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An index of sustainable economic welfare for Romania

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Abstract

This paper has the objective to develop an Index of Sustainable Welfare for Romania from 1990 to 2017, in order to more clearly establish the status of the Romanian economy in terms of economic welfare. The results show that whilst gross domestic product (GDP) per capita increased significantly, the ISEW per capita grew at a much slower pace. The value of household labour contributes strongly to the growth of welfare, but income distribution, costs of climate change, cost of road accidents and cost of air pollution limit an improvement of population economic well-being. Our new valuation approach confirms the general conclusion of most authors on economic development that, during last decades, welfare has shown little improvement in spite of a growing GDP. Our conclusion is that the ISEW provides a useful alternative to indicators such as GDP despite subjected to its limitations and criticism.

Keywords: Economic welfare, GDP, ISEW.

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1. Introduction

In the past decades, the gross domestic product (GDP) has been used by governments and economists worldwide as a measure of macroeconomic performance. However, it has been widely recognised that the GDP is an inadequate measure of well-being and social progress mainly because it does not take into account any of some relevant socioeconomic issues: volunteer, domestic and unpaid work, income distribution and defensive expenditures (i.e., expenses with the aim to remediate the damages caused by economic activity) and environmental degradation.

The Index of Sustainable Economic Welfare (ISEW) has been introduced in the scientific literature by Cobb and Daly (1989) and was methodologically improved by Cobb and Cobb (1994). ISEW is an indicator that integrates the traditional GDP, measuring macroeconomic performance, with supplementary information illustrating social and environmental aspects.

There have been a number of criticisms of ISEW. These criticisms are listed below:

- The criticism is about ISEW using the cumulative costs of some environmental items, such as the cumulative cost of land degradation, lost wetlands and long-term environmental damage (Kubiszewski et al., 2013). The ground why some researchers have adopted such a cumulative cost approach is due to their strong sustainability stance on these indices. To be consistent with strong sustainability, an appropriate estimation would necessitate the value of costs that would have bored past generation to have kept the stock of natural capital intact.

Our opinion is the stock or cumulative accounting technique might be appropriate for the calculation of an environmental state indicator, but it is not suited for the purpose of measuring yearly changes in welfare. The adoption of the cumulative accounting method implies that estimating significant environment components, such the CO_2 emission costs, will lead to extremely high values as time advances, which would overshadow other important aspects of welfare (it is possible that, using this approach, the index would reach a negative value for a longer time span). Another argument is if it would be achieved a stabilisation of CO_2 levels in the atmosphere, for example, and thus, the society would maintain its welfare level regarding this aspect; the ISEW based on a cumulative accounting method would still be decreasing even all the other components would remain the same (Beca & Santos, 2010).

- Another important criticism is the view that the calculation of the ISEW assumes that human-made capital and natural capital are substitutes. The concept of sustainability related to ISEW is weak sustainability, since it implicitly assumes a perfect substitutability between different items (Gigliarano, Balducci, Ciommi & Chelli, 2014). The basis of this criticism is that since the ISEW involves the aggregation of diverse benefit and cost items into a single index, it is assumed that the additional benefits from a growing stock of human-made capital can perfectly substitute for the reduced benefits arising from a diminished stock of natural capital (Kubiszewski et al., 2013). In response to this criticism, we consider, in line with Lawn (2003), that to account for environmental sustainability, ISEW measure needs to be supplemented with natural capital stock-based indicators or measures of energy and material throughput.
- It includes some important welfare-related items but overlooks others, such as the benefits of political freedom. There are many welfare-related factors unaccounted for, and it would be beneficial to replace some of the less important items currently included in the calculation of ISEW with items that can be clearly identified as having a greater welfare significance (Lawn, 2003). Such items are not included in the ISEW because it is not intended to be a measure of all welfare-related factors. The ISEW is limited to measure the total economic welfare generated by economic activity.
- The inconsistent and questionable monetary valuation methods used to estimate the value of non-marketed goods, especially in regard to value the depletion of non-renewable resources and the costs of long-term environmental damage (Wilson & Tyedmers, 2013).

- The lack of a standard calculation methodology and differing adjustment categories that limit comparability and consistency in results (Wilson & Tyedmers, 2013).
- As stated by Neumayer (2000), some items dominate others such that it is possible that a small variation in these dominant items tends to cancel large variations in the less important items.
- Personal consumption expenditures, the basis ISEW calculations, include several questionable categories that count positively toward the value of the ISEW, including tobacco, alcohol products and processed foods.

As a response to this criticism, our paper seeks to address some controversies in ISEW valuation methods (more specifically, the valuation for the costs of air pollution) and the implications for welfare in Romania, which is an interesting case, because it is perceived to have engaged in a development course from the mid-1990s through GDP growth, potentiated by the inclusion in 2007 in the European Union.

2. Methodology

The aim of this chapter is to describe, in more detail, the methodology we have used in the paper to compute the ISEW, the sources of the data and their availability. We have adopted the traditional methodology as in the original formulation by Cobb and Daly (1989).

The main contribution of the ISEW consists of the adjustment of the GDP with an aim to overcome most of its drawbacks, mainly related to social and environmental costs of economic growth. Specifically, ISEW subtracts from the personal consumption (which is considered as the starting point for expressing the economic welfare) are all those items that do not actually contribute to individual welfare (such as pollution, loss of natural resources and cost of car accidents). Moreover, the ISEW adjusts household consumption, accounting for inequalities in the income distribution. Indeed, a unitary increment in consumption produces different effects in terms of well-being, depending on the income level (Gigliarano et al., 2014). In addition, ISEW takes into account by adding to personal consumption, i.e., only health and education public expenses, considering that other public expenses are defensive. It also adds the value of domestic labour (such as childcare and house management) and volunteering labour, as these activities enhance economic welfare, although they are not market tradable; it also adjusts for the value of service flows from consumer durables. Most of the data that we have used to evaluate the ISEW for Romania come from the Romanian National Institute of Statistics; the data are available online at http://www.insse.ro/cms/ro/tags/anuarul-statistic-al-romaniei.

To conclude, ISEW is an indicator that integrates the traditional measure of macroeconomic performance (GDP – more specifically, a component of it – personal consumption) with additional information about environmental and social aspects. The formal expression proposed for the calculation of ISEW is described in the following (Eq. 1) and explained in Table 1:

$$ISEW = C_w + G_{eh} + K + L - N - D \quad (1)$$

where C_w is the weighted private consumption expenditure (the value in the GDP, adjusted with the Gini index, and the poverty headcount ratio); G_{eh} is the non-defensive governmental expenditure (i.e., education and health expenditure); L represents the household labour (unpaid labour); K is the capital adjustment; N is the depletion of natural environment and D represents the defensive private expenditure on health, education and social costs of car accidents.

Table 1. Components of ISEW

Category	Component (Sign)	Description	Source of data
C_w	Adjusted personal consumption (+)	Consumption*(1-Gini index)*(1-povery headcount ratio)	Romanian National Institute of Statistics (private consumption) and the World Bank (Gini index and poverty headcount ratio)
G_{eh}	Public education expenditure (+)	Percentage of GDP	Romanian National Institute of Statistics
G_{eh}	Public health expenditure (+)	Percentage of GDP	Romanian National Institute of Statistics
L	Services from domestic labour (+)	Number of hours spent by population on domestic labour multiplied by the minimum legal wage per hour	Romanian National Institute of Statistics
K	Expenditures on consumer durables (-)	Data from national accounts of durable consumer goods	Romanian National Institute of Statistics
K	Services from durable consumer goods (+)	1/8 of the stock value of consumer durable goods	Romanian National Institute of Statistics
D	Cost of car accidents (-)	The number of car accidents that caused fatalities and severe injuries multiplied by the value of socioeconomic costs of one accident	Romanian Police
D	Private health and education expenses (-)	Percentage of the private consumption expenditures	Romanian National Institute of Statistics
N	Mineral depletion (-)	The ratio of the value of the stock of mineral resources to the remaining lifetime.	World Bank
N	Energy depletion-depletion of non-renewable resources (-)	The ratio of the value of stock of energy resources to the remaining reserve lifetime.	World Bank
N	Damage from CO_2 emissions (climate change – long-run environmental damage)(-)	World Bank's estimations use the value of 20 $ per ton of carbon	World Bank
N	Cost of air pollution(-)	Emissions of main pollutants (expressed in tons) multiplied by the cost of one ton of every pollutant	European Environmental Agency
N	Cost of ozone depletion (-)	omitted	
N	Cost of water pollution (-)	omitted	
K	Net capital growth (+/-)	Increases in the stock of capital available per worker	Romanian National Institute of Statistics
K	International position (+/-)	Net international investment position (the difference between the national liabilities and assets)	Romanian National Bank

2.1. Weighted private consumption expenditures

Personal consumption expenditures on goods and services are the most important component of GDP and represent the starting point in computing the ISEW value because the consumption expenses show most accurately the welfare of the population. We adjust them to take into account the inequality of the income distribution, using the Gini index and poverty headcount ratio. *The Gini index* shows the difference between the actual distribution and equal distribution of income, by quintiles. The higher the Gini index is, the higher is the income inequality. The original version of the ISEW uses only the Gini index of inequality to reflect the unequal distribution of income. We consider that to reflect more accurately the level of well-being, we must further adjust the private consumption with the poverty headcount ratio (the proportion of individuals that are below the national poverty lines). The values of the Gini index and headcount ratio for Romania are available on the World Bank site. The formula used to compute the value of this item is: C_w = C*(1-Gini index)*(1-headcount ratio). Data for the private consumption expenditures were taken from the Romanian National Statistics Institute.

2.2. The non-defensive government expenditure

Cobb and Daly (1989) considered the expenditure on health and education as the only fraction of public expenditures which actually increase well-being, other expenditures (defence, public order and security and environmental protection) being considered as having a defensive effect. Later, they included only half of the public expenditure for health and higher education. We consider this approach too restrictive, and we embrace the original view in calculating our ISEW. Data are taken from the National Institute of Statistics.

2.3. Services from domestic labour

To compute the *value of services provided by the domestic labour*, we have considered the data on labour market provided by the National Institute of Statistics. The population is divided into three categories: employed, in search of employment and inactive population. The last category is further segmented into housewives, students, retired and others. We consider the number of hours allocated to labour used by Gigliarano et al. (2014); the most appropriate are as follows: 7 hours for housewives, 4 hours for retired persons, 1 hour for students and 3.5 hours for other people; employed people 2.25 hours and people in search of employment 3.5 hours per day. Finally, we multiply the total number of hours in each year for the minimum legal wage.

2.4. The capital adjustments

The *services provided by the durable consumer goods* (the household capital) are treated by ISEW as a benefit and the initial purchase as a cost. To compute the value of these services, we first take into consideration the households' expenditures on durable goods. Data are taken from the National Institute of Statistics. We suppose, as in Jackson, McBride, Abdallah and Marks (2008), that the period of time in which a durable good is used is about 8 years. We follow their methodology to estimate the value of durable goods stock. Finally, the annual service is computed considering 1/8 of the stock value. The actual *expenditures on consumer durables* are a negative adjustment in the ISEW value to avoid double counting the value of the services they provide.

The ISEW encompasses an estimation of the *net capital investment*. It is calculated by adding the amount of new fixed capital stock, from which is subtracted the amount of capital necessary to maintain the same level of capital per worker. The rationale of using this item is to estimate the increases of capital available per worker, as Cobb and Daly (1989) suggested that economic welfare implies that the quantity of capital goods per worker should not decline. We computed this item using the data regarding the net investments and the number of workers for every year in the 1990–2017 lapse.

Cobb and Daly (1989) suggested that economic sustainability requires self-reliance, which is used as an indicator for the *international investment position* of a country, regarding net borrowing as unsustainable consumption. The international net position of a country is a report that cumulates the information regarding a country's difference between its foreign liabilities and assets (Bleys, 2013). Data for Romania were taken from the Romanian National Bank's annual reports.

Sharing the view with Lawn (2003) that for assessing economic welfare, the Fisherian income concept is superior to the Hicksian one, we have decided to distinguish the flow of capital services from the capital that generates it, which is the objective of a welfare measure such as the ISEW (Beca & Santos, 2010). Therefore, we have estimated the value of net investments and the international position but computed the ISEW first without this capital adjustment and then the ISEW-K (an index that includes the capital adjustments).

2.5. The depletion of natural resources

Mineral depletion is the ratio of the value of the stock of mineral resources to the remaining reserve lifetime (estimated at 25 years by the World Bank). It covers tin, iron, gold, lead, zinc, copper, nickel, silver, bauxite and phosphate.

Energy depletion represents the ratio of the value of the stock of carbon-based energy resources to the remaining reserve lifetime (estimated at 25 years by the World Bank).

The *damage from carbon emissions* (or the damage from long-run climate change) is estimated by the World Bank to be 20 US dollars times the number of tons of carbon emitted in 1995. This value is based on the work of Fankhauser (1995).

In establishing the *air pollution costs*, we have taken into consideration the main pollutants with major effects on human health and environment: nitrogen oxides, sulphur oxides, non-methane volatile organic compounds, ammonia and particulate matters. In general, when assessing the effects of air pollution, the most important issue is valuing mortality, specifically the question of whether to employ the value of statistical life (VSL) or the value of a life year (VOLY). VSL, derived from aggregating the individuals' willingness to pay to secure a marginal reduction in the risk of a premature death, is a standard valuation method for assessing the cost of mortality at the level of society. The VSL is not only the value of an identified persons' life but also rather an aggregation of individual values for small changes in the risk of death. *The value of a life year* is an estimate of damage costs based on the loss of life expectancy (expressed as potential years of life lost). This measure takes into account the age at which death occurs by giving greater weight to deaths at younger age and lower weight to deaths at older age (WHO Regional Office for Europe, 2015). We have chosen the VOLY expression of costs following the OECD guidance on environmental cost-benefit analysis (OECD, 2006). The estimations for the effects of acute exposures at pollutants provide an estimated number of deaths, whereas the effects of chronic exposure are estimated in number of life years lost. It is widely recognised that the effects of acute exposures on mortality lead to a shorter loss of life per case than chronic exposures; thus, attribution of a full VSL to the acute cases being very questionable. VOLY can be regarded as a more accurate indication of the mortality impact, given its ability to discriminate how long a premature death is moved forward in time (WHO Regional Office for Europe, OECD, 2015). Thus, the choice between VSL and VOLY can be made. The cost associated with every ton of these pollutants, expressed first in VOLYs then translated to Euros and US dollars, was taken from the 2011 European Environment Agency Technical report (named 'revealing the costs of air pollution from industrial facilities in Europe'). Table 2 presents these costs of the main pollutants. The data were available for 2010 and 2020 and expressed in 2005 Euros; therefore, we estimated the cost of pollutant emission for every year using linear interpolation, a deflator for euro and the exchange rate between euro and dollars, to express the damage costs in current dollar values. We also normalised the damage costs by the value of the Romanian GDP for every year of our analysis. The cost of every ton was multiplied by the number of tons emitted, information provided by the European Environmental Agency (2018).

Bagstad, Berik and Brown Gaddis (2014) suggested that it is possible to omit the *cost of ozone depletion* as the ozone layer has been recovering slowly since the early 1990s, and there has been a consequent change in global environmental policy priorities. The cost was omitted by Castaneda (1999) in the calculation of ISEW for Chile and by Stockhammer et al. (1997) for Austria. Due to the lack of appropriate evaluations of social costs of ozone depleting substances (Mahony) and the suggestions of Bagstad et al. (2014), we have omitted the cost of ozone depletion from the calculation of ISEW for Romania.

Table 2. Damage per ton emission estimates for Romania (in 2005 Euros) using VOLY expression of costs (European Environmental Agency, 2011)

Air pollutant	Damage per ton in 2010	Damage per ton in 2020
NH_3	7,512	4,689
NO*x*	9,004	9,320
$PM_{2.5}$	20,864	18,605
PM_{10}	13,548	12,081
SO_2	6,151	6,780
NMVOC	157	32

The *cost of water pollution* could be estimated by the value of private expenses for water purification because water treatment costs supported by public and private companies are included in the calculation of GDP. No specific water pollution cost estimate is available for Romania at the time the study was carried out; therefore, due to the lack of data regarding such private expenses, we omitted these costs from the calculation of the ISEW.

2.6. The defensive private expenditures

A consistent part of personal expenditures is not only considered to directly contribute to the well-being but also considered 'rehabilitative' or 'defensive' as their aim is to restore the productive capacity of the economy, the state of health of individuals or their morale. We considered, in our study, the most important such expenses, namely, personal expenses with education and health and the socio-economic costs of road traffic accidents.

The value of *personal education and health expenses* was expressed as percentage in the total household budgets. We have computed the amount of these expenses using data from the statistical yearbooks provided by the National Institute of Statistics.

For the estimation of *socioeconomic costs of road traffic accidents,* we have used the methodology outlined in the EU Commission Green Paper, 'Towards Fair and Efficient Pricing in Transport' (1995). This study takes into account the direct costs of road accidents (approx. 10%), the value of lost economic output (approx. 20%) and the costs of pain and suffering (approx. 70%) evaluated through the willingness to pay principle. The estimated cost of an accident that caused fatalities is 1.5 million USD and the cost of an accident that provoked severe injuries is 150,000 USD, for a country with the quality of life attained in Europe with a per capita GDP equivalent to about USD 20,000 p.a. (World Bank, 1999). Thus, the cost of a fatality in 1990 (GDP/capita = 1,680.7 USD) would be 1,680.7/20,000*1.5 million USD = 126,052.5 USD. The data about the number of accidents that caused fatalities and severe injuries were taken from the Romanian police records.

3. Results and discussion

For the ISEW and GDP per capita (Fig. 1), the gap is immediately obvious although their trend is similar. GDP per capita increased from the mid 1990 to 2008, during the recession decreased, starting to grow again from 2011. The accession to the European market and to irredeemable European funds contributed to the economic growth. The ISEW follows the same trend, but the gap between the two indices grows beginning with 2005. This pattern shows that the social and environmental costs are

accounted; the contribution of a growing economy to average welfare has not been as big as it was estimated.

The ISEW-K (the index that includes the capital adjustments – from the net investments necessary to maintain the same amount of capital per worker and from the international position) followed the same trend with the ISEW, and the differences between their yearly values being minor. This was possible by the compensation of the Romania's international position (which was disadvantageous during the whole period) with the net positive investments.

The period of welfare improvement from 2000 to 2017 is predominantly attributable to items that act to boost the index: an increased consumption expenditure, household labour and public expenditure on health and education.

Between 2000 and 2016, the emissions of PM_{10} increased by 21% and the emissions of $PM_{2.5}$ increased by 16%. The emissions of NH_3 (ammonia) increased by 28% in the period 1990–2016. The emissions of SO*x* decreased by 87%. The emissions of NMVOC decreased by 27%. The emissions of NO*x* dropped by 57% (European Environmental Agency, 2018). The value of air pollution costs remained relatively stable through the period 2005–2017, due to decreased emissions of some pollutants, although the cost per ton of pollutant increased.

During this period, there are also items that act to decrease the index, through rising income distribution inequalities and the cost of car accidents. Unfortunately, Romania had the highest road fatality rate in the European Union in 2017, of 98 deaths per one million inhabitants, according to data from the European Commission, value that is double compared to the EU average of 49 deaths. In Romania, the registered overall reduction rate in road fatalities was 19% since 2010, very close to the EU average of 20%, but the cost of accidents is still extremely high, accounting for over 1% of GDP.

4. Conclusions

Several indexes have been proposed in the scientific literature to overcome the inconveniences of the GDP. Amongst them, the ISEW is one of the most used and implemented in the economic literature. Several authors proposed adjustments and improvements of its original version for applications at both the national and regional levels. This paper has offered the first implementation of the ISEW for Romania in each year of the period 1990–2017. Moreover, we have proposed and discussed a poverty-adjusted measure of personal consumption, whose formulation has the advantage of taking into account the poverty incidence on the value of ISEW. Another novelty in the calculation of ISEW that this paper brings is the use of VOLY approach for the estimation of air pollution costs.

Even if ISEW can be improved, its dependency on market prices and some questionable measure (such as the value of replacement costs for non-renewable resources) being drawbacks on the estimation of a more accurate value of well-being; this index highlights the shortcomings of traditional economic measures, especially GDP. In spite of a double Romanian GDP per capita in 2017 compared to its value in 2005, this increase was not completely transferred in a welfare advance. This result confirms Max-Neef's (2005) threshold hypothesis, which stated that there is a point after which the economic growth does not generate more well-being for the citizens of a country.

The results of this study provide some guidelines for policymakers to consider a range of economic, social and environmental issues, such as investments in road safety, providing equal chances to education for all citizens (which is the key to smooth the high-income inequalities) and encouraging the development of non-polluting new technologies.

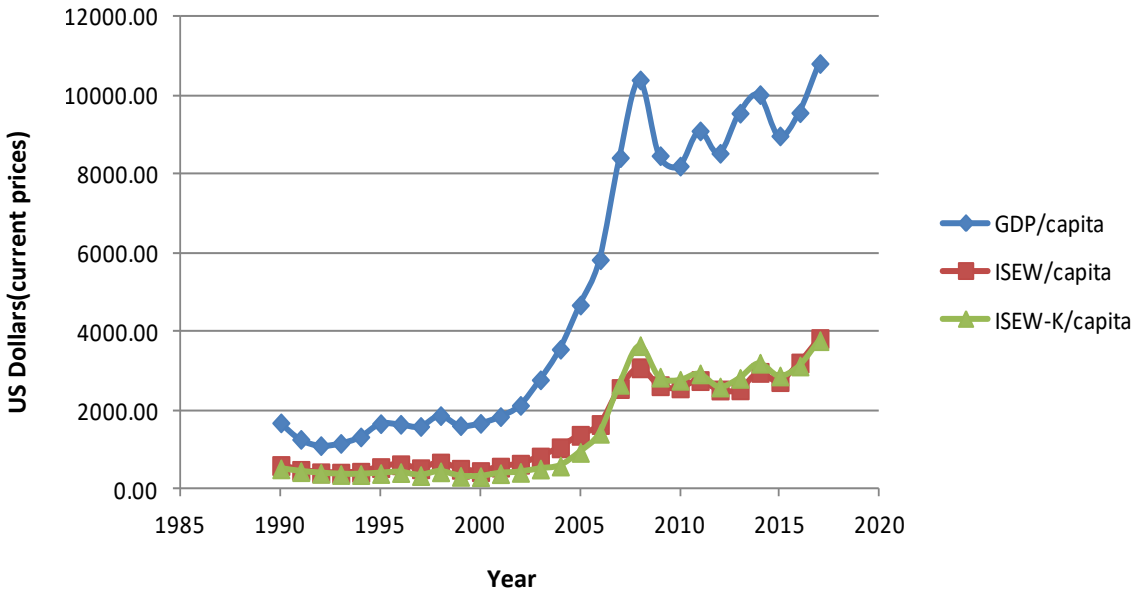

Figure 1. ISEW per capita and GDP per capita in Romania 1990–2017

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