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Human Development and Income Inequality as Factors of Regional Economic Growth

D.G. Rodionov[1], T.J. Kudryavtseva[2], A.E. Skhvediani[3]

Abstract:

This paper examines the impact of the Human Development Index and the Gini index on the Real Gross Regional Product (GRP) per person employed in 68 regions of the Russian Federation during the 2000 – 2014 period.

We test and compare the results from two groups of models. The first group of models reveals that higher GRP per person employed is associated with higher levels of human development and income inequality in the Russian Federation regions.

These results stay robust within the models estimated by linear regression with panel-corrected standard errors, where Regional FE, Time FE and Federal District FE are controlled.

The estimation results from the second group of models provide evidence that regions with higher levels of Real Gross Regional Product (GRP) per person, human development and income inequality were growing slower, on average, than regions with lower levels of these parameters.

Keywords: *Economic development, regional economics, human development, income inequality.*

JEL: *R11, O47.*

[1]*Graduate School of Public Administration And Financial Management, Peter the Great St. Petersburg Polytechnic University, Saint-Petersburg, Russia, drodionov@spbstu.ru*
[2]*Graduate School of Public Administration And Financial Management, Peter the Great St. Petersburg Polytechnic University, Saint-Petersburg, Russia, kudryavtseva_tyu@spbstu.ru*
[3]*Graduate School of Public Administration And Financial Management, Peter the Great St. Petersburg Polytechnic University, Saint-Petersburg, Russia, shvediani_ae@spbstu.ru*

1. Introduction

Economic growth is the basis of development for socio-economic systems (Solow *et al.*, 1956; Mankiw *et al.*, 1992; Barro, 1991). It allows the government to support labor productivity, ensure commercialization of innovations and strengthen the citizens' well-being (Skiter *et al.*, 2015). Russia showed unstable economic growth during 2000–2014 period. Some authors believe that the main reason for it is aggregating problems, inbounded from the USSR times (Ivanter, 2016; Veselovsky *et al.*, 2016). The uneven economic, social, and territorial development is leading to substantial differences in the standards of living and GRP per person employed in Russian regions. Moreover, recent intensification of the negative economic processes has led to the stagnation of the Russian economy (Zhogova *et al.*, 2017; Rudskaia, 2017; Goncharova *et al.*, 2017; Popkova *et al.*, 2016).

The study focuses on exploring the relationship between two determinants, the level of human development and the level of income inequality, of economic growth, expressed as GRP per person employed. Human capital is identified as a factor of economic growth in numerous studies (Fleisher *et al.*, 2010; Hanushek, 2013; Suri *et al.*, 2011; Sultanova and Chechina, 2016; Kuporov *et al.*, 2018) as well as the level of income inequality (Castelló-Climent, 2010; Lee and Hong, 2012; Heathcote *et al.*, 2010; Rodríguez-Pose and Tselios, 2010). However, these studies lack empirical evidence which would have supported the idea that Russian regions also benefit from these factors. Therefore, the purpose of this study is to examine the factors of economic growth of Russian regions. In this paper we**:**

- systematize literature by two factors determining the economic growth of the regions: the level of human development and the level of income inequality;
- evaluate the factors affecting the economic growth of the regions of the Russian Federation;
- suggest an economic interpretation of the results.

2. Systematization and justification of factors influencing economic growth

2.1 Relation between incomes and economic growth

Further on, we explore the results of studies where the authors examine the income inequality of the population as the determining factor of economic growth. For example, Delbianco *et al.* (2014) note that there are two approaches to understanding the influence of income on economic growth. According to the classic approach, the savings rate increases with the growing level of wealth. Inequality leads to an increase in income for the wealthier portion of the population, which is characterized by a higher savings rate. It allows accumulating capital and, consequently, makes economic growth possible. According to the political economy approach, an increase in inequality leads to a greater burden on income distribution mechanisms. This, in turn, leads to distortions, which affect the processes of accumulating physical and human capital adversely. In their work, the authors studied data across 20 countries of South America and the Caribbean during the period from 1980 to 2010. According to their findings, the relation between income inequality and economic growth depends on the income level. In other words, an increase in inequality in poor countries can lead to political instability, which forces the use of mechanisms of income redistribution. However, in countries with a high-income level, the negative effects caused by inequality smooth out (Delbianco *et al.*, 2014).

Different studies have put forth a proof both for the first and second approach. For example, Forbes determined that an increase in income inequality led to economic growth (Forbes, 2000; Stroeva *et al.*, 2015). On the other hand, Herzer and Vollmer concluded that an increase in income inequality had a negative effect on GDP growth. Moreover, the result does not depend on the level of economic development and type of political regime (Herzer and Vollmer, 2012). The UN has recorded in its development program that in cases where the Gini index is less than 0.3, an increase in income inequality is a factor which positively affects economic growth. However, if the value is greater than 0.45, an increase in income inequality leads to a negative effect and slows down economic growth (UN, 2013). We present the findings from the main works on the topic of how income inequality influences economic growth in Table 1.

Table 1. *Main works dedicated to the issue of how income inequality influences economic growth*

Authors	Data	Time	Conclusion
H. Li. and H. Zou (1998)	46 countries	1960 - 1990	Income inequality may theoretically lead to a higher economic growth if public consumption enters the utility function.
K. J. Forbes (2000)	45 countries	1966 - 1955	Income inequality leads to a positive economic growth in high and mid-income countries.
R.J. Barro (2000)	84 countries	1965 - 1995	Higher income inequality tends to retard growth in poor countries and encourage growth in richer locations.
S. Knowles (2005)	40 countries	1960 - 1990	There is a significant negative correlation between consistently measured inequality of expenditure data and economic growth for a sample of developing countries.
D. Herzer and S. Vollmer (2012)	46 countries	1970 - 1995	Income inequality leads to a negative economic growth both in case of developing and developed countries.
United Nations (2013)	193 countries	-	If the Gini coefficient <0.3, then an increase in inequality positively affects economic growth. If the Gini coefficient >0.45, then an increase in

			inequality negatively affects economic growth.
F. Cingano (2014)	31 OECD countries	1970 - 2010	Income inequality has a negative and statistically significant impact on subsequent growth.
M. J. D. Ostry, M. A. Berg, and M. C. G. Tsangarides (2014)	90 countries	1960 - 2010	Lower net (after taxes and transfers) income inequality robustly correlates with a faster and more durable growth, for a given level of redistribution.
F Delbianco, C. Dabús and M. Á Caraballo (2014)	20 countries of the Latin America and Caribbean Islands	1980 - 2010	In poor countries the inequality of incomes leads to political instability and blocks economic growth. In rich countries this trend is vice versa.

Source: *Compiled by the author.*

According to Table 1, there is no consensus in scientific literature on the issue of the influence caused by income inequality on economic growth. It refers both to the aggregated effects for the whole samples and for effects estimated separately for developing and developed countries.

2.2 Relation between human development and economic growth

The positive influence of the Human Development Index (HDI) on economic growth is proved by results of many studies. Y. Mine and S. Cinar looked at the influence of human capital on economic growth for 17 developed and developing countries in the period from 1985 to 2011 using an endogenous growth model. The results of the study confirmed the hypothesis that, in the long run, the development of human capital has a positive effect on economic growth both in developed and in developing countries (Mine and Cinar, 2015).

In addition Gennaioli *et al.* (2013) conducted a study using data from 1,569 subregions of 110 countries, which accounts for 97% of the world GDP. They used a large number of control variables, related to the education, population and employment structures and their characteristics. The main finding of the paper is that the level of education is a critical factor in the regional development, accounting for a significant part of the variation of GRP per capita.

Moreover, Stefan (2016) evaluated the influence of human capital, including the indicators of education, health, and social security of the population, on the economic growth in 29 European countries. According to his results individual effects of the countries explained 64.5% of the variation. An increase in social expenditures by 1% leads to a GDP growth per capita of 0.3%, while a 1% growth in expenditure in the educational sphere leads to a GDP growth per capita of 2%.

The level of development of human capital is a significant factor, which explains economic growth in a country. In this case, both various indices of human development in a given territory and individual indicators, which compose these indices, are used as variables.

3. Methodology, data and hypotheses of the study

We collected data from two main sources: Federal State Statistics Service of Russian Federation and reports of the Analytical Center for the Government of the Russian Federation. The value of GRP per person employed in a region was calculated by dividing the amount of GRP by the number of labor force in a region. In addition, the authors used the consumer price index in order to reduce its volumes to the real values of 2000. The human development index is estimated from 0 to 1. The higher the value of the index is, the higher the level of human development is in the region. The Gini index estimated from 0 to 1, where 0 is the state where all the incomes are distributed equally, and 1 is the one where all the incomes are owned by one group of population.

We use “GRP per person employed” as an dependent variable, based on the presented literature review and the limitations of the information base of the study. We consider that “GRP per person employed” reflects the economic growth in the regions of Russia. We test the following four main hypotheses:

1. According to the H1 there is positive relationship between the level of human development and volumes of GRP per person employed. This implies a basic assumption that regions with higher values of GRP per person employed, on average, have a higher value of the human development index.
2. We formulate H2 in the following way**:** there is a positive relation between the level of income inequality and volumes of GRP per person employed. This hypothesis reflects that in regions with a higher GRP per person income inequality is bigger. It means that the logic of regional development in case of Russia is closer to the classic approach, which was discussed above.
3. H3 and H4 were constructed in order to assess the causal relation between the initial differences in initial conditions of Russian regions and the average growth of GDP per person employed for the next 15 years. According to hypothesis H3 regions with higher initial value of the human development index will grow more slowly, comparing to the regions with a lower value of the human development index. This hypothesis reflects the absolute beta-convergence idea in a sense that regions with a lover value of the human development index will grow faster in order to achieve common equilibrium in terms of GDP per person employed. Hypothesis H4 follows the same logic and states that regions with a higher level of income inequality in the

year 2000 will result in a lower average growth rate of GDP per person employed for the next 15 years.

4. Research method and model

We conduct this study using two groups of models. The first group of models allows us to test H1 and H2. With the first group of models (1– 7) we use a linear regression with panel-corrected standard errors, proposed by Beck and Katz (1995). We use this approach in order to estimate whether there is a relationship between the volumes of GRP and independent variables. The chosen type of regression is an alternative to the feasible generalized least squares (FGLS) based algorithm, proposed by Parks and Kmenta in 1986. The problem with the latter arose when the panel's time dimension T was smaller than its cross-sectional dimension N, which is usually the case for microeconometric panels. In addition, the Parks-Kmenta method tends to produce unacceptably small standard error estimates (Beck and Katz, 1995; Hoechle, 2007). This approach suggests that the disturbances across the panels are assumed to be heteroskedastic (each panel has its own variance) and contemporaneously correlated across the panels (each pair of panels has its own covariance). The following is the abbreviated form of models 1 - 4:

$$\mathrm{lnGRPper\_empl}_{it} = \beta_0 + \beta_1 \mathrm{HDI}_{it} + \beta_2 \mathrm{Gini}_{it} + \Upsilon_i \mathrm{Reg}_i + \phi_t \mathrm{Year}_t + \varepsilon_{it} + U_c + U_t \quad (1)$$

where the variable $\mathrm{lnGRPper\_empl}_{it}$ – is the natural logarithm of real GDP per person employed (in rubles, at constant 2000 prices), generated in region i by one employee at moment t; HDI_{it} – is the value of the human development index (measured from 0 to 1) in region i at moment t; Gini_{it} – is the value of the Gini index (measured from 0 to 1) in region i at moment t; Reg_i – are binary variables, taking the value of 1 if the observation refers to a particular region i, and 0 if it does not; Year_t – are binary variables, taking the value of 1 if the observation refers to a particular year t, and 0 if it does not.

We use the functional form of the natural logarithm for some of the variables in order to smooth out heteroscedasticity resulting from socio-economic inequality of the regions. In addition, it allows approximating the equation to the Cobb–Douglas production function and interpretating the coefficients as elasticities.
In the case interregional effects are included in the model, the abbreviated form of models 5 - 7 is as follows:

$$\mathrm{lnGRPper\_empl}_{it} = \beta_0 + \beta_{1j} \mathrm{HDI}_{itj} + \beta_{2j} \mathrm{Gini}_{itj} + \varphi_j \mathrm{FederalDistrict}_j + \phi_t \mathrm{Year}_t + \varepsilon_{it} + u_j + u_t \quad (2)$$

where the variable $\mathrm{FederalDistrict}_j$ is a binary variable that has the value of 1 if the region refers to a particular federal district, and the value of 0 if it does not.

We use Models with fixed effects in order to receive consistent regression parameters. This necessity arises from the non-random nature of the sample and the necessity to control unobserved heterogeneity. Therefore, controlling of the Regional FE, Time FE and Federal District FE allows assessing the impact of endogenous variables not included in the model.

With the second group of the models, we use ordinary least squares in order to estimate whether the initial conditions of the regions in 2000 affected their average annual growth. This group of models allows us to test H3 and H4. For this purpose, we use absolute convergence models 8 - 10, which can be formalized in the following way:

$$\mathrm{Ln}(\mathrm{GRPper\_empl}_{iT}/\mathrm{GRPper\_empl}_{i0}))/T = \beta_0 + \beta_1 \ln(\mathrm{GRPper\_empl}_{i0}) + \beta_2 \mathrm{HDI}_{i0} + \beta_3 \mathrm{Gini}_{i0} + \varepsilon_{it} \quad (3)$$

Where the variable $\mathrm{Ln}(\mathrm{GRPper\_empl}_{iT}/\mathrm{GRPper\_empl}_{i0}))/T$ is natural logarithm of annual growth in GRP per person employed in region i; $\mathrm{GRPper\_empl}_{i0}$ is the value of GRP in 2000; HDI_{i0} –is the value of HDI in 2000; Gini_{i0} –is the value of the Gini index in 2000. This model assumes that inequality under the initial conditions has had a significant impact on the average growth of GRP within the next 14 years.

Therefore, we look for causal relationship differences in the initial conditions between the regions and the average annual growth in GRP per person employed. The second group of models is limited to the extent that they consider each panel of the regions independently and are not connected with other regions, and ignore the effects of spatial autocorrelation effects.

5. Results of the study

We obtained the initial data for 2000 – 2014 year period for 68 Russian regions out of 85 from the database of the Russian Federal Statistics Service. Each region belongs to one of eight federal districts. We perform the logarithmization of variables in order to smooth out the effect of heteroscedasticity occurring in the sample due to the inequality of the socio-economic development in the regions of the Russian Federation. In particular, the span diagram shows the distribution of values of the GRP variable per person employed in 2014 for the regions grouped together according to their corresponding federal district and in the country as a whole. The red solid line on the chart corresponds to the median value of the variable, equal to 101,667 rubles, while the blue dash line corresponds to the average value, equal to 103,260 rubles. Applying the logarithmization to the independent variable led to the decrease of data spread. In particular, the mean values of the variable and its medians become almost equal, while the skewness and kurtosis come closer to their normative values: 0 and 3 respectively (see Table 2).

During the first stage of the research, the authors tested whether there is a positive relationship between such independent variables as the human development index and the Gini index and the dependent variable of the volumes of GRP per person employed. The presented models 1 - 4 differ in their underlying assumptions about the types of fixed effects included in the model. According to the estimation results, there is a clear positive relationship between real GRP per person employed and both the Gini index and HDI. Consequently, the regions with a higher level of human development and higher income inequality, on average, have higher GRP. Ideally, it is necessary to measure the interregional differences in the HDI and Gini index in order to determine more accurately the causes of the interregional differences of the federal subjects. In this case, however, we must use 68 additional variables explaining the differences in these regions. It leads to evaluation of 151 parameters to project 1,020 values. In order to reduce the level of complexity of the model, we use the solution offered by Raffalovich & Chung (2014), and analyze the differences between the Federal Districts, into which the Government of the Russian Federation has joined the regions.

We construct Models 5 – 7 with less stringent assumptions about the impact of Regional FE. In particular, in these models we assume that primarily higher order effects, namely the Federal Districts FE, explain the regional differences. In other words, we test whether the value of real GRP per person employed in the regions belonging to one federal district differs significantly from those of the regions belonging to other districts. Model 5 shows that in some cases, there is, in fact, a difference between regions belonging to different federal districts. Likewise, the influence of the control variables increased significantly at the expense of weakening the assumption about the presence of Regional FE.

Figure 1. *Box plots of GRP distribution in 2014 over Federal Districts of the Russian Federation*

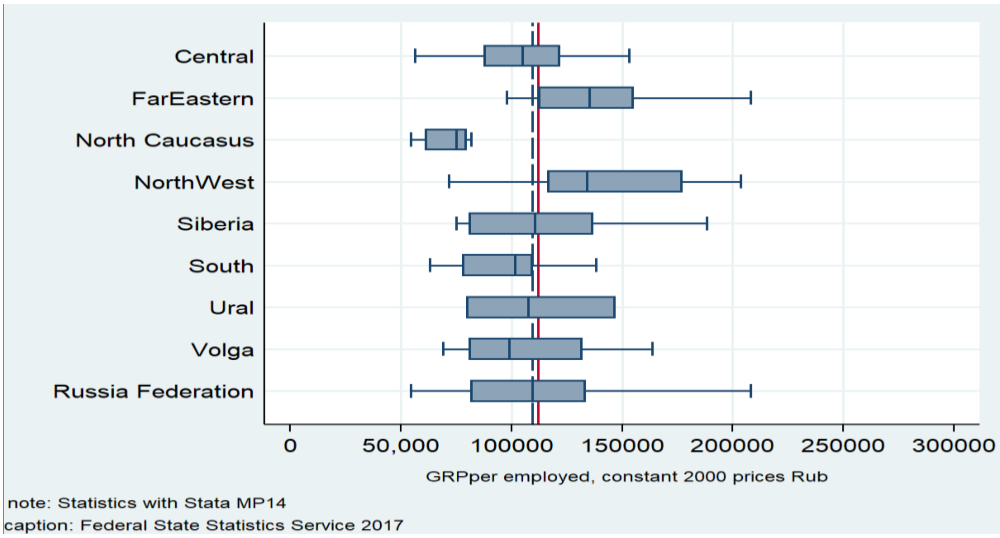

Table 2. *Descriptive statistics*

	Natural logarithm of GRP per person employed (in rubles, at constant 2000 prices)				GRP per person employed (in rubles, at constant 2000 prices)			
Year	mean	p50	skewness	kurtosis	mean	p50	skewness	kurtosis
2000	10.82	10.77	0.04	2.59	53125.65	47664.29	0.81	3.09
2001	10.88	10.86	-0.13	2.46	55428.88	52104.58	0.50	2.59
2002	10.91	10.92	-0.25	2.48	57068.59	55005.76	0.34	2.37
2003	10.98	10.99	-0.22	2.41	61133.89	59528.82	0.38	2.47
2004	11.08	11.08	0.12	2.30	68794.10	65189.08	0.81	3.24
2005	11.14	11.14	-0.08	2.05	73143.10	68586.43	0.47	2.36
2006	11.27	11.27	-0.08	1.98	82816.16	78402.63	0.38	2.03
2007	11.36	11.32	-0.07	2.01	89962.17	82049.66	0.39	2.07
2008	11.41	11.41	-0.12	2.09	94216.17	90536.63	0.35	2.09
2009	11.32	11.32	0.05	2.28	85240.09	82409.11	0.59	2.80
2010	11.38	11.39	0.00	2.11	90888.39	88320.10	0.47	2.40
2011	11.50	11.53	-0.08	2.11	103260.70	101666.98	0.41	2.30
2012	11.55	11.59	-0.05	2.04	108077.28	107697.31	0.40	2.26
2013	11.56	11.58	0.00	2.08	109100.14	106695.00	0.43	2.29
2014	11.54	11.58	-0.17	2.22	106553.12	107109.77	0.30	2.22
Total	11.25	11.26	-0.22	2.54	82587.23	77303.02	0.59	2.74

Table 3. *Empirical results of the research: models 1 - 4*

Dependent variable: Natural Logarithm of real GRP per person employed (in rubles, at constant 2000 prices)				
VARIABLES	1	2	3	4
HDI	5.174***	7.378***	4.395***	6.507***
	(0.382)	(0.318)	(0.471)	(0.374)
Gini	3.698***	2.921***	4.237***	1.186***
	(0.361)	(0.275)	(0.750)	(0.326)
Constant	5.806***	4.387***	5.870***	5.279***
	(0.279)	(0.205)	(0.295)	(0.247)
Observations	1,020	1,020	1,020	1,020
R-squared	0.606	0.645	0.935	0.963
Number of CodeReg	68	68	68	68
Year FE	NO	YES	NO	YES
Region FE	NO	NO	YES	YES
r2	0.606	0.645	0.935	0.963
rss	63.70	57.33	10.47	6.028
chi2	456.8	1190	12216	8897

Note: *Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.*

Table 4. *Empirical results of the research: models 4 - 7*

Dependent variable: Natural Logarithm of Real Gross Regional Product per person employed at constant 2000 prices (Rub.)				
Independent variables	4	5	6	7
Gini Index	1.186***	2.632***	2.294***	1.260***
	(0.326)	(0.190)	(0.180)	(0.345)
HDI	6.507***	8.966***	9.631***	9.369***
	(0.374)	(0.204)	(0.179)	(0.212)
Central Federal District		Reference	Reference	Reference
North – West Federal District		0.315***	0.801***	0.501***
		(0.0142)	(0.190)	(0.186)
× c.HDI			-0.618**	
			(0.243)	
× c.Gini				-0.510
				(0.518)
South Federal District		-0.150***	-1.766***	-1.171***
		(0.0159)	(0.257)	(0.204)
× c.HDI			2.060***	
			(0.328)	
× c.Gini				2.751***
				(0.545)
North Caucasus Federal District		-0.302***	-2.166***	-1.584***
		(0.0261)	(0.368)	(0.313)
× c.HDI			2.407***	
			(0.473)	
× c.Gini				3.517***
				(0.855)
Volga Federal District		-0.0640***	-0.655***	-0.913***
		(0.00598)	(0.209)	(0.187)
× c.HDI			0.738***	
			(0.264)	
× c.Gini				2.284***
				(0.505)
Ural Federal District		-0.00216	-0.125	0.126
		(0.0141)	(0.289)	(0.246)
× c.HDI			0.162	
			(0.365)	
× c.Gini				-0.233
				(0.638)
Siberia Federal District		0.130***	1.410***	0.207
		(0.00965)	(0.213)	(0.192)
× c.HDI			-1.640***	

			(0.276)	
× c.Gini				-0.128
				(0.523)
Far East Federal District		0.410***	0.150	0.0879
		(0.00955)	(0.179)	(0.212)
× c.HDI			0.354	
			(0.229)	
× c.Gini				0.906
				(0.571)
Constant	5.279***	3.276***	2.902***	3.462***
	(0.247)	(0.152)	(0.127)	(0.163)
Observations	1,020	1,020	1,020	1,020
R-squared	0.963	0.857	0.871	0.865
Number of CodeReg	68	68	68	68
Year FE	YES	YES	YES	YES
Region FE	YES	NO	NO	NO
Federal Distric FE	NO	YES	YES	YES
r2	0.963	0.857	0.871	0.865
rss	6.028	23.10	20.78	21.87
chi2	8897	5019	10484	9020

Note: *Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Model 6 demonstrates that the variable HDI shows a positive relationship with the dependent variable as a whole. Moreover, the level of GRP per person employed in the regions of North – West and Siberia Federal Districts is associated, on average, with a higher volume of the estimate of the HDI coefficient comparing to the regions, belonging to the Central Federal District. The regions of South, North Caucasus and Volga Federal Districts show opposite results.

Model 7 demonstrates as well that the variable Gini Index is positively related to the dependent variable as a whole. Furthermore, we observe that in the regions of the South, North Caucasus and Volga Federal Districts the levels of GRP per person employed are associated with a higher volume of the estimate of the Gini index coefficient comparing to the regions, belonging to the Central Federal District.

Table 5. *Empirical results of the research: models 8 - 10*

Dependent variable: Natural Logarithm of the average growth rate of Real Gross Regional Product per person employed			
Independent variables	8	9	10
Natural logarithm of GRP per person employed at 2000	-0.0243*** (0.001)		
HDI at 2000		-0.181*** (0.017)	

Gini index at 2000			-0.0563*** (0.016)
Constant	0.311*** (0.0105)	0.181*** (0.0128)	0.0671*** (0.00534)
Observations	1,020	1,020	1,020
R-squared	0.381	0.096	0.012
r2_a	0.381	0.0948	0.0115
rss	0.121	0.177	0.193

Note: *Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

In the second part of the research, we analyze whether there is any relationship between the initial characteristics of the regions and the average growth rate of GRP per person employed. According to the results, presented in Table 5, we can state that from the perspective of the absolute convergence models there are negative relationships between the average growth rate of GRP per person employed and the initial levels of GRP per person employed, the HDI and the Gini index. These results may be interpreted in the following way: on average, the regions with a higher growth rate of Real Gross Regional Product per person employed had lower initial rates of t GRP per person employed, HDI and the Gini index in the year 2000.

6. Discussion

We have included in the model the factors of economic growth, which contribute to the evolutionary development of the economy and its qualitative transition from one status to another, and tested their significance. The Regional FE and the general logic of the historical development of the regions have a significant effect on changes in real labor productivity.

We confirm the presence of a relation between HDI and real GRP per person employed. It general, regions with higher levels of human development have higher GRP per person employed (H1 confirmed). This result stays robust after Regional FE, Time FE and Federal – District FE have been included. However, it seems that in some sense high levels of human development in a region can be a factor which implies a low growth rate of GRP per person employed (H3 confirmed). This effect may be attributed to the fact that the level of human development has certain limitations in terms of its influence on GRP per person employed. It means that regions with a lower level of human development will grow faster in order to narrow the gap with the regions with higher levels of human development. While the last ones grow more slowly due to a lower marginal effect of each further increase in the human development level. Therefore, managing the human capital development system in a region in the long run can lead to an increase in real GRP per person employed.

The presented results also confirm the existence of relationship between income inequality and real GRP per person employed. There is a positive relationship between income inequality and real GRP per person employed. Therefore, in case of the Russian Federation regions higher levels of income inequality are associated with higher volumes of real GRP per person employed (H2 confirmed). This result stays robust after Regional FE, Federal district FE and Time FE have been included. In addition, we find a negative relationship between the initial level of income inequality and the average growth rate of real GRP per person employed in the region. Therefore, on average, Russian regions with lower initial level of income inequality were growing faster (H4 confirmed). Thereby, regions with lower levels of income inequality take this opportunity to strengthen their economic position relatively to the other Russian regions. This outcome implies additional evidence to the classic approach to understanding the influence of income on economic growth.

7. Conclusion

Economic growth in the conditions of the market economy is a gradual and evolutionary process. A quick transition from one condition to another is not possible, as it requires a lot of resources or causes an increased burden on the redistribution mechanisms of the state. Consequently, real economic growth in the regions of the Russian Federation, depicted as real GRP per person employed, can be achieved only through management of factors in the long and medium term. In the process of the evolutionary development of the Russian economy, the cumulative effect of the influence of factors will lead to the increase in real GRP per person employed. In future studies, we will include additional explanatory variables in the model in order to improve the quality of the model. Examples of such variables for the first group of models include the level of cluster interaction in the regions, their specializations, the amount of developed and used advanced production technology, other social, economic, and geographical characteristics. For the second group of models, which was built on absolute convergence idea, the robustness of the results should be tested in case of relative convergence models with using 2sls. It will allow us to make stronger conclusions about the presence of the discussed effects.

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