Theoretical and Applied Economics
Volume XXVII (2020), No. 4(625), Winter, pp. 159-168

Is there a relationship between economic welfare and innovation performance? Evidence from selected European countries

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Abstract. *Investigating economic welfare and innovation performance have been the main themes of dominant researchers in the area of economics. Despite the fact the imperfection of Gross Domestic Product to evaluate welfare is generally acknowledged in economic theory, it is still applicated as one of the crucial indicators for creation of economic policy directions. Interest related to the constraints of GDP have increased to the several attempts in the past decennium to create aggregate economic welfare indicators as substitutes or augmentations to the GDP. A number of challenging indicators have been created, although GDP remaines to be applicated as the traditional indicator of economic welfare. The outstanding of these prominent economic welfare indicators are: the Genuine Progress Indicator, the Index of Sustainable Economic Welfare, the Human Development Index and the Better Life Indicator. This paper's main goal is to determine relationship between the prominent indicators of economic welfare and innovation performance in selected European countries. In order to examine the intercorrelations between economic welfare indicators and innovation performance several methodologies have been applicated. Research was conducted via statistical software package SPSS 25. The research results have indicated that the relationship between indicators of economic welfare in selected European countries are significantly associated with their innovation performance.*

Keywords: economic welfare indicators, innovation performance, relationship, selected European countries.

JEL Classification: C8, E0, O30, O57.

1. Introduction

The idea for this investigation came from revealing the mystic tenacity of welfare measurement that variously influenced innovation performance in the selected European countries, a question that had not sustain appropriate deliberation in last decade by policy creators and government. Gross Domestic Product (GDP) is an indicator *of economic achievement.* Although GDP was not at all designed to be an indicator of well-being, it is still commonly applied as indicator reversing the evident require for a scope of economic welfare. The feasible relevance of indicators of public welfare can be emphasized. Policy procedures alternatives by authorities and entire community, indicators of economic growth and comparations among different countries, all indicate to measurements of particular and common welfare. It is occasionally debated that modifications in GDP are extremely associated with differences in economic welfare, although this disregards the issue that whenever what we evaluate is significant, thinking out literally evaluating substances it would not gain remarkably consideration.

This article is not concentrated as an exhaustive survey of the actual methods for evaluating welfare and innovation, although it assures an overview of the prominent crucial indicators in the economic welfare measurement. This paper has considerated some new improvements in methods to evaluating welfare that were conffered by the Index of Sustainable Economic Welfare (ISEW), the Genuine Progress Indicator (GPI), the Human Development Index (HDI) and the Better Life Indicator (BLI).

Modern times are notable by several threats to well-being that society needs to deal with. These are the threats of climate diversification, increasing income disparities, excalations of conflicts and human rights abuse. Even though peace and recognition for people freedom cannot be integrated in a particular-value indicator of welfare, every country requires an accumulated indicator of economic welfare that is apprehensive of the questions of environmental hazard and ultimate discrimination. Furthermore, every country needs an indicator that integrates non-market donors to welfare, which could be debased by performances on the market. Between the prominent new indicators of economic welfare, only Genuine Progress Indicator (GPI) trails every threat and aggregates non-market donors to welfare. Accordingly GPI is the best indicator to trail economic activities and welfare during the observed period. Nonetheless, exactly because the GPI is more extensive than other *beyond GDP indicators*, that does not assure that it would be properly embraced for economic policy application.

The primary goal of this paper is to explore the relationship between indicators of economic welfare and innovation performance in selected European countries. This paper incorporates four parts.

The first part of paper presents theoretical synopsis of the literature related to new “Beyond GDP indicators” in measuring economic welfare and innovation.

In order to examine the intercorrelations between economic welfare indicators (the Genuine Progress Indicator, the Index of Sustainable Economic Welfare, the Human Development Index and the Better Life Indicator) and innovation (Global Innovation

Index) several methodological measurement devices have been applicated in the second part of paper.

The third part of the paper is dealing with gathered data (primary and secondary) and research methodology.

The fourth part presents findings from Indicators of Economic Welfare and Global Innovation Index and research applicated by statistical software package SPSS 25.

2. Theoretical synopsis of the literature: Economic welfare indicators and innovation performance

Economic welfare research generally exhibits special concern in economic growth. Economist Ding (2014) has explored the possible destructive influence of welfare expense on economic growth while the other stream of researches debate that economic welfare spending could be helpful as a crucial catalyst for increasing growth (Lindert, 2003).

Correspondingly, one more stream of economic thought, that is usually attributed to as the economic school of wage-driven growth, concentrates on the influence of consumption created by the income enhancement culminating from economic welfare (Onaran et al., 2017). The welfare state can have a significant impact in creating the innovative capacity of a country (Hall, 2015), and suggest that economic welfare may play a hidden role in stimulating innovation performance.

Essential to the criticism of GDP is its mistreatment as a gauge of welfare. Its actual application as a gauge of market activities is commonly approved and infrequently investigated, nevertheless appeals for modifications to superior apprehension and configuration of new products and services which infiltrate the world market, especially the digital economics (Stiglitz et al., 2009; Coyle, 2014; Jorgenson, 2018).

Notwithstanding, associating market performances with economic welfare over policy converse, along with the media communications emphasizes relevant knowledge divergences in percepting of the non-market donors to well-being, functioning as voluntary care labour and the surroundings, or the performances that decrease from welfare, e.g. climate deterioration and resource deficiency.

Additionally, in what way economic activities are evaluated in domestic income as input or output aftermaths in an inaccurate productivity impression. Aforementioned is because state authorities-supported services (e.g. education, health care) are measured on the foundations of inputs applied to assure these services (e.g. numbers of doctors, number of professors...) comparatively then on the real made outputs (e.g. numbers of medical therapies, number of conferences...). Subsequently, if productivity increases in the public sector, then the GDP indicators undervalue economic growth.

Besides abovementioned experts have highlighted that GDP augments welfare by describing each disbursement as the donor to economic welfare, beyond differentiating among welfare-increasing and welfare-decreasing performances. Many analysts

emphasize that GDP is inadequate to evaluate sustainability in circumstances of income and well-being together. Economists Nordhaus and Tobin in 1972 created the Measure of Economic Welfare (afterwards the Index of Sustainable Economic Welfare) – a comprehensive indicator of the actual consumption of households each year, composing a few modifications to Gross National Product.

Several specialists also debate that GDP is essentially section of specific political rules which stimulate modifications, as a result of its attention on market performances. Accelerated dependence on GDP as an indicator of welfare requests to concerns that favors enlargement of market alliances, the era of creating profit-generating chances as apprehended by the GDP growth. Furthermore, that requests to affect which attempt to make negative externalities unseeable (Costanza et al., 2009). Anyhow, this element of the GDP and its accordance with the capitalism aims can interpret its maintained preeminence as an indicator of economic welfare (Felice, 2016).

The awareness on the imperfections of GDP as an indicator of economic welfare has been increased inordinately in past decennium and has boosted attempts to create new indicators so called "Beyond GDP indicators" (Stiglitz et al., 2009; Redermacher, 2015; Durand, 2013, Hayden and Wilson, 2018). Several analysists have focused their attention on improvement of the Genuine Progress Indicator methodology by creating a guide for policymaking toward sustainability (Talberth, 2007; Beneria et al., 2015; Berik, 2018).

Genuine Progress Indicator (GPI) is an indicator created to take adequate account of the nation's well-being, by integrating environmental and social components that are not evaluated by Gross Domestic Product. GDP measures income, not decency, it also evaluates economic welfare, but not desolation, and it rejects social cohesion and the natural environment (OECD, 2019). GDP presents an unique comprehensive tool that is relevant for comparative analysis between countries. Alternative indicator that tried to envelop the social dimension previously attains, although the GDP is commonly applicated as the basic gauge.

The most widely operated indicator is the Human Development Index (HDI). HDI is an aggregated indicator that incorporates dispersed indicators for the following dimensions: life assurance (gauge of nation's health and endurance); nation's education, and living standard, as measured by the GDP per capita at purchasing power parity (GDP PPP pc).

The primary goal of the popular innovation performance indicator – Global Innovation Index (GII), that was established by the World Intellectual Property Organization INSEAD – WIPO, is to reveal the flatten to which economies are answering to the innovation requires. The GII is created from the 84 components divided into eight aggregated gauges that are grouped as five input gauges and three output gauges. The five input gauges include: institutions and policies, infrastructure, human capacity, technological sophistication, business markets and capital (INSEAD – WIPO, 2019).

These gauges represent variables that are boosting the innovation capacity. The three output gauges assimilate competitiveness, knowledge and prosperity. The GII engages creditable data constrained from various associations (e.g. the World Bank, Organisation

for Economic Cooperation and Development, etc.), and subjective information constrained from the Opinion Survey.

3. Data and methodology

To explore relationship between indicators of economic welfare and innovation in selected European countries several methodological accesses and indicators, established by respectable international organisations, have been incorporated:

- the Genuine Progress Indicator and the Index of Sustainable Economic Welfare, as the macroeconomic indicators of System of National Accounts. The GPI is evaluated by the 26 indicators that could be separated into three primary dimensions: Economic, Environmental, and Social dimension;
- the Index of Sustainable Economic Welfare, developed by William Nordhaus and James Tobin;
- the Human Development Index, established by United Nations Development Programme (UNDP) methodology;
- the Better Life Indicator, created by Organisation for Economic Cooperation and Development, includes several „dimensions" of well-being: Housing, Income, Jobs, Community, Education, Quality of environment, Governance: (involvement in democracy), Health, Life Satisfaction (level of happiness), Safety and Work-life balance;
- the Global Innovation Index (GII), created by INSEAD – WIPO (World Intellectual Property Organization) methodology.

The data that are used to calculate the GPI and ISEW for selected EU countries came from the World Bank group national accounts database for abovementioned countries. ISEW is an indicator that incorporates the traditional indicator of macroeconomic activity (Gross Domestic Product – actually, the one part of it – personal consumption) with supplementary environmental and social components included. It is necessarily to create new groups of gauges that interfere the traditional quantitative measurement of economic welfare to absorb qualitative components.

The formal expression proposed for the calculation of ISEW is shown in the following formula:

$$ISEW = C(wpce) + G(ndge) + K + L(h) - N - D$$

where:
C(wpce) is the weighted private consumption expenditure;
G(ndge) is the non-defensive governmental expense;
L(h) represents the household labour;
K is the capital adjustment;
N is the reduction of natural environment and
D represents the defensive private expenditure on health care, education and social costs.

Generational economic welfare is presented by the altered life satisfaction of actual and new generations. Welfare is obtained if $dEW(t)/dt \geq 0$. Economic welfare at time (t) is presented by following formula:

$$EW(t) = \int_{t}^{\infty} \left[U(\underline{C}(p)) e^{\chi(p-t)} \right] dp$$

where: EW(t) is economic welfare in the specific time (t), χ represents life satisfaction discount rate, $\chi \geq 0$, $\underline{C}(p)$ represents consumption vector at time p.

Recently, the relevance of innovation for economic welfare has animated many explorers to investigate its variables. Very popular model which describes the innovation performance drivers in a specific economy is the knowledge – production function model. This model, that indicates the connection among Research & Development (R&D) and innovation scope, was afterwards examined by the national innovation system approach. According to the national innovation system approach, connections between the industries, academic communities, international organisations and government are relevant components of a system that is regulated toward innovation performance (Lundvall, 2006).

It accentuated the effect of innovation performance on the economic welfare. This model may be demonstrated by separating specific economies into two groups. The first group represents creation of outputs and the second division presents research and development that leads to country's innovation performance. The following equations could be applied to certain two groups of the economies:

$$Z = IPK_z^{\alpha} L_z^{\beta} H_z^{1-\alpha-\beta} \quad 0 < \alpha < 1; 0 < \beta < 1.$$

$$\overset{*}{IP} = IP^{\theta} K_{IP}^{\eta} L_{IP}^{\mu} H_{IP}^{1-\eta-\mu} \quad 0 < \eta < 1; 0\, \mu < 1.$$

where:
variable z is the quantity of determinant used for production activities,
K and L represent capital and labor,
H is human capital,
variable IP presents the quantity of gauge implicated for Research and Development,
$\overset{*}{IP}$ amplifies the innovation performance that is developed by the R&D division.

4. Findings from indicators of economic welfare and global innovation index: A comparative analysis

Table 1 presents the indicators of economic welfare: the Genuine Progress Indicator, the Index of Sustainable Economic Welfare, the Human Development Index, the Better Life Indicator and the Global Innovation Index rankings in selected European countries in 2019. The investigation was conducted in the following countries: Czech Republic, Hungary, Poland, Slovakia, Croatia, Estonia, Latvia, Lithuania, Romania and Slovenia in the 2019.

Table 1. *Rankings of the selected European countries in 2019, according to the Indicators of Economic Welfare and Global Innovation Index*

	GPI	ISEW	HDI	BLI	GII
Czech Republic	9	7	26	22	26
Hungary	27	25	43	31	33
Poland	28	29	32	27	39
Slovakia	26	27	36	26	37
Croatia	20	22	46	47	44
Estonia	11	10	30	21	24
Latvia	25	24	39	32	34
Lithuania	33	32	34	28	38
Romania	41	42	52	54	50
Slovenia	15	12	24	20	31

Note: GPI – the Genuine Progress Indicator, ISEW – the Index of Sustainable Economic Welfare, HDI-the Human Development Index, BLI-the Better Life Indicator, GII – Global Innovation Index.
Source: the World Bank Group national data base (WBG, 2019), UNDP Human Development Indicators 2019, OECD Better Life Index 2019, the Global Innovation Index Report 2019, INSEAD – WIPO (World Intellectual Property Organization).

Table 2 declares the economic welfare and innovation performance rankings in selected European countries in 2019. Czech Republic has accomplished the highest rank according to Gross Domestic Product PPP per capita, the Genuine Progress Indicator and the Index of Sustainable Economic Welfare. Slovenia is the best positioned country according to the Human Development Index and the Better Life Indicator.

Table 2. *Economic welfare and innovation performance rankings in the selected European countries in 2019*

	GPI	ISEW	HDI	BLI	GDP PPP p.c.	GII
Czech Republic	1	1	2	3	1	2
Hungary	7	6	8	7	6	4
Poland	8	8	4	5	7	8
Slovakia	6	7	6	4	4	6
Croatia	4	4	9	9	10	9
Estonia	2	2	3	2	5	1
Latvia	5	5	7	8	8	5
Lithuania	9	9	5	6	3	7
Romania	10	10	10	10	9	10
Slovenia	3	3	1	1	2	3

Note: GDP PPP p.c. – Gross Domestic Product Purchasing Power Parity per capita.
Source: Author's own calculation.

Estonia has attained the highest position conferred to innovation performance in comparison to the analyzed European countries. Croatia is the lowest positioned country by GDP PPP per capita, while Romania is the lowest classified country according to Genuine Progress Indicator, Index of Sustainable Economic Welfare, the Human Development Index, the Better Life Indicator and the Global Innovation Index.

The relationship between economic welfare and innovation performance indicators are presented in Table 3. Spearman's correlation coefficients have revealed the interconnection among crucial variables of economic welfare (GPI – Genuine Progress Indicator, ISEW – Index of Sustainable Economic Welfare, HDI – Human Development Index, BLI – Better Life Indicator) and innovation performance indicator (GII – Global Innovation Index). The necessary data for this research were collected from

constitutional and secondary sources. The investigation was carried out by applying the SPSS 25 statistical software package.

Table 3. *Relationship between different economic welfare indicators and global innovation index*

	GPI	ISEW	HDI	BLI	GDP PPP p.c.	GII
GPI	1,000	.988**	.588	.612	.406	.758*
ISEW	.988**	1.000	.564	.576	.382	.782**
HDI	.588	.564	1.000	.939**	.818**	.709*
BLI	.612	.576	.939**	1.000	.818**	.770**
GDP PPP p.c.	.406	.382	.818**	.818**	1.000	.673*
GII	.758*	.782**	.709*	.770**	.673*	1.000

**Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Source: Author's own calculation.

Investigation results have determined strong and significant relationship between the Index of Sustainable Economic Welfare (ISEW) and the Global Innovation Index (GII) conferred by correlation coefficients 0.782. Very strong positive intercorrelation is revealed among Genuine Progress Indicator (GPI) and ISEW followed by correlation coefficients 0.988. The positive interdependance is illustrated by the same correlation coefficients 0.818 between the Better Life Indicator (BLI), the Human Development Index (HDI) and Gross Domestic Product PPP per capita (GDP PPP pc), respectively. Very strong positive correlation is revealed among BLI and HDI (0.939). The intercorrelation determined among BLI and GII (0.770) illustrates that countries can gain higher position regarding innovation performance by creating adequate climate for economic environment, and approved circumstances for better life satisfaction. The level of economic welfare between selected European countries by different "beyond GDP" indicators, indicates that ISEW and BLI highly correlate with their innovation performance, which is presented by high correlation coefficients.

Conclusion

The main goal of this paper was to determine the relationship between economic welfare and innovation in the selected European countries. The investigation results have revealed positive interconnections among the Index of Sustainable Economic Welfare (ISEW) and the Global Innovation Index. In regard to the determined relationships, it can be concluded that sustainable economic welfare strongly depends on innovation performance. The results of this investigation confirmed that variations between selected European countries may be intercorrelated with the variables of innovation performance, human development and economic welfare. Apparently, the practices of the analyzed high-ranked European countries are effective for the rest of the countries in boosting economic welfare and innovation capability.

The utilization of the appropriate government policies could increase, along with developing business environment, human development, higher innovative scope, better life standard, and accelerated economic growth. The GPI, ISEW, HDI, BLI and GII indicators are valuable devices to strengthen partnership among economists, governments

and respectable world institutions. Certainly, usage of prominent "beyond GDP" indicators arouses remarkable new access into the mystic relationship between welfare and innovation performance in the analyzed countries.

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