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# REGIONAL CONVERGENCE IN INCOME INEQUALITY SINCE THE EU INTEGRATION OF BULGARIA

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## Abstract

*Economic theory emphasizes on the statement that income level is a major determinant of living standards, the risk for poverty, and social exclusion. Over the years, a number of researchers have focused on the assertion for huge differences between Bulgarian regions in terms of income inequality, along with many other economic indicators. This article examines the differences in Bulgarian districts by their income inequality levels. The study investigates the regional convergence in district income inequality applying different convergence assessment methods.*

**Key words:** income inequality; convergence; regions; Bulgaria

**JEL:** C23, O47, R11

## Introduction

At the heart of this study is the concept of income, which serves as a means of forming the distribution of income in the country. Income statistics data help analyze economic phenomena such as economic growth, income inequality, productive activity, poverty and many more. The scientists found „significant congruence, over time and between regions, in the patterns of improvement in per capita income and life expectancy" (Maddison, 2001).

The regional income distribution is directly related to the income inequality and poverty in each of the regions, as well as to the overall well-being of the country. Regional income inequality on the one hand is logically dictated by the economic policies of the countries, as well as by the different employment opportunities in the different regions. The different productivity of people, as well as their attitudes, largely predetermine this inequality. "Imbalances in income and wealth among the population create an incentive for more effort in the workplace, the search for better education, and consequently – improving the overall productivity of the population" (Христов, 2013). The same thesis that inequality can have a positive side is supported by Andor „Inequality can have a positive impact on economic growth because income differentials

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provide incentives and reward personal effort, risk-taking and innovation. It also promotes growth by stimulating savings“ (Andor, 2018).

On the other hand, income differences also have a negative impact, which is related to both the so-called cronyism „undermining economic freedom” (Roberts, 2010). Divergence between regions in terms of income inequality would lead to huge disparities and depopulation of poorer areas. “Growing inequality is one of the biggest social, economic and political challenges of our time. But it is not inevitable” (The Economist, 2012).

Bulgarian administrative division defines 28 districts, which are characterized by different levels of income inequality. In their studies of regional inequality researchers come to more general conclusions, such as “there is not just a problem with inequality in Bulgaria – it is one of the most serious in the EU” (Христов, 2013), i. e. after research and analysis found that there is a problem with inequality in Bulgaria. A number of researchers in Bulgaria are focused on the analysis of income inequality, but information on the regional convergence of income inequality is very scarce and rather descriptive.

„Inequality can have a positive impact on economic growth because income differentials provide incentives and reward personal effort, risk-taking and innovation. It also promotes growth by stimulating savings“ (Andor, 2018).

This article attempts to examine inequality of income distribution in the different regions in Bulgaria, paying special attention to whether there is convergence or divergence between them. The study examines the convergence of district income inequality through two indicators that reflect its level. At the same time, different convergence research methods are used. The thesis of this paper states that the degree of convergence between the regions of Bulgaria, in terms of their levels of income inequality, can be successfully assessed using appropriate econometric methods.

## Convergence: Theoretical background

Over time, convergence methods evolve, striving to more accurately search for an answer to the question: “Is there convergence?”. Therefore, several methods for establishing convergence are used in the current study of this phenomenon.

The first two methods included in the paper are sigma (σ) and beta (β) convergence. Xavier Sala-i-Martin is the reasercher who is considered as founder of the theory of convergence. He examines the convergence of economic growth between the United States, Japan, and five European countries, concluding that they have similar developments and “regions tend to converge at a speed of approximately two percent per year” (Sala-i-Martin, 1996). He points out that both concepts of convergence are independently interesting.

William Baumol also contributed to the theory of convergence by conducting a study of sixteen countries. Through his work, he proves the importance of researching the phenomenon in the long run, as "because it is not sensible for economists and policymakers to attempt to discern long-run trends and their outcomes from the flow of short-run developments, which may be dominated by transient conditions" (Baumol, 1986).

Two types of beta convergence emerge in the course of time (Barro and Sala-i-Martin, 1991; Magrini, 2004): 'absolute' and 'conditional'. The first one assumes convergence as in all economies a stable state is observed: "there is an inverse relation between the growth rate of an economy and the distance from its steady state only if all the economies share same steady state" (Gömleksiz et al., 2017) and the second one – with different steady states in terms of their technological level or saving rates. When we use this method we needed to include some explanatory variables which may significantly affect the phenomenon of convergence.

The involvement of panel data into econometric analyses allowed researchers to adapt them to convergence analysis methods. One of the first scholars to adapt this methodology is Nazrul Islam stating that "a panel data approach is advocated and implemented for studying growth convergence" (Islam, 1995). The analysis of convergence using panel data is becoming increasingly precise and accurate and hence enhances the possibilities for empirical research. The use of a data panel – which has a cubic data structure – in this type of study undoubtedly produces a result that adds new perspectives on the utility of empirical results.

## Data and model

### *Indicators of income inequality*

The current study utilizes data about the following indicators for district income inequality in Bulgaria.

- S80/S20 (1) – Income shares quintile ratio is a coefficient which presents the ratio between the shares of income of the poorest and richest 20% of households. The higher the values of the indicator, the higher the income inequality in the country under consideration. In advance, income is evaluated at household level "as equalized disposable income … based on the EU Statistics of Income, Social Inclusion, and Living Conditions)" (Eurostat, 2019).
- Gini coefficient (2) – measures the degree of inequality in the distribution of income. The coefficient is suggested by the Italian statistician and sociologist Corrado Gini in 1912 and is designed to reflect the economic inequality through the uneven distribution of income (Gini, 1921).

The first two indicators are one of the most commonly used in income inequality analyses, but both are based on income disparities. The Gini index has particular advantage in comparing the degree of income inequality levels between different countries or regions without being affected by the number of cases for which individual income is measured. However, the Gini index is more sensitive to differences around the mean and not so much at the tails of the distribution (Boshnakov et al., 2010). In order to enhance the results, a third indicator will be included to provide an additional aspect of the convergence analysis.

- People at risk of poverty or social exclusion (3) – this is coefficient that reflects the degree of poverty and the social exclusion in different districts.

### *Models of convergence*

The Sigma convergence method is based on the fact that dispersion of income inequality levels can be measured by standard deviation of income inequality among income units. The coefficients of validation (CV) are used in the analysis when investigating the σ-convergence by an indicator that measures the income inequality. The formula is presented bellow in Equation (1).

$$CV = \frac{SD}{Mean} \tag{1}$$

The next method implemented in this study is the so called "absolute" β-convergence. It is based on a semi-logarithmic equation estimated on the basis of cross-sectional data – the formula is presented bellow in Equation (2). As "II" is income inequality, "v" is the number of the used indicator, "i" is the region (district), and "t" is the time (year).

$$T^{-1}\log\left[\frac{II_{v,i,t}}{II_{v,i,t_0}}\right] = \alpha_0 + \alpha_1 \log II_{v,i,t_0} + \varepsilon_i \tag{2}$$

The other type of β-convergence is defined as "conditional" as far as additional explanatory variables can be included to have a controlling role. Here "R" is included as an additional explanatory variable in order to control the level of development (represented by the share of people at-risk-of poverty in a district).

$$T^{-1}\log\left[\frac{II_{v,i,t}}{II_{v,i,t_0}}\right] = \alpha_0 + \alpha_1 \log II_{v,i,t_0} + \alpha_2 \log R_{i,t_0} + \varepsilon_i \tag{3}$$

The next equation (4), however, is based on panel data also including the extra explanatory variable. This way fixed effects (FE) or random effects (RE) specification for this model is necessary in order to consider unit-specific time-invariant effects (Wooldridge, 2010).

$$\log II_{v,i,t} - \log II_{v,i,t-1} = \alpha_0 + \alpha_1 \log II_{v,i,t-1} + \alpha_2 \log R_{i,t-1} + \varepsilon_i \quad (4)$$

Equation (5) presents the formula for calculation of the so called "speed of convergence":

$$\beta = -T^{-1} \ln(1 + \alpha_1 T) \quad (5)$$

According to this equation, if convergence occurs ($\alpha_1$<0) then higher initial income levels should have a negative (reverse) effect on rates of growth. Thus, "β" measures the annual convergence rate of an economy towards its steady state income level (Gömleksiz et al., 2017).

## Empirical findings

In the current study we used as primary indicators for income inequality the quintile coefficient (S80/S20) and the Gini coefficient which are estimated at regional level NUTS3 for the period 2008-2019. In order to present some typical disparities, data are described hereafter about three selected units of the analysis.

- The first unit is Sofia city – it is the region with one of the highest levels of investigated indicators at the end of the last decade.
- The second unit is Dobrich – this is the district with typically middle levels of the indicators.
- The third one is Razgrad – this is a region with levels of the studied indicators among the lowest in the country.

Figure 1 shows the dynamics of S80/S20 for these three out of Bulgaria's 28 districts in the period 2008 and 2019.

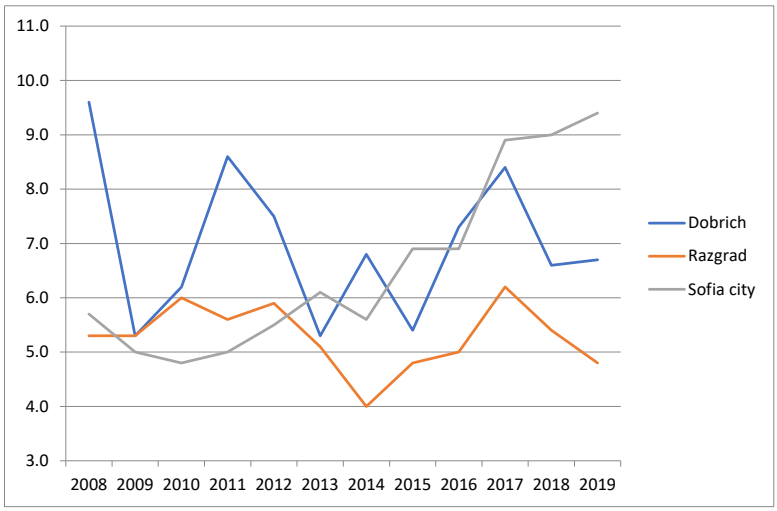


**Figure 1:** S80/S20 coefficient for Dobrich, Razgrad and Sofia city

Figure 2 shows Gini coefficient for these districts in the period 2008 and 2019. We can notice that the levels of both coefficients for Razgrad are the lowest for most of the period between 2008 and 2019. The situation with the Sofia city indicator is quite different. In the first year it occupies an intermediate position and there is a gradual increase in the levels of the coefficient. In 2019 the indicators obtain the highest values which can been seen in the charts. For Dobrich in the start of the period the coefficients have the highest values among the three districts. During the study period its levels fluctuate, and in the last year it occupies an average position. It turns out that the levels of income inequality in recent years in the capital city are the highest and tend to increase. Razgrad district, with few exceptions, manages to maintain some of the lowest levels of income inequality.

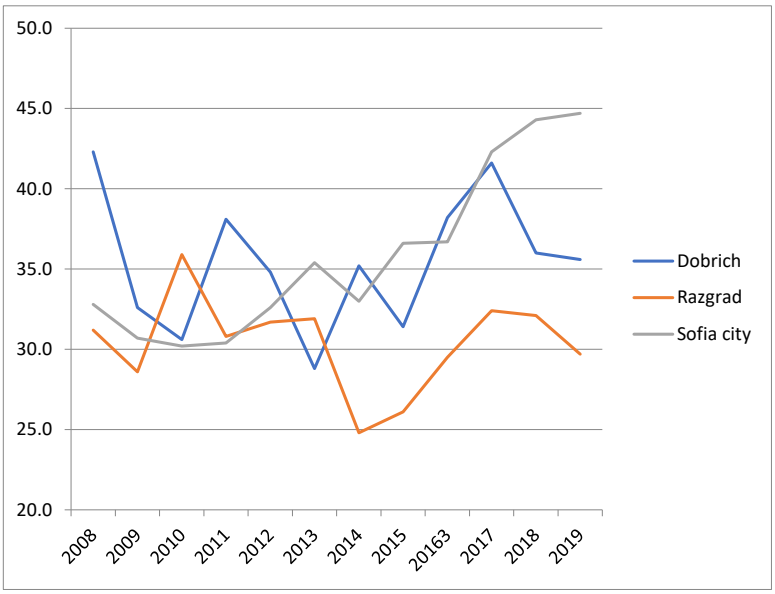


**Figure 2:** Gini coefficient for Dobrich, Razgrad and Sofia city

In the subsections below the results from σ- convergence, β- convergence, and convergence with panel data are presented. Data about the NUTS-3 regions in Bulgaria for the period 2008-2019 is used and pooled OLS, FE and RE specifications of models are estimated.

### *Sigma (σ) convergence of NUTS 3 Regions*

Table 1 presents the data about the coefficients of variation (CV) of the two indicators (S80/S20 and Gini coefficient) that reflect the income inequality of NUTS 3 Bulgarian districts in the period 2008-2019.

The results obtained from the analysis of σ-convergence for the NUTS-3 regions indicate that coefficients of variation tend to decrease across regions. Income inequality among the regions becomes more equal as much as the degree of variation between their income inequality levels decreases. This indicates the presence of convergence in the Bulgarian regions in the period 2008–2019.

**Table 1:** Coefficients of variation (CV) of NUTS 3 for the Bulgarian regions

| Year | CV of S80/S20 (1) | CV of Gini (2) |
|---|---|---|
| 2008 | 0,36 | 0,18 |
| 2009 | 0,27 | 0,14 |
| 2010 | 0,21 | 0,14 |
| 2011 | 0,25 | 0,12 |
| 2012 | 0,36 | 0,15 |
| 2013 | 0,26 | 0,14 |
| 2014 | 0,36 | 0,18 |
| 2015 | 0,25 | 0,13 |
| 2016 | 0,43 | 0,13 |
| 2017 | 0,26 | 0,12 |
| 2018 | 0,27 | 0,12 |
| 2019 | 0,23 | 0,13 |

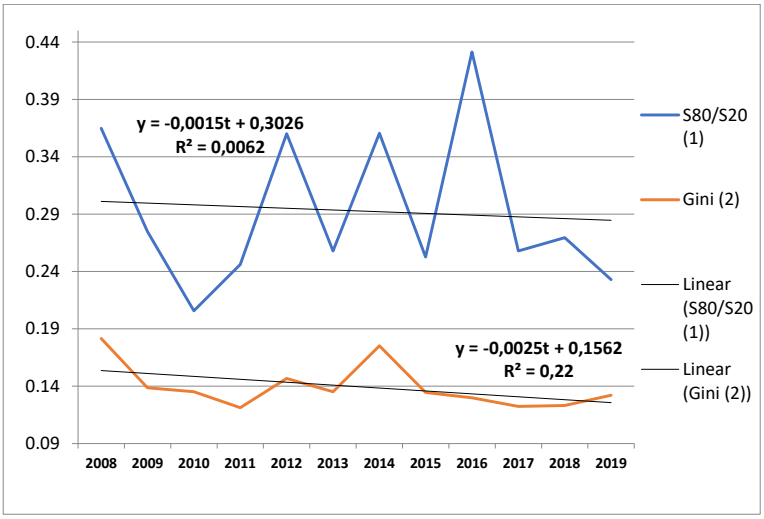


**Figure 3:** CV and trend lines of indicators (1) and (2) for NUTS 3 in the period 2008-2019

Figure 3 shows the dynamics of the coefficients of variations and their trend lines for both indicators which present the income inequality. It can be seen that there are periods of decrease and increase of the coefficient of variation of S80/S20 as well as the Gini index. The trend lines of both indicators however have decreasing slopes which certify the presence of σ-convergence.

Figure 3 also presents the equations of the trend lines. The trend coefficient before the "t" variable for indicator S80/S20 is -0,0015. It is negative and this proves the presence of σ-convergence for income inequality. The regression coefficient before the time variable for the Gini indicator is -0,0025 which is negative, too. This result confirms the presence of σ-convergence for income inequality for the regions NUTS 3 in Bulgaria.

### *Absolute and conditional β-convergence of NUTS 3 Regions*

For investigating the beta-convergence it is used OLS estimated models with cross-sectional data. For this model explanatory variables are associated with the starting period (or point t0) in time. Table 2 shows the results from absolute beta-convergence for income inequality indicators S80/S20 and Gini coefficient.

**Table 2:** Absolute *beta*-convergence for NUTS 3 regions

| Dep.Var. | Indep.Var. | Coeff. | SE | t Stat | P-value | F | Sig.F | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|
| S80/S20 | Constant | 0,12 | 0,02 | 5,54 | 0,00 | 28,21 | 0,00 | 0,50 |
| | Ln II [1,i,t0] | -0,06 | 0,01 | -5,31 | 0,00 | | | |
| Gini coefficient | Constant | 0,26 | 0,04 | 6,47 | 0,00 | 39,94 | 0,00 | 0,59 |
| | Ln II [2,i,t0] | -0,07 | 0,01 | -6,32 | 0,00 | | | |

The regression coefficient before the independent variable for S80/S20 is –0,06 and the explanatory power of the model is 50%. The regression coefficient before the independent variable for Gini index is -0,07 and the explanatory power of the model is 59%. Both coefficients are statistically significant and negative – this shows the presence of unconditional β-convergence between the regions evidenced by this method of assessment. The result from absolute *beta*-convergence confirms the conclusions from σ-convergence that the income inequality of the regions decreases (i.e. there is convergence between Bulgarian regions in the period 2008-2019). The negative sign shows that the change in inequality for districts with ***high initial levels*** of inequality is, on average, ***lower than*** the changes for districts with lower initial levels of inequality.

To get more precise results about the absolute *beta*-convergence, an additional factor variable (people-at-risk of poverty or social exclusion) is included as an independent variable in the regression models. This way the initial model is restructured into a specification for "conditional" *beta*-convergence.

Table 3 presents the estimation results of conditional *beta*-convergence which is based on cross-sectional data for the period 2008-2019. The coefficient before the independent variable for quintile ratio (S80/S20) is statistically significant and with a negative sign (−0,062). This implies the existence of conditional

convergence in NUTS 3 regions. The adjusted coefficient of determination is the same as the one for the absolute convergence model, although the coefficient before the control variable is not significant. It can't be interpreted but this has nothing to do with the established convergence.

**Table 3:** Conditional beta-convergence of NUTS 3 regions

| | | Coefficient | SE | t Stat | P-value | F | Adj $R^2$ |
|---|---|---|---|---|---|---|---|
| S80/S20 | Constant | 0,108 | 0,071 | 1,527 | 0,139 | 13,59 (0,00) | 0,52 |
| | Ln II1,i,t0 | -0,062 | 0,012 | -5,075 | 0,000 | | |
| | Ln Pr i,t0 | 0,004 | 0,020 | 0,177 | 0,861 | | |
| Gini coeff. | Constant | 0,268 | 0,055 | 4,848 | 0,000 | 19,27 (0,00) | 0,58 |
| | Ln II2,i,t0 | -0,072 | 0,012 | -6,095 | 0,000 | | |
| | Ln Pr i,t0 | -0,003 | 0,012 | -0,225 | 0,824 | | |

The other investigated indicator (Gini coefficient) has a statistically significant coefficient, too and its sign is negative (−0,072), too. The coefficient of determination is 58%. It is approximately as the one in the absolute convergence model. The coefficient before the control variable is not significant, too. It can't be interpreted but this is not a reason for correcting the conclusion that there is convergence.

Both types of models for investigating the *beta*-convergence (absolute and conditional) show the same results, which confirms the convergence indicated by the method of σ-convergence.

### *Panel data analysis of the regional convergence in income inequality*

To enhance the result obtained by using cross-sectional analysis, the current study uses also a mechanism defined under the panel data analysis approach. In order to utilize the panel data for the districts Fixed effects regression models are estimated. In this specification, in order to take into account the panel nature of the data, groups of variables were created and included in the model – one group for time and another for the districts: one dummy variable „fixed" for each region; one dummy variable „fixed" for each year.

For the purpose of this study four models are estimated. Models 1 and 2 show the results for the first indicator (S80/S20); Models 3 and 4 provide the results for the second indicator (Gini coefficient). Models 1 and 3 do not include any control variable while Models 2 and 4 include such a variable (people at-risk-of poverty or social exclusion). After the FE model, a RE model has been evaluated as well. The Hausman test has been implemented in order to choose between FE and RE specification, and as a result the FE model has been selected. Due to the presence

of autocorrelation and heteroskedasticity in the residuals of the initial model, FE model coefficients have been re-estimated with robust standard errors.

Table 4 presents the results from all four models estimated for FE and RE along with the results from the Hausman test.

**Table 4:** Panel data estimation of income inequality convergence in NUTS 3 regions

| Model | Model 1 (S80/S20) | | Model 2 (S80/S20) | | Model 3 (Gini) | | Model 4 (Gini) | |
|---|---|---|---|---|---|---|---|---|
| Effect | FE (rob) | RE | FE (rob) | RE | FE (rob) | RE | FE (rob) | RE |
| Constant | 1,296 | 0,672 | 1,553 | 1,057 | 2,373 | 1,299 | 2,227 | 1,363 |
| *p-value* | *0,000* | *0,000* | *0,000* | *0,000* | *0,000* | *0,000* | *0,000* | *0,000* |
| α1 ln II [v,i,t-1] | -0,739 | -0,366 | -0,742 | -0,383 | -0,691 | -0,371 | -0,706 | -0,369 |
| *p-value* | *0,000* | *0,000* | *0,000* | *0,000* | *0,000* | *0,000* | *0,000* | *0,000* |
| α2 ln PR [i,t-1] | X | X | -0,068 | -0,094 | X | X | 0,053 | -0,019 |
| *p-value* | *X* | *X* | *0,000* | *0,000* | *X* | *X* | *0,023* | *0,496* |
| Numb of obs. | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 |
| Numb of years | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| Numb of districts | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| Hausman Test | X | Chi-sq(1) | X | Chi-sq(2) | X | Chi-sq(1) | X | Chi-sq(2) |
| | X | 74.14 | X | 82.22 | X | 45.80 | X | 53.17 |
| *(p-value)* | *X* | *0,000* | *X* | *0,000* | *X* | *0,000* | *X* | *0,000* |

According to the obtained results, the following conclusions can be drawn for the Bulgarian districts about the period 2008-2019:

- The fixed-effects panel data model with robust standard errors is adequate in order to provide a basis for the analysis of regional convergence.
- The coefficients before the independent variables for the income inequality indicators (quintile ration and Gini index) are statistically significant so they provide reliable information about any convergence effects.
- The coefficient before the lagged log-variable of income inequality in each estimated model is negative. Thus, a conclusion can be drawn for a persistent conditional convergence, estimated at annual basis, of the income inequality for NUTS-3 districts in Bulgaria between 2008 and 2019.

## Conclusion

The goal of this article is to investigate the possible convergence across NUTS 3 regions in Bulgaria in the period 2008 and 2019. For such an analysis, an empirical investigation was conducted on the basis of the coefficient of variation of income level, regression models estimated by cross-sectional and by panel data methods – in the context of the sigma and beta convergence approaches. The latter two were implemented in both their versions of absolute and conditional

convergence. The analysis was conducted for two alternative measures of income inequality: the quintile ratio S80/S20 and the Gini index.

From the results from σ-convergence it becomes obvious that CV tends to decrease, therefore there is *sigma*-convergence between Bulgarian regions concerning the income inequality in the period 2008-2019. For *beta*-convergence a completely different method was used based on cross-sectional OLS data. This method confirms the revealed convergence also if a control variable in the regression model is added, e.g. "people at-risk-of poverty or social exclusion". But such an analysis needs to be expanded with additional control variables in a further research.

The last method for convergence study was based on panel data where a massive dataset for 11 years for 28 districts has been created. This method also confirmed the result obtained by the previous methods. In all model specifications for each of the two inequality indicators a presence of convergence between the Bulgarian regions in the period 2008-2019 has been found. Income inequality within the NUTS 3 regions decreases, as much as the variation of their income inequality levels decreases. This study provides a prerequisite for further research to confirm whether poverty rates and/or other socio-economic variables are among the main factors influencing the shifts in regional income inequalities in the country.

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