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Natural Resources, Globalization and Sustainable Economic Welfare: A Panel ARDL Approach *

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ABSTRACT

GDP has been the most widely accepted measure of economic performance but it fails to accurately measure economic development, overlooking key aspects of quality of life and sustainability. Thereby, the Index of Sustainable Economic Welfare (ISEW) emerges as the dominant alternative. This paper aims to (i) compare both GDP and ISEW as measures of economic performance and (ii) establish the effects of natural resource exploitation and globalization on both economic growth and sustainable development. A Panel Autoregressive Distributed Lag approach is used, to check for short and long-term effects. The panel is composed by 14 OECD countries, using annual data for the time span from 1995 to 2013. Results show that natural resources rents have a positive effect on GDP per capita in the short-run and a negative effect on ISEW per capita on both short and long-run. Trade openness has a positive impact on short-run economic growth and negative impact on long-term sustainable development. Policy makers ought to consider ISEW as an alternative and more accurate measure of economic performance, should implement policies that reduce the depletion of natural resources and confine the harmful effects of globalization to enhance economic development and create more welfare.

Keywords: Economic Development, Globalization, ISEW, ARDL.

Recursos Naturales, Globalización y Bienestar Económico Sostenible: Un análisis ARDL en panel

RESUMEN

El PIB ha sido la medida más aceptada de rendimiento económico, pero no se trata de una medida de desarrollo económico, no teniendo en cuenta aspectos clave de la calidad de vida y la sostenibilidad. Así, el Índice de Bienestar Económico Sostenible (ISEW) se asume como alternativa. Este artículo tiene como objetivo (i) comparar ambas medidas de desarrollo económico y (ii) estudiar los efectos de la globalización y de la explotación de recursos naturales en el crecimiento económico y el desarrollo sostenible. Se utiliza un enfoque ARDL en panel, para comprobar los efectos de corto y largo plazo. El panel se compone de 14 países de la OECD, utilizando datos anuales para el período de tiempo de 1995 a 2013. Los resultados indican que la explotación de los recursos naturales tiene un efecto positivo sobre el PIB per cápita en el corto plazo, y efecto negativo en ISEW per cápita en corto y largo plazo. La apertura comercial tiene un impacto positivo en el crecimiento económico de corto plazo y negativo en el largo plazo de desarrollo sostenible. Los directores de políticas deberían de considerar el ISEW como una alternativa de medida más exacta del desarrollo económico, debiendo implementar políticas que reduzcan el agotamiento de los recursos naturales y limite los efectos negativos de la globalización, para mejorar el desarrollo económico y crear más bienestar.

Palabras clave: Desarrollo Económico; Globalización, ISEW, ARDL.

JEL Classification: F60, I31, O11, Q01

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1. INTRODUCTION

Over the last decades, concerns about the future of our planet and sustainability of human activity rose among public eye, academics and political institutions. Recently, the UN established the Sustainable Development Goals (SDG) targeting to improve living standards and well-being of populations and reverse the trend of environmental degradation (UNDP, 2016). Sustainable development may be defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNWCED, 1987).

Gross Domestic Product (GDP) has been the most widely accepted measure of economic performance, despite its inadequacy on measuring economic welfare (Costanza *et al.*, 2009; Khan *et al.*, 2016; Kuznets, 1934), since it does not distinguish welfare improving activities from welfare reducing activities (Cobb *et al.*, 1995). Thereby, to achieve sustainable development, there is a need to go beyond GDP towards a broader measure that accounts for changes in natural, social and human capital, and therefore welfare and sustainability (Costanza *et al.*, 2009; European Commission, 2011; Kubiszewski *et al.*, 2013). Thus, the Index of Sustainable Economic Welfare (ISEW) emerges as the dominant alternative (Beça & Santos, 2014).

The ISEW, originally developed by Daly and Cobb (1994), serves a better purpose on measuring welfare and sustainability than GDP, since it considers the economy within a larger dimension, where social, natural and human capital become part of the same system. Starting with private consumption, it deducts the effects of income inequality, environmental degradation and other expenses that do not generate welfare, the so-called defensive costs (Stockhammer *et al.*, 1997). One advantage of the ISEW compared to other welfare indicators is the monetization of the items, which measure the welfare impacts of past and current activities and allows for a direct comparison between ISEW and GDP. With a broader measure of economic performance, policy makers can shift their actions to achieve general welfare and ensure the sustainability of human activity.

Natural resources exploitation has been increasing over the last decades and this intensification is expected to continue in the future (UNEP, 2011), enhancing the need to develop policies that ensure resource efficiency and a more sustainable resource management. Although developed countries with good institutional quality are more likely to have positive effects of natural resources on economic growth (Horváth & Zeynalov, 2014), the question about the welfare and long-run sustainability of natural resources exploitation remains unanswered.

Globalization is a process of economic, social and political integration that has been deepened worldwide over the last decades and usually identified as a positive driver to economic development. Since globalization is wider, multi-dimensional phenomena, this process requires analysis from a broader scope,

considering its different dimensions may affect economic performance in different ways (Dreher, 2006). Having this, the ISEW allows capturing the effects of those dimensions, examining the consequences of globalization on long-run welfare.

This paper aims to: (i) compare both GDP and ISEW as measures of economic performance, and (ii) establish the effects of natural resources exploitation and globalization on both economic growth and sustainable development. The research question is: Are globalization and natural resources exploitation harmful to sustainable development?

The remainder of this paper is displayed as follows: Section 2 contains the existent literature; Section 3 describes data and methods; Section 4 presents and discuss the results, and in section 5 final conclusions are stated.

2. LITERATURE REVIEW

2.1. Natural Resources

The relationship between natural resources and economic activity has been emphasized by researchers. There is little consensus on how natural resources exploitation affect long-term economic development. While some authors state that natural resources can boost the economy, others found negative impacts on economic growth. The former part of the literature usually defends the benefits of natural resources as higher stocks of natural capital enhance economic growth. For example, Brunnschweiler and Bulte (2008) separate natural resource dependence from natural resource abundance, therefore separating flows from stocks and conclude that while dependence does not affect economic growth, abundance is growth-enhancing.

On the other hand, some authors found the so-called resource (Ozturk, 2010; Sachs & Warner, 1995). The presence of low institutional quality or rent-seeking competition are usually some of the explanations for this stream of the literature (Parcero & Papyrakis, 2016; Torvik, 2002). In fact, having high quality institutions can help avoiding the resource curse (Havranek, Horvath, & Zeynalov, 2016).

Natural resources abundance may also be correlated with greater levels of income inequality, since the distribution of natural capital tends to be more unequal distributed than physical or human capital (Gylfason & Zoega, 2002). Parcero and Papyrakis (2016) state that in the case of oil, this happens for extreme cases of oil abundance.

Despite there is no consensus on how natural resources affect the economy, particularly in the long-run, using a measure of economic performance which accounts for income inequality or institutional quality may offer broader

comprehension of this relationship. Thus, using the ISEW instead of GDP may result in very different results.

2.2. Globalization

Globalization is a continuous and multi-dimensional process of integration which gathers economic, social and political relations of country-wide interdependence. It is usually identified as a positive driver to economic development. Thus, some authors have emphasized the effects of globalization to the economy. Main research focus on trade openness or capital flows as proxies for globalization. For example, Dollar and Kraay (2001) found a positive relation between trade flows, FDI and economic growth. Other authors state that trade openness may result in higher levels of income inequality in both developed and developing countries (Beck *et al.*, 1999).

As mentioned above, globalization is wider phenomena. Thus, it requires analysis from a broader scope, considering its different dimensions may affect economic performance in different ways (Dreher, 2006). The ISEW allows capturing the effects of those dimensions, examining the consequences of globalization on long-run welfare.

2.3. Measuring Sustainable Development

Gross Domestic Product is the most widely accepted measure of economic performance and has been used to measure both economic growth and economic development. GDP serves a good purpose to measure the market output of an economy, since it measures the flow of goods and services produced within a period of time. It is composed by private consumption, government expenditure, capital formation and net value of exports.

Achieving GDP growth has become the main goal for policy makers since its popularity rose in the aftermath of World War II. Back then, accounting for the intensity of investment, through gross capital formation and government expenditure was a good insight for the pace of countries reconstruction and capacity of production. Private consumption gave good insights about population's income and future expectations and the net value of exports was important to ensure countries economic stability and international position. Altogether, GDP growth was important to measure capacity of production and guarantee political stability. However, GDP was never designed to measure economic welfare or sustainability (Costanza *et al.*, 2009; Kuznets, 1934) since it does not account for changes in the natural, human and social capital which are inherent parts of the economic system. (Costanza *et al.*, 2009; Saunoris & Sheridan, 2013).

Ecological economists consider that GDP is no longer a good indicator of human progress. The baseline for that belief is the so-called threshold hypothesis

(Max-Neef, 1995), stating that economic growth causes improvements in the quality of life up to a certain point, beyond which its benefits are exceeded by its costs, deteriorating quality of life and welfare. Thus, alternative indicators have been developed, such as the Index of Sustainable Economic Welfare (ISEW) (Daly *et al.*, 1994) and the Genuine Progress Indicator (GPI) (Cobb), aiming to replace GDP and GDP growth as measures of sustainable economic development.

The ISEW/GPI follow Fisher's (1906) concept of physical income, distinguishing the flow of goods and services from the stock of capital it derives from. Therefore, the main difference between GDP and the ISEW/GPI methodology is the fact while the former treats all flows as income, the latter distinguish welfare generating activities from welfare reducing activities (Cobb *et al.*, 1995). By accounting for these defensive costs, the ISEW/GPI methodology attends to measure sustainable economic welfare rather than economic activity alone (Costanza *et al.*, 2009).

2.3.1. The Index of Sustainable Economic Welfare

The ISEW is a broader measure of economic performance that is composed by economic, environmental and social components. Usually, the ISEW calculation starts with a private consumption base, weighted for the distribution of income. Then, the defensive costs are subtracted, accounting for those parts of production that are not disposable for consumption but are required to maintain current levels of consumption and for future losses caused by today's production (Beça & Santos, 2010; Stockhammer *et al.*, 1997). While this approach is well stablished within the ISEW literature, the items that compose the defensive costs are not consensual, especially the social components.

Some authors developed the ISEW for specific countries, adapting the methodology for the country under analysis. For example, the Thailand ISEW (Clarke & Islam, 2005), accounts for the cost of commercial sex work. The Greek ISEW (Menegaki & Tsagarakis, 2015) accounts for the cost of noise pollution, adapting the calculation to the Greek case. Depending on data availability, some authors include items such as the cost of crime, cost of commuting or the cost of family breakdown (Beça & Santos, 2014; Castañeda, 1999; Gigliarano, Balducci, Ciommi, & Chelli, 2014; Jackson, 1996). On one hand, accounting for these disservices improve the theoretical validity of the ISEW, since it includes a wider range of components that may affect welfare and sustainability (Beça & Santos, 2010; Lawn, 2003). On the other hand, it stunts country-wide comparability and raise arbitrary issues. The lack of a standardization of the ISEW methodology remains as one of the main barriers to its development as a policy relevant indicator (Hák *et al.*, 2016; Neumayer, 2000).

In this paper, we focus on building an ISEW that could directly compare to GDP as a macroeconomic indicator. Thus, the ISEW is calculated considering data availability and comparability, comprising the existing framework.

As in Table 1, the first component of the ISEW is the private consumption base, weighted for losses from income inequality. The underneath assumption is that as income inequality rises, overall welfare decreases, since an additional amount of money benefits more a poor family than a richer one (Bleys, 2008).

Table 1
Construction of the ISEW

Component	Source	Computation
Adjusted private consumption (+)	Final household consumption expenditure - WDI Net Gini Index - SWIID 5.1	Final household consumption expenditure * (1 – Net Gini Index). Net Gini is Gini post taxes and transfers, accounting for income distributional policies. A 0 value represents perfect equality and 1 perfect inequality.
Unpaid Work (+)	Number of unpaid workers - WDI Average wage - OECD	Number of unpaid workers * Average wage
Net capital growth (+/-)	WDI	Gross Capital Formation – Gross Capital Consumption
Non-Defensive Health Expenditure (+)	WDI	Public health expenditure * 0.5
Non-Defensive Education Expenditure (+)	WDI	Public education expenditure * 0.5
Mineral Depletion (-)	WDI	Ratio of the value of the stock of mineral resources to the remaining lifetime (capped at 25 years)
Forest Depletion (-)	WDI	Calculated as the product of unit resource rents and the excess of round wood harvest over natural growth
Energy Depletion (-)	WDI	Ratio of the value of the stock of energy resources to the remaining lifetime reserves (capped at 25 years)
Carbon Dioxide Damage (-)	WDI	Carbon dioxide damage is estimated to be $20 per ton of carbon times the number of tons of carbon emitted

Source: Own elaboration.

The contribution of domestic and volunteer labor is then added, which allows to measure non-market production. By valuing the inputs of unpaid work by the average wage, this item is priced by the opportunity costs (Stockhammer *et al.*, 1997). This method enhances the contributes of household and volunteer work to economic welfare.

The ISEW relies on the concept of physic income. Net capital growth measures changes in the stock of capital. Therefore, it measures only the flows of capital and not the stock that it derives from.

Public expenditures on health and education are not always welfare enhancing. Daly and Cobb (1994) state that some of those expenses are defensive, not intended to increase welfare but to repair damages caused by the system, and to prevent the deterioration of human capital.

As in most of the literature (Castañeda, 1999; Gaspar *et al.*, 2017; Gigliarano *et al.*, 2014; Jackson, 1996; Menegaki & Tsagarakis, 2015; Menegaki & Tugcu, 2017), only half of public expenditure on health and education are considered as non-defensive.

The environmental components are forest, mineral and energy depletion which are considered to measure the costs of environmental degradation. The main assumption underneath these defensive costs is that the depletion of natural resources reduces the future stock of this capital.

Carbon dioxide damage cost intends to value the long-term environmental damage from today's structure of production and it is used as in Gaspar *et al.* (2017) and Menegaki (2016).

To avoid ambiguity, the indicators used in this ISEW are all from World Bank and OECD databases apart from Gini Index, taken from SWIID 5.1 (Solt, 2009, 2016), which favors country-wide comparability and brings more reliability to the indicator.

The formal proposition of the ISEW, as in Marques *et al.* (2016), Menegaki and Tsagarakis (2015) and Menegaki and Tugcu (2017) is:

Equation 1. Formulation of the ISEW

$$ISEW = Cw + S + Geh + Kn - Ns - Cs$$

where Cw stands for the adjusted private consumption expenditures; S is the benefits of unpaid household and volunteer work; Geh represents non-defensive public expenditures, namely education and Health; Kn is the net capital growth; N stands for the depletion of natural capital and Cs is the social defensive costs, which were not computed due to lack of available data.

3. DATA AND METHOD

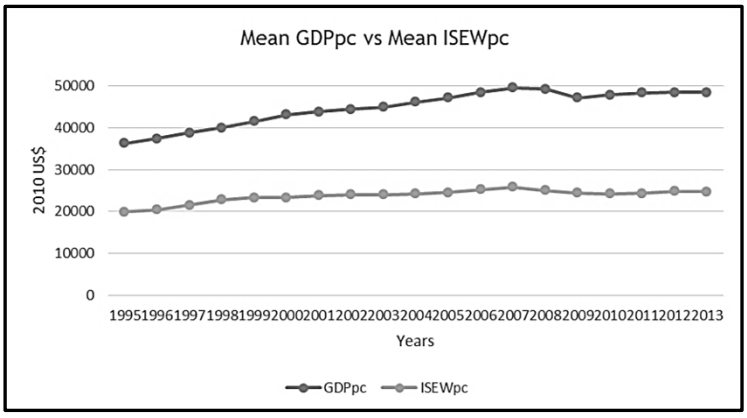
The main goal of this paper is to analyze both ISEW and GDP as measures of economic performance and to establish the relationship between globalization and natural resources exploitation with these indicators. Therefore, the first step was building an ISEW that can directly compare to GDP. The calculation of the ISEW is detailed in section 2.1.1.

To secure country-wide comparability and overcome one of the main barriers to the development of the ISEW as a relevant indicator, data availability for all the ISEW components and for the other variables that compound this study was the prior criteria to country selection. Accounting for a homogeneous

group of countries, with common policies and similar standards of economic development, was also a concern, avoiding disparities within the ISEW components. Thus, a group of 14 high-developed OECD members was selected, namely Australia, Austria, Canada, Denmark, Finland, Germany, Ireland, Korea, Netherlands, Norway, Spain, Sweden, United Kingdom and United States. Using annual data, the time span from 1995 to 2013, which was the largest available for all the variables in study. All econometric techniques and estimations were performed using software Stata 13.0 and Eviews 9.0.

Regarding the first part of this paper, Fig.1 shows the evolution of the mean values for both GDP and ISEW per capita. The gap between both indicators is notable. While mean GDP per capita rose from 36330 USD in 1995 to 48503 USD in 2013, the mean ISEW per capita was almost stagnant, rising from 19849 USD to just 24764 USD over the same period. Although the panel is composed by high-income developed countries, the gap shows that increased economic growth is not reflected in sustainable economic welfare, which supports the idea of a threshold hypothesis. Different trends between both indicators also shows the inefficiency of GDP to measure sustainable economic welfare, consistent with (Costanza *et al.*, 2009).

Figure 1
Comparisson between mean values for GDP and ISEW per capita. Values in 2010 US$



Source: Own elaboration.

The second part of this paper focus on analyzing the effects of globalization and natural resources exploitation on both economic growth (GDPpc) and sustainable economic welfare (ISEWpc). The other variables included in this study are:

- Employment rate (TXEMP) as a proxy for labor. A higher employment rate results in higher disposable income. Therefore, a positive relationship

with both GDP and ISEW per capita is expected.

- The Consumer Price Index (CPI) to account for the effects of inflation. CPI may have a negative effect on economic growth, particularly in developed countries, with better institutions. (Ibarra & Trupkin, 2016; Marques *et al.*, 2016).
- Life expectancy at birth (LIFEEXP), to account for the effects of health on human capital. A positive relationship with both ISEW and GDP is expected (Frugoli *et al.*, 2015; Were, 2015).
- Trade Openness (OPENNESS). Trade openness is the part of economic activity resulting from international trade. It is composed by the sum of all imports and exports divided by total GDP.
- Natural Resources Rents per capita (RENTSPC). Obtained by dividing the total natural resource rents by total population, it is included to capture the effects of natural resource abundance/dependence. A positive relationship with GDP is expected due to the financial benefits of natural resources exploitation. On the other hand, a negative relationship with the ISEW is expected, due to the depletion of natural capital.
- The KOF Index of Globalization (Dreher, 2006; Dreher & Dreher, 2016) is included to assess the impacts of globalization. The main advantage of this index is the detachment of the three dimensions of globalization. Therefore, economic (EKOF), social (SKOF) and political (PKOF) dimensions are included in this paper.

Two models were performed. One with economic growth (GDP per capita), and the other one with the sustainable economic welfare proxy (ISEW per capita) as dependent variables. An Autoregressive distributed lad (ARDL) approach was used to breakdown both short- and long-run dynamics. An ARDL model permits to decompose the variables into its short- and long-run effects. The most fitted estimator was selected after the specification tests.

Table 2 displays the descriptive statistics and cross section dependence (CD) tests for all variables. Cross-section dependence is identified as a problem in macro panel data. Thus, Pesaran (2004) CD test was performed and suggest the presence of cross-section dependence. This means that the countries share common developments for all variables, consistent with the fact the panel is composed by high-income OECD members and have common policies and similar living standards.

To check for multicollinearity, the Variance Inflation Factor (VIF) test was computed (Table 3). The low values for the VIF statistics states that for these variables, multicollinearity is far from being a concern.

Table 2
Descriptive Statistics and Cross-section dependence (CD) tests[1]

Variable	Descriptive statistics					Cross section dependence (CD)		
	Obs	Mean	Std. Dev.	Min.	Max.	CD-test	Corr	Abs(corr)
LISEWPC	266	10.04865	0.2347551	9.148762	10.58951	24.62***	0.592	0.641
LGDPPC	266	10.65327	0.351088	9.410764	11.42436	39.37***	0.947	0.947
LTXEMP	266	4.532221	0.0441222	4.300003	4.584968	10.86***	0.261	0.432
LCPI	266	4.81274	0.1266583	4.097372	4.702087	41.00***	0.986	0.986
LLIFEEXP	266	4.369325	0.226005	4.295847	4.419781	41.03***	0.987	0.987
LRENTSPC	266	5.260411	2.000246	0.5259663	9.273802	27.84***	0.670	0.670
LOPENNESS	266	4.245564	0.4517299	3.097822	9.273802	19.70***	0.474	0.619
LEKOF	266	4.365814	0.1604767	3.817314	4.59667	20.63***	0.496	0.553
LSKOF	266	4.396134	0.1356682	3.849704	4.527115	33.04***	0.795	0.795
LPKOF	266	4.488122	0.1071728	4.024765	4.575573	8.47***	0.204	0.398

Source: Own elaboration.

Table 3
Variance Inflator Factor (VIF) statistics[2]

Variable	VIF	1/VIF
LLIFEEXP	4.06	0.246473
LCPI	3.72	0.268807
LEKOF	3.36	0.297539
LSKOF	3.26	0.306592
LRENTSPC	2.46	0.406453
LPKOF	2.28	0.437881
LOPENNESS	1.38	0.723584
LTXEMP	1.35	0.743470
Mean VIF	2.73	

Source: Own elaboration.

Good econometric practices recommend testing the adequacy of panel data techniques. The Lagrange Multiplier (LM) test was performed to check the existence of country-specific effects, with the null-hypothesis being rejected in both models (X^2= 850.74*** with LISEWPC as dependent variable and X^2= 1010.99*** with LGDPPC), which supports the usage of panel data techniques.

One of the main advantages of the ARDL approach is its robustness in the presence of I(0) or I(1) variables. Thus, to verify the order of integration of the variables, second generation panel unit root tests, namely the CIPS (Pesaran, 2007), were performed (Table 4). This test has the advantage of being robust in the presence of heterogeneity. Some variables can be identified as I(0), like

[1] CD test was performed with the Stata routine xtcd and has N(0,1) distribution. Null hypothesis is cross-section independence. *** denotes significance at 1% level.

[2] By rule of thumb, 10 takes on as critical value for the presence of multicollinearity.

LRENTSPC and LPKOF and LISEWPC, LTXEMP, LCPI. LEKOF and LLIFEEXP are I(1) or borderline I(1)/I(0). None of the variables is I(2), so the ARDL approach can be pursued.

Table 4
Panel Unit Root Test (CIPS)[3]

Variables	2nd generation Unit Root Test	
	CIPS (Zt-bar)	
	No trend	With trend
LISEWPC	0.162	-1.126
LTXEMP	1.462	1.856
LCPI	2.476	4.926
LRENTSPC	3.291***	-1.468*
LOPENNESS	0.586	1.689
LEKOF	-1.442*	-1.623*
LSKOF	-1.361*	-3.079***
LPKOF	-5.200***	-3.138***
LLIFEEXP	-1.125	0.6511
LGDPPC	2.082	0.795
DLISEWPC	-7.117***	-5.274***
DLTXEMP	-2.584***	-0.581
DLCPI	-2.103**	-1.396*
DLRENTSPC	-10.979***	-9.118***
DLOPENNESS	-5.301***	-4.585***
DLEKOF	-8.859***	-7.491***
DLSKOF	-9.986***	-8.780***
DLPKOF	-10.864***	-9.682***
DLLIFEEXP	-6.197***	-5.452***
DLGDPPC	-4.169***	-2.759***

Source: Own elaboration.

Table 5
Westerlund Tests of Co-integration[4]

Statistic	Value	Z-value	P-value	Robust P-value
Gt	-1.418	4.821	1.000	0.862
Ga	-3.172	5.357	1.000	0.774
Pt	-3.064	5.379	1.000	0.912
Pa	-2.433	3.988	1.000	0.750

Source: Own elaboration.

Following the outcomes of the unit root test, Westerlund (2007) test of co-

[3] Table 4 - Pesaran (2007) Panel Unit Root test (CIPS). Null hypothesis: series are I(1). The Stata routine multipurt was used to compute the test. ***, **, * denote significance at 1%, 5% and 10% levels, respectively.

[4] Table 5 - Westerlund (2007) Tests of Co-integration. Null hypothesis: no co-integration. Gt and Ga test: co-integration for each country individually. Pt and Pa test: co-integration for the panel as a whole. Stata routine xtwest was used to compute the test.

integration was performed (Table 5), to check for co-integration among variables. To achieve robust results, bootstrapping is recommended. Thus, 500 reps were used. The presence of co-integration is strongly rejected, whether considering the panel as a whole (Pt and Pa tests) or considering each country individually (Gt and Ga tests).

4. RESULTS AND DISCUSSION

A series of tests were carried out to ascertain the validity of the estimations. First, the panel Lagrange Multiplier (LM) test was performed, which proved the adequacy of panel techniques.

A common characteristic in macro panels is heterogeneity. Thus, to cast for the most suitable panel estimator, the adequacy of the Mean Group (MG), Pooled Mean Group (PMG) or Dynamic Fixed Effects (DFE) ought to be tested. The models were estimated and then, the Hausman test was performed (Table 6).

Table 6
Hausman Tests[5]

Sustainable Development (LISEWPC) Models		Economic Growth (LGDPPC) Models	
MG vs PMG	MG vs DFE	MG vs PMG	MG vs DFE
60.19***	0.00	37.45***	0.00

Source: Own elaboration.

The outcomes points DFE as the most suitable estimators. The DFE models implies homogeneity for all coefficients, and therefore, the panel is homogeneous, with similar behaviors. This is consistent with the fact the panel share common policies.

Considering this, specification tests were performed to check for heteroskedasticity and serial correlation in both models (Table 7).

Table 7
Specification tests[6]

Specification tests	Sustainable Development DFE Model	Economic Growth DFE Model
Walt test	819.74***	176.73***
Woolridge test	106.248***	47.946***

Source: Own elaboration.

[5] Table 6 - Hausman test. Null hypothesis: differences in coefficients are not systematic. The stata routine xtpmg was used to compute the models. *** denotes significance at 1% level.

[6] Table 7 - Modified Wald test. Null hypothesis: Homoscedasticity. In Woolridge test, the null hypothesis is no serial correlation. *** denotes significance at 1% level.

Considering the presence of cross-section dependence among variables and heteroskedasticity and first order autocorrelation in the DFE models, the Driscoll and Kraay (1998) estimator was used. This estimator is robust in the presence of this phenomena. In the economic growth models, the variable LLIFEEXP was not statistically significant and was removed to improve the statistical quality of the models.

Table 8
Estimation results[7]

	Sustainable Development Models		Economic Growth Models	
Variable	**DK**	**DK'**	**DK**	**DK'**
DLTXEMP	1.9061354***	1.997944***	1.2102577***	1.1515259***
DLCPI	0.30367919		-0.32552446**	-0.38299278***
DLRENTSPC	-0.02613914***	-0.02303236**	0.01091384**	0.01056886**
DLOPENNESS	-0.00261013		0.04813924*	0.06714717**
DLEKOF	0.11561274	0.13279185*	0.08699618*	
DLSKOF	0.00848524		0.12030184***	0.10070603**
DLPKOF	0.2866746**	0.2961854***	-0.02242092	
DLLIFEEXP	0.08646579		----------	----------
LISEWPC (-1)	-0.37872085***	-0.35523408***	----------	----------
LGDPPC (-1)	----------	----------	-0.16156352***	-0.12139148***
LTXEMP (-1)	0.77864243***	0.79025483***	0.19053171***	0.16840149***
LCPI (-1)	-0.05613363		0.0548831	
LRENTSPC (-1)	-0.01791549**	-0.01623466**	-0.00024654	
LOPENNESS (-1)	-0.0010344**	-0.00080196**	-0.00023305*	
LEKOF (-1)	-0.009578		0.03787333*	
LSKOF (-1)	0.10712815		0.19427705***	0.16307074***
LPKOF (-1)	-0.0285898		-0.05926945***	-0.03894993***
LIFEEXP (-1)	1.8494311**	1.4233225**	----------	----------
_CONS	-7.6742801***	-6.0720824**	-0.10152289	0.00991053
Statistics				
N	252	252	252	252
R^2	0.4882	0.4823	0.7248	0.709
F	F(17,13)=2896.83***	F(9,13)=402.02***	F(15,13)=410.68***	F(9,13)=196.1***

Source: Own elaboration.

Table 8 presents the Driscroll and Kraay estimations. For both models, the estimation was computed with all variables at first. Variables that were not statistically significant were then removed. DK' denotes final estimations with only significant variables.

Considering the outcomes of Table 8, short-run elasticities are presented in Table 9. The long-run elasticities/impacts were computed. For sustainable development model (SD), the elasticities were obtained, dividing the coefficients

[7] Table 8 - Estimation results. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively. Stata routine xtscc was used to compute the estimations.

of each variable by the coefficient of LISEWPC, lagged once and the total value divided by -1. For the economic growth model (EG), the same process was carried out, but dividing by the coefficient of LGDPPC.

Table 9
Elasticities/impacts and adjustment speed[8]

Sustainable Development Model (DK')		Economic Growth Model (DK')	
Short-run elasticities/impacts			
DLTXEMP	1.997944***	DLTXEMP	1.1515259***
DLRENTSPC	-0.02303236**	DLCPI	-0.38299278***
DLEKOF	0.13279185*	DLRENTSPC	0.01056886**
DLPKOF	0.2961854***	DLOPENNESS	0.06714717**
		DLPKOF	0.10070603**
Computed long-run elasticities/impacts			
LTXEMP	2.17922***	LTXEMP	0.4888208*
LRENTSPC	-0.0463809**	LSKOF	1.96178***
LOPENNESS	-0.0024383***	LPKOF	-0.3437994***
LLIFEEXP	3.905232***		
Speed of adjustment			
ECM	-0.35523408***	ECM	-0.12139148***

Source: Own elaboration.

As expected, in both models, the employment rate has a positive impact on both short- and long-run, and significant at 1% level. Having a higher employment rate means higher disposable income. Despite the differences of the measures, labor is found to be a positive input for both sustainable development and economic growth. Life expectancy at birth has also a positive long-run impact on SD model. This means that for sustainable development, health is a positive driver in the long-run. These variables hence the importance of human capital to economic performance.

The negative impact of inflation on short-run economic growth is justified by the composition of the panel, namely OECD high-developed countries. As mentioned in section 3, inflation may have negative effects on economic growth, especially in high-developed, near steady-state countries (Ibarra & Trupkin, 2016).

Accounting for the changes in natural capital is the main difference between the ISEW and GDP methodologies (Kubiszewski *et al.*, 2013). Thus, as expected, natural resource rents per capita has a positive impact on short-run economic growth and negative impacts on both short- and long-run on sustainable development. These different impacts hence the argument that GDP

[8] Elasticities/impacts and adjustment speed. ***, **, * denotes significance at 1%, 5% and 10% levels. ECM refers to the coefficient of LISEWPC(-1) in SD model and LGDPPC(-1) in EG model.

only considers the financial benefits of resource abundance. The degradation of natural capital, through resource depletion and the environmental costs of resource exploitation exceeds the benefits it generates to sustainable economic welfare (Costanza *et al.*, 2009; Gaspar *et al.*, 2017).

The relationship between globalization and both SD and EG was studied by the inclusion of trade openness and the KOF Index of Globalization (Dreher, 2006). While the former intends to state the importance of the international trade flows to the economy, the latter is an indicator which considers the economic, political and social dimensions of globalization. Considering this, trade openness (LOPENNESS) has a positive impact on short-run EG and a negative impact on long-run SD. The positive impact on economic growth is explained through the direct financial benefits of international trade to domestic demand. On the other hand, trade openness may increase income inequality (Beck *et al.*, 1999; Dollar & Kraay, 2001), and therefore have a negative impact long-run economic welfare.

Considering the composition of the KOF Index, political globalization is measured with items such as embassies in the country, membership in international organizations, or participation in UN security council missions. This may explain the positive impact on short-run SD, since the international position of a country is usually used in ISEW methodology (Beça & Santos, 2010) as a positive welfare driver. On the other hand, considering the panel is composed by politically integrated countries (OECD members), in long-run, the costs of additional international presence do not contribute to increase economic growth.

Social globalization is identified with a positive long-run impact on economic growth, which hence the long-run contributions of social proximity between countries as well as the social development.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This paper intended to compare both ISEW and GDP as measures of economic performance and to establish the effects of natural resources exploitation and globalization on both indicators. Panel data techniques were applied, namely DFE and DK estimators, to a panel composed by 14 OECD high-developed countries.

Considering the first part of the paper, the ISEW is an indicator which compounds economic, social and environmental items, accounting for changes in natural, social and human capital. The focus was on building an ISEW which allowed to country-wide comparability, and therefore, to overcome some critiques to the ISEW methodology, namely, the lack of a standardized methodology and ambiguity on its components (Neumayer, 2000). Thus, the ISEW was computed using established framework (Gaspar *et al.*, 2017; Marques *et al.*, 2016; Menegaki & Tugcu, 2016, 2017). The gap between both indicators (Fig.1)

hences the differences when measuring sustainable development vs economic growth.

Regarding to the second part of this paper, the focus was on to directly compare the short- and long-run effects of natural resources exploitation and globalization on both indicators. While some of the variables show similar impacts on both SD and EG, namely the employment rate and short- run political globalization, the different impacts of some variables reveal the differences between both indicators. While natural resource rents per capita has a positive impact on GDP per capita in the short-run, a negative impact is found in ISEW per capita in both short- and long-run. These results demonstrate that enhancing GDP does not account for the impacts of changes in natural capital and that natural resource exploitation may represent a hazard to sustainable development.

The usage of KOF Index permits to capture the effects of different dimensions of globalization. GDP per capita brings together, in a better way, the impacts of the KOF components, which may state that the items that compose the index are not perfectly accurate to measure long-run sustainable development. Trade openness may have a long-run on ISEW per capita, due to increased income inequality. Other results show that political globalization may boost both EG and SD in the short-run, and that social globalization has a positive impact on long-run economic growth.

This paper contributes to the establishment of the ISEW as a standardized economic indicator. Future research on this topic would benefit from accounting for the social costs in the ISEW framework which would permit a deepening of the ISEW concept into a better measure of economic performance. This would require a better statistical report from all countries, making it possible to compare social costs country-wide.

Despite the actual limitations, policy makers ought to consider the ISEW as an alternative and more accurate measure of economic development, should implement policies that reduce the depletion of natural resources to guarantee the sustainability of human activity, and confine the harmful effects of globalization to enhance economic development and create more welfare.

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