



COMPARATIVE PRICE LEVEL (CPL) – A REPRESENTATIVE PARAMETER OF ECONOMIC CONVERGENCE

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Abstract

On the nominal side of economic convergence, the functional compatibility is globally reflected in the comparative price level (CPL). This is approximated through the ratio of the purchasing power parity of a given currency to its market exchange rate.

The present paper examines the behavior of this variable in the European Union context, namely 19 countries already forming the Euro Zone, and the other nine ones that have to be also integrated into this common currency area. A simple analytical framework of CPL is sketched, the main attention being paid to revealing its deep connection with the economic development level. An extended empirical analysis, covering 20-year statistical series (1995-2014) for all the 28 members of the European Union is presented.

The particular position of the Romanian economy is separately examined. The previous evolution of Romania's CPL as against the EU level is completed by an econometric attempt to forecast it for the years 2015-2016. The simulations based on updating the 2012 Version of the Romanian Macromodel were used.

Some conclusions and further research suggestions finalize the paper.

Keywords: economic convergence, comparative price level, macromodel, simulations

JEL Classification: C53, C67, F63, G12

I. Introduction: The Economic Convergence Problem

In principle, the economic convergence is understood as a tendency of two or more entities (countries, regions, groups of countries) to reduce the gaps among them and asymptotically equalize a given set of indicators. A large literature is devoted to this

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issue. It has been connected to the neo-classic growth model (Barro and Sala-i-Martin, 2004) or to the optimum currency area (OCA) theory (Mundell, 1961).

1. A special attention has been paid to the identification of the most representative indicators of convergence, considering the compared entities in both real-nominal cases and from a double perspective – their development level and functional compatibility. We shall synthesize the main results.

- The GDP per capita - at purchasing power parity (PPP) - is usually assumed as a measure of the real economic development level (Baumol, 1986; Durlauf *et al.*, 2004; Barro and Sala-i-Martin, 2004; Lisaniler and Uğural, 2007; Iancu, 2007; Kumo, 2011; Gáspár, 2012; Alexe, 2012; Drastichova, 2012; Dvorokova, 2014; Buti and Turrini, 2015; Leitner and Römisch, 2015). Complementarily to the GDP per capita, some authors also include other indicators, such as labor productivity (Baumol, 1986; Drastichova, 2012; Dvorokova, 2014), or household income per capita (Leitner and Römisch, 2015).
- The functional compatibility is evaluated in real terms through inter-entities comparison of such indicators: the sectoral structure of output (Covering, 2003; Gáspár, 2012); the openness degree of economy (Covering, 2003); the productive factor flexibility (Mundell, 1961; Covering, 2003); the endowments of productive factors and relative factor prices (Buti and Turrini, 2015); the similarity of business cycles (Covering, 2003; Drastichova, 2012). In our opinion, there are reasons to include in this class of parameters the closeness of macroeconomic production functions (as expression of the technological factor) and the optimal points of the BARS-LINS curves (as representative coordinates of public finance).
- On the nominal side of convergence, the functional compatibility is globally reflected in the comparative price level of the respective economies (CPL), which is approximated by the ratio of the purchasing power parity to the market exchange rate. A set of more diversified indicators, such as inflation, interest rate, exchange rate, public budget balance, public debt (Coevering, 2003; Drastichova, 2012; Gáspár, 2012; Dvorokova, 2014; Buti and Turrini, 2015), is also involved. The Maastricht criteria for joining the Euro Zone are a famous example.
- The economic convergence is also classified by the leading parameters, around which the respective group of entities tend to equalize. For instance, concerning the real economic development, such a referential attractor maybe:
 - a common steady state level, sometimes named unconditional convergence (Galor, 1996; Barro and Sala-i-Martin, 2004; Durlauf *et al.*, 2004; Kumo, 2011; Alexe, 2012; Drastichova, 2012; Gáspár, 2012);
 - differentiated steady states induced by the starting conditions of the respective entities or other circumstances (conditional convergence), including, of course, the possible formation of the so-called convergence clubs (Baumol, 1986; Galor, 1996; Durlauf *et al.*, 2004; Barro and Sala-i-Martin, 2004; Lisaniler and Uğural, 2007; Kumo, 2011; Drastichova, 2012; Gáspár, 2012; Alexe, 2012).
- The term "convergence" can also have two meanings:

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- beta convergence (Durlauf *et al.*, 2004; Barro and Sala-i-Martin, 2004; Monfort, 2008; Kumo, 2011; Gáspár, 2012; Alexe, 2012; Drastichova, 2012; Dvorokova, 2014) consisting in higher growth rates recorded by the less developed countries as against the more advanced ones, and
- sigma convergence (Durlauf *et al.*, 2004; Barro and Sala-i-Martin, 2004; Iancu, 2007; Monfort, 2008; Kumo, 2011; Gáspár, 2012; Alexe, 2012; Drastichova, 2012; Dvorokova, 2014), which refers to a diminishing dispersion of economic levels across the compared entities.

2. A lot of studies were focused on the statistical analysis of the convergence process in different countries or at regional level:

- European Union countries (Lisaniler and Uğural, 2007; Iancu, 2007; Drastichova, 2012; Dvorokova, 2014);
- Euro Zone countries (Buti and Turrini, 2015);
- Central and Eastern European countries (Alexe, 2012; Leitner and Römisch, 2015);
- Southern African Development Community (SADC) countries (Kumo, 2011);
- Large sample of countries (Barro and Sala-i-Martin, 1992; Durlauf *et al.*, 2004);
- Regional level: EU regions (Monfort, 2008); US states (Barro and Sala-i-Martin, 1992; Barro and Sala-i-Martin, 2004); Japanese prefectures, European regions, other regions around the world (Barro and Sala-i-Martin, 2004);
- Monte-Carlo simulations (Gáspár, 2012).

3. Our goal is to discuss the comparative price level within the European Union, examining 19 countries already included in the common currency area (Euro Zone) and the other none ones that have to be also integrated into this area.

The second section of this paper sketches an analytical framework for the computation of CPL, the main attention being paid to revealing the deep connection between the CPL and the economic development level. An extended empirical analysis was also performed, covering 20-year statistical series (1995-2014) for all 28 members of the European Union.

The particular position of the Romanian economy is examined in the third section of the paper. The previous evolution of Romania's CPL as against the EU level is completed by an econometric attempt to forecast it for the years 2015-2016. The simulations are based on an updated 2012 Version of the Romanian Macromodel.

Some conclusions and further research suggestions are synthesized in the last section of the paper.

II. CPL in the European Union Context

Based on the large literature dedicated to the convergence problem, we try to outline the intrinsic link between the comparative price levels and the economic development levels of different countries. This results from the generally accepted theoretical assumptions and, at the same time, is corroborated with many previous searches.

II.A. CPL and the Economic Development Level

A Simple Analytical Framework

1. Several standard premises.

1.1. The economy - its aggregate demand and output, respectively - is dividable into two sectors.

a) The first – conventionally named “tradables sector” - includes the production of the commodities which are the object of international trade. This category included over time the following:

- “raw material and foodstuff (plus somewhat imperfectly competitive), differentiated manufactures and services such as insurance and securities-issuing” (Harrod, quoted by Samuelson, 1994, p. 207);
- “agriculture and manufacturing” (Balassa, 1964, p. 593);
- “mobile goods” (Samuelson, 1964, p. 147, 152);
- “traded goods industries” (Bhagwati, 1984, p. 279);
- “tradables exports and imports” (Samuelson, 1994, pp. 204-205);
- “traded goods and services” (Buiters and Grafe, 2001, p. 310).

The dominant criterion was, therefore, the involvement (effective or potential) of the respective goods and services in the international commercial flows. More concretely, the tradables sector of a given country could be represented by all its domestic commodities that are included in the Standard International Trade Classification (United Nations, 2006).

b) Contrarily, there are goods and, especially, services, which do not participate directly in the external changes. These constitute the “non-tradables sector” (Balassa 1964, Bhagwati 1984, Samuelson 1994, Krugman and Obstfeld 2000, Buiters and Grafe 2001, Schreyer and Koechlin 2002); the formula “domestic goods” (Samuelson 1964) has been also used. There were mentioned in such a case “houses, fixed plants, railway services, public utility services and domestic services” (Harrod, quoted in Samuelson 1994, p. 208); “there is a large number of non-traded goods, including construction and most services” (Schreyer and Koechlin, 2002, p. 11).

1.2. The previous assumption is usually associated with two derived statements.

1.2.1. One of them stipulates: for the tradables sector “the law of one price” in principle holds. In other words, the global relationship:

$$ER_i \times P_i = ER_j \times P_j \quad (1)$$

is generally valid (i and j indicate the compared countries, ER - the market exchange rate expressed in a common currency, and P – the level of domestic prices).

The specification “in principle” must be retained because the law of one price does not literally hold for most traded goods (Isard, quoted by Engel, 1993, p. 37). Regarding the same issue, Krugman and Obstfeld (2000, p. 412) notice: “The combination of product differentiation and segmented markets, however, leads to large violation of the law of one price”. Therefore, the Cassel theorem is affected by a disturbing factor Θ (Dornbush, 1985, p. 4), which integrates all obstacles to the foreign trade or (more

precisely) to the validity of the law of one price. It seems more realistic to admit that the commodities included into the tradables sector significantly observe the law of one price. What “significantly” means depends on the scope and information sources of a given analysis. Consequently, the above-mentioned equality will be slightly modified, as follows:

$$ER_i \times P_i \times \Theta_i = ER_j \times P_j \times \Theta_j \quad (1a)$$

1.2.2. Another question concerns the labor productivity gap. As per the standard hypotheses, the labor productivity in the tradables sector was and continues to be higher than in the non-tradables sector. Some arguments insist on the specificity (the nature itself) of the greatest part of the activities included into the non-tradables sector. These (especially services) are made concomitantly with their consumption, which involves a direct (personalized) producer-customer contact. Such a circumstance limits the technological innovations, implicitly a major and rapid increase in labor productivity. It is obviously real, but - in our opinion - the following two considerations are maybe more important.

a) The tradables sector addresses to a larger market, comprising not only a segment of domestic transactions, but also a share of the international demand. As a result, a substantial improvement in scale efficiency becomes possible, with implications on the labor productivity as well.

b) On the other hand, the tradables sector is submitted to a more severe competitive environment, the respective domestic firms being confronted – through imports and exports – with a lot of foreign concurrent suppliers.

Generally, the supposition of the labor productivity gap in favor of the tradables sector as compared to the non-tradables one does not raise objections.

2. The other starting point of our attempt can be formulated as follows: both tradables and non-tradables sectors are characterized by an approximately equal mark-up on labor costs (Balassa 1964, Bhagwati 1984, Samuelson 1994, Buiters and Grafe, 2001). It seems natural to extend this rule to the total cost of production, this interpretation being more conformable to the inter-sectoral competition's effects.

3. The symbols implied in the present explicative model will be described hereinafter. Most of them are common to other similar studies.

- Subscript T means tradables sector and N – non-tradables one; the variables without subscript refer to the entire economy.
- The compared country is specified by the subscript i; in order to simplify the presentation, such an index is omitted in the case of the reference country.
- Q represents the volume of output, measured in homogenous utility units (constant prices can be also used).
- c expresses the cost per unit of homogenous utility, in domestic currency.
- m signifies the mark-up as multiplier to cost; as we already mentioned, the coefficient m is presumed to be equal in both tradables and non-tradables sectors.
- P means the price level, in domestic currency.

- ER denotes the market nominal exchange rate; it is determined as an amount of domestic currency per unit of currency of the reference country (obviously, for the reference country ER=1).
- Θ is the disturbing factor of the law of one price. Normally, it refers to the tradable sector.
- PPP symbolizes the purchasing power parity of the compared country, in the same expression as the nominal exchange rate.
- π is the international price level (affecting the tradables sector), defined in the currency of the reference country. This will be considered as an exogenous variable.
- CPL (comparative price level) is defined as a ratio of the purchasing power parity to the exchange rate (in currency of the compared).

4. The starting formalization of the relationship between the purchasing power parity and the exchange rate calls on the assumptions sketched under the points 1-2 and on the symbols described under point 3. With this goal, the countries' indicators will be algebraically characterized.

4.1. Indicators for the reference country:

$$P_T = c_T \times m = \pi \times \Theta \times ER, \text{ respectively } m = \frac{\pi \times \Theta \times ER}{c_T} \quad (2)$$

$$P_N = c_N \times m = \frac{c_N \times \pi \times \Theta \times ER}{c_T} \quad (3)$$

$$P = \frac{P_T \times Q_T + P_N \times Q_N}{Q_T + Q_N} = \frac{\pi \times \Theta \times ER \times Q_T + \frac{c_N \times \pi \times \Theta \times ER}{c_T} \times Q_N}{Q_T + Q_N} = \frac{\pi \times \Theta \times ER \times (Q_T + Q_N \times \frac{c_N}{c_T})}{Q_T + Q_N} = \frac{\pi \times \Theta \times ER \times (Q_T + Q_N \times r)}{Q_T + Q_N} \quad (4)$$

in which $r = \frac{c_N}{c_T}$

$$PPP = \frac{P}{P} = 1 \quad (5)$$

$$CPL = \frac{PPP}{ER} = 1 \quad (6), \text{ because } ER=1.$$

4.2. Symmetrically, the indicators for the compared country are the following:

$$P_{iT} = c_{iT} \times m_i = \pi \times \Theta_i \times ER_i, \text{ respectively } m_i = \frac{\pi \times \Theta_i \times ER_i}{c_{iT}} \quad (2a)$$

$$P_{iN} = c_{iN} \times m_i = \frac{c_{iN} \times \pi \times \Theta_i \times ER_i}{c_{iT}} \quad (3a)$$

$$P_i = \frac{P_{iT} \times Q_{iT} + P_{iN} \times Q_{iN}}{Q_{iT} + Q_{iN}} = \frac{\pi \times \Theta_i \times ER_i \times Q_{iT} + \frac{c_{iN} \times \pi \times \Theta_i \times ER_i}{c_{iT}} \times Q_{iN}}{Q_{iT} + Q_{iN}} = \frac{\pi \times \Theta_i \times ER_i \times (Q_{iT} + Q_{iN} \times \frac{c_{iN}}{c_{iT}})}{Q_{iT} + Q_{iN}} =$$

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$$\frac{\pi \times \theta_i \times ER_i \times (Q_{iT} + Q_{iN} \times r_i)}{Q_{iT} + Q_{iN}} \quad (4a)$$

in which $r_i = \frac{c_{iN}}{c_{iT}}$

$$PPP_i = \frac{P_i}{P} = \frac{\frac{\pi \times \theta_i \times ER_i \times (Q_{iT} + Q_{iN} \times r_i)}{Q_{iT} + Q_{iN}}}{\frac{\pi \times \theta \times ER \times (Q_T + Q_N \times r)}{Q_T + Q_N}} = \frac{\frac{\theta_i \times ER_i \times (Q_{iT} + Q_{iN} \times r_i)}{Q_{iT} + Q_{iN}}}{\frac{\theta \times ER \times (Q_T + Q_N \times r)}{Q_T + Q_N}} \quad (5a)$$

$$CPL_i = \frac{PPP_i}{ER_i} = \frac{\frac{\theta_i \times ER_i \times (Q_{iT} + Q_{iN} \times r_i)}{Q_{iT} + Q_{iN}}}{\frac{\theta \times ER \times ER_i \times (Q_T + Q_N \times r)}{Q_T + Q_N}} = \frac{\frac{\theta_i \times (Q_{iT} + Q_{iN} \times r_i)}{Q_{iT} + Q_{iN}}}{\frac{\theta \times ER \times (Q_T + Q_N \times r)}{Q_T + Q_N}}$$

$$\begin{aligned} \text{(reminding that } ER=1) \quad &= \frac{\frac{\theta_i \times (Q_{iT} + Q_{iN} \times r_i)}{Q_{iT} + Q_{iN}}}{\frac{\theta \times (Q_T + Q_N \times r)}{Q_T + Q_N}} \quad (6a) \end{aligned}$$

5. The structure discussed under point 1.1 has been invoked in the analysis of the relationship between the CPL and the level of economic development (the famous Harrod-Balassa-Samuelson theorem). Empirically, this correlation has been often corroborated.

We shall deduce a very simple specification of such an inter-connection, involving some supplementary notations:

YER - the aggregate output estimated in the currency of the reference country,

POP – the population, and

ypc – the per capita YER.

The following accounting relationships are evident:

$$YER_i = \frac{(Q_{iT} + Q_{iN}) \times P_i}{ER_i} = \pi \times \theta_i \times (Q_{iT} + Q_{iN} \times r_i) \quad (7)$$

$$ypc_i = \frac{YER_i}{POP_i} = \frac{\pi \times \theta_i \times (Q_{iT} + Q_{iN} \times r_i)}{POP_i} \quad (8)$$

$$\theta_i \times (Q_{iT} + Q_{iN} \times r_i) = \frac{ypc_i \times POP_i}{\pi} \quad (8a)$$

If the expression (8a) is substituted into (6a), a slightly modified formula of CPL_i yields:

$$CPL_i = \frac{\frac{ypc_i \times POP_i}{\pi}}{\frac{\theta \times (Q_T + Q_N \times r)}{Q_T + Q_N}} \quad (9)$$

The coefficients $s = \frac{Q_T}{Q_T + Q_N}$ and, respectively, $s_i = \frac{Q_{iT}}{Q_{iT} + Q_{iN}}$ are introduced as measures of the output sectoral structure.

$$CPL_i = \frac{\frac{ypc_i \times POP_i}{\pi \times \frac{Q_{iT}}{s_i}}}{\Theta \times [s + (1-s) \times r]} \quad (9a)$$

A sort of a foreign trade openness of economy can be also added: $opc_i = \frac{Q_{iT}}{POP_i}$. The resulted final formula:

$$CPL_i = \frac{ypc_i}{\pi \times \frac{opc_i}{s_i} \times \Theta \times [s + (1-s) \times r]} = \frac{ypc_i \times s_i}{\pi \times opc_i \times \Theta \times [s + (1-s) \times r]} \quad (9b)$$

reveals a strong link between the CPL and the economic development level (ypc). However, this connection is amended by the output structure (s), the international prices (π), the openness degree of economy (opc), the disturbing factor of the law of one price (Θ), the cost differential between tradables and non-tradables sectors (r). These influences are complicated and, obviously, need laborious further research. In this paper, we only statistically examine the relationship of the economic development level with the comparative price level, on the example of the European Union countries.

II.B. Empirical Analysis

1. The database covers the interval 1995-2014 (20 observations) for all the 28 member countries of the European Union (World Bank, OECD, Eurostat, 2015).

1.1. The following indicators have been retained:

- GDP – gross domestic product in PPP (US \$, current prices, current PPPs);
- POP – population;
- gpc - GDP per capita in PPP (US \$, current prices, current PPPs);
- CPL - comparative price level (PPP/ER in US\$);
- eu28gpc – EU28 mean of GDP per capita in PPP (US \$, current prices, current PPPs);
- eu28cpl_pop – EU28 mean of CPL, resulted from the national data weighted by countries' population.

1.2. Fortunately, there were very few cases of missing data. The empty cells have been completed by some approximations, as follows:

- Lithuania: for GDP and POP (period 1995-2003) - a retropolation of the ratio Lithuania/(Estonia+Latvia) by a Fisher moving average with four terms was used, namely $y=0.4*y(+1)+0.3*y(+2)+0.2*y(+3)+0.1*y(+4)$.
- Cyprus and Malta: for CPL (period 2008-2014) - an extrapolation again by a Fisher moving average with four terms was used, namely $y=0.4*y(-1)+0.3*y(-2)+0.2*y(-3)+0.1*y(-4)$.

1.3. Since the main indicators are defined in current prices, we propose to focus the analysis on two derived parameters - the ratios of countries' gpc and CPL to the corresponding EU28 data:

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$$rgdp_i = \frac{gpc_i}{eu28gpc} \quad (10)$$

$$rCPL_i = \frac{CPL_i}{eu28cpl_pop} \quad (11)$$

In this way, the inter-temporal comparisons become also more relevant.

2. All the rgpc and rCPL series were submitted to the Johansen test of cointegration (Table 1).

Consequently, for fifteen countries 1-5 cointegrating relations rCPL-rgpc were identified, for seven of them this number increases to 6-10, and for five to more than 10; in only one case (SVK) such a relation is absent. The connection between the comparative price level and the per capita GDP (as economic development degree) is statistically validated at the European Union scale.

Table 1

Number of Cointegrating rgpc-rCPL Relations (selected at 0.05 level*)

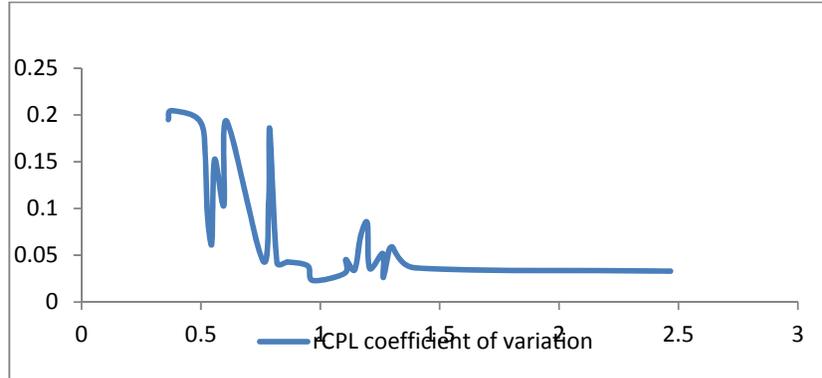
Data trend	None	None	Linear	Linear	Qua- dratic	None	None	Linear	Linear	Qua- dratic
Test type	No interc., no trend	Interc., no trend	Interc., no trend	Interc., , trend	Interc., , trend	No interc., no trend	Interc., no trend	Interc., no trend	Interc., , trend	Interc., , trend
	Trace	Trace	Trace	Trace	Trace	Max-Eig	Max-Eig	Max-Eig	Max-Eig	Max-Eig
AUTrCPL- AUTrgpc	1	1	2	1	2	1	1	2	1	2
BETrCPL- BETrgpc	0	0	1	0	0	0	0	0	0	0
BGRrCPL- BGRrgpc	1	1	1	1	2	1	1	1	1	2
CYPrCPL- CYPrrgpc	1	1	1	0	0	1	1	1	1	0
CZErCPL- CZErGPC	1	2	0	0	0	0	0	0	0	0
DEUrCPL- DEUrGPC	2	0	0	0	0	0	0	0	0	0
DNKrCPL- DNKrGPC	0	0	0	1	1	0	0	0	1	1
ESPrCPL- ESPrGPC	1	1	1	1	1	1	1	1	1	1
ESTrCPL- ESTrGPC	1	2	0	0	0	1	2	0	0	0
FINrCPL- FINrGPC	0	0	2	1	1	0	0	0	1	1
FRArCPL- FRArGPC	0	0	1	0	0	0	0	0	0	0
GBRrCPL- GBRrgpc	1	0	1	0	2	1	0	0	0	0
GRCrCPL- GRCrgpc	0	1	2	0	2	1	0	0	0	0

Data trend	None	None	Linear	Linear	Qua- dratic	None	None	Linear	Linear	Qua- dratic
HRVrCPL- HRVrgpc	0	0	0	0	1	0	0	0	0	1
HUNrCPL- -HUNrgpc	0	0	0	1	1	0	0	0	1	1
IRLrCPL- IRLrgpc	0	0	0	1	2	0	0	0	1	2
ITArCPL- ITArgpc	1	0	0	0	0	1	0	0	0	0
LTUrCPL- LTUrgpc	0	1	0	0	2	0	0	0	0	0
LUXrCPL- LUXrgpc	1	1	1	2	2	1	1	1	2	2
LVArCPL- LVArgpc	0	0	0	0	2	0	0	0	0	0
MLTrCPL- MLTrgpc	1	0	0	0	0	1	0	0	0	0
NLDrCPL- NLDrpc	0	0	1	1	2	0	1	1	1	2
POLrCPL- POLrgpc	0	0	0	1	2	0	0	1	0	0
PRTTrCPL- PRTTrgpc	1	1	2	1	2	1	1	2	1	2
ROUrCPL- -ROUrgpc	0	0	1	0	1	0	0	1	1	1
SVKrCPL- SVKrgpc	0	0	0	0	0	0	0	0	0	0
SVNrCPL- SVNrgpc	0	0	2	0	2	0	0	0	0	0
SWErCPL- -SWErgpc	0	1	2	1	2	0	1	2	1	2

Note: The number of lags is 1, except for CZE, DEU, EST, and POL, for which 1 and 2 lags has been applied.

3. It is interesting to notice that the economic development level influences not only the size of the comparative price level, but its volatility as well. For each country series (20 observations) the mean of rgpc and the coefficient of variation of rCPL were computed. The Graph CV plots the second indicator depending on the first (which is displayed in ascending order).

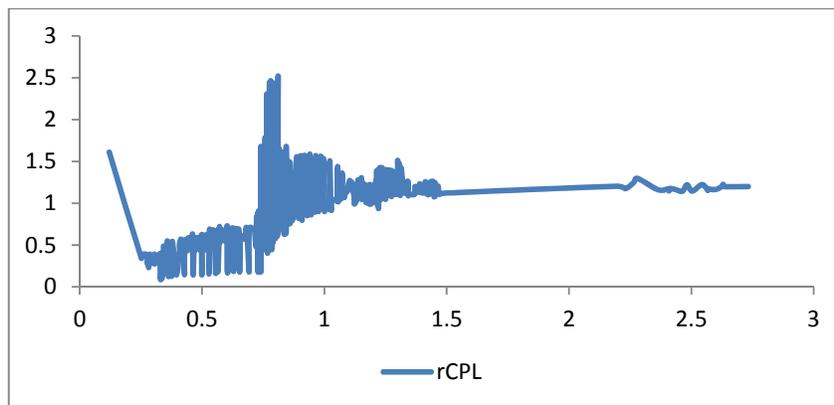
Graph CV



The picture is *per se* conclusive: the higher positions of *rgpc* are clearly associated with more stable *rCPL*.

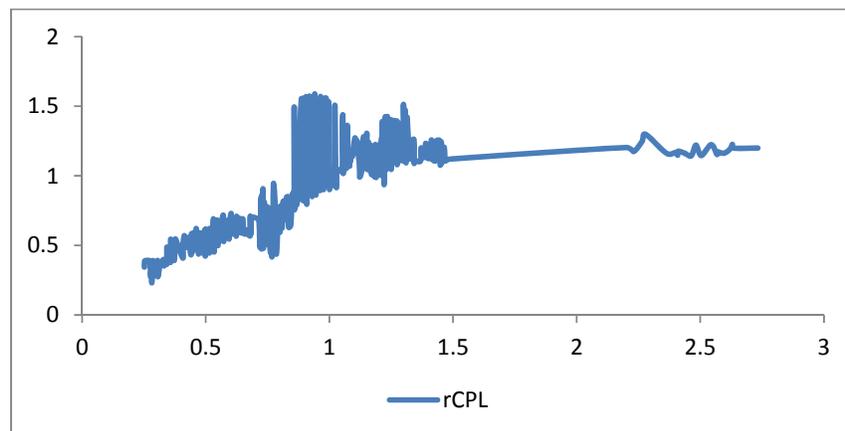
4. Our analysis has revealed another significant property of the relationship between the economic development and the comparative price level. The database (28 countries for 20 years) has been transformed into two continuous series (each of 560 observations), *rgpc* and *rCPL*. Such an operation seems reasonable, taking into account that both these variables (GDP per capita and comparative price level) are normalized as ratios of the country data to the corresponding EU28 indicators. The Graph CS1 describes the *rCPL* depending on *rgpc* (ascending arranged). It represents the entire sample.

Graph CS1



In order to easier depict the main trend, several series (LTU, MLT, and PRT) - suspected to contain many outliers because of statistical incoherencies – have been removed. The data base remains any way relevant (500 observations).

Graph CS2



Therefore, the influence of $rgpc$ on $rCPL$ is direct, but not linear (as maybe it was expected). After a certain point, the increases in $rgpc$ are associated with low modifications of $rCPL$.

III. Position of the Romanian Economy

III.A. Post-Crisis Evolution

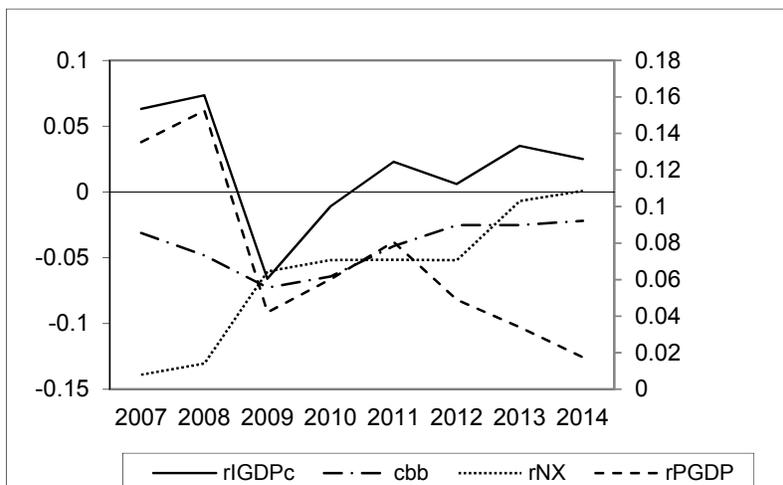
Since the evolution of the Romanian economy after the collapse of the former socialist system has been described by numerous books and articles, we shall briefly insist only on the recent period.

1. Its post-crisis recovery has been reached relatively faster than in other EU countries. For illustration, the following yearly macro-indicators will be retained:

- the rate of the gross domestic product at constant prices ($rIGDP_c$) as a measure of economic growth: $rIGDP_c = \frac{GDP}{GDP_{(-1)} \times PGDP_{-1}}$, where GDP – gross domestic product at current prices and $PGDP$ – GDP deflator;
- the ratio of the general consolidated budget deficit to GDP (cbb) as a quantitative expression of the public finance soundness; $cbb = \frac{BR - BE}{GDP}$, where BR and BE are the public budget revenues, respectively expenditures;
- the rate of the gross domestic product deflator ($rPGDP$) as a global inflation magnitude; $rPGDP = PGDP - 1$;
- the ratio of the net exports to GDP (rn_x), as a reliable mirror of the external economic position of the country; $rn_x = \frac{X - M}{GDP}$, where X represents exports and M – imports.

These indicators are plotted on Graph PCE for the period after 2007, when Romania became the member of the European Union.

Graph PCE



Therefore, a moderate growth under a fiscal consolidation and a decreasing inflation represents the main characteristic of the post-crisis recovery of the Romanian economy.

2. There are many factors that could be involved in explaining this evolution. We outline the circumstances that seem to be essential.

On the demand side, we can notice first of all the recuperation of the nominal revenues diminished during the years 2010-2011 and the reduction in the value added tax on some foods that have stimulated – although in a limited proportion – the domestic consumption. The expanding exports have also played an important role.

On the supply side, the reduction in the negative output gap (almost -7% in 2011) has exerted probably the most consistent influence. We must also not forget the “favorable” agricultural years (especially 2013), this primary sector continuing to have a large impact on the entire Romanian economy. New investments in industry and services have as well expanded the productive potential of the country.

An important role has been played by the increasing absorption degree of the financial resources provided by the European Union. Normally, the positive effects of this factor influenced concomitantly both the aggregate demand and the domestic supply.

We must also mention that during this entire period the Romanian authorities have benefited from the financial (effective or precautionary) and technical macroeconomic assistance of the International Monetary Fund, World Bank and the European Commission.

3. The domestic economic situation is now dominated by the implementation of a new Fiscal Code and a new Fiscal Procedure Code, on one hand, and the introduction of a unitary remuneration system in the public sector, on the other.

3.1. The changes induced by the new fiscal instruments and the operational measures adopted for the improvements of the fiscal authorities' activity have preponderantly three goals.

3.1.1. Continuation of fiscal relaxation - addition (to measures adopted during 2014-2015 years) of a series of new facilities as:

- the diminution (beginning with January 1st 2016) of the standard VAT rate from 24% to 20%;
- the extension of the nomenclature of goods and services with VAT of 9% and 5%;
- the reduction in excises;
- the decrease in the tax on dividends (from 16% to 5%);
- the enlargement of the non-taxed category of revenues;
- the introduction of supplementary fiscal facilities for the small-sized enterprises.

3.1.2. Strengthening the surveillance of fiscal authorities by: cleaning as most as possible the incoherencies, ambiguities and contradictions from the fiscal rules, by increasing the professional quality of the fiscal control; by fighting more efficient against the corruption in this system.

3.1.3. Stimulating the voluntary compliance of the tax payers by: simplifying the specific legislation, eliminating the bureaucratic distortions, improving the activity of the fiscal authorities

Obviously, all these measures – correctly and consequently promoted – can positively influence the business climate and the general development of Romania, by stimulating investments and consumption, a better collection of the public budget revenues, their more efficient utilization, the compression of underground economy.

3.2. There are official discussions about introduction of a unitary remuneration system in the public sector. Taking into considerations the anomalies - numerous and sometime clearly unjustifiable - accumulated in this field, a more equitable wage grading would be necessary not only from the social-moral perspective, but also as a condition of ameliorating the quality of public services.

The problem comes from the desideratum to rescale the remuneration system under the restriction "any individual salary will not be diminished", which inherently would imply an important rise in the wage average level. Depending on the length of implementation interval and the scheduling of wage increases, the pressure of such a solution on public finance may or may not be bearable. This circumstance has to be taken into account in our macromodel prospective simulations.

III.B. Macromodel Simulations for 2015-2016

1. The simulations have been processed using the 2012 Version of the Romanian Macromodel (Dobrescu, 2013; NCP, 2013; Pauna and Saman, 2013). With this aim, the indicators for 2013-2014 were updated, according to the new official statistics. Normally, this operation has been done keeping the methodological definitions adopted in the original version of the macromodel. The input-output tables have been lengthened with the year 2012, the I-O coefficients being correspondingly re-estimated, under the ten-sectoral structure of economy. In order to take into account the already occurred or

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anticipated changes in the domestic and external context of the Romanian economy (during the years 2015-2016), several equations were amended by accommodated exogenous parameters and expert corrective coefficients. Such a solution has been adopted in the previous similar applications as well.

2. The simulations were focused on three computational outputs.

- a) The indicators for 2015 have been recalculated in accordance with the updated statistical data and the macroeconomic policies effectively promoted by the Government and the Central Bank.
- b) Concerning 2016, the simulations incorporate the impact of the new Fiscal Code, under conditions of a prudent growth of wages in the public sector. This forecasting construction is considered as a Base Scenario.
- c) Separately, the consequences of a possible higher increase in the nominal revenues in this sector (including its contagious effect on private economy also) are approximated.

3. The Table 2 synthesizes the obtained results comparatively with the estimations of the National Commission for Prognosis (autumn forecast).

Table 2

The Romanian Economy during the Years 2015-2016

Indicators	Symbol	Esti- mations	2013	2014	Prel. data for 2015	Base Sc. For 2016
Gross domestic product, current prices, bill. RON	GDP	NCP	623.3	660.6	696.3	734.7
		Model	637.583	666.637	698.790	731.739
Index of gross domestic product, constant prices (previous year=1)	IGDPc	NCP	1.016	1.022	1.028	1.03
		Model	1.03341	1.031995	1.031683	1.03921
Index of households' consumption, constant prices (previous year=1)	ICHc	NCP	1.023	1.017	1.02	1.019
		Model	1.00733	1.05048	1.01415	1.03838
Index of public consumption, constant prices (previous year=1)	ICGc	NCP	1.015	1.013	1.014	1.015
		Model	0.97906	1.04365	1.02878	1.02128
Index of gross fixed capital formation, constant prices (previous year=1)	IGFCFc	NCP	1.035	1.056	1.067	1.073
		Model	0.92149	0.94551	1.07111	1.04064
Export of goods, bill. EURO	XGE	NCP	46.715	48.96	52.14	56.47
		Model	43.9	46.660	48.445	57.642
Import of goods, bill. EURO	MGE	NCP	57.55	61.06	65.455	71.15
		Model	49.5661	52.3953	60.9751	72.2028
Current account, bill. EURO	CAE	NCP	-5.76	-6.345	-6.64	-6.9
		Model	-1.168	-0.648	-8.423	-10.083

Indicators	Symbol	Esti- mations	2013	2014	Prel. data for 2015	Base Sc. For 2016
Ratio to GDP of the current account	rCAE	NCP	-0.042	-0.042	-0.042	-0.041
		Model	-0.0081	-0.0043	-0.0533	-0.0609
Consumer price index (previous year=1)	CPI	NCP	1.043	1.033	1.028	1.025
		Model	1.0398	1.0107	1.01287	1.00481
Gross domestic product deflator (previous year=1)	PGDP	NCP	1.048	1.037	1.025	1.024
		Model	1.034	1.0175	1.0160	1.0076
Exchange rate RON/EURO	ERE	NCP	4.5	4.45	4.4	4.4
		Model	4.419	4.4446	4.4189	4.42095
Employment, mill. persons, AMIGO definition	E	NCP	9.25	9.35	9.47	9.595
		Model	9.2474	9.183	9.292	9.685
Salaried persons in economy, mill. persons, AMIGO definition	ES	NCP	6.275	6.345	6.425	6.48
		Model	6.2706	6.2509	6.2239	6.5824
Unemployment rate, ILO definition	ru	NCP	0.072	0.07	0.068	0.067
		Model	0.071	0.068	0.06591	0.06443
General consolidated budget revenues, bill. RON	BR	NCP	209.285	221.9211	233.981	245.0268
		Model	200.374	214.3149	226.4062	240.5818
General consolidated budget balance, bill. RON	BE	NCP	222.691	235.957	248.605	262.081
		Model	216.1683	225.8081	239.8888	256.2956
General consolidated budget balance, bill. RON	BB	NCP	-13.406	-14.0359	-14.624	-17.0542
		Model	-15.794	-11.4932	-13.4827	-15.7138
Ratio to GDP of the general consolidated budget balance	cbb	NCP	-0.02151	-0.02125	-0.02100	-0.02321
		Model	-0.02477	-0.01724	-0.01929	-0.02147

The main features of the post-crisis evolution are, therefore, maintained.

- The negative output gap continues to decrease, the rate of economic growth approaching 4%.
- It will be based on the increase of domestic aggregate demand (private and public consumption, gross fixed capital formation) by 5.6%. An important expansion of exports of goods and services is also anticipated.
- Similarly to the year 2015, the inflation remains at a low level.

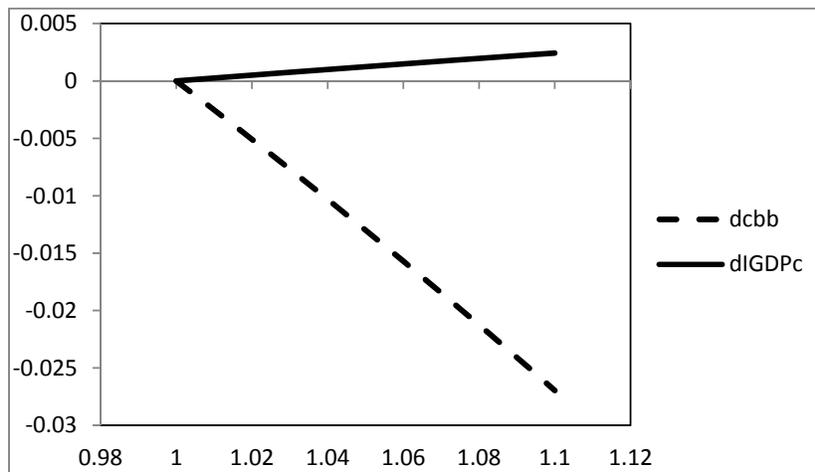
- The hypotheses adopted by the macromodel simulations allow to keep the ratio of public budget deficit to the GDP at approximately 2%, under the implementation of the new Fiscal Code.

4. The effects of a more accentuated growth of nominal revenues in the public sector were simulated solving successively the macromodel for greater levels of average wage in this sector as compared to the above-presented Base Scenario (index IWGBS, were Base Scenario=1). Illustratively, variants for IWGBS varying from =1 to =1.1 were computed.

A supplementary increase in the nominal revenues of employees in the public sector, normally, expands the domestic aggregate demand, which in a relatively price-stable environment favors the economic growth. Are these positive effects able to compensate the impact of this increase on deficit of the general consolidated budget? The Graph IWGBS is conclusive from this point of view. It sketches the differences against the Base Scenario registered by increasing IWGBS at the decisive following indicators:

- index of the real gross domestic product (dIGDPc);
- ratio to GDP of the public budget deficit (dcbb).

Graph IWGBS



Therefore, any increment of the average wage in the public sector over the Base Scenario level worsens the public budget deficit. For IWGBS=1.035, the Maastricht ceiling (-3%) is surpassed. In the case of IWGBS=1.1, this parameter becomes even -4.8%. Concomitantly, a slight deterioration of the external equilibrium (ratio to GDP of the current account) is also registered.

III.C. Projecting the CPL

1. The starting point is an econometric estimation for Romania of the relationship between the comparative price level (ROUCPL) and the GDP per capita in PPP determination (ROUgpc).

1.1. The simplest specification will be adopted, two estimators for ROUCPL being retained: the contemporaneous ROUgpc and a time factor (reflecting transitional circumstances) which asymptotically tends to stabilize (consequently, the intercept is omitted):

$$\text{ROUCPL} = c(1) \times \text{ROUgpc} + c(2) \times \frac{t}{t+1} \quad (12)$$

1.2. The cointegrating regression has been solved by fully modified least squares (FMOLS), resulting:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROUGPC	0.022571	0.005734	3.936473	0.0011
T/(T+1)	0.296772	0.079500	3.732994	0.0017
R-squared	0.769542	Mean dependent var		0.531734
Adjusted R-squared	0.755986	S.D. dependent var		0.169620
S.E. of regression	0.083789	Sum squared resid		0.119349
Long-run variance	0.012512			

The regression acceptably approximates the statistical data, except for the 2005-2009 period, characterized by the overheating pre-crisis conjuncture and the effects of subsequent severe recession.

2. Admitting, in the case of Romania, that the yearly index of gpc is equal to the same index of GDP at constant prices, and applying the above econometric parameters to the macromodel simulations presented in Table 2, we obtain the following series of gpc (GDP per capita, US \$, current prices, current PPPs, th.), and CPL (Comparative price level as PPP/ER in \$) for the entire interval 1995-2016:

Table 3

Evolution of gpc and CPL for Romania during the Period 1995-2016

Year	ROUgpc	ROUCPL	Year	ROUgpc	ROUCPL	Year	ROUgpc	ROUCPL
1995	5.380393	0.347532	2002	7.06177	0.350998	2009	15.5296	0.690788
1996	5.731492	0.32234	2003	7.746241	0.42208	2010	16.25223	0.656112
1997	5.50217	0.332976	2004	8.864758	0.473637	2011	17.36289	0.691829
1998	5.336874	0.40985	2005	9.524457	0.583659	2012	18.1367	0.612467
1999	5.340533	0.343296	2006	11.34955	0.627074	2013	18.97216	0.66236
2000	5.707344	0.335614	2007	13.17203	0.764455	2014	19.40135	0.682208
2001	6.486825	0.329717	2008	15.69427	0.811481	2015	20.01606	0.735068
						2016	20.80089	0.753369

The quality of such projections could be ameliorated by including in the econometric specification of CPL, besides gpc, other contiguous variables.

IV. Final Comments

1. Our paper has added some conceptual considerations and empirical evidences concerning the valences of the comparative price level (CPL) as a parameter of economic convergence.

On one hand, it is connected to some major indicators of the nominal economy (market exchange rate, domestic prices), being at the same time strongly linked with the economic development level (relationship $CPL=f(gpc)$).

2. The comparative price level must be taken into consideration in evaluating the capability of a given economy to participate to a regional common currency area. As it is known, the Maastricht criteria arouse many controversies. In the case of Romania, see Orăștean and Marginean, 2010; Dulgheru, 2014; Isarescu, 2015; Daianu, 2015; Dumitru, 2015; Popescu, 2015; European Commission, 2015.

There were already signalled some latent tensions between the nominal and real convergence or between the Maastricht etalons and the comparative price levels trends (Drastichova, 2012; Buti and Turrini, 2015).

3. There are, of course, many problems to be clarified in this field. The dependence $CPL=f(gpc)$ is affected by a set of intrinsic intermediate factors, such as the global structure of output, the dynamics of international prices, the openness degree of economy, the circumstances disturbing the law of one price, the cost differential between tradables and non-tradables sectors.

A more detailed analysis of these influences would allow to better identify the functional form of this relationship, implicitly to ameliorate the quantitative specification of the corresponding estimators.

4. An inciting scientific challenge is provided by the possible discrepancy between the steady-state of gpc and the steady-state of CPL, as the database of the European Union countries seems to attest (see Graphs CS1 and CS2).
5. In our opinion, a more congruent set of conditions for entering the regional common currency area ought to assign a minimal comparative price level, at which a given economy would be compatible with such participation. The estimation of this threshold will need also intensive further research.

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