1. MEDIUM AND LONG TERM CONVERGENCE IN EU

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Abstract

The dynamics and stages of Romania's economic development until 2050 will be included within at least two scenarios based on the integration of Romanian economy in European Union and on the evolution of internal factors. The development scenarios are focused on the position of Romania within EU, considering both the evolution of the gross domestic product and the evolution of real convergence. The forecast scenarios are based on the increase in the share of the urban population and modernization of economic structures, with a more important contribution in the gross value added or in the gross domestic product from the tertiary sector, from digitalization or from industries based on renewable energy and climate change objectives.

We apply a moving target model for the long-term forecast of income per capita based on the decomposition of variables used for calculating GDP per capita expressed in PPP dollars or in euros PPS. For a longer period, in a scenario of deepening integration into the EU and significant structural changes in the economy, Romania could rank 14th in the EU27 in terms of income per inhabitant.

***Keywords**: economic development, convergence, growth, economic forecast*

***JEL codes**: O10, Q40, Q47*

1. Introduction

Under the coordination of the leadership of the Romanian Academy, the final study of the Development Strategy will present the vision of the situation that Romania should reach from an economic point of view in the year 2050 and the position it should occupy in Europe in this horizon of time.

After describing the main premises and hypotheses, based on the analysis of the long-term European context and the possibilities of deepening the integration of the Romanian economy in the EU and on some considerations regarding the long-term evolution of internal factors, an attempt will be made to establish some short-term targets (up to the period 2023-2030), medium term (until 2040) and long term (until 2050). Also, at least two scenarios will be developed that describe in quantitative and qualitative terms the dynamics and stages of Romania's economic development up to the horizon of 2050.

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Last period, despite of so unpredictable events at the global level (global financial crisis, pandemic, climate changes, the war in Ukraine and its impact especially on energy consumption etc.), there are some publications trying to describe the future evolution of the society and of the economy (many of them elaborated by international organisations such as European Commission, IMF, OECD, UN, etc., but also by Romanian authors).

2. Methodological clarifications

The development scenarios are focused on illustrating the place that Romania will be able to occupy within the European Union, both from the perspective of its global potential, namely the value of the gross domestic product, and from the point of view of real convergence, measured by the product gap gross domestic product per inhabitant in Romania compared to the EU average.

In the case of real convergence, the expression of GDP and other macroeconomic variables must be done at the so-called purchasing power parity, expressed globally (by international bodies such as the World Bank, the International Monetary Fund, the UN and the OECD) through PPP (Purchasing Power Parity) international dollars and at EU level through PPS (Purchasing Power Standard). PPS is the technical term used by Eurostat for the common currency (so euro PPS) in which the national accounts aggregates are expressed.

The forecast scenarios built by us foresee the continuation of the increase in the share of the urban population and the modernization of economic structures, by increasing the contribution in the employed population and in the gross value added (GVA) or in the GDP of the tertiary sector and of the performing and creative industries, of digitization and robotization, of branches that mainly use renewable energy and those that do not lead to climate change.

The economic and social development scenarios of Romania at the horizon of 2050 will differ depending on the degree of integration of Romania into the EU, but also on the assumptions considered in the short and medium term, dictated by the programmatic community documents for the current budget horizon and PNRR (respectively the end of this decade).

Decisive for the achievement of a positive dynamic of Romania in terms of convergence in the EU, in the period with the time horizon of 2050, will be the promotion and stimulation of some processes and phenomena in the economy or in areas with a major impact on it through the implementation of appropriate policies, such as: increasing the birth rate, stopping emigration and balancing the demographic balance; stimulating investments in areas of high efficiency, including foreign ones; balancing the trade balance, mainly by encouraging exports and reducing the share of food imports; increasing the weight in the budget of vital fields for the future development of Romania, such as health, education and research; rigorous monitoring to achieve sustainable dynamics in terms of public debt and budget deficits, etc.

The long-term trends, on which economic theory is mainly based, especially that at the macroeconomic level, will be analysed in detail. Based on them, we will be able to separate the main realistic directions, having both theoretical and practical support, which should be followed by the implementation of appropriate economic policies. Thus, the most general economic law on which any forecast or development strategy should be based is that which derives from the strong correlation between economic convergence (both worldwide and in the European Union) and economic growth. This is a consequence of the general theory of complex systems, having already been demonstrated in the case of the global economy system and the EU system respectively.

In a simple expression, the general theory says that as the level of economic development increases (that is, the average income per inhabitant of the economic system, as a measure of its performance, increases) the degree of concentration within it increases. The basic indicator

on which the process of convergence/divergence between the components of the system can be evaluated (countries in the case of the world economy or the EU) is the dynamics of the coefficient of variation, whose long-term value decreases in the case of convergence and increases in the case of divergence. Its absolute value at a given moment shows the degree of concentration, a high value signifying a large dispersion between the individual incomes of the system components (states), and a low value small discrepancy between them.

At the individual level of countries, this law of convergence translates into the fact that, for states with per capita income lower than the average value of the economic system which they are a part of (the world economy, respectively the EU), the annual rate of growth in the absolute volume of income will be higher than the average rate at the level of the system which they are a part of. Conversely, for those with a higher per capita income than the average of the system they belong to, the annual growth rate of their income will be lower than the average rate of the system they belong to. In this way, the law is actually expressing that in the long term the process of convergence (of the per capita income of the states towards the community or global average) is an objective one (especially since in the case of the EU the convergence between the member states in terms of per capita income was one of the reasons for its formation, and the convergence program, including in the regional profile, is a priority).

Such economic laws, also empirically demonstrated, led us to the idea of building an economic growth forecast model, on which to base the long-term economic development strategy, similar to one with a moving ballistic target. In our case, the moving target is the EU average value of income per inhabitant, and the "projectile", which in time approaches it (converges) is represented by the income per inhabitant of a certain state, in this case Romania. Based on this moving target model it is shown that in the distribution of states by the ratio (g%) of a country's per capita income (y) to its EU average value (yM), i.e., g% = y / yM, can be distinguished two areas:

- Z1 - The area of states below the EU average for which

$$g\%_{i,t-1} < 100 \qquad where \qquad \mu_{i,t} = y_{i,t} / y_{i,t-1} > \mu M_{t-1}$$

and respectively

- Z2 - Area of states above the EU average for which

$$g\%_{i,t-1} > 100 \qquad where \quad \mu_{i,t} = y_{i,t} / y_{i,t-1} < \mu M_{t-1}$$

μ being the annual index of growth of income per inhabitant in EU member states, μM – the annual index of growth of average income per inhabitant at EU level, i – EU member states (i=1,..., 27), and t and t-1 two consecutive years (t=1995,..., 2022 for the analysis period and respectively tp=2023,...,2028 for the medium-term forecast period). Schematically, the graph of the growth index of income per inhabitant in the process of convergence is reproduced by us in Figure 1.

Depending on the available data, **the moving target model** that we apply for the long-term forecast of per capita income must necessarily start from the decomposition of the factors (variables) involved in the formula that calculates the GDP per capita expressed in PPP dollars or in euros PPS. Bearing in mind that among the data published by the World Bank (but also by Eurostat) is the annual pace (or annual rate) of GDP growth in the national currency of each state (National currency), we will have to consider a series of other macroeconomic variables (statistical indicators).

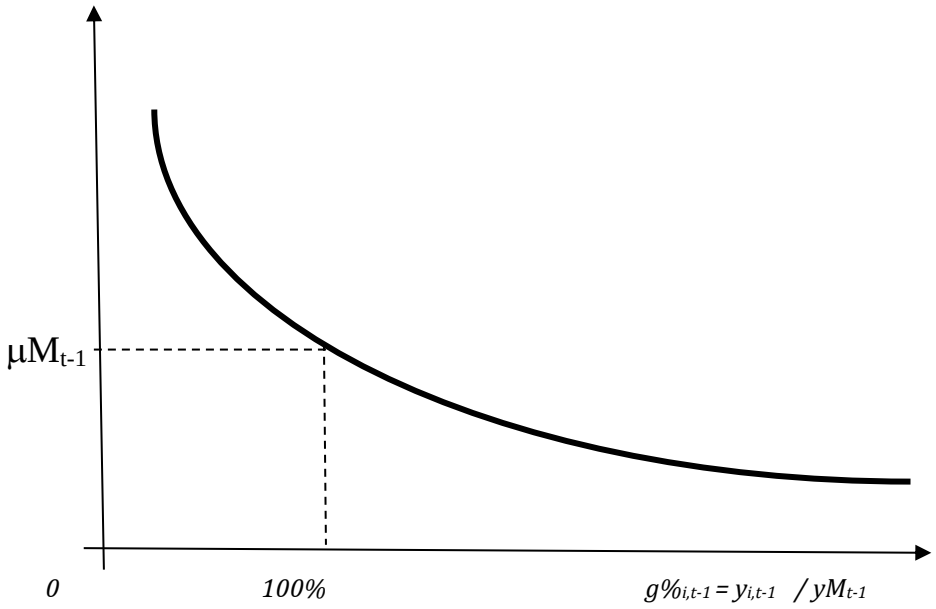
Thus, in order to reach, for example, the analysis and forecast of the dynamics of income per inhabitant in international dollars PPP current prices (main indicator published annually by the WB and within the IMF forecasts) it must be made clear that this comes from reporting the GDP to the population (another variable, which, however, comes from national statistics and the

forecast of the UN population division), and its growth rate is obtained by the relation r = μ - 1 (or percentage r% = μ% - 100).

At the same time, the absolute GDP value at PPP (or at PPS), YPPP (or YPPS), comes from the value in dollars, current prices, Y$, multiplied by a coefficient, expressed as a ratio between the two variables (YPPP/Y$). The trajectory of this ratio is similar to the one in figure 1, namely for the states placed, in terms of per capita income, to the left of the average value globally or as the case may be in the EU (ie for y < yM or g% < 100), the coefficient will be smaller than unity, and for those placed to the right of the average value (y > yM or g% > 100) it will be higher than unity.

$$\mu_{i,t} = y_{i,t} / y_{i,t-1}$$

Figure 1.



In turn, the income in current dollars (or in the case of the EU in current euros) comes by dividing the GDP in the national currency by the exchange rate, in the case of Romania the relationship is Y$ = Ylei / exchange rate lei/dollar or Yeuro = Ylei / exchange rate lei/euro. Next, the GDP in lei current prices, Ylei, must be expressed in constant prices (comparable to those of the previous year), i.e. Ypct = Ylei / Ip (where Ip is the price index calculated on the basis of the GDP deflator. Only on the basis of this indicator, Ypct, compared to the previous year's income, the GDP growth rate is obtained in the national currency, i.e. in the case of Romania, rYpct = μYpct - 1 (or percentage rYpct% = μYpct% - 100). The value of this indicator is the one that appears in all official statistics (national and international) as the pace (or rate) of economic growth in annual income (or annual GDP).

We specify that based on these assumptions we have formulated a model for optimizing the GDP trajectory (respectively its pace), according to two criteria: the first requires that the value of the total GDP estimated at the level of the entire group of countries (regions) for the entire period considered to be equal to the real one actually recorded (ie ΣΣYe = ΣΣY); the second assumes

that the total GDP estimated at the level of the entire group of countries (regions) for the last year of the period is equal to the real one actually registered (ie $\Sigma Ye = \Sigma Y$). We mention that through numerical methods we managed to solve an iterative version of the convergence model with a moving target for the analysed period. Also, for the forecast calculations, we used other solid correlations demonstrated empirically, both at the level of the global economy and the EU, such as the fundamental one between the share of investments in GDP and economic growth, that between the ratio of GDP in PPP / GDP in dollars current prices and economic growth (or, for the EU, between the ratio of GDP in PPS / GDP in euros current prices and economic growth) etc.

3. Targets until the end of the third decade of the century

In the medium term, Romania is engaged, like all European economies, in the broad process of macroeconomic sustainability and, on this basis, of achieving the budget exercise until 2028 and the PNRR objectives.

The last few years have represented for the whole world and especially for the European Union a period of extensive and unforeseen negative shocks, generated, in chronological order, by the prolongation of the global financial crisis at the end of the first decade of the century, by the 2020-2022 pandemic, by the war in Ukraine and the unprecedented energy and food crisis triggered by it, by the increasing degree of political instability and insecurity.

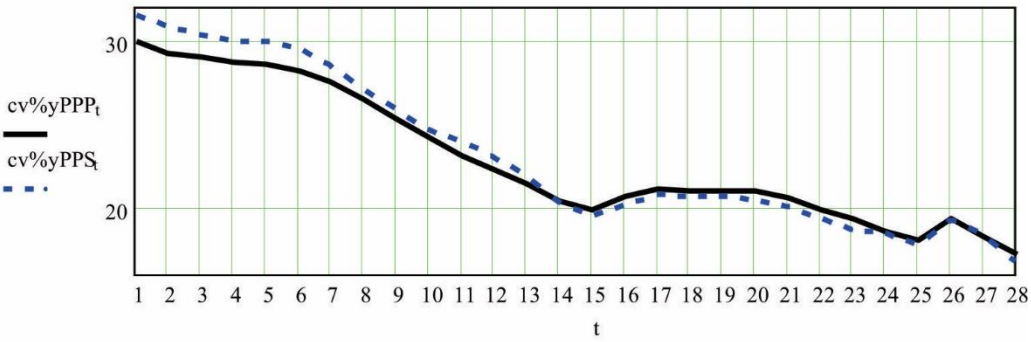
Also, the continuation of the transition to "green" energy and the reduction of the impact on climate change, development directions promoted by the EU even before the pandemic and the war in Ukraine, affected most states, leading either to a setback of the economy or to a severe reduction of the growth rate.

In the EU, the trend of real convergence (expressed by the dynamics of the value of the coefficient of variation, cv), although it was slowed down, continued, according to the graphs in Figure 2 (the black trajectory being in PPP, and the blue one in PPS, both for the period 1995-2022). Convergence between the EU states, i.e. the decrease in the value of the coefficient of variation, cv%, both for the case of expressing in PPP dollars and respectively in euros PPS (from 30.0% and 31.6% respectively in 1995, to 17.2% and respectively 16.7% in 2022) is in a close inverse relationship with the income per inhabitant (expressed in international dollars PPP and respectively in euros PPS), the correlation coefficient between the two variables being at the level of the entire considered period of -0.931 and respectively -0.956 (the values marked below the graph in figure 2, where on the horizontal axis the years are marked from 1=1995 to 28=2022).

In the case of expressing income in international PPP dollars, in the EU the real convergence trend, although somewhat slowed down, will continue, according to the graphs in Figure 3 (the black trajectory being the trajectory from 1995-2022, and the blue one, according to the data estimated by the IMF in its report from April 2023), until the 2028 horizon.

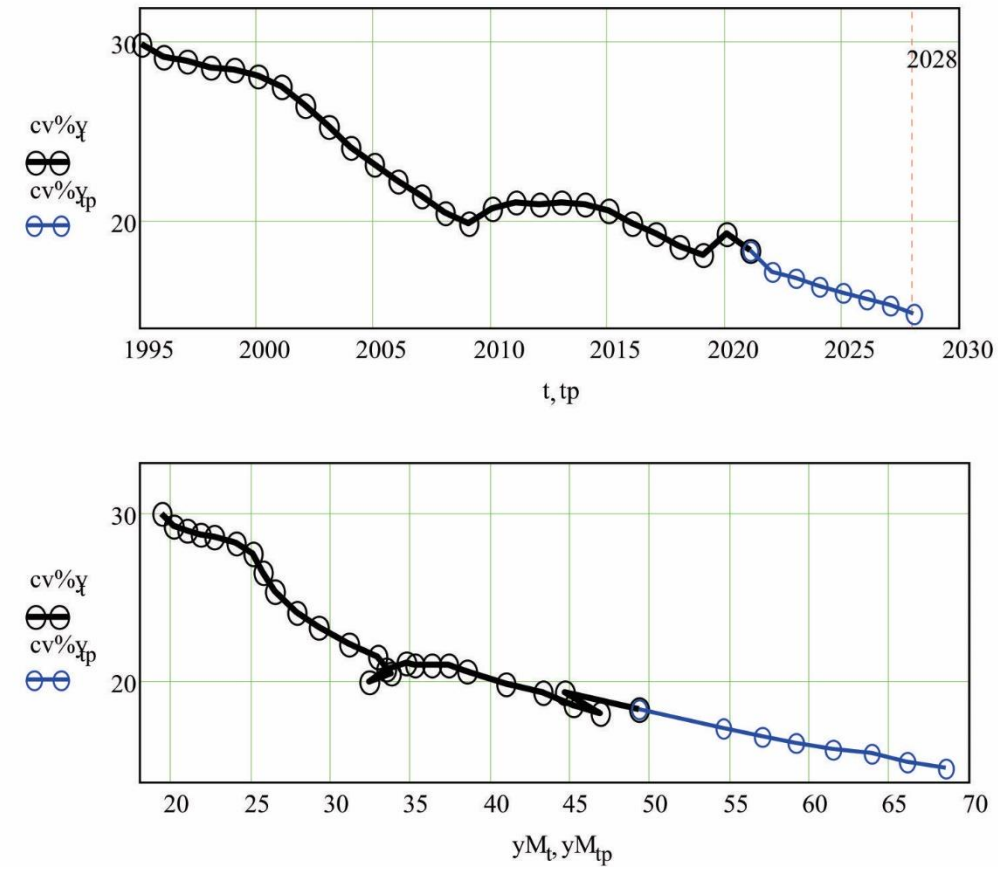
Convergence between EU states (the decrease in the value of the coefficient of variation, cv%, from 30.0% in 1995 to only 14.8% in 2028, cf. IMF) is in a close inverse relationship with income per inhabitant (in international dollars PPP, current prices), the correlation coefficient between the two variables being at the level of the entire period considered (1995-2028) of -0.928. To illustrate this strong negative correlation, in the graph at the bottom of this figure, time (years t – for the past period and tp – for the future period, respectively) was replaced by the value of per capita income in thousands of PPP dollars.

Figure 2.



corr(cv%yPPP, yMPPP) = −0.931 corr(cv%yPPS, yMPPS) = −0.956

Figure 3.



Convergence in the EU and Romania's position

According to specialist studies, the Gross Domestic Product per inhabitant, expressed at purchasing power parity (either euro PPS or PPP dollars) is used as the basic indicator for the analysis of the real convergence process at the macroeconomic level. Based on detailed analyses of the economic structures and the behaviours of the macroeconomic systems, we grouped the EU states into three conventional groups:

- Eastern states (EU11E - Bulgaria, Czech Republic, Croatia, Estonia, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia and Hungary),
- Southern states (EU6S - Cyprus, Greece, Italy, Malta, Portugal, and Spain) and
- North-Western states (EU10NV - Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands and Sweden).

Since 1995, there are comparable data for all EU states in the case of basic macroeconomic indicators. Based on the graph presented in figure 4, the analysis of the dynamics of GDP per inhabitant expressed in international dollars PPP, relative to the EU27 average (expressed as a percentage, g%), in the period 1995-2021 for the published data and for 2022-2028 for the data recently forecast by the IMF (on the horizontal axis being the years from 1995 to 2028), demonstrate the convergence towards the EU average (right 100 parallel to the horizontal axis of time) of the group of eastern countries, g%E (the upward trajectory represented by the black continuous curve), in contrast to the dynamics in the case of the group of southern countries, g%S (the downward trajectory represented by the blue continuous curve).

In the case of the North-West group of countries, g%NW, a slower convergence towards the EU27 average is observed (the continuous red trajectory slightly downwards in the upper part of Figure). The trajectory in the case of Romania is represented in the lower part of the figure (discontinuous black curve). All trajectories in the forecast period are marked with circles.

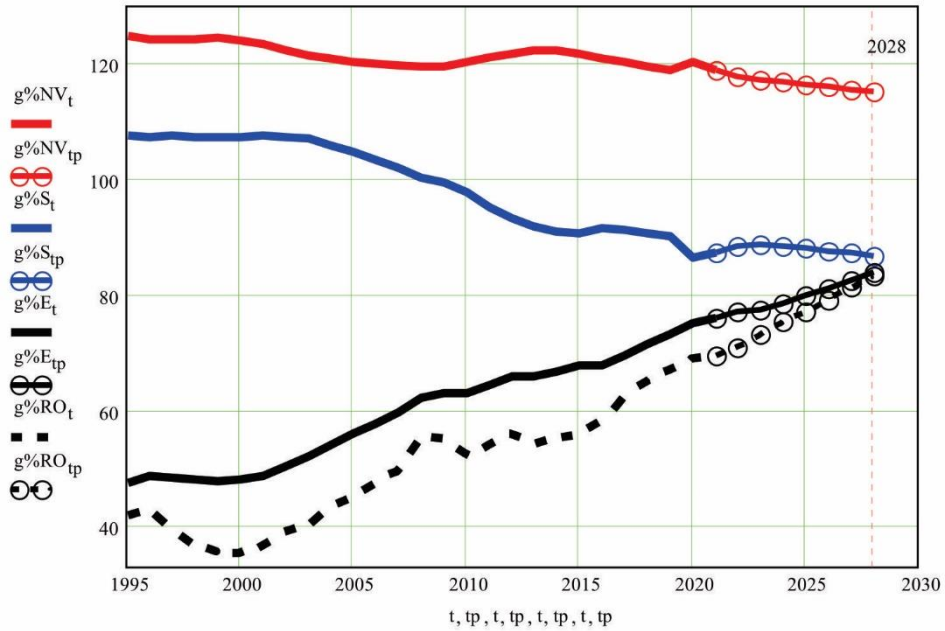
Also, Figure 5 shows the trajectories regarding the convergence/divergence of the three conventional groups of states in the EU and respectively that of Romania, but this time correlated with the level of economic development, represented on the horizontal axis, where time (past, t, and the forecast one, tp) was replaced by the per capita value of income in thousands of international PPP dollars.

Following our analyses, based on the expression in PPP dollars, it can be seen how the global financial crisis at the end of the first decade of this century, which continued after 2008, produced a slowdown in the convergence process on the whole group of Eastern countries and even a setback for two years in the case of Romania.

Compared to the EU27 average, the GDP per inhabitant in Romania decreased from 42.0% in 1995 to only 35.4% in 2000, after which it increased to 45.1% in 2005 and respectively to a maximum local of 55.3% in 2008. It was only after 2015 that the increase in the specific weight of income per inhabitant in relation to the community average was resumed. Convergence towards the EU average has resumed, Romania's position, improving continuously (even during the pandemic), up to 71.0% in 2022. Also, according to IMF forecasts, in 2028 Romania will reach the historical maximum of 83, 4% of the EU average.

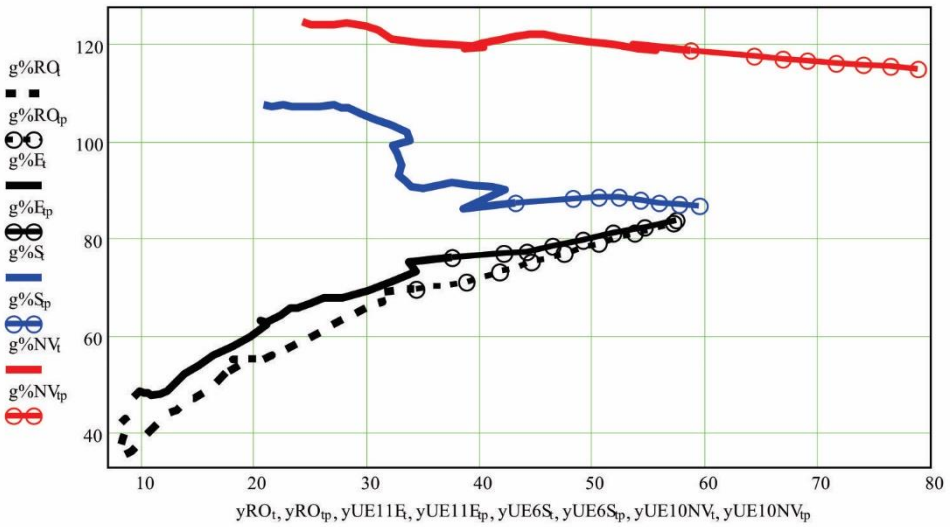
In this context, relative to the average of the Eastern group, EU11E, the GDP per inhabitant in Romania decreased from 88.3% in 1995 to a minimum of 73.8% in 2000, after which it increased quasi-continuously up to a local maximum of 88.8% in 2008. This level was exceeded only in 2017, when a share of 90.1% was recorded compared to the average in the Eastern EU group. Further, until 2022 there was an increase of 2.1 percentage points, to 92.2%. After this date, according to IMF estimates, growth will be spectacular, in 2028 practically reaching very close to the average level forecast for the Eastern group, EU11 (namely 99.4%).

Figure 4.



g%RO1995= 42.0 g%RO2000= 35.4 g%RO2010= 52.4 g%RO2020= 69.0 g%RO2028= 83.4

Figure 5.



g%NV - red
g%S - blue
g%E - black
g%RO – black dashes

In the case of PPS expressed in euros, compared to the EU27 average, the per capita income in Romania decreased from 30.2% in 1995 to only 26.4% in 2000, after which it increased to 35.7% in 2005, 51.5% in 2008 and still at a local maximum of 56.8% in 2012, a value surpassed only in 2016 (58.9%). Then the increase was continuous up to the value of 77.1% in the year 2022.

The progress made by Romania in the line of convergence within the EU is reflected by its increasingly better positioning in the European hierarchy. Thus, in terms of per capita income expressed in PPP dollars, after overtaking Bulgaria in the pre-accession period, Romania overtook Croatia since 2018, Greece since 2019, Latvia since 2022 and, according to IMF estimates, Slovakia since this year, 2023.

Also, with an income per inhabitant estimated by the IMF at approximately 50.5 thousand PPP dollars for 2026, Romania will overtake Portugal, and in 2028 it will record an income per inhabitant practically equal to that of Hungary (57.1 thousand PPP dollars). Thus, comparable values will be recorded with countries such as Spain (58.5), Poland (58.8) and Estonia (60.4).

For a longer period, according to a study carried out by us to estimate Romania's position in the EU until the horizon of 2040, within the framework of the Development Strategy of Romania in the next 20 years, published by the Romanian Academy, in the optimistic version (which implies the deepening integration into the EU and deep structural changes in the economy), Romania could rank 14th in the EU27 in terms of income per inhabitant.

In terms of economic power, i.e. the absolute value of GDP, in 1995 Romania ranked 10th in the future EU27, and in 2000 12th, being overtaken by Germany, France, Italy, Spain, the Netherlands, Poland, Belgium, Sweden, Austria, Portugal and Greece. During the period of pre-accession to the EU, Romania surpassed Portugal in this regard in 2003, and, after accession, Greece and Austria in 2007, Sweden in 2017 and Belgium in 2022. Thus, in 2028 (according to IMF forecasts), with a GDP estimated at approx. 1032 billion PPP dollars, Romania will occupy the 7th place in the EU.

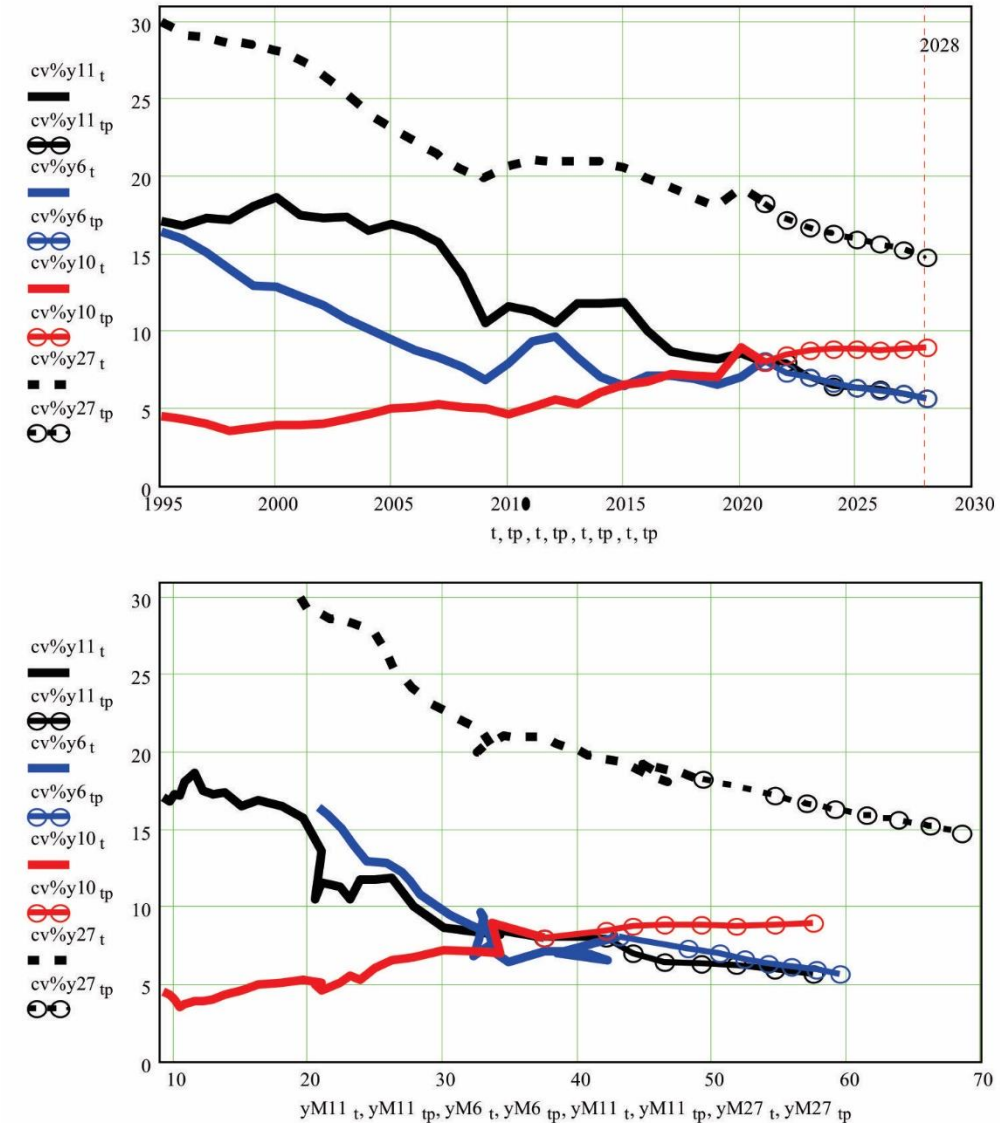
Behavioural regimes and medium-term dynamics

To estimate the convergence/divergence process, a series of indicators are used, of which we used in the present study the coefficient of variation in the case of income per inhabitant at PPP (cv%y). Its value signifies the degree of concentration between components within a system. In our case, the system is represented by the European Union (EU27), and the components are the member states.

We specify that the analysis period for the convergence process in the EU that we considered was 1995-2022, and for the short- and medium-term forecast we used the latest IMF estimates. The IMF forecast is the one published in April as part of the WORLD ECONOMIC OUTLOOK – A Rocky Recovery (INTERNATIONAL MONETARY FUND, 2023 APR), and in Figure 6 the trajectory of the coefficient of variation is also shown in correlation with the dynamics of GDP per inhabitant in international dollars PPP (the graph at the bottom of Figure).

The results of the convergence/divergence estimate at the EU27 level and the three groups of component states (for cv%y10, cv%y6 and cv%y11) are summarized in the table in Annex.

Figure 6.



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Annex

	yM27	yM10	yM6	yM11	yRO	g%y27	g%y10	g%y6	g%y11	g%yRO	cv%y27	cv%y10	cv%y6	cv%y11
1995	19.308	24.115	20.765	9.180	8.105	100.0	124.9	107.5	47.5	41.980	29.960	4.492	16.457	17.110
1996	20.018	24.875	21.504	9.721	8.628	100.0	124.3	107.4	48.6	43.099	29.220	4.339	15.950	16.819
1997	20.866	25.916	22.443	10.082	8.289	100.0	124.2	107.6	48.3	39.726	28.957	4.021	15.031	17.256
1998	21.706	26.970	23.314	10.450	8.019	100.0	124.3	107.4	48.1	36.943	28.666	3.572	13.959	17.216
1999	22.607	28.141	24.251	10.786	8.077	100.0	124.5	107.3	47.7	35.725	28.529	3.685	12.902	18.078
2000	23.992	29.760	25.740	11.523	8.502	100.0	124.0	107.3	48.0	35.436	28.164	3.897	12.827	18.692
2001	25.048	30.870	26.949	12.202	9.145	100.0	123.2	107.6	48.7	36.511	27.547	3.921	12.261	17.441
2002	25.705	31.448	27.554	12.914	10.084	100.0	122.3	107.2	50.2	39.228	26.482	4.027	11.677	17.294
2003	26.420	32.059	28.250	13.745	10.621	100.0	121.3	106.9	52.0	40.200	25.303	4.283	10.839	17.408
2004	27.776	33.555	29.397	14.995	12.092	100.0	120.8	105.8	54.0	43.534	24.119	4.599	10.134	16.503
2005	29.137	35.051	30.531	16.277	13.140	100.0	120.3	104.8	55.9	45.097	23.150	5.030	9.452	16.921
2006	31.049	37.261	32.115	17.927	14.719	100.0	120.0	103.4	57.7	47.405	22.214	5.088	8.738	16.561
2007	32.840	39.324	33.477	19.634	16.302	100.0	119.7	101.9	59.8	49.639	21.403	5.307	8.310	15.784
2008	33.669	40.212	33.721	20.955	18.613	100.0	119.4	100.2	62.2	55.283	20.414	5.089	7.694	13.598
2009	32.365	38.628	32.189	20.424	17.862	100.0	119.4	99.5	63.1	55.189	19.889	5.004	6.865	10.535
2010	33.377	40.172	32.646	21.012	17.494	100.0	120.4	97.8	63.0	52.412	20.655	4.555	7.887	11.607
2011	34.654	42.015	32.950	22.300	18.755	100.0	121.2	95.1	64.4	54.121	21.100	5.089	9.302	11.281
2012	35.125	42.701	32.751	23.100	19.772	100.0	121.6	93.2	65.8	56.290	20.985	5.573	9.597	10.559
2013	36.271	44.375	33.305	23.845	19.641	100.0	122.3	91.8	65.7	54.151	20.993	5.238	8.331	11.797
2014	37.321	45.628	33.913	24.921	20.592	100.0	122.3	90.9	66.8	55.177	20.980	6.052	7.024	11.768
2015	38.494	46.853	34.862	26.126	21.570	100.0	121.7	90.6	67.9	56.036	20.558	6.584	6.444	11.823
2016	40.830	49.342	37.403	27.741	23.832	100.0	120.8	91.6	67.9	58.368	19.827	6.716	7.102	10.063
2017	43.171	51.910	39.354	29.991	27.021	100.0	120.2	91.2	69.5	62.590	19.318	7.205	7.165	8.649
2018	45.134	53.876	40.948	32.313	29.505	100.0	119.4	90.7	71.6	65.371	18.532	7.130	6.900	8.364
2019	46.752	55.556	42.147	34.251	31.380	100.0	118.8	90.2	73.3	67.120	18.054	6.993	6.562	8.148
2020	44.597	53.581	38.495	33.556	30.751	100.0	120.1	86.3	75.2	68.954	19.326	8.929	7.052	8.557
2021	49.236	58.569	43.024	37.460	34.245	100.0	119.0	87.4	76.1	69.554	18.265	7.945	8.081	8.033
2022	54.511	64.192	48.156	42.000	38.721	100.0	117.8	88.3	77.0	71.034	17.188	8.463	7.285	7.995
2023	56.929	66.752	50.517	44.072	41.634	100.0	117.3	88.7	77.4	73.133	16.747	8.737	6.988	7.022
2024	59.053	68.947	52.283	46.421	44.484	100.0	116.8	88.5	78.6	75.330	16.293	8.877	6.596	6.427
2025	61.428	71.488	54.102	49.074	47.442	100.0	116.4	88.1	79.9	77.232	15.955	8.832	6.335	6.363
2026	63.778	73.996	55.860	51.774	50.509	100.0	116.0	87.6	81.2	79.195	15.634	8.794	6.142	6.203
2027	66.059	76.342	57.627	54.504	53.684	100.0	115.6	87.2	82.5	81.267	15.219	8.877	5.947	5.941
2028	68.428	78.773	59.431	57.401	57.076	100.0	115.1	86.9	83.9	83.410	14.807	8.981	5.701	5.667
											corr(cvy%,yM)			
											-0.928	**0.957**	**-0.806**	**-0.932**