

Ion IGNAT

"Alexandru Ioan Cuza" University of Iași, Romania
Faculty of Economics and Business Administration

Raluca Gabriela DULGHERIU

"Alexandru Ioan Cuza" University of Iași, Romania
Doctoral School of Economics and Business Administration

HOW FAR FROM THE EURO AREA?

Empirical study

Keywords

Euro area

Catching up

Real convergence

Central and Eastern Europe

JEL Classification

F43, F45

Abstract

The article performs a comparative analysis between the European Union member states from Central and Eastern Europe (Bulgaria, Croatia, Czech Republic, Hungary, Poland and Romania) in terms of real economic convergence with the Euro area. Specifically, the paper emphasizes the assessment of the time required to catch up with the average level of GDP per capita in the euro area. To determine these developments, we use a system of chain indices, calculated based on the growth rate of the GDP per capita. Assuming that the average growth specific to the period 1999-2014 will continue in the future, the results illustrate that the shortest period of catching up belongs to Poland, while Croatia remains by far the most distant country from the euro area.

1. Introduction

The process of catching up or recovery of the backwardness of the European Union (EU) peripheral countries and the euro area represents a sui generis subject and numerous field studies indicate alike, the timeliness and relevance of the subject addressed in the present research.

Currently, we are witnessing a blockage of the euro area, given the heterogeneity of the economic structures, the disparities regarding the levels of economic development both within the Economic and Monetary Union (EMU) and between the acceding countries and the euro area. Past experience of accession to the EMU shows that the catching up process takes a long time and does not stop even after accession. Thus, the countries of Central and Eastern Europe (CEE) that joined the European Union with a much lower level of real incomes, will go a long way in the process of convergence with the euro area.

The purpose of this paper is to analyze the catching up process in the countries acceding to the euro area. The analysis focuses specifically on the estimation of the period required by Bulgaria, Croatia, Czech Republic, Hungary, Poland and Romania to catch up the average level of Gross Domestic Product (GDP) per capita in the euro area. Leading from the statistical analysis of the time series, the paper uses a system of chain indices calculated based on the variation of the GDP per capita growth rates.

The structure of the article is divided into the following sections: section two reviews the specialized literature, section three describes the research methodology used and the data analysis, section four presents the results of the research, while the last section summarizes the main findings and their implications for the future research.

2. Literature review

Various research papers in the literature have focused on the study of catching up process of the real convergence.

According to the Cambridge Advanced Learner's Dictionary (McIntosh, Colin, 2013), the term of catch up is defined as: "to reach the same quality or standard as someone or something else". Based on the explanation above, the catching up can be defined, in economic terms, as an approach at a common level of two or more countries belonging to the same integration group. Production is usually measured by GDP per capita expressed at the purchasing power parity and can be interpreted empirically as a decline over time of standard deviation of this variable in a group of countries.

The theoretical foundations of the concept of catching up are found in the neoclassical theory of economic growth, known in the macroeconomic specialist literature under the name of Solow-Swan growth model. According to this theory, the

convergence towards a steady state, identical for all economies, is influenced by a combination of parameters such as savings rate, capital accumulation, labor productivity, population growth, technological progress (Solow, 1956).

Based on Abramovitz's point of view (1986), the catch-up hypothesis states that being behind in terms of productivity enables a rapid advance. Analyzing the economic growth and the labor productivity in 16 industrialized countries during 1870-1979, the author believes that the followers tend to catch up quickly the leader if they are at the beginning more backward. However, the study results illustrate that the process of catching up is limitative because as the follower catches up with the leader the possibility to make great economic leaps becomes increasingly smaller.

The process of catching up was also analyzed by professors Robert Barro and Xavier Sala-i-Martin (1991), which capture the existence of catching up recovery both among the regions of the United States and between 73 regions in Western Europe.

Quah (1996) describes a set of significant empirical studies that focus on two related main mechanisms, but distinct, named: pushing back and catching up. The author stresses that pushing back falls in correlation with the growth mechanism, while catching up is related to the mechanism of convergence.

Matkowski and Próchniak (2004) analyze the dynamics of the catching up process in eight countries in Central and Eastern Europe in the period during 1993-2004. The study results illustrate that the analyzed countries converge both with each other and towards the European Union in terms of income, which means a clear process of catching up but with an equalization of the development levels during a very long period of time. The authors estimate a period of 20 years required to reduce by half the distance towards the their common steady-state.

In The European Economic Advisory Group Report on the European Economy, Calmfors et. al. (2004) show us, according to the most optimistic scenario, that the more developed countries of the Eastern Europe will need a catching up period between 20 and 25 years and the other ones between 50 and 100 years.

The academician Aurel Iancu (2007) appreciates the time needed by Romania to perform real convergence with the European Union. The results of the analysis illustrate, in terms of an annual economic growth of four per cent, a period of 57 years needed to reach the EU-15 level, 50 years to reach the level of France and 45 years to equal Germany. According to the same study, at an annual rate of eight per cent, the catching up would be achieved in 20 years with EU-15, 18 with France and 16 years with Germany.

3. Methodology

The paper is based on the statistical analysis of time series, an important tool in the context of macroeconomic research. Starting from a system of chain variation indices calculated based on the growth rates of the GDP per capita, the study allows the characterization under a statistical report of the catching up process development in the states included in the analysis.

In the present study there was used statistical data provided by World DataBank. The main statistical indicator on which this analysis is based is the GDP per capita growth rate, calculated at constant local currency. The sample used includes data recorded over a period of 16 years, from 1999 to 2014.

According to the goal of research we have used data for six European countries (Bulgaria, Croatia, Czech Republic, Hungary, Poland and Romania), group which we will further note EU-6. Besides the group of the six candidate countries, we also include in the analysis the euro area (EA). For the six European countries, we will use in the analysis the abbreviations consisting of two letters as follows: Bulgaria (BG), Croatia (HR), Czech Republic (CZ), Poland (PL), Hungary (HU) and Romania (RO).

In order to make such an analysis it is necessary to calculate the *average growth rate* for each of the countries that form EU-6 and for EA, during 1999-2014. In calculating the average growth rate, we have to take into consideration that this index is calculated based on the *average index variation*:

$$\bar{r}_{t/t-1}^{(\%)} = \bar{i}_{t/t-1}^{(\%)} - 100 \quad (1)$$

where: \bar{r} = the average growth rate
 \bar{i} = the average index variation
 $t = 1999, 2014$

To calculate the average index variation during 1999-2014, we need the chain indices variation, $i_{t/t-1}^{(\%)}$; the average index variation is the geometric mean of chain indices variation for the observed period, as shown from the relation:

$$\bar{i}_{t/t-1}^{(\%)} = \prod (i_{t/t-1}^{(\%)})^{\frac{1}{n}} \quad (2)$$

where: \bar{i} = the average index variation
 i = the chain index variation
 $t = 1999, 2014$
 n = number of years for which we calculate indices variation.

In turn, the annual chain index variation can be calculated based on chain growth rates, according to:

$$i_{t/t-1}^{(\%)} = 100 + r_{t/t-1}^{(\%)} \quad (3)$$

where: i = the chain index variation
 r = the chain growth rate
 $t = 1999, 2014$

The annual index of variation for the EU-6 and EA, from 1999 to 2014, calculated based on the annual growth rates in Appendix A, are listed in Appendix B. Based on the data from Appendix B and the

relations (1) and (2), we obtain in the table no. 1 the values of the *average growth rate* for the period 1999-2014, specific to the EU-6 and EA.

Based on the average growth rate and knowing the GDP per capita at the 't' time for an EU-6 country and EA, we can calculate the level that will be reached by GDP per capita in a number 'k' of years:

$$GDP \text{ per capita}_{t+k}^{EU6i} = GDP \text{ per capita}_t^{EU6i} (100 + \bar{r}_{2014/1999}^{EU6i(\%)})^k \quad (4)$$

where: GDP per capita_t = GDP per capita at 't' time
 \bar{r} = the average growth rate
EU6_i - generic notation for one of the EU-6 countries, $i=1,6$
 $t = 2014$

k = the time needed to achieve the same level of GDP per capita with EA.

Based on the relation (3), we can say that the relation (4) is equivalent to:

$$GDP \text{ per capita}_{t+k}^{EU6i} = GDP \text{ per capita}_t^{EU6i} (\bar{i}_{2014/1999}^{EU6i(\%)})^k \quad (5)$$

where: GDP per capita_t = GDP per capita at 't' time
 \bar{i} = the average index of variation
EU6_i = generic notation for one of the EU-6 countries, $i=1,6$
 $t = 2014$

k = the time needed to achieve the same level of GDP per capita with EA.

The relations (4) and (5) are valid for GDP per capita dynamic of EA, as follows:

$$GDP \text{ per capita}_{t+k}^{EA} = GDP \text{ per capita}_t^{EA} (100 + \bar{r}_{2014/1999}^{EA(\%)})^k \quad (6)$$

$$GDP \text{ per capita}_{t+k}^{EA} = GDP \text{ per capita}_t^{EA} (\bar{i}_{2014/1999}^{EA(\%)})^k \quad (7)$$

The determination of the length of time required to achieve the same level of GDP per capita with EA of an EU-6 member state (GDP per capita_{t+k}^{EU6i} = GDP per capita_{t+k}^{EA}) results from the match of the relations (4) and (6) or (5) and (7). After the calculations we have the following relation for 'k':

$$k = \frac{\log(GDP \text{ per capita}_t^{EA}) - \log(GDP \text{ per capita}_t^{EU6i})}{\log(100 + \bar{r}_{2014/1999}^{EU6i(\%)}) - \log(100 + \bar{r}_{2014/1999}^{EA(\%)})} \quad (8)$$

or

$$k = \frac{\log(GDP \text{ per capita}_t^{EA}) - \log(GDP \text{ per capita}_t^{EU6i})}{\log(\bar{i}_{2014/1999}^{EU6i(\%)}) - \log(\bar{i}_{2014/1999}^{EA(\%)})} \quad (9)$$

4. Results

The estimations of the 'k' periods of catching up the GDP per capita of the EA by the EU-6 states, based on the formulas (8) or (9), are summarized in the table no. 2.

According to the data in the second table, assuming that the specific average economic growth during 1999-2014 will continue in the future, Poland ($k = 15$), followed closely by the Czech Republic ($k = 16$), has the shortest period of catching- up, while Croatia ($k = 62$) has the longest period of catching

up, being located at a distance almost twice as large as that of Hungary ($k = 32$), ranked second to last.

In the EU-6 ranking of countries, according to the annual average growth rate registered during 1999-2014, Romania occupies the middle position, with a catching up period of 22 years. But in terms of a lower economic growth of 2% per year, the GDP per capita of Romania would catch up the average level of the euro area in about 62 years. The catching up of the eurozone could occur in a reasonable period of time only under illusory conditions, namely whether Romania will achieve average annual growth rates significantly higher than those achieved so far.

Although there have been estimations under different hypothesis on the average economic growth, the most likely prognosis, based on the idea that there are no factors of economic nature that would produce a substantial change in growth rates for the EU-6 countries, remains the one stating that in the future the average growth rate during 1999-2014 will be maintained.

The results of the study highlight that the economies of the six countries acceding to the EMU are inadequately structured, weakly competitive and with a low potential for convergence with the euro area, and the lack of an appropriate mix of macroeconomic policies, the unsubstantiated government decisions and the inconsistency regarding the future path, we believe to be the main recurring errors.

5. Conclusions and future research directions

It is natural that, when talking about convergence, to try to find out what is the period of time in which a state or a group of states, in our case the EU-6, will be able to catch up the GDP per capita specific to a group of countries they are planning to join in the future.

Our approach on the analysis of the catching up process in the states of Central and Eastern Europe had as starting point the validation of the idea according to which an optimum adhesion of those countries in the euro area is a long-term process. Thus, the present study determines the length of the period of time necessary to achieve the equalization of the absolute level of GDP per capita of the countries in Central and Eastern Europe with the euro area.

Taking into account the results of the analysis, the equalization or catching up would be impossible in a more reasonable period of time, situation that would imply either that the countries included in the study need to achieve annual average growing rates significantly higher than those in the euro area or that the monetary union to stagnate during their development.

In our future research study, we intend to calculate an aggregate index of the real convergence, given

the lack of some criteria clearly stipulated in the Maastricht Treaty. The index will be calculated on a complex set of indicators consisting of: real GDP per capita growth rate, exports as share of GDP, agriculture as share of GDP, private sector as share of GDP, foreign direct investment, capital market size (% of GDP), unemployment rate, labor productivity, research and development expenditure (% of GDP).

References

- [1] Abramovitz, Moses (1986), Catching Up, Forging Ahead, and Falling Behind, *The American Economic Review*, Volume No. 76 (Issue No. 5), 1072-1085
- [2] Barro, Robert, Sala-i-Martin, Xavier (1991), Convergence across States and Regions, *Brookings Papers on Economic Activity*, Volume No. 22 (Issue No. 1), 107-182
- [3] EEAG European Economic Advisory Group (2004), *Report on the European Economy*, Ifo Institute for Economic Research, Munich, 1-148
- [4] Iancu, Aurel (2007), Economic convergence. Applications, *Romanian Journal of Economic Forecasting*, Volume No. 8 (Issue No. 4), 24 - 48
- [5] Matkowski, Zbigniew, Próchniak, Mariusz (2004), Real economic convergence in the EU accession countries, *International Journal of Applied Econometrics and Quantitative Studies*, Volume No. 1 (Issue No. 3), 5-38
- [6] McIntosh, Colin (Ed.) (2013), *Cambridge Advanced Learner's Dictionary* (4th ed.), Cambridge: Cambridge University Press
- [7] Solow, Robert M. (1956), A Contribution to the Theory of Economic Growth, *The Quarterly Journal of Economics*, Volume No. 70 (Issue No. 1), 65-94
- [8] World DataBank, World Development Indicators (WDI): GDP per capita Database, <http://databank.worldbank.org/data/home.aspx>, last accessed on April 10th 2016

Tables

Table No. 1

The average index of variation and the average growth rate specific to the EU-6 and EA, during 1999-2014

Country	Average index of variation ($\bar{i}_{(2014/1999)}^{(%)}$)	Average growth rates ($\bar{r}_{2014/1999}^{(%)}$)
BG	103.70	3.70
CZ	102.35	2.35
HR	101.85	1.85
HU	102.32	2.32
PL	103.78	3.78
RO	104.04	4.04
EA	100.86	0.86

Source: own calculation based on data from World DataBank

Table No. 2

Estimations for the 'k' periods of catching up for the EU-6 states

Country	Average annual growth rate, 1999-2014 (%)	GDP per capita 2014 (\$)	Number of years needed to match the average level of the GDP per capita from EA in terms of different hypothesis on the economic growth						Acc. average growth rate (1999-2014)
			2%	3%	4%	5%	6%	7%	
BG	3.70	16.323,840	77	41	28	21	17	15	31
CH	2.35	30.444,950	21	11	8	6	5	4	16
HR	1.85	21.252,300	53	29	20	15	12	10	62
PL	3.78	24.882,343	39	21	14	11	9	7	15
RO	4.04	19.401,350	62	33	23	17	14	12	22
HU	2.32	24.498,494	41	22	15	11	9	8	32

Source: own calculation based on data from World DataBank

Appendices

Appendix A

The annual growth rates for the EU-6 and EA, from 1999 to 2014

	The annual growth rate															
	$(r_{t/t-1}^{(\%)})$															
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
BG	-5.12	6.56	5.74	6.50	5.96	7.14	6.52	7.04	9.08	6.50	-4.40	1.32	2.64	1.08	1.63	2.25
CZ	1.54	4.59	3.44	1.84	3.63	4.92	6.30	6.59	4.92	1.86	-5.38	2.00	1.75	-0.95	-0.73	2.03
HR	-2.09	6.77	3.11	5.25	5.56	4.11	4.09	4.83	5.24	2.09	-7.27	-1.45	2.91	-1.89	-0.66	0.05
HU	3.53	4.51	3.97	4.79	4.08	5.02	4.47	4.12	0.67	1.06	-6.41	1.02	2.10	-0.97	1.81	3.97
PL	4.53	5.35	1.23	1.49	3.63	5.20	3.59	6.27	7.21	3.85	2.55	4.01	4.71	1.82	1.78	3.49
RO	-1.04	2.23	7.16	6.97	5.92	9.75	4.93	9.36	7.84	9.67	-6.02	-0.35	2.81	0.80	3.88	2.13
EA	2.69	3.48	1.65	0.45	0.14	1.69	1.15	2.78	2.53	0.01	-4.84	1.82	1.43	-0.60	-0.69	0.42

Source: World DataBank

Appendix B

The annual indices of variation for the EU-6 and EA, from 1999 to 2014

	Annual index of variation															
	$(i_{t/t-1}^{(\%)})$															
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
BG	94.88	106.56	105.74	106.50	105.96	107.14	106.52	107.04	109.08	106.50	95.60	101.32	102.64	101.08	101.63	102.25
CZ	101.54	104.59	103.44	101.84	103.63	104.92	106.30	106.59	104.92	101.86	94.62	102.00	101.75	99.05	99.27	102.03
HR	97.91	106.77	103.11	105.25	105.56	104.11	104.09	104.83	105.24	102.09	92.73	98.55	102.91	98.11	99.34	100.05
HU	103.53	104.51	103.97	104.79	104.08	105.02	104.47	104.12	100.67	101.06	93.59	101.02	102.10	99.03	101.81	103.97
PL	104.53	105.35	101.23	101.49	103.63	105.20	103.59	106.27	107.21	103.85	102.55	104.01	104.71	101.82	101.78	103.49
RO	98.96	102.23	107.16	106.97	105.92	109.75	104.93	109.36	107.84	109.67	93.98	99.65	102.81	100.80	103.88	102.13
EA	102.69	103.48	101.65	100.45	100.14	101.69	101.15	102.78	102.53	100.01	95.16	101.82	101.43	99.40	99.31	100.42

Source: own calculation based on data from World DataBank