Critical evaluation of sustainability indices

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Questions of welfare and development have been an interesting aspect for economic researchers for a long time. Though most economists agree that the most often used indices of the SNA (GDP, GNP) struggle with a serious deficit in welfare measuring, these indices are still "doing well" as welfare indicators within the current economy and economic policy decision-making. The reason for this is partially that, according to some opinions, maximization of these economic indices is a necessary but not sufficient condition of welfare growth. On the other hand convincing welfare measuring alternatives are missing.

In our study we will critically analyse three welfare indicators (GDP, Human Development Index (HDI), Sustainable Society Index (SSI)) based on the dilemmas connected to welfare theories appearing in welfare economics. Our conclusion is that (1) valid single-dimensional indicators can not necessarily be created for measuring welfare, and (2) over a certain level the GDP per capita indicator does not go hand in hand with the extent of welfare increase indicated by other welfare indicators based on broader information basis.

Keywords: Sustainability, Gross Domestic Product (GDP), Human Development, Index (HDI), Ecological Footprint (EF), Genuine Savings (GS), Sustainable, Society Index (SSI)

1. Introduction

The information base of the SNA indicators does not (or only to very limited extent) cover the natural environment, the natural processes evoked by economy, nor human welfare. Knowing this, in the past decades - and most particularly since the 1990's - more and more organisations and researchers have been trying to work out indicators and indicator systems reflecting sustainability and sustainable

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development. Nothing can prove it more than the fact that the 2003 researches mention more than 500 attempts of elaborating welfare sustainability indicators (indicator sets) (Böhringer-Jochem 2007). Nowadays every important geopolitical (EU, UNO, OECD) has its own sustainable development – and welfare as a part of it – indicator set.

In contempt of all these attempts, traditional indicators of the SNA are those determining mainstream economics analyses on one hand and economics decision-making on the other. There are more reasons for this. On one hand, according to some opinions increasing these economic indicators is a necessary, though not sufficient condition of welfare growth, on the other hand there are no convincing alternative indicators for welfare measurement and supporting economic policy decision-making. At the same time, statements above can not be considered generalized, they are rather questionable instead. The structure of our study in order to critically investigate these statements is as follows: First we will deal with a couple of welfare theories with radically differring messages, then, based on these messages we will determinate a system of viewpoints which will be later used for analysing the indicators investigated. Following this we will critically analyse the indicators of GDP, HDI and SSI based on the roughed theories, dilemmas and system of viewpoints in order to see to what extent can these (based on the level of our current knowledge) be considered valid in measuring welfare. In the third part of our study we will analyse the relationship of these indicators on national level using statistic methods. Finally, we will draw consequences based on this analysis.

2. Theoretical basis of welfare - approaches to welfare in economics

2.1. Economics theories of welfare and the resulting dilemmas with regard to measuring welfare

Defining the term welfare and its theories reaches back to a long history. In our study we will focus on those three theories that can be bound to indicators analysed by us.

The most widespread theory in welfare economics is the *preference utilitarianism* which - as indicated by its name - takes satisfying the individual preferences into consideration. This is a formal theory, ie. it provides only methodology for reaching welfare but does not determine it explicitly. The core idea of this theory is: „If the individuals are entirely following their own interest, they will prefer *x* to *y* in case and only if they think *x* is better for them than *y*. In case they are well informed, their supposition will become true and *x* will be better for them than *y* in case and only if they prefer *x* to *y*." (Hausmann-McPherson 1997,). Preference satisfaction is thus intentionally quite far from undeterminable areas of

emotions and it presumes that people know what is good for them and it is appropriately mirrored by their preference system. This theory belongs to neoclassic mainstream economics and it creates a base for most of economic policy nowadays.

Preference utilitarianism basically operates with ordinal concept of usefulness, ie. it strives to find out whether one state is better or more useful than the other. To measure and compare welfare, however, we might need also a cardinal scale, it means to assign a value to particular preferences (Dasgupta 2001). Money is obviously the simpliest solution for economists. It means we should take a look at how much people would pay for the realization of a particular preference. This point of view is called *materialistic utilitarianism*.

Another theory – also having a significant literature background - is the theory of *elementary goods*. The founder of this stream is John Rawls. According to him welfare must be measured in social goods that are instruments for the individual to live a complete life in the society. Rawls says that elementary goods are the following: freedom, law, power, opportunity, income, property and social basics of self-esteem (Rawls 1971). The command of freedom rights is the primarily important among these.

Since then many economists have tried to set a list of elementary human goods starting-up from Rawls' elementary goods. Using results of different sciences resulted in similar or absolutely different results. The lists offer quite a wide range of goods: they contain material goods such as income, drinking water, food, health; psychological factors such as complacence, happiness, self-realization; more complex terms such as education, safety, human rights as well as more abstract factors such as opportunity or freedom (Alkire 2002). In setting up the elementary goods there can be seen a tendency that along with material goods, even more emphasis is given to environmental protection, human rights, participation in public life or equality and freedom.

Another substantive – it means explicitly defining welfare - theory can be associated to the name of Amartya Sen, a Nobel-prize economist: it is the *capabilities approach*. The term "capability" is explained by Sen as real freedom enjoyed by people. The most significant difference between his and Rawls' elementary goods is that the concept of capabilities does not contain only instruments necessary for welfare, but also relevant human features that determine to what extent can the individual use his elementary goods in order to achieve his goals. Among capabilities the freedom enjoyed by individuals, which is not only an instrument but also a goal of welfare for Amartya Sen, is of special importance. According to Sen's theory the main advantage of the capabilities approach in comparison to utilitarian approaches is that it leans on a wider information base (Sen 2003), meaning that it takes such information and elements of welfare into consideration that were left out from materialistic utilitarianism due to strong reduction. Among these we can find health or education for instance.

The common factor of substantive theories is that they keep the resources of welfare in mind in one form or another, they are specifically interdisciplinary, pluralistic, it means they approach the term of human welfare from more aspects, thus they catch such aspects that can not - or can only be with difficulties - measured with money. They receive most of criticism because they want to take too much into consideration and it goes at the expense of welfare measurability.

Based on the theories sketched above building our criteria system is as follows: as a starting point we will use Sen's term of information base, it means we will criticise the indicators based on what information they include from the most widely understood term of welfare. In line with this we will investigate which information is left out by indicators, because the information left out is as important in index evaluation as the information included (Sen 2003).

Based on the width or scarcity of the information base we can state the following about the welfare theories: the most frequent accusation of utilitarian approaches is that they are over-reduced, they cover a narrow information base, ie. there is valuable information that is not taken into consideration during welfare measurement. In comparison to this, the theory of elementary goods, or the capabilities approach leans on a much wider base, it takes many kinds of welfare elements into consideration, however, this multi-dimensionality often causes difficulties with measurability.

Based on the width or scarcity of information base we have made up the following criteria system:

- **Which measuring devices are favoured by indicators.** The first visible set of problems when bringing welfare theories to practice is the question of welfare measurability and its unit of measurement. Materialistic utilitarianism uses money as a unit of measurement and valuation of different goods is done by the market. This obviously results in significant information base narrowing as most welfare elements - health for instance - are not easily measured with money. In comparison to this, substantive theories recommend using more units of measurement, thus trying to avoid information loss.
- **Mental or physical welfare are taken into consideration.** In the long list of elementary goods, but also among the Sen-like capabilities we can find factors belonging to physical welfare, such as healthy lifestyle or drinking-water and food supply, as well as categories determining mental categories such as complacence, happiness, the feeling of holding one's life in one’s own hands or optimism with regard to future events. Clean environment - which definitely contributes to human health - can also be considered as belonging to physical welfare. Though measuring mental welfare is one of the most problematic questions. We can state that their consideration increases the width of the information base.

- **Do they take such important aspects of welfare like social equality, applying human rights or clean and healthy environment into consideration?** Aggregated indicators are often criticised that during aggregation the question of equality is being overlooked. This is true for all kinds of equality: equal distribution of material goods as well as equal opportunities between sexes. We could see with substantive theories that individual values, human rights, positive freedom rights are even more stressed, therefore these make up an important element of the information base.

3. Critical evaluation of welfare indices

Based on the theoretical dilemmas roughed above we endeavour to show the particular "paradigmatic" elements in particular indicators (chosen by them), as well as evaluate those from the point of view of their information base - it means to what extent they can be considered valid in welfare measurement. As most indices or indicator systems do not unambiguously fit a welfare paradigm, we do no have the opportunity to unambiguously assign these to the theories roughed above. Next we will take the indices chosen for analysis, we will briefly introduce them and at the end we will deal with the criticism specifically touching the indicators.

3.1. GDP

With regard to the information content of the traditional accountancy systems such as the System of National Accounts (SNA) or European System of National Accounts (ESA) it can be said that those do not take action outside the market (for example housework, work in the voluntary sector and services provided by the environment) into consideration. Both of them are based on the assumption that natural resources form an inexhaustible property, and that nature can entirely accept all waste created during mining and other works, it means it is built on the theory that economic growth can reach no natural limits (Giovanelli 2004). We can meet with even more criticism related to information content of review system indicators (GDP/GNP) (Szlávik 2006, van de Bergh 2007, Dabóczy 1998a, 1998b). With regard to the aspects of our study we can state the following about these indicators: based on our first aspect here comes the main criticism of the GDP: it *evaluates in money* and deals only with measuring economic performance. On one hand evaluating in money faces serious theoretical dilemmas itself, on the other hand it excludes (or includes only for impacts on small processes) those elements of welfare about which we can not unambiguously state that they are closely connected with income growth. We can include health or healthy and good quality natural

environment here. This leads us further to our next aspect: elements describing welfare as good mental or physical state. GDP does obviously *not take mental states into consideration* and from among the physical elements of welfare only income is being dealt with. We can use the same criticism based on the third aspect: GDP can in no case be *connected with social equality* as it does not deal with distribution of income nor with applying human rights. To sum it all up, we can say about GDP that it leans on the theory of utilitarianism and it excludes much information from the evaluation, therefore it offers only an extremely narrow information base. Therefore, it can be considered a reductionist welfare indicator with very narrow information base.

3.2. HDI – Human Development Index,

One of the most famous and influencing indicator belonging to substantive theories is the Human Development Index (HDI). This indicator focuses on the human being instead of material goods as it „considers the human development a process of broadening an individual's possibilities of choice" (quotes Garami 2008). Creating the HDI is usually connected with Amartya Sen[4] whose capabilities approach provides a theoretical frame for the indicator. The main advantage of HDI is that it tries to catch the human development in more dimensions thus giving a more complex picture about the change of standard of living than the one-dimensional approaches. At the same time it has a smaller data demand in comparison with complex indicator systems; therefore, its value can be calculated for many countries and can be easily applied also in political decision-making.

HDI uses three dimensions for measuring development that represent the possibilities of choices of people:

1. long and healthy life,
2. education,
3. economic performance (HDR 2007/2008).

The first component is being approached using life expectancy at birth. This indicator gained the least criticism; therefore, it remained unchanged (Husz 2001). They had first tried to determine the second component as the rate of literate population first, but this approach got much criticism (Husz 2001) so in 1995 the combined gross education rate was added which covers the rate of all visitors of elementary, secondary and higher education institutions to the entire population (6-23 years of age) in %. This way the education dimension is obtained as the weighted mean of these two values, the number of literate population being two-thirds and the education rate being one-third of the total value. The index attempts to measure the material goods abundance using the purchasing power parity GDP per capita where

[4] De Benicourt (2002) for example denies that any theory could be in relation with creating the HDI.

a logaritmic formula has been established for HDI. It was probably this component that received most criticism later on.

The problem arising from different units of measurement of the three components was resolved in the way that instead of absolute indicator values the relative values of particular countries were compared side by side. According to this conception, performance growth of the countries was, however, bound to performance of other countries. Because of this problem following the criticism since 1994 extremes of all indicators have been recorded and data of particular countries were correlated to these extreme values. Thus the annual values of these indices have become comparable (Husz 2001).

From the values of dimensions obtained this way the HDI has been calculated as follows:

$$HDI = 1 - \frac{I_1 + I_2 + I_3}{3}$$

Analysing the HDI based on our system of viewpoints using the first point of view we can declare that this indicator does not expresses the welfare change in money but in a *point value* between zero and one. Its preferred measurement device thus is a scoring system where the education and long and healthy life factors were not reduced by financial evaluation. The selected units of measurement obviously can - and they definitely do - face methodology criticism, nevertheless, we can state for sure that using more dimensions is a step towards information base increasing (Husz 2001). With regard to taking mental and physical states into consideration we can say that though HDI does not handle mental states, it takes *three different elements of physical welfare* into consideration: health, education and income. This obviously increases the mass of information included, nevertheless, it always excludes such factors as clean environment or drinking-water and food supplement. One of the most important criticisms of the indicator belongs to our third point of view: *social differences do not appear explicitly* in the indicator. It implicitly includes the question of distribution with the logaritmic formula used for GDP calculation, though. The same way we get information about the fulfilment of human rights only indirectly: about right for education via the education dimension and about healthcare via the factor of long and healthy life. However, types of political freedom are missing as such from the indicator information base.

To summarize what we already know: the HDI per the Sen-like capabilities approach determines the development by growth of possibilities, the human possibilities and such welfare are being approached by the three emphasized factors. By involving health and education the HDI provides much broader information base for the index than the emphasized indicators of the SNA. At the same time its information base can be still considered quite narrow from the point of view of welfare, considering that certain information important of welfare are not or only

very indirectly included (we can mention inequality, political freedom rights, mental states, clean and healthy environent here). Next, the averaging used during conversion of partial values of individual components to a final HDI value can easily result in the fact that countries in entirely different situations can appear as similarly developed.

3.3. SSI – Sustainable Society Index

The SSI summarizes the most important elements of a nation's sustainability and quality of life in a simple and transparent way. *A society is considered sustainable when it is able to fulfil the needs of the current generation in a way that does not endanger future generations' ability to fulfill their needs, and where all the people have the possibility to develop their capabilities in a balanced society freely and in harmony with their environment.*

The indicator takes twenty-two factors into consideration (grouped into five categories), calculated by using data of scientific institutions and international organisations. The twenty-two factors are converted to a scale ranging from zero to ten in the following way: in case the factor fully corresponds with the sustainability criteria set, it has the value of ten points, in case it does not correspond at all, it is worth zero points. Determining the criteria was simplier for some factors (e.g. the portion of undernourished people to the whole population should be zero), while it was more complicated for others (mostly with environmental factors). From the five groups the first three were taken 1/7 of their weight while it was 2/7 of weight for the last two groups (indicators within the groups appear with equal weight) (van de Kerk-Manuel 2008a).

In the first group we can find factors of personal development, healthy life, sufficient food supply, sufficient amount of drinking-water, the appropriate health conditions, the possibility of taking part in public education as well as the equality between sexes. The second group includes factors of clean environment, air quality, quality of surface water and the quality of soil. The third group measures factors important from the point of view of a settled society: good government, unemployment, population growth, distribution of income and government debt are considered. The fourth group contains factors of sustainable use of resources, recycling of waste, utilization of renewable hydropower and renewable energy consumption. The fifth group contains factors important from the point of view of Earth sustainability, area of land covered by forests, preservation of biodiversity, emmission of greenhouse gases, ecological footprint and international cooperation.

With respect to the nature of SSI welfare sustainability indicator and the fact that our study concentrates merely on measuring welfare, during our analyses the starting point was not the entire SSI indicator, only its version narrowed to measuring welfare („well-being SSI"). From the five SSI indicator groups roughed out above the first and the third contains social indicators, while the second, the

fourth and the fifth contains environmental indicators (excluding the international cooperation) (for indicator details see van de Kerk–Manuel 2008b). The „well-being SSI" indicator created by us contains the social indicator groups as well as the one from the environmental indicator groups in connection with clean environment. The latter because this indicator is not primarily connected with sustainability (ie. capability of ensuring welfare in the future) but with the current welfare as the environmental indicators it contains influence the welfare in present directly at a particular place (see the Sen-Stiglitz material).

Based on our evaluation viewpoints it can be said that the well-being SSI uses a chiselled *point system* as the unit of measurement, thus financial evaluation is supressed. Measuring the consumption preferred by the materialistic utilitarianism is consciously denied as the GDP per capita is intentionally excluded from among the welfare indicators. Based on our first viewpoint this is definitely a step towards increasing the information included. Based on our second viewpoint we can say that SSI takes the wide offer of *physical welfare elements* explicitly into consideration: food, drinking-water, health, clean environment, etc. However, SSI also *handles the mental states as excluded information*. From some factors - for example unemployment or good government - we can deduce general satisfaction though. In accordance with our third viewpoint the strength of the indicator is that in measuring welfare it *emphasizes the particular types of social differences* (income distribution, equalitiy between sexes) and thus also justice as well as certain human rights.

To sum it all up, we can say about the index that from the three indicators analysed by us the SSI offers the broadest information base. Only mental states belong to excluded information, therefore, criticism can be first of all given to factor weighting or point system methodology. At the same time the fact that three welfare components compose one well-being SSI value brings up the problem discussed with regard to HDI, according to which countries in entirely different situations appear to be similarly developed (this problem permanently appears when calculating the SSI value as the information loss caused by averaging is even bigger here).

Finally, we would like to draw attention to one more viewpoint common for all three indicators - or rather generally with regard to welfare indicators and indicator systems based on statistical data collection. **It is the too general nature of welfare and sustainability indicators and indicator systems based on statistical data** (Simon 2003, Pataki without publication data.). As Pataki draws with regard to these indicators: „Though these indicators and associates make a big step towards a more complex and real measuring of the society, everything has certain limits. First of all it is that they are rather general, a social group, the society or its well delimitable part can not identify itself in it as a whole. This process results in customized, broad indicators - or more precisely its well selected aggregation - in which a region or a town makes common steps to sustainable development in accordance with the society." (Pataki, without publication data).

4. Analysis

The present analysis, related to well-being indexes, has been done on the basis of a 150-element data series. The main analytical objective was to study the existence of any reported correlations between well-being indexes and the interpretation method serving this correlation. The relative GDP and HDI data refer to 2005, while the SSI data relates to 2006 (as the latter indicator was not published in years prior to 2006). HDI values are based on data provided by the 2007/2008 Human Development Report and documents dealing with HDI trends and indicators (1980-2007), including the latest data (http://hdr.undp.org/en/statistics/data/). The GDP data source is the 2007/2008 annual Human Development Report[5]. The basic data for the well-being SSI values have been provided by the official homepage for this indicator (http://www.sustainablesocietyindex.com/ssi-data.htm). Original data is intentionally used in the present work; in a case of data shortage, calculations were based on the average value of a specific region (as indicated several times in this analysis).

The basic sample data proves that the average HDI value is 0.7, which indicates a moderate development level. As shown with a regional division, North-America and Europe (EU and non-EU) are highly developed; Latin-America and the Caribbean, Middle East, Central Asia and Asia-Pacific are moderately developed, while Africa - with its 0.52 HFI value - is very underdeveloped. With regard to relative GDP data, North-America and Europe (EU and Non-EU) are ranked in the first three places; intermediate locations, i.e. the medium-developed category based on HDI, is made up of the 3 aforesaid regions; and Africa is the most underdeveloped of all. The difference for this indicator compared with HDI is due to the comparative diversity of the regional development rankings (Table 1). The mainstream is unchanged in respect of SSI values, as the separate categories include the same groups of countries as the other two indicators. However, the internal category ranking changes here: Europe is first, North-America is second, and these are followed by non-EU member states. The Middle East and Central-Asia, Latin-America and the Caribbean and Asia-Pacific come ahead of Africa, which is ranked last as regards region. In short, the reported indicators uniformly separate developed, moderately- and a less-developed regional groups – though such indicators do also lead to various well-being-rankings within regional groups (Table 1).

[5] As GDP is one of the HDI components, relative GDP data of HDI has been used to avoid errors related to data diversity published by various organizations. The HDI index of several countries - Norway, Ireland, the United States, Singapore, Kuwait, and the United Arab Emirates - has been calculated with a $40 000 GDP per capital ratio. This data has been replaced in the analysis by the corresponding data of the Human Development Report.

Table 1. Regional data and range based on the analyzed well-being indicators

Region		HDI	Well-being rank by HDI (mean)	GDP (in PPP)	Well-being rank byGDP (mean)	Well-being SSI	Well-being rank by well-being SSI (mean)
Africa	Mean	0,5163		2983,6764		4,4776	
	Std. Deviation	0,1281		3666,0129		0,8528	
	Minimum	0,3302		283,2481		2,6988	
	Maximum	0,8375	7	14635,5937	7	6,6121	7
Middle East and Central Asia	Mean	0,7558		9857,1152		6,3124	
	Std. Deviation	0,1246		8773,9084		0,6528	
	Minimum	0,3473		1036,3554		5,0676	
	Maximum	0,9293	5	26321,0000	4	7,7402	4
Asia-Pacific	Mean	0,7100		9162,8517		5,5194	
	Std. Deviation	0,1414		11188,5660		1,1077	
	Minimum	0,5272		904,4509		3,6583	
	Maximum	0,9666	6	33820,6802	5	7,8549	6
Latin America and the Caribbean	Mean	0,7917		7773,0051		5,7218	
	Std. Deviation	0,0536		4287,2773		0,6727	
	Minimum	0,6910		1130,7481		4,1295	
	Maximum	0,8720	4	19998,8528	6	6,8778	5
North America	Mean	0,9588		38261,0165		7,4895	
	Std. Deviation	0,0055		5132,1577		0,2710	
	Minimum	0,9549		34632,0330		7,2979	
	Maximum	0,9627	1	41890,0000	1	7,6812	2
Europe (EU)	Mean	0,9133		25508,1959		7,5202	
	Std. Deviation	0,0455		9225,7965		0,4427	
	Minimum	0,8240		9837,4869		6,6670	
	Maximum	0,9614	2	38505,0000	2	8,4633	1
Europe (Non-EU)	Mean	0,8347		15293,6566		7,3163	
	Std. Deviation	0,0735		12981,7493		0,6017	
	Minimum	0,7124		2319,5085		6,5497	
	Maximum	0,9683	3	41420,0000	3	8,4156	3
All	Mean	0,7127		10623,8201		5,8089	
	Std. Deviation	0,1815		11319,5672		1,3683	
	Minimum	0,3302		283,2481		2,6988	
	Maximum	0,9683		41890,0000		8,4633	

Source: own creation

After basic data analysis, attention will focus on the main research issue i.e. the existence of any correlations between well-being indicators. As proved by the correlation matrix (Table 2), the well-being indicators are significantly, strongly and positively related to each other.

Table 2. Correlation matrix for the analysed well-being indicators

Correlations

		HDI value	GDP per capita, PPP (constant 2007 international $	Well-being SSI
HDI value	Pearson Correlation	1	,787**	,862**
	Sig. (2-tailed)		,000	,000
	N	150	149	150
GDP per capita, PPP (constant 2007 international $	Pearson Correlation	,787**	1	,765**
	Sig. (2-tailed)	,000		,000
	N	149	149	149
Well-being SSI	Pearson Correlation	,862**	,765**	1
	Sig. (2-tailed)	,000	,000	
	N	150	149	150

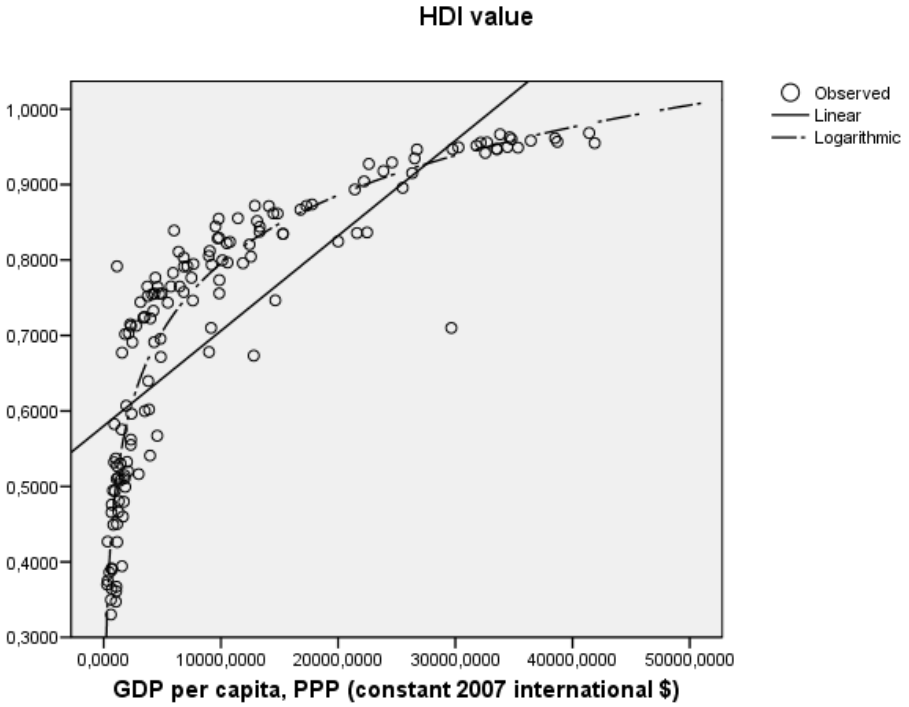
**. Correlation is significant at the 0.01 level (2-tailed).

Source: own creation

A regressive model estimate has been applied to seek out the correlations between specific indicators. Linear, logarithmical and exponential models will be later inserted into this analysis to demonstrate the direction of the correlations between indicators.

With an **analysis of GDP-HDI correlations**, we can say that these two indicators are logarithmically correlated (explanatory strength rate: R2=0,845) (Table 3), so a GDP increase proportionally follows human development for a period if the latter is measured in HDI (Figure 1). With countries having a low GDP per capita, this rise has a growing tendency, yet it slows down after the inflection point of the model; and after a point, the GDP increase hardly contributes at all to any HDI increase. It is interesting to note that happiness research results indicate a similar correlation between economic performance per capita and well-being - if this goes to equal happiness (Layard 2005) the possession of capital assets increases personal and social well-being for a period, but above a certain level it comes to a virtual halt.

Figure 1. Correlation between the development of GDP and HDI indexes (cross-section analysis relating to the countries of the Earth based on 2005 data)



Source: own creation

Table 3. Principle features of the regressive model inserted in cases of correlation between GDP and HDI indexes (cross-section analysis relating to the countries of the Earth based on 2005 data)

Model Summary and Parameter Estimates

Dependent Variable: HDI value

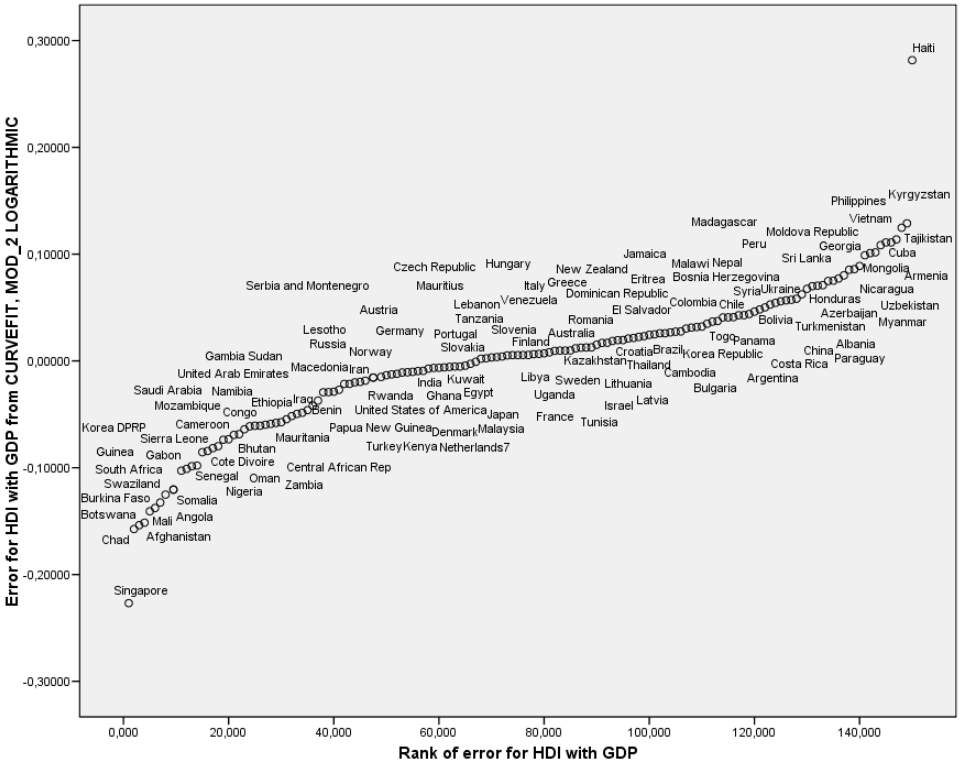
	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Linear	,619	238,837	1	147	,000	,580	1,26E-005
Logarithmic	,864	930,460	1	147	,000	-,405	,130
Exponential	,521	159,586	1	147	,000	,566	1,83E-005
Logistic	,521	159,586	1	147	,000	1,766	1,000

The independent variable is GDP per capita, PPP (constant 2007 international $.

Source: own creation

Additionally to general relations, there are exceptions - nations that most differ from the trends – that may provide us with important information relating to analysis of the correlation of well-being indexes. Exceptions - i.e. countries less adaptive regarding the logarithmic trend - can be studied by describing the rank places of the residual tags occurring during model insertion (Figure 2).

Figure 2. Deviation from the logarithmic regressive function



Source: own creation

In addition to the significant deviations, the figure also shows that the number of decreasing deviations exceeds the number of increasing ones - and this typically relates to developing countries. Therefore, the relatively high GDP of many developing countries can be associated with a comparatively low HDI level. Consequently, relative GDP well-being is an over-estimate compared with HDI, even in cases when the inflection point of the model has not been reached - though without consideration of the aforesaid result, which supposes that GDP does not bring about the well-being level seen in HDI after a specific period. So a higher

GDP does not automatically equal a higher well-being level according to HDI (Also see Sen 2003).

As information for the upper or lower position of the countries on the model is also important, residual tags are not to be regarded as absolute values. As shown in the analysis, Haiti and Singapore are marked as less adaptive countries. Thus, further analysis of these countries is, unfortunately, rejected, as the relevant HDI values have been replaced by the average value of the specific region due to data shortage. It is possible to analyse the following exceptional countries: Chad, Botswana, Afghanistan, Tajikistan and Kyrgyzstan. As seen in the analysis (Table 4), Chad, Botswana and Afghanistan are situated in the lower part of the model i.e. their relative GDP is associated with having a low HDI value. Detailed data reveals that this situation comes about due to the low educational level in Chad, whilst it is caused by low life expectancy in Botswana and Afghanistan. In contrast, Tajikistan and Kyrgyzstan are to be found above the line i.e. the well-being level calculated in HDI is relatively high and is accompanied by a relatively low GDP in these countries owing to a good education level; we must also make a comparison with economic opportunities (indicated in relative GDP) in both countries, and a relevantly high life expectancy should also be noted. A comparison of countries concerning different groupings gives further interesting results: (1) well-being diversity in two countries that have similar relative GDP values (Chad, Tajikistan); (2) a difference in HDI component values in the case of countries with very correlative HDI values; finally, (3) economic development disparities as indicated in GDP in countries with similar HDI values (Botswana, Tajikistan).

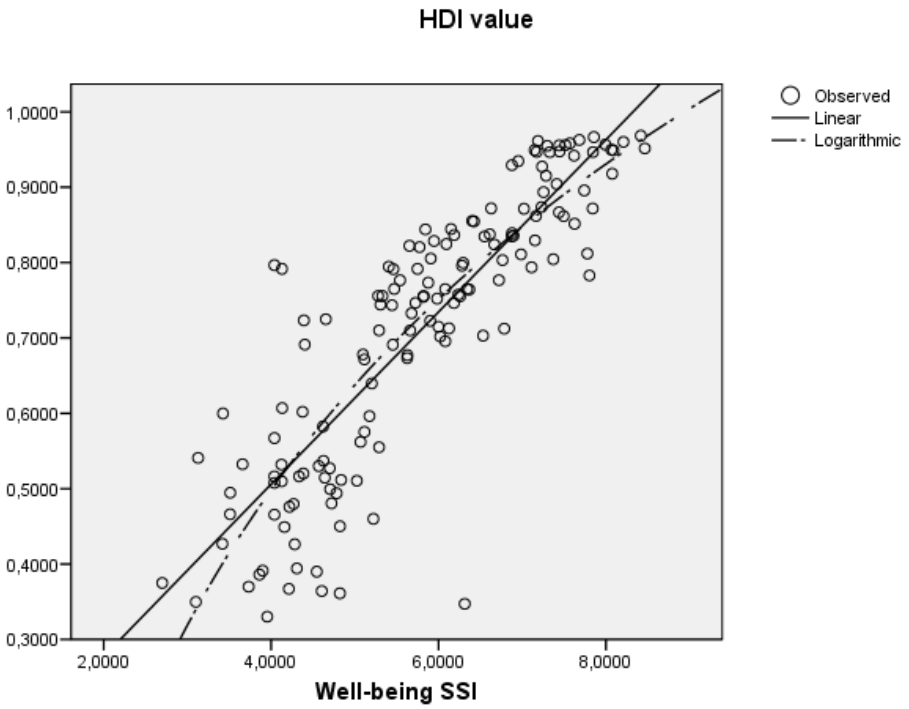
Table 4. Detailed GDP and HDI values of less adaptive countries when it comes to the logarithmic trend

		HDI	Life expectancy at birth (years)	Adult literacy rate (% of population aged 15 years and over)	Combined gross enrolment ratio (% of the population of the theoretical age group for education)	GDP	Life expectancy index	Education index	GDP index
The regression modell overestimate	Chad	0,3943	48,476	31,7648	36,53400392	1554,542	0,391267	0,333545	0,457946
	Botswana	0,6733	50,921	81,3997	70,62144985	12799,77	0,432017	0,778069	0,809821
	Afghanistan	0,3473	42,88	28,00347654	50,0510204	1036,355	0,298	0,353527	0,390271
The regression modell underestimate	Tajikistan	0,6772	65,607	99,5	70,78379431	1563,96	0,676783	0,895946	0,458954
	Kyrgyzstan	0,7018	67,12	98,7	77,49740849	1829,527	0,702	0,918325	0,485131

Source: own creation

The linear model (R2=0,743) has the most notable explanatory strength i**n a correlation of HDI with the well-being SSI**. However, the explanation strength of the logarithmic model is almost identical (R2=0,734) (Table 5, Figure 3).

Figure 3. Correlation between the development of HDI and well-being SSI indexes (cross-section analysis with reference to the countries of the Earth based on 2005 HDI data and 2006 SSI data)



Source: own creation

Table 5. Principle features of the inserted regressive model in the case of HDI and well-being SSI indexes (cross-section analysis with reference to the countries of the Earth based on 2005 HDI data and 2006 SSI data)

Model Summary and Parameter Estimates

Dependent Variable: HDI value

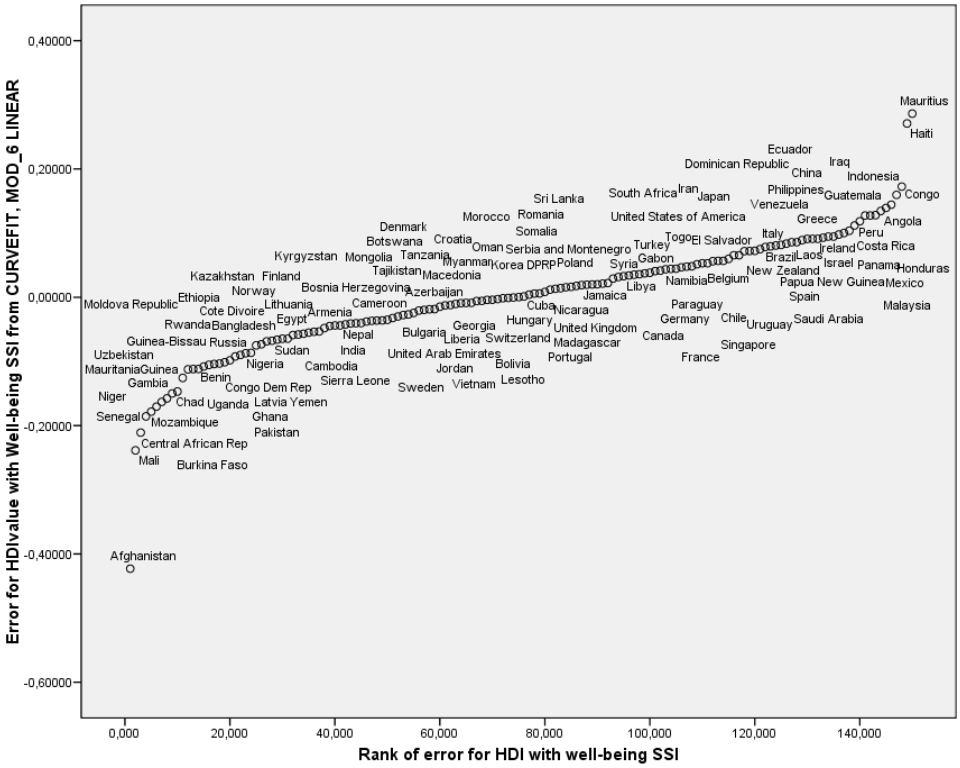
	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Linear	,743	427,108	1	148	,000	,049	,114
Logarithmic	,734	408,069	1	148	,000	-,366	,624
Exponential	,683	319,573	1	148	,000	,251	,173
Logistic	,683	319,573	1	148	,000	3,989	,841

The independent variable is well-being SSI.

Source: own creation

Should the analysis be completed with residual tags as described in the GDP-HDI correlation analysis, there will be countries that are to be regarded as relatively less adaptive in relation to the linear trend line (Figure 4).

Figure 4. Deviations from the linear regressive model



Source: own creation

As shown by the figure, Afghanistan, Mali and the Central African Republic are located on the lower side - i.e. they have high well-being SSI points and a relatively low HDI. In contrast, Haiti and Mauritius exceed the line, i.e. low well-being SSI is associated with their high HDI. The well-being SSI values gained by Mauritius and the HDI value of Haiti have been replaced by the regional average value due to data shortage, so it is impossible to carry out a more profound analysis with regard to deviations.

However, the reason for diversities can be seen in the case of Mali and the Central African Republic (Table 6). These countries have a relatively low HDI and

comparatively high well-being SSI points[6]. It would be quite logical to presume that this deviation can be associated with the environmental component, which is completely ignored by HDI. However, the situation is precisely the opposite: both countries fail to meet the requirements of clean environment as related to the well-being SSI index. Moreover, this deviation is primarily caused by the dimension of the well-being SSI index, which should correspond most of all to HDI i.e. human development, due to its major concern i.e. human development. Meanwhile, its SSI index defines the concept of human development ever more differently from HDI (See the comprehensive, theorical part of this study). The third component of SSI (a well-balanced society), whose information content - equalling that of clean environment - is not explicitly indicated by HDI, is a little lower than the final well-being SSI value.

Table 6. The HDI and well-being SSI data of countries less adaptive to the linear trend

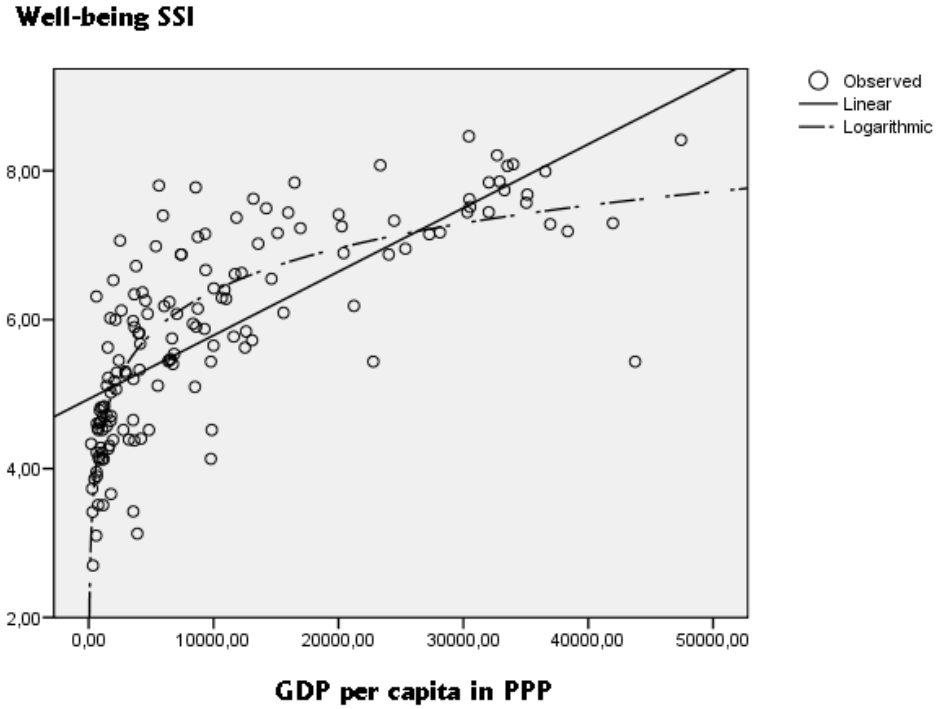
		HDI components								Well-being SSI components		
	HDI	Life expectancy at birth (years)	Adult literacy rate (% of population aged 15 years and over)	Combined gross enrolment ratio (% of the population of the theoretical age group for education)	GDP	Life expectancy index	Education index	GDP index	Well-being SSI	Well-balanced society SSI komp.	Personal development, SSI komp. 2006	Clean envrionment SSI komp. 2006
Mali	0,3612	47,354	26,17655464	42,62671424	1062,9635	0,372567	0,316599	0,394502	4,8213	4,3022	6,5940	3,5676
Central African Rep	0,3642	46,16	48,57356259	28,71530617	682,1324	0,352667	0,419541	0,320465	4,6051	4,3750	5,9112	3,5291

Source: own creation

The correlation between the well-being SSI and GDP, best described via a logarithmic model (R2=0,698) (Table 7), is analysed last in the present study. GDP growth runs in parallel with a well-being increase as indicated by the well-being SSI for a specific time period. The well-being marked by the well-being SSI does not follow GDP growth if a certain GDP level is exceeded (Figure 5).

[6] Even the similarity of the HDI point values for the two countries is contentious in view of the quite significant differences seen in the HDI value as regards the disparity between some of the HDI components. Take into account the previous critics on the reductionist feature of HDI.

Figure 5. Correlation between the development of GDP and well-being SSI indexes (cross-section analysis with reference to the countries of the Earth based on 2005 GDP data and 2006 SSI data)



Source: own creation

Table 7. Principle features of the inserted regressive model in the case of GDP and well-being SSI indicators (cross-section analysis with reference to the countries of the Earth based on 2005 HDI data and 2006 SSI data)

Model Summary and Parameter Estimates

Dependent Variable: well-being SSI

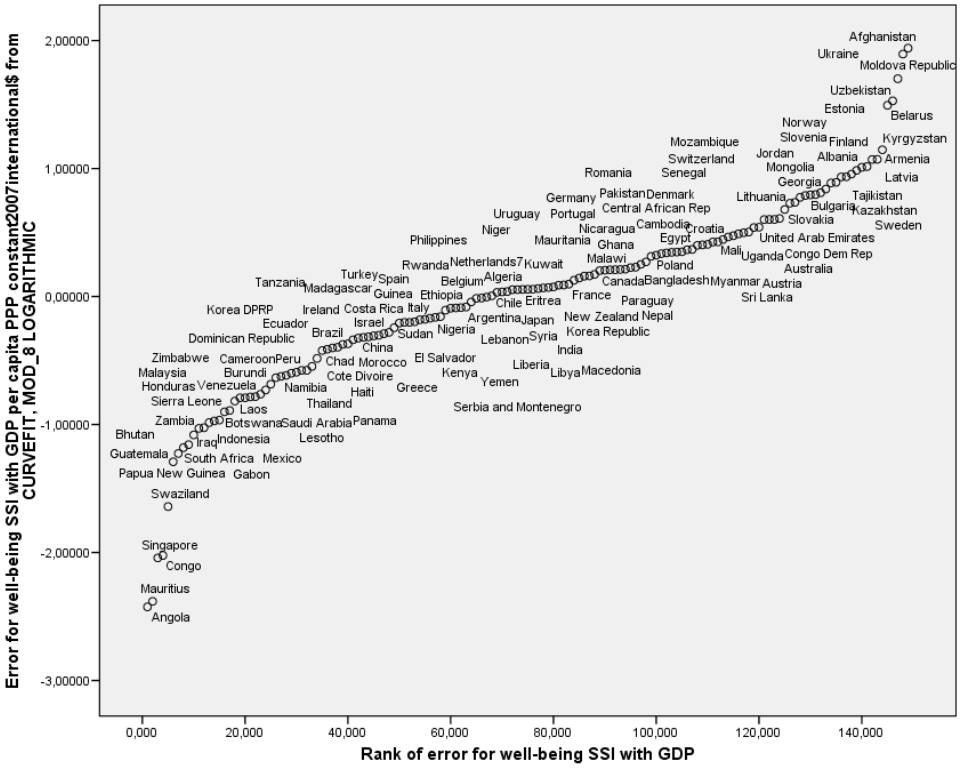
	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Linear	,585	206,965	1	147	,000	4,841	9,22E-005
Logarithmic	,698	340,425	1	147	,000	-1,755	,882
Exponential	,519	158,547	1	147	,000	4,778	1,58E-005
Logistic	,519	158,547	1	147	,000	,209	1,000

The independent variable is GDP per capita, PPP (constant 2007 international $.

Source: own creation

Should the analysis be completed with residual tags as described in the GDP-HDI correlation analysis, there will be countries that can be regarded as being relatively less adaptive to the linear trend line (Figure 6).

Figure 6. Deviations from the logarithmic regressive model



Source: own creation

As shown in the figure, Angola, Mauritius, Singapore, Swaziland and the Congo are situated on the lower side of the model i.e. they can be characterized by possessing a relatively high GDP and low well-being SSI - unlike Afghanistan, the Ukraine, Uzbekistan, the Moldavian Republic and Belarus, situated above the line, where we have a comparatively low GDP associated with a higher well-being SSI. As the well-being values of Mauritius, Singapore and Swaziland have been replaced by the regional average due to data shortage, these countries will not be part of this analysis. Detailed data for other countries are included in Table 8.

Table 8. Precise well-being SSI and GDP values of countries less adaptive to the logarithmic trend

		GDP per capita, PPP (constant 2007 international $)	Personal developm ent, SSI komp. 2006	Clean envrionme nt SSI komp. 2006	Well-balanced society SSI komp.	Well-being SSI
The regression modell overestimate	Angola	3948,3903	3,9356	2,4734	2,9734	3,1274
	Congo	3504,3508	4,3256	3,3667	2,5794	3,4239
The regression modell underestimate	Ukraine	5912,3584	8,5172	7,649	7,1661	7,7774
	Uzbekistan	2118,8273	8,6939	7,43	7,2835	7,8025
	Belarus	9044,0186	7,1811	5,9368	6,4767	6,5315
	Moldova Rep.	2319,5085	7,4022	7,5889	5,3621	6,7844

Source: own creation

Two conclusions may be drawn from the table. On one hand, SSI values may refer to countries possessing relatively different well-being states - for instance, the similar final well-being SSI values of Angola and Congo cover notable deviations between the different SSI dimensions, as in the case of Belarus and the Moldavian Republic, too. On the other hand, the well-being states suggested by the well-being SSI - the same SSI index values for different countries - may also appear with very diverse relative GDP values (as clearly proven given a comparison of both Uzbekistan-Ukraine and Belarus-the Moldavian Republic).

5. Summary

This study has focused on three indexes associated with each other in economics and with the concept of well-being in the case of the well-being SSI. As stated on the basis of an analysis of the theoretical background of such indicators, the little information basis of GDP in terms of well-being is broadened by the HDI, while the well-being SSI (i.e. the information mass required to outline national well-being levels) is additionally given special attention. In view of the amount of information that has been ignored, both indicators can be regarded as over-reductionist owing to their top-down feature and information that is lost in the process of component aggregation related to indicator creation.

The cross-section statistic analysis outlines a strong statistic correlation between the indicators. Whilst the well-being SSI and HDI are linearly correlated,

these indicators have a logarithmic correlation with GDP. Consequently, the relative GDP - i.e. economic well-being increases – will bring about the well-being growth as indicated by the well-being SSI and HDI (a major information basis in relation to aspects of well-being). However, this does not refer to a higher relative GDP. In addition, a study of exceptions - the nations which most differ from the trend that takes on board the correlation between indicators - reveals that, on one hand, the higher relative GDP situated on the side before the inflection point of the model is often associated with a lower HDI or well-being SSI ratio; while, on the other hand, identical and relative GDP values may refer to a different HDI or SSI well-being level. So the present study supports the theory of moving from an economy-focused interpretation of well-being towards a more complex approach which integrates actual well-being-related scientific knowledge both in economics and eco-political areas.

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