

GSJ: Volume 14, Issue 2, February 2026, Online: ISSN 2320-9186

[www.globalscientificjournal.com](http://www.globalscientificjournal.com)

## Development of Macro - Equality Index for Wellbeing and Strategy to Monitor its Trends with Example from EU Community Countries

---

Salih Hamza Abuelyamen

*B.Sc. on Mathematics & Physics-University of Khartoum, M. A. on Demography - Georgetown University, Retired from the Central Bureau of Statistics in Sudan, Association of Retired Staff from the Central Bureau of Statistics, Private Researcher – Sudan. Email: Email: salihabuelyamen@yahoo.co.uk*

---

### Key Words

Macro Equality, Strategy, MEI, SSD, SM, EU countries

### ABSTRACT

The subject of this paper is the development of a macro-equality index and a strategic frame work to monitor its trends and differentials, with an example of application for the EU community countries. Previous researches in this respect concerned mainly with micro-equality indices, and macro equality differentials are measured only by comparisons of micro-equality indices across subunits. In this paper a single macro-equality index is used to measure equality across different subunits, which is the first of its kind in this field. The methodology used is based on the correlation coefficient statistic of the percent values of the concerned variable, which we discovered to be the same for all units, provided that the number of subunits per unit is equal. Accordingly we developed an equation for a macro-equality index (MEI) as:  $MEI = SM - SSD$ , where SM is the mean of the percent values of the concerned variable, we defined it as Standardized Mean; and SSD is the standard deviation of the percent values of the variable, we defined it as Standardized Standard deviation. As for the strategic monitoring, we developed a system of two models: the strategic monitory model, which describes the equality strategies across subunits or through time; and an EXCEL worksheet to facilitate macro-equality monitoring through time. We applied this work for the European Union countries on human development indices levels' data from the UN, 1025 retrospective data, for the years from 2010 to 2014.

### 1. Introduction

Previous research concerned mainly with micro-equality issues. We believe that macro-equality issues are, as well, important to address the differentials in well being across linked subdivision areas, such as states of countries or countries of communities, and to know the levels of equality in distribution of services and other shared benefits in these areas. Macro-equality levels also reflect the micro-equality levels in places where different ethnics and population groups live in different subdivision areas of a country. Inequality of wellbeing among different subdivision areas proved to initiate conflicts between marginalized areas and the federal governments. For global issues international organizations are usually concerned with the improvement of the levels of human development aspect to achieve different goals and targets for different countries. The approaches towards these goals also need macro-equality strategies to monitor different macro-equality levels across the concerned countries.

This paper concerns with: first, development of a macro equality measure with comparability validity to compare well being and other beneficial factors' levels among Populations of different subdivision areas of a country or group of countries; Second, Development of a strategic method to evaluate and monitor trends of equality in specific variables among these units. The global community to be introduced here is The European Union countries classified by levels of human development indicators and its components from health, education and economic status indicators.

## 2. The Hypothesis

The basic hypothesis underlies this paper in that: The percent values of different variables across a region or a variable across sub regions is of equal values when the number of units of variables is the same for all respected areas.

## 3. Literature Review

The concept of macro equality in this paper is defined as the level of differences of variables' values across subunits. It concerns with macro units, whereas all equality measures available in the literature concern with micro units; and they defined sometimes as inequality, for example Gini inequality index (Wikipedia). There are other different concepts of equality based on categorical classification such as social equality (Mohan), gender equality (Komar), wealth equality and so on. In addition to that, there is a collective type of equality reported in the literature, which includes different interacted variables for the concerned issue, such as the affective equality (Kathleen, etal). It is also mentioned in the literature that The Equality and Human Rights Commission had been working with Statistics and other stakeholders and subject experts to develop a measurement framework that can be used to assess equality and human rights across a range of domains (E. H. R. commission). This work somewhat similar to our objective in this paper; however the measurement they are going to develop is also based on micro-equality level. All these types of equality measures are micro-equality indices that deal with individual differential of population's characteristics, and they are sector-specific indices. Generally speaking comparisons between socioeconomic indicators and indices between dependent or independent units reflect micro-equality differentials between these units. These differentials are underlined by internal factors in federal governments, regions or states; and they are specific sect-oral measurements not valid as standard indices to measure absolute equality levels for all variables. A relevant point of view which supports our objective is stated by Fineman in his paper "Beyond Equality and Discrimination" that "equality is less helpful—and may even be an unjust measure—when applied in situations of inescapable or inevitable inequality where differing levels of authority and power are appropriate" (Fineman); in this respect our macro equality measure would absorb the individuality concept of inequality into overall equality which includes the regions where the effect of authority and power are appropriate as mentioned by Fineman. We believe that there should be a macro equality index, which measures the whole equality between subunits of a region or linked communities for equal levels of beneficial issues or other, irrespective of the impact of internal micro equality differentials. We did not find in the literature such an index; so this is the first index which measures the above described situations.

As for the strategic models, there are different definitions of strategic models concept, for examples: "It generally involves setting goals and priorities, determining actions to achieve the goals and mobilizing resources to execute the actions" (Wikipedia); or "A frame work that allows organizations to map out their short and long term business plans" (Leapsome); or "A structural frame work that guide organizations in defining their direction making strategic decagons" (Heflo.com). All these definitions are at line with our macro-equality strategic concept, which conceptualized as goals, direction and action. A number of strategic models and tools for different purposes are mentioned in the literature, for example SWOT for assessing strength & weakness and opportunities & threats, which is one of the top 5 strategies (clearpointstrategy); or PEST/PESTLE Analysis for evaluation of macro-

environmental factors (spiderstrategies), which included in the top 5 strategies (clearpointstrategy); or key performance indicator, which evaluates the performance of institutions for a long run (Wojciech). Different classification of strategic types also introduced in the literature, for example, strategic tools for analysis, decision, planning and tracking (stranavapp.com); and classification of types of strategic tools classified by three strategic levels: Business strategy, functional strategy and operational strategy, which is the most detailed level (Wikipedia). We found also in the literature that the Equality and Human Rights Commission with other stakeholders had been working to develop a measurement framework to assess equality and human rights across a range of domains (EHRs Commission); however, this would be done using micro equality measurement by comparison of micro equality levels across the different domains, not a single index to monitor macro equality level across the domain. So; there are a variety of strategic models based on variety of purposes a thing which would open door to more strategic types. Our equality strategy is a new and a distinct one. It is a macro-equality strategy for any variable across place or time units; it shares the characteristics of strategic pattern of different modules, such as estimation of past and projection of future, specific required target, monitoring the interval between current and target time, and providing a matrix model of any concerned variables whether Human being benefits variables or other. The monitoring process includes evaluation of the past trend of equality levels, the current situation or future required targets. This would be done for different units (World countries, association of countries, states of federal governments).

#### 4. Methodology

##### *The Macro-equality Index*

##### Definition of Concepts

Macro Equality Index (MEI): An index to measure macro equality levels for a variable's value across group of regions or variables' values of a region that of linked units tied by inter-beneficial commitments, for example states of a country or community of countries.

Standardized mean (SM): It is the mean of the percent values of different variables across a region or for a variable across sub regions. We found that this mean is of equal values when the number of units of the variable is the same for all respected areas.

Equality Correlation Coefficient (ECC): It is the correlation coefficient of the relationships between (the values of a variable referred to a base year time) and (the differences between these values and values of the same variable referred to a subsequent or a target point of time).

Standardized Standard Deviation (SSD): The SSD is defined as the standard deviation of percent values of variables across one region or a variable across number of sub regions.

##### *Types of Macro Equality:*

We classified macro equality into 5 types as follows:

1. Uninterrupted Macro Equality: When the levels of the value of the variable in different subdivisions are not controlled.
2. Enforced Macro Equality: When the levels of the value of the variable in concern are controlled by some authorities.
3. Inertial Equality: When the respected variable has a maximum value (plateau) that all respected units approach it without any intervention.
4. Insignificant controlled Equality: When the variable under concern is controlled by individual units and the MEI is high but the ECC value is insignificant.

5. Insignificant Chance Equality: When the variable under concern is not controlled, either by individual units' institutions or by other authorities and the MEI is high, but ECC value is insignificant.

#### *Calculation of the Macro Equality Index (MEI)*

For all variables with the same number of values, the macro-equality index (MEI) across subunits of a unit is calculated by the following equation:

$$[MEI = SM - SSD] \text{ ----- (1)}$$

Where SM is the standardized mean and SSD is the standardized standard deviation. The lower limit of the index equals zero when the SM = SSD, and the upper limit equals SM when SSD=0.

Generally speaking the MEI could be taken as percent MEI (MEI %), which includes cases when the total number of units of regions/sub-regions is not equal:

$$\%MEI = (SSD/SM)*100 \text{ ----- (2)}$$

#### *Strategic System of Monitoring Macro-Equality*

We developed two models to monitor the macro-equality levels across subdivisions: the strategic monitory model, which describes the equality strategies across units or through time; and an EXCEL worksheet to facilitate macro-equality monitoring through time. This, in addition to a method to Project levels of variables' values towards desired macro-equality targets.

#### *The Strategic Monitory Model*

##### Description of the Model

Figure 1 presents the Model of the strategic monitoring system of macro-equality levels. The first column stands for the title of the Unit of the group, whether group of countries or group of subdivisions of a country. The columns from column 2 to the last column stand for, either the values of the variable for the concerned subunit through different subsequent years (Y), or the values of the specific variable for different subunits (V). In other words, it stands for the values of the same variable of the respected subunit for a number of years or the values of the different variables for the respected subunit. Four procedures of equality monitoring system could be operated from the model as follows:

1. To monitor the macro equality levels of a **specific variable** for a **subunits** of a specific unit, for example the Human Index of subdivisions of unit B in the module.
  - a. In this case column 1 would be for the subdivisions of B and column 2 would be for the Human Index variable.
2. To monitor the macro equality levels of **different variables** for **subunits** of a specific unit; for example, to monitor the equality levels of Human Index component variables: education, health and economical status for a unit's subunits, for example subunits of the country A in the model.
  - a. In this case column 1 would be for the subunits of A and the columns from 2 to 4 would be for the three variables.
3. To monitor the macro equality levels of a **specific variable** through **time**, for example the Human Development Index of the country F for years from year Y1 to year Yn in the model.
  - a. In this case column 1 for a country's subdivisions and the columns from 2 to n for the values of the Human Development Index by year.

4. To monitor the equality levels of **different variables** for subunits of a specific unit through **time**; for example the three health, education and economic status variables for subunits of unit F from year Y1 to year Yn, in the model.

a. In this case to use multiple frames, a frame for each subunit and each variable through time; to specify the subunit's name in column 1 and the specific variable by year in the columns from 2 to n.

1	2	3	4	5	6	7		→ n
Units/Subunits	Y1/V1	Y 2/V2	Y 3/V3	Y 4/V4	Y 5/V5	Y 6/V6	Y 7/V7	Yn/Vn→
A	Value-a	Value-a	Value-a	Value-a	Value-a	Value-a	Value-a	Value-a
B	Value-b	Value-b	Value-b	Value-b	Value-b	Value-b	Value-b	Value-b
C	Value-c	Value-c	Value-c	Value-c	Value-c	Value-c	Value-c	Value-c
D	Value-d	Value-d	Value-d	Value-d	Value-d	Value-d	Value-d	Value-d
E	Value-e	Value-e	Value-e	Value-e	Value-e	Value-e	Value-e	Value-e
F	Value-f	Value-f	Value-f	Value-f	Value-f	Value-f	Value-f	Value-f
G	Value-g	Value-g	Value-g	Value-g	Value-g	Value-g	Value-g	Value-g
↓	Value↓	Value↓	Value↓	Value↓	Value↓	Value↓	Value↓	Value↓

Figure 1: Model of the strategic monitoring system of macro-equality level

(Source: Self/Authors' own illustration)

#### Evaluation of Equality Trends and differentials

The Equality Correlation Coefficient (ECC) is used to evaluate the macro-equality trend/differentials for variable/variables through time or across unit/units as follows

With respect to specific variable by different subunits:

- Calculation of the Equality Correlation Coefficient (ECC) of the relationship between the values of the specific variable for all subunits, and the differences between each of these values and the values of the same variable for the subsequent subunit as follows:
  - First: To sort in descending order the values of the concerned variable for all subunits.
  - Second: To calculate the differences  $D_i$  between the values of the concerned variable for each subunit and the subsequent subunit as follows:
    - $D_i = v_i - v_{i-1}$  for  $i$  from 2 to  $N-1$ , where  $v_i$  is the specific variable of subunit  $i$  ----(3)
- A significant ECC in this respect indicates that enforced or inertial type of equality has taken place. For a complete equality the ECC value of the relationship would be -1; In this case the value of the tested variable would be the same for all Subunits. For a complete inequality the ECC value of the relationship would be 1. Accordingly, a macro-equality line could be defined to be the case when the ECC value equals zero.

With respect to the other scenarios the same procedure would be taken by the equation:

- $D_{i,j} = v_{i,j} - v_{i-1,j}$  for  $i$  from 1 to  $N-1$  and  $j$  from 1 to  $N$  where  $N$  is the last subunit .....(4)  $i$  stands for subunit; and  $j$  stands for variable from 1 to  $N$  (the second scenario) or for time from 1 to  $N$  (The third scenario).
- As for the fourth scenario (the multiple frames), the same equation would be considered for each frame (the frame referred to the specific subunit,  $i$  for the variables and  $j$  for the time).

#### The Macro-equality Monitoring System Model

The system consists of two components: The system from actual data and the system from quadratic equations.

The system from actual data: This component is aimed to monitor macro-equality levels for different subunits of unit; it is based on the variable's values at specific reference time. The system inputs are the number of subunits to be treated, the required highest target value for the subunit of the highest variable's value across subunits at the base year, and the required lowest target value for the subunit of the lowest value at the base year. The base year data would be sorted in descending order, and then the system automatically generates the future values of the variable for in between subunits, along with the macro-equality indices. The variable values for subunits in the different years between the reference-date and the future's target date could be calculated as follows:

First: To calculate the average rate  $R_{i,j}$  of increase of the variable's value for each subunit by subtracting the values of the variable's value at the base-year form that at the target year as follows:

- $R_{i,j} = (TV - V_{i,j})/T$  where TV is the value of the variable at the fixed target and  $V_{i,j}$  -----(5) is the number of the variable's value for each subunit, where i stands for subunit; and j stands for variable
- Second: To calculate the value of the concerned variable for the subsequent years after the base year:
  - $V_{i,j} = V_{i,j} + R_{i,j}$  for i from 2 to i-1, and j from 2 to j-1 ----- (6)

The system from quadratic equations

This component is aimed to monitor macro-equality levels based on the highest value of the concerned variable across subunits using two quadratic equations derived from regression analysis operation. The method of deriving the quadratic equations is as follows:

1. First, a fixed required value to be attained for each unit is assigned at the target year
2. The variable's values of the subunit at the base year are sorted in ascending order.
3. A required future upper value is fixed for the unit acquired the highest value of the variable at the base year.
4. A hypothetical series of increasing decrements (D) from the upper limit value at the target year assigned to each of the other subunits are calculated by arithmetic progression, starting from  $0.05 / (n-1)$  and increasing by  $0.005 / (n-1)$ , where n is the number of subunits.
5. A set of ECC values are calculated from the association between the values of the variable at the reference time and D values.
6. Two regression quadratic equations are obtained by regressing D and ECC variables mutually as dependent variables. This would be done by bargaining the operation with different numbers of units for each dependent variable to get the best fit. Then, the two quadratic equations would predict the following:
  - First; the expected ECC values from the hypothetical average rate of increase per year (D) for the subunit of the highest value of the variable at the base year up to the fixed value at the target year
  - Second; using the same equation, taking the average rate of increase per year this turn as independent variable to predict the D value.

Figure 2 shows representation of the frame of the output of the regression operation and the two quadratic equations derived from it.

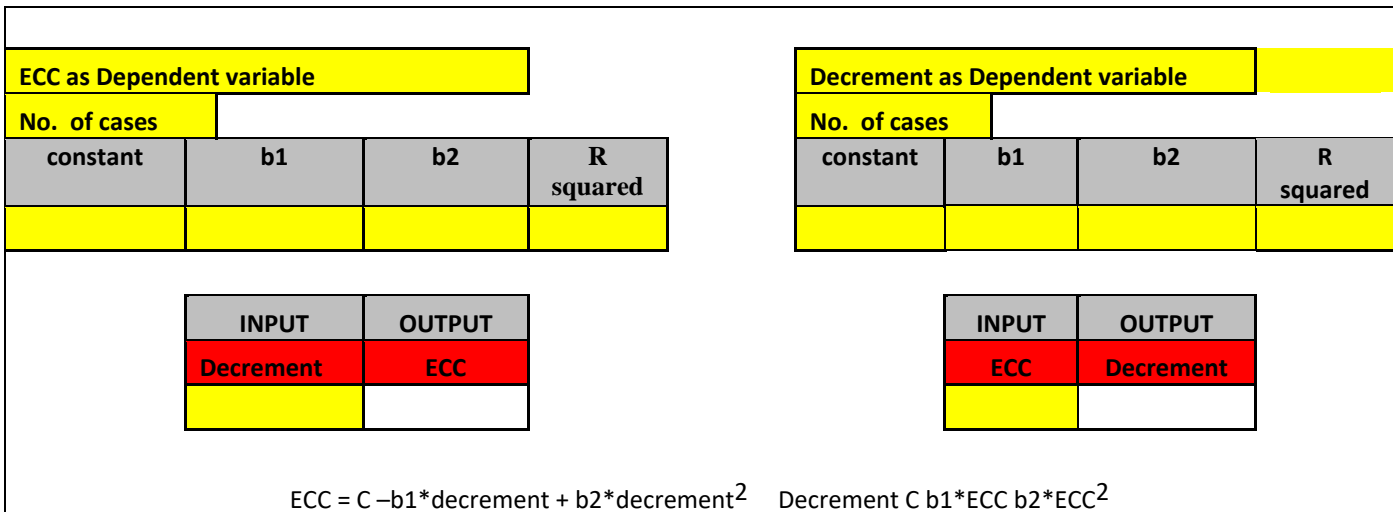


Figure 2: Worksheet 1The EXCEL Worksheet System from Quadratic Regression Fit  
(Source: Self/Authors' own illustration)

Projections of levels of variables values across subunits towards desired macro-equality targets

In this part of the section we used the third procedure type, which is one variable for different subunits through time. The following steps were taken to project the levels and the corresponding macro-equality indices of a variable across different units through a period of time towards specific targets:

- First: To sort in descending order the first-year' values of the concerned variable for the concerned subunits:
- Second: To specify the required target of the variable's value to be attained for each unit. This would be done by assigning a fixed value for all units or a maximum and minimum value for the first and last units respectively.
- Third: The in-between values of the variable for each subunit could be calculated as follows:
  - $V_{i+1} = V_i - (V_i - V_i / (N-1))$  for i from 1 to i-2 ----- (7)
  - Where  $V_i$  is the value of the variable of subunit i, and N is the total number of subunits
- Fourth: To calculate the average rates  $R_{i,j}$  of increase for the variable's value for each subunit, by subtracting the values of the variable's value at the base-year form that at the target year as follows:
  - $R_{i,j} = (V_t - V_{i,j}) / T$  where  $V_t$  is the value of the variable at the fixed target at time t, T is the interval of time and  $V_{i,j}$  are the variable's values for each i subunit at time j -----(8).
- Fifth: To calculate the value of the concerned variable for the subsequent years after the base year:
  - $V_{i,j} = V_{i,j} + R_{i,j}$  for i and j from 2 to j-1] ----- (9)
- Sixth: To calculate the corresponding macro-equality indices.

#### 4. The Application

The European Union countries (28 countries) were considered in this application. The indicators used are the Human Development Index, life expectancy at birth for health factor, mean years of schooling for education factor and Gross National Income per capita for economical status fac6o5. Data of these indicators were obtained from United Nations sources in its Web side. We used in this paper the data referred to the years from 2010 to 2014 (UN); see (Appendices 1).

In this application first, we applied the micro-equality Index to compare equality in human development level and its components of health, education, and economic status indicators across the EU members in a specific year (2010); second, we evaluated equality experience in human development across these countries during some back years (2010, 2011, 2013, 2014); third, we projected the HDI values for the member countries and the corresponding equality levels through the 10 forward years ( from 2014 to 2024). We applied the developed Excel worksheet system as an example to monitor planning of macro equality levels through time.

*Findings*

Levels

Table (1) presents the macro equality Indicators of human development, health, education, and Economical status for the European Union countries in 2014. The Value of the MEI in human development across EU members in 2014 was found to be 95.56%, which is very high. The maximum value of HDI equals 0.923 registered in Demark, and the minimum equals 0.830 registered in Portugal as shown in Appendix 1. With respect to the HDI components; education, longevity, and economic status among the EU countries Table 1 shows that in 2014 longevity experienced the highest degree of equality across these countries with MEI equals 96.33%. Appendix 1 shows that the maximum life expectancy at birth equals 83.1 years registered in Italy, and the minimum equals 73.3 years registered in Lithuania. Equality level in education came in the second place with MEI equals 90.27%. The maximum mean years of schooling equals 13.1 years registered in Germany and United Kingdom, and the minimum equals 8.3 years registered in Portugal as shown in Appendix 1. Macro-Equality Index in economic status across EU members (67.45%) lagged other components by considerable gap. The maximum GNI per capita equals 58711 PPP\$ registered in Luxemburg, and the minimum equals 15956 PPP\$ registered in Bulgaria as shown in Appendix 1.



*Table 1  
 Macro Equality Indicators of Human development, Health, Education  
 And Economical status for European Union countries in 2014*

<b>Indicator</b>	<b>HDI%</b>	<b>Life Expectancy %</b>	<b>Mean Sch. Year %</b>	<b>GNP/Capita %</b>
SM	3.57	3.57	3.57	3.57
SSD	0.16	0.13	0.35	1.16
MEI	3.41	3.44	3.22	2.41
%MEI	95.56	96.33	90.27	67.45

*(Source: Calculated from data in Appendix 1)*

Previous Trends

We present here the results of evaluation of macro equality experience in human development across EU countries for the years from 2014 back to the year 2010, four years before the reference year. Table 2 shows the values of these indicators during these years. As shown in the table the Macro Equality level in human development in 2010 across EU countries registered 95.38%; it was almost the same as in 2011, with very slight equality retardation of ECC = 0.0298 between 2010 and 2011. Equality development measured by ECC increased gradually between the four years to be – 0.2866, -0.2868, and -0.3277 ECC values respectively as shown in the table. Accordingly, the MEI% values increased gradually in the years 2012, 2013, and 2014 to be 95.44%, 95.51%, and 95.56% respectively. It should be noted here that the ECC values are not significant; therefore, this type of equality is described as insignificant equality; this is because although the MEI is high, the ECC is not significant. It could be one of the two insignificant types of equality as indicated in the

Methodology Section. Appendix 2 presents the human development indices for the EU countries in the years from 2010 to 2014.

*Table 2*  
*Macro-Equality indicators of human development for the European Union Countries during 2010-2014*

Years/ Levels	2010	2011	2012	2013	2014
MEI	3.406	3.406	3.408	3.411	3.413
MEI%	95.38	95.37	95.44	95.51	95.56
Interval / Development	2010/11	2011/12	2012/13	2013/14	2014/15
ECC	0.0298	-0.2866	-0.2868	-0.3277	-0.2878

(Source: Calculated from Appendix 2)

### Projection of Equality Levels

Table 3 and Table 4 present the projection of macro-equality levels and other equality indicators of HDI for the EU countries during 2014-2024 according to two scenarios: a fixed value of HDI equals 0.95 for all members of EU countries in 2024 the target year, and maximum & minimum values at the target year equal 0.95 and 0.85 respectively. Graphic representations of the projections are presented in Figure 3 and Figure 4 for the two scenarios; as for the projected values of HDI See Appendix 3 and Appendix 4. With respect to the first scenario the HDI value assigned to be equals 0.95 for all EU members in 2024 the target year. In this case the development of equality through each year would be of ECC value equals -1, indicating a complete equality. Accordingly, the MEI values increase gradually from 95.56% in the year 2014 to 100% in the year 2024, as shown in Table 3, representing a horizontal straight line of HDI values equal 0.95 for all members as shown in Figure 3. With respect to the second scenario the HDI in 2024 the target year expected to start with evenly decreasing values from a maximum value equals 0.95 in 2024 for the country of the maximum value in 2014 to a minimum value equals 0.85 in 2024 for the country with the lowest HDI in 2014. During this period the HDI value for the country with the maximum value (Denmark, 0.9230) would decrease by 3% while the country with the minimum value in 2014 would increase by 9%. Accordingly, the MEI values in the EU countries would increase gradually from 95.56% in the year 2014 to 96.615% in the year 2024, showing gradual decrease in equality development, compared to the 2013-2014 period, from ECC equals -0.84889 in 2013-2014 to ECC equals -0.75917 in 2023-2024 as indicated in Table 4. The graph of this scenario shows a straight descending line in the target year of HDI values equal 0.95 for the upper target and 0.85 for the lower target as presented in Figure 4. It is noticed here that the ECC values are significant, indicating a deliberate action expected for equality improvement. The lines in the two graphs represent the projected values of HDI for the two scenarios in the years from 2014 up to 2024.

*Table 3*  
*Projections of macro equality indicators of HDI during 2014-2024 of HDI target equals 0.95 in 2024 for all members of EU countries*

	2014	2015	2016	2017	2018	2019
ECC between		-1	-1	-1	-1	-1
SM	3.571	3.571	3.571	3.571	3.571	3.571
SSD	0.159	0.141	0.124	0.108	0.092	0.076
MEI	3.413	3.430	3.447	3.464	3.480	3.496
%MEI	95.56	96.04	96.52	96.98	97.44	97.88

(Source: Calculated from Appendix 3)

*Table 3 continued*

	2020	2021	2022	2023	2024
ECC between	-1	-1	-1	-1	-1
SM	3.571	3.571	3.571	3.571	3.571
SSD	0.060	0.045	0.029	0.015	0.000
MEI	3.512	3.527	3.542	3.557	3.571
%MEI	98.32	98.75	99.18	99.59	100.00

(Source: Calculated from Appendix 3)

*Table 4*  
*Projections of macro equality indicators of HDI for EU countries during 2014-2024 of targets, maximum equals 0.95 and minimum equals 0.85*

	2014	2015	2016	2017	2018	2019
*ECC between	-0.84889	-0.84144	-0.83346	-0.82494	-0.82494	-0.81580
SM	3.571	3.571	3.571	3.571	3.571	3.571
SSD	0.159	0.154	0.149	0.145	0.141	0.137
ME	3.413	3.418	3.422	3.426	3.430	3.434
%MEI	95.56	95.69	95.82	95.94	96.05	96.16

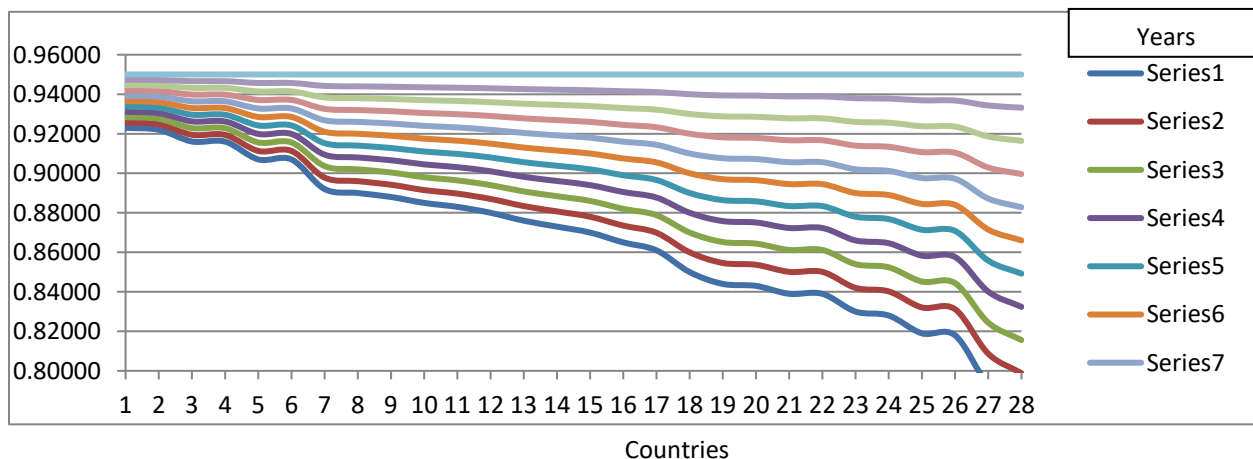
(Source: Calculated from Appendix 4)

**Table 4 continued**

	2020	2021	2022	2023	2024
*ECC between	-0.80602	-0.79552	-0.78426	-0.77217	-0.75917
SM	3.571	3.571	3.571	3.571	3.571
SSD	0.133	0.130	0.127	0.124	0.121
MEI	3.438	3.442	3.445	3.448	3.451
%MEI	96.27	96.36	96.46	96.54	96.62

(Source: Calculated from Appendix 4)

\*At significant level below 0.05



*Figure 3: The projected HDI values for the EU countries from 2014 to 2024 based on HDI target of 0.95*  
*(Source: Self/Authors' own illustration from Table 3)*

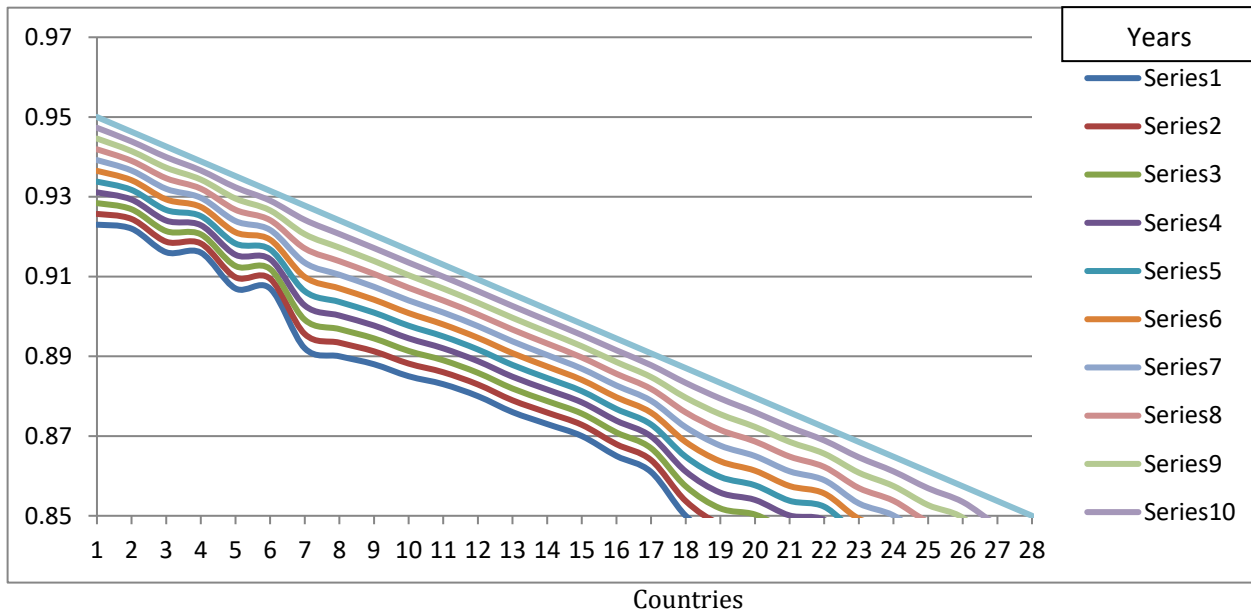


Figure 4: The projected HDI values for the EU countries from 2014 to 2024 based on HDI targets of 0.95 maximum and 0.85 minimum (Source: Self/Authors' own illustration from Table 4)

The macro-equality monitoring system model

We applied this system on the human development indices for the EU members in 2014. We used the method illustrated in the Methodology Section, with the hypothetical decrement (D) values. We considered the maximum target of HDI to be 0.95. After regressing D values and ECC values mutually, the best fit was obtained for 8 cases when ECC taken as dependent variable and 9 cases when D taken as dependent variable. With this number of cases R squared value reached 0.997 for the first operation and 0.984 for the second operation. Hence; the system predicted first; the ECC value corresponds to a specific pace of decrease of the HDI values for the EU countries from the fixed maximum target value; second, the decrement value corresponds to a specific ECC value. The following worksheet presents the model of the system.

ECC as Dependent variable				Decrement as Dependent variable			
8 cases				9 cases			
constant	b1	b2	R squared	constant	b1	b2	R squared
-0.892	-107.243	28565.808	0.997	-0.286	-0.623	-0.335	0.984

INPUT	OUTPUT
Decrement	ECC
0.003	-0.957

INPUT	OUTPUT
ECC	Decrement
-0.957	0.00307

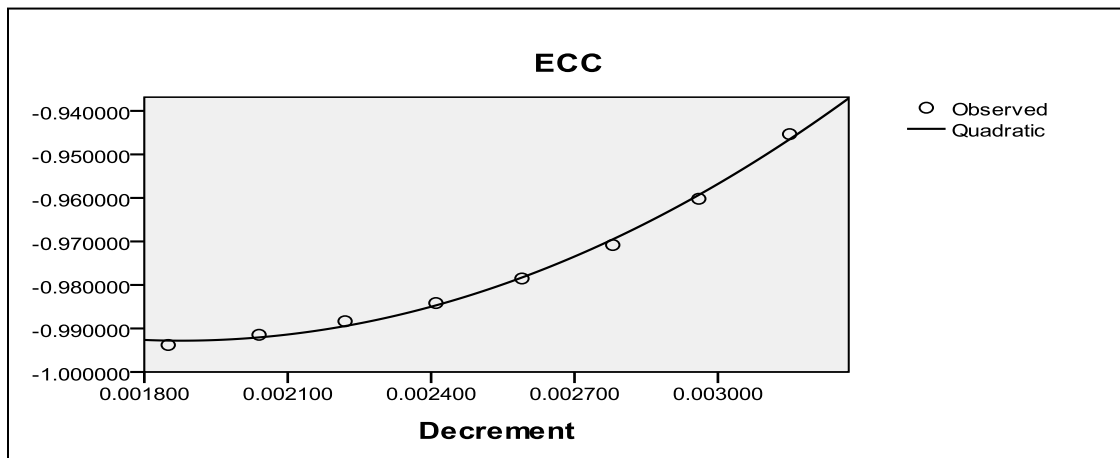
$ECC = -0.892 - 107.243 * \text{decrement} + 28565.808 * \text{decrement}^2$     
  $\text{Decrement} = -0.286 - 0.623 * ECC - 0.335 * ECC^2$

Figure 5: The EXCEL Worksheet System from Quadratic Regression Fit (Source: Self/Authors' own illustration from Table 5)

As shown in the above figure, the left-hand side part of the system presents the quadratic regression coefficients and R squared value when the ECC is dependent variable, and the right-hand side part presents the coefficients and R squared value when the decrement D is the dependent variable. In this example, according to the underlying data of the system, equality in human development across the EU countries expected to improve by a very high level of ECC equals -0.957 between the base-time and target-time when the pace of decrease of the HDI from the highest value (0.95) taken to be 0.003; and the same value of ECC would yield HDI decrement of 0.00307 from the highest value at the target time, which support the robustness of the method. The input values along with the quadratic curves of the two operations are shown in Table 5 and Figures 6 and 7.

*Table 5*  
 Quadratic Regression Inputs

S. N	Decrement	ECC
1	0.001852	-0.99379
2	0.002037	-0.99146
3	0.002222	-0.98834
4	0.002407	-0.98416
5	0.002593	-0.97851
6	0.002778	-0.97082
7	0.002963	-0.9602
8	0.003148	-0.94534
9	0.003333	-0.92421



*Figure 6 Quadratic Curve when ECC as Dependent Variable*  
 (Source: Self/Authors' own illustration from Table 5)

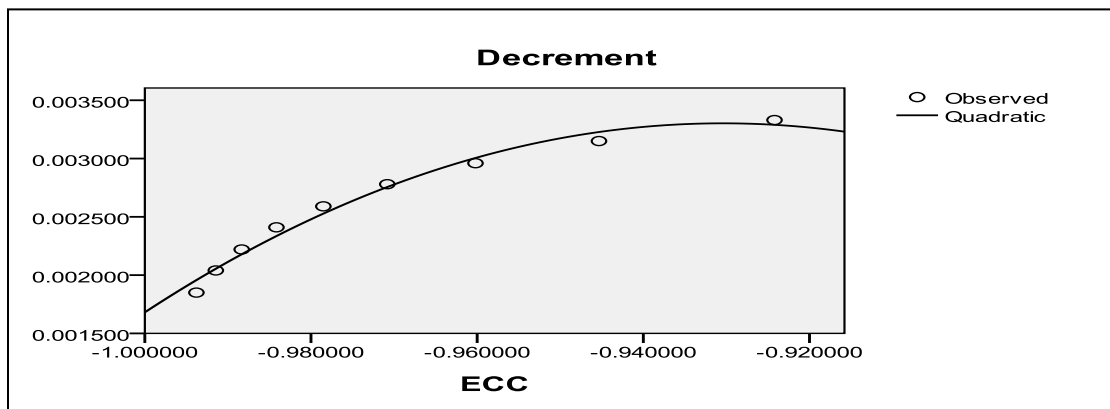


Figure 7: Quadratic Curve when Decrement as Dependent Variable  
(Source: Self/Authors' own illustration from Table 5)

With the two equations in Figure 5 we can predict the required macro-equality values of HDI across the EU countries according to the hypothetical decrement of change of the HDI value so as to obtain a complete macro-equality level for these countries of HDI value equals .95 across the countries at the target time. We note here that the hypothetical space of change of HDI by time, which we used here, could be changed to the desired value.

## 6. Conclusions

- A Macro-Equality Index was developed by the author to measure macro equality levels of variable/variables across units/subunits.
- An EXCEL worksheet system of two components was developed to monitor differentials and trends of macro-equality levels through time.
- According to our Micro-Equality Index, longevity reported the highest level of equality of the three human development components (longevity, education and economical status) across the EU countries) in 2014. Education came in the second level in this respect, followed by economical status which registered the lowest level.
- The high level of equality in longevity among these countries is attributed to the inertial trend of life expectancy at birth toward the maximum life span; so, it is described as inertial type of equality development.
- According to our MEI and ECC values, equality level in human development, measured by HDI, across EU countries dropped very slightly between 2010 and 2011 and increased gradually with slight pace during 2011-2014 showing insignificant value of ECC.
- The insignificance of ECC indicates that the development of the level of HDI during these periods was as a result of higher human development level in countries with lower levels of HDI than countries with higher levels of HDI, a case which described as macro equality type of insignificantly high MEI value.
- The projections of human development levels for the EU countries between 2014 and 2024 using the fixed target scenario and the maximum & minimum targets scenario yielded the following macro equality levels:
  - For the fixed scenario of HDI equals 0.95 at the target year 2024:
    - The MEI% expected to increase from 95.56% in 2014 to 100% in 2024 for all members of EU countries.
  - For the scenario of maximum & minimum values of HDI equals 0.95 and 0.85 respectively at target year 2024:
    - The HDI expected to increase by 3% for the maximum value in 2014, while it expected to increase by 9% for the minimum value in 2014. Accordingly, the MEI% across the EU countries expected to increase from 95.56% in 2014 to 96.62 in 2024.

Appendix 1

EU Countries by Human Development Index, Life Expectancy at Birth, Mean Years of Schooling and GNP per Capita as in 2014

Serial Number	Country	Human Development Index (HDI)	Life expectancy at birth	Mean years of schooling	Gross national income (GNI) per capita
		Value	(years)	(years)	(2011 PPP \$)
1	Denmark	0.923	80.2	12.7	44,025
2	Netherlands	0.922	81.6	11.9	45,435
3	Germany	0.916	80.9	13.1	43,919
4	Ireland	0.916	80.9	12.2	39,568
5	Sweden	0.907	82.2	12.1	45,636
6	United Kingdom	0.907	80.7	13.1	39,267
7	Luxembourg	0.892	81.7	11.7	58,711
8	Belgium	0.890	80.8	11.3	41,187
9	France	0.888	82.2	11.1	38,056
10	Austria	0.885	81.4	10.8	43,869
11	Finland	0.883	80.8	10.3	38,695
12	Slovenia	0.880	80.4	11.9	27,852
13	Spain	0.876	82.6	9.6	32,045
14	Italy	0.873	83.1	10.1	33,030
15	Czech Republic	0.870	78.6	12.3	26,660
16	Greece	0.865	80.9	10.3	24,524
17	Estonia	0.861	76.8	12.5	25,214
18	Cyprus	0.850	80.2	11.6	28,633
19	Slovakia	0.844	76.3	12.2	25,845
20	Poland	0.843	77.4	11.8	23,177
21	Lithuania	0.839	73.3	12.4	24,500
22	Bulgaria	0.782	74.2	10.6	15,596
23	Croatia	0.818	77.3	11.0	19,409
24	Romania	0.793	74.7	10.8	18,108
25	Hungary	0.828	75.2	11.6	22,916
26	Malta	0.839	80.6	10.3	27,930
27	Latvia	0.819	74.2	11.5	22,281
28	Portugal	0.830	80.9	8.2	25,757

(Source: UN, 2015\_statistical\_annex\_tables\_all)

*Appendix 2*  
*EU Countries by Human Development Index as in the Years from*  
*2010 to 2014*

Country	Human Development Index (HDI)				
	2010	2011	2012	2013	2014
Denmark	0.908	0.92	0.921	0.923	0.923
Netherlands	0.909	0.919	0.92	0.92	0.922
Germany	0.906	0.911	0.915	0.915	0.916
Ireland	0.909	0.91	0.912	0.916	0.916
Sweden	0.901	0.903	0.904	0.905	0.907
United Kingdom	0.906	0.901	0.901	0.902	0.907
Luxembourg	0.886	0.888	0.888	0.89	0.892
Belgium	0.883	0.886	0.889	0.888	0.89
France	0.881	0.884	0.886	0.887	0.888
Austria	0.879	0.881	0.884	0.884	0.885
Finland	0.878	0.881	0.882	0.882	0.883
Slovenia	0.876	0.877	0.878	0.878	0.88
Spain	0.867	0.87	0.874	0.874	0.876
Italy	0.869	0.873	0.872	0.873	0.873
Czech Republic	0.863	0.866	0.867	0.868	0.87
Greece	0.866	0.864	0.865	0.863	0.865
Estonia	0.838	0.849	0.855	0.859	0.861
Cyprus	0.848	0.852	0.852	0.85	0.85
Slovakia	0.827	0.832	0.836	0.839	0.844
Poland	0.829	0.833	0.838	0.84	0.843
Lithuania	0.827	0.831	0.833	0.837	0.839
Bulgaria	0.773	0.775	0.778	0.779	0.782
Croatia	0.807	0.814	0.817	0.817	0.818
Romania	0.784	0.786	0.788	0.791	0.793
Hungary	0.821	0.823	0.823	0.825	0.828
Malta	0.824	0.822	0.83	0.837	0.839
Latvia	0.811	0.812	0.813	0.816	0.819
Portugal	0.819	0.825	0.827	0.828	0.83

*(Source: UN, 2015\_statistical\_annex\_tables\_all)*

*Appendix 3*  
*Projections of HDI for EUCs 2014-2024 for HDI Target = 0.95*

Country Code	2014	2015	2016	2017	2018	2019
1	0.9230	0.9257	0.9284	0.9311	0.9338	0.9365
2	0.9220	0.9248	0.9276	0.9304	0.9332	0.9360
3	0.9160	0.9194	0.9228	0.9262	0.9296	0.9330
4	0.9161	0.9195	0.9229	0.9263	0.9296	0.9330
5	0.9070	0.9113	0.9156	0.9199	0.9242	0.9285
6	0.9070	0.9113	0.9156	0.9199	0.9242	0.9285
7	0.8920	0.8978	0.9036	0.9094	0.9152	0.9210
8	0.8900	0.8960	0.9020	0.9080	0.9140	0.9200
9	0.8880	0.8942	0.9004	0.9066	0.9128	0.9190
10	0.8850	0.8915	0.8980	0.9045	0.9110	0.9175
11	0.8830	0.8897	0.8964	0.9031	0.9098	0.9165
12	0.8800	0.8870	0.8940	0.9010	0.9080	0.9150
13	0.8760	0.8834	0.8908	0.8982	0.9056	0.9130
14	0.8730	0.8807	0.8884	0.8961	0.9038	0.9115
15	0.8700	0.8780	0.8860	0.8940	0.9020	0.9100
16	0.8650	0.8735	0.8820	0.8905	0.8990	0.9075
17	0.8610	0.8699	0.8788	0.8877	0.8966	0.9055
18	0.8500	0.8600	0.8700	0.8800	0.8900	0.9000
19	0.8440	0.8546	0.8652	0.8758	0.8864	0.8970
20	0.8430	0.8537	0.8644	0.8751	0.8858	0.8965
21	0.8390	0.8501	0.8612	0.8723	0.8834	0.8945
26	0.8390	0.8501	0.8612	0.8723	0.8834	0.8945
28	0.8300	0.8420	0.8540	0.8660	0.8780	0.8900
25	0.8280	0.8402	0.8524	0.8646	0.8768	0.8890
27	0.8190	0.8321	0.8452	0.8583	0.8714	0.8845
23	0.8180	0.8312	0.8444	0.8576	0.8708	0.8840
24	0.7930	0.8087	0.8244	0.8401	0.8558	0.8715
22	0.7820	0.7988	0.8156	0.8324	0.8492	0.8660

*(Source: Calculated from Appendix 2)*

*Appendix 3 continued*

Country Code	2020	2021	2022	2023	2024
1	0.9392	0.9419	0.9446	0.9473	0.95
2	0.9388	0.9416	0.9444	0.9472	0.95
3	0.9364	0.9398	0.9432	0.9466	0.95
4	0.9364	0.9398	0.9432	0.9466	0.95
5	0.9328	0.9371	0.9414	0.9457	0.95
6	0.9328	0.9371	0.9414	0.9457	0.95
7	0.9268	0.9326	0.9384	0.9442	0.95
8	0.9260	0.9320	0.9380	0.9440	0.95
9	0.9252	0.9314	0.9376	0.9438	0.95
10	0.9240	0.9305	0.9370	0.9435	0.95
11	0.9232	0.9299	0.9366	0.9433	0.95
12	0.9220	0.9290	0.9360	0.9430	0.95
13	0.9204	0.9278	0.9352	0.9426	0.95
14	0.9192	0.9269	0.9346	0.9423	0.95
15	0.9180	0.9260	0.9340	0.9420	0.95
16	0.9160	0.9245	0.9330	0.9415	0.95
17	0.9144	0.9233	0.9322	0.9411	0.95
18	0.9100	0.9200	0.9300	0.9400	0.95
19	0.9076	0.9182	0.9288	0.9394	0.95
20	0.9072	0.9179	0.9286	0.9393	0.95
21	0.9056	0.9167	0.9278	0.9389	0.95
26	0.9056	0.9167	0.9278	0.9389	0.95
28	0.9020	0.9140	0.9260	0.9380	0.95
25	0.9012	0.9134	0.9256	0.9378	0.95
27	0.8976	0.9107	0.9238	0.9369	0.95
23	0.8972	0.9104	0.9236	0.9368	0.95
24	0.8872	0.9029	0.9186	0.9343	0.95
22	0.8828	0.8996	0.9164	0.9332	0.95

*(Source: Calculated from Appendix 2)*

*Appendix 4*  
*Projections of HDI for EUCs 2014-2024 for HDI Targets from*  
*0.95 Down to 0.85*

Country Code	2014	2015	2016	2017	2018	2019
1	0.9230	0.9257	0.9284	0.9311	0.9338	0.9365
2	0.9220	0.9244	0.9269	0.9293	0.9317	0.9341
3	0.9160	0.9187	0.9213	0.9240	0.9266	0.9293
4	0.9161	0.9184	0.9206	0.9229	0.9252	0.9275
5	0.9070	0.9098	0.9126	0.9155	0.9183	0.9211
6	0.9070	0.9094	0.9119	0.9143	0.9168	0.9192
7	0.8920	0.8956	0.8992	0.9027	0.9063	0.9099
8	0.8900	0.8934	0.8968	0.9002	0.9036	0.9070
9	0.8880	0.8912	0.8945	0.8977	0.9009	0.9042
10	0.8850	0.8882	0.8913	0.8945	0.8977	0.9008
11	0.8830	0.8860	0.8890	0.8920	0.8950	0.8980
12	0.8800	0.8829	0.8859	0.8888	0.8917	0.8946
13	0.8760	0.8790	0.8819	0.8849	0.8878	0.8908
14	0.8730	0.8759	0.8788	0.8817	0.8845	0.8874
15	0.8700	0.8728	0.8756	0.8784	0.8813	0.8841
16	0.8650	0.8679	0.8709	0.8738	0.8768	0.8797
17	0.8610	0.8640	0.8669	0.8699	0.8729	0.8759
18	0.8500	0.8537	0.8574	0.8611	0.8648	0.8685
19	0.8440	0.8479	0.8519	0.8558	0.8597	0.8637
20	0.8430	0.8467	0.8503	0.8540	0.8577	0.8613
21	0.8390	0.8427	0.8464	0.8501	0.8538	0.8575
26	0.8390	0.8423	0.8456	0.8490	0.8523	0.8556
28	0.8300	0.8339	0.8377	0.8416	0.8454	0.8493
25	0.8280	0.8317	0.8354	0.8390	0.8427	0.8464
27	0.8190	0.8232	0.8274	0.8316	0.8358	0.8401
23	0.8100	0.8219	0.8259	0.8298	0.8338	0.8377
24	0.7930	0.7991	0.8051	0.8112	0.8173	0.8234
22	0.7820	0.7888	0.7956	0.8024	0.8092	0.8160

*(Source: Calculated from Appendix 2)*

Appendix 4 continued

Country Code	2020	2021	2022	2023	2024
1	0.9392	0.9419	0.9446	0.9473	0.950
2	0.9366	0.9390	0.9414	0.9439	0.946
3	0.9320	0.9346	0.9373	0.9399	0.943
4	0.9298	0.9320	0.9343	0.9366	0.939
5	0.9239	0.9267	0.9295	0.9324	0.935
6	0.9217	0.9241	0.9266	0.9290	0.931
7	0.9135	0.9170	0.9206	0.9242	0.928
8	0.9104	0.9139	0.9173	0.9207	0.924
9	0.9074	0.9107	0.9139	0.9171	0.920
10	0.9040	0.9072	0.9103	0.9135	0.917
11	0.9010	0.9040	0.9070	0.9100	0.913
12	0.8976	0.9005	0.9034	0.9063	0.909
13	0.8937	0.8967	0.8996	0.9026	0.906
14	0.8903	0.8932	0.8961	0.8990	0.902
15	0.8869	0.8897	0.8925	0.8953	0.898
16	0.8827	0.8856	0.8886	0.8915	0.894
17	0.8788	0.8818	0.8848	0.8878	0.891
18	0.8722	0.8759	0.8796	0.8833	0.887
19	0.8676	0.8715	0.8755	0.8794	0.883
20	0.8650	0.8686	0.8723	0.8760	0.880
21	0.8612	0.8648	0.8685	0.8722	0.876
26	0.8623	0.8656	0.8689	0.8722	0.8722
28	0.8570	0.8608	0.8647	0.8685	0.8685
25	0.8538	0.8575	0.8611	0.8648	0.8648
27	0.8485	0.8527	0.8569	0.8611	0.8611
23	0.8456	0.8495	0.8535	0.8574	0.8574
24	0.8355	0.8416	0.8476	0.8537	0.8537
22	0.8296	0.8364	0.8432	0.8500	0.8500

(Source: Calculated from Appendix 2)

6. References

[1] Clearpointstrategy, <https://www.clearpointstrategy>.  
 [2] E. H. R. Commission. The Equality and Human Rights Commission.  
 [3] Heflo.com, Effective strategic planning models for your business.  
 [4] Kathleen etal, Lynch. Affective Equality Love, Care and Injustice, Maeve O'Brien University College Dublin, Ireland.  
 [5] Komar, Olivera, Gender Equality Index, Proofreading and copy editing: Charlotte Rimmer  
 [6] Leapsome, Effective strategic planning models for your business  
 [7] Mohan, Access to Social Services in India, Findings from a Social Equality Index (SEI), Research Analyst. for New Economics Studies and a Research Fellow at ICRIER (Delhi).  
 [8] Spiderstrategies, <https://www.spiderstrategies.com> 4/3/2025  
 [9] Wikipedia, <https://en.Wikipedia.org> 11/12/2025  
 [10] Wojciech, Kaniak. Rexroth Bosch Group Canada, CANADA  
 [11] UN, 2015\_statistical\_annex\_tables\_all