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ECONOMIC WELFARE IN CENTRAL AND SOUTHEASTEUROPEAN UNION COUNTRIES – AN ECONOMETRIC APPROACH

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Abstract: *The importance of economic aggregates per capita: final consumption expenditure and Gross Domestic Product, for the well-being of the entire population of a country determined the analysis of the economic convergence in the countries of the Central and South-Eastern European Union (CSE). The econometric approach of convergence as a steady state of these variables was performed on panel data models with an error correction term. Establishing the long-run and short-run equations describes the convergence of welfare in the CSE region and the choice of the best model.*

Key words: *error correction term, long-run equilibrium, short-run equation, cointegration.*

1. Introduction

The indicators of economic development of each EU country are converging towards their national equilibrium. In the same way also the EU regions' economic development has different economic movements towards its own equilibrium. The Central and South-Eastern (CSE) part of the European Union includes the countries: Czech Republic, Hungary, Poland, Slovakia and Slovenia - in the centre of the EU, and Bulgaria, Croatia and Romania - in the south-eastern part.

Final consumption expenditure is an indicator of the economic well-being of each nation. Household final consumption expenditure represents the largest proportion of final consumption expenditure; shows the welfare of the population.

Fig. 1 shows the upward evolution of final consumption expenditure per capita of households in euro 2010 and their proportions in final consumption expenditure per capita in euro 2010, each year from 2000 to 2022, for each EU country from the central and south-eastern part. The 2008 financial crisis and the 2020 COVID-19 pandemic are the shocks perceived differently in intensity by these countries.

In Table 1 we observe in the descriptive statistics of the weights of final consumption expenditure of households that Romania had the highest values.

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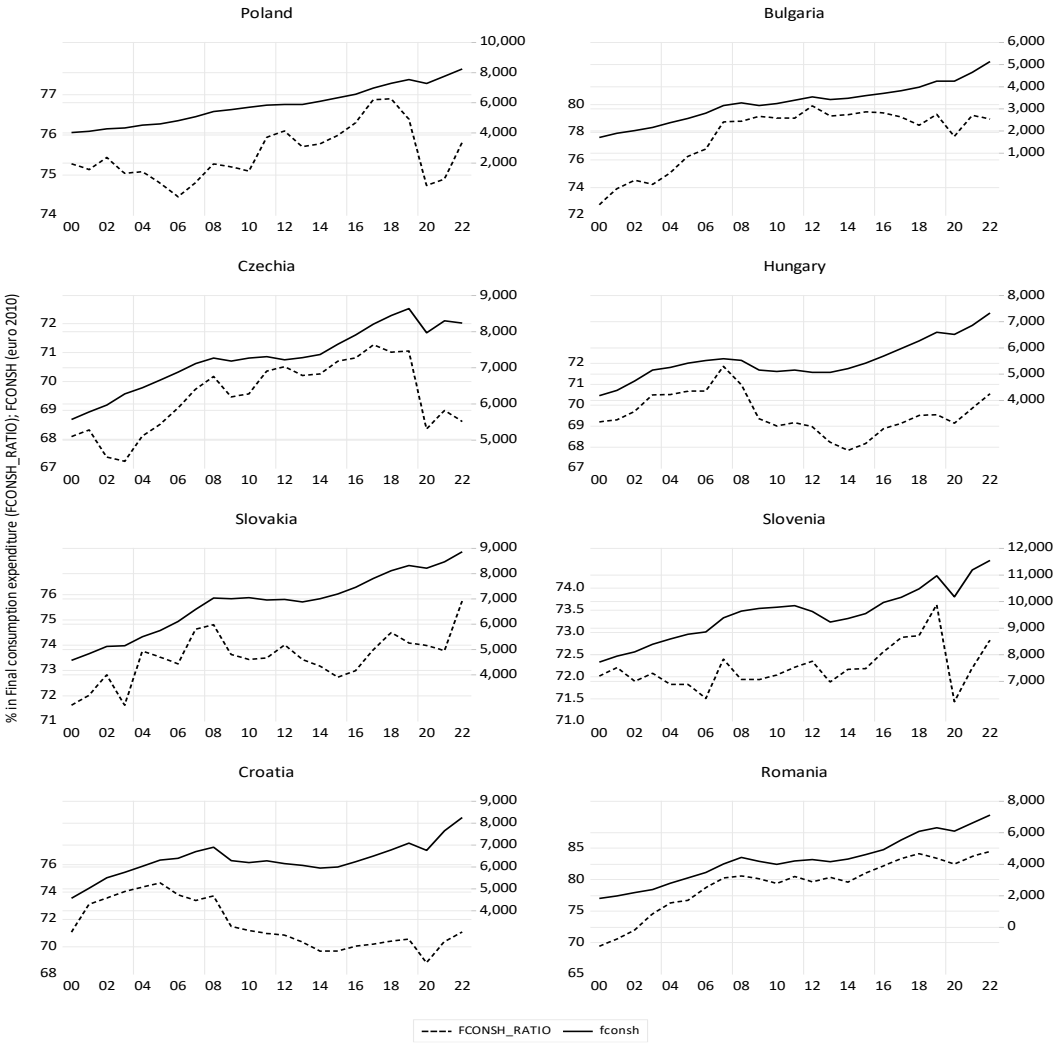

Fig. 1. *Comparison of household consumption and their shares in final consumption expenditure in central and south-eastern EU countries*

Table 1

Descriptive Statistics for FCONSH_RATIO Categorized by values of COUNTRIES
Sample: 2000 2022 Included observations: 184

COUNTRIES	Mean	Min	Max.	Std. Dev.	Obs.
Czechia	69.5%	67.2%	71.3%	1.2%	23
Hungary	69.6%	67.8%	71.9%	1.0%	23
Croatia	71.6%	68.8%	74.7%	1.8%	23
Slovenia	72.2%	71.4%	73.6%	0.5%	23
Slovakia	73.5%	71.6%	75.7%	1.0%	23
Poland	75.5%	74.5%	76.9%	0.7%	23
Bulgaria	77.8%	72.8%	79.9%	2.2%	23
Romania	**79.3%**	**69.4%**	**84.5%**	**4.2%**	**23**
All	73.6%	67.2%	84.5%	3.9%	184

Countries with lower proportions of final consumption expenditure of households allocated more to government consumption expenditure; the goal is the welfare of the entire population.

The evolution of household consumption proportions is very different for EU CSE countries and also during the two economic shocks of 2008 and 2020.

Economic growth provides the source of final consumption expenditures, and GDP per capita (euro 2010) is an important indicator to analyse. Final consumption expenditure and GDP per capita follow an upward trend towards long-term equilibrium, in Fig. 2.

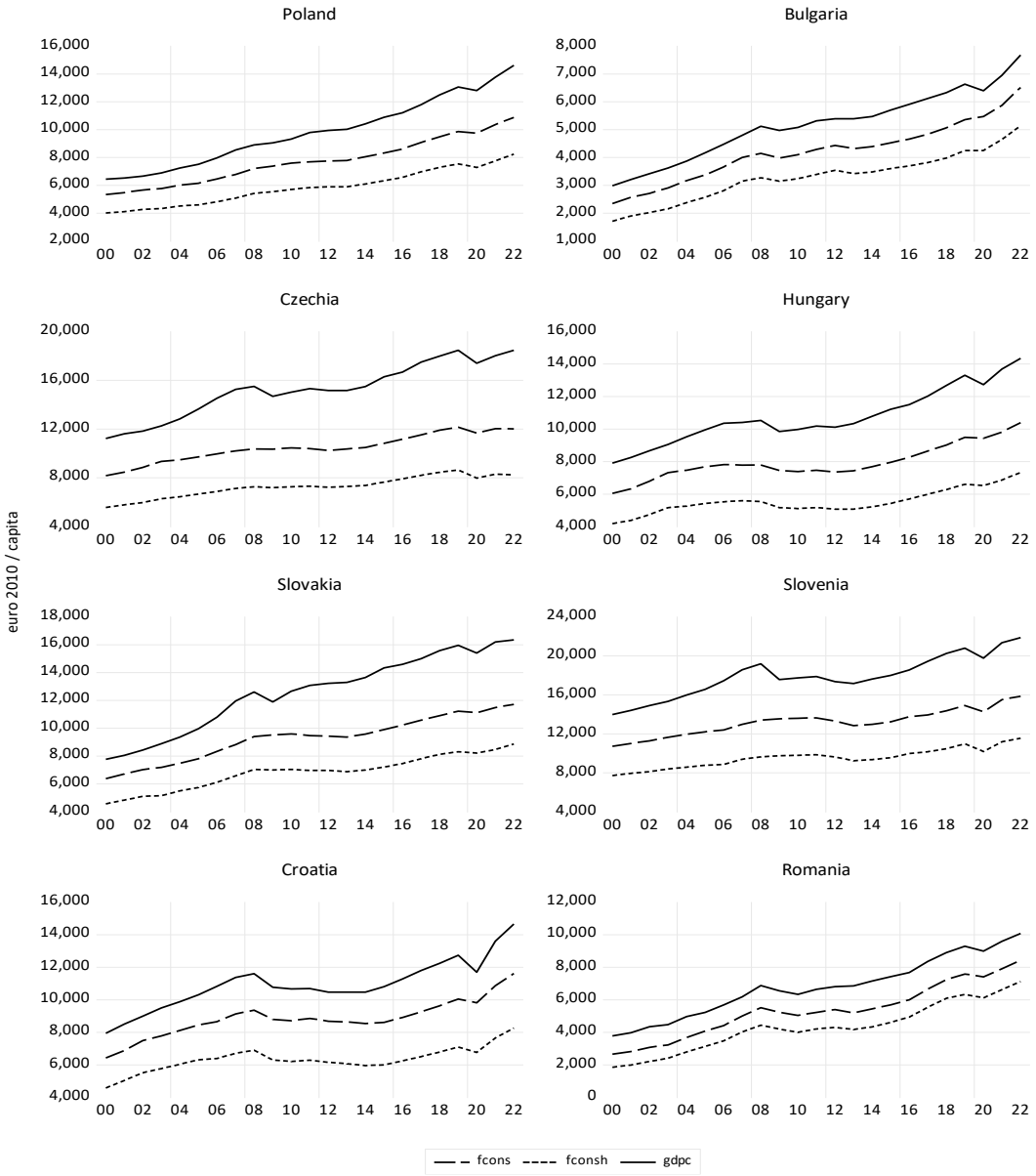

Fig. 2. *Real GDP per capita, final consumption expenditure and household consumption expenditure in EU CSE countries in the period 2000-2022*

The importance of final consumption expenditure (FCONS) for the well-being of the population and GDP (GDPC) as an economic source led to the choice of these variables for the study. They are expressed in real terms per capita, in euros at constant 2010 prices.

The econometric approach of panel data allows the analysis of the convergence of GDP influence on final consumption expenditure, as a barometer of the economic development of the CSE EU countries.

2. Objectives and Methodology

The objective of this study is to analyse the equilibrium relationship of the CSE countries and their common economic equilibrium. To reach this purpose the econometric approach in Eviews is appropriate.

The cointegration of the variables final consumption expenditure per capita and GDP per capita must be proven as a condition of the existence of the long-term relationship.

If the variables are nonstationary, that is, I(1) integrated, and if they are cointegrated, then the variables have a long-run relationship. Both short-term and long-term dynamics can be examined with the panel VECM (Vector Error Correction Model).

The error correction model (ECM) is the short-run model for adjustments to the steady state. For each EU CSE country, the long-run and short-run model will show the evolution of final consumption expenditure per capita depending on GDP per capita.

The average levels of the two models for the panel data define this relation to the equilibrium as an economic convergence of the EU CSE countries.

3. Results and Discussion

To demonstrate the cointegration of the two variables FCONS and GDPC, they should first be non-stationary. Then their combination, which are the residuals, must be stationary. Transforming the two variables (LFCONS, LGDPC) into their logarithmic values allows a better interpretation of the models' coefficients as percentages. Fig. 3 provides a picture of the similar evolution of the variables at the panel data level.

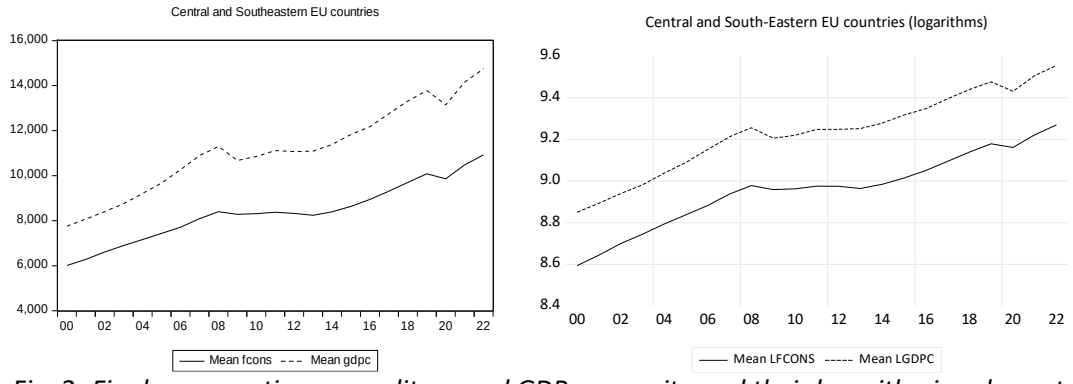

Fig. 3. *Final consumption expenditure and GDP per capita and their logarithmic values at the CSE EU region*

The Q statistic of global tests of stationarity in correlograms reject the null hypothesis and both variables FCONS and FGDPC are non-stationary.

The panel unit root tests in levels and then in their 1-st differences show that both variables FCONS and FGDPC have unit root and they are integrated of the same order, they are I(1).

There are two approaches of the Error Correction Model: one based on the VECM which automatically establish the model and the coefficients and another, based on the residuals of long-run model and then building the short-run model.

3.1. Panel Data Cointegration and VECM

The Panel Data Cointegration test of Pedroni with individual intercept and individual trend, and automatic selection of lag length gives 11 test statistics, of which in 5 cases, the probability is less than 5%; almost half of them indicate the rejection of the null hypothesis of no cointegration.

Running the Fisher Johansen test of panel cointegration, which is system based, one cointegration equation is significant. The individual cross section results indicate the rejection of null hypothesis and the variables are cointegrated at the level of each CES EU country.

The residual tests for cointegration conclude that the variables LFCONS and LGDPC are cointegrated. Having decided that the variables are cointegrated at the panel data level, the VECM is to be followed.

The representation of only the dependent variable LFCONS from the system, with 1 and 2 lags, the substituted coefficients is:

EC(C,1) 1 2 LFCONS LGDPC

D(LFCONS) = C(1)*(LFCONS(-1) - 0.7636*LGDPC(-1) - 1.9127) + C(2)*D(LFCONS(-1)) + C(3)*D(LFCONS(-2)) + C(4)*D(LGDPC(-1)) + C(5)*D(LGDPC(-2)) + C(6)

D(LFCONS) = -0.1097*(LFCONS(-1) - 0.7637*LGDPC(-1) - 1.9127) + 0.4712*D(LFCONS(-1)) + 0.0853*D(LFCONS(-2)) - 0.1497*D(LGDPC(-1)) - 0.1039*D(LGDPC(-2)) + 0.0200

The coefficient -0.1097 of the error correction term is negative and significant, and this proves the existence of the long run relation. This coefficient represents the speed of adjustment toward equilibrium. The whole system is getting back to long-run equilibrium at the speed of 10.97% annually.

The long-run relation is described by: LFCONS= 0.7637*LGDPC + 1.9127.

Applying the Wald test to the C(4) and C(5) coefficients of the lagged values of LGDPC, we find that together they are not significantly different from 0, which means that there is no short-run relationship from LGDPC to FCONS.

If testing the system with 1 and 1 lags as in the representation of the dependent variable LFCONS, the substituted coefficients are:

EC(C,1) 1 1 LFCONS LGDPC

D(LFCONS) = C(1)*(LFCONS(-1) - 0.7296*LGDPC(-1) - 2.225) + C(2)*D(LFCONS(-1)) + C(3)*D(LGDPC(-1)) + C(4)

D(LFCONS) = - 0.0943*(LFCONS(-1) - 0.7296*LGDPC(-1) - 2.225) + 0.4668*D(LFCONS(-1)) - 0.1345*D(LGDPC(-1)) + 0.0200

The coefficient of the error correction term is negative and significant, proving the existence of the long run relation between LFCONS and LGDPC with the speed of adjustment of 9.43% during each year towards the equilibrium, but on short term the relation running from LGDPC to LFCONS is not significant, because the coefficient C(3) is not significant.

3.2. The Error Correction Model of Panel Data

The estimation cointegrating equation COINTREG LFCONS LGDPC allows to establish the residuals, called ECT – Error Correction Term. When establishing the short-run model, the regression table is in Table 2:

Table 2

Dependent Variable: D(LFCONS)
Method: Panel EGLS (Cross-section SUR)
Date: 11/27/23 Time: 21:44
Sample (adjusted): 2002 2022
Periods included: 21
Cross-sections included: 8
Total panel (balanced) observations: 168
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018927	0.003920	4.828810	0.0000
D(LFCONS(-1))	0.328836	0.084896	3.873389	0.0002
D(LGDPC(-1))	0.029954	0.067773	0.441981	0.6591
ECT(-1)	-0.114264	0.041395	-2.760317	0.0065
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.296660	Mean dependent var		0.052884
Adjusted R-squared	0.251861	S.D. dependent var		1.371749
S.E. of regression	1.013165	Sum squared resid		161.1611
F-statistic	6.622055	Durbin-Watson stat		2.056918
Prob(F-statistic)	0.000000			

The residuals of the short-run model are normally distributed, no autocorrelation and the cross-section independence is ensured.

The speed of adjustment towards the equilibrium at CES EU countries level during one year is of 11.42%. The coefficient of ECT is significant and negative.

The chart of LFCONS and both long-run and short-run models is in Fig. 4. The ECM model define the long-run equilibrium.

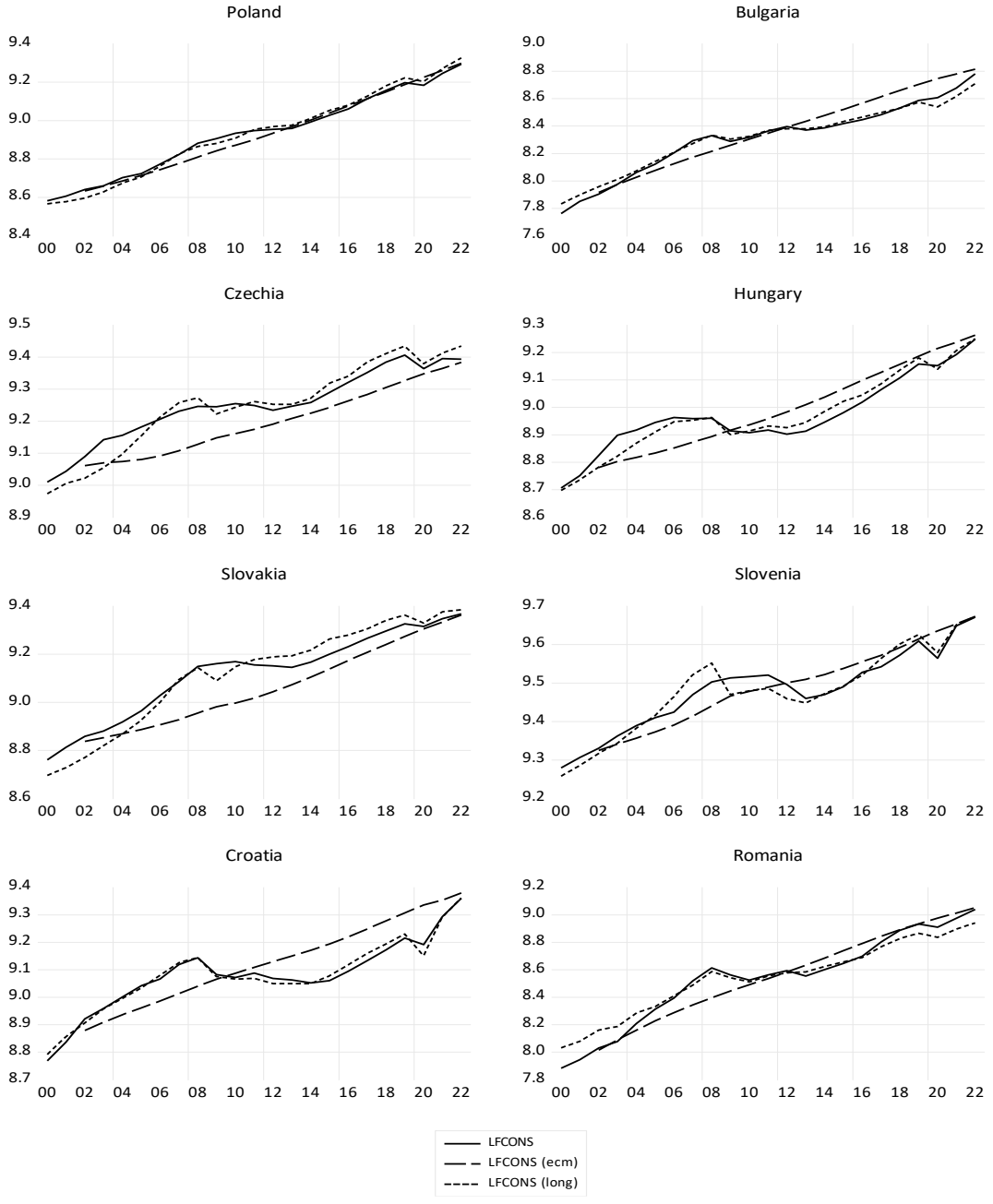

Fig. 4. *Theoretical values on short and long run and the FCONS in the CSE EU countries*

The descriptive statistics of theoretical values obtained with the corresponding ECM and cointegration equation, in Table 3, show close values of logarithms and of the transformed values of FCONS in euro 2010.

Table 3

Models:	LFCONS	Logarithms of FCONS		Euro 2010		
Indicators		LFCONS_ecm	LFCONS_long	FCONS	FCONS_ecm	FCONS_long
Mean	8.9917	8.9770	8.9919	8036	7919	8038
Median	9.0642	9.0397	9.0535	8640	8431	8548
Maximum	9.6716	9.6732	9.6730	15860	15887	15883
Minimum	7.9047	7.9169	7.9578	2710	2743	2858

Average values smooth the upward trend and are not relevant, but still useful when looking to the maximum and minimum values.

4. Conclusions

The best model is that selected by a procedure of looking into the models Autoregressive and with Distributed Lag (ARDL) until minimizing an informational criterion, here Akaike info criterion (AIC). The selected model was ARDL(4,1), meaning lag 4 for LFCONS and 1 for LGDPC. The estimation equation is describing the long-run, with the substituted coefficients: LFCONS = 1.0896*LGDPC. The regression model is presented in Table 4:

Table 4

Dependent Variable: D(LFCONS); Method: ARDL
Sample: 2004 2022; Included observations: 152
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): LGDPC
Fixed regressors: C; Number of models evalulated: 16
Selected Model: ARDL(4, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
LGDPC	1.089603	0.024796	43.94238	0.0000
Short Run Equation				
COINTEQ01	-0.258179	0.068899	-3.747188	0.0003
D(LFCONS(-1))	0.135418	0.071357	1.897761	0.0599
D(LFCONS(-2))	0.097283	0.056329	1.727034	0.0864
D(LFCONS(-3))	-0.027071	0.089704	-0.301777	0.7633
D(LGDPC)	0.403326	0.056301	7.163743	0.0000
C	-0.278691	0.072108	-3.864913	0.0002
Mean dependent var	0.027637	S.D. dependent var		0.034498

S.E. of regression	0.011803	Akaike info criterion	-4.765963
Sum squared resid	0.018808	Schwarz criterion	-3.909811
Log likelihood	487.4686	Hannan-Quinn criter.	-4.418954

The coefficients of cointegration term represent the speeds of adjustment. Romania had the highest speed of 55.7%, followed by Bulgaria with 45.9%, in Table 5.

Table 5

Countries	Final consumption expenditure per capita (euro 2010)			Coefficient of COINTEQ	Prob.
	Mean	Min.	Max		
Bulgaria	4204	2350	6510	-0.4590	0.0029
Romania	5343	2650	8430	-0.5567	0.0001
Poland	7714	5340	10870	-0.0524	0.0000
Hungary	7946	6040	10390	-0.2411	0.0000
Croatia	8838	6430	11620	-0.2647	0.0001
Slovakia	9273	6380	11710	0.0091	0.0583
Czechia	10440	8180	12160	-0.1451	0.0000
Slovenia	13185	10720	15860	-0.3555	0.0001

The two countries have lower values of final consumption expenditure per capita (2010 euro) than all other CSE countries, starting in 2000 and reaching their maximum value in 2022. It is understandable why they need to have higher speed of adjustment towards the long-run equilibrium of CSE region (Table 5). The coefficients of cointegration term of Slovakia is positive and insignificant, as indicates the probability in the last column of Table 5. For Slovakia there is no long-run relation between FCONS and GDP per capita. In Figure 5 we can see the very close theoretical values of LFCONS with the ECM short-run model and with ARDL(4,1) at the CES region level.

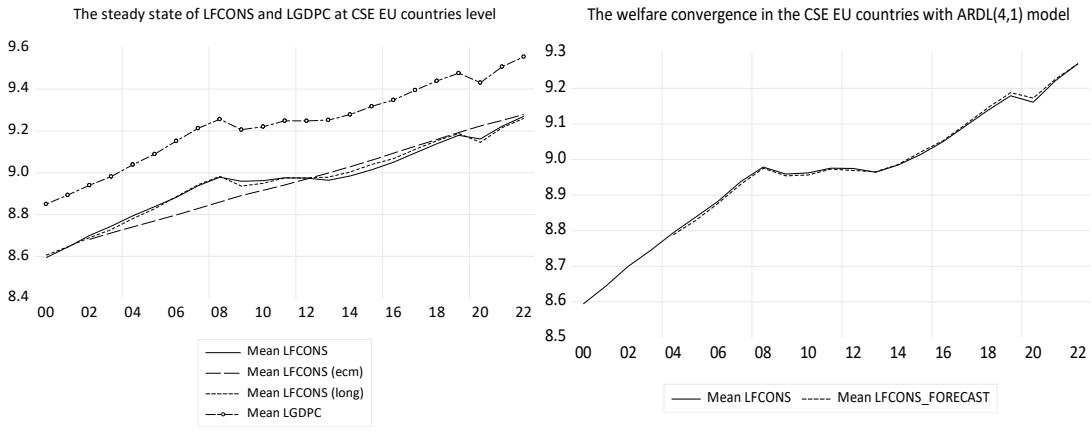

Fig. 5. *Comparing the theoretical values of FCONS with ECM and ARDL(4,1) models at CSE region level*

This econometric approach presents well-being as a spatial autocorrelation based on the membership of the European Union in the Central and South-East countries, which implies the convergence of their economic development.

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