MEASURING REGIONAL DEVELOPMENT DISPARITIES: SOME METHODOLOGICAL CONTRIBUTIONS AND EVIDENCE FROM ARMENIA AND SERBIA

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Abstract

There are manifestations of regional development disparities in almost every country, but this phenomenon is especially dangerous in those countries that have only one "center of gravity". Significantly more developed capital can transform itself from "center of gravity" to a "black hole" by emptying the potential of the regions. To prevent such a destructive scenario, it is firstly necessary to disclose the roots of regional development disparity, and the reasons for its subjective perception. Without these steps, any intervention, policy, or measure taken or implemented by the state can aggravate further disproportion or at least be ineffective. Only after discovering the above-mentioned roots, it will become possible to develop a comprehensive strategy for overcoming regional disproportionate development and derive from it a complex of effective measures. All these goals are intended to be achieved within the framework of the research funded by the Science Committee of the Ministry of Education, Science, Culture and Sports of the Republic of Armenia within the support program for young researchers (project code: 19YR-5B038). This paper focuses mainly on discussion of regional disparity measurement tools and development of a tool appropriate not only for accurate measurements, but also for serving as a motivational tool for authorities. Calculations have been made for Armenia and Serbia, taking into consideration several key similarities of economic, social, and cultural nature, which have significantly influenced the perception of local governance and role of communities, as well as the mindset toward socioeconomic processes in general.

Keywords: regional development, regional disparity, measurement, development indicator, governance
JEL classification: H700, H770, H830, R500, R580

1. Introduction

The disproportionate development of territories, although it may sound disturbing, is a natural phenomenon: at least the territories have different natural resources, conditions, opportunities, and threats, which historically determine the quantitative and qualitative progress of human resources and technologies, the development of infrastructures and institutions. The development of territories, of course, can be cyclical, but even in that case only some people will live on wealth, although being interchanged. Therefore, measured, justified, moderate and at the same time targeted intervention is needed to ensure a balanced territorial development. Thus, the fact that regional disparity is a natural phenomenon probably forces us to study not only the obstacles to proportionate development (which is a rather widespread approach among public administration bodies and researchers), but also the reasons for the development disparity.

The United Nations Development Program (UNDP) annually publishes the Human Development Index (HDI) indices for almost all countries. According to the 2018 report, 37 countries (including Armenia) are in the range of 0.723 to 0.796 by HDI. The total population of these countries exceeds 2 billion 236 million, making about 30 percent of the world's population (UNDP 2018). The mentioned range shows the diversity of HDI values of the Armenian regions (marzes and Yerevan) according to the database created by the Radboud University Nijmegen, the Netherlands (Institute for Management Research, n.d.). Thus, one can say that the territorial diversity of human development in Armenia corresponds to the diversity of human development of around 30% of the world's population (Table 1).

Table 1. HDI of Regions of Armenia (2017)

Region	HDI	Countries with similar HDI value
Yerevan	0.796	Seychelles (0.797), Costa Rica (0.794)
Kotayk	0.760	Venezuela (0.761), Brazil (0.759)
Armenia	**0.756**	**Lebanon (0.757), Republic of North Macedonia (0.757)**
Syunik	0.755	Thailand (0.755), Algeria (0.754)
Shirak	0.753	China (0.752), Ecuador (0.752)
Vayotz Dzor	0.747	Colombia (0.747), Saint Lucia (0.747)
Aragatsotn	0.739	Fiji (0.741), Mongolia (0.741)
Tavush	0.735	Jordan (0.735), Tunisia (0.735)
Ararat	0.730	Jamaica (0.732)
Lori	0.726	Tonga (0.726)
Armavir	0.724	Saint Vincent and the Grenadines (0.723)
Gegharkunik	0.723	Saint Vincent and the Grenadines (0.723)

Source: Institute for Management Research, n.d.

Though all the regions of Armenia are currently considered to be of a high level of development (according to the UNDP methodology), the variety of HDI values is 73 points (maximal value of 0.796 in Yerevan and minimal value of 0.723 in Gegharkunik), which is a significant range. The gap between the capital and the marzes is especially significant: Yerevan is, in fact, very close to a very high level of development (threshold: 0.800), whereas most regions are closer to the medium human development zone (upper threshold: 0.700).

The range of values of sub-national HDI is not that huge in Serbia. In 2016-2019, values from 0.786 to 0.799 may be observed in Sumadija and West Serbia, South and East Serbia, and Vojvodina (Institute for Management Research, n.d.). However, those regions have only a below average HDI, as the values for Belgrade were 0.822-0.834, which means, that as in case of Armenia, the gap between the Serbian capital and the regions is especially significant.

A very simple, but extremely inclusive indicator of regional development disparities is the average market price of a 1 square meter area in apartment buildings (Table 2).

Table 2. Average Market Prices of Area in Apartment Buildings in Towns and Administrative Districts of Yerevan (as of November 2018)

Town or Administrative District	Price per 1 square meter, drams	Town or Administrative District	Price per 1 square meter, drams
Kentron, Yerevan	563800	Spitak, Lori	98200
Arabkir, Yerevan	385200	Berd, Tavush	95800
Davtashen, Yerevan	297000	Vedi, Ararat	95500
Kanaker-Zeytun, Yerevan	285600	Armavir, Armavir	94700
Tsaghkadzor, Kotayk	285000	Vayk, Vayots Dzor	87200
Avan, Yerevan	261000	Gyumri, Shirak	87000
Achapnyak, Yerevan	260200	Sevan, Gegharkunik	84600
Erebuni, Yerevan	257000	Sisian, Syunik	83500
Shengavit, Yerevan	253200	Ararat, Ararat	82600
Nor-Nork, Yerevan	248600	Aparan, Aragatsotn	82100
Malatia-Sebastia, Yerevan	246200	Vanadzor, Lori	78800
Nubarashen, Yerevan	170000	Charentsavan, Kotayk	74500
Abovyan, Kotayk	164500	Talin, Aragatsotn	73200
Goris, Syunik	137500	Stepanavan, Lori	67500
Nor Hachn, Kotayk	128500	Metsamor, Armavir	66500
Vagharshapat, Armavir	127800	Hrazdan, Kotayk	62500
Martuni, Gegharkunik	123000	Noyemberyan, Tavush	62300
Yeghegnadzor, Vayots Dzor	121900	Artik, Shirak	61000

Town or Administrative District	Price per 1 square meter, drams	Town or Administrative District	Price per 1 square meter, drams
Yeghvard, Kotayk	120600	Ayrum, Tavush	60200
Ijevan, Tavush	116650	Tashir, Lori	58600
Dilijan, Tavush	114000	Vardenis, Gegharkunik	56500
Ashtarak, Aragatsotn	111500	Gavar, Gegharkunik	54200
Masis, Ararat	108050	Maralik, Shirak	51300
Jermuk, Vayots Dzor	107500	Alaverdi, Lori	51000
Artashat, Ararat	107200	Chambarak, Gegharkunik	40500
Kapan, Syunik	106500	Akhtala, Lori	38300
Kajaran, Syunik	104200	Shamlugh, Lori	28300
Meghri, Syunik	102500	Tumanyan, Lori	23500
Byureghavan, Kotayk	99300	Dastakert, Syunik	21400

Source: Statistical Committee of the Republic of Armenia 2018c

The picture shown in Table 2 generally corresponds to the description of disproportional development of the regions by HDI. Only Tsaghkadzor can compete with Yerevan in fact. The disparity becomes even more evident by the fact that the prices for apartments in the "cheapest" district of Yerevan are about two times higher than in Gyumri, which is considered to be the second city of the country (170 thousand and 87 thousand drams per 1 square meter respectively). If comparing the highest and lowest values presented in Table 2 to evaluate the distance between the poles, the scale is about 26:1 (the real difference is several times greater if considering real estate market prices in rural areas). The same scale is about 9:1 in Serbia, if comparing prices in the most expensive municipality of Savski venac in Belgrade and the "cheapest" town Bor in Borska oblast (Republic Geodetic Authority of the Republic of Serbia, n.d.).

It is noteworthy that even poverty is quantitatively and qualitatively disproportionate. Particularly, in 2017 only 27.7% of the poor population of Armenia lived in Yerevan (32% in other cities and 40.3% in rural areas), whereas the residents of the capital make up more than 36% of the population. As for the quality of poverty, the poverty depth in Yerevan is 3.6%, while in other cities and rural areas it is 4.7% and 4.8% respectively (Statistical Committee of the Republic of Armenia 2018b).

It seems that the regional disparity is very much evident, and the factors making it should have been properly studied and fully disclosed long ago, and the public administration system should have overcome the apparent disproportionality by a set of measures. However, in practice, neither Armenia, nor Serbia has formulated a concept of regional development and has launched a clearly targeted strategic approach yet. There are several documents, such as the Territorial Development Strategy of the Republic of Armenia for 2016-2025 (in which the provision of proportion is included in the defined vision) or the Operational Program of Territorial Development of the Republic of Armenia for 2018-2020, but one single, clear, and utilized approach is essentially missing (Government of the Republic of Armenia 2016, 2017). The proportionate development of territories is mentioned among programs and priorities listed on the official website of the Ministry of Territorial Administration and Infrastructure of the Republic of Armenia (n.d., 2013), but only programs compiled in 2013 could be found in grounds. Perhaps one of the reasons for such a mess is the lack of a united strategic approach and an ideology.

The situation is not much better in Serbia. After the expiration of the Regional Development Strategy of Serbia 2007-2012, there has been a lull in terms of the regional aspect of development. The adoption of the National Plan of Regional Development for Serbia, and in particular the regional policy action plan, is delayed. With the closure of the Ministry of Economy and Regional Development, regional issues are being neglected in domain of public policies. In doing so, regional disparities in Serbia are among the largest in Europe. In this context, it is worrying that public policy makers do not attach adequate importance to the preparations for the opening of Chapter 22 (tackling with regional development issues) in the process of the European Union (EU) accession. Therefore, the Republic of Serbia is using EU Cohesion Policy funds insufficiently to ensure a balanced regional development, which is its constitutional obligation. Occasional and inconsistent

activities aimed at supporting the development of underdeveloped areas only produce sporadic and insufficiently sustainable results (Rikalović, and Molnar 2020, 145).

2. Methods

2.1. Common methods of measuring regional development disparities: advantages and disadvantages

Regional disparity is a ubiquitous issue. It exists in almost all countries to different extents, and almost the whole world strives to combat it. However, before developing policies and actions, and before allocating resources to the "holy war" against the regional disparity, it is essential to answer a simple question: what regional development disparity is, or what we try to reduce. It seems that these are very simple questions, but no answer, clear and acceptable to all, exists yet.

It is logical to use the same indicators while measuring disparity, setting goals, planning concrete actions, and evaluating achievements.

Gross domestic product (GDP) per capita in a region compared to GDP per capita in the country is used as an indicator of proportionality in the "Republic of Armenia 2014-2025 Strategic Program of Prospective Development" (Government of the Republic of Armenia 2014). Moreover, predictions have been made and goals have been set based on the factual figures in 2012 and previous years (Table 3).

Table 3. GDP per capita in regions compared to GDP per capita in Armenia by base scenario of development and by goals of policy scenario

	Factual %	Base scenario of development, %				Policy scenario, %			
	2012	2015	2017	2021	2025	2015	2017	2021	2025
Yerevan	151.7	151.5	152.4	154.0	155.3	136.0	127.6	123.5	121.8
Aragatsotn	82.6	81.7	80.1	77.1	74.1	79.0	79.3	84.6	92.0
Ararat	71.1	71.4	71.0	70.2	69.7	74.3	81.1	84.1	87.1
Armavir	67.0	66.5	65.2	62.8	60.6	68.3	74.6	77.4	80.2
Gegharkunik	69.7	68.7	66.9	63.3	60.0	75.9	83.3	85.6	87.1
Lori	52.7	53.1	53.2	53.4	53.7	58.3	69.3	91.5	100.5
Kotayk	78.4	79.3	80.0	81.5	83.1	83.4	90.2	91.9	93.5
Shirak	59.7	59.3	58.5	56.9	55.4	61.4	70.4	79.7	85.6
Syunik	133.5	136.7	139.0	143.8	149.1	130.6	125.8	119.5	115.8
Vayotz Dzor	57.7	57.3	56.7	55.4	54.2	62.7	71.6	79.6	83.3
Tavush	62.6	61.8	60.9	59.0	57.2	68.2	78.3	81.2	84.2

Source: Government of the Republic of Armenia 2014

These predictions are worth comparing to factual figures (Table 4).

Table 4. GDP per capita in regions compared to GDP per capita in Armenia (2015-2018)

	2015, %	2016, %	2017, %	2018, %
Yerevan	151.8	151.5	150.8	148.9
Aragatsotn	78.6	80.5	73.4	74.4
Ararat	78.5	83.4	79.2	81.3
Armavir	74.2	72.4	68.8	71.1
Gegharkunik	55.9	51.9	52.2	50.6
Lori	68.0	66.8	67.6	56.6
Kotayk	71.7	70.4	73.6	80.3
Shirak	60.6	58.4	53.7	57.6
Syunik	109.0	112.5	129.4	138.0

	2015, %	2016, %	2017, %	2018, %
Vayotz Dzor	71.5	85.9	101.3	75.8
Tavush	54.5	50.6	51.2	54.9

Source: Statistical Committee of the Republic of Armenia, n.d.b

Thereby the Armenian government had predicted that the disparity would deepen, but in case of implementation of policy and planned actions, the differences of GDP per capita values among regions would be significantly reduced. In other words, without intervention the regions would continue "moving away", while with the planned intervention the regions would "close in". The factual trends, however, differed from both predicted and planned values (Figure 1).

Figure 1: GDP per capita in regions compared to GDP per capita in Armenia: predictions and plans of the government and factual figures (2015-2018)
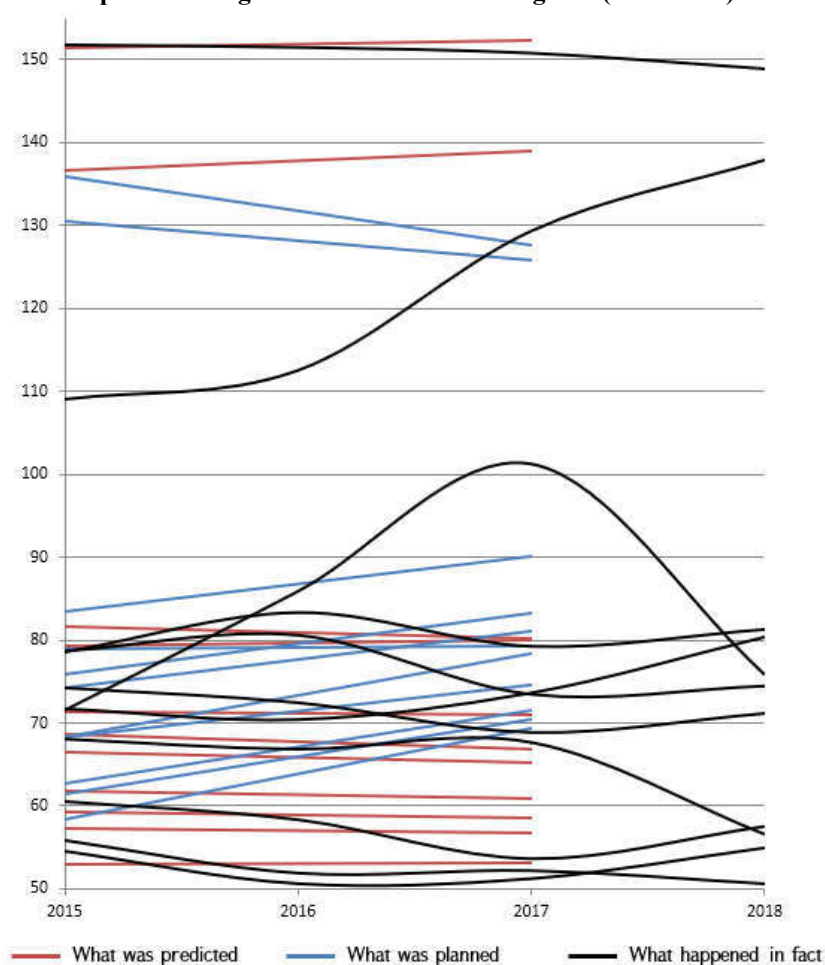

Source: Created by authors based on data from Republic of Armenia 2014-2025 Strategic Program of Prospective Development and Statistical Committee of the Republic of Armenia

Of course, the factors of the displayed tendencies may be studied and understood. For example, maybe some population has moved from regions to the capital, or maybe some economic processes have affected regions in different ways depending on the structure of regional economy, or maybe the tendencies have been resulted by some changes in just one of the regions. Many hypotheses may be listed, but in this case the approval of such hypotheses is not important, as it becomes obvious that the indicator used by the government brings no opportunity of planning and implementing targeted actions. It shows neither success nor failure.

Several other indicators of regional development disparity are used in international practice. Perhaps the most widely used ones are designed on the basis of the HDI. Radboud University (Nijmegen, the Netherlands), in particular, uses the Subnational Human

Development Index, and a database has been created by including data on 1765 regions of 187 countries (Image 1).

Image 1: Subnational HDI by ventiles (2018)
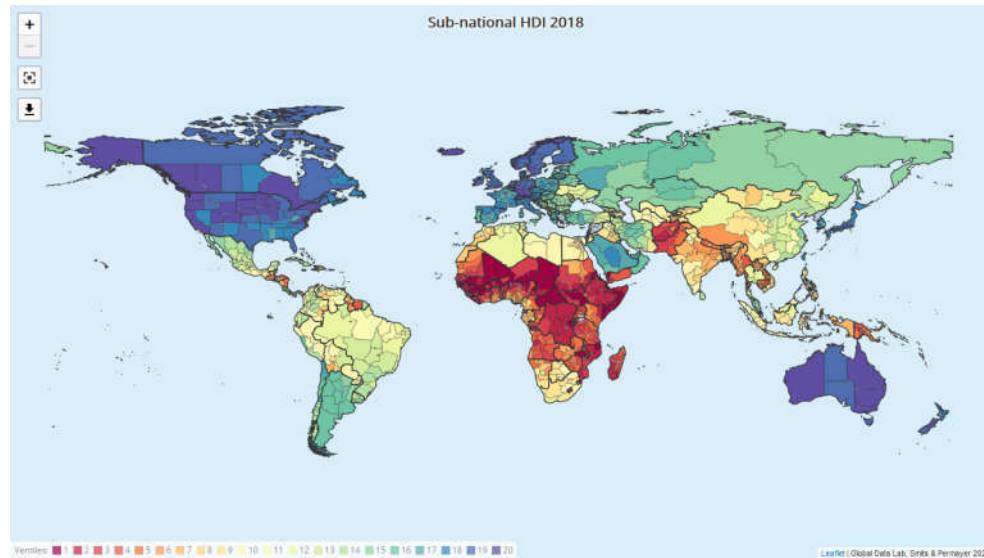
Source: Institute for Management Research, n.d.

The mentioned database obviously makes it possible to draw some general picture of regional disparity in the world and in particular countries. For instance, as it is known and may also be concluded from the Subnational HDI values, China, Burkina Faso, Nigeria, Ethiopia have very disproportionately developed regions (Image 2).
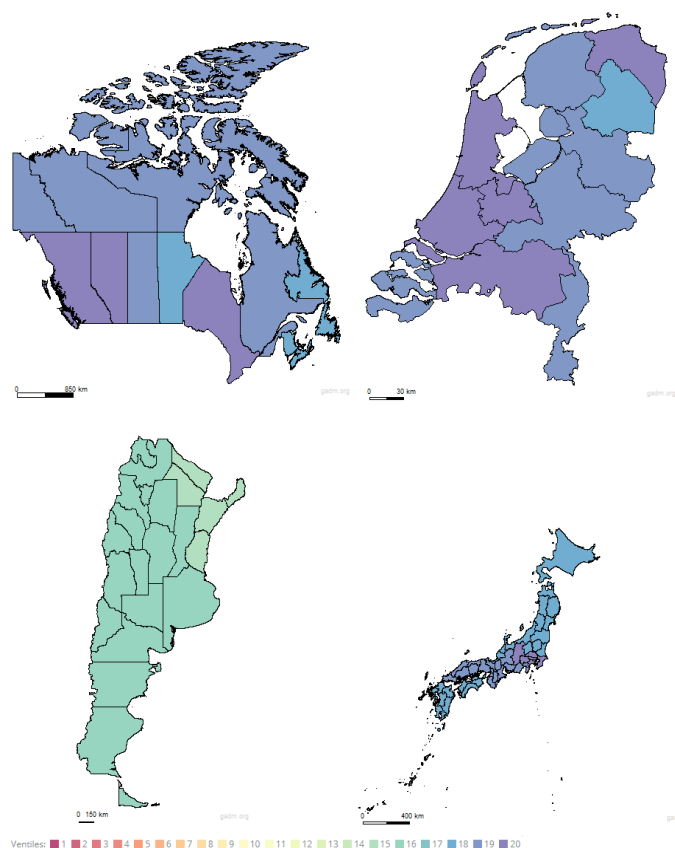
Image 2: Subnational HDI in Burkina Faso, China, Nigeria, and Ethiopia by ventiles (2018)
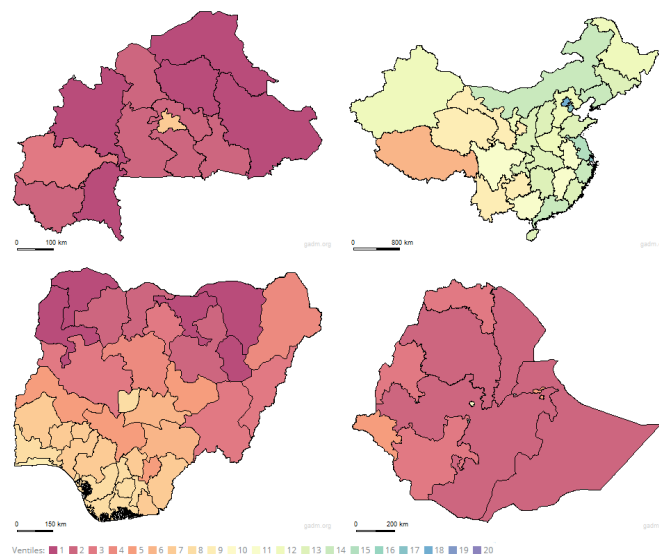
Source: Compiled by authors based on maps of the Database of Global Administrative Areas and data from Global Data Lab of the Institute for Management Research

If not taking into consideration microstates and countries with very small numbers of administrative division units, then the Netherlands, Canada, Japan, and Argentina are among countries with the most proportionally developed regions by the same approach applied (Image 3).

Image 3: Subnational HDI in Canada, the Netherlands, Argentina, and Japan by ventiles (2018)

Source: Compiled by authors based on maps of the Database of Global Administrative Areas and data from Global Data Lab of the Institute for Management Research

Besides visualizing disparity, the database of Subnational HDI values provides ground for calculating several more measurable indicators of disparity, such as the difference of Subnational HDI values of the most developed and the least developed regions of a country, or variance-to-mean ratio (Table 5).

Table 5. The range and variance-to-mean ratio of Subnational HDI values in different countries (2018)

Range (maximal – minimal)		Variance-to-mean ratio (%)	
Countries with smallest range / variance-to-mean ratio			
Libya	0.013	Libya	0.77
Ukraine	0.017	Kuwait	0.96
Kuwait	0.019	Ukraine	0.99
Barbados	0.021	Barbados	1.12
Bosnia and Herzegovina	0.029	Trinidad and Tobago	1.36
Countries with smallest range / variance-to-mean ratio with 10 or more regions			
The Netherlands	0.050	Argentina	1.94
Canada	0.055	The Netherlands	1.99
Japan	0.055	Japan	1.99
Argentina	0.061	Germany	1.99
Greece	0.063	New Zealand	2.07
Countries with largest range / variance-to-mean ratio			
China	0.359	Chad	22.57
Burkina Faso	0.341	Eritrea	20.65
Nigeria	0.334	Mali	18.69
Ethiopia	0.280	Nigeria	18.53
Eritrea	0.274	Somalia	18.44
Mali	0.271	Ethiopia	18.26
Chad	0.265	Burkina Faso	17.92
Guinea	0.262	The Gambia	17.69
Papua New Guinea	0.261	Guinea	17.41
Cameroon	0.259	Central African Republic	16.82
Armenia	**0.076**	**Armenia**	**3.21**
Serbia	**0.042**	**Serbia**	**2.06**

The success in overcoming regional development disparities may be evaluated by the number of years needed for all the regions of a country to achieve the level of the most developed region. For example, if taking 1991 as a base year, the highest Subnational HDI was in Yerevan – 0.672, and only in 2007 all the Armenian regions had achieved that level. Thus, 16 years were needed. It is worth comparing countries of Eastern Europe by this indicator, as the "transformation" period in those countries started almost in the same years (Figure 2).

Figure 2: Years needed for achieving the highest Subnational HDI of 1991 in all regions in some countries of Eastern Europe
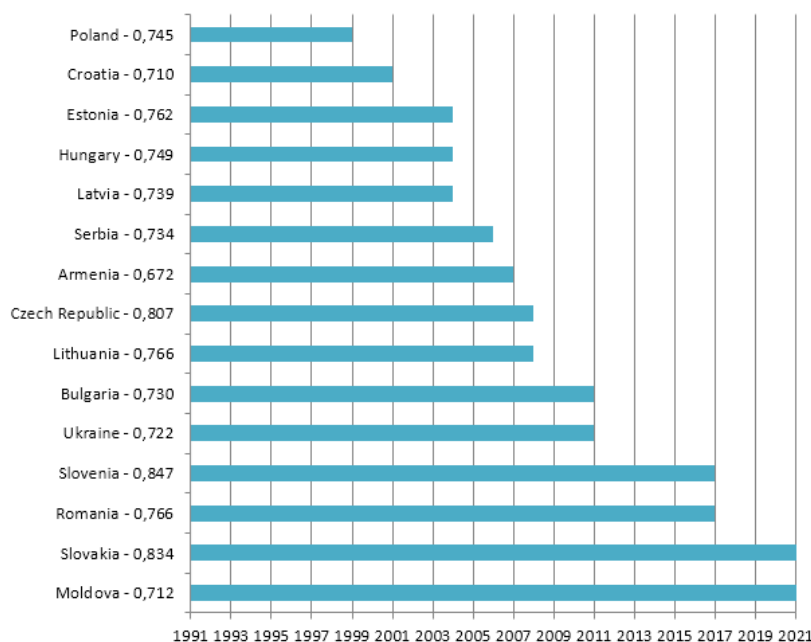
Source: Created by authors based on data from Global Data Lab of the Institute for Management Research

For sure, available databases allow researchers to develop many statistical solutions, which can be much more "elegant" than the presented calculations (Pourmohammadi, Valibeigi, and Sadrmousavi 2014; Lukis Panjawa, Rizky Samudro, and Maqnus Soesilo 2018; Guastella, and Timpano 2010). However, such statistical solutions, although reflecting regional disparities, have at least one obvious and important shortcoming: it is difficult to set goals for those indicators and to connect them to the activities of state and local authorities.

The same shortcoming exists in the case of the Gini index, which is used by several organizations and individuals to evaluate regional development disparities. For example, the Organization for Economic Co-operation and Development (OECD) tries to measure the most differentiated factors of welfare by Gini index and some other indicators (Theil entropy index, Malmquist index, and others). According to OECD (2016) studies, regional development disparity is mostly significant in such fields as security, incomes, employment, environment, and GDP per capita. Conclusions of this kind are certainly very valuable, and they indicate the fields with need for additional attention. However, those indicators do not guide decision-makers anyhow. Besides that, OECD countries have many similarities, and the used methods do not consider the fact that different perceptions of development and welfare exist in different countries and regions. Employment is a priority in one region, and environment is a priority in another. These perceptions should be taken into account in all the cases when multi-dimensional evaluation is carried out. At this point we would avoid calling those perceptions subjective, as an existence of some regularity cannot be excluded.

However, in conditions of measurability issues in social sciences, at least hundreds of attempts to measure disparity, and the replication crisis in science, a simpler approach of one-dimensional evaluation became quite attractive and perhaps even justified (Fidler, and Wilcox 2018). Evaluations based on education, employment, incomes, salaries, poverty rates are

among such approaches (Korres, and Kokkinou 2011; Correia, and Alves 2017; Prodromidis 2012; Diniz, and Upadhyay 2010). Demographic indicators are also used, such as natural growth, migration figures, etc. Each of these has some specific logic (Wilkinson, and Pickett 2010; Lamande et al., n.d.; Novkovska 2017). For example, the education level describes potential of development, unemployment describes compliance of opportunities to needs in a region, incomes, salary, and poverty describe regional resources and efficiency of their use, natural population growth and especially migration may describe the overall attractiveness of regions. Nevertheless, the comprehensiveness of evaluation is endangered almost for sure if being guided by any one-dimensional approach.

Therefore, many methods have been developed to evaluate regional development disparity, but the applicability of those methods is worth some critical treatment at least. Having no desire to overburden researchers, authorities, or anybody else with one more method with questionable usability, first we find it necessary to outline what characteristics an indicator of regional development disparity should have, and only after that consider designing such an indicator.

## 2.2. Requirements for methods of measuring regional development disparities

Keeping in mind the idea of designing a measurement tool ideal enough for being implemented as a key performance indicator for authorities responsible for regional development and its parity, it is essential for an indicator or complex of indicators to be:

- Inclusive. An indicator should take into consideration all the aspects or dimensions of regional development. On the one hand, an absolute inclusiveness might be ensured: all economic, social, environmental, and other factors should be taken into consideration. On the other hand, however, if all factors are included, it will become necessary to determine the weight of each factor. Therefore, it is reasonable to consider an indicator inclusive if all components of development important to the local population are taken into account.
- Accurate. An indicator shouldn't result in false judgements or wrong activities. For instance, no decrease of disparity should be recorded if there was a decrease in the most developed region. In other words, an indicator should clearly differentiate positive and negative trends. This is also important while planning activities and making decisions.
- Quantitative. It should be possible to measure an indicator quantitatively, which would make evaluation of progress, comparisons, and setting of measurable goals feasible. Moreover, an indicator should be insensitive to various influences of subjective nature.
- Available. Data needed for measurements should be available. No huge new efforts should be required each time measurements are done. For example, regular pricey surveys are not acceptable.
- Understandable. The meaning of an indicator should be clear to policymakers and the public. For example, what would happen if asking a random citizen or even a head of community about the figures of HDI in their region, or ask them to interpret its value of 0.750? Being understandable is necessary for making the results of decrease in disparity visible and tangible, as well as for guiding the public in its efforts of regional development.
- Sensitive. Decreasing regional disparity is not a self-propelled process: many resources are allocated to it. Those resources are managed mostly by state and local authorities (although there are many cases of private organizations or individuals taking remarkable roles in the development of certain regions). It should be visible for those authorities how their decisions and activities affect an indicator (Ziaril, and Mohammadi 2016). Surely, it is not mandatory for that effect to be direct, but it should be possible to evaluate the indirect impact as well. Thus, the content of an indicator should be sensitive to decisions made and activities carried out.

Ideally, if all the mentioned characteristics are ensured, it becomes real to evaluate activities of officials responsible for decreasing regional development disparities through the same indicator.

Considering the presented characteristics as the standard and guideline for methods of evaluation of regional development disparity (Figure 3), a tool is to be designed, which can reliably serve as a ground for recording, evaluating, and overcoming disparity with its content, measurability, and usability.

Figure 3: The suggested standard of methods of evaluation of regional development disparity
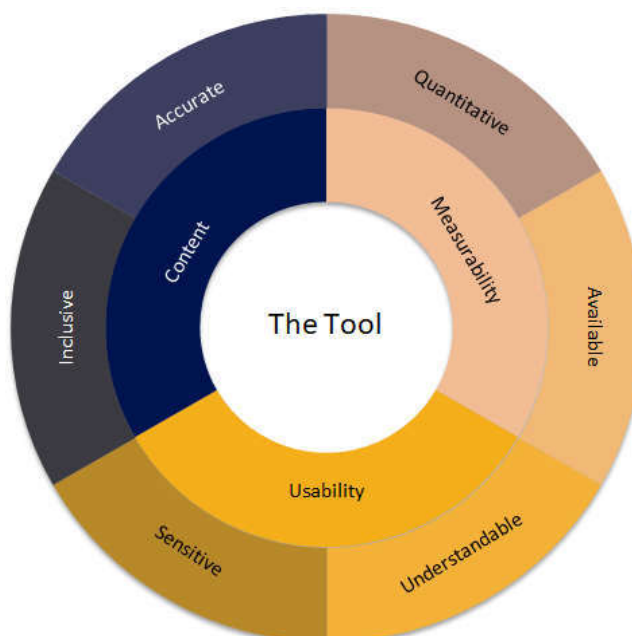
Source: Created by authors

The first step could perhaps be the identification of most inclusive descriptors. What does it include to be a developed region? Overall, the threshold of being developed is when a proper level of quality of life may be ensured in a region without significant difficulties, and it is mostly ensured in fact. In other words, in a region there should be:

- Sufficient infrastructure ensuring access to goods and services needed for the good quality of life
- Conditions and opportunities for generating legal incomes
- Conditions contributing to the stability of conversion of incomes into goods and services

Sufficient infrastructure covers availability of roads and necessary transportation flows, trade and various services, and any general features of the area which are important for locals (Constantin, Nastaca, and Geambasu 2021). Each component of sufficient infrastructure may be separately evaluated with some specific indicators. However, all those components affect real estate prices in a region. From this point of view, real estate prices (in particular, prices of residential properties) are perhaps the most inclusive indicator. Moreover, market prices are almost impersonal, as being resulted by numerous deals. Of course, there are various preferences among actors of real estate markets, but if in case of other indicators some weighting of preferences is needed, then in case of market prices the preferences are already weighted through market mechanisms. Therefore, residential property prices are a good indicator of sufficient infrastructure. However, it is mostly true for urban areas, while in rural areas the real estate market may perform with a bit different logic.

Conditions and opportunities for generating legal incomes refer to forming incomes in a region through labor, entrepreneurship, or any other legal activity. In other words, there should be a proper number of jobs with proper remuneration in a region, as well as there should be a capital market developed enough for ensuring efficiency of savings. Incomes of the population, poverty rate, jobs, employment rate, unemployment rate, average salary, investments, and many other indicators may be considered for this domain (Hirobe 2014, 2020; Alexiadis, and Ladias 2011; Sokolowicz 2011). The most understandable one is

perhaps average salary. As some components of the capital market are not well developed in many countries (including Armenia), and incomes generated through the capital market are mostly relevant to people with higher incomes, the average salary becomes a more important indicator for evaluation of regional development. However, depending on the extent of distribution, the average salary may reflect the opportunities for forming incomes not accurately. Though it seems that the average salary should be complemented with other indicators, the tandem with residential property prices reflects the distribution of incomes, as higher rates of unemployment or poverty usually negatively affect the property prices in a region, for example, through increase of the crime rate: analyses of crime rates and residential property prices outside the center of 223 cities show moderate correlation (Numbeo, n.d.b, n.d.c).

Conditions contributing to the stability refer to low level of obstacles or threats, which could reduce or interrupt conversion of incomes into goods and services. Such threats may be environmental, in the field of health care, concerning the availability and quality of food and water, be related to crimes, etc. In this sense, the average life expectancy is one of the most inclusive indicators. Regarding economic threats (such as crime against property), they are already reflected via residential property prices. Besides that, it is known and empirically validated that average life expectancy is interconnected with figures of gross domestic product per capita, incomes, equality, education, and many other important characteristics (Bloom, and Canning 2017; Hummer, and Hernandez 2013). Various studies claim that development of urban settlements resulted in a higher life expectancy. For instance, such a tendency could be observed in the United States of America at the beginning of the 1990s and in Armenia in the mid-2000s (Singh, and Siahpush 2014). At the same time, the average life expectancy for rural populations is not lower than for urban populations in England, where rural settlements are usually characterized with better sustainability conditions (Kyle, and Wells 2010). This is another reason why average life expectancy should be considered a good indicator of regional development.

For certain, there are many general indicators to reflect the degree of regional development, such as migration, for example. However, such general indicators are unsuitable, as they may be significantly affected by state policy (for example, immigration limitations), require unified methodology and monitoring by administrative authorities. Hence, the above mentioned three main indicators are to be considered as a basis for evaluating development and its regional disparity (Table 6).

Table 6. The considered indicators of regional development and its disparity and their compliance with the suggested standard of methods of evaluation

Component of the standard	Average market price per 1 square meter of residential properties	Average net monthly salary	Life expectancy
Inclusive	Reflects availability of almost all the prioritized goods and services.	Reflects opportunities for generating legal incomes.	Reflects conditions contributing to the stability of conversion of incomes into goods and services
Accurate	From the side of affordability, it is obviously not positive to have high prices for residential properties. On the other hand, higher prices mean more infrastructure and opportunities. Residential property prices should be in accordance with incomes of the population. To reflect this, the intended method of evaluation should identify parity between property prices	In some cases, high salaries may be unattractive for investors, but this peculiarity refers to the initial stages of development of a region. In long terms the increase of investments results in the increase of salaries. Therefore, higher values of average salary are positive in almost all cases. To neutralize the influence of differences and changes of taxes and fees, net	The higher life expectancy, obviously the better.

| Component of the standard	Average market price per 1 square meter of residential properties	Average net monthly salary	Life expectancy
Quantitative	and salaries as a more positive situation. Monetary units are used. It is better to use the United States dollar (USD) for comparisons and progress evaluation. Besides that, USD is factually used in the Armenian real estate market as the main unit. The indicator comes from the market, therefore it is not directly influenced by any single person.	values are more suitable to be used. Monetary units are used. It is better to use USD for comparisons and progress evaluation. Besides that, USD is incomparably more stable than Armenian dram. The indicator comes from the market, therefore it is not directly influenced by any single person.	Years or months are used as units. To increase the visibility of changes, it is more suitable to use months for the measurements. The indicator is completely insensitive to personal influences of subjective nature.
Available	Most of the data is regularly published by the Statistical Committee of Armenia and statistical services of other countries, as well as international organizations. However, data for not all the regions is being processed, though microdata is available.	Data is regularly published by the Statistical Committee of Armenia and statistical services of other countries, as well as international organizations.	Data is regularly published by the Statistical Committee of Armenia and statistical services of other countries, as well as international organizations.
Understandable	The indicator is understandable for policy makers and the public.	The indicator is understandable for policy makers and the public.	The indicator is understandable for policy makers and the public.
Sensitive	The direction of influence of decisions by state or local authorities is mostly predictable.	The direction of influence of decisions by state or local authorities is mostly predictable.	It is hard to predict the influence of decisions by state or local authorities, as it is always indirect. However, by studying factors of life expectancy, it becomes possible to predict the direction and approximate extent of influence.

Source: Created by authors

2.3. The proposed method of measuring regional development disparity

As the considered three indicators basically match with the requirements of the suggested standard of methods of evaluation of regional disparity, they may be used as the key components of the method.

Regarding the issue of parity between property prices and salaries, the simplest solution is application of product or geometric mean. In this case an increase of any indicator with, for instance, 200 USD will indicate a smaller progression than in case of 100 USD increase for each indicator. This can be easily observed graphically (Figure 4).

Figure 4: The product of two indicators and its progression
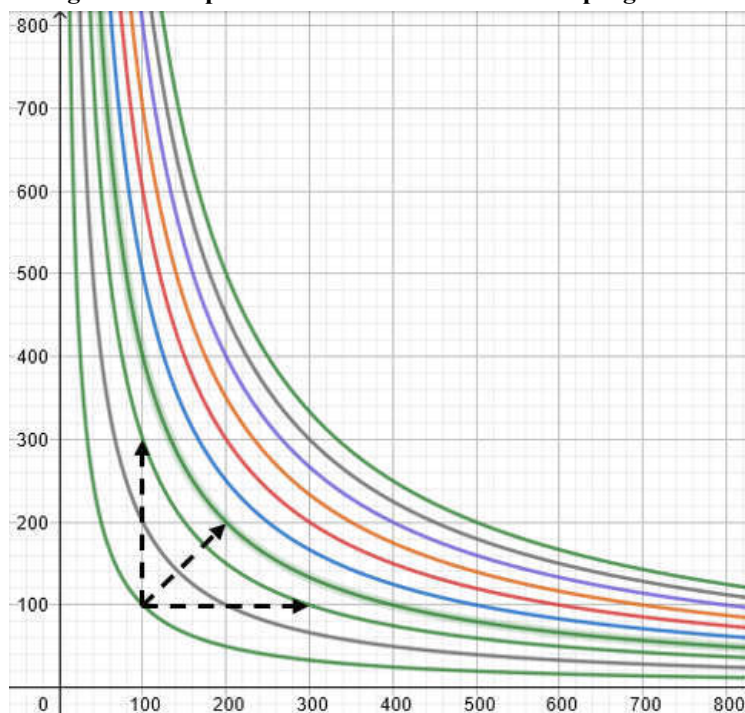
Source: Created by authors with GeoGebra Calculator Suite

Approaching to the third indicator with the same although not that much obvious logic (Figure 5), the formula (1) is to be used to measure regional development:

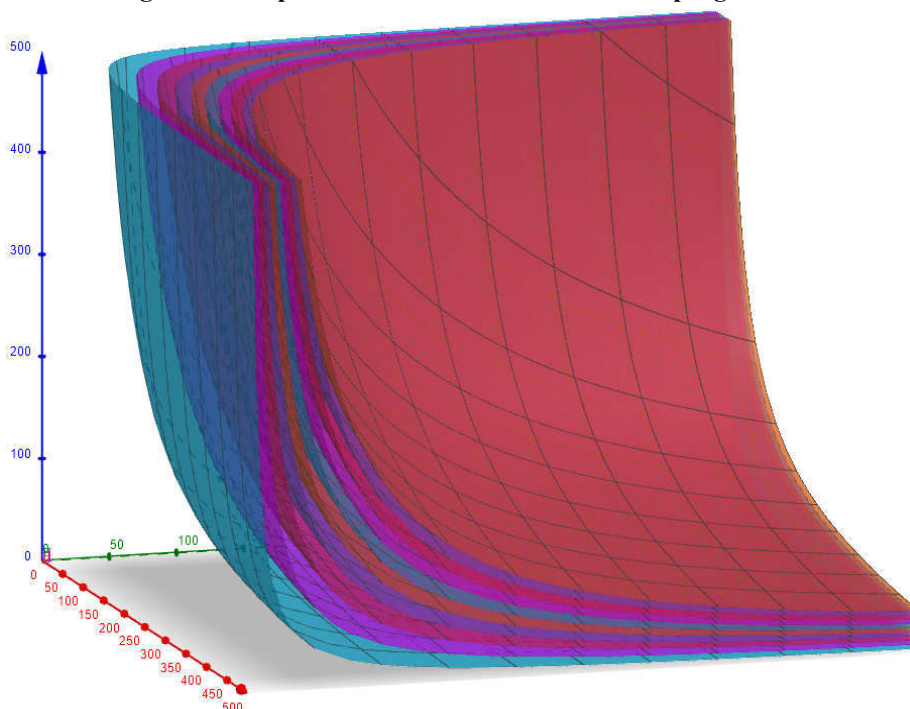$$D = (P \times S \times L)^{1/3} \qquad (1)$$

where

D is the score of development of a region,

P is the average market price per 1 square meter of residential properties in USD,

S is the average net monthly salary in USD,

L is the life expectancy in months.

Figure 5: The product of three indicators and its progression

Source: Created by authors with GeoGebra 3D Calculator

The application of geometric mean is more suitable than product, as it makes the meaning of D more understandable, while almost not changing the logic of calculations. For example, if D equals 900, then the situation in the region is equivalent to the one when the average market price per 1 square meter of residential properties is 900 USD, the average net monthly salary is 900 USD, and the life expectancy is 900 months or 75 years.

To test D as an indicator of development, calculations are made and shown in Table 7 for many countries, for which comparable data is available (Nubmeo, n.d.d, n.d.a; Worldometer, n.d.).

Table 7. D in different countries (2020)

	Country	D		Country	D
1.	Hong Kong	3908,73	48.	Latvia	1051,16
2.	Switzerland	3765,1	49.	Panama	1033,67
3.	Luxembourg	3371,28	50.	Costa Rica	1006,64
4.	Singapore	3212,08	51.	Malaysia	1005,23
5.	France	2603,16	52.	Argentina	987,55
6.	South Korea	2579,12	53.	Romania	942,92
7.	Israel	2576,57	54.	Russia	933,46
8.	Norway	2491,2	55.	Montenegro	915,68
9.	Denmark	2443,11	56.	Serbia	883,88
10.	Japan	2425,22	57.	Bulgaria	866,94
11.	Australia	2414,73	58.	South Africa	864,54
12.	Germany	2340,32	59.	Bosnia and Herzegovina	857,43
13.	Finland	2316,16	60.	Iran	815,45
14.	Netherlands	2241,99	61.	Vietnam	790,36
15.	United Kingdom	2240,81	62.	Jordan	786,68
16.	Sweden	2217,28	63.	Peru	784,64
17.	New Zealand	2207,5	64.	Philippines	777,16
18.	Ireland	2206,55	65.	Belarus	765,85
19.	Iceland	2173,89	66.	Guatemala	760,46
20.	Qatar	2128,28	67.	Ecuador	750,2
21.	Austria	2097,55	68.	Bolivia	726,28
22.	United States	2051,19	69.	Mexico	716,81
23.	Canada	2033,76	70.	Indonesia	701,98
24.	Taiwan	1934,46	71.	Morocco	699,49
25.	Belgium	1896,06	72.	North Macedonia	693,28
26.	United Arab Emirates	1778,59	73.	Iraq	690,88
27.	China	1722,49	74.	Brazil	688,71
28.	Italy	1636,05	75.	Colombia	681,57
29.	Malta	1596,66	76.	Armenia	681,27
30.	Spain	1572,65	77.	India	680,76
31.	Czech Republic	1553,47	78.	Albania	677,22
32.	Slovenia	1520,15	79.	Kazakhstan	653,19
33.	Estonia	1372,72	80.	Ukraine	628,97
34.	Slovakia	1300,36	81.	Turkey	614,12
35.	Portugal	1293,15	82.	Georgia	608,6
36.	Cyprus	1233,67	83.	Algeria	583,25
37.	Croatia	1231,32	84.	Moldova	581,09
38.	Puerto Rico	1220,2	85.	Azerbaijan	572,66
39.	Poland	1192,56	86.	Tunisia	557,07
40.	Hungary	1163,52	87.	Dominican Republic	548,04
41.	Lithuania	1143,29	88.	Bangladesh	547,11
42.	Greece	1130,27	89.	Nepal	537,67
43.	Lebanon	1108,3	90.	Venezuela	516,8
44.	Saudi Arabia	1073,05	91.	Uzbekistan	466,39
45.	Chile	1060,26	92.	Egypt	460,85
46.	Thailand	1059,25	93.	Pakistan	428,82
47.	Uruguay	1058,61	94.	Syria	380,64

Source: Calculated by authors with Apache OpenOffice Calc

The ranking of countries by D provides a picture very similar to many other rankings by various indicators of development. Thus, D provides a well-directed reflection of development of regions.

A suppositive example may be considered to understand the transformation of D into an indicator for measuring regional development disparity (Table 8).

Table 8. Suppositive example for measuring regional development disparity through D

Region	P	S	L	D
Region 1	245	360	840	420
Region 2	270	450	750	450
Region 3	432	450	810	540
Region 4	630	490	810	630

Source: Created by authors

It may seem that the simplest solution is application of standard deviation for values of D (StDev(D)), which equals 94.87 points. However, if D increases in all the regions, for example, by 40 points (thus becoming 460, 490, 580, and 670 accordingly), then the standard deviation for D will remain 94.87. This means that some progress has occurred in every region, but it has not been captured by the indicator. That is why the application of diagonal standard deviation (StDev(Dgn)) is more reasonable (Figure 6).

Figure 6: Measuring regional development disparity through diagonal standard deviation for D values
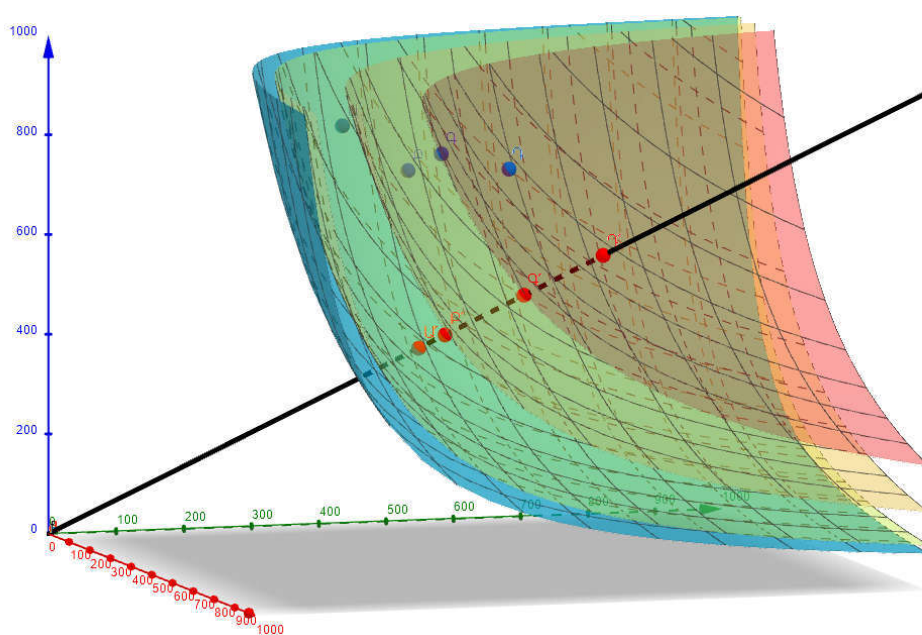
Source: Created by authors with GeoGebra 3D Calculator

The red spots in Figure 6 are diagonal or parity equivalents of blue spots, which represent D values for regions. For example, at the parity equivalent spot for Region 1 the values of P, S, and L are all equal to 420, as well as the value of D.

Diagonal standard deviation reflects distribution of parity equivalent spots on the diagonal. Evidently, wider distribution means deeper regional disparity.

Values of parity equivalents on the diagonal (Dgn) are calculated with the formula (2):

$$Dgn = D^{1/3} \times 3^{1/2} \qquad (2)$$

As Dgn measures the distance of parity equivalents from the zero-point, diagonal standard deviation captures proportionate increase of D values in regions (Table 9).

Table 9. Measuring regional development disparity through diagonal standard deviation for D values

Region	D	Dgn	D'	Dgn'	D (+/-)	Dgn (+/-)
Region 1	420	12.97	460	13.37	+40	+0.40
Region 2	450	13.27	490	13.66	+40	+0.38
Region 3	540	14.10	580	14.44	+40	+0.34
Region 4	630	14.85	670	15.16	+40	+0.31
StDev(D)	**94.87**	-	**94.87**	-	**0**	-
StDev(Dgn)	-	**0.848**	-	**0.807**	-	**-0.041**

Source: Calculated by authors with Apache OpenOffice Calc

Therefore, the StDev(Dgn) indicator or diagonal standard deviation of D values reflects regional disparity more accurately. Nevertheless, the StDev(D) indicator or standard deviation of D values is more understandable. For example, if it equals 94.87, then the gap between regions with below average level of development and country average may be described with 95 USD cheaper residential properties, 95 USD lower salaries, and 8 years shorter life expectancy. As such interpretation is more understandable, it is worth using both StDev(D) and StDev(Dgn) indicators while evaluating regional development disparity.

3.   <u>Calculations and results</u>

Calculations of the D, StDev(D) and StDev(Dgn) indicators have been made for Armenia and Serbia. The rationale behind that is the existence of several key similarities of economic, social, and cultural nature. Historically, both nations were on the frontline of cultural clashes through centuries. Armenia and Serbia had been heavily involved in World War I and passed through Ottoman Empire, socialism, and relatively recent wars. It is crucial that both countries are landlocked. All those factors have significantly influenced the perception of local governance and role of communities, as well as the mindset toward socioeconomic processes in general (Hayrapetyan, Asatryants, and Mnatsakanyan 2017).

By processing data published by the Statistical Committee of the Republic of Armenia (n.d.b, n.d.a, 2018a) and the Statistical Office of the Republic of Serbia (2014, 2015, 2016, 2017, 2018, 2019, 2020, n.d.), as well as by the Cadastre Committee of Armenia (n.d.) and Republic Geodetic Authority of Serbia (n.d., 2021), and by using currency exchange rate archives, a database was created and calculations were made for different levels, in particular, regions and towns of Armenia, and provinces, municipalities and towns of Serbia (the Nomenclature of Territorial Units for Statistics (NUTS) 1 and NUTS 2 levels were also observed, but not given importance due to the small number of units).

D was estimated for all the mentioned levels for a start. The results were primarily used for measuring disparity, but also for being compared with common perception of development level of particular regions to validate the methodology of D once more. Some results are presented in Tables 10, 11, and 12.

Table 10. D in Armenian regions in 2014-2019

Region	2014	2015	2016	2017	2018	2019	P (2019)	S (2019)	L (2019)
Yerevan	592	593	601	598	623	644	761	382	920
Syunik	410	407	408	418	442	461	212	506	918
Armavir	371	374	382	365	348	369	214	256	915
Kotayk	359	358	362	351	344	351	182	260	917
Ararat	311	312	320	312	305	342	137	318	914
Vayotz Dzor	348	349	352	344	335	339	177	240	915
Tavush	334	337	352	344	329	336	185	224	916
Shirak	348	350	358	343	327	335	196	210	917
Aragatsotn	313	313	311	310	306	316	161	215	914
Lori	332	335	338	333	306	308	136	236	917
Gegharkunik	302	307	310	301	285	290	123	217	914
Armenia	**507**	**508**	**509**	**505**	**519**	**539**	**494**	**346**	**918**

Source: Calculated by authors with Apache OpenOffice Calc

Table 11. D in Armenian towns in 2019

Top 10 towns	D	Bottom 10 towns	D
Yerevan	644	Artik	298
Tsaghkadzor	538	Vardenis	294
Goris	528	Tashir	293
Kapan	484	Alaverdi	290
Meghri	473	Maralik	286
Kajaran	472	Dastakert	279
Abovyan	452	Tchambarak	278
Ejmiatsin	450	Akhtala	263
Sisian	448	Shamlugh	262
Masis	438	Tumanyan	231

Source: Calculated by authors with Apache OpenOffice Calc

Table 12. D in Serbian provinces (oblast), towns and municipalities in 2019

Province	D	Town	D	Municipality	D
Top 10					
Beogradska oblast Grad Beograd	1005	Grad Beograd	1005	Savski venac	1275
Južnobačka oblast	839	Grad Novi Sad	879	Stari grad	1213
Šumadijska oblast	715	Kragujevac	746	Vračar	1197
Nišavska oblast	712	Grad Niš	728	Novi Beograd	1131
Zlatiborska oblast	688	Grad Požarevac	727	Zvezdara	1011
Južnobanatska oblast	677	Grad Užice	715	Voždovac	990
Braničevska oblast	675	Pančevo	704	Zemun	965
Severnobačka oblast	664	Vršac	691	Čukarica	926
Srednjobanatska oblast	662	Šabac	689	Palilula (Grad Beograd)	918
Kolubarska oblast	662	Novi Pazar	683	Novi Sad	880
Bottom 10					
Rasinska oblast	608	Grad Vranje	647	Kovačica	433
Pčinjska oblast	602	Kruševac	645	Plandište	430
Pomoravska oblast	600	Loznica	625	LJubovija	427
Jablanička oblast	599	Jagodina	623	Mali Zvornik	423
Raška oblast	595	Sombor	616	Bela Crkva	421
Zapadnobačka oblast	575	Leskovac	610	Trstenik	420
Severnobanatska oblast	569	Zaječar	589	Aleksandrovac	419
Toplička oblast	561	Prokuplje	581	Brus	417
Zaječarska oblast	557	Kikinda	577	Ćićevac	416
Borska oblast	537	Bor	565	Varvarin	406
Serbia	**835**				

Source: Calculated by authors with Apache OpenOffice Calc

Although estimations of D already give grounds for discourse, many hypotheses and conclusions, StDev(D) and StDev(Dgn) are still the main indicators of regional development disparity (Table 13).

Table 13. StDev(D) and StDev(Dgn) in Armenia and Serbia in 2014-2019

Level	2014	2015	2016	2017	2018	2019
StDev(D)						
Regions, Armenia	81,1	80,5	81,6	83,4	96,7	100,6
Towns, Armenia	82,3	82,4	84,1	81,6	77,1	80,5
NUTS 1 units, Serbia	140,6	132,6	140,7	153,5	162,7	184,1
NUTS 2 units, Serbia	133	123,9	130,6	141,4	149,7	167,2
Provinces, Serbia	85,3	77,2	80,6	85,7	90,4	97,4
Municipalities, Serbia	133,9	120,5	124,3	131,6	141,8	150,7
Towns, Serbia	81,9	74,2	77,6	81,4	83	89,5
StDev(Dgn)						
Regions, Armenia	0,815	0,805	0,81	0,835	0,967	0,986
Towns, Armenia	0,974	0,975	0,989	0,959	0,851	0,869
NUTS 1 units, Serbia	0,986	1,005	1,053	1,116	1,127	1,259
NUTS 2 units, Serbia	0,899	0,905	0,943	0,992	1	1,103
Provinces, Serbia	0,632	0,614	0,632	0,65	0,651	0,691
Municipalities, Serbia	1,04	1,01	1,03	1,057	1,06	1,101
Towns, Serbia	0,601	0,586	0,604	0,613	0,591	0,626

Source: Calculated by authors with Apache OpenOffice Calc

4. Discussion and conclusions

The described method of measuring regional development disparity and the corresponding estimations have been discussed by authors with representatives of the Armenian and Serbian scientific communities. It is worth making special mention of the discussion held at the Faculty of Economics of the University of Belgrade in May 2021. The discussion with the academic staff of the faculty contributed to refining and rationale of the methodological choices.

One of the primary reflections refers to D values, which are in line with common understanding of levels of development of regions. In general, this is an extra validation of the fact that D is a proper indicator for measuring development.

Through observing the structure of D in Armenian regions (Table 10), one can notice that a very broad range of S to P ratio exists in regions (from 0.5 to 2.4). It means that usually the

development is not properly planned. The incomes and infrastructures are not in accordance. This is a very crucial factor for authorities responsible for regional and local development planning and implementation: the development should be planned toward all its dimensions, ensuring equilibrium of economic, social, and environmental policies (Papadaskalopoulos, and Nikolopoulos 2018).

Both countries have gravity centers and black holes of development.

Development of towns, as gravity centers, determine development of regions in most of the cases. It cannot be said that existence of such gravity centers is either positive or negative, but the observed role of towns prompts considering at least two strategies: the strategy of betting on towns, with which the authorities should concentrate more on development of urban communities to promote services, industry, and construction; and the strategy of covering all the settlements, with which the authorities should try to prevent flow of population to urban areas and concentrate more on the weakest points on the whole map. Although the dilemma of these two strategies may seem obvious to arise at the very beginning of forming a policy for regional development, neither Armenia, nor Serbia has formulated a clear vision on the issue.

The capital cities of both countries have played the role of black holes of development for years. Migration, urbanization, real estate market growth, investments, services, better quality of life, incomes, labor market growth – it is an unbreakable vicious circle, which leads to draining of regions and deeper disparity. The outcomes of such processes are not always negative, and many successful agglomerations are formed (for example, in Germany, United States, or Japan), but in the cases of Armenia and Serbia, the social and economic conditions for population of regions are strict limitations for such success (Hayrapetyan, Asatryants, and Mnatsakanyan 2017). That is why the strategic planners of regional development should consider forming competitive advantages over the capital city. Such advantages may refer to taxation, special infrastructure for specific industries, excellent professional education for specific specializations, and many other features.

Another conclusion is that both countries do not register any meaningful trend in overcoming regional disparity. Without properly implemented policies for reducing disparity, StDev(Dgn) varies not much and not in a guided direction in Armenia and Serbia. However, the trendlines show clear difference of the two countries (Figure 7).

Figure 7: Trendlines of StDev(Dgn) values in 2014-2019
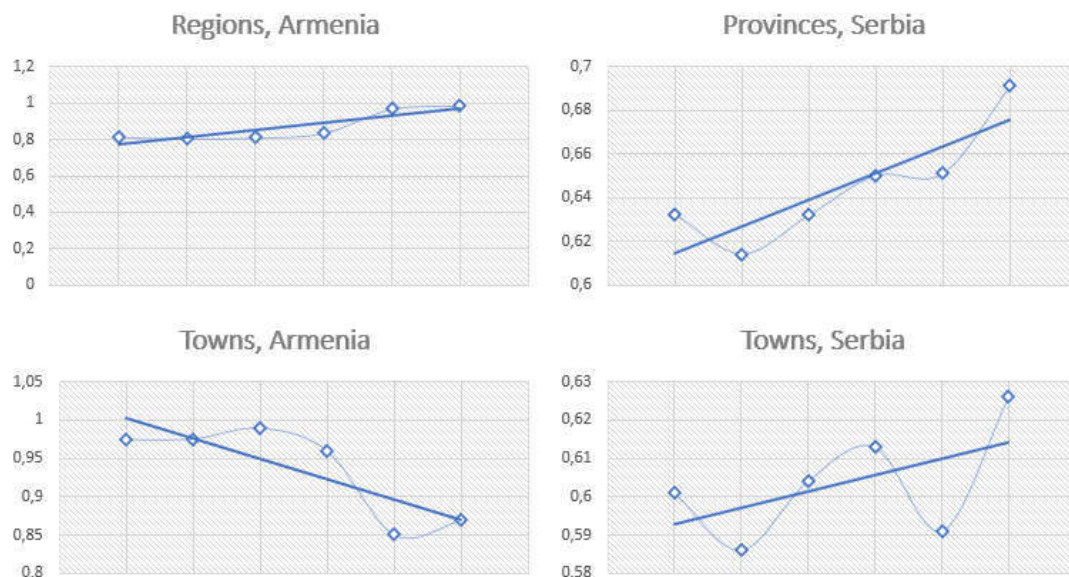
Source: Created by authors with Microsoft Excel

Both Armenia and Serbia have increasing StDev(Dgn) at the regional level, but the trends are different at the level of towns. It means that in the case of Armenia a rising issue is the disparity between urban and rural areas, while in the case of Serbia an issue of increasing disparity among urban areas also exists.

In the case of Serbia, it is very logical that the disparity on the level of municipalities is higher than on the level of provinces, and on the level of towns disparity is lower. Obviously,

rural areas are less developed, and it is reflected in Table 13. A similar situation may be observed in Armenia only since 2018. The disparity among towns in 2017 and previous years was higher than disparity among regions. The explanation is the effect of the black hole both on rural and urban areas. However, at some point the lack of affordability of living in the capital city affected the system: gravity centers became more attractive, and expansion of tourism played its role as well (Andrei et al. 2015).

Taking into consideration all the discussed factors and revealed gaps of regional development planning, the following recommendations are made:

- A complex of key performance indicators should be developed and implemented for state, regional and local authorities who are responsible for regional development and its parity.
- In particular, D should be used on the local level in both Armenia and Serbia, as local self-government bodies are mainly responsible for the development of communities. In case of consolidated communities and relatively large cities, D should be combined with standard deviation indicators to secure parity among settlements or districts.
- Both D and standard deviation indicators should be used as key performance indicators for authorities on state and regional levels, who are also responsible for balance of urban and rural lives.
- Concrete targets should be set. In Armenia, it could be D equal to 1000 in each region and each town. The goal for StDev(Dgn) could be set at 0.7 for regions and 0.6 for towns by 2025.
- In Serbia, although disparity is increasing at all the evaluated levels, development disparity among towns should be in focus of authorities. The goal for StDev(Dgn) could be set at 0.5 for towns by 2025 through achieving the current level of Belgrade in all Serbian towns (D equals 1005).
- To ensure proper implementation of the indicators, a training program should be designed for corresponding authorities. This program should include the toolkit of regional government and local self-government with all the tools discussed in connection with the main dimensions of development (P, S, and L). Any decision maker should understand probable consequences of a decision and be directly affected by its outcomes.
- To identify the most effective ways of ensuring development in specific regions, all local budgetary and regional statistics should be monitored in regard to indicators of development and disparity.

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