



## PATTERNS OF INEQUALITY OF LITHUANIAN REGIONS

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**Abstract.** Though a country's economy is growing, separate regional development disparities could be even more significant. This paper aims to identify the situation of inequality of Lithuania's regions, taking into consideration the most important factors of regional economic growth and investments. Evaluation of regions by 15 criteria is carried out by a ranking method. Results show a big disparity between regions. Significant Spearman correlation is found between FDI and total investment with all investigated group of factors of economic growth in the group of City Municipalities, but in the group of District Municipalities, it differs. Four scenarios for regional policy formation were distinguished.

**Keywords:** regions, municipality, inequality, ranking, FDI, factors of economic growth, convergence.

**JEL Classification:** E01, E22, E24.

### Introduction

Despite the huge body of theoretical and empirical studies dedicated to the convergence of regional economics in between countries, such as Europe Union (EU) regional economy, there is still a gap in small countries' regional inequality research. Several questions still need to be answered. Is uneven foreign direct investment (further FDI) in the country a condition of regional differentiation? Should small countries seek regional convergence inside the country? Brauers, Ginevičius and Podvezko (2010) suggest to equilibrate automatically regional inequality by transferring payments from richer to the poorer regions, but doubt if the automatic system could be a guarantee for success. Regarding the issue of regional inequality, Tselios (2009) has distinguished three approaches of different scientists. Mirrlees (1971) and Rebelo (1991) suggest that a certain level of inequality can be good for growth. In contrast,

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Perotti (1996), Easterly (2001), and Dollar and Kraay (2002) contend that inequality may harm growth. Galor (2000) and Bertola, Foellmi and Zweimüller (2006), Burns and DeVillé (2017) combine both effects.

Inequality of small countries' regions usually is not noticeable in statistical evaluations because only big countries are divided into separate regions according to the different rate of gross domestic product (GDP). EU statistics evaluate the whole country, but ignore small countries' regions, because for the national statistic, studies of regions are not a priority. Under these conditions, it is very easy to hide problems: tremendous emigration, big differences in household income, business conditions, educational attainment, and unemployment.

The growth rate of Lithuanian economy is reasonably fast compared to other EU countries, but domestic regional development disparities are significant enough (Rakauskiene & Strunz, 2016). This paper aims to identify the situation of inequality of Lithuania's regions, taking into consideration the most important factors of regional economic growth and FDI.

The paper is organized as follows. After the scientific literature was analysed, important factors of economic growth were identified. Five groups of factors were investigated: financial indicators (1), human capital (2), technological innovation (3), sectorial structure and employment (4), and infrastructure (5), including socio-geographical aspects. The investment was analysed and ranked in the paper separately. The methodology and data of the research led to rankings of inequality in regions of Lithuania. To finalize the research, four scenarios for regional policy formation were proposed.

## 1. The overview of factors of regional economic growth

In the global economic context, regions are engines of the entire economy (Tselios, 2009; Simionescu, Lazányi, Sopková, Dobeš, & Balcerzak, 2017). Blažević and Jelušić (2006) analysed the dynamics and structural features of the regional economic system through econometric estimation of the parameters of production functions, investment functions, and employment-related functions, based on a series of data dealing with fixed funds (capital assets), new investments, employment and domestic product. Bucci and La Torre (2009) stated that economic growth depends positively on technological progress and human capital investment, but did not ignore the facts and cited Kelley (1988), Ehrlich and Lui (1997) and Tournemaine (2007) to show that there is still no consensus between economists and demographers on the connections between population change and economic growth.

Different factors of economic growth and one more additional factor—foreign direct investment (FDI), as the factor conditioning inequality of the regions—will be analysed and an overview of determinants will be conducted.

The connection between economic growth and income distribution within an aggregate economy, such as a region, is a classical question (Quah, 1996). Tournemaine (2007) presented an economic growth model in which technical progress, human capital accumulation, and population growth are endogenous. Tournemaine (2007) attempts to reconcile the effects of population change on per capita income growth. Tselios (2009) examined the complex relationship between income inequality and economic growth. He analysed whether income per capita increases and income inequality decreases over time (growth mechanism), or

whether low-income per capita regions grow faster than high-income per capita regions and within-region income inequality falls in regions with initially high inequality, and eventually catches up in the long run (convergence mechanism). The results showed the presence of a conditional convergence in income per capita after controlling for educational attainment, unemployment, sectorial composition, spatially lagged growth of income per capita, and regional fixed effects and of an unconditional convergence in income inequality. Aghion, Caroli and Garcia-Penalosa (1999), using socioeconomic theories, stated that income distribution affects regional aggregate output and growth through factors such as incentives, investment in physical and human capital and innovation.

Analysing the differences of regional development, human capital is the determining factor for regional competitiveness, development, and implementation of new technologies, and amplification of productivity. Pompili (1994), Atkočiūnienė, Gineitienė and Žiogelytė (2010), Bode and Villar (2017) identified human capital as an essential indicator of regional development. Usually, human capital is assessed by the skills of the labour force (Kilijoniene, Simanaviciene, & Simanavicius, 2010). Knowledge, skills, education, professional development and investment in appropriate components are the most common human capital factors and opens up new opportunities to manage the economic performance more precisely (Bilan, Mishchuk, & Dzhyhar, 2017).

Economic theory considers human capital to be the key component that ensures competitiveness at a regional level. Researchers have examined the nexuses between human capital use and regional economic growth. In achieving well-qualified human capital, universities play an important role. For example, Guerrero, Urbano and Fayolle (2016) showed that for 102 universities from 12 EU countries, social measures like the talent of human capital had a stronger impact on regional competitiveness than economic factors like GDP per capita (Simionescu, 2016). Most economists agree that the population or employment share with a bachelor's degree or higher measures of human capital sufficiently well at the aggregate, regional and national level. Measuring human capital in terms of formal education is convenient not only because data on educational attainment are readily available for almost all countries and regions over a long period of time. It is also convenient because education-based measures are reasonably well founded in microeconomic theory. Human capital investment theory establishes a systematic positive relationship between a worker's earnings and his/her educational attainment and work experience (Bode & Villar, 2017). Florida, Mellander and Stolarick (2008) concentrate on educational and occupational measures of human capital and show that the occupational measure outperforms the educational measure when one attempts to account for regional labour productivity measured in wages. In contrast, the educational measure is better if one's objective is to account for regional income (Batabyal & Nijkamp, 2013). Berger and Frey (2017) supported this idea, stating that education is a key predictor of city growth. In Czaller's (2017) opinion, the average level of education explains a large part of subsequent total factor productivity growth, suggesting an important role for human capital externalities in raising productivity. Economists propose that the main reasons for wage inequality include the widening of increasing returns to education and skill-biased technological change (Melo, 2017). Moretti (2004) agrees that the difference in earnings is, in fact, a reflection of education and not a result of differences in unmeasured workers' characteristics.

The mechanism underlying the link between human capital and new industry creation may reflect that skilled cities are suited better to adapt to new technologies to reinvent themselves: “<...> skilled workers being better able to adapt to technological change” (Berger & Frey, 2017). Pede, Florax and De Groot (2007) investigated sectorial variation across sub-national regions of the US and found that geographic and technological proximity are both relevant for sectorial productivity growth, but the technological effect seems to be more prominent. Pelkonen and Nieminen (2016), Włodarczyk (2017) discuss the success factors of peripheral regions in the knowledge economy and difficulties in turning them into real innovation outcomes. They investigated the viability of the knowledge-based development model for peripheral regions by examining the experiences of a follower region in Finland and concluded that regions may benefit from a knowledge-based development strategy, but the development is slow and only takes place through building base capacity in the region. Because unemployment could be seen as having one of the strongest impacts on people’s economic expectations in a region, the main components of growth can be analysed through labour market performance and capital investment. Picci (1999) researched the impact of infrastructure on the productivity of Italian regions. Public investment, start-ups of new business or decisions about business development depend on infrastructure and impact on productivity in the long term. Blien, Suedekum and Wolf (2006) investigated the regional labour market of West Germany, evaluating the impact of diversity and specialization on the development of the regional industry. Arratibel et al. (2007) investigated the determinants of economic growth in the central and eastern European EU member states. They analysed economic growth with the traditional production function approach that links output with both the accumulation of labour and capital and technological progress. Gimenez-Nadal and Molina (2014) explored the relationship between unemployment rates and individual well-being in Spanish regions. Nowak and Wójcik (2015) examined the regional differentiation of labour productivity in Poland. Cuaresma, Doppelhofer and Feldkircher (2014) identified that regions that include the capital of the state and have a more qualified labour force grow faster. Therefore, it is not surprising to admit that investing in human capital and other growth – enhancing factors of regional economies could lead to the successful economic growth of municipalities.

Foreign direct investment is one of the most important factors influencing regional growth and growth of the overall economy. The Asian economic integration report (2016) noted that FDI helps achieve inclusive growth and regional integration. It contributes to economic development through physical and human capital accumulation as well as technological and knowledge transfers. Casi and Resmini (2017) emphasize that FDI can have important positive effects on growth because FDI is a valuable source of innovation, technology, and know-how. FDI can promote growth by stimulating efficiency and productivity gains and generating technological diffusion from home to host locations (Casi & Resmini, 2017). Many scientists and economists have analysed the impact of FDI on regional growth. Bajo-Robio, Díaz-Mora and Díaz-Roldán (2009) indicated that after the Spanish integration with the European Union in 1986, FDI inflows became one of the most important features shaping the behaviour of the Spanish economy in the last 20 years. An aggregate production function augmented with FDI inflows was estimated in its research by using data for the 17

Spanish regions over the period 1987–2000. The results support the important role played by foreign direct investment in promoting productivity growth, which proves to be robust to several alternative specifications. Iwasaki and Suganuma (2015) estimated the remarkable role of FDI in regional economic development in Russia. They found that the positive effect of FDI on total factor productivity (TFP) may increase in regions that received larger amounts of foreign capital. Furthermore, they detected a surprisingly robust and positive synergistic effect between FDI and local R&D potential, indicating that the absorptive capability is essential for linking FDI and regional economic development (Iwasaki & Suganuma, 2015). Kersan-Skabic and Tijanic's (2014) basic conclusion is that FDI inflows follow the development path of the Croatian regions (with the highlighted agglomeration effect) and that efforts in creating preconditions for economic growth will, at the same time, have an impact on the attractiveness of a particular region for foreign investments. Generally, all these findings prove that FDI should be analysed as a factor conditioning inequality of the regions.

Taking into consideration these factors, the analysis of regions can bring useful information for Lithuania's regional inequality issue. The following five groups are investigated in this paper: financial indicators (1), human capital (2), technological innovation (3), sectorial structure and employment (4), and infrastructure (5) including socio-geographical aspects. Investment, which consists of FDI and material investment, is analysed and ranked in the research separately.

## 2. The methodology of ranking of regions

Each country aspired to prosperity and well-being. Less developed EU countries seek smart growth and convergence with other countries. Welfare development of the whole country depends on political, economic, social and technological conditions of its regions. To compare all municipalities of Lithuanian regions by the several criteria expressed by different statistical measures, the Excel custom sorting function is used. This comparison is performed for each pair of elements and for all selected criteria. The result of this comparison is ranking by priorities of municipalities by selected criteria. Table 1 shows the multicriterion ranking process. The ranks of each criteria are entered in the table columns. Then the sum of ranks of all the criteria is calculated, and it is the basis for total priority.

Table 1. The principal of ranking elements by several criteria (made by authors)

Elements	Ranking by three criteria			The sum of ranks	Total priority
	1	2	3		
1	3	3	2	8	3
2	4	1	1	6	1
3	2	2	3	7	2
4	1	4	4	9	4

Ranking elements by several criteria allow identifying patterns of Lithuanian cities and regions according to selected groups of factors: financial indicators (1), human capital (2),

technological innovations (3), sector structure and employment (4), infrastructure (5) and investment. The total number of criteria is 15. The data for ranking (both for groups of factors and investment) were taken from Statistics Lithuania (2017) and Ministry of Finance of the Republic of Lithuania (2017a, 2017b). The ranking of regions by several criteria allows us to determine region leaders and problems of less developed regions.

The correlation of priorities of groups of factors, total priority, FDI, material investment and total investment is made by Spearman correlation method. Calculations are done between ranks of all groups of factors and ranks of foreign direct investment, material investment and total (FDI and material) investment. The Spearman correlation coefficient can take values from +1 to -1. The coefficient value of +1 indicates a perfect association of ranks, a value of zero indicates no association between ranks and a coefficient value of -1 indicates a perfect negative association of ranks. If they are in intervals [-1; -0.6] and [0.6; 1], the values of Spearman coefficient are significant (Statistics, 2017).

For the prediction of development of Lithuanian regions, taking into consideration FDI policy, scenarios creation is used. The different states of regions are calculated according to present data of FDI. Different distributions of present FDI presents the different FDI policy possibilities of Lithuanian governance.

### 3. The data for the research

Lithuania is a small country with 60 municipalities. For this investigation, the municipalities were divided into two blocks: 12 cities and 48 districts. The 12 cities block consists of the capital city Vilnius, three second biggest cities (e.g., Kaunas, Klaipėda, and Šiauliai), four cities form the industrial centres (Panevezys, Marijampolė, Alytus, and Visaginas) and four cities are resorts (Palanga, Neringa, Druskininkai, and Birštonas). Furthermore, this group is named Cities (City Municipalities). The district block is more agrarian and includes municipalities (this group is named Districts (District Municipalities)). According to the structure of Lithuania's districts, five cities (Vilnius, Kaunas, Klaipėda, Šiauliai, and Panevezys) are distinguished separately as City Municipalities and District Municipalities. The municipalities of districts have a central city and countryside around them. The municipalities of cities are responsible only for a city. The 48 districts and 12 cities of Lithuania were ranked by 15 criteria that reflect the present welfare of the country, using data of 2016. FDI value is the average of criteria taken for the period of 2010–2015. The ranking of District Municipalities and City Municipalities is made via Excel custom sort function and leads to the investigation of reasons of inequality. The investigation of inequality of Lithuanian regions is divided into five groups of factors that are very important for development and convergence of regions. Each group of factors includes particular criteria (named by letters in Table 2 and explained below) and the ratio of maximum and minimum of criteria is presented in Table 2. It reflects the level of differences in Lithuanian cities and districts.

*Financial indicators (1).* This group of variables has a direct impact to economic growth and consist of four criteria: income accumulated by the municipality per capita (a), financial grant per capita (b), all incomes per capita (c), and debt per capita (d). All the variables are expressed in thousands of euros. The bigger income shows that the municipality itself earns

Table 2. Ratios of maximum and minimum of criteria (made by authors according to Statistics Lithuania, 2017)

	Criteria	First block – 12 Cities			Second block – 48 Districts		
		Max	Min	Ratio	Max	Min	Ratio
(1) Financial indicators	a	2.35	0.39	6.03	0.44	0.37	1.19
	b	0.50	0	–	0.18	0	–
	c	3.00	0.44	6.82	0.64	0.41	1.56
	d	0.52	0.07	7.43	0.25	0.02	12.50
(2) Human capital	e	0.44	0.21	2.10	0.25	0.11	2.27
	f	0.27	0.16	1.69	0.30	0.17	1.71
	g	0.003	0.001	3.00	0.01	0.002	5.00
(3) Technological innovation	h	0.01	0.001	10.00	0.0007	0.002	2.86
(4) Sectorial structure and employment	i	12.70	5.30	2.40	15.40	4.80	3.21
	j	0.06	0.02	3.00	0.01	0.01	1.11
	k	0.03	0.01	3.00	0.02	0.004	5.00
	l	18.85	9.20	2.05	26.20	8.50	3.08
(5) Infrastructure	m	5.00	0	–	6.00	0	–
Investment	n	16729	60	278.82	8077	1	8077
	o	20.90	6.30	3.32	22.77	2.80	8.13

more income and is less dependent upon grants. Bigger grants show the dependence of the municipality from all economy of a country, and smaller value has a bigger priority. High levels of debt have a negative impact on the activities of the municipality, so smaller debt has a bigger priority.

*Human capital* (2). This group of variables is very important for small countries with high levels of emigration. Positive impact on the well-being of the region has 20–69 years old people with higher education (e) and the same age group with higher professional or secondary professional education (f). There are 45–61% in the cities and 31–50% in the districts people with both levels of education.

The negative impact for the development of a municipality comes from people who have only secondary education, elementary education, have not finished primary school, and are illiterate (g). The variables are expressed as the ratio of the number of educated people to the total number of people in the municipality. There are 0.1–0.4% school drop-out people in the Cities and 0.2–1.2% – in the Districts.

*Technological innovation* (3). This criterion is expressed through the number of small and middle-size companies with professional, science or technological activity per capita (h). An innovative activity of Lithuania is concentrated in the capital city Vilnius and around it – 56.1% of all companies. Kaunas and its region have 15.2%, while Klaipeda and its region have 7% of all technological companies.



*Sectorial structure and employment (4).* This group of factors consist of four criteria: ratio of registered unemployed and working people in percentages (i), number of small enterprises (turnover < 50 000 euros per year) per capita (j), number of large companies (turnover > 50 000 euros per year) per capita (k), and work productivity in euros per worker (l). Unemployment rates in Cities vary between 5.3 and 12.7 percent, and between 4.8 and 15.4 percent in Districts. The highest level of unemployment and the lowest number of small and large companies per capita is in Visaginas city, which is caused by the closing of the nuclear power station. The highest number of small and large companies per capita is in Neringa, a resort place. In Districts, the better values of criteria are distributed close to the three biggest cities: Vilnius, Klaipėda, Kaunas.

*Infrastructure (5)* including socio-geographical aspects. In this group of factors, access of municipalities to sea, roads, air and rail transport, a resort area, and capital city region are evaluated by points (m). Infrastructure in Lithuania can be divided into three main zones: capital Vilnius, middle of country Kaunas – Kedainiai, and Baltic Sea port city Klaipėda with the coastline. Infrastructural benefits provide municipalities additional growth incentives.

Taking into account all these criteria, comparison of District Municipalities and City Municipalities is conducted.

The investment consists of two parts: foreign direct investment (FDI) per capita (n) and material investments per capita (o). Foreign direct investment varies in Cities between 60 and 16 729 euros per capita and in Districts, between 1 and 8077 euros per capita. Material investments are not so scattered and varies between 6.3 and 20.8 in City Municipalities and between 2.8 and 22.8 euros per capita in District Municipalities.

Data of FDI show high inequality of Lithuanian municipalities in accumulating foreign direct investment (see Figure 1). The ratio of highest and lowest six year average of FDI per capita is 383 euros in City Municipalities and 5028 euros in District Municipalities. Highest

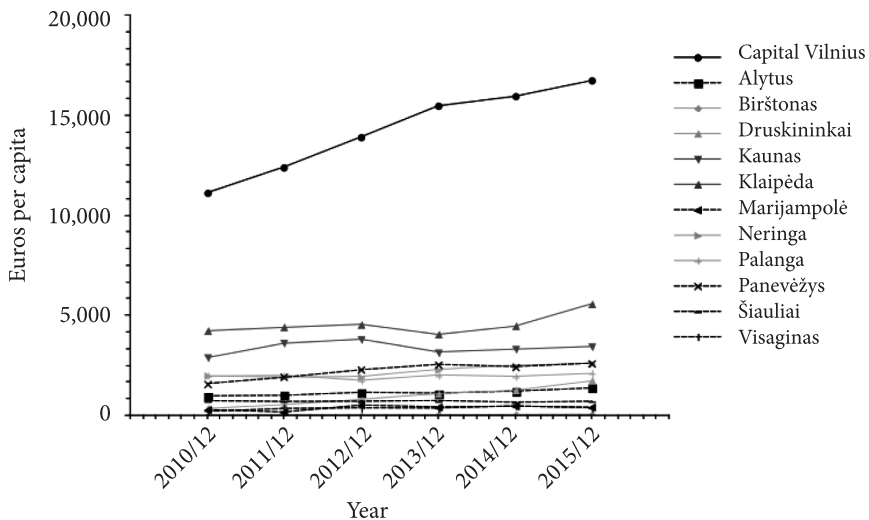


Figure 1. FDI per capita dynamic in Lithuanian cities (made by authors according to Statistics Lithuania, 2017)



FDI per capita is in Vilnius (the average is 14262 for the period 2010–2015), and the other cities have a significantly lower FDI. The average of FDI per capita for the period of six years is in Kaunas (3371) and port Klaipeda (4543), which three to four times less than in Vilnius.

More radical inequality of FDI is visible in District Municipalities (Figure 2). The analysis exposes that 48 District Municipalities can be classified into three groups. Seven District Municipalities fall into the group with the highest range of the average of FDI per capita (from 1630 to 8077 euros) for the period of 2010–2015. The exclusive outbreak is noticeable in Mazeikiai District, due to an oil refinery, which in 2013 suffered the greatest losses in its history. The root cause is shale gas extraction in the US that injured Europe’s oil refiners’ margins. Eighteen District Municipalities are in the group with a range of the average of FDI per capita from 184 to 1514 euros, and 22 Districts Municipalities are in the lowest range of the average of FDI per capita from 2.7 to 164 euros for the same period.

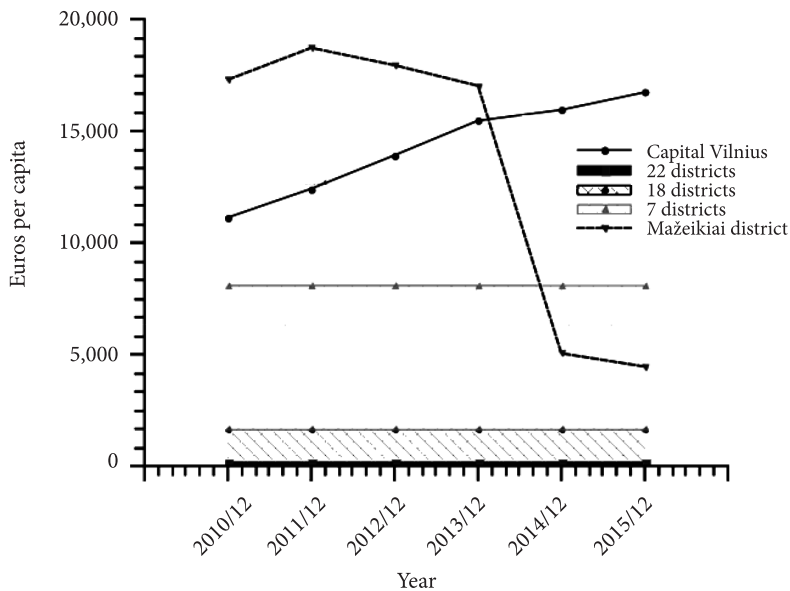


Figure 2. Ranges of the average of FDI per capita in District Municipalities and the average of FDI per capita in Vilnius City (made by authors according to Statistics Lithuania, 2017)

Figure 2 shows that 22 District Municipalities have accumulated significantly less FDI per capita than the other two groups of 18 and seven District Municipalities. All 47 District Municipalities are behind the average of FDI per capita of Vilnius. Such an inequality has a big influence on migration from rural regions to cities, especially Vilnius, and also it leads to emigration, which is one of the biggest challenges for Lithuania.

#### 4. Ranking to identify the inequality of cities and district municipalities of Lithuania

After the analysis of the selected data, groups of factors and the situation of FDI dynamic in Lithuania, the ranking of each group of factors, separate ranking for FDI and material

investment were analysed. Later, the total priority for the groups of factors and total priority for total investment were set (Appendix 1). The results show that Vilnius takes the first position from total priority and first position in 2–5 groups as well. According to financial indicators, Neringa and Klaipėda overtake Vilnius. The second position of total priority is held by Klaipėda, which has the best results from groups of factors according to financial indicators. The worst positions are held by three cities: Birštonas, Druskininkai, and Marijampolė. Figure 3 shows the general view of ranking results for Lithuania Cities. The first number represents the total priority for the group of factors, and the second number (in brackets) represents the priority for total investment.

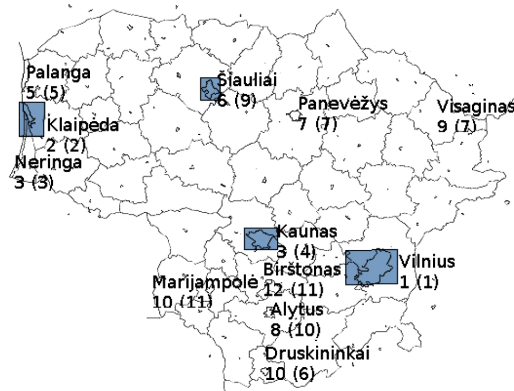


Figure 3. Ranking results of Cities Municipalities of Lithuania (made by authors according to National Land Service under the Ministry of Agriculture of the Republic of Lithuania, 2017)

Table 3 shows the results of Spearman correlation of priorities of groups of factors and priorities of investment. The correlation of priorities of FDI and priorities of all groups of factors are significant, and FDI has a direct impact on all groups of factors. The correlation of priorities of material investment and priorities of financial indicators is significant, but other groups of factors have no significant correlations. Priorities of total investment correlate with priorities of all groups of factors. The correlation between priorities for groups of factors and priorities of total investment shows that total investment correlates most with total priority for groups of factors, financial indicators, and technological innovations.

Table 3. The results of correlation of priorities for the Cities (made by authors)

	FDI	Material investment	Total investment
(1) Financial indicators	0.57	0.85	0.83
(2) Human capital	0.72	0.34	0.63
(3) Technological innovations	0.86	0.48	0.80
(4) Sectorial structure and employment	0.83	0.47	0.75
(5) Infrastructure including socio-geographical aspects	0.69	0.32	0.60
Total priority	0.89	0.58	0.87

Lithuanian District Municipalities have been ranked in a similar way (Appendix 2). Table 4 presents the results of correlation of priorities of groups of factors and priorities of investment for the districts. The correlations of priorities of FDI and priorities of all groups of factors are not significant. The material investment priorities and total investment priorities show significant correlation with financial indicators, sectorial structure and employment and total priority.

Table 4. The results of correlation of priorities for the Districts (made by authors)

	FDI	Material investment	Total investment
(1) Financial indicators	0.48	0.76	0.68
(2) Human capital	0.29	0.23	0.29
(3) Technological innovations	0.32	0.41	0.38
(4) Sectorial structure and employment	0.54	0.72	0.69
(5) Infrastructure including socio-geographical aspects	0.04	0.16	0.12
Total priority	0.48	0.67	0.63

FDI influences almost all groups of factors in the cities of Lithuania, but in districts, in agrarian parts of the country, the correlation is not significant. Half of the cities have FDI of more than 1600 euro per capita average per year, but only eight regional municipalities have the same amount of FDI. This could be one of the main reasons for different correlations in Cities and Districts. Total investment priority and total priority have a significant correlation, e.g., 0.63 correlation coefficients, meaning that investment plays a significant role in all districts, but FDI is very low in most of the regions.

## 5. Scenarios for regional policy formation and distribution of FDI

Only Vilnius, the capital of Lithuania, has a growing population of citizens. The number of people in other cities is decreasing due to emigration and a declining birth rate. Emigration for regional municipalities is tremendous. Technological innovations are concentrated in the capital of Lithuania. Regional policy is chaotic. On the bases of FDI, different regional policy formation scenarios representing the current situation of Lithuanian municipalities (Figure 4) and future regional policy formation scenarios for Lithuanian municipalities (Figure 5) are developed.

The x-axis represents the number of municipalities and reflects the urbanization-region-alization situation of Lithuania. The y-axis represents FDI per capita expressed in euros on a logarithmic scale. Based on the official classification of municipalities of Lithuania (stat. gov.), the intersection point on the x-axis is at the point 12. It represents the block of 12 City Municipalities (urbanization) and is taken as the starting point on the x-axis. For the better convergence of regions of Lithuania, active FDI is needed. It is assumed that active FDI represents higher FDI per capita, and inactive FDI represents lower FDI per capita.

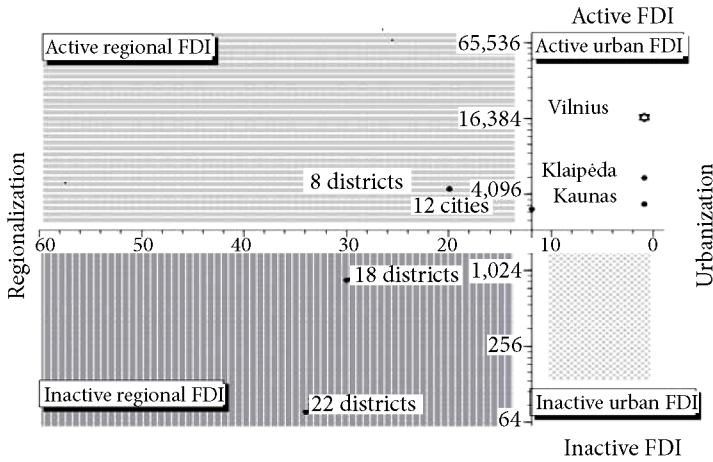


Figure 4. Regional policy formation scenarios representing the current situation of Lithuanian municipalities (made by authors)

The bullet points of different FDI policy (Figure 4) were calculated using the data of FDI of all City Municipalities and District Municipalities and represent the current situations of Lithuania municipalities. The classification of District Municipalities is taken from Figure 2.

In the right square at the top, which represents urbanization and active FDI (*Active urban FDI*), there are all 12 City Municipalities, but due to lack of place, only the three biggest cities of Lithuania are marked. On the y-axis, the average of FDI of 12 cities takes place. In the left square at the top, which represents regionalization and active FDI (*Active regional FDI*), the point for eight Districts is shown. This bullet point, which is the average of FDI of the eight districts group (seven districts together with Mazeikiai District) is on point 20 on the x-axis. The explanation for this is the representation of the current situation. The 12 Cities block should be taken into consideration in all calculations of districts. The same principles of calculations were done with the 18 district and 22 district groups. Both groups take place in the left square below, which shows regionalization and inactive FDI (*Inactive regional FDI*).

Future regional policy formation scenarios for Lithuanian municipalities (Figure 5) look similar to the current situation, but some differences should be pointed out.

The new bullet point in the right square at the top (*Active urban FDI*) represents the average of FDI of the three cities group. The eight districts group in a combination of three cities has moved to the active urban FDI square. And the bullet point of the 57 municipalities group, which represents the average of FDI of all municipalities in Lithuania, appears in the inactive regional FDI square (*Inactive regional FDI*).

The same bullet point is left for one city, as capital, that cannot be calculated as average (*Active urban FDI*). In addition to the bullet points for the average of the 12 cities group, the 18 districts group and the 22 districts group are at the same positions (*Inactive regional FDI*). The following four scenarios are distinguished as active, inactive, urban or regional.

Active urban FDI. If the government will not change the regional policy, Lithuania will be a country with one city. The inequality of regions will grow. One possibility could be named the concentration of FDI in three cities: Vilnius, Kaunas, and port Klaipėda. Another option

could be concentration of FDI in the three biggest cities (Figure 1) and the eight districts group (Figure 2), which has the highest amount of FDI per capita compared to other districts of Lithuania.

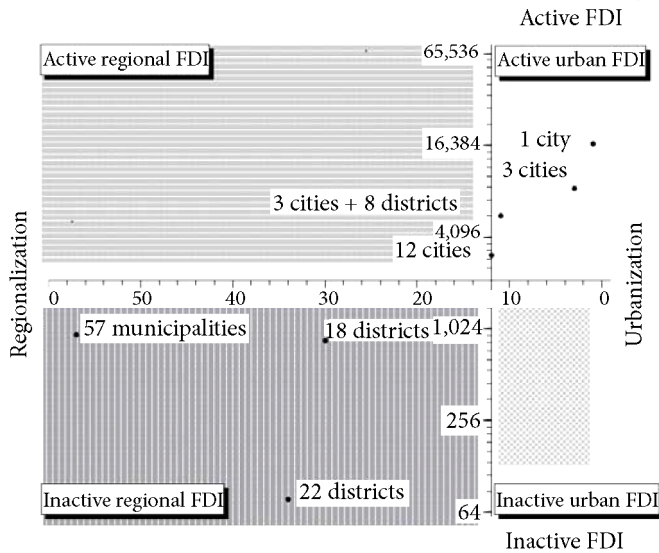


Figure 5. Future regional policy formation scenarios for Lithuanian municipalities (made by authors)

*Active regional FDI* is possible only with active regional policy, active agricultural, resort or rural tourism investment.

*Inactive urban FDI* is possible only if Lithuania will become unattractive to foreign investors: insecurity, political instability, war.

*Inactive regional FDI* describes the policy of equality of all regions, absolute convergence.

*Active governance policy of FDI* must cover all groups of investigated factors. Financial indicators (1) can be improved by better distribution of taxes in regions, methods of calculation of grants for municipalities and policy of debt management. Positive influence in the convergence of regions in the field of human capital (2) can be reached by a good distribution of high and special education. The infrastructure of high education and centres of science can inspire the distribution of small and medium-size technological companies in regions (3). Sectorial structure and employment (4) can be influenced by better taxation systems for small and medium-size businesses. Better use of regional infrastructure (5) advantages also promotes economic growth and makes the regions more attractive.

The developed scenarios, based on the distribution of FDI, reveal two most attractive ways of economic growth for Lithuania: active urban FDI and active regional FDI. The other two scenarios do not meet expectations of the society. The concentration of FDI in one, two or three cities of Lithuania grows the industry and technologies of the country, but problems of regional inequality cause tremendous emigration from regions and other problems of the well-being of the population. Active regional FDI can be reached only with active regional policy, active agricultural, resort or rural tourism investment.

## Conclusions

The investigation of five groups factors, including 15 criteria, of economic growth of Lithuania and separate and total ranking of municipalities of Lithuania, provide detailed information about the present state of inequality of regions. Differences between incomes per capita (with and without grants) of municipalities are not very high. The incomes accumulated by municipality per capita are in a range between 0.37 and 2.35 thousand in euros, all incomes per capita are between 0.41 and 3.99 thousand in euros.

No significant differences in the distribution of education and in small and large business work conditions were found. The infrastructure of roads and railways is good in all the country. It means that people have approximately equal conditions for work and education. But some variables have a higher variation. The debt of municipalities varies between 20 and 250 euros per capita. Furthermore, 56.1% of technology companies are concentrated in the capital Vilnius and around it. Most significant differences are in FDI—between 60 and 16729 in cities and between 1 and 8077 euros per capita in regions.

An impact of FDI on inequality of Lithuanian regions was investigated by correlating all five groups of factors and investment distinguished as FDI, material and total investment. The significant correlation was found in the group of City Municipalities: FDI and total investment correlate with all groups of factors of economic growth. The correlation of priorities of material investment and priorities of financial indicators is significant, and total investment correlates most with total priority for groups of factors, financial indicators, and technological innovations.

In the group of District Municipalities, FDI per capita of 22 municipalities is very low, not exceeding 1000 euros in six years. Furthermore, FDI per capita of 18 municipalities does not exceed 10000 euros per capita in eight years, and only eight of municipalities have high FDI per capita. This is the reason for not significant correlations between ranking municipalities by FDI and all groups of factors of economic growth. Material investment per capita has the significant correlation with total ranking, ranking by financial indicators and sectorial structure and employment. This pattern of inequality in the distribution of FDI shows the weak regional policy in Lithuania.

The developed scenarios for regional policy formation reveal two from four most attractive ways of economic growth for Lithuania. The proposed scenarios can have attributes biases of researchers since only 4 scenarios are presented. However, a larger spectrum of scenarios would more reveal the peculiarities of urbanization rather than regional convergence.

As it is described in scientific literature convergence is the process of sustainable development and differs in terms of the EU levels for a large and small country. These differences were disclosed in the article just partially by focusing on the issues of the one small country in Eastern Europe.

The biggest limitations lie in the areas of data acquisition and application. Only 6 years of data are used. The calculation methodology is still changing so frequently in Lithuania. Also, the speed of data collection varies a lot too. Some data are not available at the regional level, as they aren't collected by the EU statistical databases. Therefore, data were collected from just one source – the Lithuanian Department of Statistics. Regional data, such as surveys and

expert evaluation, were not used for uniform data collection. However, usage of additional not only macroeconomic but also other external data could provide new useful information.

## References

- Aghion, P., Caroli, E., & Garcia-Penalosa, C. (1999). Inequality and economic growth: the perspective of the new growth theories. *Journal of Economic Literature*, 37(4), 1615-1660. <https://doi.org/10.1257/jel.37.4.1615>
- Arratibel, O., Heinz, F. F., Martin, R., Przybyła, M., Serafini, R., Zumer, T., & Rawdanowicz, L. (2007). *Determinants of growth in the central and eastern European EU member states—a production function approach*. Retrieved from <https://www.ecb.europa.eu/pub/pdf/scpops/ecbocp61.pdf?f431c86b389e0f7e42ed1990150a60e1>
- Asian economic integration report. (2016). *What drives foreign direct investment in Asia and the Pacific?* Asian development bank. Retrieved from <https://www.adb.org/sites/default/files/publication/214136/aeir-2016.pdf>
- Atkočiūnienė, Z. O., Gineitienė, Z., & Žiogelytė, L. (2010). Regionų plėtra: žmogiškųjų išteklių potencialas [Regional development: the potential of human resources]. *Viešasis administravimas*, 1(2), 44-52.
- Bajo-Rubio, O., Díaz-Mora, & C., Díaz-Roldán, C. (2010). Foreign direct investment and regional growth: an analysis of the Spanish Case. *Regional Studies*, 44(3), 373-382. <https://doi.org/10.1080/00343400802508844>
- Batabyal, A. A., & Nijkamp, P. (2013). A multi-region model of economic growth with human capital and negative externalities in innovation. *Journal of Evolutionary Economics*, 23, 909-924. <https://doi.org/10.1007/s00191-012-0293-1>
- Berger, T., & Frey, C. B. (2017). Industrial renewal in the 21st century: evidence from US cities. *Journal of Regional Studies*, 51(3), 404-413. <https://doi.org/10.1080/00343404.2015.1100288>
- Bertola, G., Foellmi, R., & Zweimüller, J. (2006). *Income distribution in macroeconomic models*. Princeton: Princeton University Press.
- Bilan, Y., Mishchuk, H., & Dzhyhar, T. (2017). Human capital factors and remuneration: analysis of relations, modelling of influence. *Business: Theory and Practice*, 18, 208-214.
- Blažević, B., & Jelušić, A. (2006). Modelling regional economic development. *Kybernetes*, 35(7/8), 1190-1202. <https://doi.org/10.1108/03684920610675265>
- Blien, U., Suedekum, J., & Wolf, K. (2006). Local employment growth in West Germany: a dynamic panel approach. *Labour Economics*, 13(4), 445-458. <https://doi.org/10.1016/j.labeco.2006.02.004>
- Bode, E., & Villar, L. P. (2017). Creativity, education or what? On the measurement of regional human capital. *Papers in Regional Science*, 96(S1), S51-S61. <https://doi.org/10.1111/pirs.12180>
- Brauers, W. K. M., Ginevičius, R., & Podvezko, V. (2010). Regional development in Lithuania considering multiple objectives by the MOORA method. *Technological and Economic Development of Economy*, 16(4), 613-640. <https://doi.org/10.3846/tede.2010.38>
- Bucci, A., & La Torre, D. (2009). Population and economic growth with human and physical capital investments. *International Review of Economics*, 56(1), 17-27. <https://doi.org/10.1007/s12232-008-0054-5>
- Burns, T. R., & DeVillé, P. (2017). Socio-economics: the approach of social systems theory in a forty year perspective. *Economics and Sociology*, 10(2), 11-20. <https://doi.org/10.14254/2071-789X.2017/10-2/1>
- Casi, L., & Resmini, L. (2017). Foreign direct investment and growth: can different regional identities shape the returns to foreign capital investments? *Environment and Planning C: Politics and Space*, 35(8), 1483-1508.



- Cuaresma, J. C., Doppelhofer, G., & Feldkircher, M. (2014). The determinants of economic growth in European regions. *Regional Studies*, 48(1), 44-67. <https://doi.org/10.1080/00343404.2012.678824>
- Czaller, L. (2017). Increasing social returns to human capital: evidence from Hungarian regions. *Journal of Regional Studies*, 51(3), 467-477. <https://doi.org/10.1080/00343404.2015.1112898>
- Dollar, D., & Kraay, A. (2002). Growth is good for the poor. *Journal of Economic Growth*, 7(3), 195-225. <https://doi.org/10.1023/A:1020139631000>
- Easterly, W. R. (2001). The middle class consensus and economic development. *Journal of Economic Growth*, 6(4), 317-335. <https://doi.org/10.1023/A:1012786330095>
- Ehrlich, I., & Lui, F. (1997). The problem of population and growth: a review of the literature from Malthus to contemporary models of endogenous population and endogenous growth. *Journal of Economic Dynamics & Control*, 21(1), 205-242. [https://doi.org/10.1016/0165-1889\(95\)00930-2](https://doi.org/10.1016/0165-1889(95)00930-2)
- Florida, R., Mellander, C., & Stolarick, K. (2008). Inside the black box of regional development—human capital, the creative class, and tolerance. *Journal of Economic Geography*, 8(5), 615-649. <https://doi.org/10.1093/jeg/lbn023>
- Galor, O. (2000). Income distribution and the process of development. *European Economic Review*, 44(4-6), 706-712. [https://doi.org/10.1016/S0014-2921\(99\)00039-2](https://doi.org/10.1016/S0014-2921(99)00039-2)
- Gimenez-Nadal, J. I., & Molina, J. A. (2014). Regional unemployment, gender, and time allocation of the unemployed. *Review of Economics of the Household*, 12(1), 105-127. <https://doi.org/10.1007/s11150-013-9186-9>
- Guerrero, M., Urbano, D., & Fayolle, A. (2016). Entrepreneurial activity and regional competitiveness: evidence from European entrepreneurial universities. *The Journal of Technology Transfer*, 41(1), 105-131. <https://doi.org/10.1007/s10961-014-9377-4>
- Iwasaki, I., & Sukanuma, K. (2015). Foreign direct investment and regional economic development in Russia: an econometric assessment. *Economic Change and Restructuring*, 48(3-4), 209-255. <https://doi.org/10.1007/s10644-015-9161-y>
- Kelley, A. C. (1988). Economic consequences of population change in the Third World. *Journal Economic Literature*, 26(4), 1685-1728.
- Kersan-Skabic, I., & Tijanic, L. (2014). Regional determinants of foreign direct investments in Croatia. In *Transylvanian review of administrative sciences SI* (pp. 70-89). Retrieved from [https://apps.webofknowledge.com/full\\_record.do?product=WOS&search\\_mode=GeneralSearch&qid=1&SID=Z2kCMhxz8h934FjShj&page=7&doc=66](https://apps.webofknowledge.com/full_record.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=Z2kCMhxz8h934FjShj&page=7&doc=66)
- Kilijoniene, A., Simanaviciene, Z., & Simanavicius, A. (2010). The evaluation of social and economic development of the region. *Inzinerine Ekonomika-Engineering Economics*, 21(1), 68-79.
- Melo, P. C. (2017). People, places and earnings differentials in Scotland. *Journal of Regional Studies*, 51(3), 389-403. <https://doi.org/10.1080/00343404.2015.1100286>
- Ministry of Finance of the Republic of Lithuania. (2017a). *Forecasting of budgets for municipalities and state budget grants*. Retrieved from [http://finmin.lrv.lt/uploads/finmin/documents/files/LT\\_ver/Veiklos\\_sritys/Biud%C5%BEetas/Biud%C5%BEeto\\_vykdymas/Savivaldybi%C5%B3\\_biud%C5%BEetai/Pagrindiniai\\_finansiniai\\_rodikliai/Internetui%202016%20prognozuojamos%20pajamos\\_1\\_lentele.pdf](http://finmin.lrv.lt/uploads/finmin/documents/files/LT_ver/Veiklos_sritys/Biud%C5%BEetas/Biud%C5%BEeto_vykdymas/Savivaldybi%C5%B3_biud%C5%BEetai/Pagrindiniai_finansiniai_rodikliai/Internetui%202016%20prognozuojamos%20pajamos_1_lentele.pdf)
- Ministry of Finance of the Republic of Lithuania. (2017b). *Debt of municipalities*. Retrieved from <http://finmin.lrv.lt/lt/veiklos-sritys/biudzetas/biudzeto-vykdymas/savivaldybiu-biudzetai/savivaldybiu-skolinimosi-limitai/2016-m-3/2016-m-rugsejo-30-d>
- Mirrlees, J. A. (1971). Exploration in theory of optimum income taxation. *Review of Economic Studies*, 38(114), 175-208. <https://doi.org/10.2307/2296779>
- Moretti, E. (2004). Human capital externalities in cities. *Handbook of Regional and Urban Economics*, 4, 2243-2291. [https://doi.org/10.1016/S1574-0080\(04\)80008-7](https://doi.org/10.1016/S1574-0080(04)80008-7)

- National Land Service under the Ministry of Agriculture of the Republic of Lithuania. (2017). Retrieved from <http://www.nzt.lt/>
- Nowak, A., & Wójcik, E. (2015). Regional differentiation of production factors productivity in rural farms of Poland. *Zagadnienia Doradztwa Rolniczego*, 2, 43-55.
- Pede, V. O., Florax, R. J., & De Groot, H. L. (2007). Growth and technological leadership in US industries: a spatial econometric analysis at the state level. In *2007 Annual Meeting, July 29-August 1* (pp. 1963-1997). Portland, Oregon TN, 9691.
- Pelkonen, A., & Nieminen, M. (2016). How beneficial is a knowledge-based development strategy for peripheral regions? A case study. *European Planning Studies*, 24(2), 364-386. <https://doi.org/10.1080/09654313.2015.1047740>
- Perotti, R. (1996). Growth, income distribution, and democracy: what the data say. *Journal of Economic Growth*, 1(2), 149-187. <https://doi.org/10.1007/BF00138861>
- Picci, L. (1999). Productivity and infrastructure in the Italian regions. *Giornale Degli Economisti e Annali di Economia*, 58(3-4), 329-353.
- Pompili, T. (1994). Structure and performance of less developed regions in the EC. *Regional Studies*, 28(7), 679-694. <https://doi.org/10.1080/00343409412331348576>
- Quah, D. T. (1996). Twin peaks: growth and convergence in models of distribution dynamics. *Economic Journal*, 106(437), 1045-1055. <https://doi.org/10.2307/2235377>
- Rakauskiene, O. G., & Strunz, H. (2016). Approach to reduction of socioeconomic inequality: decrease of vulnerability and strengthening resilience. *Economics and Sociology*, 9(4), 243-258. <https://doi.org/10.14254/2071-789X.2016/9-4/15>
- Rebelo, S. T. (1991). Long-run policy analysis and long-run growth. *Journal of Political Economy*, 99(3), 500-521. <https://doi.org/10.1086/261764>
- Simionescu, M. (2016). Competitiveness and economic growth in Romanian regions. *Journal of Competitiveness*, 8(4), 46-60.
- Simionescu, M., Lazányi, K., Sopková, G., Dobeš, K., & Balcerzak, A. P. (2017). Determinants of economic growth in V4 countries and Romania. *Journal of Competitiveness*, 9(1), 103-116. <https://doi.org/10.7441/joc.2016.04.03>
- Statistics Lithuania. (2017). Retrieved from <https://osp.stat.gov.lt/statistiniu-rodikliu-analize?region=all#/>
- Statistics. (2017). *Spearman's rank order correlation*. Retrieved from <https://statistics.laerd.com/statistical-guides/spearman's-rank-order-correlation-statistical-guide-2.php>
- Tournemaine, F. (2007). Can population promote income per-capita growth? A balanced perspective. *Economics Bulletin*, 15(8), 1-7.
- Tselios, V. (2009). Growth and convergence in income per capita and income inequality in the regions of the EU. *Spatial Economic Analysis*, 4(3), 343-370. <https://doi.org/10.1080/17421770903114711>
- Włodarczyk, J. (2017). Innovations and income inequalities – a comparative study. *Journal of International Studies*, 10(4), 166-178. <https://doi.org/10.14254/2071-8330.2017/10-4/13>

## APPENDIXES

**Appendix 1. Ranking of Lithuanian Cities by selected groups of factors, FDI, material investment and total investment (made by authors)**

Cities Municipalities of Lithuania	Priorities for the groups of factors					Total priority for the groups of factors	Priorities for FDI	Priorities for material investment	Priorities for total investment
	(1)	(2)	(3)	(4)	(5)				
Vilnius	3	1	1	1	1	1	1	2	1
Alytus	12	3	8	9	11	8	7	12	10
Birstonas	8	10	12	10	9	12	12	8	11
Druskininkai	10	10	10	9	9	10	8	6	6
Kaunas	5	7	2	3	1	3	3	7	4
Klaipėda	2	3	4	4	3	2	2	3	2
Marijampolė	11	12	11	8	6	10	10	10	11
Neringa	1	6	3	2	6	3	5	1	3
Palanga	3	2	7	7	3	5	6	5	5
Panevezys	8	5	6	6	6	7	4	11	7
Siauliai	7	9	5	5	3	6	9	9	9
Visaginas	6	7	9	11	11	9	11	4	7

## Appendix 2. Ranking of Lithuanian District Municipalities by selected groups of factors, FDI, material investment and total investment (made by authors)

District Municipalities of Lithuania	Priorities for the groups of factors					Total priority for the groups of factors	Priorities for FDI	Priorities for material investment	Priorities for total investment
	(1)	(2)	(3)	(4)	(5)				
Akmene	10	47	37	29	25	33	6	9	6
Alytus	18	26	20	36	25	28	13	3	8
Anyksciai	26	15	29	33	25	30	33	36	35
Birzai	33	22	32	37	25	34	17	41	28
Ignalina	24	29	41	46	25	43	26	35	30
Jonava	29	4	33	20	25	22	30	8	16
Joniskis	23	40	45	38	13	40	42	22	33
Jurbarkas	32	3	28	26	25	24	41	40	42
Kaisiadorys	15	40	25	15	3	15	31	19	25
Kaunas district	3	6	2	2	2	2	14	5	11
Kedainiai	6	11	14	5	25	6	4	11	7
Kelme	37	39	31	42	13	42	39	44	43
Klaipeda district	2	2	3	1	3	1	3	2	1
Kretinga	20	5	6	6	5	4	22	18	18
Kupiskis	41	34	35	39	25	44	27	38	34
Lazdijai	42	4	40	47	25	37	46	43	47
Mazeikiai	13	6	10	10	25	8	1	6	2
Moletai	38	13	17	32	13	23	32	42	39
Pakruojis	7	45	24	21	25	27	10	17	12
Panevezys district	8	14	9	13	7	5	25	16	19
Pasvalys	12	23	46	41	13	32	23	31	26
Plunge	19	19	12	7	7	9	19	14	13
Prienai	35	17	19	22	13	18	37	48	45
Radviliskis	17	6	38	25	7	14	28	21	24
Raseiniai	44	26	26	16	13	29	15	30	22
Rokiskis	47	19	39	28	25	38	24	33	27
Skuodas	45	47	21	40	25	46	29	47	40
Sakiai	16	33	42	35	25	35	20	26	23
Salcininkai	48	31	30	44	25	47	45	45	48
Siauliai district	14	30	23	11	5	12	21	13	15

## End of Appendix 2

District Municipalities of Lithuania	Priorities for the groups of factors					Total priority for the groups of fac- tors	Priori- ties for FDI	Priori- ties for mate- rial invest- ment	Priori- ties for total invest- ment
	(1)	(2)	(3)	(4)	(5)				
Silale	36	44	13	27	13	31	48	39	46
Silute	30	24	11	19	25	21	16	25	20
Sirvintos	31	32	7	30	7	19	40	32	37
Svencionys	27	36	36	34	25	39	9	24	14
Taurage	11	6	15	17	13	7	18	20	17
Telsiai	40	34	8	14	7	16	34	28	31
Trakai	4	26	5	4	25	10	11	7	10
Ukmerge	39	10	22	23	13	20	12	29	21
Utena	43	1	18	12	13	13	5	12	9
Varena	22	17	27	24	25	25	35	27	32
Vilkaviskis	46	19	47	45	4	41	38	46	44
Vilnius district	1	12	1	3	1	3	8	4	4
Zarasai	21	42	43	43	25	45	36	37	38
Elektrenai	5	15	16	8	25	11	7	1	3
Kalvarijos	34	46	44	48	13	48	44	34	41
Kazlu Ruda	25	37	34	18	7	26	2	10	5
Pagegiai	9	42	48	31	25	36	43	15	29
Rietavas	28	38	4	9	25	17	47	23	36