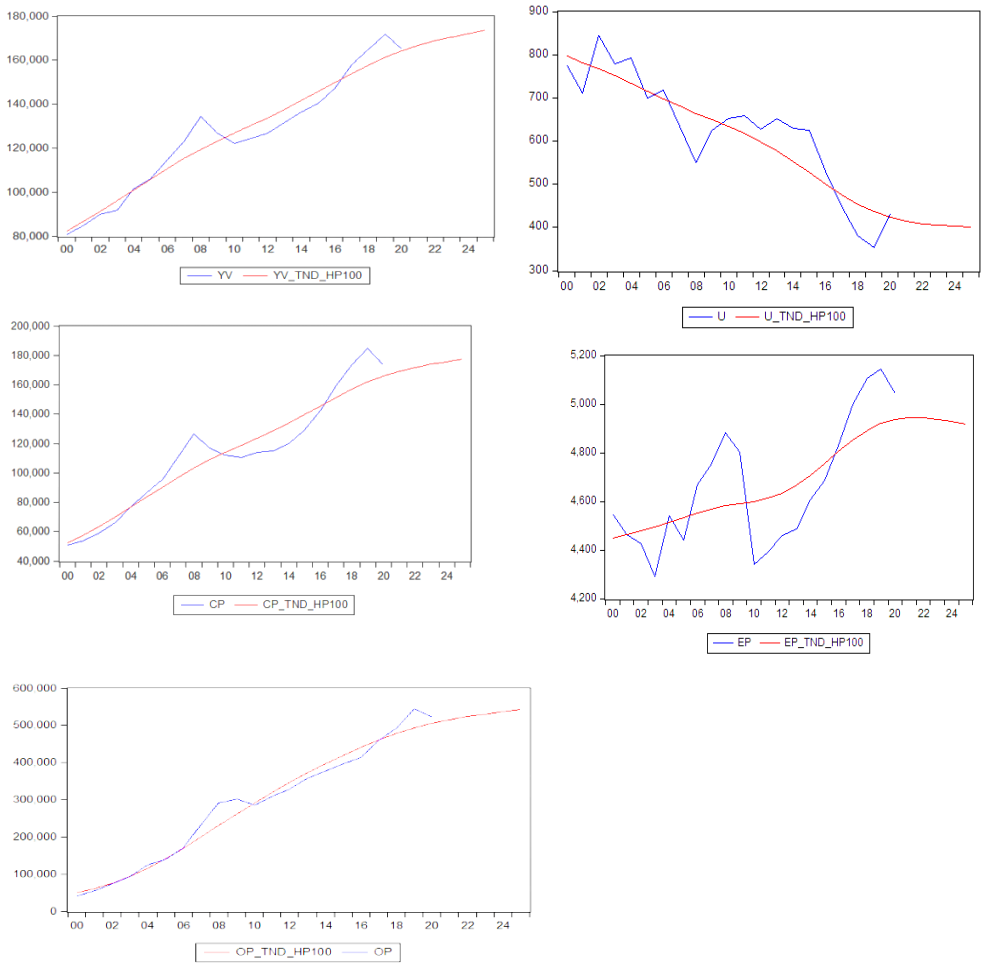
The main difference between the four methods used, is the way the equilibrium GDP is determined. Methods of achieving equilibrium GDP, range from determination on the basis of a production function (method proposed and used by the Commission and the Ministries of Finance of the countries that are required to produce Reports of Convergence or Stability, European Commission (2002)), when determined by static filter (Hodrick-Prescott used by the European Central Bank, Bouthevillain et. al (2001)) or combination of these (method used by the IMF, Robert Hagemann (1999)). Also, the OECD uses a structural VAR and statistical filters (Paul van der Noord (2000)), and the Central Bank of Canada estimates using the GMM method (Stephen Murchison and Janine Robbins (2003)).

Martin Larch and Alessandro Turrini (2009) argue that "the cyclically-adjusted budget balance (CAB) plays a key role in the fiscal surveillance framework of the Economic and Monetary Union".

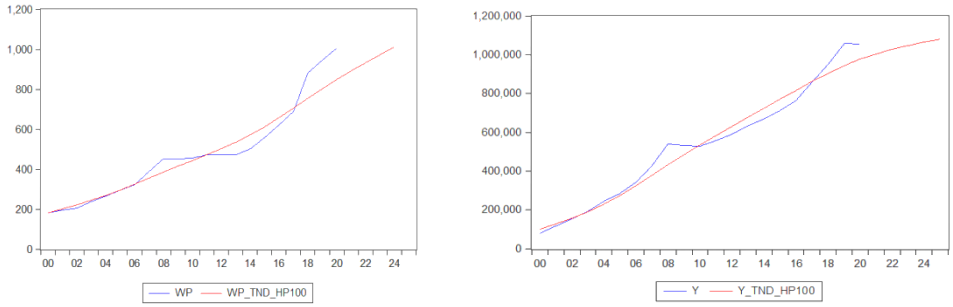
3. Structural budget balance in Romania

We analysed the cyclically adjusted structural budget balance, resulting in the difference between the actual deficit and its cyclical component. To determine the structural budget balance, we followed, on the one hand, the aggregate ECB methodology and, on the other hand, the disaggregated ECB methodology, better expressed by Bouthevillain et al (2001). To use both methods and to avoid the so-

called "endpoint problem", we predicted the macroeconomic bases using an autoregressive model AR(1), for the 2021-2025 sample, so that we can obtain undistorted results after applying the Hodrick-Prescott filter. All the budget elements are expressed in millions of lei and the number of employees and unemployed are expressed in thousands of persons. The following charts show the forecasted trend of the macroeconomic variables for the period 2021-2025, as follows: actual individual household consumption (cp), GDP in volume (yv), GDP at market prices (y), earnings average gross private sector wage (wp), number of private sector employees (ep) and number of unemployed (u), and operational surplus (op).



Source: authors own computations using Eviews 11 software.



Source: authors own computations using Eviews 11 software.

Figure 1. Forecasted trend of the macroeconomic variables 2021-2025

The aggregate methodology

To achieve the aggregate method, we calculated the budget elasticity by summing the aggregate elasticities of revenues and expenditures against the basic macroeconomic variables. Then, we calculated for each subcategory, its share in the higher category to which it belongs. These weights were aggregated with the elasticities obtained by the econometric method. In order to obtain the elasticity of the budget balance, we needed the following partial elasticities:

Table 1. Partial elasticities

Elasticity between	2020
Direct tax revenues on households – average salary in the private sector (salary fund)	0.85
Direct tax revenues on households – number employees in the private sector	0.85
Revenue from direct taxes on corporations – operating profit	1.1
Indirect tax revenues - individual consumption of households	0.85
Revenue from social contributions – average salary in the private sector * number of employees (salary fund)	0.82
Revenue from social contributions – number employees in the private sector	0.82
Number of unemployed - number of private sector employees	-0.13
Average salary in the private sector (salary fund) – GDP	1
Number of employees in the private sector – GDP	1
Operating surplus – GDP	1
Individual consumption of households – GDP	1
Number of unemployed – GDP	1

Source: authors own computations

These elasticities were calculated using the Vector Error Correction Model by estimates made following the rules of Johansen cointegration tests (most were made using only intercept, not trend) and by imposing restrictions.

The elasticity between the number of unemployed and the number of employees in the private sector was obtained by using the method of estimating the smallest squares, respecting all the tests that demonstrate the validity of the result. The case of the elasticity between the income from social contributions and the average salary or the number of employees in the private sector was different, as well as the case of the elasticity between the revenue from household tax and the salary fund, to which we also added a dummy variable. The elasticities were estimated using the least squares method, in which we introduced the social security income, the salary fund (average private salary * number of private employees) and a dummy variable meant to act for the pandemic year as well as the 2014Q3-2015Q4 period, since in November 2014 the CAS quota decreased by 5 percentage points, which lead to a distortion of revenue due to this measure. The validity of the estimate was confirmed by the testing of the residues, in which case, the null hypothesis of the ADF test was rejected, which claims that they are not stationary, being accepted the cointegration hypothesis (see Annex I).

These elasticities were recalculated (multiplied) to obtain the elasticity of each component of income and expenditure in relation to GDP. For example, for revenues the formula can be observed as follows, stating that also for expenditures the analogous can be used:

$\varepsilon_i^V = \epsilon_i^{macroj} * \epsilon_{macroj}^{GDP} * p_i^{VT}$ = the contribution of "*i*" type revenue to budgetary elasticity.

The results are presented in the table 2:

Table 2. Elasticities

Elasticity in relation to GDP	2020
Direct tax revenues on households – average salary in the private sector -> GDP	0.1125
Direct tax revenues on households – number employees in the private sector -> GDP	0.1125
Revenue from direct taxes on corporations/firms – operating profit -> GDP	0.0548
Indirect tax revenues - individual consumption of households -> GDP	0.2543
Revenue from social contributions – average salary in the private sector * number of employees (salary fund) -> GDP	0.1570
Revenue from social contributions – number employees in the private sector -> GDP	0.1570
Number of unemployed - number of private sector employees -> GDP	-0.0022

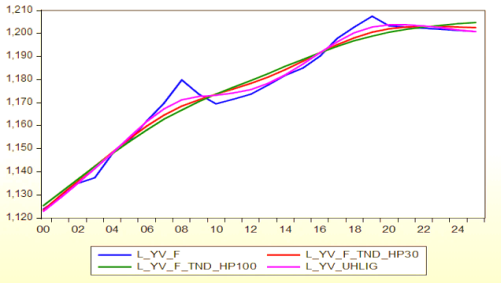
Source: authors own computations

Furthermore, the elasticity of the budget balance was obtained by adding the above elasticities and weighting them according to the share of the upper category, they belong to, in GDP, meaning revenues (33.20%) and expenditures (42.32%). Thus, we obtained, for 2020:

Semi-elasticity of budget balance with respect to output gap	0.3737

Source: authors own computations

We used the latest GDP data (in volume and value) and to obtain the cyclical component of the budget balance by aggregate method, we multiplied the GDP by the elasticity of the budget balance, initially calculated with the output gap GDP, obtained by applying the Hodrick-Prescott filter. This filter was applied twice, using two values of the lambda coefficient 30 (ECB paper proposal) and 100(EC proposal). The graph of the components of this GDP output gap can be followed below: real GDP (yv) (taken from public data for the period 2000-2020 and forecasted for the period 2021-2025), GDP after applying the Hodrick-Prescott filter with lambda 30 (yv_t30) and GDP after applying the Hodrick-Prescott filter with lambda 100 (yv_t100), and lambda 6.5 (l_yv_uhlig) by Ravn and Uhlig frequency rule of power 4, in comparison to HP, which is 2. Some authors have also argued in favour of smaller values of λ for annual data. Furthermore, according to Ravn and Uhlig (2001), a value of 1600 for quarterly data corresponds to a value of 6 to 8 for annual data:

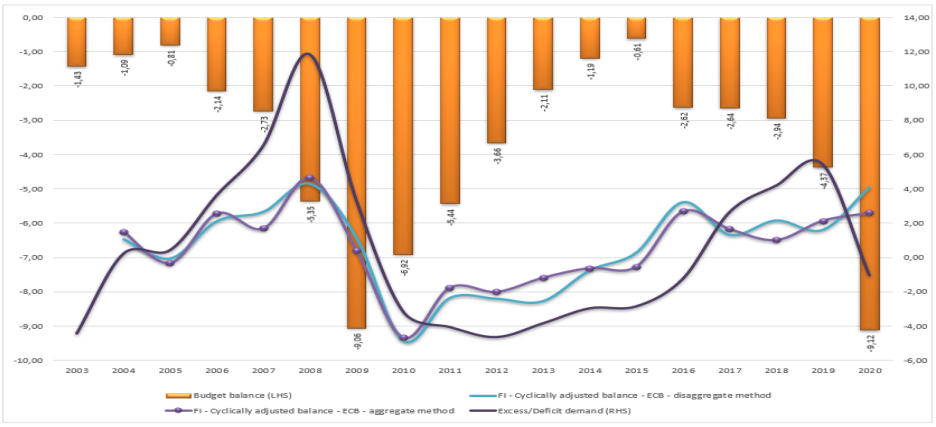


Source: authors own computations

Figure 2. Components of this GDP output gap

In the graph we can see that in the period before the global financial crisis (2004-2008) the budget balance remains considerably lower than the cyclically adjusted hips obtained by aggregate method, and in the post-crisis period the budget balance is higher than the cyclically-adjusted one, thus highlighting the pro-cyclicality of Romania's fiscal policy.

By the difference between the potential GDP and the actual GDP we obtain the excess / deficit of demand. Thus, we graphically represented the excess demand, the fiscal impulse, and the budget balance:

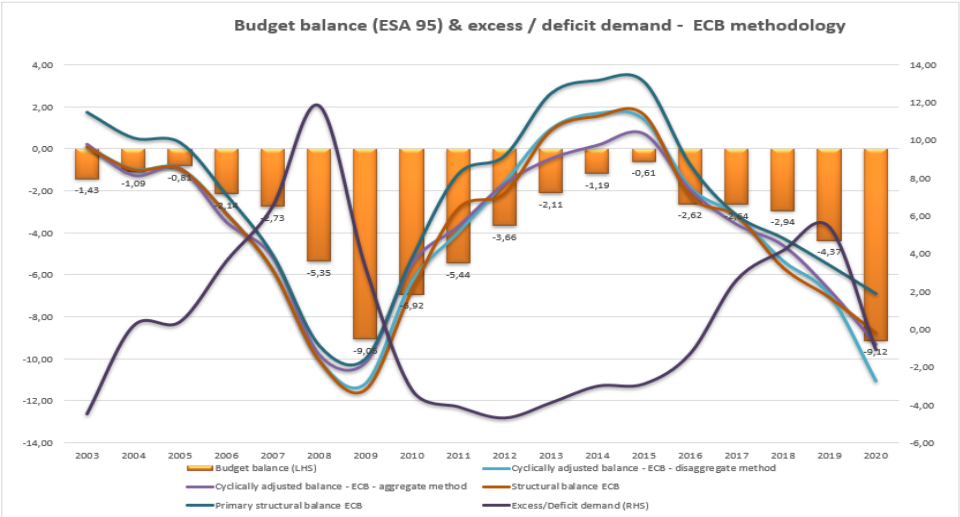


Source: authors own computations

Figure 3. Excess demand, fiscal impulse, and budget balance

The conclusion of the pro-cyclicality of fiscal policy can be seen in the figure 3, in which the curve of fiscal impulses follows the trend of excess demand.
In order to compare the results obtained with official data, we took statistics from the spring 2020 report of the European Commission. The results are close, in particular, in terms of the aggregate method with the application of the lambda smoothing coefficient 100 for the Hodrick-Prescott filter.

Thus, we obtained two cyclical components of the budget balance, by aggregated method, for the period 2000-2020, one being obtained using the Hodrick Prescott filter with lambda 30, and the second with lambda 100. The values of the calculated cyclical components can be seen in the Figure 4:



Source: authors own computations

Figure 4. Budget balance

In the period 2006-2015, Romania practiced a strongly pro-cyclical fiscal policy, by stimulating needless but strongly and counterproductive the economy when it was in expansion (2006-2008) and decelerating it when it was in recession (2010-2015), contributing to the augmentation of cycle fluctuations (see Figure 4). Essentially, the pro-cyclical fiscal-budgetary policy during period of the pre-crisis when the economy was in ascension, has exhausted the space needed to stimulate the economy during the recession. Therefore, the automatic action that could even out the cyclic deficit (called automatic stabilizers) was harshly cut off by pro-cyclical and discretionary policy.

Disaggregated method

The second method by which we calculated the cyclically-adjusted budget balance is the method proposed and used by the European Central Bank, the disaggregated method. We applied this method according to the steps presented by Bouthevillain et al (2001), in a study published at the ECB.

The disaggregated method involves calculating the cyclical components of each of the following variables: income from direct taxes on private households, social contributions paid by the private sector, direct taxes on operating surplus, indirect taxes and unemployment expenses. These cyclical components, for each year, were calculated according to the following rule:

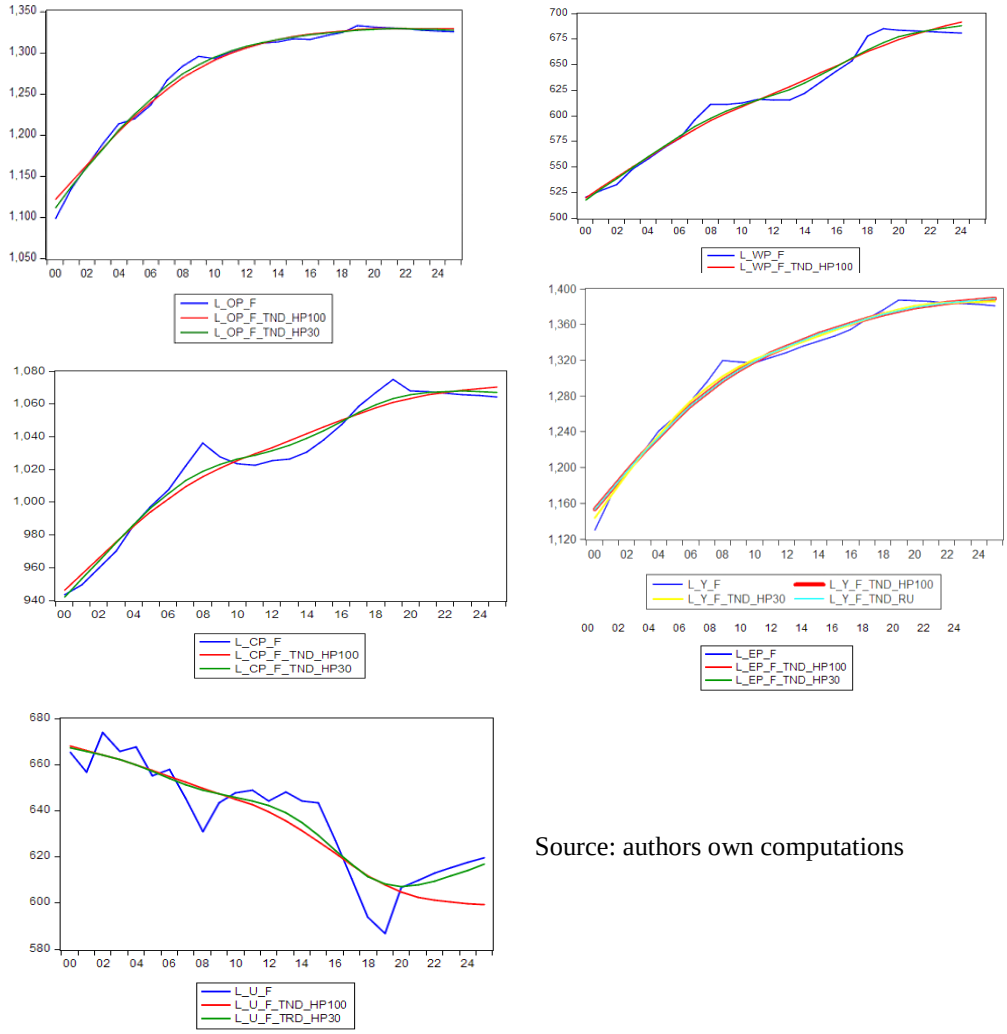
$$\textit{Cyclical component}^{i} = VB^{i} * \left[\sum_{j=1}^{n} \left(\varepsilon_{j}^{i} * ln \frac{VM_j}{VM_j^*} \right) \right]$$, where:

VB^i = *"i"* budget element value
$\varepsilon_j{}^i$ = elasticity of the budgetary element *"i"* in relation to the *"j"* macroeconomic variable
VM_j = the *"j"* macroeconomic variable value (with which the budget element is considered to be related)
VM_j*= the potential value of the *"j"* macroeconomic variable

Therefore, each cyclical component was obtained by multiplying the value of a category of income or expenditure by the sum of the product between its elasticity to the basic macroeconomic variables (only indirect tax revenues and unemployment expenditures have only a fixed macroeconomic basis, the others having two) and the growth rate of each macroeconomic component.

The potential values of the macroeconomic variables used in this disaggregated method were calculated by applying the Hodrick-Prescott filter. As we presented at the beginning of the case study, in order to avoid the "endpoint" problem in the application of the respective filter, the variables were predicted for the 2016-2020 sample, using an autoregressive AR model (1). And in the disaggregated method we used the Hodrick-Prescott filter in two variants, once with

the lambda coefficient 30 and the second time the lambda coefficient was 100. These macroeconomic variables used can be seen in Figure 5:



Source: authors own computations

Figure 5. Potential values of the macroeconomic variables using Hodrick-Prescott filter

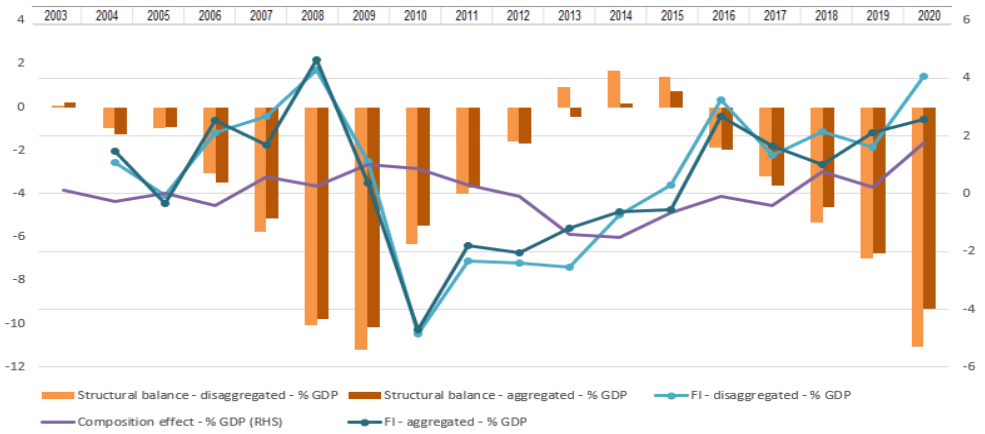
The links between the chosen budgetary elements and the macroeconomic variables, as well as the elasticities were taken from the article by C. Buthevillain et al. (2001) and from the published annexes, considering the specificities of the Romanian fiscal rules and verified with taken from the aggregate method). They can be tracked as in table 3:

Table 3. Links between the chosen budgetary elements and the macroeconomic variables

Budgetary element	Macroeconomic variable	Elasticity
Income from direct taxes on households	Average gross salary in the private sector	1
	Number of employees in the private sector	1
Income from social contributions paid in the private sector	Average gross salary in the private sector	0.82
	Number of employees in the private sector	0.82
Revenue from direct taxes on operating profit	GDP (volume)	1
Revenues from indirect taxes	Private consumption	0.85
Unemployment expenses	Number of unemployed	1

Source: authors own computations

By subtracting the cyclical component from the budget balance, we obtain the cyclically-adjusted budget balance by the disaggregated method. Figure 6 is a comparison of the structural budget balance calculated both with the aggregate method and the disaggregated method, the fiscal impulse and of the composition effect, as percentage of GDP. On the left side scale, the structural budget balance is represented, and on the right-hand scale, the fiscal impulse together with the composition effect. As we can see, mostly the composition effect does not surpass 1%, this happening only in 2004 due to the VAT reduction from 24% to 19%, and in the 2020 pandemic year due to the decrease in consumption.



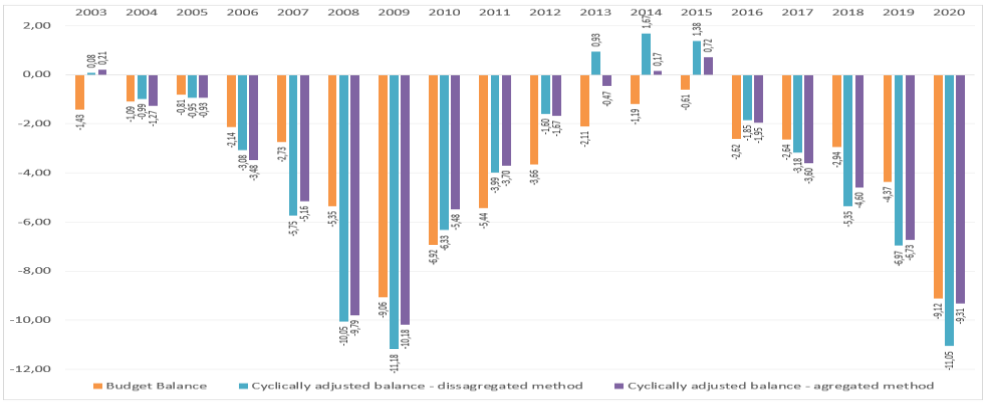
Source: authors own computations

Figure 6. Comparison of the structural budget balance, fiscal impulse and composition effect, as percentage of GDP

That in the case of the aggregate method, we notice that the budget balance has a lower value than cyclically-adjusted balances in the pre-crisis period, while in

the post-crisis period the budget balance exceeds them, which symbolizes the pro-cyclical fiscal policy in Romania.

Therefore, a centralized statement of cyclically adjusted budget balances by the two methods can be seen in Figure 7:



Source: authors own computations

Figure 7. Cyclically adjusted budget balances

Starting with 2003, Romania went through a period in which the actual GDP exceeded the potential GDP (inflation gap or positive output gap), the effect of automatic stabilizers being positive and culminating with a maximum of 2.6% of GDP, in 2008, when Romania recorded an inflation gap of just over 8% of potential GDP. In the Czech Republic, the most intense positive impact of automatic stabilizers was similar to that in Romania, of 2.5% of GDP in 2007, in Hungary of 2% of GDP in 2006, while in Poland it was slightly lower, of 1.4% of GDP (in 2007). After the crisis, with production declining below the potential level, the impact of automatic stabilizers became negative, with its intensity generally lower than in the pre-crisis period.

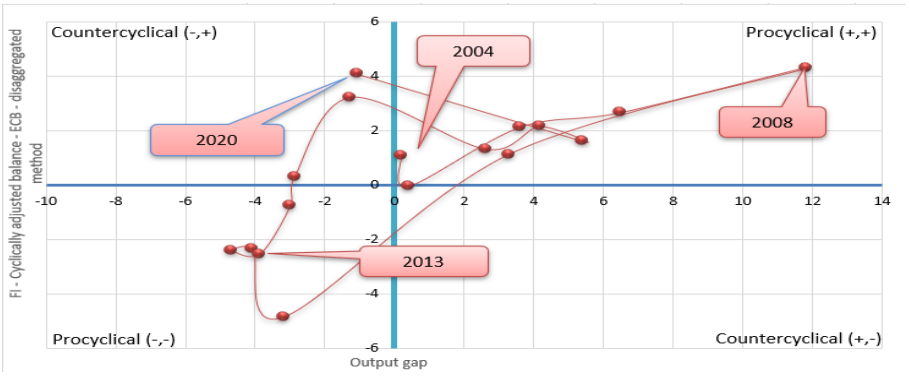


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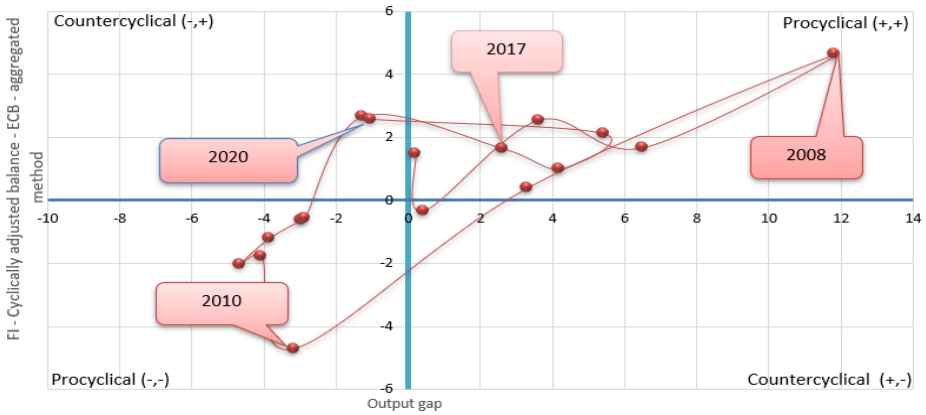
Figure 8. Cyclically adjusted balance – disaggregated method



Source: own computation

Figure 9. Cyclically adjusted balance –aggregated method

4. Conclusions

The risks related to the evolution of public debt appear all the more obvious in the context in which the beginning of 2020 marked the manifestation of a large economic crisis, generated by the partial closure of economies as a result of measures implemented internationally to combat the SARS-CoV-2 pandemic.

Even in the absence of up-to-date estimates of interest rate developments, the severe worsening of the macroeconomic framework of 2020 is likely to lead to a sharp reversal of the gap between growth and the cost of financing, with the adverse effect of the recession being exacerbated by the deflator GDP that will increase the real cost of financing public debt. To this effect is added the unfavourable impact of the rapid increase in the budget deficit, accentuated by the cost of measures to mitigate the economic and social effects of the pandemic. However, the widening of the deficit is projected to continue in 2021, even in the conditions of a recovery of economic growth, due to the effects of the application of the current calendar of pension increases, as well as the increase of allowances (January 1st, 2021).

Based on the updated EC projections for the period 2020-2021, as well as the estimates of the MFF on the evolution of public debt interest expenditure (made under the SFB 2020-2022), a forecast of the share of public debt in GDP was made during for the next 2 years, considering that the stock-flow adjustment will be equal to 0 on the forecast horizon. Thus, the possibility is foreseen that, under the impact of the economic crisis caused by the COVID-19 pandemic, doubled by the budgetary impact of the current pension law enforcement calendar, Romania's public debt will increase rapidly over the next 2 years (a similar evolution was recorded and in the case of the previous crisis of 2008-2009), approaching significantly at the end of 2021 the ceiling of 60% of GDP set at European level.

Romania is characterized by a ***redistribution function*** of public finance that is significantly lower, in both scale and efficiency, than that in advanced economies, considering the distribution branch, responsible in Musgrave's (1960) scheme. Also, the computed semi-elasticity, of only 0.37 underline the fact that this represents only half of what an EU developed country has.

The ***stabilization function*** from 2004 to 2019 was unaligned with the business cycle and had a pro-cyclical feature, as the positive fiscal impulse was applied at a time of above-potential economic growth, und underlines the fact that more anti-cyclical policies have to be applied. The pro-cyclical fiscal policy of Romania can also be observed in the estimations of this paper.

The evidences show a small efficiency also on the ***allocation function***.

The general **functions of public finance** in Romania operate entirely out of phase with the society's demands, which diminishes the economic growth, the efficient use of funds, the quality and quantity of public goods and services allocated for the citizens, and social cohesion and equilibrium. This was also underlined in the study of Georgescu et al. (2020).

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Annex I - Tables presenting the OLS equations and the Augmented Dickey/Fuller unit root test results for the Romanian variables

Augmented Dickey-Fuller Unit Root Test on RESID_RHT

Null Hypothesis: RESID_RHT has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.522569	0.0097
Test critical values:	1% level	-3.513344	
	5% level	-2.897678	
	10% level	-2.586103	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID_RHT)
Method: Least Squares
Date: 03/20/21 Time: 14:44
Sample (adjusted): 2000Q3 2020Q3
Included observations: 81 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID_RHT(-1)	-0.383620	0.108903	-3.522569	0.0007
D(RESID_RHT(-1))	-0.317043	0.106743	-2.970147	0.0040
C	0.187766	0.696134	0.269727	0.7881

R-squared	0.348199	Mean dependent var	0.026100
Adjusted R-squared	0.331486	S.D. dependent var	7.656916
S.E. of regression	6.260503	Akaike info criterion	6.542732
Sum squared resid	3057.124	Schwarz criterion	6.631415
Log likelihood	-261.9806	Hannan-Quinn criter.	6.578313
F-statistic	20.83418	Durbin-Watson stat	2.103018
Prob(F-statistic)	0.000000		

Dependent Variable: L_RHT
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 03/20/21 Time: 14:28
Sample: 2000Q1 2020Q3
Included observations: 83
Convergence achieved after 14 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-388.4288	24.74022	-15.70030	0.0000
L_WP+L_EP	0.859235	0.015782	54.44321	0.0000
AR(1)	0.426411	0.092380	4.615859	0.0000
SIGMASQ	54.02462	6.851757	7.884784	0.0000

R-squared	0.989173	Mean dependent var	970.1696
Adjusted R-squared	0.988762	S.D. dependent var	71.06920
S.E. of regression	7.533926	Akaike info criterion	6.926120
Sum squared resid	4404.044	Schwarz criterion	7.042691
Log likelihood	-283.4340	Hannan-Quinn criter.	6.972952
F-statistic	2405.942	Durbin-Watson stat	2.256717
Prob(F-statistic)	0.000000		

Dependent Variable: L_RHT
Method: Least Squares
Date: 03/20/21 Time: 14:40
Sample (adjusted): 2000Q1 2020Q3
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-372.8179	16.88470	-22.08022	0.0000
L_WP+L_EP	0.850237	0.010612	80.11670	0.0000
DUMMY_RHT	-10.04354	2.658103	-3.778461	0.0003

R-squared	0.988806	Mean dependent var	970.1696
Adjusted R-squared	0.988527	S.D. dependent var	71.06920
S.E. of regression	7.612501	Akaike info criterion	6.932936
Sum squared resid	4636.013	Schwarz criterion	7.020364
Log likelihood	-284.7168	Hannan-Quinn criter.	6.968059
F-statistic	3533.486	Durbin-Watson stat	1.011790
Prob(F-statistic)	0.000000		

Annex II - Vector Error Correction Estimates & Johansen Cointegration tests

Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 03/20/21 Time: 14:48
Sample (adjusted): 2000Q4 2019Q4
Included observations: 77 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:
B(1,1)=1, B(1,2)=-0.85
Convergence achieved after 1 iterations.
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 1):
Chi-square(1) 2.472986
Probability 0.115818

Cointegrating Eq:	CointEq1
L_RHT(-1)	1.000000
L_WP(-1)+L_EP(-1)	-0.850000
C	372.8128

Error Correction:	D(L_RHT)	D(L_WP+L_EP)
CointEq1	-0.324609	0.049965
	(0.12194)	(0.06365)
	[-2.66213]	[0.78499]
D(L_RHT(-1))	-0.347823	0.153830
	(0.12694)	(0.06627)
	[-2.73997]	[2.32141]
D(L_RHT(-2))	-0.123366	0.195537
	(0.11265)	(0.05881)
	[-1.09508]	[3.32510]
D(L_RHT(-2))	-0.123366	0.195537
	(0.11265)	(0.05881)
	[-1.09508]	[3.32510]
D(L_WP(-1)+L_EP(-1))	0.008422	0.276209
	(0.21803)	(0.11381)
	[0.03863]	[2.42684]
D(L_WP(-2)+L_EP(-2))	0.310545	0.154150
	(0.21421)	(0.11182)
	[1.44974]	[1.37859]
C	3.671142	0.951128
	(1.13788)	(0.59398)
	[3.22629]	[1.60128]
R-squared	0.349364	0.395485
Adj. R-squared	0.303545	0.352914
Sum sq. resids	2474.314	674.2266
S.E. equation	5.903345	3.081582
F-statistic	7.624803	9.289915
Log likelihood	-242.8499	-192.7941
Akaike AIC	6.463634	5.163482
Schwarz SC	6.646268	5.346116
Mean dependent	3.355554	3.935832
S.D. dependent	7.073780	3.830828
Determinant resid covariance (dof adj.)		289.4575
Determinant resid covariance		246.1048
Log likelihood		-430.4882
Akaike information criterion		11.54515
Schwarz criterion		11.97129
Number of coefficients		14

Johansen Cointegration Test Summary

Date: 03/14/21 Time: 18:04
Sample: 2000Q1 2025Q1
Included observations: 77
Series: L_WP+L_EP L_OP L_Y
Lags interval: 1 to 5

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	3	1	1	1	0
Max-Eig	0	1	1	1	0

Johansen Cointegration Test Summary

Date: 03/14/21 Time: 18:09
Sample: 2000Q1 2025Q1
Included observations: 82
Series: L_IT L_AIC
Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	1	2	1	2
Max-Eig	1	1	2	1	0

*Critical values based on MacKinnon-Haug-Michelis (1999)

Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 03/20/21 Time: 16:07
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:
B(1,1)=1, B(1,2)=-0.85
Convergence achieved after 1 iterations.
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 1):
Chi-square(1) 6.431498
Probability 0.011211

Cointegrating Eq:	CointEq1
L_IT(-1)	1.000000
L_AIC(-1)	-0.850000
C	10.92168

Error Correction:	D(L_IT)	D(L_AIC)
CointEq1	-0.302543	-0.077522
	(0.07582)	(0.03156)
	[-3.99053]	[-2.45603]
D(L_IT(-1))	-0.552039	0.036891
	(0.11942)	(0.04972)
	[-4.62277]	[0.74203]
D(L_IT(-2))	-0.116658	0.082584
	(0.11436)	(0.04761)
	[-1.02010]	[1.73456]
D(L_AIC(-1))	0.227653	0.114911
	(0.29661)	(0.12349)