Regional Divergence in Lithuania before joining EU as consequence of Cumulative Causation Process

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Abstract

The article analyses the processes of divergent regional development in Lithuanian and estimates the basic parameters and causes of the this process during 1995 - 2003. The process of differentiation is carried out by estimation of region's gross domestic product, foreign direct investment and investment in tangible fixed assets in a separate region. Mydral–Kaldor cumulative causation process was used to analyse the reasons for uneven development. The situation shows that return from investment in education is bigger in economically stronger regions. Employees' low qualification and lack of human capital in a weaker region determine inefficient production and economic loss. Therefore in order to overcome the effect of cumulative causation process government intervention is necessary. It should finance and promote investment in labour force education.

Keywords*:* Regional Convergence, Regional Divergence, Interregional Disparities, Cumulative Causation Process.

1 Introduction

During the process of reform, the socio-economic situation of separate regions in Lithuania has been influenced by a set of new factors. These include: the rate and scale of economic transformations; the development of market sectors; foreign economic co-operation; mutual relationship of each separate region with the Central Government and ability to accumulate human capital. All these factors have promoted the growth of regional differentiation.

The issue of uneven development of the Lithuanian regions has been actively discussed more then ten years when it became possible to refer to the county level statistics. A new push for discussions emerged at the end of 1999 after Lithuania had been invited to negotiate its membership in the EU, therefore the necessity to form the policy of regional development as one of the requirements arose. During the last decade the subject of development of Lithuanian regions has been actively discussed, however a more detailed analysis about tendencies of uneven economic growth in Lithuanian regions, covering a longer-term period, is lacking. Therefore the aim of the research – applying the theory of the process of cumulative causation to identify the factors that determine divergent development of territories and to provide economic arguments for the proposed strategy aimed at the reduction of divergence tendencies. Data for this research was used from 1995 to 2003 because only in 1995 statistical information about Lithuania’s regions social – economical development were accumulated and regional politics changed when Lithuania entered the EU

in 2004. Practical evaluation of uneven economic growth and identification of its determinant factors are necessary in the formation of regional national development policy and while planning appropriate means that would help to reduce uneven economic and social development.

2 Research of uneven regional development in Lithuania

2.1. Theoretical Framework on Regional Underdevelopment and its Estimation

Regional development questions have attracted the attention of a diverse group of scholars during the past fifty years. Topics that were initially of interest only to economists and geographers are now being investigated by sociologists, political scientists, and researchers from other social science disciplines. This growing interest in regional development studies is due in part to the recognition that the processes driving innovation and national economic growth are fundamentally spatial in nature.

Beyond the theories of regional economic convergence, there are a number of other approaches attempting to explain the reasons why regional growth disparities exist and persist. Theories of regional underdevelopment and polarised growth see underdevelopment as self-perpetuating, in contrast with convergence theories which claim that the less favoured regions can bypass the problems accruing due to their underdevelopment and enter a path of stable economic growth. Last-mentioned theories (for example neoclassical approach) indirectly state that free market conditions tend to eliminate the regional economic disparities through the price mechanism, while regional growth is mainly the outcome of technical progress and of the efficient allocation of recourses.

Regional economies are not uniform. Local-specific factors like the sectoral composition, the history of development, the geography, the degree of their integration to the national and international economy, etc. affect the growth prospects of each region. In general, three types of regions can be identified: prosperous or growing regions, stagnating or declining regions, and underdeveloped or developing regions.

Most of the theories of regional growth focus on one or two specific factors in their task to describe the growth process, lacking a holistic analysis. In this sense, it would be more appropriate to refer to them as “models” rather than as “theories”.

Most early theories of regional economic growth were spatial extensions of neoclassical economic theories of international trade and national economic growth. Together, these early neoclassical theories predict that over time, differences in the price of labour and other factors across regions will diminish and tend toward convergence. This prediction has generated considerable controversy among theorists, particularly in light of the apparent tendency toward international divergence between the per capita incomes of industrialized and less developed nations. Early theories of regional economic development emerged out of this controversy and can be distinguished from one another in terms of differences in the theoretical predictions regarding interregional convergence or divergence in per capita incomes and factor prices over time.

The concept of convergence, even in its weaker formulation as long-run constant per capita income growth rates, or conditional convergence, has come under attack from many sides. One criticism is largely empirical. The field of development economics emerged in the post–WorldWar II period in recognition of the growing economic disparities between industrialized nations and less developed countries. Although empirical studies [1; 2] supported a trend toward economic convergence at the regional scale, at least in the United States, critics pointed to the persistent poverty in most less developed countries evidence that some regions of the world were not conforming to the predictions of the neoclassical growth models.

Another criticism focuses on the unrealistic assumptions underlying neoclassical growth theories, particularly those having to do with the assumption of constant returns to scale, zero transportation costs and etc.

One response to the convergence critique has been to directly incorporate a prediction of divergence into extant theories of regional economic growth. Here cumulative causation theory is examined. The theory of polarised growth is proposed to explain the existence of regional economic disparities and to describe the process of regional growth. Unlike other (Marxist, socio-economic and the vicious-cycle approaches) this theory was not initially proposed to explain national economic growth. This is probably one of the reasons why it is the most popular among the different approaches that have been employed by policy-makers in order to assist regional development.

Mydral [3] argues that increasing returns to scale produces clustering of economic activity within those regions that are first to industrialize. Moreover, the process of growth tends to feed on itself through a process of cumulative causation. Although underdeveloped regions offer the advantage of low-wage labour, these benefits tend to be offset by the agglomeration economies found in the industrialized regions. Kaldor [4] elaborates on and expands Mydral's theory [3] of cumulative causation by introducing ideas from export base theory and the concept of an efficiency wage. Like Mydral's model [3], Kaldor [4] assumes that increasing returns to scale give early industrializing regions the advantage in international trade. Cumulative causation sets in when an exogenous shock increases the worldwide demand for an industrial good. Actual monetary wages may be the same in all regions, but efficiency wages, defined as monetary wages divided by a measure of labor productivity, tend to be lower in industrialized regions due to scale economies. Since regions with lower efficiency wages can produce more output, which in turn leads to further reductions in the efficiency wage (and so on), growth may build on itself without bound.

To conclude, the convergence-divergence debate is no longer simply an academic when viewed in light of policy issues related to efficiency and equity. If one accepts the convergence hypothesis, then one can assume that lagging regions will tend to grow faster and approach standards of living in developed regions over time, and inequities will be resolved in the long run simply by improving the functioning of the market. If, on the other hand, there are substantial market imperfections (researchers advocate this approach) in regional trade and knowledge diffusion, as suggested by Stiglitz [5], then market inefficiencies will result in interregional inequities. The appropriate strategy for improving interregional efficiency and/or equity depends on the nature of the original source of divergence; it's speed and the benefits and costs of diverting the path of growth in the other direction.

Authors give qualified approval to conclusions of these theories and maintain that without conceptual regional politics in conditions of market economy territorial differentiation of Lithuania's regions are the bigger, the faster is economic growth.

The earliest interests in the assessment of the process of convergence are found in the works of Easterlin [6], Borts and Stein [7]. They focus on the so-called *σ-convergence* that enables to size up whether dispersion of per capita gross regional product (further – GRP_c) is decreasing in the course of time. In more recent works by Barro and Sala–i–Martin [8, 9], Mankiw et al. [10], also Vohra [11], *β-convergence* is analysed by measuring whether regions with smaller initial per capita GRP were growing faster than regions with larger initial per capita GRP.

To measure an uneven economic growth of regions, classical evaluation methods of income distribution (Lorenz curve, Gini coefficient and etc.) can also be applied. So that the obtained results were trustworthy, the selected concentration statistics fulfil conditions that are

characterised and formulated into five axioms in Atkinson's [12, 13], Cowell's [14], Sen's [15] works.

Selection of indicators enabling to evaluate disparities of interregional development depends upon the goals of public policy. In the majority of cases, this goal is economic growth. In such a way, typical indicators could be the growth of output, the change in one employee's level of produced output, wage, full employment, investments, etc.

2. 2. General statistical information about Lithuanian counties and their weight in the economy of the country

According to the Law on the "Territorial Administrative Units of the Republic of Lithuania and their Boundaries" Lithuania is divided into 10 counties all named after their capitals. This division corresponds with the EU NUTS level 3 of the regional criteria. Previously Lithuania was divided into 44 provinces. The counties are divided into 60 municipalities: 9 city municipalities, 43 district municipalities and 8 municipalities. Each municipality is then divided into neighbourhoods. Such division was created in 1994 and slightly modified in 2000.

Counties do not have great powers vested in them, and so it is suggested that 10 counties are too much for Lithuania as the two smallest counties contain only 4 municipalities. It is proposed to replace the counties with 4 or 5 lands, a new administrative unit that would be decided according to the ethnographic regions of Lithuania and based on the 5 major cities. The general statistical information about Lithuania counties are given in Table 1.

Table 1: General statistical data on Lithuanian counties in 2003

County	Area in km²	Population	Population per km²	GDP (million LTL)	Counties contribu-tion to countries GDP (%)	Per capita GDP (thous. LTL)	FDI (mln. LTL)	Per capita FDI (thous. LTL)	FTI (mln. LTL)	Per capita FTI (thous. LTL)
Alytus	5425	185574	34.3	2210.1	3.9	11.9	189.6	1026	348.9	1880
Kaunas	8089	693794	86.1	10963.3	19.3	15.8	1849.4	2675	1485.8	2142
Klaipėda	5209	383597	73.7	6716.2	11.8	17.5	1547.4	4038	932.4	2431
Marijampolė	4463	187172	42	2109.5	3.7	11.3	78.1	419	262.6	1403
Panevėžys	7881	296341	37.8	4047	7.1	13.7	678.5	2299	570.7	1926
Šiauliai	8540	365621	43	4517.3	8.0	12.4	187.2	514	443	1212
Tauragė	4411	133101	30.3	1182.4	2.1	8.9	22.6	170	137.9	1036
Telšiai	4350	178639	41.2	2482.4	4.4	13.9	767.9	4311	465.1	2604
Utena	7201	182122	25.4	2546.2	4.5	14.0	251.7	1390	286.1	1571
Vilnius	9731	848244	87.2	19997.4	35.2	23.6	8127	9581	3354.4	3955
Country	65300	3454205	53	56804	100	16.4	13699.4	3976	8677.7	2512

GDP – gross domestic product; FTI – investment in tangible fixed assets; FDI – foreign direct investment; LTL – Lithuania currency Litas.
Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

Lorenz curve and Gini coefficient as concentration standards enable to evaluate the comparative weight of regions as territorial-administrative entities in the Lithuanian economy as well as their economic power in the economy regardless of the population size in each of them.

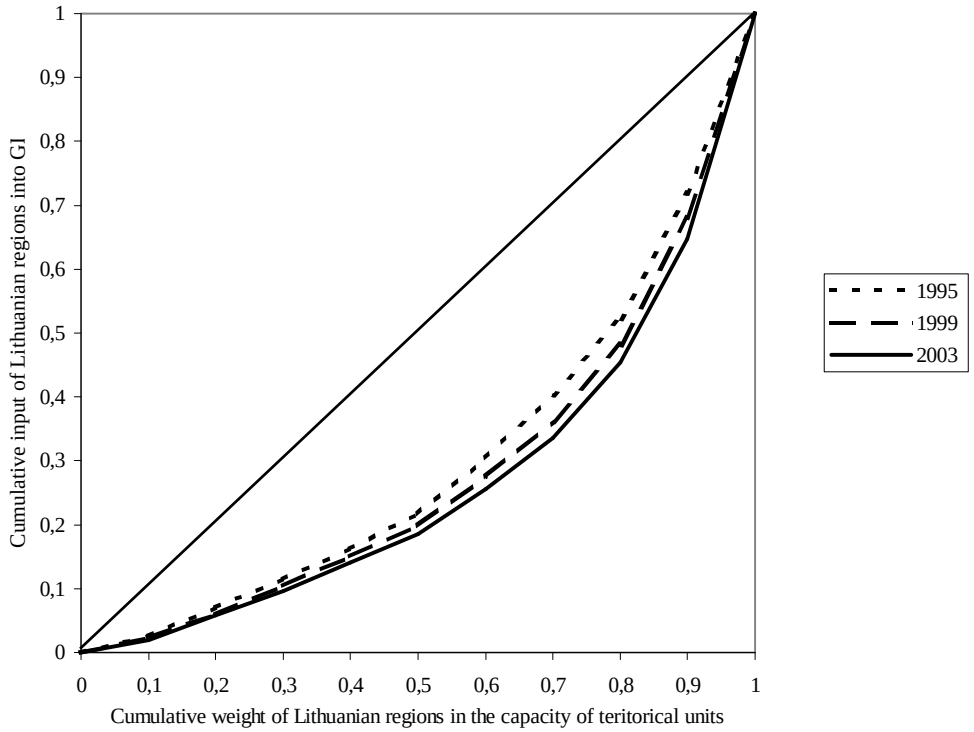

Figure 1. Lorenz curve of GDP distribution in the Lithuanian Regions in 1995-2003
Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

According to Figure 1 that reflects GDP distribution among the Lithuanian regions, it is possible to claim that the input of administrative – territorial entities into the country's economy is very uneven. The total annual value added of five counties (Alytus, Marijampolė, Tauragė, Telšiai and Utena) where GDP comparative parts are the smallest, amounts to only 20 percent of the whole country production output, while a comparative part of a single Vilnius county during the period ranges from 28 to 35 per cent.

The two most economically productive regions of Vilnius and Kaunas, in their own turn create about 50 per cent of the total value added. The uneven distribution of GDP among regions is inclined to change. In Figure 1, during the period of 1995–2003 Lorenz curves are receding from the absolute straight line reflecting an increasing uneven regional input into the country's economy.

The estimated Gini coefficients enable us to evaluate the rate of the regional divergence process more precisely (see Figure 2).

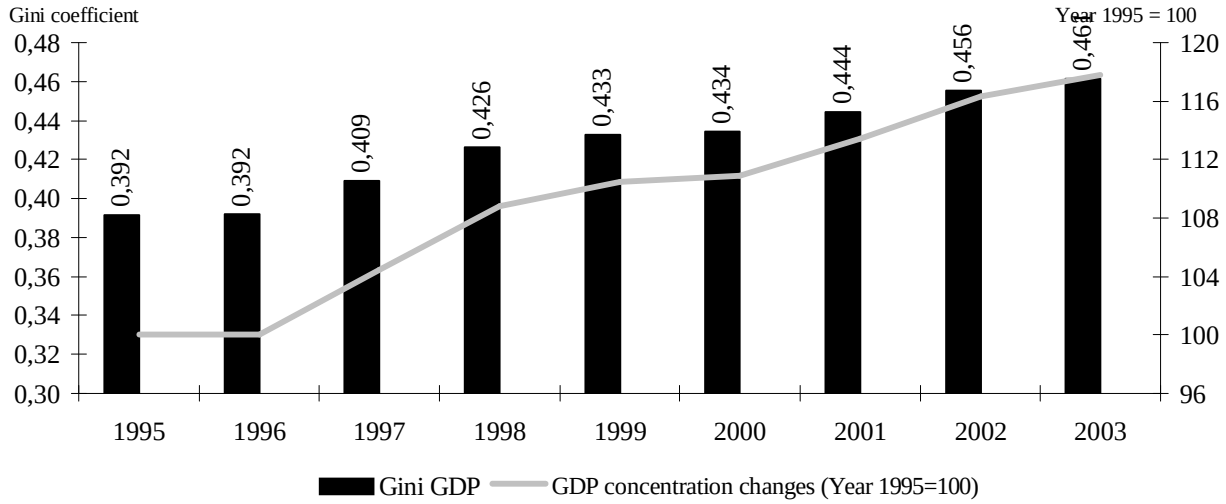

Figure 2. Distribution of GDP between Lithuanian counties based on Gini coefficient and its variations over the period of 1995-2003

Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

In Figure 2, Gini coefficients indicate a significant and continuous divergence process of the Lithuanian regions. During the period of 1995–2003 Gini coefficient increased from 0.39 to 0.46, i.e. by about 18 per cent (the average annual growth rates were around 2 per cent). The divergence process itself was not steady: the peak was during the periods of 1996–1998 and 2000–2003. The periods coincide with the country's rapid economic growth. The estimated correlation coefficient between the GDP and its concentration (according to Gini coefficient) in the regions equals to 0.97. Such a high correlation permits to assume with the probability of 99.5 per cent that there is a strong link between the total economic growth and the divergence process in the regions and that the former directly determines the latter, i.e. the economic development in Lithuania is extremely uneven from the territorial point of view.

A good indicator of the economic development of the regions would be the territorial distribution foreign direct investment and investment in tangible fixed assets. In developing countries, where labour productivity is low and industrial technologies and facilities are obsolete, only investments can stimulate the economic growth and work efficiency by implementing new modes and means of production. The attraction of investments is a relevant indicator of regional economic growth depending on the production growth, business infrastructure, political decisions related to taxation, privatisation, reduced bureaucracy. Every country should regulate investments so that they were directed towards the most underinvested territories. Regional distribution of investments is one of the most relevant issues of a territorially well-balanced development.

The uneven presence of factors necessary for foreign investments in the territories influenced the uneven regional distribution of investments (see Table 2).

Table 2: Distribution of FDI and FTI in the Lithuanian Regions in 1993-2003

Indicators \ Period		1995	1996	1997	1998	1999	2000	2001	2002	2003
In counties	Gini FDI	0,626	0,621	0,678	0,699	0,710	0,729	0,740	0,714	0,688
	Gini FTI	0,374	0,486	0,491	0,495	0,512	0,552	0,589	0,519	0,500
	Gini FDI per capita	0,343	0,341	0,425	0,464	0,457	0,481	0,494	0,472	0,432
	Gini FTI per capita	0,097	0,186	0,208	0,202	0,214	0,251	0,302	0,217	0,203
In municipalities	Gini FDI	…	…	…	…	…	0,920	0,924	0,921	0,914
	Gini FTI	…	…	…	…	…	0,779	0,796	0,735	0,720
	Gini FDI per capita	…	…	…	…	…	0,639	0,653	0,644	0,618
	Gini FTI per capita	…	…	…	…	…	0,395	0,447	0,351	0,323

Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.
1) The distribution of FDI and FTI at the level of municipalities has been analysed since 2000 because a changing number of municipalities and size of territories did not allow measuring the distribution of investments.

In 1995, when FDI data became available by regions, Gini coefficient that estimated its concentration was 0.63 (estimating FDI per capita it was 0.34). The concentration of FDI reached its peak in 2001, when coefficients were correspondingly 0.74 and 0.5, i.e. they increased by 18 and 44 percent over the five-year period (average annual growth rate was 2.7 and 6.6 percent respectively). Since 2002, the uneven regional FDI distribution began decreasing, but the reason might have lied in the change of FDI calculation method (Since 2002 FDI and FTI data have been registered by investment address, previously – by enterprise registration address).

Analysing FDI in smaller territorial administrative units, i.e. in municipalities, a far higher degree of concentration is visible – here the estimated Gini coefficient has exceeded 0.9, and in the case of FDI per capita – 0.6 since the year 2000.

Analysing FDI by the type of activity it becomes obvious that the majority of investments in 1995–2003 went to the sectors of industry and services. According to the statistical yearbook of the Lithuanian counties, industrial investments concentrate in the field of manufacturing, where about 40 per cent goes to the food industry and 10 per cent to the textile. In the sector of public services investments concentrate in trade (comparative part is decreasing) and intermediation services (comparative part is increasing). In the sector of trade most of investments go to wholesale and in the sector of intermediation – to financial intermediation. The sectors of the wholesale, financial intermediation and food industry attract around 40 per cent of all FDI.

The fact that most of the enterprises are concentrated in the five major cities of Lithuania increases the attraction for investments in the cities. The material facilities and infrastructure created there are equally important in attracting the investments. Even though some of the light and food industry enterprises emerged in other Lithuanian cities and towns, and this is a premise enabling to distribute the foreign investments more evenly, high concentration nonetheless persists. This tendency is very likely to remain in the future, particularly when the comparable part of investments is increasing in the sector of services, the territorial concentration of which is higher than of the industry. Hence, it is possible to state that foreign direct investments depend upon the concentration of industry and service sectors in the counties. The bigger industry centre, the greater chances to attract the investments. The sector of agriculture that is large enough in Šiauliai, Tauragė and Marijampolė counties according to the generated value added, receives almost no foreign direct investments. The situation is

complicated by high production costs that result from low work efficiency; without possibility to make a profit foreign capital bypasses this branch of economy.

Analysing the distribution of FTI (see Table 2), it is possible to state that the degree of concentration of FTI here is lower than that of FDI both on the level of counties and municipalities. Up to the year 2002 the concentration was increasing, but recently it has dropped which could be, as mentioned above, the result of the change in the method of calculation. 70 per cent of the investments are concentrated in Vilnius, Kaunas and Klaipėda counties. The data on the sources of FTI and the directions of investments are presented only on the county level; therefore it is impossible to perform a more detailed analysis.

According to the Statistical Yearbook of the Lithuanian Counties, in 1995 – 2003 Telšiai County invested the biggest part of its GRP (18 per cent); then economically strongest regions of Klaipėda, Vilnius and Kaunas follow with corresponding 17.8, 16.5 and 12.3 per cent. The least was allocated by the weakest regions: Šiauliai and Marijampolė – 9 per cent each, and Tauragė - 7 per cent; consequently, most of the generated GRP went to consumption and the accumulation of investments was not sufficient. For the investments to enable the renovation of economy (where new production facilities exceed the depreciation of the old) they have to reach at least 25 - 30 per cent of the GRP. In developing regions this percentage must be even higher.

Calculated correlation between Gini GDP and Gini FDI per capita (0.79) in 1995–2003 gives a clear view that distribution of FDI and GDP interact with each other. Similar dependence during this period is visible between GDP and FTI distribution (correlation coefficient equals 0.62). Regions like Klaipėda and Vilnius in 1998–2001 accumulated 15-20 per cent of total value added for investment and stimulated 25.5 per cent and 52.8 per cent economic growth respectively. Regions, which invested less than 10 per cent from all income, weakly promoted their economic activity.

2.3. The Analysis of the Convergence-Divergence Process of the Lithuanian Regional Economy Based on Per Capita GRP

After the restoration of independence, there were expectations that the development of the market would level up all greater regional disparities. However, it soon became obvious that the metropolitan areas had more benefit from the market economy – owing to short distances, large sales market potential and the accessibility of capital markets. Insufficient mobility of the capital and labour force in the country predetermined the steady structural unevenness to become the reason of regional disparity. It became obvious that in rural areas per capita income is lower, the level of unemployment is higher, the dependence on agriculture is stronger, there are more obsolete technologies and more of slowly developing branches of industry.

The course and rate of uneven development of the Lithuanian regions were evaluated by applying the classical methods of convergence-divergence process analysis. For the estimation, the indicator of regional per capita GDP was used.

The analysis starts from Barro and Sala–i–Martin's [9] suggested evaluation of β – *convergence* process. With per capita GDP data in different country regions, we can nominate $\gamma_{i,t,t+T} \equiv \frac{\log\left(\frac{y_{i,t+T}}{y_{i,t}}\right)}{T}$ as an annual growth rate of per capita GDP in region *i* during the period from *t* to *t+T*, and $\log(y_{i,t})$ - as logarithm of per capita GDP in a region *i* during period *t*. Having created a linear model of regression $\gamma_{i,t,t+T} = \alpha + \beta \cdot \log(y_{i,t}) + \varepsilon_{i,t}$ and having received $\beta<0$, we may assert that the data in our disposition disclose an absolute β-convergence. The

data for the regression may be used in two different ways depending on whether we consider *T* equal to the whole period of analysis or only to one year.
In the first stage, analysing per capita GRP and annual growth rate, we obtain the following results (see Figure 3). In the computed equation of the regression (where independent variable is region GDP_c's logarithm at a time period *T*, and the dependent variable is region GDP_c's logarithm of annual growth rate) the obtained β coefficient is negative (–0.144). However, in the Lithuanian regions the absolute β – convergence process that takes place due to the rapid growth of the least developed areas, is not evident due to three reasons.

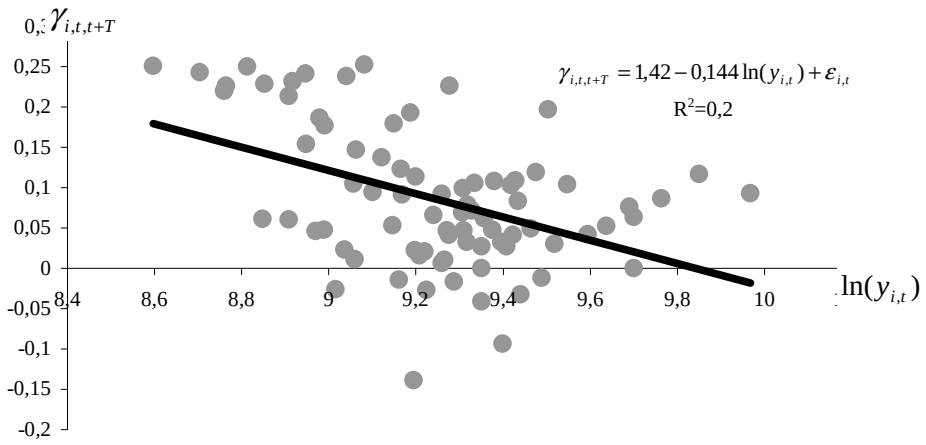

Figure 3. Estimation of the process of β –convergence in the Lithuanian regions based on annual GRP_c growth rate

Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

(1) The obtained equation of regression is not statistically significant due to the small determination coefficient (R^2=0,2), though the hypothesis of the equality of β coefficient to zero while using Student's test is rejected.
(2) Instead of the annual GRP_c growth in the region, an average GRP_c growth within the certain period may be used. In such a way, it is possible to evaluate whether in neglected regions, where the initial GRP_c (year 1995) was lower, this indicator was growing more rapidly and was catching up with the regions of high initial GRP_c level. The results of the analysis are revealed in Figure 4.

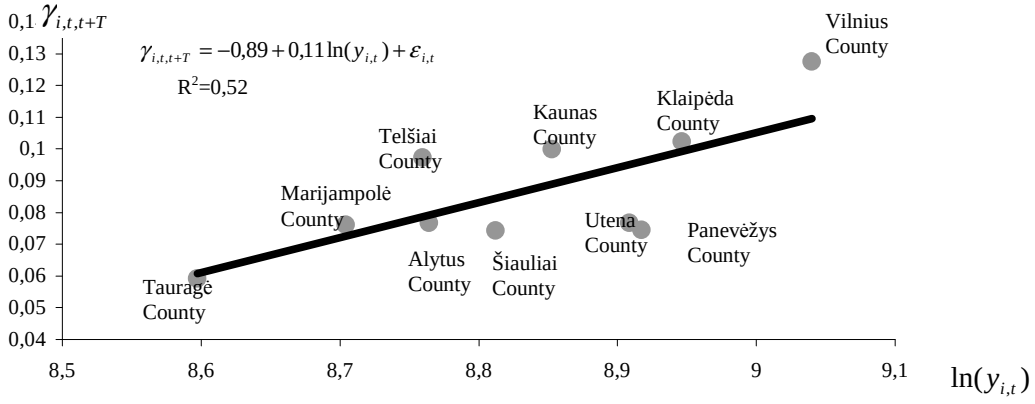

Figure 4. The estimation of β- convergence process in the Lithuanian regions based on the average growth rate of GRP_c in 1995 – 2003

Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

Figure 4 gives a clear view of regions where initial GRP_c was higher: the growth rate of this indicator was also higher (β=0.11). The coefficient of determination of this regression equation was equal to 0.52, so statistically it is more significant than the previous equation; the hypothesis of the coefficient β being equal to zero when applying the Student's test could also be dismissed. According to the calculation, it may be asserted that there exists absolute β divergence based on GRP_c in Lithuania.

(3) A higher percentage of annual GRP_c growth in less prosperous regions may have been obtained owing to the small initial indicator, from which the increment is calculated (e.g. increase from 8 to 10 will make 25 percent and from 20 till 24 - only 20 per cent). Due to this reason, in the more prosperous areas the growth of absolute GRP_c will result in a relatively smaller percentage than in the less prosperous regions with the small initial GRP_c indicator.

In the subsequent stage of this research that seeks to evaluate the uneven development of the Lithuanian regions, the analysis of *σ*-convergence hypothesis was applied.

The concept of *σ-convergence* suggested by Easterlin [6], Borts and Stein [7] may be characterised in the following way: a group of regions converge according to *σ* if cross-regional dispersion of per capita GDP declines over time: $\sigma_{t+T} < \sigma_t$, where σ_t is the standard regional $\log(y_{i,t})$ deviation within the period *t* [16]. According to Foster and Ok [17], there are practical cases, when the dispersion of general distribution is declining and σ_t is increasing, which leads to doubt if the latter statistics gives full account of σ-convergence. Instead, the adjusted weighted variant of standard deviation ought to be employed: $\sigma_t^{\omega}(\log y_{i,t}) = \sqrt{\sum_{i=1}^{n} p_{i,t}\left(\log y_{i,t} - \log \mu_{y_t}^{\omega}\right)^2}$, where $\log \mu_{y_t}^{\omega} = \sum_{i=1}^{n} p_{i,t} \log y_{i,t}$ is the weighted average of $\log y_{i,t}$, and $p_{i,t}$ are the corresponding weights. See results in Figure 5.

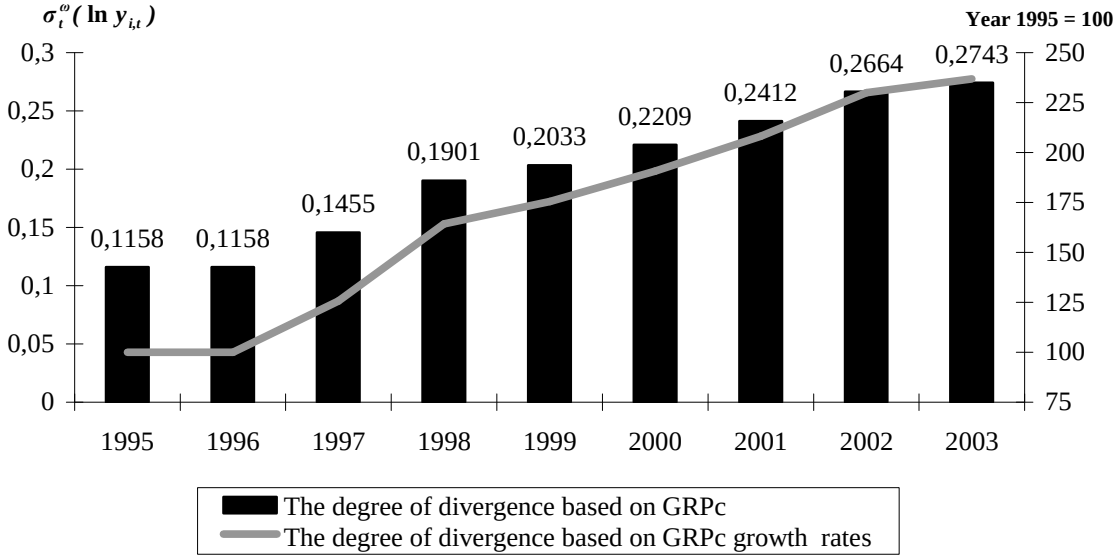

Figure 5. Estimation of the process of σ divergence in Lithuania's regions in 1995 – 2003

Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

The findings displayed in Figure 5 allow to assert that Lithuania's regions diverge according to σ. The process of divergence is continuing but its rate is declining. The fastest uneven

development occurred in 1996 - 1998 (with the average annual increment of 28 per cent), a slower development took place in 1998 - 2002 (with the average annual increment of 8.8 per cent), whereas the remaining period is marked with the lowest divergence rate (the average annual increment is 3 per cent). During the whole research period the indicator reflecting σ – convergence increased by almost 2.5 times which permits to conclude that over the incomplete decade the inequality of the Lithuanian regions according to GRP_c increased by the same degree. The rest of the indicators of uneven economic development are presented in Table 3.

Table 3: The indicators of uneven economic development of the Lithuanian regions based on GRP_c during 1995 – 2003

Indicator	1995	1996	1997	1998	1999	2000	2001	2002	2003
GE(0)	0,103	0,099	0,125	0,144	0,147	0,163	0,177	0,187	0,196
GE(1)	0,102	0,099	0,123	0,146	0,151	0,170	0,184	0,199	0,206
GE(2)	0,339	0,338	0,351	0,368	0,373	0,384	0,395	0,411	0,417
G	0,053	0,054	0,073	0,097	0,105	0,111	0,124	0,138	0,143

Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

The three generalised entropy (further – GE) indicators presented in the table above permit us to identify the uneven distribution of GDP_c in separate regional groups. The indicators that belong to the GE class have a common estimation formula: $GE(\alpha) = \frac{1}{\alpha^2 - \alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_{i,t}}{\mu_{y_t}}\right)^{\alpha} - 1\right]$, where n is a number of analysed regions, $y_{i,t}$ - the indicator of year t in region i, $i \in (1, 2, ..., n)$, μ_{y_t} - the arithmetic mean of $y_{i,t}$: $\mu_{y_t} = \frac{1}{n}\sum_{i=1}^{n} y_{i,t}$.

The values of GE(α) may range from zero to ∞, where zero represents an absolute evenness of regions according to the analysed criterion. The greater is the value of GE, the higher the inequality. For lower values of α, GE is more sensitive to changes in inequality in the group of regions with the lower value of the indicator $y_{i,t;}$ higher values of α are more sensitive to changes in inequality in the group of regions with higher value of the indicator $y_{i,t.}$

Most frequently used values of α are *0*, *1* and *2*, hence, a value of $\alpha=0$ gives more weight to the inequalities within the group of weaker regions. $\alpha=1$ applies equal weights across the distribution on the disparities of the regions under research, while value $\alpha=2$ gives proportionally more weight to inequalities within economically prosperous regions [18].

The results of the calculation enable us to assert unambiguously that GRP_c –based inequality is far smaller (2.6 times on the average during the research period) in neglected regions in comparison to the prosperous ones. However, the disparity came down from 3.3 times in 1995 to 2.1 times in 2003. It came as the result of a faster process of divergence in the least favoured regions in comparison to the richest ones (see Figure 6), where the changes of indicators estimated in Table 3 during the research period are presented and where the the figures of 1995 are equal to 100).

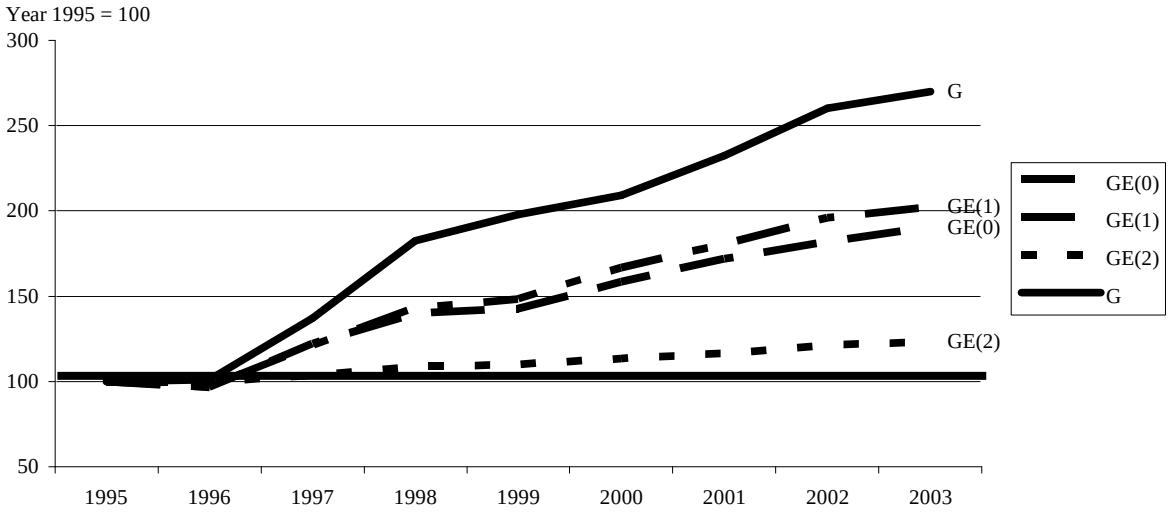

Figure 6. The indicators of growing rates of uneven economic development in separate Lithuanian regions
Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

Estimating the indicator of GE(1), when $\alpha=1$, equal weight is given to gaps between the regions under research and this indicator doubled twice during the time of the research. The estimated Gini coefficient reflects the general extent of uneven GRP_c distribution and its value has the same change direction as the above-analysed σ–convergence indicator (see Figure 5). The estimated correlation coefficient between GDP_c and Gini coefficient is equal to 0.964. This shows a strong direct relationship between these indicators with 99.5 per cent accuracy, i.e. the bigger the increase of GDP_c in Lithuania, the more unevenly it distributes across the regions.
All findings of concentration suggest that the GRP_c gap between regions in the course of time is widening, consequently, the process of divergence in Lithuania is taking place. Interregional disparities measured by GRP_c coefficient of Gini in the majority of cases were growing faster than economy itself: during the period of 1995 through 2003, GDP per capita grew by 120 per cent and Gini coefficient increased by 170 per cent.

2.4. Regional divergence in wages and calculation of efficient wages

Wages are often stressed in the analysis of regional attractiveness for investment. The lower wages are in a region the better are its possibilities to attract investment because every enterprise, striving to maximise its profit, will seek to reduce production costs, the biggest part of them being labour costs. Regions, where wages are lower, should attract more investments and, consequently, their economic development, induced by more rapid investment, should be more rapid. Data, however, evidence quite opposite dependence. It shows that direct dependence of average wages and foreign direct investment and investment in tangible fixed assets per employee exists. It is proved by correlation coefficients, which are correspondingly 0.8 and 0.82. The phenomenon, which contradicts the assumptions above, may be explained by the fact that investors are more concerned not about wages but about ratio of wages and labour productivity.
Kaldor [4] maintains that real wages in all regions may not be different but effective wages, understood as ratio of real wages and labour productivity, are lower in industrialised regions because of the scale economy. Because those regions, where effective wages are lower, can produce more goods it will influence further decrease in wages; the scale economy gives advantage attracting investment to the regions, which were industrialised first. In the first

phase differences in wages among regions will be evaluated. Figure 7 shows difference in wages among regions not considering labour productivity.

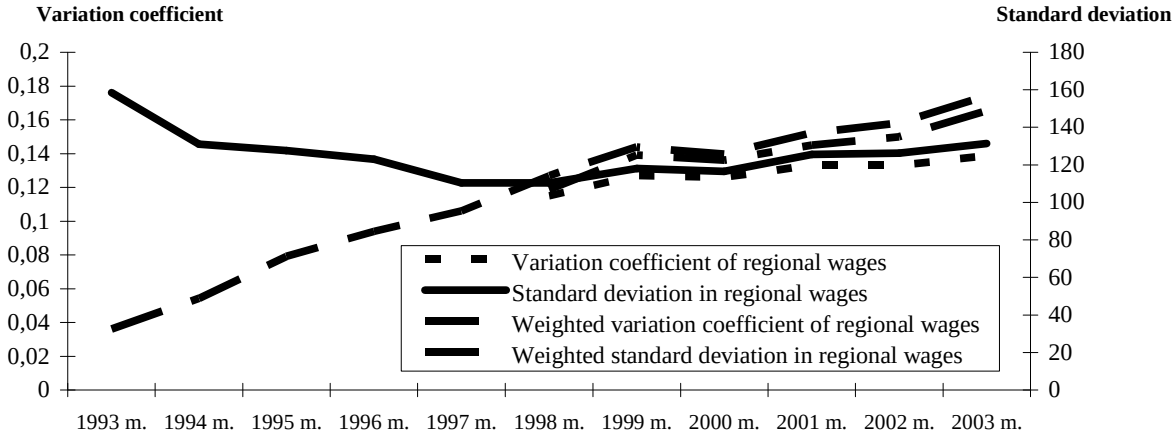

Figure 7. Differences in wages among regions (1993-2003)[1]

Source: compiled by the authors with reference to the data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

1) Calculations of weigh standard deviation in wages and the variation coefficient were started in 1998 when the Department of Statistics began registering employed persons by counties.

In the period of 1993-1998 difference in wages among regions by the variation coefficient decreased, but standard deviation in wages shows a completely opposite tendency. Since 1998 tendencies of changes in all indicators started coinciding and until 2003 showed increasing difference in wages among regions; an exception was 2000, when average monthly wages in the country decreased because of economic slump. Correlation coefficients among the indicators in Figure 7 and average wages in the country were calculated and were 0.97, 0.91, 0.97 and 0.91 correspondingly. Coefficients close to 1 show direct correlation of average wages in the country and difference in wages in regions. Thus in 2000 decreased divergence among regions was the result of economic slump; economic growth, which started later, increased those divergences. Once again it proves the hypothesis that economic growth in Lithuania is divergent from the territorial aspect and difference of labour costs in regions becomes more evident in the course of time.

In the next phase efficient wages in the country and in particular regions were evaluated. The results of calculations are presented in Figure 8. Data on employed persons in regions was used for calculations.

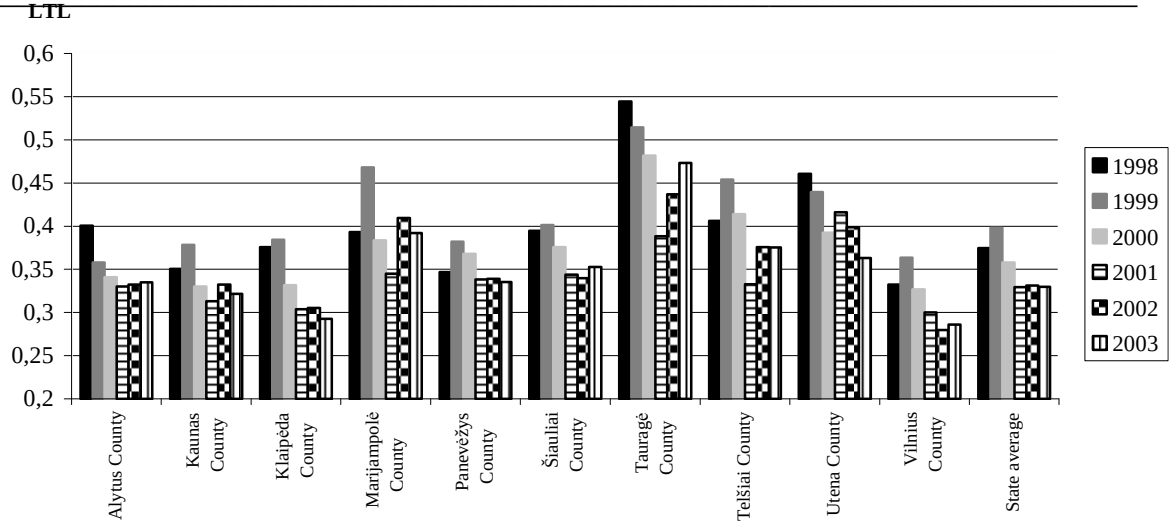

Figure 8. Efficient wages in Lithuania and counties (1998-2003)

Source: compiled by the authors with reference to data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania. Here LTL is the Lithuanian currency Litas.

Data on efficient wages in Figure 8 explain why foreign direct investment and investment in tangible fixed assets concentrate in several counties. Efficient wages in Vilnius and Kaunas counties are the lowest; it is determined by the economy of agglomeration when the economy of scale is achieved setting up a business in an urbanised territory, what gives advantage because of infrastructure and skilled labour force there, i.e. wages (by absolute value) are set higher but their real value, considering created added value, are considerably lower. It may be concluded that difference in wages by absolute value among regions will keep growing until reaching convergence of efficient wages.

Dependence of efficient wages and foreign direct investment and investment in tangible fixed assets per employee in counties is presented in Figure 9. Graphs show adverse dependence of efficient wages and FDI and FTI per employee.

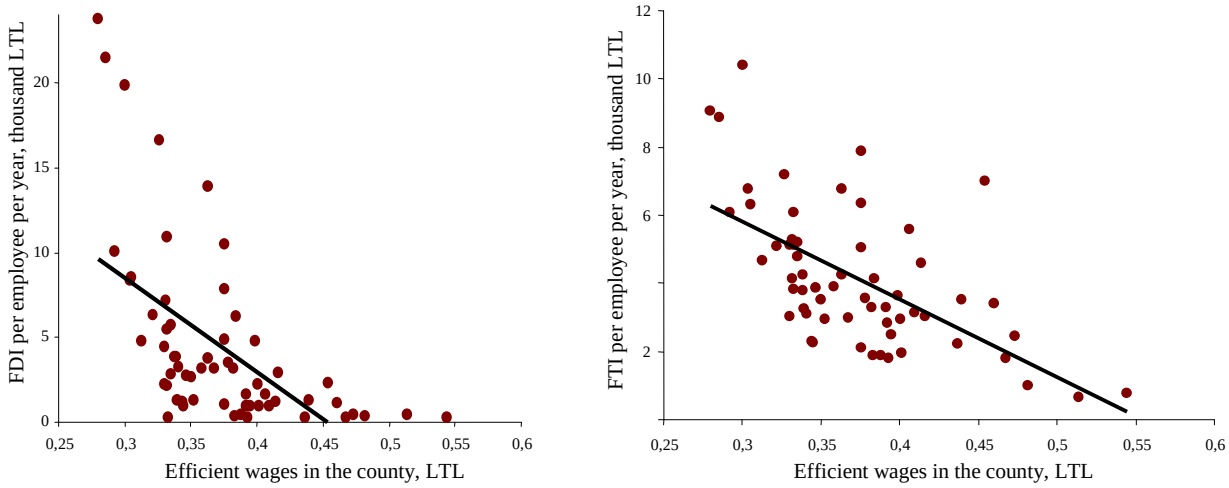

Figure 9. Dependence of efficient wages and foreign direct investment and investment in tangible fixed assets per employee (1998-2003)

Source: compiled by the authors with reference to data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

Because of this dependence the process of cumulative causation proposed by Mydral [3] comes into effect: although underdeveloped regions have an advantage of low-cost labour force (by absolute value) this advantage is outweighed by the scale economy of industrialised regions and low efficient wages in them. Lower efficient wages and higher labour productivity stimulate investment in industrialised regions what increases labour productivity; thereby efficient wages reduce and incentives to invest strengthen. In this way underdeveloped regions become less attractive for investment, production volume and employment fall, employees lose their qualification, labour productivity falls; all this makes the region less attractive for investment.

2.5. Qualitative divergence of population and expanded process of cumulative causation in regions

Because of the existing link between economic development and human capital while analysing the effect of investment on economic development the structure of human capital should be evaluated, i.e. proportion between investment in physical and human capital; unfortunately, the Department of Statistics does not provide any data on it. Moreover, costs for staff training and qualification updating are included into operational costs in the functioning system of accounting. Private spending for education national accounting system classifies as consumption and in states level as government spending. Thus the only indicators, which allow setting the value for human capital, are the number of population and its structure by education; whereas capital accumulation potential may be defined as the number of students in educational institutions per 1 000 population in the region. However, the latter indicator may not necessarily show capital accumulation potential because no statistical data on students' migration exists, therefore it is impossible to determine the number of graduates, who have stayed in or have left the region they have studied.

Changes of a comparative part of population by all levels of educational attainment for 1998–2003 were irregular. For summarised evaluation calculated average of educational attainment of population for 1998–2003 is presented in Table 4.

Table 4: Average structure of population (age 25-64) by educational attainment in regions

County	Comparative part of population with primary and basic education	Comparative part of population with secondary and post-secondary education	Comparative part of population with higher education	Comparing with state average		
				Part with primary and basic education	Part with secondary and post-secondary education	Part with higher education
State average	**15,4%**	**64,1%**	**20,5%**	100,0%	100,0%	100,0%
Alytus	17,0%	68,8%	14,1%	110,3%	107,4%	68,9%
Kaunas	*13,1%*	63,2%	*23,7%*	84,7%	98,7%	115,7%
Klaipėda	*14,0%*	65,3%	*20,7%*	90,9%	101,9%	100,8%
Marijampolė	16,7%	70,0%	13,3%	108,0%	109,3%	64,9%
Panevėžys	17,5%	66,8%	15,7%	113,6%	104,2%	76,4%
Šiauliai	19,0%	64,2%	16,8%	123,3%	100,2%	81,9%
Tauragė	18,8%	67,6%	13,6%	121,7%	105,5%	66,5%
Telšiai	20,2%	67,8%	12,1%	130,7%	105,7%	58,9%
Utena	20,6%	62,1%	17,3%	133,6%	96,9%	84,5%
Vilnius	*12,7%*	60,3%	*27,0%*	82,3%	94,1%	131,9%

Source: compiled by the authors with reference to data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

Data in Table 4 show that the biggest comparative part of population with low educational attainment was registered in Utena, Telšiai and Šiauliai counties. This indicator in regions exceeds the state average by 33.6%, 30.7% and 23.3% correspondingly. The smallest comparative part of population (age 25-64) with low educational attainment was registered in Vilnius, Kaunas and Klaipėda counties, its difference comparing with the state average is

17.7%, 15.3% and 9.1% correspondingly. The biggest comparative part of population with higher education was registered in the last-mentioned counties. 68.4% of all state population (age 25-64) with higher education live in Vilnius, Kaunas and Klaipėda counties (48.3% with primary and basic education), meanwhile this percentage in Telšiai, Tauragė and Marijampolė counties is 8.7% and 16.3% correspondingly. Therefore, the biggest human capital is been accumulated in three economically strong regions – Vilnius, Kaunas and Klaipėda.
Summarised data for 1998–2003 on the number of population in different types of post-secondary educational institutions per 1 000 of population in regions is presented in Table 5.

Table 5: Number of population in different types of post-secondary educational institutions per 1 000 of population in regions (1998-2003), per cent

County	Vocational high schools, colleges and universities (institutes)	High schools, colleges and universities (institutes)	Univer-sities (institutes)	Comparing with state average		
				Vocational high schools, colleges and universities (institutes)	High schools, colleges and universities (institutes)	Univer-sities (institutes)
State average	**50,1**	**36,0**	**27,8**	100%	100%	100%
Alytus	23,9	6,0	2,3	48%	17%	8%
Kaunas	*74,6*	*59,2*	*49,6*	149%	165%	179%
Klaipėda	*46,4*	*29,2*	*18,7*	93%	81%	67%
Marijampolė	21,6	8,2	1,9	43%	23%	7%
Panevėžys	25,1	11,5	5,0	50%	32%	18%
Šiauliai	41,7	24,8	19,1	83%	69%	69%
Tauragė	12,8	2,5	0,1	26%	7%	0%
Telšiai	17,1	5,3	1,8	34%	15%	6%
Utena	23,9	11,3	4,0	48%	31%	14%
Vilnius	*74,4*	*62,9*	*51,9*	149%	175%	187%

Source: compiled by the authors with reference to data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

Data in Table 5 shows that the bigger the number of population in educational institutions per 1000 of population in a region is, the bigger is a part of population with higher education in it (Table 4). Correlation coefficients, estimating the students and graduates from universities and other educational institutions as well as dwellers having higher education in regions for the period during 1998–2003 are correspondingly equal to 0,85 and 0,82. It means that a strong direct link between these two phenomena exits. A part of educated population will grow faster in the regions with many higher educational institutions at the expense of other regions because is a tendency for gifted graduates to stay in those regions and higher educational institutions exists.
If population with a higher level of education gets higher wages than those with no education, the question arises: should not the same tendency be observed at state or regional level, i.e. GDP per capita is higher in those regions where a part of population with higher education is bigger. Because the level of education and GRP per capita are closely linked, it is difficult to answer the question whether bigger GRP per capita is the cause or the consequence of a higher level of education. It may definitely stated that education helps to make use of achievements in science and to contribute to their development, i.e. higher levels of education enable people to use modern technologies. Therefore, labour productivity in regions should depend on the number of educated persons there. This dependence is presented in Figure 10.

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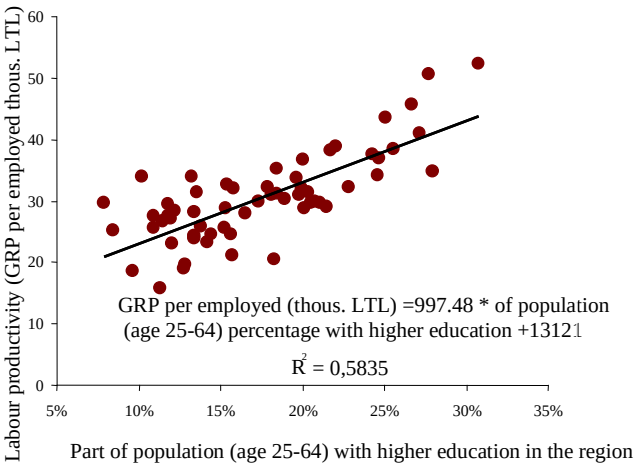
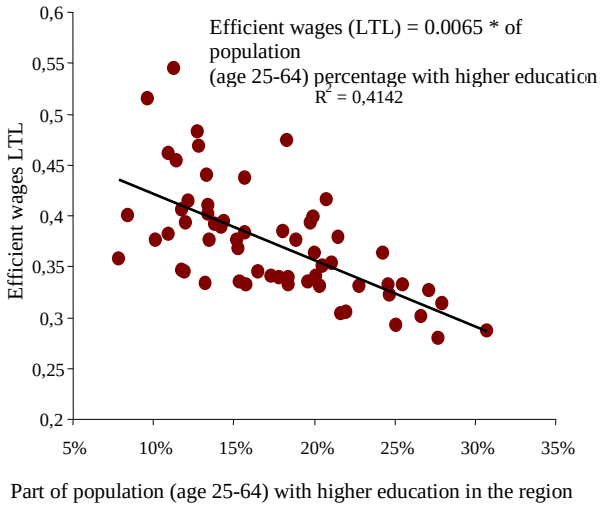


a) Dependence of labour productivity on a comparative part of educated population



b) Dependence of efficient wages on a comparative part of educated population

Figure 10. Dependence of labour productivity and the level of education of population in regions (1998-2003)

Source: compiled by the authors with reference to data in "Counties in Lithuania: Social and Economic Development" provided by Department of Statistics to the Government of the Republic of Lithuania.

Figure 10 shows that: if a comparative part of population (age 25-64) with higher education grew by 1% and we made an assumption that educated and uneducated persons may perfectly substitute each other of no account whether the level of education of all this 1% of population would rise at the same proportion, average labour productivity would increase by 997.5 LTL and efficient wages would decrease by 0.0065 LTL. The cause of such dependence is increased supply of skilled labour force and decreased demand for unskilled labour force. An increase of labour productivity (amount of goods produced per employee) will depend on a comparative part of labour force in the structure of production, i.e. the more production is labour-intensive, the bigger will be the growth of production volumes. It is also likely that a part of capital per employee will be higher (calculated correlation coefficient between FTI per employed persons in the region and a comparative part of population with higher education equals to 0.6 and confirms this hypothesis) in regions with a bigger number of educated populations and will affect the process of cumulative causation. This process can now be expanded and defined in the following way: the bigger a part of population with higher education in the region is, the higher is labour productivity there and the lower are efficient wages (Figure 10). The latter two factors promote investment (Figure 9); it increases labour productivity and reduces efficient wages. But wages higher than state average (in absolute measure) are paid to employees with higher education in those regions where efficient wage is lower (for correlation only data on wages by the level of education for 2002 – 2003 were obtained, therefore this data is statistically insignificant and the correlation coefficient equals to -0.38). For this reason these regions will attract employees with higher education because absolute but not efficient wages are important for them, efficient wages being important for employers (the analysis does not take into consideration living standard in a particular region). Moreover, high-status universities mainly concentrate in those regions, where least efficient wages are paid, cultural life is more active there and provided services are of better quality there. All that attracts the most active part of young people, who stay in these regions after graduation (the calculated correlation coefficient of university graduates per 1 000 of population and a part of population with higher education in regions for 1998–2003 equals to

0.82). It increases a comparative weight of employees with higher education in economically advanced regions; the analysed dependences function anew increasing interregional differences

Significance of population with higher education in regions is confirmed by the fact that an adverse dependence of a part of population with low or even average level of education and labour productivity exists. By the formed regressional equation a 1% increase of a comparative part of population (age 25-64) with low level of education will reduce average labour productivity by 1144.5 LTL and increase efficient wages by 0.0089 LTL; an increase of a comparative part of population with average education will reduce labour efficiency by 1196 LTL and increase efficient wages by 0.0061 LTL. It may be concluded that the quantity of human capital in a region determines productivity of all other production factors; the growth of a comparative part of unskilled population will result in economic loss.

Mincer [19] and Psacharopoulos [20] in their research maintain that return from investment into human capital in economically disadvantaged regions (where GRP per capita is lower) will be bigger because a surplus of skilled labour force may exist in economically developed regions; therefore, an increase of a comparative part of population with higher education in those regions, where labour productivity is low, may stimulate a faster growth of GRP per capita there than in those regions, where labour productivity is high.

In our case all regions were categorised into 3 groups by average labour productivity for 1998–2003. The formed equations of regression disclosed quite different dependence than the one proposed by the researchers mentioned above. The dependence of GRP per employed person and a comparative part of population with higher education in high labour productivity regions (Vilnius, Kaunas and Klaipėda) is statistically most significant (R^2=0,58) and between efficient wages and a comparative part of population with higher education equals to 0.47. In other groups of regions the determinant coefficients are correspondingly: in the regions of average labour productivity (Alytus, Telšiai, Utena, Panevėžys) – 0.31 and 0.11 and in the regions of low labour productivity (Šiauliai, Marimpolė, Tauragė) – 0.38 and 0.27.

Direct relation of a comparative part of population with higher education and labour productivity is observed in the regions of all groups. A conclusion can be made that there is no surplus of skilled labour force in Lithuania. The increase of a part of educated population in the regions of higher labour productivity has the most significant effect on the increase of labour productivity (a 1% increase of a comparative part of population with higher education would raise labour productivity by 1 464 LTL), in the regions low of and average labour productivity - by 390 LTL and 723 LTL correspondingly. The reason may be more effective employment of skilled labour force in economically stronger regions because of their infrastructure and orientation towards the service sector. The effect of the increase of skilled labour force on the decrease of efficient wages will be stronger also in high labour productivity regions.

3 Conclusions

A research was carried out for the quantitative assessment of the degree of uneven economic activity in Lithuanian regions using classical methods of convergence – divergence analysis. It was also made an attempt to identify main causes of divergent growth process. The results of this research provide an opportunity to identify and assess evolution and speed of divergent regional development in Lithuania. All used distribution indexes reflect constantly growing regional disparities. Moreover, speed of this process is not steady and correlates with economic cycles.

The results of the assessment of a β–convergence process based on per capita GRP. In the presented regression equation (where independent variable is region GRP_c's logarithm in 1995 and the dependent variable is GRP_c's logarithm of average growth rate during the

analysed period) the obtained β coefficient is positive (0.11). The coefficient of determination of this regression equation equals 0.52, hence statistically it is significant and the hypothesis of the coefficient β being the equal of zero when applying the Student's test, has been rejected. On the ground of these calculations it may be asserted that there exists an absolute β divergence based on per capita GRP_c. in Lithuania.

The results of the assessment of a σ –convergence process based on per capita GRP. Regions in Lithuania diverge according to σ. The process of divergence is continuous but its pace is slowing down. The fastest unequal development took place in 1996 - 1998 (average annual increase amounted to 28 per cent), a slower one in 1998 - 2002 (with average annual increase of 8.8 per cent), and the last one during the period of analysis was marked by the slowest rate of divergence (annual increase of 3 per cent). Over the period of analysis the indicator reflecting σ –convergence grew by 2.5 times and this enables to assert that during the period of incomplete ten years the inequality of the Lithuanian regions based on per capita GDP grew by the same degree.

The results of expanded cumulative causation process in Lithuania regions. The process may be defined in the following way: the bigger a part of population with higher education in the region is, the higher is labour productivity there and the lower are efficient wages. The latter two factors promote investment; it increases labour productivity and reduces efficient wages. But wages higher than state average are paid to employees with higher education in those regions where efficient wage is lower. For this reason these regions will attract employees with higher education because absolute but not efficient wages are important for them, efficient wages being important for employers.

All findings of concentration suggest that the GRP_c gap between regions in the course of time is widening, consequently, the process of divergence in Lithuania is taking place. Interregional disparities measured by GRP_c coefficient of Gini in the majority of cases were growing faster than economy itself: during the period of 1995 through 2003, GDP per capita grew by 120 per cent and Gini coefficient increased by 170 per cent.

The summarising conclusion can be made that the current situation determines higher return from investment in education at personal as well as at business level in economically strong regions. Therefore, with the aim to overcome the effect of cumulative causation intervention on the part of government is necessary: to promote and finance labour force training and invest in human capital. Researchers Nelson and Phelps (1966) point out that lack of education rather than education itself helps to explain why some regions may fail managing and using the potential of economic growth, making use of comparative advantage of other production factors because employees' low qualification and deficiency of human capital determine inefficient production and economic loss.

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