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MULTI–OBJECTIVE OPTIMIZATION OF WELL–BEING IN THE EUROPEAN UNION MEMBER STATES

ABSTRACT

Well-being is of crucial importance for both individual and society as a whole. It is therefore important to quantify performance and progress made by certain states, regions, communities, social groups, and individuals in improving their well–being. The aim of study was to offer a new framework for multi–criteria assessment as well as international comparison of objective well–being. Well–being is a multi–dimensional phenomenon; hence the appropriate indicator system should be capable to identify the most important underlying processes influencing well–being. For our research we have established the indicator system of twelve indicators identifying various dimensions of well–being. Therefore we propose MULTIMOORA, a model which can be used for approaching the objective of societal well–being. It is applied for international comparison of the well-being in the EU Member States. Consequently, it was revealed that Ireland, the Netherlands, Denmark, Austria, France, Cyprus, Finland, Germany, and Belgium have achieved the highest level of well–being as of 2009. At the other end of spectrum, Czech Republic, Lithuania, Slovakia, Bulgaria, Poland, Hungary, Estonia, Latvia, and Romania can be considered as those peculiar with relatively lowest well–being.

Keywords: *welfare state, well–being, sustainable development, MULTIMOORA, multi–objective optimization.*

1. INTRODUCTION

Welfare, well-being, and happiness are issues of crucial importance for both individual and society as a whole. Furthermore, all these phenomena, united under the umbrella of the quality of life, constitute a basis for sustainable development of the aforementioned subjects. Pigou (1920) launched the concept of welfare state. In addition, so called welfare state offers a way to avoid the shortcomings of the liberal market economy identified by Marxists (Gilpin, 2001). It is therefore important to quantify performance and progress made by certain states, regions, communities, social groups, and individuals in improving their quality of life (Pukeliene, Starkauskiene, 2011).

The measurements of quality of life began in 1960s (Pukeliene, Starkauskiene, 2011; Janušauskaitė, 2008). Indeed, the initial insights into the issue were mainly mono–criteria ones and took such indicators as gross domestic product (GDP) per capita as their basis. Such an outlook, however, appeared to be quite an inconsistent one, for it pays attention solely to economic welfare and under certain circumstances can even mistakenly identify processes of

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societal development. The need for multi–dimensional assessment of quality of life is widely acknowledged in recent studies (Pukeliene, Starkauskiene, 2011; D'Acci, 2010; Brauers *et al.*, 2010; Fleurbaey, 2009; Ginevičius, Podvezko, 2009; Brauers, Ginevičius, 2009; Janušauskaitė, 2008; Ray, 2008). Hence, the aim of study is to offer a new framework for multi–criteria assessment as well as international comparison of objective well–being. The object of this study is the European Union (EU) Member States. The research period with some exclusion covers data of year 2009.

The branch of operational research, namely multi–objective decision making (MODM) offers a variety of scientific methods suitable for tackling multi–dimensional comparisons. Indeed, Roy (1996) put the following classification of MODM problems: 1) α *choosing* problem – choosing the best alternative; 2) β *sorting* problem – classifying alternatives into relatively homogenous groups; 3) γ *ranking* problem – ranking alternatives from best to worst; 4) δ *describing* problem – describing alternatives in terms of their peculiarities and features. In our study we will apply MULTIMOORA method for multi–criteria assessment of well–being in the EU Member States. Zavadskas and Turskis (2011) presented an overview of MODM methods.

The Multi–Objective Optimization by Ratio Analysis (MOORA) method was offered by Brauers and Zavadskas (2006). Subsequently, these authors further developed the method (Brauers, Zavadskas, 2010) thus presenting the MULTIMOORA (MOORA plus the full multiplicative form). Numerous examples of application of MULTIMOORA are present. The MULTIMOORA, for instance, was applied in regional development studies, both at national (Brauers, Ginevičius, 2009, 2010; Brauers *et al.*, 2010) and international (Baležentis *et al.* 2010, 2011; Baležentis, Baležentis, 2011b) levels. The theory of dominance (Brauers and Zavadskas, 2011) enables to summarize the ranks obtained from different parts of MULTIMOORA. Moreover, the MULTIMOORA has been updated with fuzzy number theory (Brauers *et al.*, 2011) and 2–tuple linguistic representation (Baležentis, Baležentis, 2011a).

The article is organized as follows. Section 2 discusses welfare and well–being themselves. The following Section 3 presents MODM methods and MULTIMOORA. Finally, the international comparison of well–being is presented in Section 4.

2. WELL–BEING AND MEASUREMENT THEREOF

In the well-being economy, each individual would have to feel good concerning material wealth, entrance to the most essential free goods like water supply, health, life expectancy at birth, education, all kind of security and concerning the environment. With other words, multiple objectives have to be fulfilled.

Well-being "tout court" concerns the well-being of the actual generation. Sustainable or Durable Development means well-being not only for the actual generation but also for the future generations. Indeed: development indicates time, for instance *Developing Countries* means developing over time. After the dictionary *sustainable* means capable of being maintained. In this way the Kyoto agreement is sustainable development accentuated mainly on CO2 emissions. The following Fig. 1 depicts the relationships between these concepts.

Figure. 1. Relationships between different elements of quality of life.

The first attempts to perform international comparison of well–being were initiated by United Nations (UNDP, 1990; 2010). More specifically, United Nations Development Programme is aimed at preparing and maintaining methodology for such indicators as Human Development Index (HDI), Human Poverty Index (HPI) and Gender-related Development Index (GDI). HDI is based on such indicators as adult literacy rate, GDP per capita, life expectancy at birth, education level. There are two types of poverty index: HPI-1 for developing countries and HPI-2 for OECD countries. HPI-1 is based on such indicators as probability of not surviving to age 40, adult illiteracy rate, population not using an improved water source and population below income poverty line. HPI-2 is estimated according to indicators of probability of not surviving to age 60, people lacking functional literacy skills, long-term unemployment, and population living below 50% of median income. GDI is estimated by dissolving above mentioned indexes by gender. Physical Quality of Life Index (PQLI) can also be used for international comparison (Ray, 2008). PQLI is based on illiteracy rate, infant mortality rate and life expectancy.

At the EU level, the initiative *Beyond GDP* was launched in 2007 (European Commission, 2007) aimed at research into estimations of well–being. The need for multi–dimensional measurements of well–being was stressed once again in report of group chaired by J. E. Stiglitz (Stiglitz *et al*., 2009). More specifically, the latter commission concluded that at least the following well–being dimensions should be considered simultaneously:

- Material living standards (income, consumption and wealth);
- Health;
- Education;
- Personal activities including work;
- Political voice and governance;
- Social connections and relationships;
- Environment (present and future conditions);
- Insecurity, of an economic as well as a physical nature.

Considering the aforementioned findings, one can define the two main issues of well–being measurement, namely creation of appropriate indicator system and choice of appropriate aggregation method. The following section, therefore, deals with the former issue.

Well–being is a multi–dimensional phenomenon; hence the appropriate indicator system should be capable to identify the most important underlying processes influencing well–being. For our research we have established the indicator system of twelve indicators identifying various dimensions of well–being. The data from EUROSTAT, European Environmental Agency, and World Health Organization databases mainly covering years 2008–2009 were used for analysis.

The following Table 1 summarizes indicator system for well–being assessment. As one can note, these indicators are expressed in different units, hence the application of multi–objective optimization methods becomes important. The last column of Table 1 indicates the

direction of optimization of each criterion where *max* means that the higher value of indicator is preferable, whereas *min* stands for the opposite.

Table 1. Indicator system for objective societal well–being measurement.

No.	*Indicator*	*Units*	*Direction of optimization*
1.	Median equivalised net income	EUR per capita	max
2.	Unemployment rate	per cent	min
3.	Crude rate of net migration	per 1000 inhabitants	min
4.	Total fertility rate	births per woman	max
5.	Physicians density	per 1 000 inhabitants	max
6.	Life expectancy at birth	years	max
7.	Criminal offences	per 1000 inhabitants	min
8.	Participation rates in education	per cent	max
9.	Total expenditure on social protection	EUR per capita	max
10.	Voter turnout in the most recent elections	per cent	max
11.	Overcrowding rate	per cent	min
12.	GHG emission	tonnes per capita	min

Median equivalised net income can be considered as one of the main indicators defining annual earnings and thus welfare of citizens and the whole nation. Indeed, median income is more robust indicator than average income, for the former is likely to be less impacted by exclusions. Furthermore, equivalisation of income takes into account the number of members of certain household and therefore enables to assess income distribution among breadwinners and their dependants. Similarly, unemployment rate identifies both economic and social situation in certain state, for unemployment is related to increased need in social support (e. g. transfer payments) as well as in increase of social problems (e. g. criminal offences).

Rate of net migration resembles attitude of inhabitants as well as foreigners towards overall situation in certain state: the higher the rate, the higher level of societal well–being is achieved. Total fertility rate is interrelated with materialism–based happiness and life satisfaction (Li *et al.*, 2011). It can be assumed that lower life satisfaction leads to increase in materialism and, therefore, weaker desire to have children (i. e. lower total fertility rate). In addition, higher physicians' density leads to more intensive health care. As a result, values of the next investigated indicator, namely life expectancy at birth, might increase. As Schultz (1981) argued, the increased life expectancy would result in higher amount of value–added generated by inhabitants and make them eager to invest into improvements of their health, education etc.

Criminal offences cover homicide, violent crime, robbery, domestic burglary, motor vehicle theft, and drug trafficking. Obviously, higher number of such misdemeanors somehow limits well–being. Participation rates in education are expressed as a percentage of 15-24 year old population enrolled in any sort of educational institutions. The higher rate of participation in educations leads to increased quality of population (or human capital) and thus higher well–being in the future[4]. Total expenditures on social protection quantify the stability of wel-

[4] Cunado and Perez de Gracia (2011) reported that education impacts happiness both directly and indirectly. Firstly, indirect effect means increased earnings gained after respective improvement of qualification. Secondly, direct effect stands for some sort of self–realization and self–confidence raised due to the acquired knowledge. Moreover, it was revealed that the direct impact of education on happiness does not depend of the level of education (primary, secondary or tertiary).

fare in the society, for persons living in societies with more intensive social support are less likely to fall in panic in case of unemployment of after becoming socially vulnerable in other way. Voter turnout identifies political participation (Segre *et al.*, 2011), and, to some extent, overall satisfaction with current politics[5]. Overcrowding rate is defined as the percentage of the population living in an overcrowded household. A person is considered as living in an overcrowded household if the household does not have at its disposal a minimum of rooms determined by number of household dwellers. Finally, GHG emission identifies environmental pollution. To cap it all, the proposed indicator system identifies various aspects of well–being and thus can be applied for international comparison.

3. MODM METHODS AND MULTIMOORA

Belton and Stewart (2002) defined the three broad categories of MODM methods (Løken 2007): 1) value measurement models; 2) goal, aspiration, and reference level models; 3) outranking models (the French school). A more detailed overview of MODM methods is presented by Guitouni and Martel (1998) and Zavadskas and Turskis (2011).

Value measurement methods are, for instance, SAW (Simple Additive Weighing) introduced by MacCrimmon (1968) and Analytic Hierarchy Process (AHP) was proposed by Saaty (1980, 1997).

The *reference level* approach is applied in such methods as TOPSIS, COPRAS, VIKOR, MOORA, and ARAS. Technique for the Order Preference by Similarity to Ideal Solution (TOPSIS) was introduced by Hwang and Yoon (1981) and modified by applying grey numbers (Lin *et al.* 2008), fuzzy numbers (Wang *et al.* 2003) or Mahalanobis distance (Antuchevičienė *et al.* 2010). Method of Complex Proportional Assessment (COPRAS) (Zavadskas *et al.* 1994) was improved by applying grey number technique (Zavadskas *et al.* 2008a, 2008b) as well as fuzzy numbers (Zavadskas and Antucheviciene 2007), and used in many studies (Ginevičius and Podvezko 2009; Zavadskas *et al.* 2009a). VIKOR method is based on linear normalization (Opricovic and Tzeng 2002, 2004). Cevikcan *et al.* (2009) discussed application of fuzzy VIKOR method. Multi-Objective Optimization by Ratio Analysis (MOORA) method was offered by Brauers and Zavadskas (2006) on the basis of previous researches. This method was further developed (Brauers and Zavadskas 2010) and became MULTIMOORA (MOORA plus the full multiplicative form). New Additive Ratio Assessment (ARAS) method was introduced by Zavadskas and Turskis (2010) and subsequently extended into fuzzy environment (Turskis, Zavadskas 2010).

ELECTRE (Roy 1968; Ulubeyli and Kazaz 2009; Xidonas *et al.* 2009), NAIADE (Munda *et al.* 1995, Munda 1995, 2005), PROMETHEE (Brans and Mareschal 1992; Behzadian *et al.* 2010; Podvezko and Podviezko 2010) are families of MODM methods based on *outranking preferences*.

In this study we will apply the MULTIMOORA method which encompasses value measurement as well as reference level methods. In his book of 2004 Brauers (Brauers 2004a) described the three parts of MULTIMOORA, namely the Ratio System Approach, the Reference Point Approach (but still based on scores), and the Full Multiplicative Form. Some time later but also in 2004 (Brauers, 2004b) he switched over to a Reference Approach with instead of scores uses the ratios found in the Ratio System Approach. In this way dimensionless

[5] Noteworthy, in Belgium, Luxembourg, and Greece voting is compulsory.

measures were obtained. Later on this combination was called MOORA by Brauers and Zavadskas (2006). Finally Brauers and Zavadskas (2010) launched MULTIMOORA. MULTIMOORA is composed of MOORA and of the Full Multiplicative Form of Multiple Objectives. MOORA method begins with matrix X where its elements x_{ij} denote *i*-th alternative of *j*-th objective ($i = 1, 2, \cdots, m$ and $j = 1, 2, \cdots, n$). In this case we have $n = 12$ objectives – indicators – and $m = 27$ alternatives – European Union Member States. MOORA method consists of two parts: the ratio system and the reference point approach.

The Ratio System of MOORA. Ratio system defines data normalization by comparing alternative of an objective to all values of the objective:

$$x_{ij}^{*} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^{2}}}, \tag{1}$$

where x_{ij}^{*} denotes *i*-th alternative of *j*-th objective (in this case – *j*-th structural indicator of *i*-th state). Usually these numbers belong to the interval [-1; 1]. These x_{ij}^{*} are added (if desirable value of indicator is maximum) or subtracted (if desirable value is minimum) delivering a sum for each alternative in this way:

$$y_{i}^{*} = \sum_{j=1}^{g} x_{ij}^{*} - \sum_{j=g+1}^{n} x_{ij}^{*}, \tag{2}$$

where $g = 1, \cdots, n$ denotes number of objectives to be maximized. Then every outcome per alternative is ranked in a descending order.

The Reference Point of MOORA. Reference point approach is based on the ratios obtained in the Ratio System. The Maximal Objective Reference Point (vector) is found according to ratios found in formula (1). The *j*-th coordinate of the reference point can be described as $r_j = \max_i x_{ij}^{*}$ in case of maximization. Every coordinate of this vector represents maximum or minimum of certain objective. Then every element of normalized responses matrix is recalculated and the ranks are given according to deviations from the reference point and after the Min-Max Metric of Tchebycheff:

$$\min_i \left(\max_j \left| r_j - x_{ij}^{*} \right| \right). \tag{3}$$

Finally, the outcomes per alternative are ranked in an ascending order.

The Full Multiplicative Form and MULTIMOORA. The Full Multiplicative Form method embodies maximization as well as minimization of purely multiplicative utility function. Overall utility of the *i*-th alternative can be expressed as a dimensionless number:

$$U_{i}^{'} = \frac{A_i}{B_i}, \tag{4}$$

where $A_i = \prod_{j=1}^{g} x_{ij}$, $i = 1, 2, \cdots, m$ denotes the product of objectives of the *i*-th alternative to be maximized with $g = 1, \cdots, n$ being the number of objectives (structural indicators) to be maximized and

where $B_i = \prod_{j=g+1}^{n} x_{ij}$ denotes the product of objectives of the *i*-th alternative to be minimized with $n - g$ being the number of objectives (indicators) to be minimized.

Thus MULTIMOORA summarizes MOORA (i. e. Ratio System and Reference point) and the Full Multiplicative Form. Ameliorated Nominal Group and Delphi techniques can also be used to reduce remaining subjectivity (Brauers and Zavadskas, 2010). The theory of dominance (Brauers and Zavadskas, 2011) enables to classify the ranks obtained from the different parts of MULTIMOORA.

4. COMPARISON OF WELL–BEING IN EU MEMBER STATES

The international comparison of well–being was performed on a basis of indicator system defines in Section 2 (Table 1). The MULTIMOORA method, discussed in Section 3, was applied for the analysis. This section presents the results with special focus on the three Baltic States, namely Latvia, Lithuania, and Estonia.

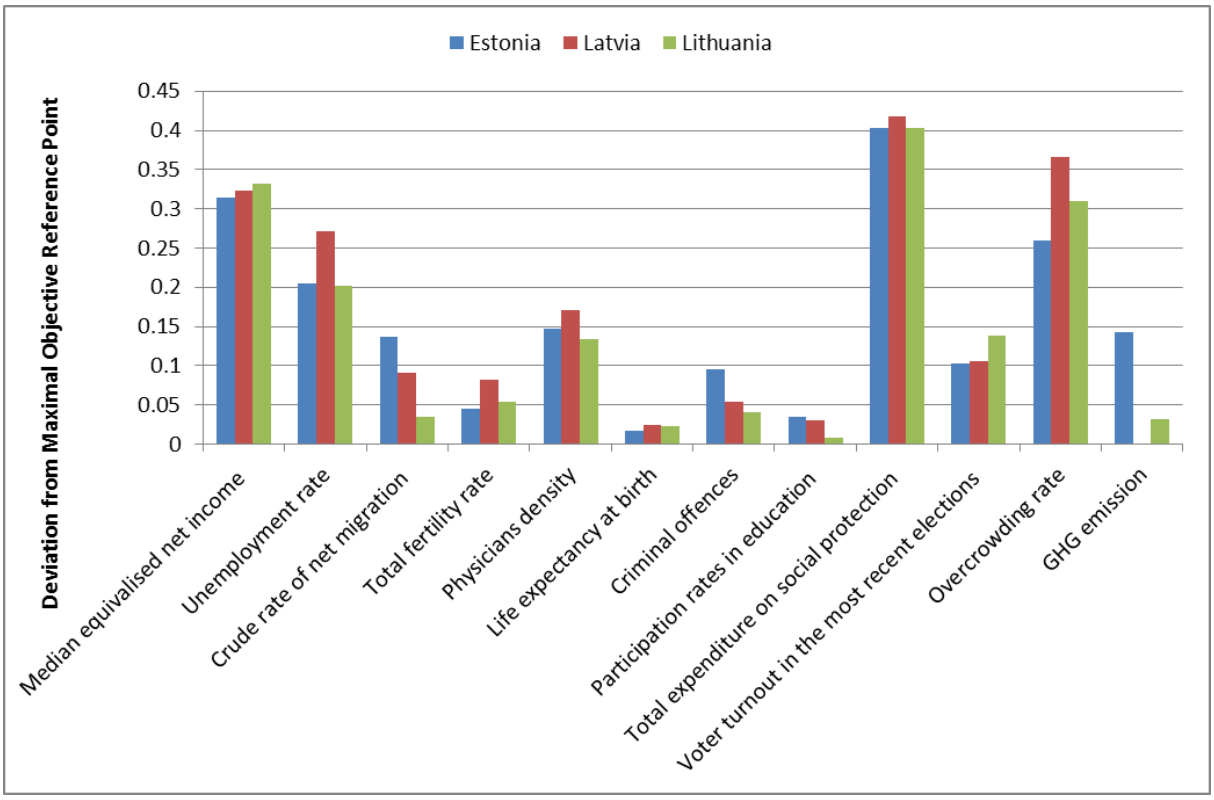
The initial data are summarized in Table 2. It concerns 2008 or 2009 after the availability of the data. As one can see, the indicator of migration was peculiar with negative as well as zero values. Indeed, these values would distort results of the Full Multiplicative Form. Therefore, they are transformed to positive numbers by applying the shifting constant b_j to each *j*-th criterion having at least one negative $x_{ij}^{'}$ value (Ginevičius *et al.*, 2010):

$$x_{ij} = x_{ij}^{'} + b_j , \qquad (5)$$

where $b_j = \min_i x_{ij}^{'} + 0.001$ is the shifting constant.

Hence, Eq. 5 was applied for migration indicator. The latter computation enabled to avoid both negative and zero values and thus perform ranking according to all three parts of MULTIMOORA. The data were normalized by employing Eq. 1 and thus turned into dimensionless numbers. Consequently, Eq. 2 was applied in order to rank the states according to the Ratio System. In addition, EU Member States were ranked with respect to the Reference Point approach (Eq. 3). Furthermore, the deviations from Maximal Objective Reference Point were used to identify strengths and weaknesses of the three Baltic States (Fig. 3). Finally, Eq. 4 was applied in order to rank the countries according the Full Multiplicative Form. The theory of dominance (Brauers, Zavadskas 2011) was applied to summarize the three ranks provided by respective parts of MULTIMOORA into single final rank. The results are presented in Table 3.

Figure. 3.
Deviations from maxima of well–being indicators in the EU for the Baltic States, 2009



As it was mentioned above, Fig. 3 presents comparison of separate well–being indicators for the three Baltic States, namely Estonia, Latvia, and Lithuania. Larger deviation from Maximal Objective Reference Point means that certain state is peculiar with relatively low value of respective indicator (and vice versa for indicators to be minimized). The Baltic States are close to the maximal values in the EU according to participation rate in education and total fertility rate. This suggests that appropriate management of education systems in the region could turn it into competitive, high-technology production oriented hub. In addition, social support could sustain high fertility rates and thus mitigate further demographic problems. Although life expectancy indicator exhibits relative closeness to the maximum in the EU, it is mainly caused by narrow range of its values across EU countries. Indeed, Estonia, Latvia, and Estonia with life expectancy of 75, 72, and 73 years, respectively, have still much to achieve in order to reach 82 years for Italy and Spain. Noteworthy, physicians' density in the region is mediocre and this, alongside with other factors, can be considered as a cause of shorter life expectancy. The three Baltic States are also peculiar with relatively low rates of criminal offences. The low values of median net income and expenditures on social protection indicate poor economic performance. As a result higher levels of unemployment and overcrowding are observed in the three Baltic States. Finally, Latvia is peculiar with the lowest GHG emissions, whereas Estonia exhibits a higher rate. The Baltic States, hence, could cooperate in developing their energetic sectors and promoting renewable energy.

Table 2. Initial data for assessment of well–being in the EU Member States, 2008–2009

	Median equivalised net income (EUR)	Unemployment rate (%)	Crude rate of net migration (per 1000 population)	Total fertility rate (births per woman)	Physicians density (per 1 000 population)	Life expectancy at birth (years)	Criminal offences (per 1000 population)	Participation rates in education (%)	Total expenditure on social protection per capita (EUR)	Voter turnout in national parliamentary elections (%)	Overcrowding rate (%)	GHG emission (tonnes per capita)
Belgium	19313	7.9	5.9	1.82	2.987	80	93.13842	68.9	7568.651	89.2	3.9	11.5725
Bulgaria	2828	6.8	-2.1	1.57	3.635	74	16.57972	52.4	491.6088	60.6	47	7.821285
Czech Republic	7295	6.7	2.7	1.49	3.625	77	33.11769	61.6	2222.625	62.6	26.6	12.69878
Denmark	24933	6	1.8	1.84	3.419	79	87.10212	66.1	10845.74	86.6	7.8	11.06514
Germany	18586	7.8	-0.1	1.36	3.531	80	74.36498	65.1	7462.713	70.8	7	11.21551
Estonia	6209	13.8	0	1.63	3.409	75	38.01601	60.7	1253.348	61.9	41.2	12.56104
Ireland	22432	11.9	-6.2	2	3.187	80	24.51858	61.7	6946.115	67	3.7	14.02125
Greece	11496	9.5	3.1	1.52	6.043	80	37.22124	64.2	4231.627	70.9	25	10.88265
Spain	13300	18	1.1	1.39	3.705	82	51.47766	56.3	4169.84	75.7	3.2	8.020132
France	19760	9.5	1.1	1.98	3.497	81	57.26774	57.8	8029.932	60.2	9.6	8.035651
Italy	15637	7.8	5.3	1.41	4.242	82	45.45321	57.3	5900.946	80.5	23.3	8.17919
Cyprus	17432	5.3	2.3	1.51	2.3	81	9.266803	46.6	3184.118	89	1	11.79733
Latvia	5474	17.1	-2.1	1.32	2.988	72	25.30942	62	752.0687	61	57.7	4.741975
Lithuania	4815	13.7	-4.6	1.55	3.664	73	21.32632	69.3	1231.975	48.6	49	6.450694
Luxembourg	31764	5.1	13.2	1.59	2.862	81	58.30934	42.5	13870.28	100	6.4	23.67579
Hungary	4739	10	1.7	1.33	3.097	74	40.65612	64.6	1645.77	64.4	55	6.652095
Malta	9933	7	-0.4	1.44	3.073	80	33.64206	47	2212.95	93.3	4	6.92925
Netherlands	20156	3.7	2.3	1.79	3.921	81	74.24524	68	8616.805	75.4	1.7	12.06324
Austria	19886	4.8	2.5	1.39	4.749	80	68.84518	55.1	8164.654	81.7	13.2	9.581868
Poland	5097	8.2	0	1.4	2.144	76	28.38879	71.7	1444.178	53.9	49.1	9.876763
Portugal	8282	9.6	1.4	1.32	3.755	79	40.54918	58.9	3131.335	59.7	14.1	7.01809
Romania	2162	6.9	-0.1	1.37	1.9166	73	13.43936	56.9	339.1865	39.2	55.3	6.085415
Slovenia	11864	5.9	5.6	1.53	2.473	79	40.74927	70.4	2753.836	63.1	38	9.515529
Slovakia	5671	12	0.8	1.41	3	75	19.39604	57.5	1337.439	59	39.7	8.019579
Finland	20962	8.2	2.7	1.86	2.735	80	66.9803	69.9	8096.914	65	5.9	12.45439
Sweden	21248	8.3	6.7	1.94	3.583	81	150.0452	65.3	9383.512	82	10.5	6.481391
United Kingdom	16256	7.6	3	1.94	2.739	80	84.81499	48.4	5849.471	65.5	7.2	9.192453

The final ranking is given in the last column of Table 3. It is possible to define the three relative groups of EU Member States: Group 1 consisting of states attributed with ranks 1 to 9, Group 2 encompassing those with ranks 10–18, and Group 3 for the remaining states.

Table 3. Results of multi–objective assessment of well–being in the EU Member States, 2008–2009

Member State	*Ratios*			*Ranks*			
	RS	*RP*	*MF*	*RS*	*RP*	*MF*	***MULTI-MOORA***
Ireland	0.88741	0.220899	21699071239170.3	1	6	1	**1**
Netherlands	0.836532	0.215319	10570913835	3	4	3	**2**
Denmark	0.864383	0.257923	2131676486	2	9	4	**3**
Austria	0.752838	0.197425	1061347888	4	3	5	**4**
France	0.726729	0.186323	1010556702	5	1	6	**5**
Cyprus	0.666578	0.340917	13147479240	6	13	2	**6**
Finland	0.637462	0.195535	873632544.4	7	2	10	**7**
Germany	0.633385	0.215716	883980081.1	8	5	9	**8**
Belgium	0.549913	0.277925	972254487.5	11	10	7	**9**
Malta	0.602377	0.3719	901191048	9	17	8	**10**
Luxembourg	0.591421	0.426223	789486014.2	10	24	11	**11**
Italy	0.526718	0.254243	268638493.9	12	7	15	**12**
United Kingdom	0.448642	0.255885	326449111.8	15	8	14	**13**
Greece	0.508293	0.307499	181845623.5	13	11	16	**14**
Spain	0.393226	0.30947	574893035.3	17	12	12	**15**
Sweden	0.487246	0.466497	549747211.9	14	27	13	**16**
Portugal	0.39762	0.342601	121956013.6	16	14	17	**17**
Slovenia	0.210451	0.354644	42286978.76	20	15	19	**18**
Czech Republic	0.25106	0.371591	38977538.28	18	16	20	**19**
Lithuania	0.202512	0.403196	56020533.05	21	22	18	**20**
Slovakia	0.111578	0.399831	15734703.66	22	20	21	**21**
Bulgaria	0.224664	0.426815	10969502.66	19	25	22	**22**
Poland	0.062333	0.396426	9270241.3	23	19	23	**23**
Hungary	0.01661	0.389994	8415302.381	24	18	25	**24**
Estonia	0.00956	0.402514	7238001.355	25	21	26	**25**
Latvia	-0.02418	0.418506	9104744.697	27	23	24	**26**
Romania	-0.01205	0.431678	1646733.873	26	26	27	**27**

According to our research, Group 1 consisted of Ireland, the Netherlands, Denmark, Austria, France, Cyprus, Finland, Germany, and Belgium. Thus, Ireland has achieved the highest level of well–being (as of 2009). Indeed, such rankings as Quality-of-life index (Economist Intelligence Unit 2005) and HDI (UNDP 2010) also place Ireland at the top of the

EU Member States. In the later years Ireland will certainly loose its first rank given its financial breakdown.

The Group 2 consists of Malta, Luxembourg, Italy, United Kingdom, Greece, Spain, Sweden, and Portugal. As one can note in this group there are many states experiencing serious fiscal crises, e. g. Greece, Italy, Portugal. Hence it is likely that some changes will occur in this group of states.

Finally, the Group 3 encompasses relatively least advanced EU Member States, namely Czech Republic, Lithuania, Slovakia, Bulgaria, Poland, Hungary, Estonia, Latvia, and Romania. We can notice Estonia, Latvia, and Lithuania in this group with the latter being the most advanced one.

The results of suchlike studies could be successfully integrated in the further researches. For instance, the wider comparison of EU Member States, G–20 countries, BRICs, CIVETS (or the *new* BRICs) would provide us with some additional insights on the trends of well–being and thus possible shifts in migration. Moreover, integrated assessment of well–being and economic, ecological, or energetic performance (Cravioto *et al.* 2011) of certain states would also provide with a comprehensive overview of socio–economic development there.

CONCLUSION

In our study we proposed a model for the objective *societal well–being*. It was applied for international comparison of the EU Member States. Ireland, the Netherlands, Denmark, Austria, France, Cyprus, Finland, Germany, and Belgium have achieved the highest level of well–being. In the middle we find Malta, Luxembourg, Italy, United Kingdom, Greece, Spain, Sweden, and Portugal. At the other end of the spectrum, Czech Republic, Lithuania, Slovakia, Bulgaria, Poland, Hungary, Estonia, Latvia, and Romania can be considered as those with relatively lowest well–being. Nevertheless some reservations have to be made for the years studied namely the recession years 2008-2009. Afterwards the outcome of this recession will certainly influence the position of Ireland, Italy, Portugal Spain and Greece. However, no more recent data were available during the preparation of the study.

The discovery and application of an appropriate method, nevertheless, is more valuable than the availability of data, as a general application is made possible. This method is MULTIMOORA, a method that enclose MOORA (i. e. Ratio System and Reference Point) and the Full Multiplicative Form. The advantage of this composed approach is that the composing parts control each other and that all parts are based on dimensionless measures and in this way are escaping from the choice of subjective weights.

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VIŠECILJNA OPTIMIZACIJA BLAGOSTANJA U ZEMLJAMA ČLANICAMA EUROPSKE UNIJE

SAŽETAK

Blagostanje je od ključnog značaja kako za pojedinca tako i za društvo u cjelini. Stoga je važno kvantificirati performanse i napredak određenih država, regija, zajednica, društvenih grupa i pojedinaca kako bi se unaprijedilo njihovo blagostanje. Cilj istraživanja je ponuditi novi okvir za višeciljnu procjenu kao i međunarodnu usporedbu objektivnog blagostanja. Blagostanje je višedimenzionalna pojava; stoga bi prikladni sustav indikatora trebao biti u mogućnosti identificirati najvažnije temeljne procese koji utječu na blagostanje. Za potrebe našeg istraživanja ustanovili smo indikatorski sustav od dvanaest indikatora koji identificiraju razne dimenzije blagostanja. Stoga predlažemo MULTIMOORA, model koji se može koristiti za približavanje cilju društvenog blagostanja. Primjenjuje se u svrhu međunarodne usporedbe blagostanja u zemljama članicama EU. Tako se otkrilo da su Irska, Nizozemska, Danska, Austrija, Francuska, Cipar, Finska, Njemačka i Belgija dosegle najviši stupanj blagostanja od 2009. Na drugom kraju spektra se nalaze Češka, Litva, Slovačka, Bugarska, Poljska, Mađarska, Estonija, Latvija i Rumunjska u kojima je blagostanje najniže.

***Ključne riječi**: socijalna država, blagostanje, održivi razvoj, MULTIMOORA višeciljna optimizacija*