

Development of the Happiness Index in a country

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Abstract

In this paper, a Happiness Index is built through the Human Dignity Respect Index which is explained by Author (2014). The index is created using three main values: development, freedom and equality. But the equality is explained by solidarity, justice and peace. Then, the Happiness Index is developed with this five concepts. The aim of this paper is to obtain the minimum quantitative variables to explain these values as well as to obtain a generic formula, which allows measuring the happiness of a country/region. The term "generic" is introduced because this formula could be extrapolated to any country. The variables to obtain the Development Index are health (Life Expectancy at birth), income (Gross National Income per capita), education (Mean year of schooling and Expected years of schooling) and education quality (Primary school teachers trained to teach, Performance of 15-year-old students in reading, mathematics and science, Pupil-teacher ratio, primary school and Public expenditure on education). The Freedom Index is calculated through Net migration rate, International inbound tourists, Exports and imports and Research and development expenditure. In the case of Solidarity Index, the variables are At-risk-of-poverty rate, Share of total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames of floor and Material Deprivation rate. Prison population and Homicide rate are the variables which are used to obtain the Peace Index. Finally, the Justice Index is calculated with Police Officers, Professional Judges, Prison population and Crimes and violence. In this work the index is calculated for a selection of countries of European Union (Austria, Croatia, Cyprus, Czech, France, Iceland, Latvia, Lithuan, Portugal, Slovenia, Spain, Sweden and United Kingdom). This selection is produced because the data information is not available for all countries. The data information is obtained from EUROSTAT and the Human Development Report (UNDP, 2014). Finally, the Happiness Index has been compared with Overall Life Satisfaction Index from UNDP (2014).

Keywords: *Happiness Index, UNDP, Overall Life Satisfaction Index.*

1. Introduction

The interest to measure the happiness is increasing in last years. Authorities, academic and professionals are committed to improve nonmonetary welfare of people.

In this paper, a Happiness Index is built with quantitative variables that are defined in the United Nations Development Report (UNDP) and EUROSTAT.

The literature review shows different authors who try to measure the happiness of people through satisfaction enquiries. George Gallup created the GNW (Gross National Well-Being), in which the state of person is measured from 1 to 10. The scale of life satisfaction of Diener (1985), in which happiness is measured by 5 questions that are answered on a scale from 1 to 7. The scale of subjective happiness created by Lyubomirsky (1999), where four questions measure the happiness on a scale from 1 to 7.

Moreover, there are other organizations that try to measure the happiness of a country, as The Happy Planet Index (*HPI*) is a measure which captures the degree to which long and happy lives are achieved per unit of environmental impact. It is calculated through, life expectancy at birth, Experiencec well-being ladder of life (Gallup) and ecological footprint. Or the Overall Life Satisfaction Index that is created by created by Adrian G. White and is used in the UNDP Reports. In this calculation, subjective well being questions are involved about health, wealth, and access to basic education.

The Index presented in in this work is calculated through the terms that Caselles A. proposes in his research “Trying to evaluate the human dignity in a social group” which was presented in 9th Congress of the European Union of Systems (UES-EUS). Valencia (Spain), 2014. There, an exhaustive analysis of the literature has been done to conclude that the supreme value is Human Dignity and a Human Dignity Respect Index has been proposed.

In this work, the Happiness Index has been built from the Human Dignity Respect Index. Immediate subordinated values to human dignity are *development*, *freedom* and *equality*. Subordinates to equality are *solidarity*, *justice* and *peace*. In Figure 1 the causal diagram shows the relation between them.

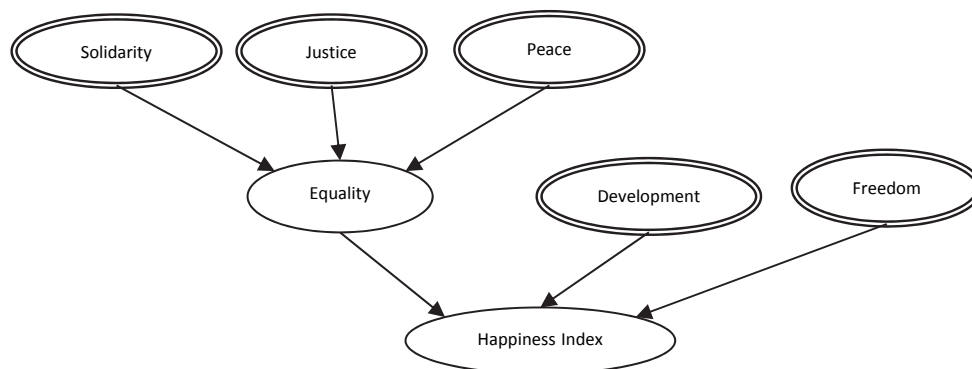


Fig 1. Causal diagram of the degree of respect to Human Dignity (which is considered equivalent to the Happiness Index).

The aim of this paper is to obtain the minimum quantitative variables to explain these values as well as to obtain a generic formula, which allows measuring the happiness of a country/region. The term “generic” is introduced because this formula could be extrapolated to any country, nevertheless in this work the

index is calculated for a selection of countries of European Union (13 countries) in 2013, because the data information is not available for all countries in the UNDP (2014) and Eurostat.

The rest of the paper is organized as follows. Section 2 presents, explains and builds the Happiness Index through the five subindices: Solidarity, Justice, Peace, Freedom and Development. Section 3 shows the value of these subindex in the different countries. The Happiness Index and the relation with the Overall Life Satisfaction Index are developed in Section 4. Finally, some conclusions and suggestions for future research appear in Section 5.

2. Happiness Index Formula

The methodology to obtain the Happiness Index is the methodology used in UNDP Reports.

Minimum and maximum values (values limits) are determined to transform the real variables into variables with values between 0 and 1. With this method, all variables can be used in the same formula because they have the same dimension.

The minimum and maximum values are obtained by two different ways. On the one hand, the variables which are obtained from UNDP Reports, in this case the maximum and minimum value are selected from a temporal serie (1996-2014) for all countries are considered in these Reports- On the other hand, the variables obtained from EUROSTAT, the maximum and minimum are chosen from a temporal serie (2000-2014) for the countries studied in this paper.

2.1 Development

The definition of Development from Caselles (2014) is “*Options of survival and self-fulfillment. It includes: life/health, social progress (education, culture, etc.) and standard of life (economic resources, comforts, etc.).*”.

It is related with the Human Development Index (*HDI*). Nevertheless, the *HDI* is not used in this paper because the Happiness Index is built per gender. The Gender Development Index (*GDI*) is also calculated in the (UNDP). The new *GDI* measures gender gaps in human development achievements by accounting for disparities between women and men in three basic dimensions of human development: health, knowledge and living standards using the same component indicators and the same methodology than in the *HDI*.

Note that the *GDI* reveals the level of delay experienced by women respect to males and how much women advance in every dimension of human development to bridge the delay. This index provides some insight into real gender differences in human development achievements, and is useful to design regulatory tools to reduce the differences. But, the *GDI* is not the variables used to study the development, other variables have been used to obtain the development, and it is explained in the following paragraphs.

The quantitative variables used for this measurement are related with the *GDI* and are explained in detail in the UNDP.

LEBI “Life expectancy at birth: Number of years a new born infant could expect to live if prevailing patterns of age-specific mortality rates at the time of birth stay the same throughout the infant’s life.

$$lebi = \frac{1}{\frac{prpf}{\left(\frac{lebf - 22.50}{87.50 - 22.50}\right)} + \frac{prpm}{\left(\frac{lebm - 17.50}{82.50 - 17.50}\right)}} \quad (1);$$

$$prpf = \frac{popf}{popt} \quad (2); \quad prpm = \frac{popm}{popt} \quad (3).$$

Where *LEBF* and *LEBM* are the Female and Male Life Expectancy at Birth respectively. *PRPF* and *PRPM* are the Females and Males proportion. *POPF* Female population, *POPM* Male population and *POPT* Total population.

MYSC Mean year of schooling: Average number of years of education received by people ages 25 and older, converted from education attainment levels using official durations of each level.

EYSC Expected years of schooling: Number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life.

EDIF and *EDIM* are the Education Index by gender, which is calculated by education variables, *MYSC* and *EYSC*.

$$edif = \frac{\frac{mysf - 0}{15 - 0} - \frac{eysf - 0}{18 - 0}}{2} \quad (4);$$

$$edim = \frac{\frac{mysm - 0}{15 - 0} - \frac{eysm - 0}{18 - 0}}{2} \quad (5);$$

Where *MYSF* and *MYSM* are the Female and Male mean year of schooling respectively and *EYSF* and *EYSM* are the Female and expected years of schooling respectively.

With Education Index by gender, is calculated the Education Index. *EDIN*,

$$edin = \frac{1}{\frac{prpf}{edif} + \frac{prpm}{edim}} \quad (6);$$

GNIP Gross National Income per capita (PPP \$): Aggregate income of an economy generated by its production and its ownership of factors of production, less the incomes paid for the use of factors of production owned by the rest of the world, converted to international dollar.”

$$gnip = \frac{1}{\left(\frac{prpf}{\left(\frac{\text{Log}(gnif) - \text{Log}(100)}{\text{Log}(75000) - \text{Log}(100)} \right)} \right) + \left(\frac{prpm}{\left(\frac{\text{Log}(gnim) - \text{Log}(100)}{\text{Log}(75000) - \text{Log}(100)} \right)} \right)} \quad (7);$$

Where *GNIF* and *GNIM* are the Female and Male Gross National Income per capita respectively

Note that Health is measured with Life Expectancy at Birth. This variable can embrace the level of Health in a country.

In the case of Education the Education Quality should be included. This concept is shown in the Table 10. Education Achievements (UNDP, 2015), and the following four variables have been chosen to obtain the Education Quality, *EDLI*.

$$edly = \sqrt[4]{\frac{pstt - 0}{100 - 0} \cdot prms \cdot \left(1 - \frac{rpts - 7}{25 - 7}\right) \cdot \frac{pexe - 2}{10 - 2}} \quad (8);$$

Where,

PSTT Primary school teachers trained to teach: Percentage of primary school teachers that have received the minimum organized teacher training (pre-service or in-service) required for teaching at the primary level.

PRMS Performance of 15-year-old students in reading (*PERE*), mathematics (*PEMA*) and science (*PEXC*): Score obtained in testing of skills and knowledge of 15-year-old students in these subjects essential for participation in society.

$$prms = \frac{\left(\frac{pere - 100}{1000 - 100} \right) + \left(\frac{pema - 100}{1000 - 100} \right) + \left(\frac{pexc - 100}{1000 - 100} \right)}{3} \quad (9);$$

RPTS Pupil–teacher ratio, primary school: Average number of pupils per teacher in primary education in a given school year.

PEXE Public expenditure on education: Current and capital spending on education, expressed as a percentage of GDP.”.

Finally, the Development Index, *DEIN*, is calculated with (10),

$$dein = \sqrt[4]{lebi \cdot edin \cdot gnip \cdot edli} \quad (10).$$

2.2 Freedom

The definition of Freedom that is given by Caselles (2014): “*non-restrictions to self-fulfillment. This would be the total freedom that, obviously, in a group must be limited by the dignity of the other members of the group.*” The equation 11 presents the quantitative variables which have been selected to obtain the Freedom Index, *FRIN*,

$$frin = \sqrt[6]{\frac{rami - (-1000)}{1000 - (-1000)} \cdot \frac{inst - 0}{100 - 0} \cdot \frac{iito - 0}{100000 - 0} \cdot \frac{mpsu - 0}{100 - 0} \cdot \frac{exim - 0}{100 - 0} \cdot \frac{rede - 0}{5 - 0}} \quad (11).$$

Where,

RAMI Net migration rate: Ratio of the difference between the number of in-migrants and out-migrants from a country to the average population, expressed per 1,000 people.

INST Stock of immigrants: Ratio of the stock of immigrants into a country, expressed as a percentage of the country's population. The definition of immigrant varies across countries but generally includes the stock of foreign born people, the stock of foreign people (according to citizenship) or a combination of the two.

IITO International inbound tourists: Arrivals of nonresident visitors (overnight visitors, tourists, same-day visitors and excursionists) at national borders.

MPSU Mobile phone subscriptions/Internet Users: Number of subscriptions for the mobile phone service expressed per 100 people.

EXIM Exports and imports: The sum of exports and imports of goods and services, expressed as a percentage of gross domestic product (GDP). It is a basic indicator of openness to foreign trade and economic integration and indicates the dependence of domestic producers on foreign demand (exports) and of domestic consumers and producers on foreign supply (imports), relative to the country's economic size (GDP).

REDE. Research and development expenditure. Current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge and the use of knowledge for new applications, expressed as a percentage of GDP. It covers basic research, applied research and experimental development.

2.3 Peace

Also following Caselles (2014), peace can be defined as “*absence of violence, coercion and fear*”.

The corresponding quantitative variables, which are extracted from the UNDP (2015), are the following:

PRPO “Prison population: Number of adult and juvenile prisoners —including pre-trial detainees, unless otherwise noted —expressed per 100,000 people.

RAHO Homicide rate: Number of unlawful deaths purposefully inflicted on a person by another person, expressed per 100,000 people.”

The Peace Index, *PEIN*, is

$$pein = \sqrt{\left(1 - \frac{prpo - 0}{100000 - 0}\right) \cdot \left(1 - \frac{raho - 0}{100000 - 0}\right)} \quad (12).$$

2.4 Solidarity

The definition of Solidarity that is given by Caselles (2014): “*it is considered synonymous of brotherhood, that is to say, mutual aid*” can include the following variables:

The information to create the Solidarity Index, *SOIN*, is obtained in EUROSTAT,

$$soin = \sqrt[3]{\left(1 - \frac{ripr - 0}{100 - 0}\right) \cdot \left(1 - \frac{pldw - 0}{100 - 0}\right) \cdot \left(1 - \frac{madr - 0}{100 - 0}\right)} \quad (13).$$

RIPR. At-risk-of-poverty rate. The share of persons with an equivalised disposable income below the risk-of-poverty threshold, which is set at 60 % of the national median equivalised disposable income (after social transfers).

PLDW. Share of total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames of floor. The indicator is defined as the percentage of the total population living in a dwelling with either a leaking roof, or damp walls/floors/foundation, or rot in window frames or floor.

MADR. Material Deprivation rate. The indicator is defined as the percentage of population with an enforced lack of at least three out of nine material deprivation items in the 'economic strain and durables' dimension.

2.5 Justice

Following Caselles (2014) justice can be considered as the set of, “*mechanisms of prevention, protection and compensation for individuals or groups face to possible damages or benefits*”.

In this case, descriptors are not in the UNDP reports. For this reason, the information is obtained from statistical databases. In the EUROSTAT, the following information is obtained,

POOF. Police Officers. Policias por habitante.

PRJU. Professional Judges. Jueces por habitante.

PRIP. Prison population. Gente en prisión por habitante.

CRPO. Crimes and violence. %

With these information the Justice Index, JUIN, is calculated with (14),

$$juin = \sqrt[4]{\left(1 - \frac{poof - 0}{1 - 0}\right) \cdot \left(1 - \frac{prju - 0}{1 - 0}\right) \cdot \left(1 - \frac{prip - 0}{1 - 0}\right) \cdot \left(1 - \frac{crpo - 0}{100 - 0}\right)} \quad (14).$$

3. The Index in the Countries

In this section the value of each subindex is shown. The subindices is necessary to obtain the Happiness Index.

Note that attempted to perform the calculation for all countries of the European Union, but it could not be possible because of the absence of data from some of them, which is why in some tables are seen more countries than others.

Table 1 shows the Development Index, Iceland and Sweden are the most develop countries in the EU and Bulgaria is the least develop country.

Table 1. Development Index by Country

Country	Development Index	Country	Development Index
Austria	0.789	Ireland	0.803
Belgium	0.808	Italy	0.774
Bulgaria	0.671	Latvia	0.741
Croatia	0.717	Lithuania	0.758
Cyprus	0.775	Poland	0.764
Czech	0.720	Portugal	0.757
Estonia	0.770	Romania	0.677
Finland	0.803	Slovakia	0.721
France	0.769	Slovenia	0.767
Germany	0.807	Spain	0.775
Greece	0.750	Sweden	0.829
Hungary	0.742	U.K.	0.777
Iceland	0.837		

In regard to Freedom Index (Table 2) the most and least free countries in the EU are Denmark and Estonio respectively.

Table 2. Freedom Index by Country

Country	Freedom Index	Country	Freedom Index
Austria	0.455	Latvia	0.288
Belgium	0.417	Lithuania	0.352
Croatia	0.205	Luxembourg	0.402
Cyprus	0.373	Montenegro	0.216
Czech	0.359	Netherland	0.422
Denmark	0.532	Portugal	0.180
Estonia	0.163	Serbia	0.312
Finland	0.363	Slovenia	0.243
France	0.321	Spain	0.364
Germany	0.380	Sweden	0.412
Iceland	0.326	Switzerlan	0.319
Ireland	0.366	U.K.	0.192
Italy	0.263		

The Justice and Peace Index (Table 3 and 4) are high in all countries, remark that Croatia and Iceland have the same justice index. 0.990, and the Peace Indeces are different in the third decimal.

Table 3. Justice Index by Country

Country	Justice Index	Country	Justice Index
Austria	0.961	Malta	0.961
Bulgaria	0.926	Montenegro	0.977
Croatia	0.990	Netherland	0.938
Cyprus	0.943	Norway	0.980
Czech	0.953	Poland	0.978
Denmark	0.965	Portugal	0.965
Estonia	0.959	Romania	0.952
France	0.945	Serbia	0.936
Greece	0.943	Slovakia	0.969
Hungary	0.956	Slovenia	0.971
Iceland	0.990	Spain	0.950
Latvia	0.963	Sweden	0.966
Lithuania	0.985	U.K.	0.944

Table 4. Peace Index by Country

Country	Peace Index	Country	Peace Index
Austria	0.99945	Lithuania	0.99891
Belgium	0.99939	Luxembourg	0.99970
Bulgaria	0.99734	Montenegro	0.99830
Croatia	0.99846	Netherland	0.99639
Cyprus	0.99879	Norway	0.99934
Czech	0.99944	Poland	0.99980
Denmark	0.99956	Portugal	0.99906
Finland	0.99967	Romania	0.99958
France	0.99951	Serbia	0.99852
Germany	0.99904	Slovakia	0.99927
Hungary	0.99862	Slovenia	0.99947
Iceland	0.99925	Spain	0.99923
Ireland	0.99966	Sweden	0.99976
Italy	0.99926	Switzerlan	0.99959
Latvia	0.99924	U.K.	0.99936

Finally, the Solidarity Index (Table 5) shows the most solidarity country, Norway, and the least, Bulgaria.

Table 5. Solidarity Index by Country

Country	Solidarity Index	Country	Solidarity Index
Austria	0.877	Latvia	0.703
Belgium	0.850	Lithuania	0.757
Bulgaria	0.661	Luxembourg	0.876
Croatia	0.771	Malta	0.843
Cyprus	0.720	Netherland	0.886
Czech	0.884	Norway	0.924
Denmark	0.875	Poland	0.821
Estonia	0.815	Portugal	0.744
Finland	0.915	Romania	0.710
France	0.872	Serbia	0.691
Germany	0.864	Slovakia	0.852
Greece	0.746	Slovenia	0.803
Hungary	0.698	Spain	0.820
Iceland	0.886	Sweden	0.910
Ireland	0.823	Switzerlan	0.900
Italy	0.780	U.K.	0.836

4. Hapiness Index vs Overall Life Satisfaction Index

In this section the Happiness Index is calculated as

$$hain = \sqrt[5]{dein \cdot frin \cdot juin \cdot pein \cdot soin} \quad (15)$$

Table 6 shows the Hapiness Index for each country (Formula) and the Overall Life Satisfaction Index (Satisfaction Index) which is calculated thro a quiz in UNDP. In Figure 2 the same is represented and the r^2 is 0.5027.

Table 6. Index by Country

COUNTRY	Formula	Satisfaction Index
Austria	0.74168166	0.74
Croatia	0.57865172	0.6
Cyprus	0.6654394	0.62
Czech	0.68312945	0.63
France	0.6711497	0.66

Iceland	0.69938758	0.76
Latvia	0.61657566	0.51
Lithuan	0.66763397	0.58
Portuga	0.55896431	0.5
Sloveni	0.61762304	0.61
Spain	0.68453398	0.63
Sweden	0.74034153	0.76
United Kingdom	0.58577153	0.69

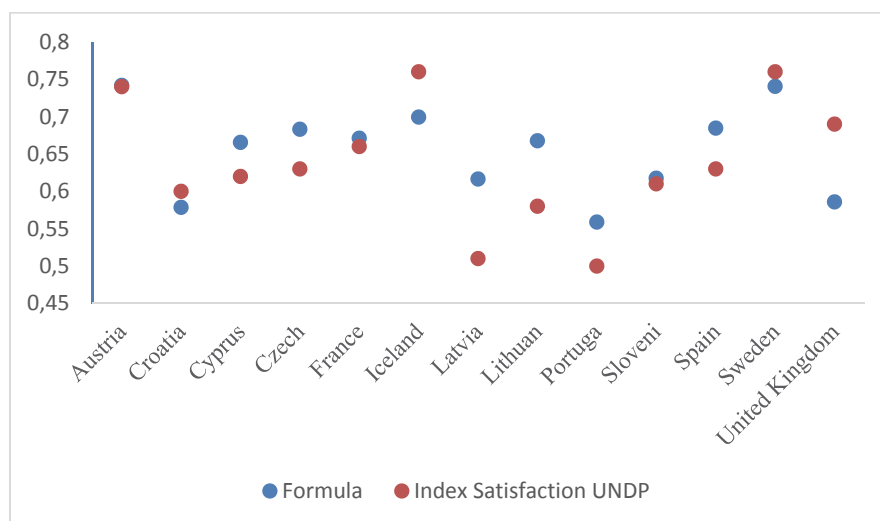


Fig 2. Happiness Index (Blue Point) and Overall Life Satisfaction Index (Red Point). $R^2=0.502745$

5. Conclusions

This paper has presented the formula to calculate the Happiness Index. The qualitative variables involved are obtained from Caselles (2014) and they are the development, freedom, justice, peace and solidarity. These variables have been calculated through quantitative variables which are defined by the UN's Human Development Report (UNDP, 2014) and also through the Eurostat.

The formula of the Happiness Index is generic, i.e., it is applicable to any country in the world. That is why here the index is calculated for 13 countries of the European Union. The countries have not selected randomness, all countries studied in the UNDP (2014) have been studied in this paper but some of them have not enough data to calculate the formula completely.

This index is compared with the Overall Life Satisfaction Index presented by the UN in its reports, and notes that the value is similar in the countries studied.

In the future work, we will try to get enough data to get calculate this index for a greater number of countries in the world, not only countries of the European Union.

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In addition, this index will be included in a socio-demographic dynamic model (Sanz et al., 2016) to observe the relation between demographic rates and the same.

6. References

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