Impact of the Financial Crisis on the Convergence of the Czech Economy with the Euro Area Economy[1]

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Abstract
In 2004 the Czech Republic has become one of the EU Member States but so far has not accepted the single currency. The fulfillment of the Maastricht convergence criteria is the exhaustively defined condition for the adoption of the euro. Given that these criteria are very often criticized, the real convergence is examined at countries that want to become a member state of the euro area. The process of the economic convergence has been certainly affected by the financial crisis. Thus, this article will be focused on analyzing and evaluating the impact of the financial crisis on the convergence of the Czech economy to the economy of the euro area (EA17). The convergence process will be verified by econometric models with the use of the panel analysis. It will be focused on the research of the economic level, the price level of investments and the openness of examined economies.

Keywords: convergence, econometric approach, euro area, panel data analysis
JEL codes: C33, O47

1. Introduction

Since 2004 the Czech Republic has been involved in integration processes that have been going on in Europe since the 50th of 20th century. Together with nine other states[2] the Czech Republic became a member of the European Union in that year. From the legal point of view, there is an obligation to develop efforts to meet the Maastricht convergence criteria because of the Czech Republic membership in the EU. Their achievement is a necessary condition for adopting the euro and the possibility to join the euro area. Following states (from the states that joined the EU in 2004) - Cyprus, Malta, Slovenia, Slovakia and Estonia (the countries are sorted by the date of joining the euro area) have fulfilled the convergence criteria so far. Although the fulfillment of the convergence criteria is exhaustively defined obligation, it is the responsibility of individual countries to set the precise date of the entry into the euro area and it depends primarily on their readiness to adopt the euro. Thus the question of the euro adoption is still topical for the Czech Republic. With considering the fact that the Czech economy has been hit by the economic crisis as well as other world economies, but also because of the prevailing euroscepticism of the current political representation of the Czech Republic, there is a continual reassessment of the expected data of the possible euro adoption.

The study of the economies convergence in real ways has become the phenomenon of answering the question of euro readiness not only in the Czech Republic. The traditional question "When will the Czech Republic meet the exhaustively defined convergence criteria?" is therefore associated with the new unknown questions "Will the compliance with nominal convergence criteria ensure the equalization of economic and living standards of the Czech Republic with the Euro Area?",

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[2] Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Slovakia, Slovenia, Poland

"How has the current economic crisis affected the convergence of the economic level of the Czech Republic economy to the average economic level of the euro area?".

2. Brief Literature Overview

Above all, the convergence of economic level is a key aspect during the examination of the real convergence of economies. But there are many other areas and approaches to measure the real convergence. Generally, these approaches can be divided according to economic theories they proceed from.

2.1 Economic convergence from the perspective of comparative economics

In research studies[3], where the comparative-economic analysis is applied, the real convergence is viewed as the reduction of economic performance disparities of individual countries or regions. Formally, the process of convergence can be written as follows[4]:

$$\frac{y_{1,t}}{y_{2,t}} < \frac{y_{1,t+1}}{y_{2,t+1}}, \qquad (1)$$

where y is the income per person of unit 1 (catching up economy) and 2 (advanced economy) at time t and $t+1$. The research of the convergence has become an integral part of international economic comparisons, which compare the economic performance and especially living standards of individual countries or regions in a predefined time period. The outcomes of such research are not only findings about the convergence or divergence of examined variables, but also how quickly these changes take place, see Gomez (2008), Slavík (2005), Soukiazis and Castro (2005). Two following concepts of convergence are based on the theoretical framework of growth models. The first type of convergence is β-convergence; the second type is the σ-convergence. The concept of *β-konvergence*[5] is based on the neoclassical theory of the economic growth, which postulates that the initially poorer countries evince more dynamic growth. Thus the poorer countries gradually converge to richer countries, whose growth rate is not so high. GDP growth is negatively dependent on the initial economic level:[6]

$$\frac{1}{T}\log\left(\frac{Y_{i,T}}{Y_{i,0}}\right) = \alpha + \beta \log Y_{i,0} + \gamma Z_i + \varepsilon_i, . \qquad (2)$$

Where the left side of the equation is the average growth of GDP per capita in the real formulation of the purchasing power parity during the period from 0 to T, which is dependent on the initial economic level $Y_{i,0}$ and a set of exogenous factors Z_i. T variable expresses the number of analyzed years, α indicates the tiered constant, β and γ are coefficients, ε_i is a random component. Index *i* denotes particular countries. The β-convergence occurs when there is the negative direction of the beta line. The concept of *σ-convergence*[7] comes also from the neoclassical theory of the economic growth, according to which all countries converge to the same level of maturity or to the same economic performance. This type of convergence works with the dispersion around the average national income per capita in analyzed countries. Sigma convergence means a reduction in dispersion of individual countries economic levels over the time. The difference between these types of convergences lies in the fact that the sigma convergence means so-called catching up effect among particular economies, while beta convergence is associated with countries converging to a steady state. As Smrčková et al.

[3] Brada and Kutan (2001), Bruha and Podpiera (2011), Crihfield et al. (1995), Fung (2009), Hančlová et al. (2010), Palan and Schmiedeberg (2010), Quah (1996), Sala-i-Martin (1996), Skott (1999), Taylor (1999), Verspagen (1995)

[4] Smrčková et al. (2008)

[5] Furceri (2005), Michelacci and Zaffaroni (2000), Pfaffermayr (2009)

[6] Smrčková et al. (2008)

[7] Dalgaard and Vastrup (2001), Lucke (2008), Miller and Upadhyay (2002)

(2008) states, when marking the variance (dispersion) of the logarithm of real GDP per capita σ^2_t in the group of countries at time *t*, then σ-convergence between period *t* and *t +1* means:

$$\sigma^2_t > \sigma^2_{t+1}. \quad (3)$$

According to institutional parameters, the economic convergence can be divided into absolute and conditional one. The *absolute* convergence assumes the convergence to a steady state, which is identical for all economies, and which is influenced by individual characteristics and parameters of the researched economy (savings, population growth, depreciation degree of capital goods, etc.). All economies have the same steady state in this theoretical approach; however countries with lower GDP per capita have higher growth rates in real terms. The concept of the *conditional* convergence abstracts from the assumption of same stable conditions for all economies. The convergence is conditioned by variables that affect different stable states (savings rate, parameters of the production function, government policies influencing the position of the production function, infrastructure, etc.). If the convergence is measured in the terms of homogeneous group of economies with similar institutional characteristics, it can be described as the conditional convergence. OECD countries are the typical block of countries for measuring the conditional convergence. On the other hand the convergence of Bangladesh and the USA can be hardly expected.

2.2 Definition of the convergence in growth theories

Fundamentals of the convergence theory are based on the theory of the economic growth. The beginnings of convergence testing in practice were developed from the Solow-Swan model of the economic growth (Swan, 1956), (Solow, 1956), in which the output of each country converges to the steady state given by economic conditions. The Slow-Swan model is based on the assumption of decreasing returns on capital, which result in the convergence of economies towards equilibrium.

The basic hypothesis of the Solow-Swan model is the existence of exogenous variable (unexplained by the model) – the technical progress as the economic growth driving power. While respecting the default hypotheses, the Solow-Swan model explains the convergence as a process in which more advanced countries accumulate capital more quickly, which results in dimishing marginal product of capital and ceteris paribus, dimishing returns on capital. Therefore capital is placed in countries, in which higher yields are achieved because of the lack of capital. In the mid 80 of 20th century new growth theories followed the neoclassical approach in the form of the endogenous growth theory of Lucas (1988) and Romer (1986), Boucekkine´s et al. AK models (2010), Gomez (2008) and others and a Lucas two-sektor-model of the endogenous growth, Lucas et al. (1993). The key contribution of endogenous growth theories is the explanation of the technological progress, which was considered by that time as an exogenous variable by neoclassical growth theories. Another important contribution of new growth theories was the possibility of knowledge spillovers, which resulted in increasing returns from capital accumulation. The capital accumulation is viewed as the accumulation of physical and human capital, i.e. it depends on the size of the workforce in the research. Empirical studies based on these models confirmed the *conditional* convergence, thus the direction to the steady state at researched economies, which showed the same institutional parameters. Mainly Barro and Sala-i-Martin (1992) followed above mentioned concepts of the growth theory by defining *β-convergence* and *σ-convergence.*

2.3 Real convergence and the theory of the optimum currency area

In the terms of the Czech economy, the study of the convergence is relevant mainly for answering the question whether the country should join the euro area and adopt a common currency or not. If the country decides whether to join EMU, then the theory of optimum currency area (Mundell, 1961) (hereinafter OCA) offers different approaches for such appraisal. The primary aim of the OCA

theory is to explore how the countries adapt to economic shocks within the euro area[8]. If the country is sufficiently prepared for adopting the common currency, then it reduces the probability of asymmetric shocks hitting. The theory of the optimal area assesses the readiness eg through the correlation analysis of supply and demand shocks, see Babetski et al. (2004), the convergence of business cycles, see Allegret and Sand-Zantman (2009), convergence of monetary policies, the OCA index, e.g. Bayoumi and Eichengreen (1997), Kim and Chow (2003) or exploring the role of intra-industry business. The review of the OCA theory is showed in Kučerová´s study (2005).

3. Methodology and goal

3.1 Methodological solutions of a linear regression model of panel data

The panel approach to the analysis of convergence was introduced by Islam (1996b), who emphasized that using a cross-sectional analysis the differences in steady states of individual economies may be observed and measured; however, there also may be differences that the cross-sectional analysis is not able to capture. And thus he pointed out that only the analysis of panel data allows eliminating the gaps of conventional cross-sectional data analysis.

The basic advantage of panel analysis is the ability to explore the relationship and correlation of data in two dimensions. The first dimension captures quantities in terms of time; the second dimension captures cross-sectional data of particular objects of research. A typical feature of panel (or longitudinal) data is that individual observations are investigated for several time periods. Exploring panel data is a model approach of solution, where both methods of time series analysis and also elements of regression analysis are applied.

Panel is generally a set of units that are in some respects similar (companies, countries, etc.). This set of units is then continuously observed. So panel data enable several advantages compared to the cross-sectional analysis of data - better detection and measuring the effects that the cross-sectional analysis of data or time series cannot identify. To other advantages of panel models belong a construction and verification of more complex models with the corresponding number of degrees of freedom. Conversely, the problematic moments in the panel analysis are primarily a small length of time series, measurement errors deformation or data collection. Despite these deficiencies is the panel data analysis applied in the field of micro- and macroeconomics, and thus appears to be suitable for the convergence analysis.

3.2 Input data

Statistical input data of linear regression model to measure the convergence of selected euro area economies and the economy of the Czech Republic to the average economic level of the euro area is made up of particular national data, drawn from the Penn World Table database, see Heston et al. (2011) and World Bank (2011) database - World Development Indicators section & Global Development Finance section. For the studied economies were applied time series of three indicators: gross domestic product (GDP per capita, converted according to purchasing power parity, constant 2005 prices, international $), the price level of investment (PLI) and the degree of openness of the economy (OPENK, constant 2005 prices, international $). The comparability of data was ensured by the fact that the variables were transferred to a common base by conversion according to the natural logarithm. From the development of time series of selected indicators for individual euro area

[8] Shocks can occur both on the demand and supply side, see Fidrmuc and Hagar (2004), may be permanent or temporary, may be exogenous or generated by the economic policy, may affect symmetrically or asymmetrically. It is the symmetric shock when it affects all parts of the researched unit (region, state, group of countries) equally. The asymmetric shock is manifested by different impacts in different parts of the unit, see Hušek and Formánek (2006).

economies were then calculated their average values for the whole euro area, separately for each year, depending on which countries were members of the monetary union in a given year. The subject of the analysis is data for all euro area Member States[9] and the Czech Republic in the reference period 1995-2009[10].

3.3 Specification of the linear panel data model for the euro area economy and the economy of the Czech Republic

The aim of a panel regression is not to look for a model helping to predict the future evolution of the convergence process, but to examine the dependencies between the explanatory variables (PLI and OPENK) and the explained variable (GDP) and to estimate for each country, whether it converges or diverges to the average economic level of the euro area. Although the model works with a small number of observations in time - for individual economies about 20 observations in the reference period 1990-2009, this modeling approach can be applied. Restriction on short time series is slightly eliminated by using a panel approach to the analysis of time series, but also by use of techniques of dummy variables that can be used to monitor the possible convergence or divergence among the studied economies (fixed effects). Mathematically, the estimate of a linear regression model of panel data using dummy variables for the euro area countries and the CR economy can be written as follows:

$$\ln GDP_{i,t} = \hat{\alpha} + \hat{\beta}_1 \ln PLI_{i,t} + \hat{\beta}_2 \ln OPENK_{i,t} + \sum_{i=1}^{18} \hat{\gamma}_i D_{i,t} + \hat{\varepsilon}_{i,t}, \qquad (4)$$

Where:

$\ln GDP_{i,t}$	natural logarithm of gross domestic product per capita,
$\ln PLI_{i,t}$	natural logarithm of price level of investment,
$\ln OPENK_{i,t}$	natural logarithm of openness of the economy,
α	constant level,
β_1, β_2	slope parameters,
γ_i	differential parameter of fixed effect,
$\varepsilon_{i,t}$	random component,
$D_{i,t}$	binary dummy variable to identify the country (the value 1 for country data in time t, otherwise the value 0),
i	index indicating the country (base country is the euro area average, total of 18 countries monitored - including 16 euro area countries in the reference period 1990-2009, Estonia and the CR)
t	index indicating the time (t = 1990, 1991, ..., 2009).

Dependent variable in the model is a macroeconomic indicator of gross domestic product per capita (GPD). This is the basic macroeconomic aggregate that is normally used in studies to examine the convergence of economic levels, e.g. (Abiad et al., 2007) (Barro and Sala-i-Martin, 1992) (Novak, 2009), (Slavík, 2005). The explanatory variables represent the estimate of impact of the price level of investment (PLI) and the openness of the economy (OPENK) on the development of economic level approximated by the gross domestic product per capita. These are mainly about examining the relative

[9] Belgium, Estonia, Finland, France, Ireland, Italy, Cyprus, Luxembourg, Malta, Germany, Netherlands, Portugal, Austria, Greece, Slovakia, Slovenia, Spain

[10] Estonia and the Czech Republic did not enter the calculation of average values for the euro area, because Estonia was not in the reference period a Member State of the monetary union and the Czech Republic has not entered the Monetary Union yet

contribution (in %) of the foreign trade relations to the convergence process of the euro area economies and the CR economy. Furthermore, it was necessary to assign dummy variables to individual reference countries. The model works with 18 economies (17 euro zone countries and the CR), which are represented by the following dummy variables:

Table 1: List of dummy variables for individual euro area economies and the CR

Dummy variable	Country
D1	Austria
D2	Belgium
D3	Cyprus
D4	Estonia
D5	Finland
D6	France
D7	Germany
D8	Greece
D9	Ireland
D10	Italy
D11	Luxembourg
D12	Malta
D13	Netherlands
D14	Portugal
D15	Slovakia
D16	Slovenia
D17	Spain
D18	Czech Republic

Source: self-elaboration

With model in this specification it is possible to determine which countries are converging or diverging to the average economic level of the euro area, which was obtained as an arithmetic average of 16 member states of the monetary union in the reference period 1990-2009. Average economic level of the euro area countries is seen as a permanent state, to which the studied economies of the euro area (including Estonia) and the Czech economy converge (diverge), with a dynamic steady state in time. Dynamization is ensured by the fact that the euro area expanded at the time and the new Member States were gradually included to a diameter. For example, in 1990-1999 (before the actual start of construction of the third stage of Economic and Monetary Union) is the arithmetic average calculated from the first 11 member states that joined the euro area in 1999).

To be able to assess the impact of the financial crisis in 2008, which had its origin in the U.S., the model has been carefully calculated in four versions: the base period (1990-2009), the period before the impact of the crisis on the studied variables (1990-2008), the period before the euro area (1990-1999) and the period of functioning of the euro area (2000-2009). With this structure it will be possible to analyze both the impact of financial crisis on the convergence of economies, but also it will be possible to evaluate the rate of convergence of the studied economies in particular periods.

4. Estimation of the econometric model and interpretation of results

Parameters of linear regression model of panel data are estimated using least-squares method (OLS). The model will be verified statistically at 5% (*) and 10% (**) significance level and for the calculations is used the SPSS (15.0) program.

Before performing the economic verification and interpretation of the model, the model will be subjected to statistical and econometric verification. Statistical significance of the model was tested using the F-test. Individual model parameters were tested by the t-test. Model as a whole, including the individual parameters are statistically significant at 5% or 10% level of significance.

The statistical verification is folowed by econometric verification, which includes autocorrelation, heteroscedasticity and multicollinearity testing in the model. Autocorrelation was tested using the Durbin-Watson (D-W) test and graphically using the autocorrelation (ACF) and partial autocorrelation function (PACF). With the D-W test was identified first-order autocorrelation, for all four mutations in the econometric model of the reference periods. For this reason, it was necessary to remove the revealed residual autocorrelation using the "Cochrane-Orchut". It is a method that estimates the regression model using the generalized least squares method (GLS). By this method, the original estimated model is transformed via the parameter "Rho". With this correction the autocorrelation of first and higher orders was eliminated, which is evident from the graphs in the Appendix.

Heteroskedasticity and multicollinearity of residues were tested on the final models that have been deprived of autocorrelation. Heteroskedasticity was tested using the graphical analysis, which assessed the development of standardized levels of residues of the final model against the predicted value (GDP), for all countries. On the selected levels of significance the model can be considered heteroscedastic. Based on this fact the regression model was modified to achieve the homoscedasticity. The regression equation was divided by unstandardized predicted values and this method ensured the constant variance of residues. Multicollinearity, i. e. the mutual dependence of the explanatory variables, was not detected in the regression models and this was proved by Pearson correlation coefficients (in absolute value), which did not exceed the admitted value 0.8.

Subsequently, an econometric model can be verified economically and its results can be interpreted. Table 2 lists estimates of the level constants α and parameters $\beta_{1, 2}$.

Table 2: Estimates of the parameters α and $\beta_{1, 2}$

Period	α	Sig.	β_1 (PLI)	Sig.	β_2 (OPENK)	Sig.
1990-2009	18,848	,000 *	-,011	,086 **	,018	,153
1990-2008	20,441	,000 *	-,015	,015 *	,002	,867
1990-1999	15,349	,000 *	-,017	,005 *	-,007	,571
2000-2009	10,301	,000 *	,093	,010 *	,314	,000 *

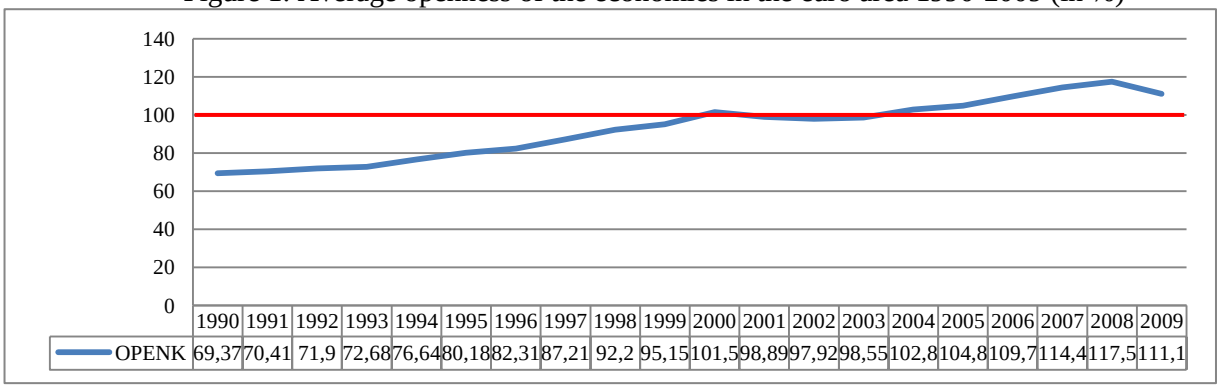
Source: self-elaboration

The table contains in the second column values of level constant α, which corresponds to the average economic level in particular periods assuming if both explanatory variables PLI and OPENK have zero value. Comparing the periods that include the average economic level during the financial crisis (1990-2009, 2000-2009) with the pre-crisis periods (1990-2008, 1990-1999), we see that the level of economic level reaches lower values. When comparing the two longest periods (1990-2009 and 1990-2008) it is clear that the average economic level decreased by about 1.6 percentage points. If we compare the period before the formation of monetary union (1990-1999) with the period of operation of monetary union (2000 -2009), we see that the average economic level decreased by about 5 percentage points. This fact can be attributed to the lower economic level of countries, which were gradually entering the euro area. For example, in 2009 reached the economic level of Slovakia only 64% of the average economic level of EU-15 and in Slovenia amounted to 79% of the average economic level of EU-15 (Eurostat, 2011).

From Table 2 it is possible to read different partial effect of explanatory variables on the development of the average economic level of the euro area, even within every particular period. The largest statistically significant partial effect has the indicator of openness of the economy (OPENK). Specifically, the period between 2000-2009, where if the index of openness of the economy increases by 1%, then ceteris paribus increases the average expected economic level in the euro area of about 0.314%. In accordance with the hypothesis of optimality in the monetary field according to McKinnon

(1963), the optimality of a currency area increases with the trade openness of the economy. When we put this hypothesis in the context of our econometric model, only in the reference period 2000-2009 can be said that with the creation of monetary union increased the openness between the Member States, see Figure 1. We can therefore also validate the hypothesis of endogeneity of the optimum area criteria; see Frankel and Rose (1998), which postulates that meeting the criteria of optimality is only ex post, i.e. after the integration of the economy into the monetary union. In other periods was the effect of openness of the economy insignificant and therefore it cannot be decided about its impact on the average economic level of the euro area.

Figure 1: Average openness of the economies in the euro area 1990-2009 (in %)



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
OPENK	69,37	70,41	71,9	72,68	76,64	80,18	82,31	87,21	92,2	95,15	101,5	98,89	97,92	98,55	102,8	104,8	109,7	114,4	117,5	111,1

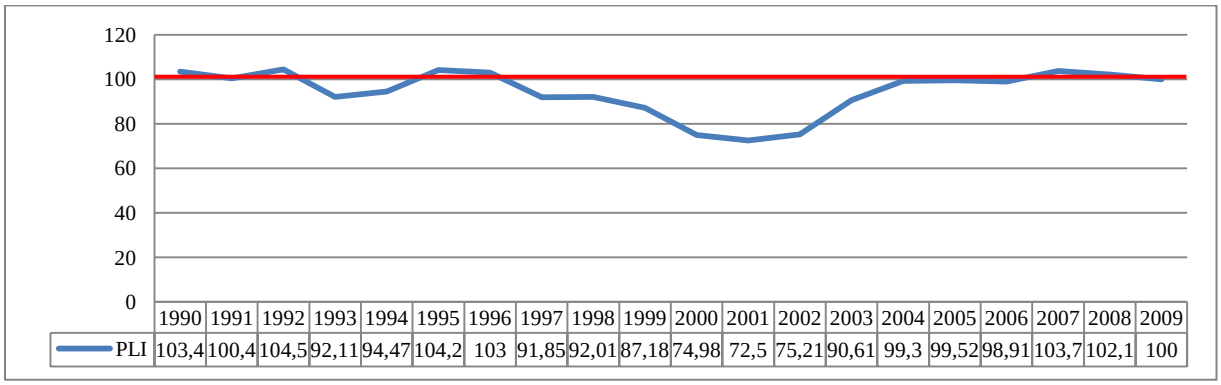
Source: self-elaboration, Penn World Table (Heston et al., 2011)

Partial, but very low effect has a price level of investment index (PLI). This effect is statistically significant for all studied periods at 5 or 10% level of significance. The influence of this indicator has rather negative effect on the average economic level, i.e. if there is a price level increase by 1%, then the average economic level of the euro area decreases ranging from 0.011 to 0.017%. The only period with a positive effect of this indicator is 2000-2009, where an increase in the price level of investments by 1% influenced the rise in the average euro area economic level of 0.093%. This effect is rather negligible and we can conclude that with the rising price level of investment the economic level of the euro area is reduced.

All presented results of the econometric model are a reflection of cross-section effect in 18 studied economies (17 euro area countries and CR) in different reference periods covering the years 1990-2009. The effects of cross-sectional units are captured by dummy variables that reveal which countries have the greatest contribution to the formation of the average economic level in the euro area over time and cross-country, i.e. whether they converge or diverge to the average economic level of the euro area. The results of estimated contribution of particular countries are listed in Table 3.

Among the countries which got closer to a steady state, i.e. the average economic level, in the period 1990-2009, were the Austria, Belgium and Cyprus. On the contrary, the economies of Czech Republic, Spain and Slovenia were furthest away from the steady state. In the period 1990-2008 is eliminated the year 2009 due to the decline of the variables under the influence of the financial crisis. Although in this reference period, the order of convergence remained the same for three fastest and slowest converging economies. Closer we see that only Ireland has slowed its convergence to the average economic level of the euro area in favor of Luxembourg. At this point it is worth mentioning that Luxembourg is one of the typical countries converging to the average economic level of the euro area from above, while the Czech Republic converges to the average economic level from the bottom.

Figure 2: The average price level of investment in the euro area in 1990-2009 (in %)



Source: self-elaboration, Penn World Table (Heston a kol., 2011)

If we compare the period before (1990-1999) and after the monetary union (2000-2009), we find out that in the first period the Austria, Belgium and Cyprus converged to the average economic level the most, while in the following period the France overtook the position of Cyprus. In contrast, in the years 1990-1999 and in 2000-2009 as well, the economies of Czech Republic, Slovakia and Slovenia were most remoted from the average economic level.

Table 3: Estimation parameters for the dummy variables and the rate order of convergence

Dummy variable	**Country**	**1990-2009**		**1990-2008**		**1990-1999**		**2000-2009**	
		γ_i	**Sig.**	γ_i	**Sig.**	γ_i	**Sig.**	γ_i	**Sig.**
D1	Austria	-0,200	0,000	-0,290	0,000	-0,199	0,000	0,118	0,002
D2	Belgium	-0,552	0,000	-0,688	0,000	-0,427	0,000	-0,106	0,066 **
D3	Cypurs	-1,150	0,000	-1,336	0,000	-0,943	0,000	-0,300	0,000
D4	Estonia	-2,171	0,000	-2,414	0,000	-1,852	0,000	-1,433	0,000
D5	Finland	-1,413	0,000	-1,580	0,000	-1,037	0,000	-0,329	0,002
D6	France	-1,650	0,000	-1,924	0,000	-1,127	0,000	-0,241	0,052 **
D7	Germany	-1,805	0,000	-2,119	0,000	-1,213	0,000	-0,243	0,077 **
D8	Greece	-2,420	0,000	-2,797	0,000	-1,767	0,000	-0,557	0,001
D9	Irland	-2,847	0,000	-3,243	0,000	-1,886	0,000	-0,720	0,000
D10	Italy	-3,260	0,000	-3,763	0,000	-2,140	0,000	-0,592	0,002
D11	Luxembourg	-2,826	0,000	-3,365	0,000	-1,672	0,000	-0,281	0,174
D12	Malta	-4,463	0,000	-5,075	0,000	-3,135	0,000	-1,259	0,000
D13	Netherlands	-4,281	0,000	-4,932	0,000	-2,845	0,000	-0,744	0,001
D14	Portugal	-5,079	0,000	-5,798	0,000	-3,564	0,000	-0,968	0,000
D15	Slovak Republic	-5,629	0,000	-6,384	0,000	-4,075	0,000	-1,635	0,000
D16	Slovenia	-5,855	0,000	-6,700	0,000	-3,905	0,000	-1,478	0,000
D17	Spain	-6,058	0,000	-7,021	0,000	-3,874	0,000	-1,182	0,000
D18	Czech Republic	-6,581	0,000	-7,598	0,000	-4,286	0,000	-1,792	0,000

Source: self-elaboration in SPSS

In the next step the distance of average economic level (α) and the average economic level of particulate countries ($\alpha+\gamma_i$) is compared in the both choosen time periods 1990-1999 and 2000-2009, see Table 4. If the difference of economic levels in absolute value is declining in the time, i. e. in the time period 1990-1999 is the difference of economic levels higher than in the time period 2000-2009, one can state that the economic level of studied economy converges to the steady state. Results presented in the table point out that all studied economies, including the Czech Republic, converge to the steady state in the choosen time period. Although the years 2008 and 2009 affected by crisis are included in the analyzed time period, there was no significant negative influence on the convergence

of economic levels of studied economies in the sence that countries will start to diverge. For a detailed analysis is necessary to wait for a future macroeconomic performance to ensure that the data base would be enlarged of the fresh observations.

Table 4: Evaluation of the convergence process

Dummy variable	Country	1990-1999		2000-2009		Result
		$\alpha+\gamma_i$	$[\alpha-(\alpha+\gamma_i)]$	$\alpha+\gamma_i$	$[\alpha-(\alpha+\gamma_i)]$	
D1	Austria	15,150	0,199	10,419	0,118	Convergence
D2	Belgium	14,922	0,427	10,195	0,106	Convergence
D3	Cypurs	14,406	0,943	10,001	0,300	Convergence
D4	Estonia	13,497	1,852	8,868	1,433	Convergence
D5	Finland	14,312	1,037	9,972	0,329	Convergence
D6	France	14,222	1,127	10,060	0,241	Convergence
D7	Germany	14,136	1,213	10,058	0,243	Convergence
D8	Greece	13,582	1,767	9,744	0,557	Convergence
D9	Irland	13,463	1,886	9,581	0,720	Convergence
D10	Italy	13,209	2,140	9,709	0,592	Convergence
D11	Luxembourg	13,677	1,672	10,020	0,281	Convergence
D12	Malta	12,214	3,135	9,042	1,259	Convergence
D13	Netherlands	12,504	2,845	9,557	0,744	Convergence
D14	Portugal	11,785	3,564	9,333	0,968	Convergence
D15	Slovak Republic	11,274	4,075	8,666	1,635	Convergence
D16	Slovenia	11,444	3,905	8,823	1,478	Convergence
D17	Spain	11,475	3,874	9,119	1,182	Convergence
D18	Czech Republic	11,063	4,286	8,509	1,792	Convergence

Source: self-elaboration in SPSS

5. Conclusion

The estimated model examined the dependence of the average economic level of the euro area on the development of the price level of investment and openness of the economy, in the base period 1990-2009, which was further divided into three sub periods. With the integration of artificial variables in the model we could identify the order of convergence of the studied economies to a steady state, which was understood as a dynamic average of euro area economic level, depending on the changing membership in particular years.

The results of the model suggest a rather low dependence of the average economic level of the euro area on the independent variables (PLI and OPENK). However, we can say that the price level of investment has a negative effect on the economic level, while the openness of the economy, the GDP per capita multiplies. If the convergence of the economies is studied in terms of economic level, it is necessary to define the steady state in line with the growth theories, to which the economies converge. As this steady state has been chosen the above mentioned average economic level of the euro area, which has been dynamic over time. In comparison of average economic level of particular countries to dynamic average economic level of steady state we can conclude that all studied economies converge to the steady state in the time periods1990-1999 and 2000-2009. The process of convergence of these economies was not negatively affected by the financial crisis in 2008, which broke out in the U.S. The reason can be seen in the decline of individual country´s economic level and that is why the average level of economic level of the euro area declines as well.

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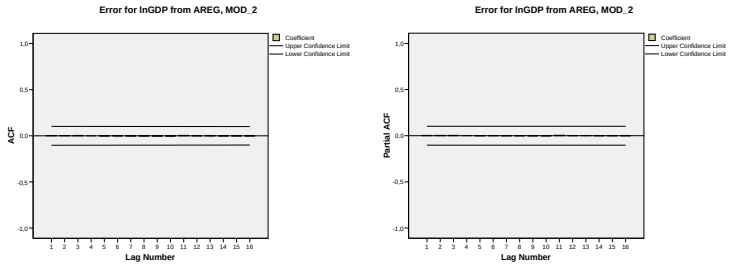
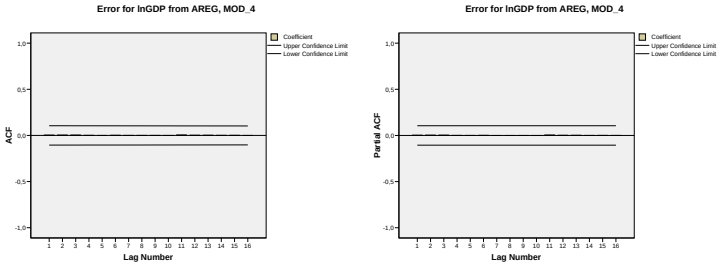
Appendix

Figure 3: Graphical analysis of the ACF and PACF, the reference period 1990-2009



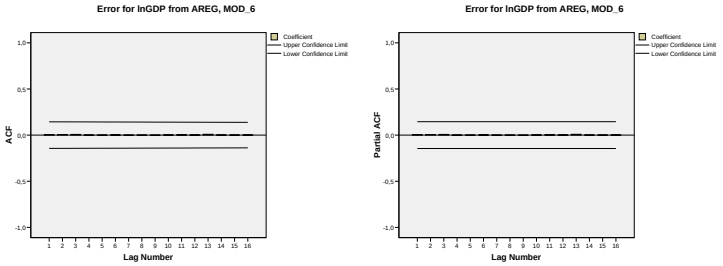
Source: self–elaboration in SPSS

Figure 4: Graphical analysis of the ACF and PACF, the reference period 1990-2008



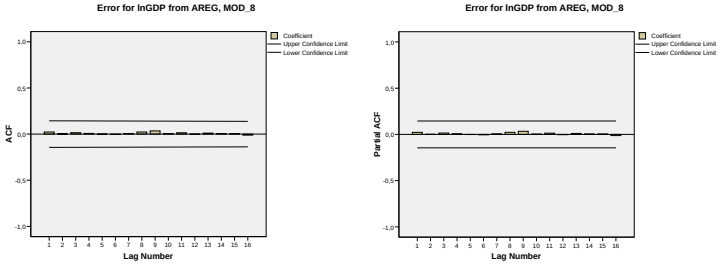
Source: self–elaboration in SPSS

Figure 5: Graphical analysis of the ACF and PACF, the reference period 1990-1999



Source: self–elaboration in SPSS

Figure 6: Graphical analysis of the ACF and PACF, the reference period 1990-1999



Source: self–elaboration in SPSS