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WELFARE CONVERGENCE IN TRANSITION ECONOMIES

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This paper presents an analysis of the welfare convergence among 27 transition economies based on the evaluation of a micro-based summary statistic combining income, consumption, leisure, life expectancy, and inequality (Jones & Klenow, 2016). The results show that the countries of the former Soviet Union significantly diverged from the standard of living of developed states in 1990–2017, while the Central European transition economies were the most successful in catching up. The main sources of welfare growth were an increase in income, life expectancy, and the amount of leisure time.

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Introduction

The fall of the Berlin Wall in 1989 marked the beginning of a new historical era, accompanied by significant economic changes and shocks. The transition of post-socialist countries from a planned to a market economy created the ground for an enormous amount of scientific research (Fischer & Sahay, 2000; Meyer & Peng, 2005; Kornai, 2008; Aslund, 2013). It was generally expected that the transformation would lead to an increase in the standards of living in post-communist countries to the level of capitalist countries. However, the transition process was accompanied by a severe economic downturn. As a result, during the first years of transformation, the economies were moving further away from Western countries in terms of economic development. Thirty years later, the transition from a planned to a market-based economic model may already be considered complete in many countries, although in some states the reforms were essentially curtailed and did not reach completion (Sonin, 2013). Have the post-socialist economies managed to reach a trajectory that leads them closer to the standard of living in developed countries? This paper provides an analysis of the sigma and beta convergence of transition economies and developed countries using the micro-based welfare metric proposed by Jones and Klenow (2016). The metric takes into account not only income but also a number of other crucial aspects of the living standard of the population: leisure, inequality, life expectancy, and the level of consumption within an expected utility framework.

This study contributes to the broad range of empirical literature on convergence. The branch of empirical research on this phenomenon began to gain popularity with the study by Baumol (1986), which claimed that groups of homogeneous countries are approaching a common growth rate. This work was followed by a tremendous amount of research on income convergence. However, it is not clear if the convergence process of welfare coincides with the convergence process of income, since GDP is an imperfect measure of the well-being of the population. Many crucial factors, such as mortality, the quality of institutions, education, and healthcare, are poorly if at all taken into account in such analysis. It seems indisputable that the consideration of only economic indicators provides a narrow look at the population's well-being. In response to this, economists research complex welfare indicators. Most of them, such as the Human Development Index, Gender-related Development Index, etc. are criticized for their mashup nature (Ravallion, 2012).

Studies on the convergence of alternative measures of welfare in transition economies are rare and mostly concentrated on subjective welfare indicators. Thus, Guriev and Melnikov (2018) investigated the dynamics of the happiness gap between transition economies and the developed world. They found that by 2016 the "transition happiness gap" had closed. However, a subjective index of happiness cannot be considered as a comprehensive measure of welfare. In contrast, our research uses the micro-based objective composite welfare metric proposed by Jones and Klenow (2016) to research the dynamics and convergence of welfare

in 27 transition economies.

Articles that followed Baumol (1986) in the investigation of income convergence for large samples of countries found the opposite result: poor countries demonstrated lower growth rates than rich countries over the past two hundred years, which led to even greater divergence between them (Barro 1991; Pritchett 1997; Johnson & Papageorgiou, 2020).

Recent papers revisited the question with an updated set of data for the 21st century. They found that there has been a trend towards convergence in the last twenty years, with absolute convergence occurring for only a short period (Kremer et al., 2021). Many developing countries demonstrated a higher rate of economic growth than developed states (Subramanian, 2011; Roy et al., 2016). However, the rate of the catch-up was quite low. While studies of the 1990s predicted that poor countries should converge with the rich ones at a speed of 2% per year (Barro & Sala-i-Martin, 1992; Sachs & Warner, 1995), newer papers estimated this parameter to be 0.4% per year (Patel, Sandefur & Subramanian, 2021). In contrast, our paper got a range for speed of beta convergence from 1% to 5.1% for GDP and from 1% to 3.8% for the welfare of different groups of transition economies.

The results of the analysis may vary largely for different groups of countries (Barro and Sala-i-Martin, 1995). Therefore, there is probably a diversity of convergence patterns across regions. To test for this, economists often study the phenomenon across more homogeneous samples such as Central European countries, emerging economies, the developed world, and many others. Baumol (1986) found that a group of socialist countries (Bulgaria, China, Czechoslovakia, East Germany, Hungary, Poland, Romania, USSR, and Yugoslavia) formed a separate convergence club between 1950 and 1980, but the rate of convergence was much lower than in Western countries. The collapse of socialism at the end of the 1980s and the transition of post-socialist states from a centrally planned to a market economic model provided a great field for political, social, and economic research. It was generally expected that a series of structural reforms and the creation of a democratic political system would allow post-socialist countries to approach the living standards of the developed countries. With an access to the technologies of capitalist countries low-income transition economies should grow faster than rich western states according to the Solow growth model (Solow, 1956). Therefore, a large corpus of literature was devoted to the convergence of transition economies. In general, the studies showed that the income gap between the EU and groups of Central and South-Eastern Europe has narrowed since the beginning of the transition (Vojinovic et al., 2009). However, the global financial crisis hit the Western Balkan states and slowed the pace of their catch-up (Stanišić, 2016). In contrast, countries of the former Soviet Union demonstrated a steady pattern of divergence from Western Europe. Moreover, both sigma and beta convergence of income between transition economies is verified for groups of Central, South-Eastern Europe, and countries of the former USSR (Rapacki & Próchniak, 2009).

The results of our research generally confirm the conclusions of these papers for income but reveal some new findings on welfare. We found that the welfare gap between transition economies and Western Europe widened due to the transformation crisis in the period 1990–1998. Afterwards, the trend was reversed, and countries achieved a certain degree of convergence. In line with the predictions of Jones and Klenow (2016), our paper shows that when we take into account life expectancy, consumption, leisure, and inequality in addition to income, it appears that the transition economies approached the standards of living of Western Europe more slowly than GDP shows. Therefore, post-socialist countries were more successful in increasing the income of the population than they were in improving other factors of well-being. The inequality in welfare between transition economies and Western Europe appears to be even greater than the inequality in incomes. However, the patterns of welfare convergence were different inside groups of countries. The transition economies of Central Europe were the most successful and reduced the welfare gap with Western Europe by almost 25% due to the fast growth of income per capita and life expectancy, and convergence to the amount of leisure and the level of inequality of the developed world. South-Eastern European states remain at the same level to the end of the period. The welfare gap between former Soviet Union members and developed countries increased by 23% between 1990 and 2017. This was mainly due to the slow growth of household incomes. The countries of the former Soviet Union were moving away from Western Europe in terms of the share of consumption in income and the amount of leisure. The results of intra-group convergence analysis appear to be essentially the same. While the transition economies of Central and South-Eastern Europe steadily converged with each other from 1990 to 2017, the welfare gap between former the Soviet Union significantly increased over this period.

The paper is organized as follows. The second section describes the research methodology and the data used. The third section is devoted to the results of the analysis of the convergence of post-socialist economies with the countries of Western Europe, and the process of catching-up within the groups of transition economies: Central Europe, South-Eastern Europe, and the former Soviet Union. The fourth section concludes.

Methodology

This paper uses the comprehensive measure of well-being proposed by Jones and Klenow (2016). The index aggregates the amount of consumption, the amount of leisure time, life expectancy and the level of inequality into a single indicator based on the utility function, comparable not only by countries, but also over time. Well-being can be assessed using micro- and macro-data. The method considers an abstract person who will live their entire life in a certain country. The indicator evaluates the share of consumption of the given agent that will provide them with the same level of utility in this state as in another, taking into account the differences in life expectancy, the level of inequality and the amount of leisure time .

The method uses the so-called "veil of ignorance"of the American philosopher John Rawls: a person does not know whether they will be rich or poor, working hard or little, what kind of inheritance they will have and how many years they will live. In this paper, in order to analyze the dynamics of well-being in different countries and at the same time preserve the possibility of comparing countries with each other, the indicators of the US in 2006 were taken as a benchmark. That is, the indicator of well-being for each year in all the transition economies studied was calculated relative to the level of well-being of the US in 2006 and, simply put, answered the question: what share of consumption would an agent be willing to give up in order to be born in the US in 2006, and not in country i in year s? In addition, the calculation of welfare metrics relative to the US characteristics of 2006 makes our results comparable with those of Jones and Klenow.

Model

The elementary utility function of an agent has the form:

$$u(C, l) = \bar{u} + log(C) + v(l) \tag{1}$$

C (consumption) is assumed to be lognormally distributed and independent of age. l (share of leisure time) is assumed to be unchanged and the same for people of all ages in a given country in a given year. $v(l)$ (the utility of free time) has the form that implies a constant elasticity of the supply of labor according to Frisch. The expected lifetime utility of an agent is the mathematical expectation of the discounted sum of the elementary utility functions of consumption and leisure for each year:

$$U = E \sum_{a=1}^{100} \beta^a u(C_a, l_a) S(a) \tag{2}$$

a – age;
β – discount factor;
$S(a)$ – probability to live until age a.

To make an agent behind the "veil of ignorance"indifferent where to be born – in the US in 2006 or in country i in year s, we estimate the share of consumption λ that makes expected utility of life in the US equal to the expected lifetime utility in country i taking into account the differences between countries in income per capita, life expectancy, leisure and inequality. Consumption equivalent welfare metric λ is calculated by the following formula:

$$log\ \lambda_{(i,s)} = \frac{e_{(i,s)} - e_{us}}{e_{us}} \left(\bar{u} + log\ c_{(i,s)} - \frac{\sigma^2_{(i,s)}}{2} + v(l_{(i,s)})\right) \quad \text{Life expectancy}$$

$$+ log\ \bar{c}_{(i,s)} - log\bar{c}_{us} \qquad\qquad\qquad \text{Consumption}$$

$$+ v(\bar{l}_{(i,s)}) - v(\bar{l}_{us}) \qquad\qquad\qquad\qquad \text{Leisure}$$

$$- \frac{1}{2}(\sigma^2_{(i,s)} - \sigma^2_{us}) \qquad\qquad\qquad\qquad \text{Inequality}$$

(3)

The welfare indicator obtained in the calculations is an equivalent variation: how much of an agent's consumption in the US must be taken away in order for their well-being to become the same as in another country.

To analyze the convergence of welfare in transition economies we use concepts of absolute beta (β) and sigma (σ) convergence.[4]

Data

We conduct an analysis of 27 transition economies for the period between 1990 and 2017 based on macro data[5].

It is worth noting that the Baltic states (Latvia, Lithuania, Estonia) can be classified as Central, Northern, or Eastern European countries. Here we consider them not as former members of the Soviet Union, but as a part of Central Europe because of their affiliation with the EU.

Data on consumption, population size, and labor force were obtained using the Penn World Table 9.1. This source also contains information on the number of working hours per year in 12 of the 27 countries studied. For another 12 transition economies, this indicator was measured by multiplying the average length of the working week estimated by the International Labor Organization by the average number of working weeks per year for OECD countries. For the three remaining countries: Turkmenistan, Tajikistan and Uzbekistan, the number of working hours per year was estimated according to the production calendar of these states. The gaps in the data were filled by the average value of the variable for that country. Information on life expectancy at birth was obtained from the World Bank website. Finally, data on Gini coefficients for transition economies from the UNU-WIDER World Income Inequality Database, Version 4, were used to estimate inequality. If available, Gini coefficients for consumption were used. If they were absent, then the Gini coefficients for net

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[4]See Appendix A for more detailed information about derivation of the formula and description of convergence analysis methodology.

[5]**Central European countries (CE):** Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia. **South-Eastern European states (SEE):** Albania, Bulgaria, Croatia, Montenegro, North Macedonia, Romania, Serbia. **The former Soviet Union (FSU):** Armenia, Azerbaijan, Belarus, Georgia, Moldova, Kazakhstan, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan, Ukraine, Uzbekistan.

income or gross income were taken. The gaps in the data were filled by the average value of the variable for that country.

For the purpose of analyzing whether the transition economies converged to the living standards of developed countries we have also obtained estimates of the welfare dynamics for a group of developed countries of Western Europe: Belgium, Great Britain, Germany, Ireland, and France. Again, data on consumption, population size, the number of working hours per year, and labor force were obtained using the Penn World Table 9.1. Information on life expectancy at birth was obtained from the World Bank website. Data on Gini coefficients for net income from the UNU-WIDER World Income Inequality Database, Version 4, were used to estimate inequality. The gaps in the data were filled by the average value of the variable for that country.

Results

Welfare Estimation

We start with the results of welfare estimation for transition economies.

Fact 1. *In line with the arguments of Jones and Klenow, we found that the welfare of transition economies was on average 20% below their income level at the beginning of transition. However, average growth rates of welfare were higher than GDP per capita growth rates during the period under consideration. The main contribution to welfare growth was made by the increase of life expectancy and to a lesser extent by the increase in leisure time. The major factor that reduced welfare was an increase in inequality.*

In 1990, before the start of the transformation period, 22 of the 27 countries studied were less prosperous than GDP indicates, as can be seen in Table B1 in Appendix B. The first and second columns of the table show the value of the wealth and income as a percentage of the US values in 2006. The logarithm gap between these indicators is shown in column 3. On average, the level of well-being of these countries was 23% lower than the level of income predicts. Due to what factors, the quality of life was so much lower than US standards than GDP demonstrates? The decomposition of the influence of the components on this result is presented in columns 4 – 8. The main reason for this is a lower life expectancy (it is responsible for 82% of this negative effect), and, to a lesser extent, a greater amount of working time, a higher level of inequality, and a lower share of consumption in income. The remaining 5 states were actually closer to the standards of the well-being of developed countries than GDP demonstrates. On average, their welfare was 12% higher than their income. Similarly, the welfare of these countries was more seriously affected by low life expectancy. However, a very high share of consumption in GDP and a greater amount of leisure time compared to developed countries offset this effect.

The dynamics of the indicator of welfare and GDP are generally the same for the period under review. They moved mainly in the same direction. However, the gap between them did not remain constant. In terms of wealth, the transformational downturn was less deep and less prolonged than GDP indicates. The average drop in income was 41%, but the positive impact of other factors smoothed out this effect, resulting in a drop in wealth of 37%. The main contribution to this was made by the increase in life expectancy and the amount of leisure time, which was half offset by the increase in inequality.

However, at the end of the transformational recession, the well-being of the population began to grow at a higher rate than the GDP growth rate on average. By 2017, in 13 of the 27 countries under analysis, wealth was actually higher than GDP indicated, by an average of 11%, as shown in Table B2 in Appendix B. The lion's share of this difference is due to the high share of consumption in GDP, and a large amount of leisure time, although life expectancy is still significantly less than in the developed world. The other 14 countries remained 20% less prosperous than their incomes show by 2017, even though their GDP was on average higher than that of the first group of countries. The main reasons for this again include low life expectancy, long working hours, and high inequality.

Thus, on average, the welfare of the transition economies has more than doubled during the period under review, however, the gap between welfare and GDP has narrowed only slightly.

To analyze what factors contributed the most to the growth of welfare during the period, we conducted a counterfactual analysis. Our calculations show that the rise of life expectancy was by far the most important component of the welfare growth. If life expectancy had not increased during the period under review and remained at the level of 1990, the welfare of transition economies in 2017 would have been lower by an average of 17%. Without an increase in the share of leisure time, well-being would be 4% lower. At the same time, if inequality remained at the initial level, the welfare of transition economies would be 2% higher.

Nevertheless, considering the results of the countries relative to each other, it should be noted that the dynamics of well-being in the states of Central Europe, South-Eastern Europe, and the former Soviet Union differ significantly.

Convergence Analysis

In order to investigate whether the transition economies approached the standard of living of the developed countries in the period from 1990 to 2017, we compare their welfare dynamics with those of Western European states.

Fact 2. The welfare gap between transition economies and Western Europe widened due

to the transformation crisis in the period 1990–1998. Afterwards, the trend was reversed, and countries achieved a certain degree of convergence with the speed of welfare convergence from 1% to 3.8% per year for different groups of transition economies. The speed of convergence of GDP is higher than that of welfare. Therefore, when we take into account life expectancy, consumption, leisure, and inequality in addition to income, it appears that the transition economies approached the standards of living of Western Europe more slowly than GDP shows.

Figure 1 shows the welfare dynamics in the transition economies of Central Europe, South-Eastern Europe, and the former Soviet Union relative to the welfare dynamics of the developed countries of Western Europe. It can be seen from the graph that the beginning of the transformation process provoked a significant drop in welfare in post-socialist countries. During the 1990s, the transition economies were moving further behind the standard of living of the population of Western Europe. However, the trend was reversed after 2000, and there was a steady convergence over the next 20 years. Surprisingly, the global financial crisis did not have a negative impact on this tendency. Nevertheless, the transition process has caused such a deep decline in well-being that only Central European countries have managed to narrow the gap in quality of life with the developed world to date.
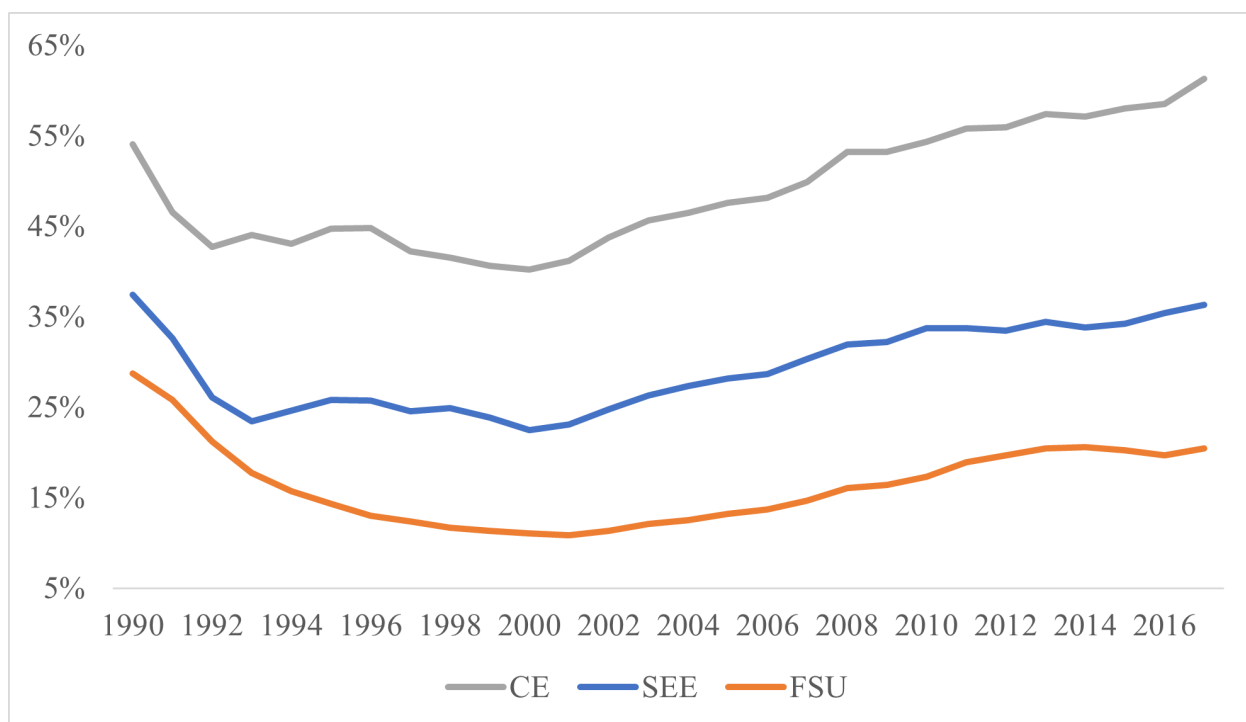
Figure 1: Welfare dynamics in transition economies of Central Europe (CE), South-Eastern Europe (SEE), and the former Soviet Union (FSU), in % of the welfare of Western European countries (WE)
Source: authors' calculations

The results of the sigma convergence analysis are shown in Figure 2. The variation of welfare among Western Europe and the groups of transition economies was increasing on average until the beginning of the 21st century with the most dramatic dynamics observed

in the former Soviet Union. After this time, the dispersion started to decrease steadily in all three groups. The impact of the global financial crisis was negligible.

Fact 3. *The transition economies of Central Europe were the most successful, reducing the welfare gap with Western Europe by almost 25%. South-Eastern European states remain at the same level to the end of the period. The welfare gap between former Soviet Union and the developed countries significantly increased between 1990 and 2017 (by 23%).*
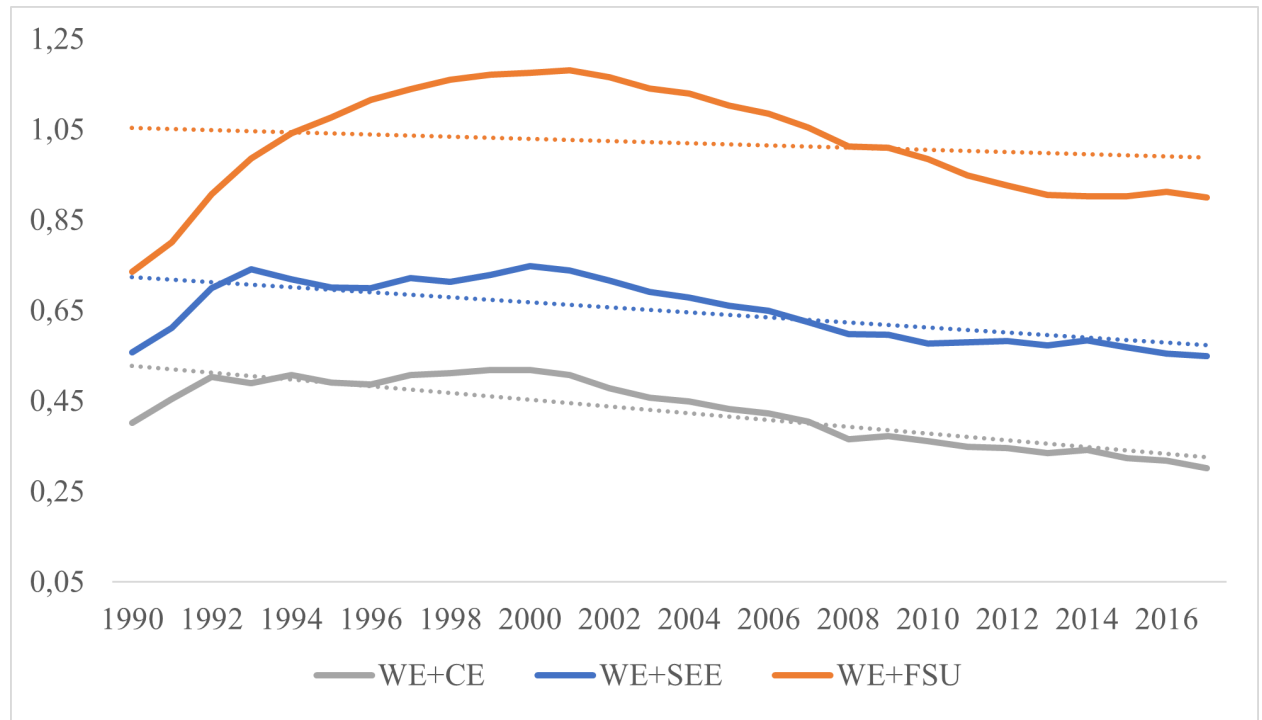
Figure 2: Sigma convergence of welfare between groups of countries (measured by coefficient of variation)
Source: authors' calculations

These observations are confirmed by the results of the regression analysis presented in Tables 1–3. The first column indicates the tested period, estimated coefficients α_0 and α_1 are given in the next two columns, followed by their t-statistics (t) and P-values (p). Convergence (divergence) is verified if the value of the coefficient α_1 is negative (positive) and statistically significant at the 5% level.

The regression analysis indicates that all three groups of countries diverged in the period 1990–1998 and converged afterwards. Overall, we can conclude that the transition economies of Central and South-Eastern Europe tended to narrow the well-being gap with Western Europe from 1990 to 2017, while no statistical inference can be drawn for the former Soviet Union.

Which factors can explain these results? According to the sigma convergence analysis of the components of the well-being indicator (Table 4), the Central European countries have been successful in increasing per capita income and in improving life expectancy. Moreover, they were approaching Western countries in terms of the amount of free time and the level of

inequality. The countries of South-Eastern Europe have achieved similar successes, but have not been able to approach the life expectancy of the developed world. The former Soviet Union did not get closer to the countries of Western Europe either in terms of per capita income, the amount of leisure time, or the share of consumption in income.

Table 1: Sigma convergence of welfare in the WE and CE countries

Period	α_0	α_1	$t(\alpha_0)$	$t(\alpha_1)$	$p(\alpha_0)$	$p(\alpha_1)$	R^2	Conclusion
1990–2017	0.5348	**-0.0074**	34.21	-7.92	0.000	0.000	0.7070	**convergence**
1990–1998	0.4355	**0.0095**	23.49	2.90	0.000	0.023	0.5451	**divergence**
1999–2008	0.5462	**-0.0165**	87.10	-16.42	0.000	0.000	0.9712	**convergence**
2009–2017	0.3777	**-0.0078**	96.51	-11.23	0.000	0.000	0.9474	**convergence**

Source: authors' calculations

Table 2: Sigma convergence of welfare in the WE and SEE countries

Period	α_0	α_1	$t(\alpha_0)$	$t(\alpha_1)$	$p(\alpha_0)$	$p(\alpha_1)$	R^2	Conclusion
1990–2017	0.7296	**-0.0055**	36.01	-4.58	0.000	0.000	0.4464	**convergence**
1990–1998	0.6090	**0.0151**	18.13	2.54	0.000	0.038	0.4803	**divergence**
1999–2008	0.7723	**-0.0162**	88.19	-11.48	0.000	0.000	0.9428	**convergence**
2009–2017	0.5968	**-0.0046**	102.78	-4.47	0.000	0.003	0.7408	**convergence**

Source: authors' calculations

Table 3: Sigma convergence of welfare in the WE and FSU countries

Period	α_0	α_1	$t(\alpha_0)$	$t(\alpha_1)$	$p(\alpha_0)$	$p(\alpha_1)$	R^2	Conclusion
1990–2017	1.0555	**-0.0024**	22.09	-0.84	0.000	0.407	0.0266	–
1990–1998	0.7273	**0.0536**	24.83	10.31	0.000	0.000	0.9382	**divergence**
1999–2008	1.2204	**-0.0179**	94.54	-8.63	0.000	0.000	0.9030	**convergence**
2009–2017	0.9967	**-0.0128**	65.07	-4.72	0.000	0.002	0.7611	**convergence**

Source: authors' calculations

Beta convergence analysis, presented in Table 5, provides generally the same results. It does not confirm the divergence for Central and South-Eastern European countries throughout 1990–1998 or the convergence of the former Soviet Union from 2009 to 2017 and the convergence of South-Eastern Europe during the whole period under analysis. In addition, the beta convergence model allows us to examine the speed of convergence β. Central European countries converged with Western Europe from 2 to 3 times faster than other transition economies. On average, they reduced the distance to the common hypothetical steady-state by 1.9% per year during 1990–2017. The pace of convergence for all three groups of transition economies outperformed the predictions of the literature. Patel, Sandefur, and Subramanian

Table 4: Sigma convergence of the components of welfare in the groups of transition economies and WE countries over the period of 1990 - 2017

	CE + WE	SEE + WE	FSU + WE
Income	convergence***	convergence***	–
Life expectancy	convergence***	divergence**	convergence***
Leisure	convergence***	convergence***	divergence**
C/Y	divergence***	–	divergence***
Inequality	convergence***	convergence**	convergence*

Significance level: *** – 1%, ** – 5%, * – 10%.
Source: authors' calculations

(2021) estimated the speed of GDP convergence to be 0.4 % per year over the last 20 years for developing countries. We found a range for welfare convergence pace from 1% to 3.8% per year for the same period for transition economies.

Table 5: Beta convergence of welfare in WE and the groups of transition economies and the speed of convergence β (% per year)

	1990–1998	1999–2008	2009–2017	1990–2017
WE+CE	–	convergence*** ($\beta = 3.8\%$)	convergence*** ($\beta = 2.7\%$)	convergence*** ($\beta = 1.9\%$)
WE+SEE	–	convergence*** ($\beta = 2.2\%$)	convergence** ($\beta = 1\%$)	–
WE+FSU	divergence*** ($\beta = -4.6\%$)	convergence** ($\beta = 1.3\%$)	–	–

Significance level: *** – 1%, ** – 5%, * – 10%.
Source: authors' calculations

The results for the beta convergence analysis of GDP (Table 6) do not differ from that for welfare in terms of qualitative conclusions. However, they do differ quantitatively. The speed of convergence (and divergence) of GDP is higher than that of welfare. Therefore, when we take into account life expectancy, consumption, leisure, and inequality in addition to income, it appears that the transition economies approached the standards of living of Western Europe more slowly than GDP shows. Thus, the post-socialist countries were more successful in increasing the income of the population than they were in improving other factors of well-being. The inequality in welfare between transition economies appears to be even greater than inequality in incomes.

Besides the research of the dynamics of the welfare gap between post-socialist countries and the developed world, it is also worth investigating whether the transition economies of Central Europe, South-Eastern Europe, and the former Soviet Union follow different trajectories and converged to their own steady states. We continue the paper with a study

Table 6: Beta convergence of GDP in WE and the groups of transition economies and the speed of convergence β (% per year)

	1990–1998	1999–2008	2009–2017	1990–2017
WE+CE	–	convergence*** ($\beta = 5.4\%$)	–	convergence*** ($\beta = 2.7\%$)
WE+SEE	–	convergence*** ($\beta = 2.8\%$)	–	convergence*** ($\beta = 1\%$)
WE+FSU	divergence*** ($\beta = -5.1\%$)	convergence** ($\beta = 2.1\%$)	convergence*** ($\beta = 1.2\%$)	–

Significance level: *** – 1%, ** – 5%, * – 10%.
Source: authors' calculations

of local convergence within subgroups of the data.

Fact 4. *The results of the intra-group convergence analysis show that while the transition economies of Central and South-Eastern Europe steadily converged with from 1990 to 2017, the welfare gap between the former Soviet Union significantly increased through the period.*

Central Europe

The results of the sigma convergence analysis for Central European transition economies are shown in Figure B1. The inequality of welfare and income was at the same level of 0.35 in the region at the beginning of the transition. It fell even lower to 0.3 a year later and then started to grow until 1995 and reached the value of 0.4 in terms of the coefficient of variation. Afterwards, it steadily decreased. The results of regression estimations presented in Tables 7 and B3 confirm the convergence hypothesis for both GDP and welfare over the period. An episode of divergence was observed during 1990–1998, but it was not statistically significant.

However, in 2017 the variation of GDP was half the variation of welfare. Therefore, the CE countries were more successful in reducing the GDP gap than the welfare gap. The possible reasons for this may be the divergence of countries in terms of life expectancy, leisure time, consumption, or inequality. In order to test this assumption, we conducted a sigma convergence analysis for these factors. The results presented in Table B4 show that we are able to obtain a statistically significant conclusion for the whole period under analysis only for leisure. However, a closer look at the results for the subperiods confirms our assumption. The countries moved away from the hypothetical steady state from 2009 to 2017 and to a lesser extent in the period 1999–2008.

Table 7: Sigma convergence of welfare in the CE countries

Period	α_0	α_1	$t(\alpha_0)$	$t(\alpha_1)$	$p(\alpha_0)$	$p(\alpha_1)$	R^2	Conclusion
1990–2017	0.3811	**-0.0071**	37.51	-11.59	0.000	0.000	0.8379	**convergence**
1990–1998	0.3202	**0.0057**	15.07	1.50	0.000	0.177	0.2436	–
1999–2008	0.3351	**-0.0102**	65.09	-12.34	0.000	0.000	0.9501	**convergence**
2009–2017	0.2381	**-0.0062**	38.19	-5.59	0.000	0.001	0.8167	**convergence**

Source: authors' calculations

South-Eastern Europe

The trajectory of welfare dynamics in South-Eastern Europe was a little bit different. Figure B2 illustrates that the initial inequality in this group of countries was higher than in Central Europe. It actually decreased afterwards and reached a low in 1996 with a value of the coefficient of variation of 0.25. In 2004, however, the countries returned to the initial state and then started to converge again. Thus, overall, by 2017, both the wealth gap and the income gap had narrowed.

The results of the regression analysis in Tables 8 and B5 confirm these observations. They allow us to draw a statistically significant conclusion that the transition economies of South-Eastern Europe approached a hypothetical steady state in terms of both income and well-being over the period under review.

Nevertheless, in terms of GDP, the countries converged more slowly than in terms of welfare. The reason for this was that the countries of South-Eastern Europe were successful in approaching a frontier in incomes and in the other social factors of the population's life. Table B6 shows that during the period 1990–2017, there was a convergence between the countries of this region in all the factors that we take into account.

Table 8: Sigma convergence of welfare in the SEE countries

Period	α_0	α_1	$t(\alpha_0)$	$t(\alpha_1)$	$p(\alpha_0)$	$p(\alpha_1)$	R^2	Conclusion
1990–2017	0.373	**-0.0055**	27.50	-6.72	0.000	0.000	0.6346	**convergence**
1990–1998	0.4112	**-0.0159**	13.02	-2.83	0.000	0.025	0.5343	**convergence**
1999–2008	0.3291	**-0.0026**	24.32	-1.19	0.000	0.270	0.1495	–
2009–2017	0.2543	**-0.0046**	31.73	-3.24	0.000	0.014	0.6005	**convergence**

Source: authors' calculations

Former Soviet Union

However, in the former Soviet Union, the situation was different (Figure B3). In 1990, inequality in this group was at the same level as in South-Eastern Europe. With the start of the transition process, inequality increased dramatically and continued to grow until 2017. The results of the regression analysis confirm that the countries diverged during the whole period (Tables 9 and B7). However, there was a statistically significant convergence in the last subperiod of 2009–2017. This trend may become stable and eventually lead to a reduction in inequality in the region. However, today the inequality between these countries is twice that in Central and South-Eastern Europe. Similarly to South-Eastern Europe, GDP inequality in this region was higher than welfare inequality.

Table 9: Sigma convergence of welfare in the FSU countries

Period	α_0	α_1	$t(\alpha_0)$	$t(\alpha_1)$	$p(\alpha_0)$	$p(\alpha_1)$	R^2	Conclusion
1990–2017	0.3991	**0.0028**	42.27	4.94	0.000	0.000	0.4846	**divergence**
1990–1998	0.3703	**0.0079**	19.69	2.36	0.000	0.050	0.4441	**divergence**
1999–2008	0.4285	**0.0027**	31.41	1.23	0.000	0.252	0.1600	–
2009–2017	0.4974	**-0.0062**	64.13	-4.53	0.000	0.003	0.7454	**convergence**

Source: authors' calculations

In addition, table B8 highlights the heterogeneity of the region. While countries were converging on life expectancy, they were moving away from each other on other parameters.

A specific feature of this group is the gap between the dispersion of income and the dispersion of welfare. A possible reason for this may be the high volatility of GDP compared to the other welfare components. While some countries of the region are resource-rich, they are still institutionally underdeveloped. The components of welfare appear to be at the lowest level here and do not differ significantly across countries despite the large differences in income between them.

Table 10: Speed of beta convergence of welfare in the groups of transition economies (% per year)

	1990–1998	1999–2008	2009–2017	1990–2017
CE	–	6%	2.7%	**4.6%**
SEE	2%	–	–	**5.5%**
FSU	–	–	–	–

Source: authors' calculations

The results of the beta convergence analysis do not contradict what we have just discussed. Figure B4 illustrates a negative relationship between the initial level of well-being and the

rate of its growth in all groups of countries. However, statistically, convergence was confirmed only for some periods for the countries of Central and South-Eastern Europe. Nevertheless, in addition to qualitative conclusions, beta convergence analysis also allowed us to calculate the speed of convergence (Table 10). When comparing these results with the data obtained from the beta convergence analysis with Western Europe (Table 5), it can be concluded that the intra-group rate of convergence in Central Europe and South-Eastern Europe is several times higher than the rate of their convergence with the standards of living in developed countries.

Conclusion

The results of the paper show that the welfare gap between transition economies widened due to the transformation crisis in the period 1990–1998. Afterwards, the trend was reversed, and the countries achieved a certain degree of convergence. However, the patterns were different inside the groups of countries. The transition economies of Central Europe were the most successful and reduced the welfare gap with Western Europe by almost 25%. South-Eastern European states remained at the same level to the end of the period. The welfare gap between the former Soviet Union and the developed countries significantly increased between 1990 and 2017 (by 23%). The results of intra-group convergence analysis appear to be essentially the same. While the transition economies of Central and South-Eastern Europe steadily converged from 1990 to 2017, the welfare gap between the former Soviet Union significantly increased through the period.

Although the transition from a planned to a market-based economic model can be considered complete in many regions, the process of convergence with the Western standard of living is much more complex and slow. This problem is not unique to post-socialist economies (Wachtel, 2019). The reason for its occurrence may be the crucial role of institutions as an engine of growth and development. Therefore, the implementation of Western Europe's institutions is necessary for encouraging competition and to boost production efficiency. Thus, the success of transition economies in achieving higher living standards is largely determined by the trajectory of their transformation. At the beginning of the transition process, Central European countries (and to a lesser extent South-Eastern European countries) were better institutionally developed, had higher per capita incomes, and a more stable macroeconomic environment than the rest of the post-socialist countries. They have carried out rapid reforms and have now become not only culturally but also economically close to the European Union. The former Soviet Union (except the Baltic States) suffered from the resource curse, were more agrarian, and economically less developed. They were not able to the create European-style market institutions that would lead them on a path of convergence with developed countries in a short period of time.

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Appendix A

Model

In this paper we use the model of well-being calculation proposed by Jones and Klenow (2016). For the full derivation of the welfare metric and calibration of parameters see the original paper.

The elementary utility function of an agent has the form:

$$u(C, l) = \bar{u} + log(C) + v(l) \tag{1}$$

where C is and l – share of free time.

Consumption is supposed to be lognormally distributed and independent of age with an expected value of $c_{(i,s)}$ and a variance of logarithm of consumption of $\sigma^2_{(i,s)}$. Then $E[log\, C_{(i,s)}] = log\, c_{(i,s)} - \sigma^2_{(i,s)}/2$ according to the property of the distribution.

Share of free time is assumed to be unchanged and the same for people of all ages in a given country in a given year.

$v(l)$ – the utility of free time. It has the form that implies a constant elasticity of the supply of labor according to Frisch:

$$v(l) = -\frac{\theta\epsilon}{1 + \epsilon}(1 - l)^{\frac{1+\epsilon}{\epsilon}} \tag{2}$$

ϵ - Frisch elasticity
θ - disutility of work

The expected lifetime utility of an agent is the mathematical expectation of the discounted sum of the elementary utility functions of consumption and leisure for each year:

$$U = E \sum_{a=1}^{100} \beta^a u(C_a, l_a) S(a) \tag{3}$$

a – age;
C_a – consumption in the age of a;
l_a – leisure in the age of a;
β – discount factor;
$S(a)$ – probability to live until age a;

Thus, 4 parameters are used in the calculations:

1. **Frisch elasticity:** $\epsilon = 1$

2. **Disutility of work:** $\theta = 14.2$

3. **Discount factor:** $\beta = 1$

4. **Minimal utility value:** $\bar{u} = 4.7133$

$\beta = 1$ makes it possible to express the sum of the probabilities of survival as a single statistic – life expectancy at birth: $e = \sum_{a=1}^{100} S(a)$.

The expected utility of an agent who will live all his entire life in country i and be born in year s, with consumption multiplied by λ in each year is:

$$U_{(i,s)} = E_{(i,s)} \sum_{a=1}^{100} \beta^a u(\lambda C_{a(i,s)}, l_{a(i,s)}) S_{(i,s)}(a) \tag{4}$$

In order for the agent behind the "veil of ignorance" to be indifferent where to be born – in the United States in 2006 or in country i in year s, the following condition must be met:

$$U_{US}(\lambda_{(i,s)}) = U_{(i,s)}(1) \tag{5}$$

After the substitution of the functions in this equality, the expression, and the simplification we get the following formula for calculating the welfare index λ:

$$
\begin{aligned}
log\,\lambda_{(i,s)} &= \frac{e_{(i,s)} - e_{us}}{e_{us}} \left(\bar{u} + log\,c_{(i,s)} - \frac{\sigma_{(i,s)}^2}{2} + v(l_{(i,s)}) \right) && \text{Life expectancy} \\
&+ log\,\bar{c}_{(i,s)} - log\bar{c}_{us} && \text{Consumption} \\
&+ v(\bar{l}_{(i,s)}) - v(\bar{l}_{us}) && \text{Leisure} \\
&- \frac{1}{2}(\sigma_{(i,s)}^2 - \sigma_{us}^2) && \text{Inequality}
\end{aligned}
\tag{6}
$$

Convergence Analysis

In this paper, we analyze two types of convergence: absolute beta (β) convergence and sigma (σ) convergence.

Sigma (σ) convergence occurs when the variation of welfare in a group of countries decreases over time. The variance of welfare is measured by a coefficient of variation CV:

$$CV = \frac{\text{the standard deviation } (Welfare)}{\text{the arithmetic mean } (Welfare)} \tag{7}$$

In order to understand whether the sigma convergence occurs we need to estimate the following regression:

$$CV(\lambda_t) = \alpha_0 + \alpha_1 * t + \epsilon_t \tag{8}$$

The dependent variable is the coefficient of variation of welfare in a group of economies, the independent variable is the time that varies from 1 to 28 for the years from 1990 to 2017 respectively. ϵ_t is an error term. We can conclude that sigma convergence exists if welfare differentiation reduces over time, that is if the coefficient α_1 is negative.

Beta (β) convergence exists if the welfare of more developed economies grows slower than that of less developed economies. To test for the beta convergence hypothesis we estimate the following form of regression:

$$\frac{1}{T} * ln(\frac{\lambda_{i,T}}{\lambda_{i,0}}) = \alpha_0 + \alpha_1 * ln(\lambda_{i,0}) + \epsilon_i \tag{9}$$

where $\lambda_{i,T}$ and $\lambda_{i,0}$ are the welfare levels of country i in the last and the first years of the period under analysis, respectively.

Beta convergence occurs if the coefficient α_1 is negative, which indicates that the higher is the initial level of welfare of the economy, the lower is its consequent growth rate.

If the beta convergence hypothesis is verified for a group of economies, then we can calculate the speed of convergence β:

$$\beta = -\frac{1}{T} * ln(1 + \alpha_1 * T) \tag{10}$$

Appendix B

Table B1: Welfare levels in economies of transition in 1990

| | Welfare λ | Income Y | $\ln \frac{\lambda}{Y}$ | Decomposition | | | |
				Life expectancy	C/Y	Leisure	Inequality
United States	100.0	100.0	0.000	0.000	0.000	0.000	-0.000
Central Europe							
Czech Rep.	33.9	41.6	-0.204	-0.246	-0.026	-0.020	0.089
Slovenia	29.6	36.8	-0.216	-0.162	-0.034	-0.045	0.025
Slovakia	26.9	31.4	-0.155	-0.243	-0.008	0.002	0.095
Latvia	24.2	28.4	-0.159	-0.298	0.063	0.023	0.053
Lithuania	22.8	24.1	-0.055	-0.219	0.116	0.001	0.047
Hungary	17.2	23.3	-0.302	-0.255	-0.032	-0.030	0.014
Estonia	13.3	19.5	-0.379	-0.219	-0.016	-0.098	-0.045
Poland	12.5	15.0	-0.184	-0.171	-0.044	0.017	0.015
Mean	*22.5*	*27.5*					
South-Eastern Europe							
Montenegro	21.9	18.2	0.181	-0.096	0.210	0.090	-0.023
Croatia	20.8	23.0	-0.100	-0.176	0.084	-0.002	-0.006
Bulgaria	20.6	18.2	0.125	-0.193	0.251	0.009	0.058
Serbia	19.0	20.7	-0.088	-0.191	0.144	-0.021	-0.019
Macedonia	9.7	10.4	-0.064	-0.141	0.124	0.011	-0.058
Romania	7.3	13.3	-0.600	-0.142	0.027	-0.176	-0.309
Albania	7.2	6.1	0.161	-0.101	0.224	0.036	0.001
Mean	*15.2*	*15.7*					
Former Soviet Union							
Belarus	20.0	25.1	-0.229	-0.218	0.006	-0.075	0.059
Georgia	16.8	19.9	-0.173	-0.216	0.245	-0.098	-0.104
Kazakhstan	15.4	21.0	-0.310	-0.273	-0.001	-0.037	0.001
Kyrgyzstan	14.4	13.5	0.064	-0.266	0.328	0.012	-0.011
Ukraine	12.9	19.8	-0.434	-0.197	-0.197	-0.059	0.019
Russian Fed.	12.7	27.5	-0.774	-0.230	-0.332	-0.077	-0.134
Turkmenistan	9.9	18.9	-0.641	-0.369	-0.270	0.009	-0.011
Armenia	9.5	11.8	-0.218	-0.218	0.060	-0.087	0.028
Moldova	9.3	9.8	-0.045	-0.222	0.193	-0.045	0.030
Uzbekistan	8.4	8.2	0.017	-0.234	0.246	0.023	-0.018
Tajikistan	7.9	11.5	-0.371	-0.426	0.061	0.034	-0.040
Azerbaijan	7.2	13.4	-0.624	-0.245	-0.214	-0.111	-0.053
Mean	*12.0*	*16.7*					

Source: authors' calculations

Table B2: Welfare levels in economies of transition in 2017

	Welfare λ	Income Y	$\ln \frac{\lambda}{Y}$	Decomposition			
				Life expectancy	C/Y	Leisure	Inequality
United States	100.0	100.0	0.000	0.000	0.000	0.000	-0.000
Central Europe							
Slovenia	79.7	65.6	0.195	0.156	-0.044	0.027	0.055
Czech Rep.	73.7	69.8	0.055	0.080	-0.065	-0.009	0.049
Slovakia	68.7	59.2	0.149	-0.024	0.076	0.037	0.059
Estonia	57.5	59.9	-0.041	-0.002	0.001	-0.020	-0.019
Poland	57.3	55.3	0.034	0.007	0.033	0.005	-0.011
Lithuania	55.4	60.3	-0.084	-0.132	0.146	-0.004	-0.094
Hungary	51.3	53.7	-0.044	-0.068	0.017	-0.007	0.014
Latvia	45.2	51.6	-0.133	-0.124	0.039	0.004	-0.053
Mean	*61.1*	*59.4*					
South-Eastern Europe							
Croatia	50.1	47.3	0.057	0.006	-0.011	0.064	-0.001
Montenegro	38.4	33.3	0.141	-0.039	0.134	0.069	-0.023
Romania	35.1	48.9	-0.330	-0.089	0.020	0.047	-0.309
Bulgaria	32.9	39.1	-0.173	-0.106	0.041	0.024	-0.132
Serbia	30.3	28.8	0.051	-0.056	0.157	-0.031	-0.019
Albania	28.0	22.5	0.222	0.021	0.134	0.066	0.001
Macedonia	27.8	27.2	0.022	-0.072	0.084	0.038	-0.028
Mean	*34.6*	*35.3*					
Former Soviet Union							
Kazakhstan	35.3	43.7	-0.214	-0.184	-0.068	0.014	0.023
Russian Fed.	31.9	46.0	-0.367	-0.210	0.006	-0.028	-0.134
Belarus	31.3	33.2	-0.059	-0.130	-0.014	0.044	0.041
Azerbaijan	24.6	28.9	-0.160	-0.169	0.007	0.006	-0.003
Armenia	22.0	19.4	0.125	-0.091	0.180	0.079	-0.043
Ukraine	20.9	19.0	0.095	-0.189	0.198	0.067	0.019
Georgia	20.6	22.6	-0.093	-0.133	0.052	0.087	-0.099
Turkmenistan	16.8	45.5	-0.999	-0.298	-0.574	-0.057	-0.070
Uzbekistan	16.3	19.3	-0.169	-0.181	0.108	-0.019	-0.078
Moldova	13.6	10.9	0.223	-0.156	0.260	0.081	0.037
Tajikistan	7.2	6.9	0.043	-0.123	0.103	0.090	-0.027
Kyrgyzstan	4.3	8.0	-0.622	-0.065	-0.630	0.048	0.024
Mean	*20.4*	*25.2*					

Source: authors' calculations
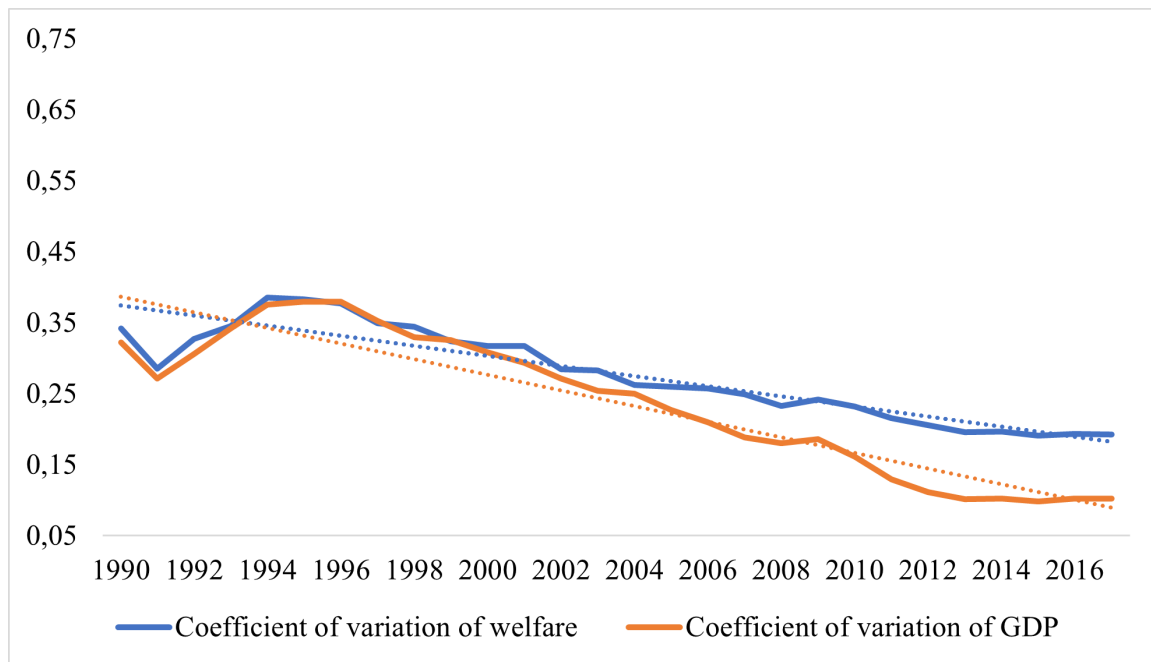
Central Europe

Figure B1: Sigma convergence of welfare and GDP in the Central European countries, 1990 - 2017
Source: authors' calculations

Table B3: Sigma convergence of GDP in the CE countries

Period	α_0	α_1	$t(\alpha_0)$	$t(\alpha_1)$	$p(\alpha_0)$	$p(\alpha_1)$	R^2	Conclusion
1990–2017	0.3975	**-0.0111**	27.56	-12.67	0.000	0.000	0.8607	**convergence**
1990–1998	0.3018	**0.0076**	12.82	1.81	0.000	0.114	0.3180	–
1999–2008	0.3407	**-0.0163**	123.52	-36.80	0.000	0.000	0.9941	**convergence**
2009–2017	0.1702	**-0.0097**	13.00	-4.17	0.000	0.004	0.7134	**convergence**

Source: authors' calculations

Table B4: Sigma convergence of the components of welfare in the CE countries

	1990–1998	1999–2008	2009–2017	1990–2017
Life expectancy	–	divergence**	divergence**	–
Leisure	convergence***	–	divergence***	convergence***
C/Y	–	divergence**	divergence***	–
Inequality	–	convergence**	divergence***	–

Significance level: *** – 1%, ** – 5%, * – 10%.
Source: authors' calculations
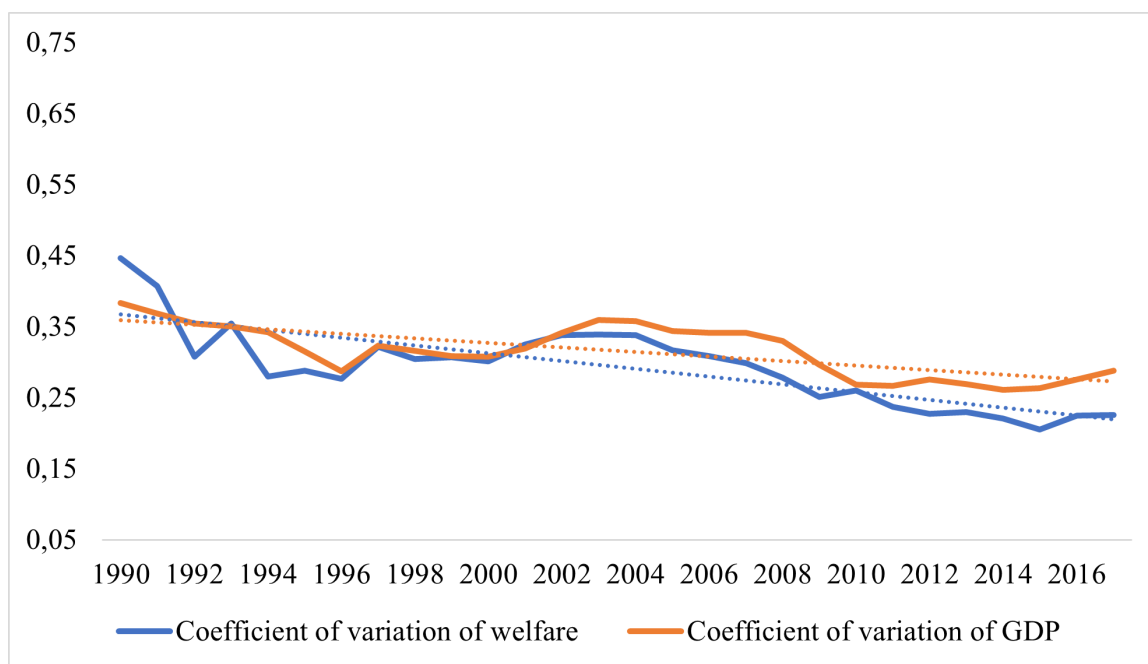
South-Eastern Europe

Figure B2: Sigma convergence of welfare and GDP in the South-Eastern European countries, 1990 - 2017
Source: authors' calculations

Table B5: Sigma convergence of GDP in the SEE countries

Period	α_0	α_1	$t(\alpha_0)$	$t(\alpha_1)$	$p(\alpha_0)$	$p(\alpha_1)$	R^2	Conclusion
1990–2017	0.3621	**-0.0032**	36.72	-5.36	0.000	0.000	0.5245	**convergence**
1990–1998	0.3853	**-0.0095**	33.74	-4.70	0.000	0.002	0.7597	**convergence**
1999–2008	0.3167	**0.0033**	28.58	1.84	0.000	0.103	0.2979	–
2009–2017	0.2762	**-0.0005**	30.85	-0.34	0.000	0.746	0.0160	–

Source: authors' calculations

Table B6: Sigma convergence of the components of welfare in the SEE countries

	1990–1998	1999–2008	2009–2017	1990–2017
Life expectancy	–	–	–	convergence***
Leisure	divergence*	convergence***	–	convergence***
C/Y	convergence***	–	–	convergence***
Inequality	convergence*	–	–	convergence***

Significance level: *** − 1%, ** − 5%, * − 10%.
Source: authors' calculations
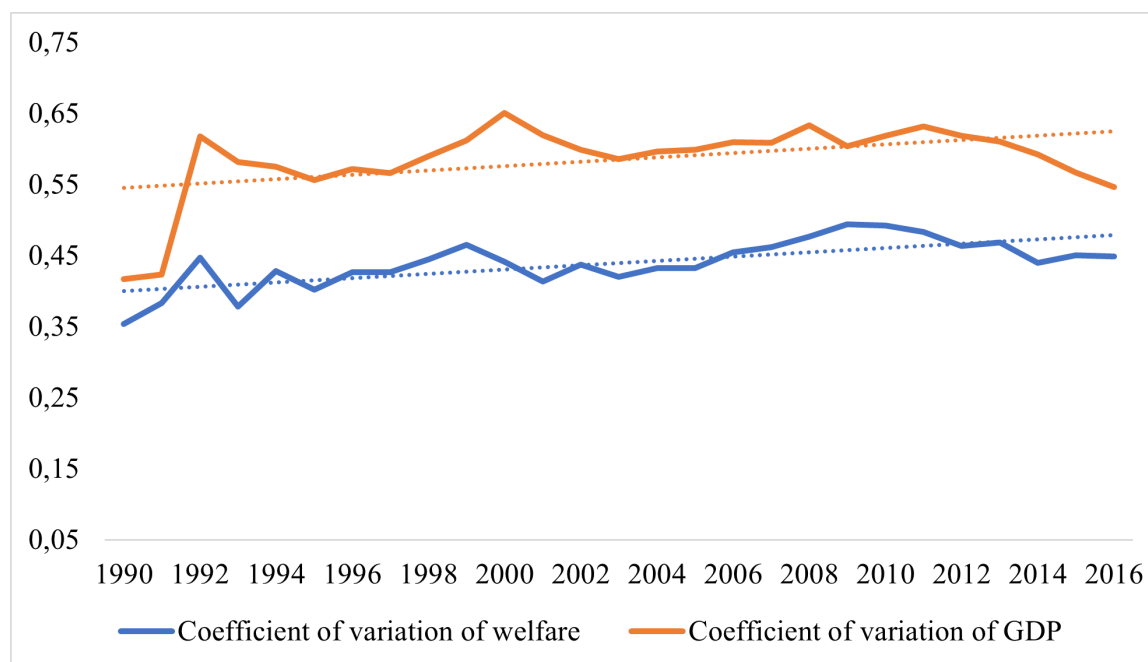
Former Soviet Union

Figure B3: Sigma convergence of welfare and GDP in the former Soviet Union countries, 1990 - 2017
Source: authors' calculations

Table B7: Sigma convergence of GDP in the FSU countries

Period	α_0	α_1	$t(\alpha_0)$	$t(\alpha_1)$	$p(\alpha_0)$	$p(\alpha_1)$	R^2	Conclusion
1990–2017	0.5485	**0.0024**	28.07	2.06	0.000	0.050	0.1399	**divergence**
1990–1998	0.4606	**0.0167**	10.53	2.15	0.000	0.069	0.3973	–
1999–2008	0.6159	**0.0008**	44.74	-0.38	0.000	0.715	0.0176	–
2009–2017	0.6439	**-0.0103**	48.75	-4.41	0.000	0.003	0.7351	**convergence**

Source: authors' calculations

Table B8: Sigma convergence of the components of welfare in the FSU countries

	1990–1998	1999–2008	2009–2017	1990–2017
Life expectancy	convergence***	convergence***	–	convergence***
Leisure	–	divergence***	divergence***	divergence***
C/Y	convergence***	divergence***	convergence**	divergence*
Inequality	–	divergence***	–	–

Significance level: *** – 1%, ** – 5%, * – 10%.
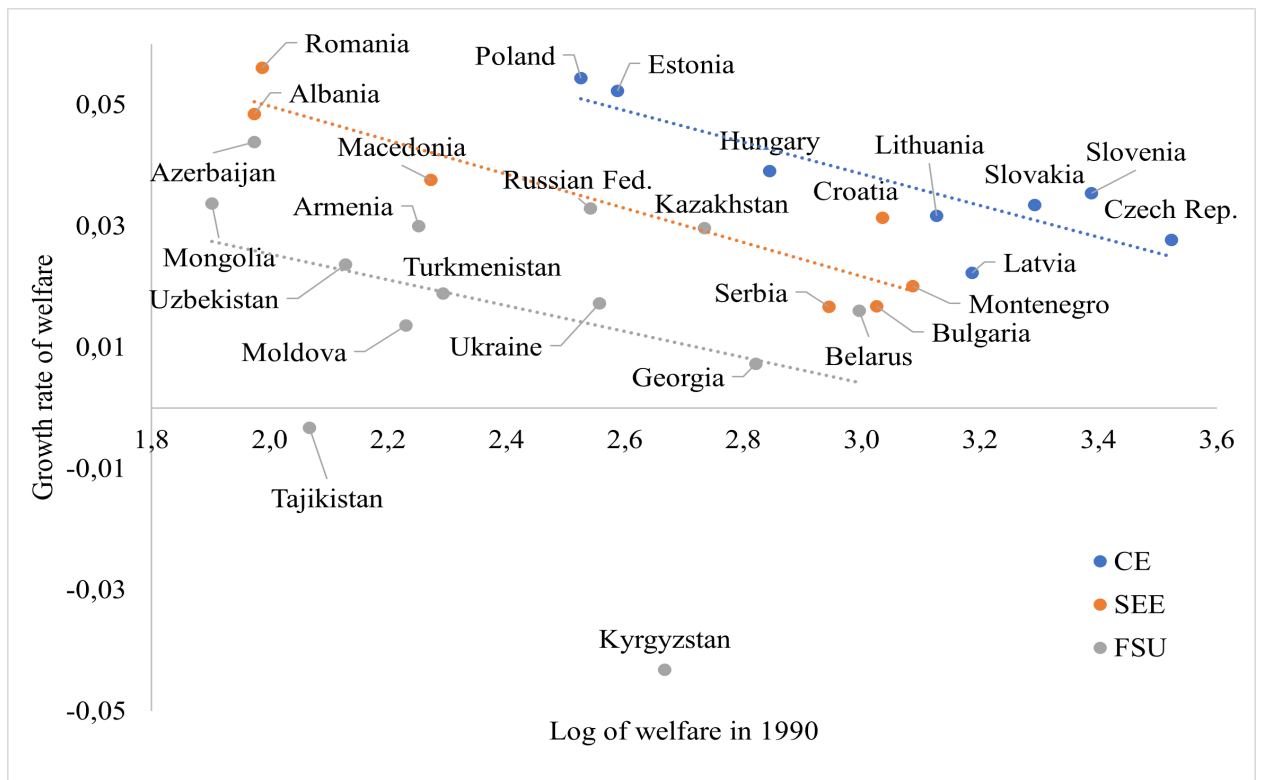Source: authors' calculations

Intra-Group Beta Convergence

Figure B4: Beta convergence of welfare in the former Soviet Union, Central Europe, and South-Eastern Europe, 1990 - 2017
Source: authors' calculations