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THE PATH TO BALANCED RURAL DEVELOPMENT IN THE VISEGRAD AND NORDIC-BALTIC COUNTRIES OF THE EUROPEAN UNION

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Abstract

This study raises the question whether or not rural areas in Visegrad and Nordic-Baltic countries have been approaching the state of balance between the triple dimensions (economic, social and ecological) of the sustainability paradigm. To answer it, we assessed the multidimensional rural development level, determined the distance between genuine state of development and its sustainability equilibrium, and identified distance changes over time for each country. The quantitative results for the 2000-2013 period were derived by using factor analysis to build synthetic indexes for each dimension and then to aggregate them into the composite index providing overall measure of sustainable development; the 3D Cartesian system to find the development distances from the sustainability, and time-series analysis. The findings indicate that over the whole period rural development was generally higher in Nordic-Baltic countries but Visegrad rural areas were relatively much closer to their balanced state, with top positions of Hungary (EU-28 leader), Czech Republic and Poland, than these in Nordic-Baltic region with the largest unbalance in Latvia (last-place in EU-28), Estonia and Sweden. Development patterns ranged from 'high and sustainable' in Finland through 'high but unsustainable' in Sweden to 'low but sustainable' development in Poland. From 2000 to 2013, the progress towards rural sustainability took place merely in Poland, Finland and Denmark whereas the reverse was evident in Czech Republic. Our results suggest that synergy between high level of rural development and its high sustainability degree may exist without making trade-offs between the three sustainability dimensions. How this balance can be achieved depends on various factors that need further research.

Keywords: sustainability, development, rural areas, Visegrad group, Nordic-Baltic countries
JEL Codes: Q01, O18, C43

Introduction

The sound and sustainable development of the European Union (EU) rural regions is one of the main policy priorities and important challenges of the future as rural communities are assumed to remain domiciles as well as economic and social activity spaces for the great part of the Community population. Notably, the Common Agricultural Policy (CAP) is supposed to maintain sustainable development in the EU's rural areas. Such development has been a key objective of the rural policy since 2000 when it was formally established as the CAP second pillar, with increasingly important budget allocations (Rivza et al., 2015).

The sustainable development as an economic and political concept was born in response to a growing environmental pressures and inequities in global and regional developments, and it has dominated international research and policy agenda for almost three decades. Sustainability consists of at least three dimensions or pillars: 'economy', 'social well-being and equity' and 'environment quality' (Bruntland, 1987; Harwood, 1990; UNCED, 1992; Norberg and Cumming, 2008; UN, 2015) for which society needs to achieve a balance or even an optimum. The biggest challenge for policy makers and other stakeholders remains in the real implementation of the sustainability concept and, consequently, in the practical assessment of sustainability performance of countries or regions (Hugé, et al., 2013). Today, the notion of 'sustainable development' is used by governments, organisations and even scholars with widely varying (often contradictory) interpretations and applications (for review see, for example, Williams and Millington, 2004; Lempert and Nguyen, 2011; Hugé, et. al, 2013).

In this paper, we make a subtle distinction between phrases 'sustainable development' and 'sustainability of development' although these terms appear interchangeably (often noted with different connotations) in the literature. By sustainable or balanced development, we understand societal development at certain level that equitably addresses diverse and multiple aspects (economic, social, ecological, political, etc.) of human life in a society. We think of sustainability as a phenomenon that requires multi-dimensional development not decreasing over the time and maintaining or enhancing a balance between all dimensions (components).

In an effort to address the sustainability measurement or evaluation issue, this study proposes a methodology to assess the distance between the level of actual multidimensional development of rural areas and its 'perfect' sustainability or equilibrium (state of equally balanced dimensions).

Academic research on sustainability and sustainable performance is regularly addressed in diverse streams of literature (e.g. developmental and ecological/environmental economics, regional studies, agricultural and life sciences, educational studies, etc.) using multiple theoretical perspectives and variables for quantitative analysis. A pragmatic approach adopted by many researchers and other stakeholders (for example businesses, governments, NGOs) around the world consists of characterising the sustainability through a set of indicators.

Consequently, several indicator-based methods to quantify the sustainability of economy, society and nature have been proposed and applied so far. Although their in-depth review is beyond the scope of the present study, we could mention some examples. These contain: the Index of Sustainable Economic Welfare (Daly and Cobb, 1989), the Genuine Progress Indicator (Cobb et al., 1995), the Sustainable Net Benefit Index (Lawn and

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Sanders, 1999), the City Sustainability Index (Mori and Christodoulou, 2012), the Rural Development Index (Michalek and Zarnekow, 2012), and the Sustainable Development Goals (SDGs) Index (Sachs et al., 2018).

Our research concentrates on the ten countries of the EU spanning two distinct geographical sub-regions: the Visegrad region and the Nordic-Baltic region. All four Visegrad group (V4) countries (the Czech Republic, Hungary, Poland and Slovakia) represent post-communist Central European states of the EU and its 2004 enlargement members. Out of eight Nordic and Baltic states, only six belong to the EU and these include its three 'old' members (Denmark, Finland and Sweden) and three 'new' members (Estonia, Latvia and Lithuania – former communist states).

This study aims to explore whether the rural economies of these countries are moving towards sustainability or away from sustainability. Other study questions include the following: In which of these countries are rural areas most/least developed according both to each dimension of sustainability and aggregated (integrated) dimensions?; Whether there are trade-offs (negative correlations) or synergies (positive correlations) between the three dimensions?; What countries have their rural areas more/less sustainable?

Materials and methods

Our study analyses the sustainability of rural areas for the period 2000-2013 within quantitative modelling framework. The key assumption is that sustainability assessment needs a set of multi-dimensional indicators integrated into comprehensive index reflecting an overall (i.e. economic, social and environmental) rural development.

The analysis was composed of a sequence of steps. First, we calculated synthetic indexes for each of the three sustainability dimensions (economic, social and environmental/ecological) by applying factor analysis. Table 1 presents three dimensions of sustainability and 15 partial indicators depicting different themes.

Table 1. Description of original indicators/variables used in factor analysis

Dimensions	Indicators/variables (x_i)	Direction of change desired	Themes/domains
Economic	GDP per capita (current USD)	(+)	Economic growth/development
	Cereal yield (kg ha^{-1})	(+)	Agricultural resources
	Livestock production index (2004-2006 = 100)	(+)	Agricultural resources
	Agriculture value added per worker (2005 USD)	(+)	Agriculture labour productivity
Social	Employment in agriculture (% of total)	(+)	Employment
	Unemployment rate (% of active population)	(-)	Employment
	At-risk-of-poverty rate (% of total population)	(-)	Poverty-income poverty
	Total social expenditures (EUR per inhabitant)	(+)	Social protection
	Rural population (% of total population)	(+)	Demography
Ecological	Forest area (% of land area)	(+)	Land-forests
	Sulphur oxide (SOx) emission by agriculture (tonnes)	(-)	Atmosphere-climate change
	Nitrogen oxide (NOx) emission by agriculture (tonnes)	(-)	Atmosphere-climate change
	Electric power consumption (kWh per capita)	(-)	Consumption patterns/energy
	Alternative and nuclear energy[1/] (% of total energy use[2/])	(+)	Sustainable and modern energy
	Organic farming (% of total agricultural area)	(+)	Land/sustainable agriculture

Notes: [1/] Energy that does not produce carbon dioxide when generated (hydropower and nuclear, geothermal and solar power, among others); [2/] Energy use (kg of oil equivalent).

The selection of individual indicators (drawn from the World Bank, the OECD and the European Commission statistics databases) was determined by their adequacy for research purpose, content relevance, harmonization, geographical coverage and availability. They are measured in a sufficiently comparable way across countries and over time. They also are consistent with the Sustainable Development Goals and targets released by the United Nations (2015).

The original variables x_i (i = 1, .., n) representing each dimension were subjected to a factor analysis, with Varimax method of factor rotation. Kaiser criterion (eigenvalue >1) was applied to determine a number of retained main factors F_k (k = 1, ..., t) needed to represent the data. Estimated factor values were Z-normalized for each of the EU-28 countries and each year (2000-2013), thus indicating a relative position of a given country against the EU average. Positive (negative) values reflect a positive (negative) deviation from this average.

A synthetic index for each sustainability dimension (single-dimension or sub-index) was estimated as follows:

$$SI_D = a_1F_1 + a_2F_2 + \cdots + a_tF_t \quad (1)$$

where SI_D – synthetic index for dimension D (economic, social and environmental respectively);
a_k – coefficient which reflects k-factor's contribution to the total variance (k = 1, .., t);
F_k – an estimated score for kth factor.

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The next step was to compute a composite index of sustainable development defined as a weighted sum of the three single-dimension indexes. For the sake of simplicity and clarity (Stapleton and Garrod, 2007), it was constructed by assigning equal importance/weight to each dimension, which means using an arithmetic average of the sub-indexes:

$$CISD = \frac{1}{3}SI_{EC} + \frac{1}{3}SI_{SO} + \frac{1}{3}SI_{EN} = \frac{SI_{EC} + SI_{SO} + SI_{EN}}{3} \quad (2)$$

where *CISD* – composite index of sustainable development level of rural areas;
SI_{EC} – economic dimension index;
SI_{SO} – social dimension index;
SI_{EN} – environmental/ecological dimension index.

Without being related to a reference value, we cannot speak of an index since in that case it does not point towards something (a target, benchmark, etc.) and, as such, does not acquire meaning and provides no information about (changes in) the state of development (Waas et al., 2014).

The absolute deviation of each single-dimension index from an average or composite index (*CISD)* helps to define the dimension(s) having the greatest impact on rural development imbalances.

To calculate the distance between actual (current) rural development level and its target (*CISD* as the reference value), the following generalization of the distance formula (based on the three-dimensional Cartesian coordinate system) was used:

$$d = \sqrt{(x_0 - x_j)^2 + (y_0 - y_j)^2 + (z_0 - z_j)^2} \quad (3)$$

where d - Euclidean distance between points P_1 and P_0;
$x; y; z$ - coordinates of P;
point $P_1 = (x_1; y_1; z_1)$;
point $P_0 = (x_0; y_0; z_0)$, and $x_0 = y_0 = z_0$.

Rearranging, the detailed formula for the distance of actual development point P(SI_{EC}, SI_{SO}, SI_{EN}) to the equilibrium (target) point P(*CISD, CISD, CISD*) is given by:

$$d_s = \sqrt{(CISD - SI_{EC})^2 + (CISD - SI_{SO})^2 + (CISD - SI_{EN})^2} \quad (4)$$

With equation (4) it is very easy to demonstrate the approach of each set of single-dimensional indexes to equilibrium ('perfect sustainability').

In order to discover whether, or not, rural development was becoming more sustainable or balanced over time we just estimated and compared the three-year averages of these distances for the periods of 2000-2002 and 2011-2013, respectively. By following the footsteps of Ginevicius and co-authors (2018), who proposed the quantitative assessment of the dynamics of the development of a socioeconomic system, we measured the intensity of sustainability performance of each country using the ratio between the inverse Euclidean distance values at the beginning of the period and those at the end:

$$INT = (1/d_f) / (1/d_b) = d_b / d_f \quad (5)$$

where *INT* - intensity of sustainability;
d_f - distance at the end of reference period (2011-2013 average);
d_b - distance at the beginning of the reference period (2000-2002 average).

Additionally, linear time trends of the Euclidean distances were estimated by applying standard analysis within the ANOVA procedure.

Results

When speaking about all EU-28 countries, values of composite indicators of sustainable development, averaged for 14 years (2000-2013), were highest for the Swedish, Finnish, Luxemburgish, Austrian and Danish rural areas. The Romanian, Polish, Croatian, Greek and Bulgarian rural areas occupied the bottom five positions, respectively (Figure 1). Narrowing the analysis to the regions being on the focus of our study, rural development was generally higher in the Nordic and Baltic countries than in the V4 countries. Poland, Slovakia and Hungary (also Lithuania) reported *CISD*s below the EU average.

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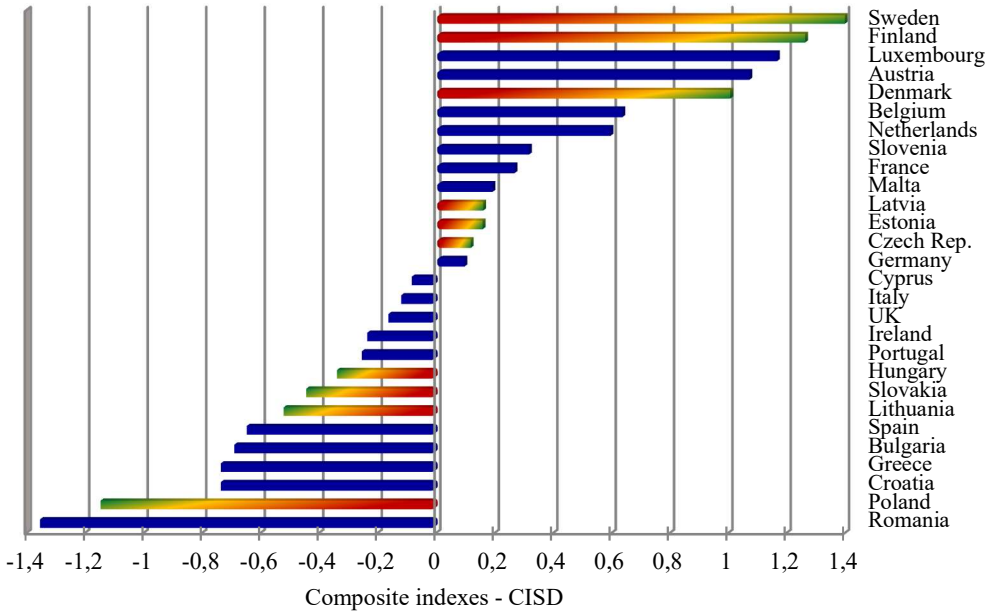

Figure 1. The level of rural development in the EU countries measured by composite indexes, 2000-2013 (Source: Own research)

Our results are consistent with that of Ostasiewicz (2012) who, applying different methods, ranked EU countries (but not their particular regions) according to the level of their sustainable development (for 2007), and appointed Sweden as an absolute 'winner'. This country occurred as the best one regardless of the ranking method used. In contrast, Hungary and Poland were repeatedly amongst the worst five countries.

Sweden is also ranked the most sustainable country in the world on the Sustainable Development Solutions Network's SDG Index, being followed by Denmark and Finland (Sachs et al., 2018). Generally speaking, the Nordic countries, which launched their first joint strategy on sustainable development in 2001, top the charts in global sustainability rankings (Halonen et al., 2017).

Looking at economic dimension of rural sustainable development, not only all Visegrad countries but also a half of those from the Nordic-Baltic region (i.e. new EU member states) were performing below the EU average in the 2000-2013 period (Figure 2). The economic pillar influenced strongest rural un-sustainability (as estimated by the absolute country SI_{EC} deviation from country *CISD*) in Sweden, Finland and the Czech Republic. Social dimension (found the strongest, and above the EU average, in Denmark, Sweden, Finland and the Czech Republic) was responsible for the sustainable development distortion particularly in Latvia, Denmark and Lithuania. In terms of environmental component of the development, the Nordic-Baltic countries were evidently ahead of all V4 group with highest indexes (SI_{EN}) for Latvia, Finland, Sweden and Estonia. The ecological axis affected mostly rural unbalance in Latvia, Estonia and Lithuania.

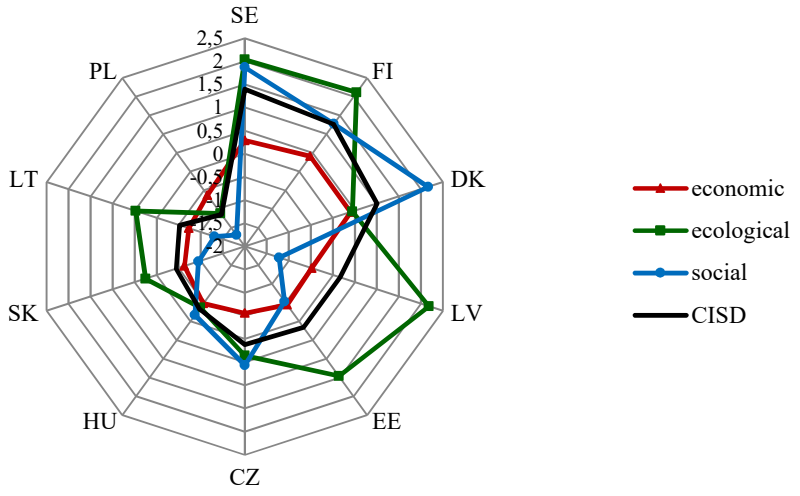

Figure 2. The level of rural multidimensional development, 2000-2013 (sub- & composite indexes) (Source: Own research)

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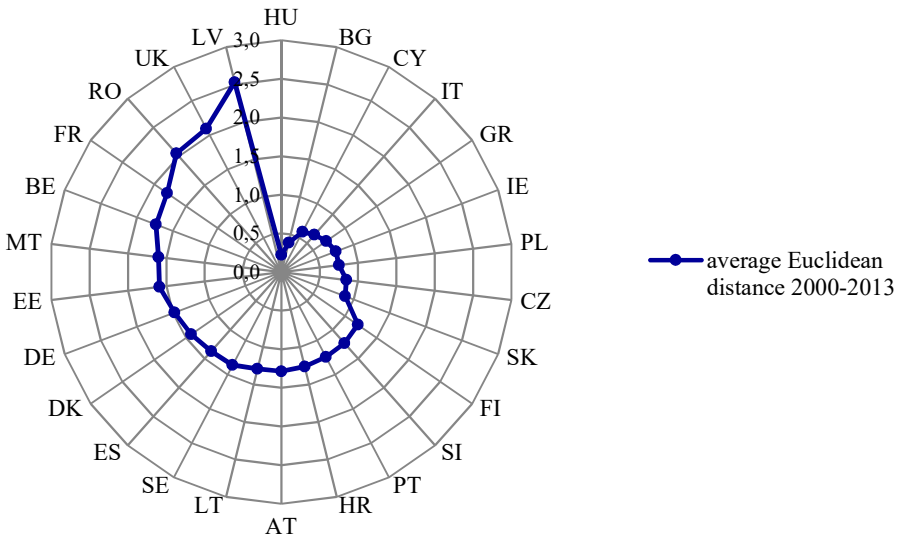
Table 2 shows the results of Pearson correlation analysis between pairs of single-dimension indexes of rural development in respective countries for the period of 2000-2013. Viable rural development (stronger economy with stronger environment) took place in all Nordic-Baltic countries of the EU and in Poland. In all Visegrad countries, except for Hungary, as well as in Denmark, Finland and Lithuania the environment was positively associated with the society. This suggests bearable rural development in these countries. The society and the economy were significantly directly correlated in four Nordic and Baltic countries (Denmark, Finland, Lithuania, and Estonia) and in two Visegrad countries (Hungary and Poland), so rural areas in these countries were situated within the equitable sphere. However, merely in four out of ten countries under the investigation (i.e. Denmark, Finland, Lithuania and Poland) the rural development was at the same time equitable, viable and bearable, i.e. sustainable. Rural areas in these countries achieved the synergy between the pillars of development. In the remaining countries, the trade-offs between sustainability dimensions might have existed.

Table 2. Interrelationships between dimensions of rural sustainability, 2000-2013 (Source: own research)

Dimensions	Sign	Countries	Spheres
Economic and social	(+)	DK***, EE**, FI***, HU*, LT***, PL***	*equitable*
Economic and ecological	(+)	DK***, EE***, FI**, LV***, LT***, PL***, SE***	*viable*
	(-)	CZ***, HU***, SK***	*not-viable*
Social and ecological	(+)	CZ***, DK***, FI***, LT*, PL***, SK***	*bearable*
	(-)	SE*	*unbearable*

Notes: The signs are resulting from the calculation of Pearson correlation coefficients between values of single-dimension indexes, 2000-2013. Table presents only those countries for which statistically significant coefficients (*** $p \leq 0.01$; ** $p \leq 0.05$; * $p \leq 0.1$) were obtained.

The Figure 3 displays the gaps (distances) between actual rural development and the targeted or desired outcome across all EU countries. The centre of the radar chart corresponds to an ideal point (perfect sustainability or balanced sustainability dimensions). On average, in the period 2000-2013, the countries like Hungary, Bulgaria, Cyprus and Italy were the best sustainability performers whereas Latvia, the United Kingdom, Romania and France lagged behind all the others.



AT – Austria; BE – Belgium; BG – Bulgaria; CY – Cyprus; CZ – Czech Republic; DE – Germany; DK – Denmark; EE – Estonia; ES – Spain; FI – Finland; FR – France; GB – United Kingdom; GR – Greece; HR – Croatia; HU – Hungary; IE – Ireland; IT – Italy; LT – Lithuania; LU – Luxemburg; LV – Latvia; MT – Malta; NL – Netherlands; PL – Poland; PT – Portugal; RO – Romania; SE – Sweden; SI – Slovenia; SK – Slovakia.

Figure 3. The EU countries ranking according to rural sustainability performance, 2000-2013 (Source: Own research)

The use of sustainability indicators has more merit when we evaluate them with respect to trends over time rather than based on the time-averaged scores. The comparison of the Euclidean distances of actual rural development to its perfectly balanced state between the sub-periods of 2000-2002 and 2011-2013 (Figure 4) reveals the discrepancies among EU countries in achieving the sustainability goal. At the end of the investigated period, Italian, Cyprian and Bulgarian rural areas were the nearest to their balanced condition (or equilibrium point), while these situated in Latvia, Romania and Luxembourg were the most far away from it. The countries shown in Figure 4 with points above the 2011-2013 line are those where sustainability distances have decreased

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since 2000-2002. Among them there are only two Nordic and Baltic countries (Finland and Denmark), as well as one Visegrad country (Poland).

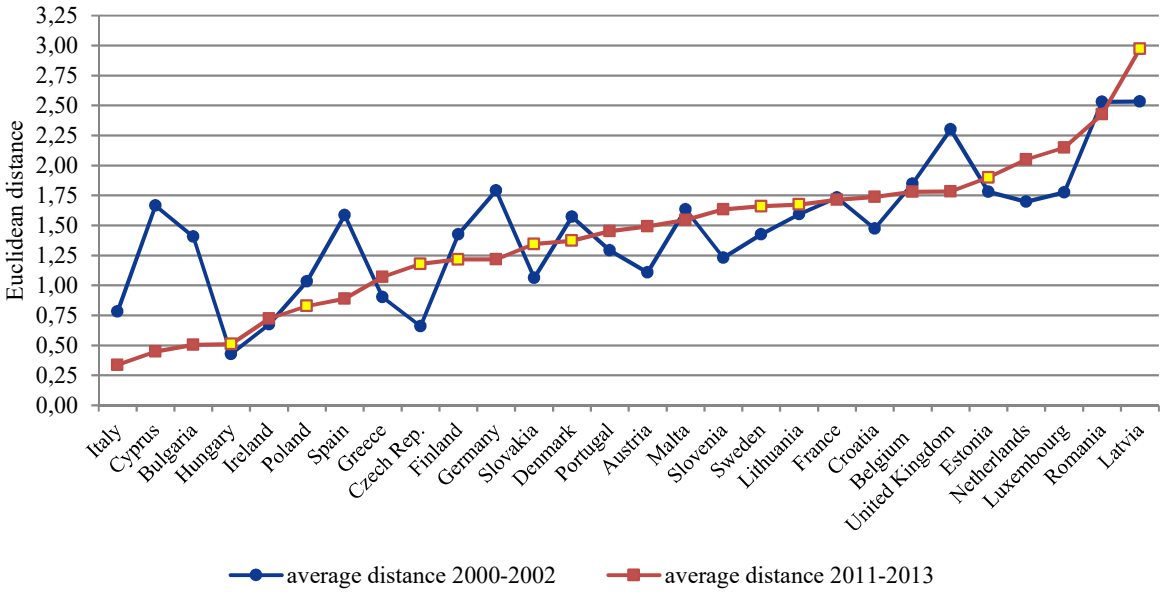

Figure 4. Euclidean distance from rural balanced development in EU countries, 2000-2013 (Source: Own research)

The levels of sustainability intensity varied remarkably across the EU countries. The lowest ones (indicating the biggest deterioration in the sustainability of rural development) occurred in the Czech Republic, Austria, Slovenia and Slovakia, whereas the highest ones (indicating the strongest improvement, respectively) were in Cyprus, Bulgaria, Italy and Spain (Table 3).

The changes in the Euclidean distances, over 14 years, which reflect the progress (or its lack) in rural sustainability in both country groups, are presented in the Figure 5 and Figure 6. It is apparent from those figures that in the V4 countries the sustainability distances (vertical axis) were generally lower than in the Nordic and Baltic countries. The overall impression from these graphs is that the distance changes were not linear over time, at least in some countries. To identify the nature of dynamics, the simple linear trend for distances was studied for each of ten countries. The linear trend models are given in Table 4.

Table 3. Intensity of rural development sustainability in the EU countries (Source: own research)

Nordic-Baltic and V4 regions	INT	Other EU countries (progress or stability)	INT	Other EU countries (regress)	INT
Finland	1.18	Cyprus	3.70	Ireland	0.93
Denmark	1.15	Bulgaria	2.78	Portugal	0.89
Lithuania	0.95	Italy	2.33	Croatia	0.85
Estonia	0.93	Spain	1.79	Greece	0.84
Sweden	0.86	Germany	1.47	Netherlands	0.83
Latvia	0.85	United Kingdom	1.30	Luxembourg	0.83
Poland	1.25	Malta	1.05	Slovenia	0.75
Hungary	0.84	Romania	1.04	Austria	0.75
Slovakia	0.79	Belgium	1.04		
Czech Republic	0.56	France	1.01		

Notes: INT = average Euclidean distance for 2000-2002 divided by average Euclidean distance for 2011-2013. A ratio above 1 indicates improvement in rural development sustainability.

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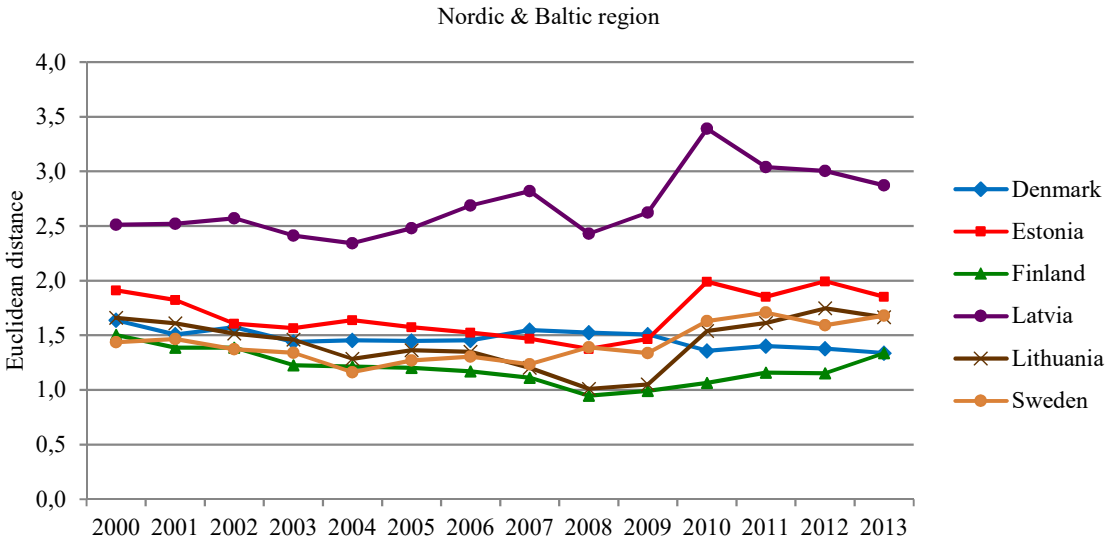

Figure 5. Time series of the sustainability distances in Nordic-Baltic countries, 2000-2013 (Source: Own research)

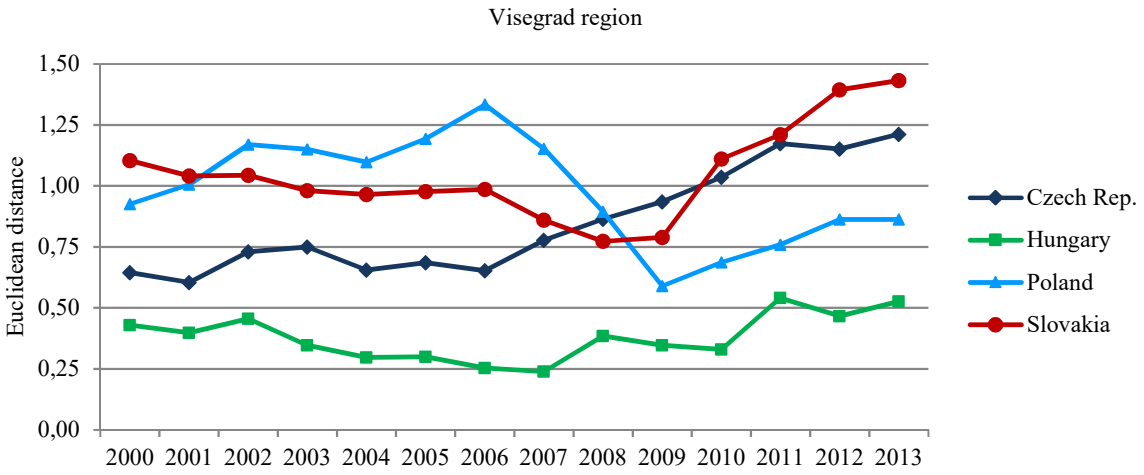

Figure 6. Time series of the sustainability distances in Visegrad countries, 2000-2013 (Source: Own research)

Table 4. Summary of linear trend models for sustainability distances in years from 2000 to 2013 (Source: own research)

Countries	The trend line equitation for distance	Goodness-of-fit		Regression coefficients	
		R^2	AR^2	p-values	t Stat
Denmark	d = -0.0150t + 1.58	0.59	0.50	0.0028	-3.742
Finland	d = -0.0216t + 1.37	0.33	0.28	0.0309	-2.445
Poland	d = -0.0285t + 1.19	0.30	0.25	0.0407	-2.292
Czech Republic	d = 0.0471t + 0.49	0.84	0.82	0.0000	7.827
Latvia	d = 0.0495t + 2.32	0.48	0.44	0.0057	3.352
Sweden	d = 0.0236t + 1.25	0.33	0.28	0.0307	2.448
Slovakia	d = 0.0197t + 0.90	0.18	0.11	0.1351	1.602
Hungary	d = 0.0069t + 0.33	0.10	0.02	0.2889	1.109
Estonia	d = 0.0105t + 1.61	0.05	-	0.4689	0.748
Lithuania	d = 0.0014t + 1.42	0.00	-	0.9305	0.089

Notes: 95% confidence interval, d - Euclidean distance; t = year; R^2 - coefficient of determination; AR^2 – adjusted coefficient of determination.

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The distance trend with time was linear and statistically significant ($p \leq 0.05$) for Denmark, Finland, Poland (negative regression coefficients – downward trend), the Czech Republic, Latvia and Sweden (positive regression coefficients – upward trend). A linear trend explains from 30 to 84 percent of the variation in distances (R^2) in these countries. A regression model fitted the distance data best for the Czech Republic and Denmark.

Conclusions and Discussion

This paper provides the framework for the analysis of the sustainability of rural development and applies it to investigate whether the Visegrad and the Nordic-Baltic countries achieved (or failed to achieve) balanced rural development, and what were the trends in terms of distance of actual development from its sustainable balance.

Taking holistic approach, we view sustainable development as an integration of economic, societal and environmental dimensions ('triple bottom line') of sustainability, and consequently we assess its level by using composite index incorporating all three dimensions. Such perspective is sometimes criticized in the literature (Pope et al., 2004) for emphasising competing goals rather than interdependencies, and for promoting trade-offs between dimensions (e.g. higher economic development at the expense of either the environment or the society, or both). Our results obtained for three Nordic-Baltic countries (Denmark, Finland and Lithuania) as well as for Poland suggest, however, that economic development of rural areas is possible without undue societal and environmental costs.

The main research results concerning the selected countries can be summarised as follows:

1. Based on the 14-year average (2000-2013) composite indexes of sustainable development, Swedish and Finnish rural areas were on the highest level of development, whereas Polish rural areas were the second least developed in the EU-28.
2. Although multidimensional rural development was generally higher in the Nordic and Baltic region, the Visegrad countries were much closer to its balanced state (i.e. equal achievement across three dimensions).
3. On average, during 2000-2013, the highest degree of rural development sustainability (as measured by Euclidean distance) occurred in Hungary (EU-28 leader), the Czech Republic and Poland while the lowest one – in Latvia (last position in EU-28), Estonia and Sweden.
4. Rural development followed different patterns among the analyzed countries; from 'high and sustainable' in Finland and Denmark, through 'high but unsustainable' in Sweden, to 'low but sustainable' in Poland and Lithuania.
5. The progress towards rural sustainability, from 2000 to 2013, was achieved by Poland, Finland and Denmark only. For these countries, declining linear trend in the distance to equally balanced dimensions of development was observed. The other Nordic-Baltic and Visegrad countries faced increasing deterioration of this sustainability – the most intensive in the Czech Republic.

According to the current authors, analyses presented in this paper open a space for further inquiry into the sustainability of development. We realize that our effort was insufficient to uncover all aspects of rural sustainability (we omitted its institutional and cultural pillars, for example). It is likely that a selection of larger number of criteria and indicators employed in order to assess the sustainable development would have provided a more accurate picture of rural areas or even would have altered the results in some countries. Additionally, we did not try to explain the causes of differences between countries or regions both in terms of development sustainability and its changes over time. As Bryden (1994) suggests, we must first understand the reasons of un-sustainable conditions in order to move to more sustainable rural communities.

Despite a number of critiques, we believe that composite indexes of sustainable development (including that proposed in this study) can be useful tools for societal understanding of interactions between economy, society and nature, and for aiding public policy decisions at sub-national, regional and local levels aimed at promotion of rural development and guiding it along the sustainability path. Our results show that both in the Nordic-Baltic countries and the Visegrad countries there is still a room for improvement in sustainability of rural development.

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