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DID EUROPEAN COUNTRIES SUFFER FROM DIFFERENT CALCULATION OF HDI?

MARIA-LENUTA CIUPAC-ULICI[1]

ABSTRACT. The Human development index (HDI) was introduced for the first time in the summer of 1990. The objective was to provide a more complex indicator that captures a country`s development level better than the gross national product. UNDP (United Nations Development Programme) justified this approach by the need to attempt to provide an informative value that exceeds the strict quantitative aspects. This article analyzes the impact of different calculation of HDI, by comparing the values of the index calculated relying on the Human Development Report from 2005 with the values of the index calculated based on the Human Development Report from 2010 for 10 European countries (five emerging countries and five developed countries). When using the new methodology in calculating the Human Development Index, there is a small and insignificant difference. The HDI values obtained based on the new methodology from the Human Development Report from 2010 are smaller, but these values do not change their rank.

Keywords: human development index (HDI), education, gross domestic product, life expectancy

JEL classification: O10, I21, E23

1. Introduction and Review of Literature

Development is a preamble of improving quality of life, and comprises both material elements such as infrastructure, housing quality and living standards, in general, and spiritual elements such as education, freedom of expression and cultural manifestation. These elements were summarized in the concept of human development that was introduced by the economist Amartya Sen, Nobel laureate for economics, in close relation with a concept of capability. Mahbub ul Haq, a Pakistani economist, further developed this concept by embedding it in the construction of the Human Development Index (HDI).

[1] *Lecturer PhD., IPAG Business School Paris, France & Commercial Academy Satu Mare, Romania, maria.ulici.ciupac@gmail.com*

Since 1990, the United Nations Development Programme (UNDP) promotes human development as an alternative paradigm to the classical economic approach to measure. UNDP uses Global Human Development Reports (24 in number) and National Reports on Human Development (so far - more than 400 national and sub national reports from more than 170 countries), respectively considers people as the center and goal of development. Human development, according to UNDP, means those capacities and justification of the people to choose and pursue their own choices in all areas of life. In overall size, this concept integrates health care, education, religion, a decent standard of living and political freedom. Also, human development does not reduce only to these aspects of life. The cultural identities of individuals must be recognized, being the state's obligation to give them a major focus. Individuals should be free to express their own identity without being subject of discrimination in various areas of their existence. In conclusion, cultural liberty is a human right and an important integrated part of human development.

Each year, Human Development Reports make efficient recommendations at both national and international levels. At national level, Human Development Reports focus on the priority of human development politics, the need to establish a new partnership between state and market, promotion of new forms of alliance between governments, civil society institutions, communities and individuals. National, regional, and global reports regarding human development played over the past two decades a key role in promoting human development.

Since 1990, when the Human Development Index (HDI) was included in the first Human Development Report, the index successfully served as an alternative assessment for the level of development and as a complement to economic indicators. HDI assesses a country's achievements in three aspects of human development: longevity, educational level and living standard (Secăreanu, 2000). Longevity is measured by life expectancy at birth; knowledge which is a combination of the level of mean years of schooling and expected years of schooling; standard of living that is based on Gross National income per capita measured in US dollars at purchasing power parity (PPP). For all these aspects an index is calculated; value 0 indicates a low level of human development, while value 1 indicates a high level of human development. The combination of these three indices underpins the annual country rank.

Human Development Index provides a complete radiography of human development level of countries worldwide, an overall assessment of progress and different strategies that have been followed by countries to achieve human welfare.

This index transposes into a synthetic substitute of the three indicators presented before. HDI measures the relative distance that separates each country

of the world by the targets considered to be priority, either: a long and healthy life, a free access to the acquisition of knowledge and, last but not least, a level of income to ensure a decent standard of living, which would be preferable to be on the world's average level of gross national income per capita.

Yang and Hu (2008) analyze China's HDI data for the years 1982, 1995, 1999, and 2003, respectively classify China's provinces into four tiers. The authors adopt both one-dimensional and multi-dimensional cluster analysis. The empirical results find that the overall regional disparities in China have been increasingly attributable to the regional economic disparities.

Abayomi and Pizarro (2013) used the variables of gross domestic product, literacy rate and life expectancy for a sample of 135 countries for the period 1970 through 2010. Also, they used the scores generated by the Principal Component Analysis results as initial the values in a Bayesian estimation process. The replicates for the weights of Human Development Index seem to be all statistically different, but high weights are assigned to education variable in Human Development Index.

Pinar et al. (2013) used in their research the Human Development indicators (education, life expectancy and gross domestic product) during the period 1975–2000 in 5-year increments. The authors compare the official equally-weighted HDI with all possible indices constructed from a different set of individual components in order to obtain the most optimistic scenario for human development. The study suggests that any indicator declined, on prior grounds, in order to weight education more strongly than does the official Human Development Index, would try to take a more optimistic view to the extent of general improvements in welfare.

Tofallis (2013) tries to find new weights for components HDI but he is careful not to disadvantage certain nations. Therefore, in order to avoid the use of arbitrary weights, he proposes to find the most advantageous set of weights that will be specific for each country, respectively to regress the associated optimal scores and identify a single weight set. The analysis is made on 169 countries for the year of 2010. His research indicates that the highest weight is placed on the variable of life expectancy at birth.

Terzi et al. (2014) studied the impact of causal effects of the different types of institutions on different components of human development. Their analysis includes the sample of countries that are in the report of HDI from 2006. The methodology used is partial least squares path modeling (PLS-PM) algorithm and it comprises 34 indicators. The results show that political and social institutions are positively affected by economic institutions. In fact, economic development produces a parallel process of the social conditions' improvement, which determines knowledge and health. The variable of aggregate demand (used in the model as an economic growth tool) leads to economic development.

Wu et al. (2014) built an efficiency model in order to evaluate the rationality of Human Development Index ranking. The study covers 19 evaluated OECD countries during 2009. The obtained results show that a weight of 75% from the evaluated countries has different results in the efficiency rankings and HDI rankings. Also, the input slack shows that almost 70% of analyzed countries over-used their capital to labor relative to the existing outputs.

This article is the first to investigate if the new methodology in calculating Human Development Index changes the countries' ranking for a sample of ten countries. The HDI values obtained by using the new methodology from Human Development Report of 2010 are smaller, but these values do not change their rank.

2. Material and Method

Human Development Index comprises three basic elements: longevity (measured by life expectancy at birth), education level (calculated as a weighted arithmetic average between the mean years of schooling and expected years of schooling); standard conditions of living (expressed in GNI per capita calculated at purchasing power parity).

The HDI measures the relative distance that separates every country of the world from the prioritized goals for social development, namely providing an overall assessment of progress and different strategies followed by states to achieve human welfare. The index is calculated as a geometric average of the three dimensions: health, education and living standard.

HDI level varies in the interval 0 and 1; an HDI closer to 1 indicates a higher level of human development. The maximum and the minimum values of variables are set in order to turn indicators into indices expressed in different units between 0 and 1. These values are presented in Table 1.

Table 1: The Minimum and the Maximum Values of HDI`s Variables

Dimension	Indicator	Minimum	Maximum
Health	Life expectancy at birth	20	85
Education	Average years of schooling	0	18
	Expected years of schooling	0	15
Standard of living	Gross National Income (GNI) per capita (PPP 2011)	100	75,000

Source: UNDP (2011)

These values act as "natural zeros" respectively as "aspirational goals", values from which are standardized components of indicators. The variables are set at the following values: life expectancy at birth (20 to 85), average years of schooling (0 to 18), expected years of schooling (0 to 15), and Gross National Income per capita (PPP 2011) (ln(100) - (ln(75,000)).

Having defined the minimum and the maximum values, the indicators' of dimensions are calculated as follows:

$$\text{Indicator dimension} = \frac{\text{actual value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \quad (1)$$

In the Human Development Report from 2005, the Human Development Index had the following formula:

$$HDI = \frac{I_{health} + I_{Education} + I_{GNI}}{3} \quad (2)$$

where:
I_{Health} – index of health
$I_{Education}$ – index of education
I_{GNI} – index of gross national income

In the Human Development Report from 2010, the Human Development Index formula has changed; it is a geometric average such as:

$$HDI = \sqrt[3]{\left(I_{Health} * I_{Education} * I_{Standard\ of\ life}\right)} \quad (3)$$

where:
$I_{Standard\ of\ life}$ – index of standard conditions of life

To analyze the impact of the different formulas of HDI, for the current the values of the index calculated according to the Human Development Report from 2005 were compared to the values of the index calculated relying on the Human Development Report from 2010. The paper analyzes the evolution of ten countries: five emerging countries and five developed economies in order to observe the differences between them.

The analyzed period covers the years 1980, 1985, 1990, 2000 and the period 2005-2013. The frequency data is annual. Data were collected from the database of the United Nations Development Program: life expectancy at birth, average years of schooling, expected years of schooling and gross national income per capita.

The sample comprises 10 countries from Europe, of these: 5 countries have a very high Human Development rank (they are developed countries: Norway, Switzerland, Netherlands, Germany and France), and 5 countries have a high human development (they are emerging countries: Czech Republic, Poland, Hungary, Romania and Bulgaria).

3. Results and Discussions

Over the past 60 years, the average life expectancy at birth has increased globally by almost 21 years, from 46.5 years in 1950 to 71 years in 2013. This represents a global average increase in life expectancy of 3 months per year during that period. On average, the gain in life expectancy was 9 years in developed countries. Life expectancy at birth in the analyzed developed countries is between 73 years (in Germany in 1980) and 82.6 years (in Switzerland in 2013). It can be observed that this variable has an ascending trend (Figure 1). Life expectancy at birth is increasing in Norway. This indicator was around 50 years at the end of 1800s. Starting with 1900, it increased to around 70 years in 1950, respectively to 81 years in 2000. In 2012, life expectancy at birth for women was of 83.4 years, respectively of 79.4 years for men. Since 1900, it has increased by 30 years. Norway is among the 8 or 10 countries that have the highest life expectancy at birth. Life expectancy in Switzerland is one of the highest in the world, which has had a significant rise during the 20th Century. Since 1900, it had grown from 46.2 to 83 years. The indicator is with three years higher than the OECD average. People form most of the Western European countries, including Netherlands, are living longer, they have healthier lives. By 2050, it is expected that Dutch citizens will spend in retirement approximately twenty years of their lives. In the mid eighteenth century, life expectancy at birth in France was of just 25 years. During the nineteenth century, it reached 45 years. Life expectancy is still increasing, due to progress in cardiovascular diseases and cancer. French life expectancy is of 82 years now.

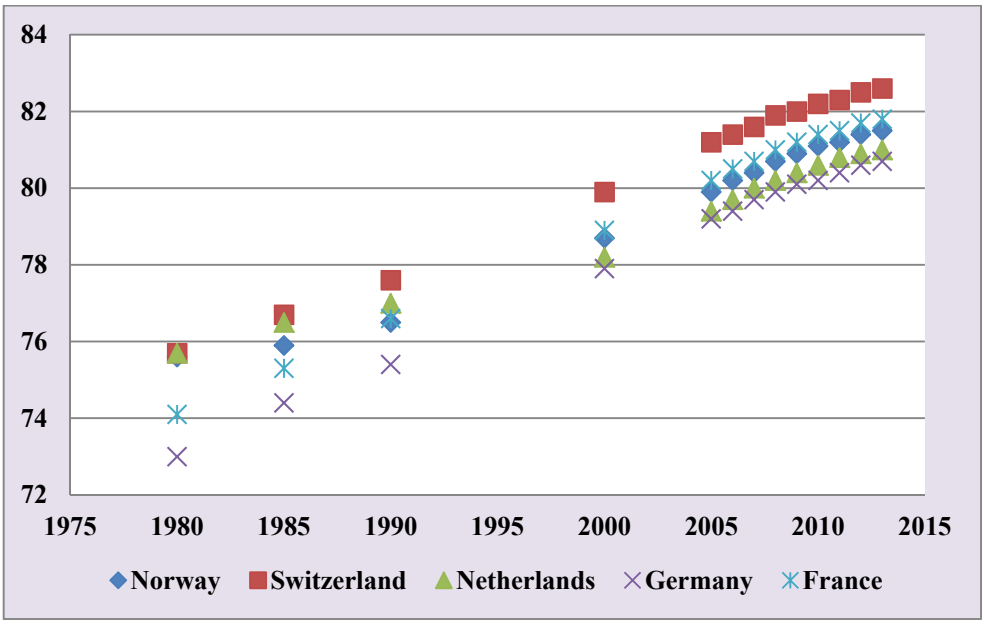

Figure 1: Life Expectancy at Birth in Developed Countries

Source: www.undp.org

The trend is similar within the developing countries, too. It can be observed that the scale is different: 69.2 years (in Hungary in 1985) and 77.7 years (in Czech Republic in 2013), the average values are down by 5 years compared to those of the developed countries (Figure 2). In 2013, the life expectancy at birth in Romania increased to 75.20 years. In this year, the life expectancy at birth for men was of 71.60 years and for women of 78.70 years. Romania's position has improved, dropping in one year from the 71st level in 2012 to the 65th position in 2013. The increase in life expectancy at birth that occurred during the first half of the 20th Century in many developed countries was the result of a rapid decline in mortality (especially infant and maternal mortality). Access to better sanitation and education, housing, an increased trend to smaller families, the increasing of incomes, and public health measures contributed greatly to this epidemiological transition. In most of the developed countries, this started approximately 100 to 150 years ago, and the process was much faster. In developing countries, this transition started even later, but it has not yet been completed. Also, in developed countries, the improvements in life expectancy at birth come mainly from reductions in death rates of adults now.

Life expectancy at birth in the Czech Republic increased to 77.7 years. Czech Republic's position took the 39th position in the ranking of 191 countries. In Poland, this indicator increased to 76.40 years. Poland's position was the 48th in the ranking of 191 countries. Hungary's position improved in this rank of life expectancy, dropping from the 61st in 2012 to the 59th in 2014. Hungarian life expectancy at birth reached 74.6 years. Bulgaria is one of the EU countries that have the lowest life expectancies at birth, it is around 73.5. The only countries where life expectancy is lower than in Bulgaria are Lithuania and Latvia. Bulgaria's position improved, dropping from the 76th in 2012 to 70th place in 2013.

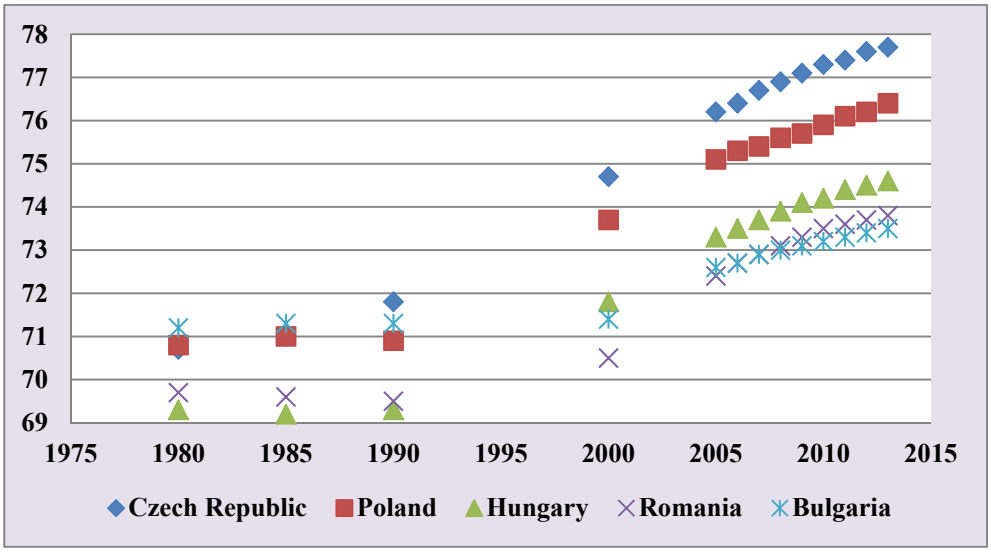

Figure 2: Life Expectancy at Birth in Developing Countries

Source: www.undp.org

There has been a strong upward trend in the variable average years of schooling for all countries worldwide, however, with only some exceptions; the gap between developing and developed countries has changed very little. Education represents the most powerful tool for reducing poverty and inequality; et the same time, it lays a foundation for a sustained economic growth.

In a fast-changing knowledge economy, education is understood as being about learning skills for life. The question is how many years of school, college or training will expect to attend future generations? The answer is that, on average,

people may expect to go through 17.7 years of education, if we judge by the number of people that have ages between 5 and 39 and they are currently in schools or colleges. The trend in education has been an ascending one until the year of 2008, except for the Czech Republic. From 2009, the analyzed countries have constant values for the average years of schooling. This variable is for the analyzed developed countries is between 5.7 years (in Germany in 1980) and 12.9 years (also, in Germany in 2013). It can be observed that this variable is on an ascending trend until 2008 (Figure 3), followed by a constant trend during 2009-2013. The Norwegian educational system is considered to be among the best in the world (close to the Finnish one), the average years of schooling already achieved 12.6 years.

Switzerland has registered a higher level of education over the past years, with the proportion of those that have graduated at tertiary level having grown by about 13.5 % during the 1995-2010 timespan. The average schooling years increases from 10 years (in 1980) to 12.2 years in 2013 in Netherlands, due to the increase of compulsory schooling. Only 72.5% of the French adults (25 to 64 years) have completed high school, compared to an average of 74.2% across the European Union. The indicator has increased from 6 years (in 1980) to 11.1 years (in 2013).

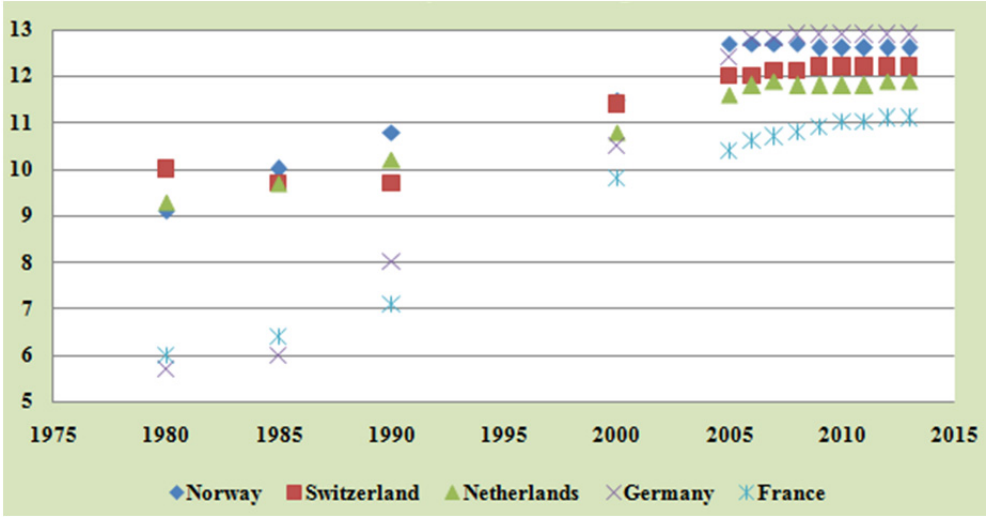

Figure 3: Average Years of Schooling in Developed Countries

Source: www.undp.org

The average schooling years in the analyzed developing countries are between 7.7 years (for Poland in 1980) and 13.1 years (Czech Republic in 2005). The Czech Republic is the only country that presents a decrease of this variable (by 0.8 years) for the period 2006-2010 (Figure 4). In Czech Republic, 92% of the adults with ages between 25-64 years have completed an upper secondary education cycle. The average schooling years have increased by 4.1 years in 2013 in Poland.

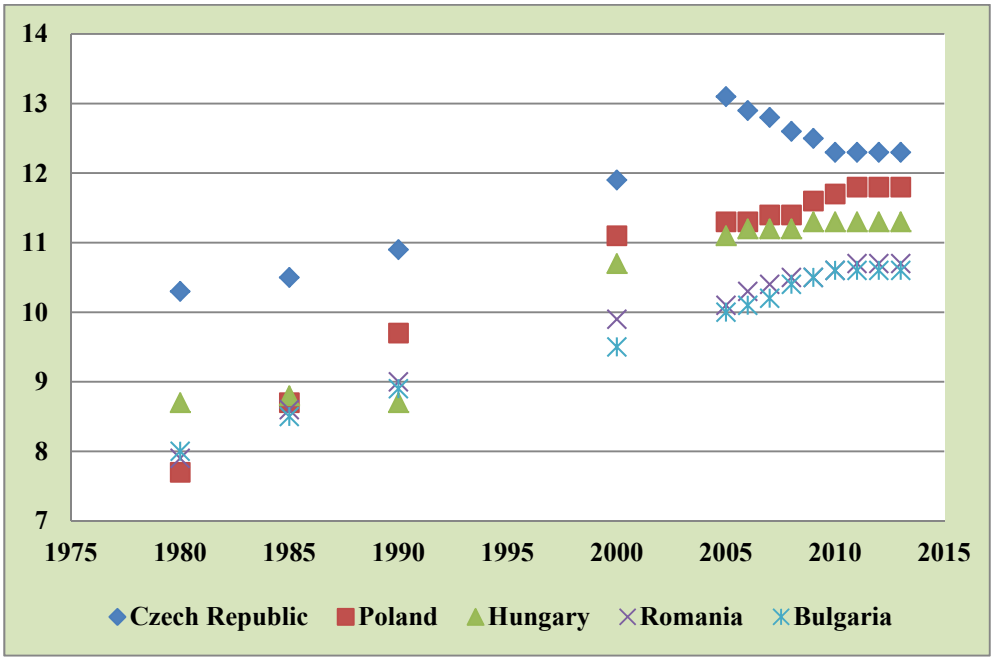

Figure 4: Average Schooling years in Developing Countries

Source: www.undp.org

Poland is followed by Romania, with an increase by 4.0 years during 1980-2013. The indicator rose only by 3.6 years to 11.3 years in 2013 in Hungary. The lowest increase and value of the indicator from analyzed countries is registered by Bulgaria with an increase of 2.6 years to 10.6 years in 2013.

A well-educated population is essential for each country's social and economic well-being. A good education contributes to improve the likelihood of finding a job and of earning enough money. Germans may expect to go through 18.2 years of education, 5.3 years above the average level (Figure 5). It can be

observed a little decrease for Norway during 2006-2009. The French education expects to go through 16.4 years between the ages of 5 and 39. People in the Netherlands expect to go through 18.7 years of education for people ageing between 5 and 39 years. In Switzerland, the indicator is expected to be of 17.3 years, due to the rise in tertiary-level education and changes in migration regarding the level of education.

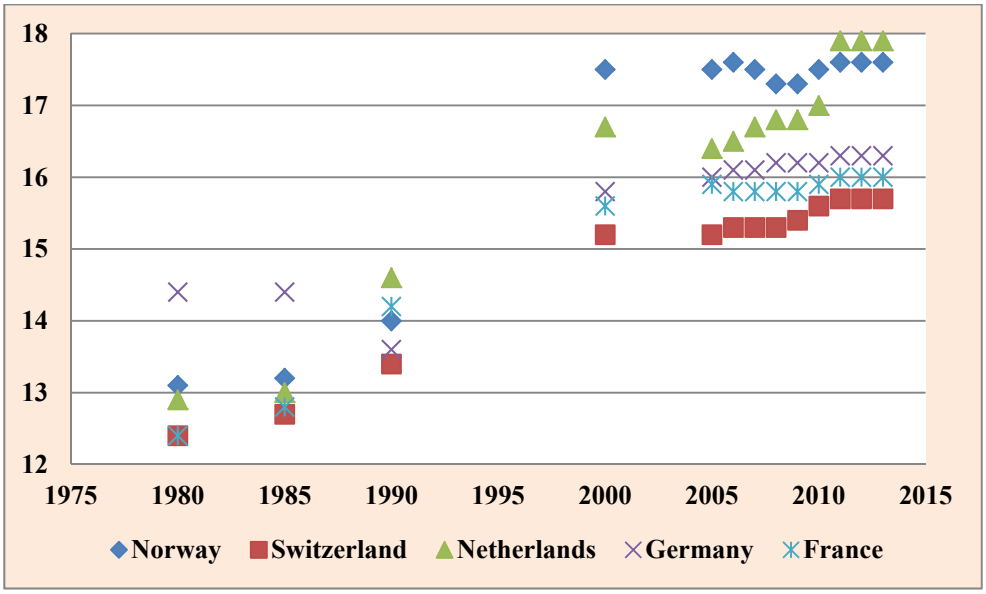

Figure 5: Expected Years of Schooling in Developed Countries

Source: www.undp.org

Czech Republic is expecting to go through 18.1 years of education between 5 and 39 years, by 2013 this value was 16.4 years up with 4.1 years above the mean (figure 6). The average values among developed and developing countries regarding the differences between the average years of schooling and expected years of schooling is around 1.1 years. Romania expects to obtain a value with 3.3 years above the average years of schooling. Hungarian people may expect to go through 17.6 years of education, while in Bulgaria is expected to register a value of only 14.3 years. Poland is supposed to register a higher value for the expected years of schooling (18.4 years), slightly more than the OECD average of 17.7 years.

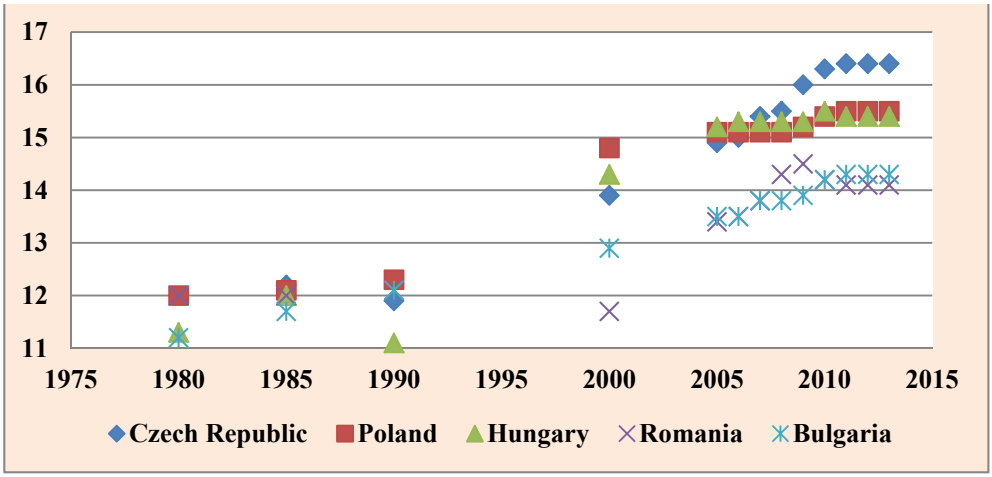

Figure 6: Expected years of schooling in developing countries

Source: www.undp.org

While money cannot buy happiness, it is an important tool to achieve higher living standards, respectively greater well-being. A higher economic wealth can also improve the access to quality health care, education and housing. The total value of the global income almost reached $70 trillion per year in 2013, and there were seven billion people worldwide. This means that the average income should have been of $10,000 per person per year in 2013. The reality is very different.

Gross national income (GNI) per capita has decreased in all analyzed countries during the global financial crisis. In 2013, the gross national income per capita was between 36.6 thousands PPP$ (France) and 64 thousands PPP$ (Norway) in developed countries (Figure 7), while in developing countries (Figure 8) the values were between 15,400 PPP$ (Bulgaria) and 24,500 PPP$ (Czech Republic).

The value of GNI per capita in Germany was of 43,991 for 2013. Over the past 43 years this indicator reached the maximum value of 44,085 in 2012 and a minimum value of 5,199 in 1970. In Norway, the indicator was of 65, for 2013. Over the past 33 years, the value for this indicator has fluctuated between 66,490 in 2012 and 32,658 in 1980. GNI per capita, PPP$ in Switzerland was of 53,762 in 2013. Over the past 33 years, the value has fluctuated between 54,323 in 2010 and 38,928 in 1980. In Netherlands, the indicator has the value of 42,397 in 2013. During the 1980-2013 timespan, this indicator has fluctuated between 44,471 in 2007 and 26,145 in 1980. The value for GNI per capita, PPP is lower in France, than in other analyzed developed countries. It has registered the value of 36,629 in 2013.

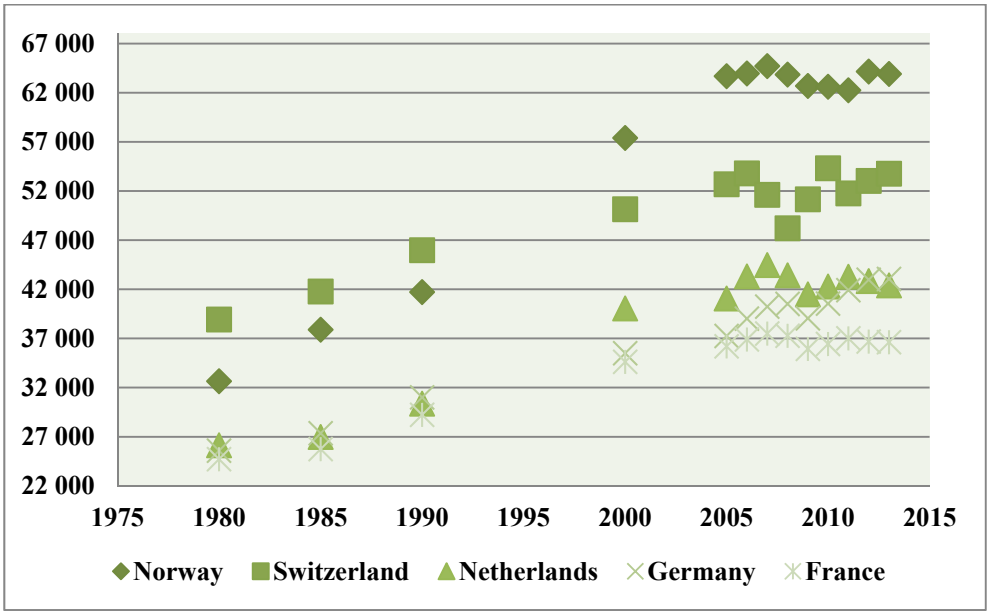

Figure 7: Gross National Income per Capita in Developed Countries

Source: www.undp.org

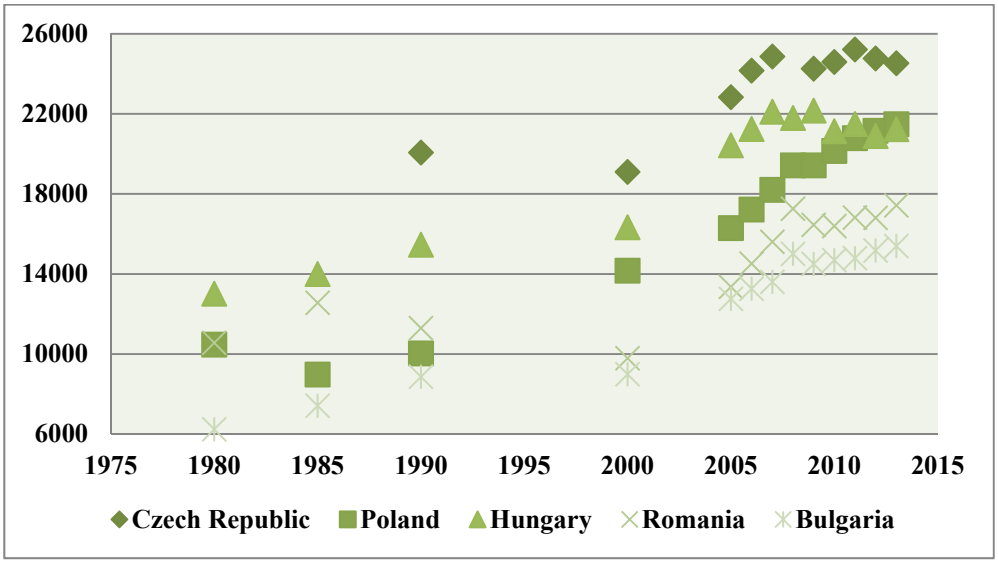

Figure 8: Gross national income per capita in developing countries

Source: www.undp.org

The higher values of GNI per capita, PPP$ was of 24,535 in 2013 in the Czech Republic from all analyzed developing countries. On the second place in our analysis, Czech Republic is followed by Hungary, where the value of the indicator is 21,239 PPP$ in 2013. Poland registered a decrease by almost 1500 PPP$, between 1980 and 1985, but now it is on an upward trend, being the only country in Europe that wasn`t affected by the global financial crisis. The GNI per capita is situated on an oscillating trend during the analyzed period in Romania. The values are between 9,796 PPP$ (in 2000) and 17,433 PPP$ (in 2013). In Bulgaria, the income level is still the lowest among the new EU member states, its value is of only 15,402 PPP$ in 2013.

By using the new methodology in calculating the Human Development Index, there is a very small and insignificant difference in the new values of the index. The HDI values obtained after the new methodology from the Human Development Report of 2010 are smaller, but these values do not change the countries ranking (Table 2). Researchers agree to use geometric mean in calculating the index in order to use the average mean of the three dimensions.

Table 2: Values of HDI in 2005 and 2010

Years	Developed Countries									
	Norway		Switzerland		Netherlands		Germany		France	
	HDI (2005)	HDI (2010)	HDI (2005)	HDI (2010)	HDI (2005)	HDI (2010)	HDI (2005)	HDI (2010)	HDI (2005)	HDI (2010)
1980	0.798374	0.792520	0.811646	0.805619	0.788408	0.783459	0.747778	0.738754	0.735701	0.721733
1985	0.818822	0.814115	0.819724	0.812784	0.800363	0.796019	0.761178	0.751863	0.753173	0.740994
1990	0.843096	0.840276	0.835663	0.829228	0.828121	0.825908	0.788626	0.781699	0.787175	0.778982
2000	0.911070	0.910321	0.887877	0.885783	0.874745	0.873992	0.855100	0.853717	0.849976	0.847509
2005	0.935593	0.935169	0.903405	0.901519	0.888882	0.888294	0.887670	0.887393	0.868551	0.866588
2006	0.938010	0.937612	0.907197	0.905347	0.895422	0.894843	0.895717	0.895545	0.871855	0.869820
2007	0.938908	0.938465	0.906729	0.904974	0.901222	0.900735	0.899647	0.899462	0.875085	0.873121
2008	0.937214	0.936733	0.904928	0.903291	0.901256	0.900762	0.901826	0.901642	0.877294	0.875364
2009	0.937372	0.936925	0.910053	0.908412	0.900164	0.899666	0.901188	0.900997	0.877563	0.875682
2010	0.939715	0.939330	0.916437	0.914850	0.904153	0.903719	0.904282	0.904065	0.880728	0.878902
2011	0.941307	0.940966	0.915696	0.914239	0.914535	0.914361	0.908457	0.908270	0.883855	0.882132
2012	0.943307	0.942921	0.917696	0.916164	0.915177	0.915005	0.910791	0.910574	0.885516	0.883813
2013	0.943974	0.943587	0.919030	0.917444	0.915511	0.915322	0.911791	0.911550	0.886183	0.884434

Years	Developing Countries									
	Czech Republic		Poland		Hungary		Romania		Bulgaria	
	HDI (2005)	HDI (2010)	HDI (2005)	HDI (2010)	HDI (2005)	HDI (2010)	HDI (2005)	HDI (2010)	HDI (2005)	HDI (2010)
1980	0.7790	n.a.	0.692078	0.687554	0.698974	0.695525	0.688767	0.685187	0.663531	0.657701
1985	0.736494	n.a.	0.696852	0.693873	0.709467	0.706856	0.703811	0.700993	0.683291	0.679089
1990	0.763574	0.761874	0.715220	0.713551	0.705556	0.701110	0.704437	0.702535	0.699503	0.696458
2000	0.805893	0.805482	0.784536	0.783886	0.773634	0.773449	0.707633	0.705833	0.715741	0.713825
2005	0.844696	0.844495	0.803703	0.803055	0.805561	0.805483	0.750878	0.749815	0.750199	0.749015
2006	0.848253	0.848104	0.808359	0.807792	0.809597	0.809527	0.759790	0.758838	0.754039	0.752915
2007	0.852921	0.852772	0.812682	0.812171	0.813708	0.813620	0.769555	0.768812	0.759989	0.759051
2008	0.856145	0.85602	0.817338	0.816908	0.814151	0.814056	0.781355	0.780832	0.767161	0.766306
2009	0.856073	0.855842	0.820627	0.820193	0.816262	0.816162	0.781726	0.781233	0.767926	0.767124
2010	0.858815	0.858574	0.826007	0.825635	0.816891	0.816801	0.779976	0.779333	0.773210	0.772538
2011	0.861407	0.861176	0.830518	0.830176	0.817298	0.817188	0.782298	0.781649	0.775136	0.774467
2012	0.861407	0.861138	0.832900	0.832569	0.816631	0.816492	0.782631	0.781965	0.776802	0.776147
2013	0.861741	0.861419	0.834567	0.834217	0.817965	0.817816	0.785298	0.784612	0.778136	0.777457

Source: www.undp.org and own calculations

Last but not least, human development is about the development of the people, for the people and by the people. The essential difference between the concepts of economic growth and human development is that the first is focused exclusively on expanding an opportunity – one for income, while the second involves strengthening all possibilities – either economic, social, cultural or political. In terms of the human development concept, the income is a means for human development but not the only one. Using various methods, the benefits of income need to be used for encompassing many aspects of development. Therefore, economic growth is a necessary condition but not sufficient for human development.

Even if the values of the indicators (life expectancy at birth, average years of schooling, expected years of schooling, Gross National Income per capita expressed in PPP) varied over time, they did not affect the values of Human Development Index.

4. Conclusions

Human Development Index is not the ultimate index to calculate and assess the level of human development. Still, this index is better than other indices that are used to study the development level of various countries. Now, there are

assessments that the new HDI can better assess this development than the old HDI, even if the new methodology of HDI did not affect the evolution of countries in Human Development ranking.

According to the Human Development Report, human development matters, firstly, not in the quantity, but in the quality of economic growth. An important lesson for future synthetic indicators is the need of transparency regarding the tradeoffs implicit especially in complicated indices. These compromises are keys to understanding the properties and implications of the index.

The use of a geometric average in the new methodology of calculating the HDI is considered to be the most accurate result of calculating the averages even if there do not occur changes in the countries' rankings. Also, the geometric average has a positive impact on the new methodology, because it allows finding a value that is qualitatively equidistant from both the minimum and the maximum values of the indicator.

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