SUSTAINABLE DEVELOPMENT AND NATIONAL DIFFERENCES: AN EUROPEAN CROSS-NATIONAL ANALYSIS OF ECONOMIC SUSTAINABILITY

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1. Introduction

In literature, the term sustainable development is widespread, but it has no unified definition. As shown by R. B. Gibson (2010), there are many definitions of this term currently in circulation, often divergent to each others. The importance of sustainability for economic growth was just underlined in 1972 by the Club of Rome: *if the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years* (Meadows et al. 1972, 23). This analysis was based on the recognition of the serious social and environmental consequences of a development idea based exclusively on growth and technological progress and on the importance of taking into account the scarcity of resources.

The term sustainable development was first introduced in 1987 by the Brundtland Commission and its report *Our Common Future* (WCED, 1987). *Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (WCED 1987, 41). This may be considered the first classical definition of sustainable development, emphasizing its intergenerational aspect. There has been a transformation of the meaning of sustainability, no longer focused only on scarcity of resources and the importance of their conservation (such as in *Limits to Growth*), but also on the satisfaction of the actual and future generations' needs.

The need to use the resources available to meet the needs of current generations and to keep them in order to meet the needs of future generations is one of the main characteristics distinguishing sustainable development from traditional one. However, the Brundtland's definition does not explain how to reach this goal. In literature, the dominant model proposed to achieve this goal is to conceive development as a multidimensional concept taking into account economic, social and environmental aspects. Nowadays, *the definition focuses on this holistic*

approach linking economic development, social inclusion and environmental sustainability (Sachs 2015, 6). Thus, sustainable development can be considered a three-way holistic framework, involving three complex systems - economic, social and environmental - interacting each others.

Since the release of Brundtland Commission's report, the concept of sustainable development was criticized[1]. Furthermore, in literature there is no consensus about the three-way framework. *One of the main obstacles to developing a common conceptual framework incorporating social, economic and ecological problems is the lack of genuine consensus among experts in each discipline as to how ecological, economic and social systems relate to one another* (Elliott 2012, 40). In other words, the debate focuses on the role that each component must have and on their mutual relations[2]. Despite the criticism, the tripartite model remains dominant and hegemonic in literature and it is the basis of the indicators' system proposed by the United Nations. For this reason, in this paper we analyze sustainable development by making this perspective.

Governments must define appropriate policies and actions for achieving sustainable development and the individuation of a set of goals is undoubtedly useful for doing this. The so-called *Agenda 2030*, adopted at the UN Sustainable Development Summit in September 2015, released the SDGs framework of 17 goals and 169 targets across social, economic and environmental areas of sustainable development, defined according to the principles of the *Rio+20 Summit*. At the same time, it is also essential to identify a global framework of indicators, functional to know and monitor the situation of each country with respect to each goal and target. *Quality, accessible, timely and reliable disaggregated data will be needed to help with the measurement of progress and to ensure that no one is left behind. Such data is key to decision making* (United Nations Division for Sustainable Development 2015, 12). The global indicator

[1] Some scholars reject the idea of sustainable development. S. Latouche, for instance, is very critical of this concept, defining it a mystification. *The term is so broad that it can be applied to anything and everything* (Latouche and Macey 2009, 10). According to Latouche, sustainable development is an oxymoron, since the only development we know is that which arose from the industrial revolution: an economic war among men and against nature.

[2] R. K. Turner, D. Pearce and I. Bateman (1993) suggest that the various approaches and definitions differ from each other because they are linked to two opposite perspectives, respectively labelled as *strong* and *weak* sustainability. The first one emphasizes environmental protection and it rejects the anthropocentric vision of the three-way framework, according to which environment is instrumental and subjected to human needs, putting them to the center of sustainable development. Environment cannot be considered as a dimension of sustainable development; it is the necessary condition for any kind of human activity, including the development. At the opposite, the second one focuses on free markets and claims that the sustainability notion is too vague to be helpful. Thus, nature is considered only instrumental to satisfy human needs. This perspective is based on a different understanding of the role and importance of the economic dimension, in terms of both development and growth. Creating well-being now and in the future is only achievable through increasing the value of total capital.

framework, adopted by the UN General Assembly on 6 July 2017, includes 232 indicators.

In this paper we will focus on the European countries. As highlighted in the monitoring report published by Eurostat in 2017, SDGs have long been at the heart of European policy and are integrated into key projects, sectoral policies and initiatives. Our goal is to analyze the level of achievement of SDGs in European countries, focusing in particular on the goals that belong to the economic dimension of sustainable development:

- Goal 8 - Decent Work and Economic Growth
- Goal 9 - Industry, Innovation, Infrastructure
- Goal 10 - Reduce inequalities
- Goal 12 - Sustainable Consumption and Production

We want to highlight the characteristics of the various countries with respect to each goal analysed, also comparing them to the EU situation, and to construct a synthetic index of *economic sutainability* taking into account these four goals. In particular, we will focus on the Italian situation and compare it with the situation in other EU countries.

2. Data and methods

The aim of this article is to define a synthetic index, which allows us to compare different countries regarding their level of economic sustainability. In doing this, we follow the hierarchical design, requiring the definition of different components (Maggino, 2017:90-91):

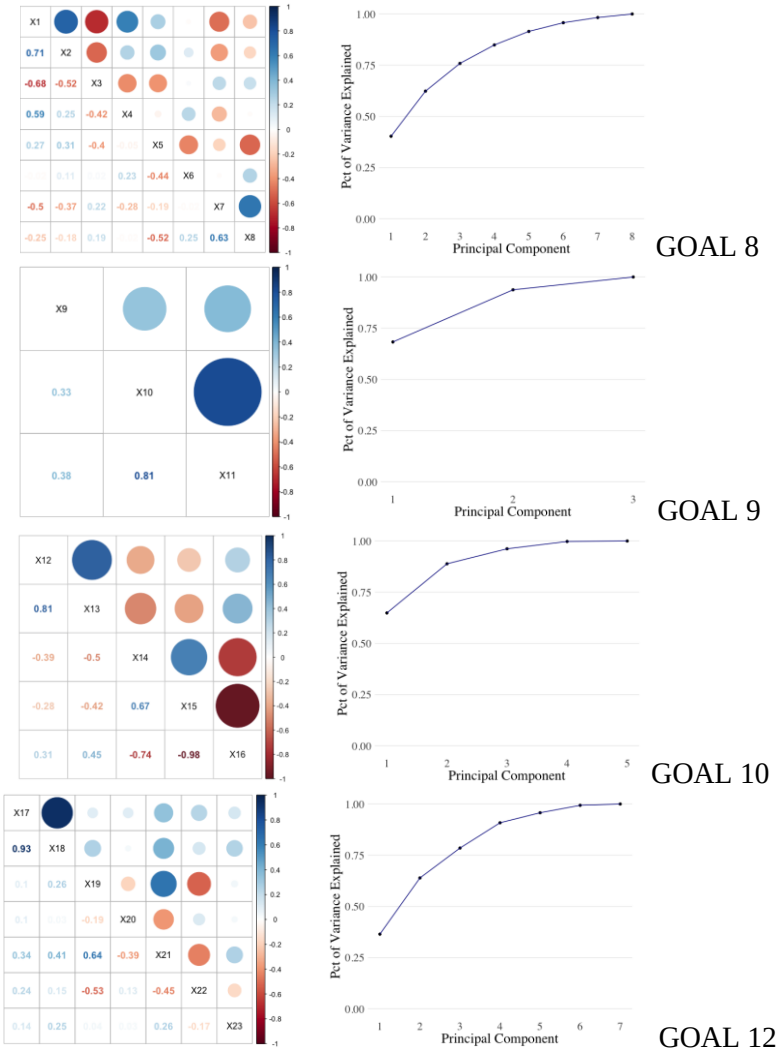
1. the phenomenon, its domains and its general aspects;
2. the variables and their (possible) domains, which represent each aspects, allowing the phenomenon to be specified;
3. the basic indicators, representing what is actually measured in order to investigate each variable and its domains.

We assumed that our model of measurement is formative, since indicators are considered as causing the phenomenon, then changes in indicators determine changes in the value and the meaning of the latent variable.

The data source is the Eurostat data-warehouse[3] and we considered the *Sustainable Development Indicators dataset* updated to May 2018. We used a set of 23 basic indicators all in time series from 2010 to 2016. Table A1 shows the indicators used, their definition and the goal to which they belong.

[3] http://ec.europa.eu/eurostat/data/database

Figure 1 – *Corrplots and scree plots: Goal 8; Goal 9; Goal 10; Goal 12.*



The corrplots report the ID of the indicators: please see table A1 for their names and descriptions.

We followed the *composite indicators approach* to build our synthetic index of economic sustainability. In particular, we first synthesized an index for each goal considered, and then we constructed the synthetic measure of economic sustainability, taking into account the indices obtained for the four goals. From the operational point of view, the construction of a composite index is a step-by-step

process: after the definition of the phenomenon and the selection of basic indicators, the following phases are the normalization of the individual indicators and the aggregation of the normalized indicators (Mazziotta and Pareto, 2017).

Before constructing our composite indices, we performed an exploratory analysis of the basic indicators chosen for each goal. In Figure 1, we report the *corrplots*, representing correlations among the basic indicators, and the *scree plots*, obtaining performing a principal components analysis (PCA) for each goal; at the same time, the PCA has a purely descriptive purpose, since the basic indicators were selected by Eurostat on the basis of a reasoned choice. The exploratory analysis provided results that supported the methodological choices. The analysis of the *scree plots* shows that the first two components explain more than 60% of variance in all goals; so, most of the indicators are correlated and represent similar aspects of the phenomenon considered. Therefore, this leads us to the conclusion that we can consider only one latent variable for the four goals and, then, we can construct a single composite index for each of them.

For the synthesis of the basic indicators, we used the Adjusted Mazziotta-Pareto Index (AMPI), which is a partially non-compensatory composite indicator based on a Min-Max standardization and a re-scaling of the basic indicators in a range (70; 130), according to two goalposts, representing a minimum and a maximum value of each variable for all units and time periods (Mazziotta, Pareto, 2016). Given the original matrix (1):

$$X = \{x_{ij}\} = \begin{pmatrix} x_{11} & \cdots & x_{1m} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{nm} \end{pmatrix} \quad (1)$$

where *i=1,..,n* are the units of analysis and *j=1,..,m* are the variables, we calculate the normalized matrix as follows:

$$r_{ij} = \frac{(x_{ij} - Min_{x_j})}{(Max_{x_j} - Min_{x_j})} * 60 + 70 \quad (2)$$

where x_{ij} is the value of the indicator *j* in the unit *i* and Min_{x_j} and Max_{x_j} are the *goalposts* for the indicator *j*[4]. We chose the goalposts so that 100 represents the value assumed by the EU in all basic indicators in 2010.

The adjusted MPI is given by:

$$AMPI^{\pm} = \mu_{r_i} \pm \sigma_{r_i} * cv_i \quad (3)$$

[4] Let Inf_{x_j} and Sup_{x_j} be the minimum and the maximum of indicator *j* across all time periods considered, and Ref_{x_j} be the reference value for indicator *j*. Then the "goalposts" are defined as: $Ref_{x_j} \pm \Delta$, where $\Delta = (Sup_{x_j} - Inf_{x_j})/2$ (Mazziotta and Pareto, 2017:178).

where μ_{r_i}, σ_{r_i} and $cv_i = \sigma_{r_i}/\mu_{r_i}$ are the mean, the standard deviation and the coefficient of variation of the unit i and the sign $\pm$ depends on the kind of phenomenon measured. In this work, all the composite indices are positive, i.e., increasing values of each index correspond to positive variations of the phenomenon in a specific domain, then AMPI$^-$ is used (Mazziotta and Pareto, 2017).

3. Results and discussion

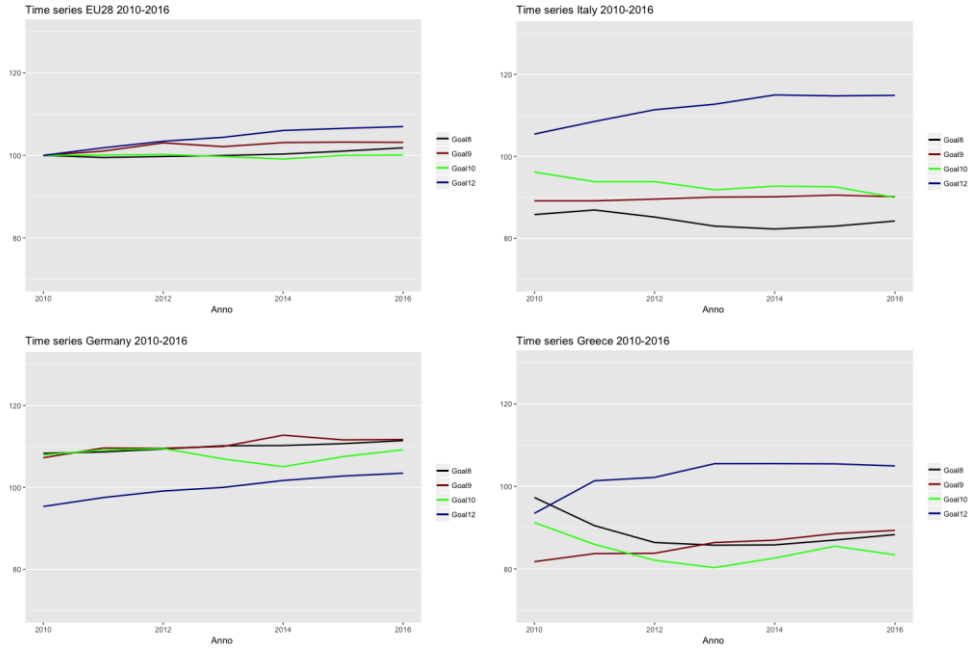
Table 1 presents the values of the composite indices for each goal and those of the *Economic Sustainability Index* (ESI) - constructed synthesizing the previous ones - in 2010 and 2016. The analysis of the values reported in the table seems to confirm the presence of different groups of countries with respect to their levels of economic sustainability. Indeed, some countries have higher values (Germany, Sweden, United Kingdom, Denmark, etc.), while others have lower values (Bulgaria, Croatia, Latvia, Greece, Italy, Spain, Portugal, etc.) than the EU in all the composite indices. As mentioned in section 2, composite indices have been constructed by taking as their goalposts the value assumed by the EU in the basic indicators in 2010. Thus, the value of 100 in the composite indices is set equal to the value of the basic indicators in the EU in 2010. It seems useful to start from an analysis of the evolution of the values of the synthetic indices assumed by the EU in the reference period (2010-2016) and compare them with Italian, Greek and German values. The choice of Germany and Greece is dictated by the will to compare the Italian data with that of countries that express performances that tend to be better (Germany) and worse (Greece) than the Italian ones. For a full and better understanding of the meaning of synthetic indices, it is, also, always necessary to refer to the basic indicators and analyse them.

Figure 2 shows the time series of the synthetic indices for the four goals considered, respectively, for the EU, Italy, Germany and Greece. The trends of the four indices tend to be the same in all four cases considered: in fact, Goal 8 and 9 have moderately positive trends (except in Greece), Goal 12 increases significantly its values in the reference period, while Goal 10 worsens between 2010 and 2016 in all cases examined (except in Germany where, after decreasing, starting in 2014 increases). On the contrary, the values of the indices are profoundly different, with Germany having significantly higher values than those of the EU, Greece much lower values and Italy in an intermediate situation between the two previous nations.

With reference to the European Union, it is possible to observe that there have been some improvements in the values of the indices for all the goals (more marked in Goal 12), except for Goal 10, which has remained virtually unchanged,

since improvements in some basic indicators were offset by a worsening in the *relative median at-risk-of-poverty gap*, which rose from 22.9% (2010) to 25% (2016).

Figure 2 – *Economic sustainability goals: time series 2010-2016 for European Union, Italy, Germany and Greece.*



Germany performs better than Europe in all composite indices, with the exception of Goal 12, where it is 4 points lower on average than Europe for the entire time series. In Germany, in fact, there are worse values than in the EU for some basic indicators considered in Goal 12: the *share of renewable energy* (the value of the indicator rises from 12.9% to 17% in the EU and from 12.9% to 17% in Germany); the *average CO2 emissions per km from new passenger cars* (the value decreases from 140 g CO2 per km to 118 in the EU and from 151 g CO2 per km to 127 in Germany) and the *volume of freight transport cars* (the value decreases from 93.2 tonne-kilometres to 90 in the EU and from 102 tonne-kilometres to 99 in Germany). The best values compared to the EU in the composite indices of Goal 8 and 9 are due to Germany's best performances in all the basic indicators (with the exception of the *percentage of fatal accidents at work*, where Germany has values three times higher than EU).

Table 1 – *Composite indices: Goal 8; Goal 9; Goal 10; Goal 12; ESI; values 2010 and 2016*

	Goal 8 2010	Goal 8 2016	Goal 9 2010	Goal 9 2016	Goal 10 2010	Goal 10 2016	Goal 12 2010	Goal 12 2016	ESI 2010	ESI 2016
EU28	100.00	101.83	100.00	103.16	100.00	100.09	100.00	106.98	100.00	102.93
AUT	103.35	107.08	106.69	117.24	109.69	113.67	98.54	103.47	104.35	110.01
BEL	100.44	103.78	105.78	110.49	112.97	112.83	96.31	101.01	103.37	106.74
BGR	78.47	83.96	81.23	85.45	77.50	74.44	87.79	100.60	80.98	84.75
CYP	93.62	96.45	78.52	79.88	104.65	98.97	92.94	106.28	91.19	94.09
CZE	101.18	103.29	95.25	101.38	105.70	108.45	90.64	97.82	97.75	102.54
DEU	108.31	111.43	107.24	111.69	107.93	109.20	95.34	103.47	104.33	108.81
DNK	114.06	112.20	121.14	119.13	110.40	111.03	105.96	109.41	112.53	112.78
ESP	89.84	92.81	94.12	92.40	88.60	86.25	104.12	112.10	93.64	94.58
EST	90.35	102.02	97.31	99.30	90.10	92.49	85.49	98.42	90.55	97.89
FIN	103.30	102.66	130.15	123.05	116.58	117.37	87.55	94.02	106.36	107.65
FRA	101.41	101.34	100.09	104.70	106.40	110.50	103.63	109.71	102.81	106.39
GBR	112.00	114.36	102.10	106.27	97.85	101.81	101.38	110.31	102.98	107.92
GRC	97.31	88.32	81.76	89.34	91.24	83.42	93.47	104.96	90.46	90.56
HRV	87.83	87.78	84.56	85.59	86.82	92.13	93.00	108.44	87.91	92.34
HUN	88.97	98.49	95.43	95.23	102.70	102.77	92.86	99.88	94.64	98.99
IRL	94.45	105.62	104.16	106.62	105.85	108.98	104.89	115.10	102.06	108.91
ITA	85.80	84.23	89.15	90.15	96.17	89.96	105.46	114.91	93.34	92.84
LTU	89.22	100.38	84.24	87.32	77.55	82.15	92.30	102.46	85.35	92.02
LUX	110.81	110.55	100.48	94.67	121.11	110.70	78.70	85.92	99.58	98.96
LVA	83.25	97.43	84.50	82.19	78.00	86.40	88.88	104.67	83.42	91.54
MLT	100.32	102.93	87.77	87.83	N.A.	N.A.	102.83	111.88	N.A.	N.A.
NLD	114.26	112.10	95.70	104.10	117.00	114.04	98.81	104.37	105.36	108.41
POL	86.05	91.36	83.69	85.95	92.50	96.04	91.34	98.44	88.19	92.62
PRT	90.44	90.10	95.15	94.92	91.24	90.14	105.50	110.76	95.08	95.49
ROU	84.05	83.09	76.44	76.77	77.81	76.85	95.79	107.05	82.59	83.53
SVK	90.96	98.36	88.67	89.24	99.62	103.03	92.34	101.71	92.66	97.69
SVN	98.59	98.96	105.44	106.78	107.91	107.73	95.45	100.89	101.52	103.41
SWE	109.53	111.30	120.14	123.56	112.48	110.43	95.87	104.84	108.57	111.98

The value of Malta for Goal10 and ESI not computed because of lack of data

The values of Greece are lower than those of the EU for all the indices with the exception of Goal 12, where the best Greek performances are linked to lower *energy consumption* (*primary* and *final*) and lower *average CO2 emissions per km*

from new passenger cars. Goal 8 has had a negative trend during the period, decreasing from values in line with those in Europe in 2010 (EU28=100; GRC=100.2) to values below those in 2016 (EU28=102; GRC=96.6).

Although Greece is worse than the EU for several basic indicators (*NEET*, *total employment rate*), the radical worsening of the synthetic index is linked to a significant increase in *long-term unemployment rate*, from 5.7% (EU28=3.8%) in 2010 to 15.6% in 2016 (EU28=3.4%). Goal 10 has significantly lower values than those of the EU for the whole series, due to the fact that in Greece almost all the basic indicators selected (in particular *purchasing power adjusted GDP per capita*, *adjusted gross disposable income of households per capita* and *relative median at-risk-of-poverty gap*) perform worse than in them EU.

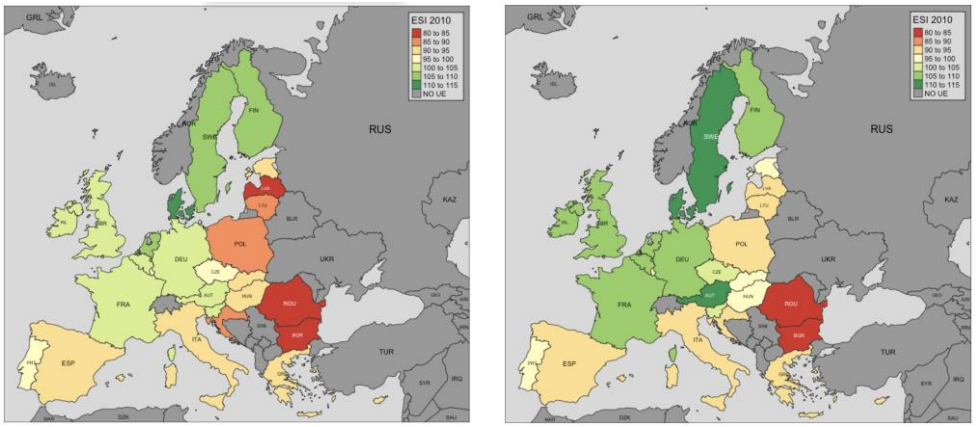
With regard to Italy, we can observe that the synthetic index of Goal 12 shows values that are much higher than those in Europe, as well as those in Germany and Greece, mainly due to better performances in almost all the basic indicators (in particular, *energy productivity* and *share of renewable energy*). In the other goals, Italy has lower performances than the EU ones. In Goal 8, it has the highest levels and the worst trends in Europe for *NEET* (in 2010, EU28=12.8% and ITA=19%; in 2016, EU28=12.8% and ITA=19%), the *percentage of population not seeking employment because discouraged* (in 2010, EU28=1.2% and ITA=3.8%; in 2016, EU28=1.3% and ITA=4.5%) and the *total employment rate* (in 2010, EU28=71% and ITA=62%; in 2016, EU28=73.4% and ITA=65%). In Goal 9, Italy shows rather low values in the *percentage of intramural R&D expenditure* (in 2010, EU28=1.93% and ITA=1.22%; in 2016, EU28=2.03% and ITA=1.29%) and the *percentage of R&D personnel* (in 2010, EU28=1% and ITA=0.6%; in 2016, EU28=1.2% and ITA=0.7%). As regards Goal 10, the Italian trend is worse than the European one for the whole period considered, due to the fact that Italy has the worst value in Europe (except the Romanian one) for the *relative median at-risk-of-poverty gap* (in 2010, EU28=22.9% and ITA=24.8%; in 2016, EU28=25% and ITA=31.6%).

Figure 3 shows two *cartograms*, one for 2010 and one for 2016, with the values of *economic sustainability index* (ESI) for the 28 EU member countries. In 2010, it can be observed that Denmark has the highest value (> 110), while Bulgaria, Croatia, Romania, Lithuania, Poland and Latvia have the lowest ones (< 90). With a score of 93.34, Italy stands between Greece (90.5) and Germany (104.33), along with nations such as Hungary and Spain. In 2016, the highest values of the ESI are recorded for Denmark and Sweden (> 110), while the lowest for Romania and Bulgaria (< 90). Italy shows a not very significant decrease, reaching 92.84, always standing between Greece (90.56) and Germany (108.81).

4. Conclusions

Our analysis focused on the economic dimension of sustainable development, trying to highlight some distinctive features of the EU and some of its Member States. It was evident that there are profound differences between the different countries, in all the goals considered, which suggest the need for different policies and strategic choices to achieve economic sustainability.

Figure 3 – *Economic sustainability Index (ESI): European countries' data 2010 and 2016.*



Appendix

Table A1 – *Basic Indicators: ID; description; polarity*

ID	Basic Indicator	Description	Polarity
		Goal 8	
X1	NEET	Share of the population aged 15 to 29 who is not employed and not involved in education or training.	-
X2	Inactive population not seeking employment	Share of population aged 15 to 64 not seeking employment because think no work is available.	-
X3	Total employment rate	Percentage of total population aged 15 to 64 employed.	+
X4	Long-term unemployment rate	Share of the economically active population aged 15 to 74 who has been unemployed for 12 months or more.	-
X5	Fatal Accidents at work	Number of people killed in accidents of work per 100,000 persons in employment.	-
X6	Involuntary temporary employment	Percentage of employees aged 20 to 64 working on fixed-term contracts because they were unable to find a permanent job on total employees.	-
X7	Percentage of GDP per capita	Percentage of GDP per capita on EU28 total per capita (EU = 100, based on million purchasing power standards).	+
X8	Resource productivity and domestic material consumption	Gross domestic product (GDP) divided by domestic material consumption (DMC) - Euro (chain-linked volumes, 2010) per kilogram DMC.	+

Goal 9			
X9	Employment in high and medium-high technology manufacturing sectors and knowledge-intensive service sectors	Share of employment in high and medium-high technology manufacturing sectors and in knowledge-intensive service sectors on total employment.	+
X10	PCT Intramural R&D expenditure (GERD)	Gross domestic expenditure on R&D (GERD) as a percentage of the gross domestic product (GDP).	+
X11	R&D personnel	Share of R&D personnel broken down by the following institutional sectors: business enterprise (BES), government (GOV), higher education (HES), private non-profit (PNP).	+
Goal 10			
X12	Purchasing power adjusted GDP per capita	Purchasing power adjusted GDP per capita	+
X13	Adjusted gross disposable income of households per capita	The indicator reflects the purchasing power of households and their ability to invest in goods and services or save for the future, by accounting for taxes and social contributions and monetary in-kind social benefits.	+
X14	Relative median at-risk-of-poverty gap	Distance between the median equivalised total net income of persons below the at-risk-of-poverty threshold and the at-risk-of-poverty threshold itself, expressed as a percentage of the at-risk-of-poverty threshold.	-
X15	Gini coefficient of equivalised disposable income	Extent to which the distribution of income among individuals or households within a society deviates from a perfectly equal distribution.	-
X16	Income share of the bottom 40 % of the population	Income share received by the bottom 40 % of the population	+
Goal 12			
X17	Primary energy consumption	Total energy demand of a country excluding all non-energy use of energy carriers (e.g. natural gas used not for combustion but for producing chemicals) divided the amount of population. It covers the energy consumption by end users such as industry, transport, households, services and agriculture, plus energy consumption of the energy sector itself, losses occurring during transformation and distribution of energy.	-
X18	Final energy consumption	Total energy demand of a country excluding all non-energy use of energy carriers (e.g. natural gas used not for combustion but for producing chemicals) divided the amount of population. It only covers the energy consumed by end users, such as industry, transport, households, services and agriculture, it excludes energy consumption of the energy sector itself and losses occurring during transformation and distribution of energy.	-
X19	Energy productivity	Amount of economic output that is produced per unit of gross inland energy consumption.	+
X20	Share of renewable energy	Share of renewable energy consumption in gross final energy consumption according to the Renewable Energy Directive.	+
X21	Resource productivity and domestic material consumption (DMC)	Gross domestic product (GDP) divided by domestic material consumption (DMC).	+
X22	Average CO2 emissions per km from new passenger cars	Average carbon dioxide (CO2) emissions per km by new passenger cars in a given year.	-
X23	Volume of freight transport	Ratio between tonne-kilometres (inland transport only) and GDP (chain-linked volumes, at 2005 exchange rates). It is indexed on 2005	-

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SUMMARY

Sustainable Development and National Differences: an European Cross-National Analysis of Economic Sustainability

The 2030 Agenda for Sustainable Development (2015) can be considered the synthesis of a debate, which sets the sustainable development as a priority for the International Community, committing Member States of the United Nations collectively to achieve by the year 2030 a series of sustainable development goals (SDGs) in the social, economic and environmental fields. The achievement of the SDGs has therefore made necessary to develop a system of indicators, to evaluate and compare the state of achievement of the over 100 targets in which the 17 SDGs are organized. In this paper, we would like to analyze the situation of some European countries in terms of achievieng SDGs. We focus on the four goals belonging to the economic dimension of sustainable development, in particular comparing the situation of Italy with that of the other nations of the European Union. The research methodology is to use the Adjusted Mazziotta-Pareto Index (AMPI) for creating a composite index for each goal considered, and then to construct the synthetic measure of economic sustainability, taking into account the previous indices.

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