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An Evaluation of the Convergence of Six Different Environmental Sustainable Development Goals in OECD Countries

Ocena zbieżności 6 środowiskowych Celów zrównoważonego rozwoju w krajach OECD

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Abstract
The aim of this study is to analyze the convergence of the six Sustainable Development Goals (SDGs) closely related to the environment, out of the 17 SDGs targeted to be achieved by all countries by 2030 by the United Nations, in the context of OECD countries. To this end, the convergence of the general SDG index and SDG 6, 7, 12, 13, 14, and 15, which are related to the environment, has been analyzed between 2000 and 2023. A recently-introduced structural unit root test has been used in the study. The study concluded that OECD countries with the same convergence/divergence results and expectations for the SDG Index, SDG 6, SDG 7, SDG 12, SDG 13, SDG 14, and SDG 15 should monitor their environmental policies, while countries with different expectations should update their environmental policies.

Key words: OECD, SDG Index, convergence, divergence, environmental policies

Streszczenie
Celem niniejszej pracy jest analiza zbieżności sześciu Celów Zrównoważonego Rozwoju (SDGs) ściśle związanych ze środowiskiem, spośród 17 SDGs, które mają zostać osiągnięte przez wszystkie kraje do 2030 r. przez Organizację Narodów Zjednoczonych, w kontekście krajów OECD. W tym celu przeanalizowano zbieżność ogólnego indeksu SDG i SDG 6, 7, 12, 13, 14 i 15, które są związane ze środowiskiem, w latach 2000–2023. W badaniu wykorzystano niedawno wprowadzony test strukturalnego pierwiastka jednostkowego. Badanie wykazało, że kraje OECD o takich samych wynikach zbieżności/rozbieżności i oczekiwaniach dla indeksu SDG, SDG 6, SDG 7, SDG 12, SDG 13, SDG 14 i SDG 15 powinny monitorować swoje polityki środowiskowe, podczas gdy kraje o różnych oczekiwaniach powinny aktualizować swoje polityki środowiskowe.

Słowa kluczowe: OECD, indeks SDG, konwergencja, dywergencja, polityka środowiskowa

1. Introduction

SDGs were announced by the United Nations in 2015. The 17 goals expected to be achieved globally by 2030 and these goals are generally related to the economy, environment, education, health, and justice (Mabhaudhi et al., 2021). For instance, Goal 6 aims to ensure that every citizen has access to clean water resources and the sustainability of water consumption, while Goal 7 involves the target of clean energy and everyone's access to energy. Goal 12 entails target connected to environmentally sustainable consumption and production structures, while Goal 13 aims to reduce climate change and its effects. Goal 14 involves the protection of marine and ocean resources, and Goal 15 entails the protection of the terrestrial ecosystem.

The sixth SDG is defined as ensuring access to water and sanitation for all and ensuring their sustainable management. The third sub-goal of this objective is defined as *improving water quality by reducing pollution, eliminating waste dumping, minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and significantly increasing recycling and safe reuse globally by 2030*. Additionally, the sixth sub-goal includes the provision to *protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes*. The name of SDG7 is to *ensure access to affordable, reliable, sustainable, and modern energy for all*. The second sub-goal states *significantly increase the share of renewable energy in the global energy mix by 2030*, while the third sub-goal states *increase international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, to promote energy efficiency and clean energy research and technology, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, to promote energy efficiency and clean energy research and technology, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, to promote energy efficiency* and *enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and encourage investment in energy infrastructure and clean energy technology*. SDG12 is defined as *ensuring sustainable consumption and production patterns.* Looking at its sub-goals, the second sub-goal is *ensuring the sustainable management and efficient use of natural resources by 2030*, Sub-goal 4 is to *ensure the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with internationally agreed frameworks, and minimize their adverse impacts on human health and the environment, including by significantly reducing their release to air, water, and soil*. Sub-goal 5 is defined as *significantly reducing waste generation by 2030 through prevention, reduction, recycling, and reuse.* SDG 13 is titled *take urgent action to combat climate change and its impacts*, while its second sub-goal is *integrate climate change measures into national policies, strategies, and planning*, and the third is *to develop education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning*. The objective of SDG 14 is defined as *protecting and sustainably using oceans, seas, and marine resources for sustainable development*. The first of its sub-goals is to *prevent and significantly reduce marine pollution of all kinds, including marine debris and nutrient pollution resulting from land-based activities*, and the third *minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels*. Finally, SDG 15 is titled *protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss*. The third sub-goal is to *combat desertification by 2030, restore degraded land and ecosystems, including those affected by desertification, drought, and floods, and strive to achieve a world without land degradation*, The fourth is *to ensure the conservation of mountain ecosystems, including their biodiversity, to enhance their capacity to provide benefits essential for sustainable development by 2030*. 5. *Take urgent and significant steps to reduce the degradation of natural habitats, halt the loss of biodiversity, and protect and prevent the extinction of threatened species*, The ninth is defined as *Integrating ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies, and accounts* (United Nations, 2025). Therefore, six of the 17 SDGs (SDG 6, SDG 7, SDG 12, SDG 13, SDG 14, and SDG 15) are related to the environment, both in their core objectives and in their sub-goals.

Convergence is defined as the tendency of a time series to move toward a specific long-term equilibrium value or fixed limit over time. In an econometric context, this means that the mean and/or variance of the series settles at a specific value over time, or that different series move toward a common trend. Therefore, from a broad perspective, convergence analysis is used to mean that the groups of countries being analyzed influence each other and converge toward their means.

OECD countries constitute a significant portion of the global economy. Therefore, the environmental awareness of OECD countries is a major concern worldwide. The aim of this study is to analyze the convergence level of OECD countries with regard to the environmental goals of the SDG. A literature review reveals that analyzing convergence in the SDG is an under-researched topic for OECD countries. Analyzing the convergence dynamics of environmental performance series is important in many ways. Such an analysis reveals the similarities in environmental policy successes and responses to common environmental shocks between countries, while also serving

as a critical tool for understanding changes in environmental inequalities over time. Identifying convergence provides concrete contributions to future policy design through the transfer of successful practices or the development of special support mechanisms for lagging countries. It also provides an important framework for evaluating the effectiveness of global and regional environmental governance mechanisms. In this respect, our study is considered to be broad and comprehensive, and it will fill the gap in the literature. It is widely accepted that the SDGs form an indivisible structure encompassing environmental, social, and economic dimensions. However, this study deliberately focuses only on the environmental dimension (SDGs 6, 7, 12, 13, 14, 15) in order to gain greater methodological depth and fill a specific gap in the literature on environmental convergence in high-income countries. Analyzing all 17 goals simultaneously would significantly increase the complexity of the econometric models used and could lead to a superficial analysis, reducing the reliability of policy implications. Therefore, our study aims to address the lack of in-depth analysis in this area by comprehensively examining the convergence dynamics of environmental SDGs within the OECD, a group with high environmental awareness.

In our study, since the OECD group of countries has the largest production volume and is sensitive to the environment, achieving SDG globally would be easier. Therefore, the indices for SDG 6, 7, 12, 13, 14, and 15 related to the environment in OECD countries were considered as the general SDG index data set. This data set uses 24 observations collected from 2000 to 2023. The unit root test of Payne et al. (2022) has been used to determine the convergence of these goals. Some of the main reasons for using this test are its different approach than traditional methods by addressing structural breaks and cross-correlations simultaneously. It provides country-based results in panel data analyses where many countries are analyzed, more accurate results are obtained; and finally, it brings a breath of fresh air to the analysis by using the panel analysis of non-stationarity in idiosyncratic and common components (PANIC) procedure initiated by Bai & Ng (2004).

This study makes an important and original contribution to the convergence analysis literature. Empirical studies on convergence generally fall into two main categories: The first category consists of studies that aim to determine whether the groups of countries being analyzed exhibit a general tendency toward absolute or conditional convergence (whether the series moves toward a single equilibrium over time). The second category consists of studies that examine whether countries form convergence clubs with similar characteristics or whether they converge toward a specific country/standard. However, most convergence analyses in the literature evaluate the convergence of the series toward the mean or a general trend, but do not sufficiently address the differing convergence expectations of countries based on their performance, especially in indicators considered *positive* (such as SDG index values). In series such as SDG index values, which are considered positive from an economic or environmental perspective, it is desirable for countries that perform above mean to differentiate themselves at their own successful levels or move toward (or away from) the leading group, while countries that remain below mean and have development potential converge toward the mean or the leading group. In this regard, our study will fill this important gap in the literature by evaluating each country's individual convergence dynamics relative to a specific reference standard (for instance, the OECD mean or the best-performing countries), and by separately analyzing both converging and diverging countries and the potential underlying causes of these behaviors, thereby distinguishing itself from other convergence studies in the literature.

Our study consists of six sections. Following the introduction, the second section is the literature review, where the related studies are investigated; the third section is the methodology; the fourth section is the econometric analysis, where the convergence analysis of the SDG indices is performed; the fifth section is the discussion; and the last section, the conclusion, includes the evaluation of the results and policy recommendations.

2. Literature review

The convergence of many economic and environmental series has been analyzed in OECD countries. For instance, Agudelo-Botero et al. (2025) investigated the convergence of the burden of disease of the elderly in OECD countries. The study in question revealed a convergence trend in the relevant criteria in this field among OECD countries. Jeon et al. (2024) investigated the convergence of artificial intelligence investments and robotics in several countries including OECD countries. In the study, it was concluded that artificial intelligence investments converged. André et al. (2024) investigated the convergence of long-term housing prices in 18 OECD countries and found some convergence in real house prices in the euro area, but no evidence that it strengthened after the introduction of the euro. Similarly, Pan & Matsuki (2024) investigated the convergence of house prices for OECD countries. The study concluded that there is a trend of convergence in 11 out of 12 OECD countries.

There are few studies examining SDG convergence among OECD countries. Among these studies, Eleftheriou et al. (2024) analyzed the convergence of the Sustainable Development Index (SDI) of 137 countries using data from 1990 to 2019. The analysis concluded that the US, Canada, and OECD countries are in the same convergence club. Solarin et al. (2023), with reference to the 12th SDG, investigated the convergence of nitrogen oxide in 20 OECD countries using data from 1820 to 2019. The study specifically indicated a lack of nitrogen oxide convergence due to light oil consumption. Bigerna et al. (2021) analyzed 176 countries, including OECD countries, with reference

to Goal 7 of the SDG. Based on the analysis, policy recommendations were made to ensure convergence for the world in general.

Bektas & Ursavas (2023) examined the convergence of the ecological footprint for OECD countries between 1981 and 2015. The results of the analysis show that OECD countries did not converge to the same steady-state levels in terms of their footprint levels. Solarin (2023) investigated the convergence of the per capita emissions of non-methane volatile organic compounds in 20 OECD countries. According to the results of the study, which used data for the period between 1820 and 2019, there was stochastic convergence both in general and in agriculture, industry, trade, and waste sectors. Solarin et al. (2022) analyzed the convergence of ammonia emissions using the data from 37 OECD countries for the period 1750-2019. It was concluded that ammonia emissions do not exhibit stochastic convergence. Solarin & Tiwari (2020) analyzed the sulfur dioxide convergence of 32 OECD countries. There is sulfur dioxide convergence among OECD countries. Yilanci & Gorus (2021) analyzed clean energy convergence for 30 OECD countries using data for the period 1965-2017. There is almost no convergence among OECD countries. Erdogan and Acaravci (2019) analyzed carbon emission convergence using data from OECD countries from 1960 to 2014. Carbon emission convergence is valid in OECD countries. Solarin et al. (2018) analyzed the convergence of renewable energy consumption for 27 OECD countries. In the study, convergence was found in 8 countries according to parametric test results, and in 14 countries according to semi-parametric test results, while no convergence was detected in 13 countries. Parker and Liddle (2017) analyzed the convergence of energy efficiency, using data from a panel of 23 low and middle-income countries and 10 OECD countries. In the results of the analysis, four clubs were identified for economy-wide energy efficiency and six clubs for energy efficiency in the manufacturing sector. Another result of the study is that OECD member countries are in the same category as better-performing countries. Acar & Lindmark (2017) investigated the CO_2 emission convergence of OECD member countries by emission source. According to the results of the study, which was analyzed for two different periods, 1973-1991 and 1992-2010, oil-based CO_2 emissions showed stronger convergence behavior until 1991. Fallahi & Voia (2015) investigated the per capita energy use of 25 OECD countries for the period 1960-2012 using convergence analysis. According to the results of the study, convergence was detected in 13 out of 25 countries, but not in the remaining 12 countries. Camarero et al. (2013) investigated convergence in eco-efficiency in 22 OECD countries between 1980-2008, taking into account three air pollutants that represent the impact of economic activity on the environment: carbon dioxide, nitrogen oxides, and sulfur oxides. The analysis found that both the most eco-efficient countries and the worst countries tended to form convergence clubs. Meng et al. (2013) analyzed the convergence of per capita energy use of 25 OECD countries for the period from 1960 to 2010. Per capita energy consumption data converged among OECD countries. Kiran (2013) analyzed the convergence of energy intensity for 21 OECD countries for the period 1980-2010. Energy intensity convergence was found in 9 out of 21 OECD countries. Mulder & de Groot (2012) conducted a convergence analysis using energy intensity data in 50 sectors of 18 OECD countries. Convergence in service sectors is stronger than convergence in manufacturing sectors.

The reviewed literature shows that there are many studies analyzing the convergence of OECD countries in environmental or other areas. However, the convergence of environmental SDG using index values has not been investigated. We believe that our study will fill this gap in the literature.

3. Data and methodology

The variables used in the study are the SDG Index Scores, which are compiled by combining raw indicators for the relevant SDG and published annually by the Sustainable Development Report (SDG Index). For each goal examined (General SDG Index, SDGs 6, 7, 12, 13, 14, and 15), these scores are aggregate/composite measures indicating the degree to which countries are achieving the respective targets. In other words, these index scores represent a single numerical value indicating how close each country is to the relevant SDG target. This approach allows for an econometric analysis of countries' general performance toward complex SDG targets, rather than focusing on a single indicator.

The focus of our study is to test the convergence of the SDGs using data covering the period 2000-2023 in OECD countries. For this purpose, we use the Lagrange Multiplier (LM) unit root test with two breaks, developed by Lee & Strazicich (2003), and the test by Payne et al. (2022), which adapts the PANIC procedure developed by Bai & Ng (2004). The LM test of Lee & Strazicich (2003) does not show spurious rejections under the H_0 hypothesis, allows for structural breaks under the null and alternative hypotheses. Augmented procedure versions indicate that LM tests also exhibit good size properties under strong serial correlations. At the same time, unit root tests that only consider cross-correlations and do not allow for structural breaks can lead to a loss of statistical power. The new PANIC unit root test developed by Payne et al. (2022), is particularly preferred in this study as it provides more realistic results by reducing bias and retaining power. The data generation process based on the unobservable component representation is as follows:

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + \varepsilon_t \quad (1)$$

Table 1. General SDG Index Score Convergence

	Two Level Breaks Model				Two Trend Breaks Model			
Country	LM Stat.	P. Value	Break 1	Break 2	LM Stat.	P. Value	Break 1	Break 2
Australia	-2.94*	0.08	2012	2015	-3.64	0.34	2012	2015
Austria	-2.78*	0.09	2008	2016	-4.45	0.13	2008	2016
Belgium	-0.68	0.98	2007	2013	-3.76	0.30	2007	2013
Canada	-1.04	0.92	2011	2015	-4.03	0.21	2012	2016
Switzerland	-2.68	0.12	2010	2016	-3.61	0.35	2010	2016
Chile	-1.07	0.96	2007	2013	-2.64	0.75	2006	2013
Colombia	-0.65	0.98	2007	2012	-3.10	0.58	2007	2012
Costa Rica	-2.32	0.26	2009	2016	-2.68	0.73	2006	2009
Czechia	-1.29	0.87	2011	2016	-3.20	0.53	2011	2016
Germany	-2.03	0.40	2007	2014	-1.71	0.99	2011	2014
Denmark	-1.99	0.43	2011	2014	-2.87	0.65	2011	2014
Spain	-1.60	0.68	2008	2014	-3.15	0.52	2008	2014
Estonia	-2.41	0.20	2009	2015	-2.53	0.79	2009	2014
Finland	-3.15**	0.05	2008	2011	-3.40	0.41	2008	2011
France	-0.36	1.00	2007	2011	-2.17	0.89	2007	2011
United Kingdom	-3.86**	0.01	2009	2015	-3.50	0.39	2009	2015
Greece	-2.63	0.15	2009	2011	-2.68	0.73	2009	2012
Hungary	-1.93	0.46	2007	2015	-2.45	0.82	2007	2015
Ireland	-2.09	0.32	2006	2015	-2.36	0.85	2013	2016
Iceland	-1.68	0.62	2008	2015	-1.80	0.98	2006	2009
Israel	-2.26	0.26	2012	2015	-3.28	0.46	2013	2016
Italy	-2.14	0.32	2008	2014	-2.78	0.73	2010	2014
Japan	-1.90	0.48	2007	2011	-3.39	0.45	2007	2014
Korea Rep.	-2.22	0.30	2014	2016	-3.62	0.35	2007	2016
Lithuania	-1.61	0.68	2007	2011	-3.40	0.41	2007	2011
Luxembourg	-1.93	0.46	2006	2012	-1.97	0.96	2006	2011
Latvia	-3.05**	0.05	2006	2013	-1.14	1.00	2006	2009
Mexico	-1.41	0.75	2009	2014	-1.89	0.97	2009	2015
Netherlands	-1.03	0.93	2006	2010	-2.89	0.65	2006	2016
Norway	-2.98*	0.06	2007	2016	-2.68	0.73	2007	2013
New Zealand	-1.08	0.95	2011	2015	-0.82	1.00	2011	2016
Poland	-2.34	0.25	2006	2015	-2.51	0.80	2006	2015
Portugal	-3.17**	0.04	2007	2013	-1.63	0.98	2007	2016
Slovak Republic	-2.91*	0.08	2010	2013	-2.49	0.81	2010	2013
Slovenia	-2.28	0.27	2011	2013	-2.88	0.66	2011	2015
Sweden	-1.02	0.97	2009	2012	-1.53	1.00	2006	2009
Türkiye	-2.02	0.36	2007	2013	-1.54	0.98	2006	2013
United States	-1.76	0.52	2006	2014	-2.62	0.76	2006	2014

Note: * and ** indicate critical values at the 10% and 5% significance levels, respectively.

The above equation shows the estimation equation of the regression that takes into account two structural breaks in the Lee & Strazicich (2003) test. *t*= 2 represents the number of structural breaks, and y_1 and Z_t are the coefficients representing the first observation.

$$\tilde{S}_t = y_t - \tilde{\psi} - Z_t\tilde{\delta} \quad (2)$$

$$\tilde{\psi} = y_1 - Z_1\tilde{\delta} \quad (3)$$

$\tilde{S}_{t-1}$ refers to the series decomposed by Equations (2) and (3).

Payne et al. (2022), by adding structural breaks and factors to the Lee and Strazicich (2003) test, developed an alternative panel model as presented in Equation 4:

$$y_{it} = \delta_i' Z_{it} + \pi_i F_t + e_{it}, e_{it} = \beta_i e_{i,t-1} + \varepsilon_{it}, i = 1, \dots, N;\ t = 1, \dots, T \quad (4)$$

Here, *i* is the cross-sectional unit, Z_{it} is one or two structural breaks, F_t is an $r \times 1$ vector of unobserved common factors, and π_i is the factor loadings that capture the responses of each cross-sectional unit to the common factors.

$$\Delta y_{it} = \delta_i' \Delta Z_{it} + \pi_i' \Delta F_t + \Delta e_{it} \quad (5)$$

Equation 5 estimates the break points and factor terms using the first differences of the variables.

The following equation is used to estimate each *i*'th cross-section unit:

$$\Delta y_{it} = \delta_i' \Delta Z_{it} + w_{it}^* \quad (6)$$

The variable ΔZ_{it} is used to identify the optimal break points.

$$q_{it} = \Delta y_{it} - \delta_i' \Delta Z_{it} \quad (7)$$

The q_{it} has zero mean and a pure factor structure defined as in Equation 8.

$$q_{it} = \pi_i' f_t + \eta_{it}, \quad (8)$$

Equation (9) is used for information criteria and Equation (10) for parameter estimates.

$$\xi_{it} = \Delta y_{it} - \hat{\pi}_i' \hat{f}_t \quad (9)$$

$$\xi_{it} = \delta_i' \Delta Z_{it} + w_{it}^{**} \quad (10)$$

Payne et al. (2022) estimated the following equation using the above factor structures, information criteria and parameter estimates.

$$\Delta y_{it} = \gamma_i + \beta_i \tilde{S}_{i,t-1}^{*} + \delta_i' \Delta Z_{it} + \pi_i' \hat{f}_t + \sum_{s=1}^{k_i} c_{is} \Delta \tilde{S}_{i,t-s} + v_{it} \quad (11)$$

The optimal augmented terms of $\Delta \tilde{S}_{it}$ are included to correct for autocorrelations. $\tilde{S}_{i,t-1}^{*}$ denotes the transformation of the series, $\hat{f}_t$ denotes the factor estimated using the optimal number of factors.

4. Empirical findings

In the study, the index values of Goals 6, 7, 12, 13, 14, and 15 (related to the environment) and the index values of the general SDG were used (Sustainable Development Report, 2025). Austria, Czechia, Hungary, Luxembourg, the Slovak Republic, and Switzerland which they do not have SDG 14 index values.

Table 2. SDG 6 Index Score Convergence

	Two Level Breaks Model				Two Trend Breaks Model			
Country	LM Stat.	P. Value	Break1	Break2	LM Stat.	P. Value	Break 1	Break 2
Australia	-2.27	0.24	2007	2010	-1.69	0.97	2007	2010
Austria	-3.78**	0.01	2006	2008	-3.27	0.50	2006	2011
Belgium	-0.37	1.00	2007	2010	-3.22	0.49	2007	2015
Canada	-1.14	0.93	2006	2009	-1.11	1.00	2006	2009
Switzerland	-0.20	1.00	2010	2013	-1.99	0.93	2010	2013
Chile	-0.39	0.99	2008	2011	-2.29	0.90	2008	2011
Colombia	-0.80	1.00	2008	2011	-2.94	0.66	2008	2011
Costa Rica	-2.71	0.10	2009	2016	-1.43	0.99	2009	2016
Czechia	-3.78**	0.01	2008	2012	-2.64	0.78	2006	2012
Germany	-0.23	1.00	2006	2009	-1.50	0.98	2006	2009
Denmark	-3.92**	0.01	2006	2012	-2.21	0.92	2006	2012
Spain	-1.33	0.84	2009	2012	-4.58	0.11	2009	2012
Estonia	-0.88	0.99	2009	2012	-3.47	0.39	2009	2012
Finland	-3.74**	0.01	2010	2016	-4.57	0.12	2010	2016
France	-2.24	0.25	2008	2010	-4.33	0.15	2006	2010
United Kingdom	-1.53	0.73	2006	2014	-2.61	0.80	2006	2014
Greece	-1.84	0.52	2008	2010	-2.40	0.84	2007	2012
Hungary	-0.74	0.99	2008	2011	-3.81	0.29	2008	2011
Ireland	-2.20	0.31	2010	2013	-2.39	0.87	2010	2013
Iceland	-2.06	0.38	2007	2011	-2.51	0.80	2007	2010
Israel	-1.08	0.91	2008	2016	-3.93	0.25	2008	2016
Italy	-1.93	0.43	2008	2011	-1.48	0.98	2008	2011
Japan	0.68	1.00	2008	2011	-2.15	0.92	2008	2011
Korea Rep.	-1.07	0.94	2007	2009	-2.66	0.78	2007	2010
Lithuania	-1.92	0.44	2008	2014	-2.92	0.67	2012	2016
Luxembourg	-4.96***	0.00	2006	2012	-1.25	0.99	2009	2012
Latvia	-3.26**	0.03	2006	2011	-3.12	0.56	2006	2011
Mexico	-0.77	1.00	2011	2013	-6.00**	0.02	2011	2016
Netherlands	-1.43	0.79	2011	2015	-3.15	0.52	2007	2011
Norway	-1.88	0.47	2007	2014	-2.44	0.82	2007	2012
New Zealand	-1.78	0.50	2011	2013	-3.99	0.24	2011	2016
Poland	-0.64	0.99	2008	2010	-2.62	0.76	2008	2015
Portugal	1.63	1.00	2006	2009	-2.17	0.93	2006	2010
Slovak Republic	-2.28	0.23	2010	2015	-0.79	1.00	2010	2015
Slovenia	-1.84	0.52	2009	2011	-2.92	0.62	2008	2011
Sweden	-0.72	0.99	2009	2012	-2.62	0.79	2008	2015
Türkiye	-2.25	0.29	2009	2013	-2.88	0.66	2007	2013
United States	-3.14**	0.04	2011	2014	-2.66	0.74	2011	2014

Note: ** and *** indicate critical values at the 5% and 1% significance levels, respectively.

The results regarding general SDG index convergence, based on data for OECD countries covering the 2000-2023 period, are presented in Table 1. Countries with convergence in the two-level break model are shown in bold.

Accordingly, Australia, Austria, Norway, and the Slovak Republic are significant at the 10% level, while Finland, the United Kingdom, Latvia, and Portugal are significant at the 5% level. These significance levels indicate that there is General SDG Index convergence in Australia, Austria, Finland, United Kingdom, Latvia, Norway, Portugal, and the Slovak Republic.

The convergence results for the SDG 6 index, compiled using data from OECD countries for the period 2000-2023, are presented in Table 2. Countries with convergence in the two-level break model or the two-trend break model are shown in bold. According to the two-level break model, 5% significance is found in Austria, Czechia, Denmark, Finland, Latvia and United States, 1% in Luxembourg, and 5% significance in Mexico according to the two-trend break model. These results indicate that there is SDG 6 index convergence in Austria, Czechia, Denmark, Finland, Luxembourg, Latvia, Mexico, and the United States.

Table 3. SDG 7 Index Score Convergence

	Two Level Breaks Model				Two Trend Breaks Model			
Country	LM Stat.	P. Value	Break 1	Break 2	LM Stat.	P. Value	Break 1	Break 2
Australia	-0.08	1.00	2009	2012	-3.05	0.58	2009	2012
Austria	-2.15	0.34	2006	2011	-2.95	0.61	2006	2011
Belgium	-1.65	0.65	2008	2015	-3.48	0.41	2008	2015
Canada	-1.60	0.68	2008	2012	-2.59	0.77	2007	2010
Switzerland	-2.29	0.23	2006	2008	-1.91	0.97	2006	2009
Chile	0.82	1.00	2006	2009	-3.26	0.51	2006	2009
Colombia	0.77	1.00	2008	2016	-2.13	0.93	2008	2016
Costa Rica	-1.62	0.61	2010	2015	-1.14	1.00	2010	2015
Czechia	-1.18	0.87	2010	2014	-4.46	0.13	2009	2014
Germany	-0.91	0.99	2006	2008	-3.21	0.49	2006	2009
Denmark	-2.30	0.26	2013	2016	-2.79	0.69	2013	2016
Spain	-3.47**	0.02	2009	2016	-3.42	0.43	2009	2016
Estonia	-0.45	0.99	2009	2011	-3.93	0.25	2009	2013
Finland	-1.16	0.93	2008	2011	-3.10	0.54	2008	2015
France	1.72	1.00	2007	2009	-3.40	0.41	2009	2012
United Kingdom	-2.06	0.36	2008	2011	-2.57	0.78	2008	2011
Greece	0.06	1.00	2009	2012	-5.53**	0.03	2009	2013
Hungary	-1.95	0.39	2006	2013	-2.55	0.78	2006	2013
Ireland	-2.46	0.20	2010	2016	-3.49	0.40	2010	2016
Iceland	-1.18	0.87	2008	2011	-3.46	0.42	2008	2011
Israel	-0.74	1.00	2008	2011	-3.23	0.52	2008	2011
Italy	-0.46	1.00	2007	2012	-0.66	1.00	2010	2013
Japan	0.39	1.00	2008	2011	-2.68	0.73	2008	2011
Korea Rep.	-1.41	0.80	2008	2011	-1.39	1.00	2008	2011
Lithuania	-0.58	0.99	2009	2014	-1.15	1.00	2009	2014
Luxembourg	-2.35	0.25	2010	2012	-2.86	0.66	2008	2012
Latvia	-3.59**	0.02	2008	2016	-4.70	0.10	2008	2016
Mexico	-1.39	0.81	2008	2016	-2.07	0.92	2008	2011
Netherlands	0.38	1.00	2009	2011	-3.16	0.55	2010	2013
Norway	-1.59	0.69	2008	2015	-1.79	0.96	2008	2011
New Zealand	-2.79*	0.09	2011	2016	-2.78	0.69	2007	2011
Poland	-1.95	0.45	2010	2015	-3.18	0.51	2010	2015
Portugal	-1.40	0.80	2014	2016	-2.94	0.66	2012	2016
Slovak Republic	-2.19	0.27	2007	2016	-2.14	0.92	2013	2016
Slovenia	-1.83	0.50	2012	2014	-3.70	0.33	2011	2014
Sweden	-3.61**	0.02	2011	2014	-2.01	0.93	2011	2014
Türkiye	-2.72	0.12	2009	2013	-3.24	0.50	2013	2016
United States	-3.15**	0.05	2010	2015	-4.11	0.21	2010	2015

Note: * and ** indicate critical values at the 10% and 5% significance levels, respectively.

The convergence results of the SDG 7 index, compiled using data from OECD countries for the period 2000-2023, are presented in Table 3. Countries with convergence in the two-level break model or the two-trend break model are shown in bold. According to the two-level break model, Spain, Latvia, Sweden, and the United States show significance at the 5% level. New Zealand shows 10% significance, whereas Greece shows 5% significance according to the two-trend break model. Therefore, SDG 7 index convergence is found in Spain, Greece, Latvia, New Zealand, Sweden, and the United States.

Table 4. SDG 12 Index Score Convergence

	Two Level Breaks Model				Two Trend Breaks Model			
Country	LM Stat.	P. Value	Break 1	Break 2	LM Stat.	P. Value	Break 1	Break 2
Australia	-2.00	0.39	2010	2013	-7.37***	0.00	2007	2011
Austria	-0.48	1.00	2011	2014	-3.10	0.58	2011	2014
Belgium	-1.36	0.83	2007	2015	-3.22	0.52	2007	2015
Canada	-3.15**	0.05	2009	2014	-4.81*	0.09	2007	2014
Switzerland	-1.77	0.57	2007	2010	-1.81	0.98	2007	2010
Chile	-0.96	0.99	2007	2011	-2.41	0.84	2007	2011
Colombia	-1.13	0.94	2008	2011	-3.35	0.46	2008	2016
Costa Rica	-2.70	0.11	2008	2016	-2.91	0.63	2006	2009
Czechia	-2.31	0.24	2012	2014	-2.63	0.79	2011	2014
Germany	-3.00*	0.07	2007	2010	-3.00	0.63	2007	2014
Denmark	-2.41	0.19	2008	2011	-2.82	0.67	2006	2015
Spain	-1.05	0.96	2014	2016	-2.93	0.66	2013	2016
Estonia	-0.90	0.99	2008	2016	-2.49	0.81	2008	2016
Finland	-2.68	0.14	2008	2014	-3.80	0.29	2008	2014
France	-0.08	1.00	2007	2009	-2.14	0.94	2006	2009
United Kingdom	-1.14	0.92	2007	2011	-2.30	0.90	2006	2011
Greece	-0.13	1.00	2009	2011	-2.11	0.93	2009	2012
Hungary	-1.00	0.98	2006	2009	-1.64	1.00	2006	2009
Ireland	-1.67	0.64	2009	2015	-2.76	0.70	2006	2013
Iceland	-2.32	0.24	2007	2016	-2.45	0.85	2006	2009
Israel	-1.19	0.87	2008	2012	-2.57	0.78	2006	2012
Italy	-0.69	1.00	2011	2014	-2.42	0.83	2007	2011
Japan	-1.29	0.87	2007	2011	-0.03	1.00	2007	2011
Korea Rep.	-1.68	0.63	2008	2013	-3.39	0.45	2008	2013
Lithuania	-3.42**	0.02	2007	2014	-4.51	0.12	2007	2014
Luxembourg	-0.93	0.99	2011	2015	-1.83	0.98	2007	2011
Latvia	-2.99*	0.06	2006	2008	-2.03	0.92	2006	2009
Mexico	-0.92	0.99	2006	2008	-2.44	0.83	2006	2009
Netherlands	-1.61	0.68	2006	2011	-1.85	0.98	2006	2009
Norway	-1.72	0.57	2006	2009	-1.46	1.00	2006	2009
New Zealand	-1.49	0.74	2011	2013	-3.81	0.29	2013	2016
Poland	-3.55**	0.02	2008	2016	-2.53	0.79	2008	2012
Portugal	1.70	1.00	2007	2010	-5.02*	0.07	2007	2012
Slovak Republic	-0.15	1.00	2010	2012	-2.36	0.86	2009	2012
Slovenia	0.16	1.00	2009	2013	-2.94	0.62	2008	2011
Sweden	-0.77	1.00	2009	2013	-3.20	0.54	2009	2016
Türkiye	-3.10**	0.05	2008	2015	-2.25	0.89	2008	2011
United States	-2.31	0.24	2006	2014	-3.13	0.57	2006	2014

Note: *, ** and *** indicate critical values at the 10%, 5% and 1% significance levels, respectively.

The convergence results of the SDG 12 index, compiled using data from OECD countries for the period 2000-2023, are presented in Table 4. Countries with convergence in the two-level break model or the two-trend break model are shown in bold. According to the two-level break model, Germany and Latvia have 10% significance, Lithuania, Poland, and Türkiye have 5% significance. According to the two-trend break model, Australia has 1% significance, and Portugal has 10% significance. Canada has 5% significance according to the two-level break model and 10% significance according to the these significance levels imply that there is SDG 12 index convergence in Australia, Canada, Germany, Lithuania, Latvia, Poland, Portugal, and Türkiye.

The convergence results of the SDG 13 index, compiled using data from OECD countries for the period 2000-2023, are presented in Table 5. Countries with convergence in the two-level break model or the two-trend break model are shown in bold. According to the two-level break model, 5% significance is found in Colombia, while 10% significance is found in France, Türkiye, and the United States. According to the two-trend break model, 10% significance is found in Germany, and in the Netherlands, 1% significance is found according to the two-level break model and 5% significance is found according to the two-trend break model. These results indicate that there is SDG 13 index convergence in Colombia, Germany, France, Netherlands, Türkiye, and the United States.

Table 5. SDG 13 Index Score Convergence

	Two Level Breaks Model				Two Trend Breaks Model			
Country	LM Stat.	P. Value	Break 1	Break 2	LM Stat.	P. Value	Break 1	Break 2
Australia	-1.68	0.60	2006	2013	-3.49	0.41	2007	2013
Austria	-2.50	0.19	2008	2013	-1.90	0.97	2006	2010
Belgium	-2.70	0.13	2008	2014	-3.76	0.30	2008	2014
Canada	-2.29	0.27	2006	2009	-3.70	0.30	2006	2009
Switzerland	-1.89	0.43	2008	2010	-3.89	0.25	2008	2016
Chile	-2.82	0.10	2008	2010	-3.34	0.46	2007	2012
Colombia	-3.58**	0.02	2008	2013	-3.08	0.57	2006	2009
Costa Rica	-1.56	0.66	2008	2013	-2.42	0.83	2006	2009
Czechia	-1.07	0.94	2007	2014	-2.74	0.70	2007	2012
Germany	-1.90	0.42	2006	2009	-4.89*	0.07	2006	2012
Denmark	-1.35	0.82	2012	2015	-2.46	0.85	2012	2015
Spain	-0.67	0.99	2007	2009	-1.67	0.97	2012	2015
Estonia	-0.62	0.98	2007	2014	-2.19	0.91	2006	2009
Finland	-1.73	0.59	2011	2016	-2.02	0.95	2006	2009
France	-2.87*	0.07	2006	2008	-2.13	0.90	2006	2009
United Kingdom	-1.98	0.43	2006	2011	-1.38	0.99	2006	2011
Greece	-1.27	0.83	2006	2009	-3.15	0.54	2009	2016
Hungary	-0.93	0.99	2009	2013	-0.97	1.00	2006	2009
Ireland	-2.34	0.21	2010	2015	-2.42	0.83	2010	2015
Iceland	-1.78	0.54	2007	2011	-2.65	0.78	2007	2011
Israel	-2.17	0.28	2007	2012	-2.58	0.77	2007	2012
Italy	0.84	1.00	2006	2011	-2.25	0.89	2006	2012
Japan	-0.90	0.99	2006	2011	-2.38	0.85	2006	2011
Korea Rep.	-2.31	0.22	2009	2016	-3.31	0.48	2008	2011
Lithuania	-2.11	0.36	2008	2010	-2.62	0.79	2007	2010
Luxembourg	-0.86	0.98	2008	2013	-1.97	0.94	2008	2011
Latvia	0.01	1.00	2006	2010	-2.19	0.91	2006	2010
Mexico	-2.52	0.15	2006	2008	-2.76	0.71	2006	2009
Netherlands	-6.17***	0.00	2006	2010	-5.15**	0.05	2006	2014
Norway	-1.54	0.70	2007	2009	-2.34	0.89	2006	2009
New Zealand	-1.13	0.94	2011	2013	-3.86	0.28	2013	2016
Poland	-1.67	0.63	2008	2016	-2.34	0.89	2006	2009
Portugal	-1.81	0.48	2008	2014	-3.63	0.33	2008	2011
Slovak Republic	-0.70	1.00	2007	2011	-3.38	0.45	2007	2011
Slovenia	-1.21	0.90	2007	2011	-3.12	0.55	2007	2014
Sweden	-2.05	0.34	2009	2016	-1.64	0.97	2009	2016
Türkiye	-3.00*	0.06	2008	2015	-1.32	0.99	2008	2015
United States	-3.00*	0.06	2008	2015	-1.32	0.99	2008	2015

Note: *, ** and *** indicate critical values at the 10%, 5% and 1% significance levels, respectively.

The convergence results of the SDG 14 index, derived using data from OECD countries for the period 2000-2023, are presented in Table 6. Countries with convergence in the two-level break model are shown in bold. According to the two-level break model, 5% significance is detected in the United Kingdom, and Japan, and 1% significance is detected in Slovenia. Therefore, it is concluded that there is SDG 14 index convergence in the United Kingdom, Japan and Slovenia.

Table 6. SDG 14 Index Score Convergence

	Two Level Breaks Model				Two Trend Breaks Model			
Country	LM Stat.	P. Value	Break 1	Break 2	LM Stat.	P. Value	Break 1	Break 2
Australia	-1.44	0.74	2006	2013	-3.29	0.49	2007	2016
Belgium	-1.12	0.93	2010	2013	-2.89	0.65	2010	2013
Canada	-2.38	0.23	2010	2012	-2.00	0.93	2009	2013
Chile	-0.10	1.00	2011	2013	-3.66	0.34	2011	2015
Colombia	-1.97	0.41	2013	2016	0.06	1.00	2012	2016
Costa Rica	-0.93	0.95	2007	2014	-2.09	0.94	2006	2009
Germany	-2.51	0.15	2006	2014	-1.72	0.99	2006	2010
Denmark	-1.12	0.94	2007	2016	-3.77	0.30	2007	2016
Spain	-1.15	0.93	2012	2014	-2.86	0.66	2010	2014
Estonia	-1.79	0.55	2010	2015	-3.23	0.52	2010	2016
Finland	-2.70	0.13	2011	2014	-3.02	0.58	2011	2014
France	-0.84	1.00	2011	2015	-2.07	0.94	2011	2015

	Two Level Breaks Model				Two Trend Breaks Model			
United Kingdom	-3.54**	0.02	2008	2013	-4.41	0.15	2008	2013
Greece	-2.25	0.29	2010	2016	-0.39	1.00	2010	2016
Ireland	-2.30	0.25	2009	2015	-2.78	0.72	2009	2015
Iceland	-2.27	0.28	2010	2016	-3.30	0.45	2007	2012
Israel	-0.67	0.98	2010	2013	-3.14	0.52	2010	2013
Italy	-1.70	0.61	2008	2011	-3.44	0.40	2008	2011
Japan	-3.31**	0.03	2009	2015	-2.27	0.91	2012	2015
Korea Rep.	-1.27	0.87	2006	2011	-3.17	0.55	2006	2011
Lithuania	-0.19	1.00	2008	2010	-4.34	0.15	2007	2010
Latvia	-1.60	0.68	2011	2016	-2.16	0.93	2010	2013
Mexico	0.46	1.00	2010	2014	-1.92	0.94	2010	2014
Netherlands	-2.45	0.19	2006	2011	-1.31	0.99	2008	2011
Norway	-2.21	0.30	2007	2011	-4.21	0.18	2007	2011
New Zealand	-1.45	0.78	2012	2014	-1.84	0.98	2011	2014
Poland	-1.94	0.46	2006	2014	-4.30	0.16	2006	2014
Portugal	-1.45	0.78	2007	2013	-2.52	0.83	2007	2013
Slovenia	-5.04***	0.00	2011	2013	-2.93	0.66	2012	2015
Sweden	-0.38	1.00	2007	2010	-0.31	1.00	2007	2010
Türkiye	-2.07	0.36	2011	2015	-1.53	1.00	2010	2013
United States	-2.07	0.36	2011	2015	-1.53	1.00	2010	2013

Note: ** and *** indicate critical values at the 5% and 1% significance levels, respectively.

Table 7. SDG 15 Index Score Convergence

	Two Level Breaks Model				Two Trend Breaks Model			
Country	LM Stat.	P. Value	Break 1	Break 2	LM Stat.	P. Value	Break 1	Break 2
Australia	-0.85	0.96	2008	2015	-2.83	0.66	2006	2014
Austria	-1.00	0.98	2010	2012	-3.16	0.51	2006	2016
Belgium	-2.14	0.30	2007	2015	-2.16	0.90	2007	2015
Canada	-1.85	0.49	2009	2016	-1.85	0.98	2006	2016
Switzerland	-1.29	0.86	2007	2010	-0.06	1.00	2007	2016
Chile	-1.18	0.92	2008	2012	-2.27	0.91	2006	2016
Colombia	-1.51	0.69	2010	2014	-2.42	0.83	2006	2014
Costa Rica	-0.97	0.94	2009	2016	-1.56	0.98	2006	2009
Czechia	-2.57	0.13	2006	2008	-1.23	0.99	2008	2011
Germany	-0.85	0.98	2008	2010	-5.23*	0.06	2008	2016
Denmark	-1.42	0.75	2011	2016	-2.05	0.95	2006	2015
Spain	-1.39	0.81	2009	2014	-4.63	0.11	2012	2015
Estonia	-1.37	0.83	2007	2009	-1.80	0.98	2006	2016
Finland	-1.60	0.68	2014	2016	-0.10	1.00	2010	2016
France	-0.34	1.00	2006	2013	-2.01	0.95	2006	2013
United Kingdom	-1.06	0.96	2011	2016	-2.24	0.90	2006	2009
Greece	-0.30	1.00	2009	2014	-2.26	0.87	2008	2011
Hungary	-0.54	1.00	2007	2010	-2.75	0.70	2006	2009
Ireland	-1.43	0.79	2006	2009	-2.81	0.69	2006	2016
Iceland	-1.31	0.85	2008	2011	-1.89	0.97	2008	2011
Israel	-1.70	0.61	2006	2008	-1.03	1.00	2006	2016
Italy	-1.26	0.88	2007	2009	-3.62	0.33	2007	2014
Japan	-0.86	1.00	2012	2016	-2.66	0.78	2010	2013
Korea Rep.	0.22	1.00	2007	2011	-2.66	0.75	2007	2016
Lithuania	0.67	1.00	2007	2009	-3.46	0.41	2006	2016
Luxembourg	-1.90	0.45	2007	2014	-5.70**	0.03	2006	2014
Latvia	-1.40	0.79	2007	2010	-1.46	1.00	2006	2009
Mexico	-1.31	0.86	2007	2015	-3.26	0.47	2007	2015
Netherlands	-0.87	1.00	2012	2014	-2.21	0.92	2006	2012
Norway	-0.17	1.00	2007	2009	-5.08*	0.06	2010	2016
New Zealand	0.82	1.00	2008	2011	-2.66	0.74	2006	2016
Poland	-1.77	0.57	2006	2009	-3.00	0.58	2006	2009
Portugal	-0.79	0.99	2007	2010	-1.55	0.99	2007	2010
Slovak Republic	-0.24	1.00	2007	2010	-3.48	0.40	2006	2010
Slovenia	-2.32	0.22	2007	2009	-0.68	1.00	2006	2012
Sweden	-1.13	0.94	2011	2016	-3.03	0.61	2006	2016
Türkiye	-0.91	0.95	2011	2016	-1.54	0.98	2006	2010
United States	-0.91	0.95	2011	2016	-1.54	0.98	2006	2010

Note: * and ** indicate critical values at the 10%, and 5% significance levels, respectively.

The convergence results of the SDG 15 index, compiled using data from OECD countries for the period 2000-2023, are presented in Table 7. Countries with convergence in the two-trend break model are shown in bold. According to the two-trend break model, 10% significance was found in Germany and Norway, and 5% in Luxembourg. These results indicate that there is SDG 15 index convergence in Germany, Luxembourg, and Norway.

5. Discussion

Table 8. Summary of the Country-Specific Results

	Two Level Breaks Model							Two Trend Breaks Model						
Country	General SDG	SDG 6	SDG 7	SDG 12	SDG 13	SDG 14	SDG 15	General SDG	SDG 6	SDG 7	SDG 12	SDG 13	SDG 14	SDG 15
Australia	**X**										**X**			
Austria	**X**	**X**											**NA**	
Belgium														
Canada				**X**							**X**			
Switzerland													**NA**	
Chile														
Colombia					**X**									
Costa Rica														
Czechia		**X**											**NA**	
Germany				**X**								**X**		**X**
Denmark		**X**												
Spain			**X**											
Estonia														
Finland	**X**	**X**												
France					**X**									
United Kingdom	**X**					**X**								
Greece										**X**				
Hungary													**NA**	
Ireland														
Iceland														
Israel														
Italy														
Japan						**X**								
Korea Rep.														
Lithuania				**X**										
Luxembourg		**X**											**NA**	**X**
Latvia	**X**	**X**	**X**	**X**										
Mexico									**X**					
Netherlands					**X**							**X**		
Norway	**X**													**X**
New Zealand			**X**											
Poland				**X**										
Portugal	**X**										**X**			
Slovak Republic	**X**												**NA**	
Slovenia						**X**								
Sweden			**X**											
Türkiye				**X**	**X**									
United States		**X**	**X**		**X**									

In this study, the OECD convergence of the SDG index and Goals 6, 7, 12, 13, 14, and 15 indices was conducted. Unlike standard convergence studies in the literature, based on the objectives of the SDG indices, which are positive indicators, countries are divided into two categories: expected convergence and expected divergence, based on their initial performance relative to the OECD mean (Table 9). This distinction is critical in terms of efforts to achieve the SDG targets. This is because convergence among high-performing countries implies a downward trend in SDG index values, which signals a negative dynamic that conflicts with global goals. Therefore, while countries below mean are expected to converge by closing the gap, countries above mean are expected to diverge from the mean in order to maintain their leadership levels.

The **X** indicates that convergence to the SDGs applies to OECD countries for the 2000-2023 period.

The expected convergence and divergence of countries are given in Table 9.

Table 9. Expectation Table

Indexes	Expected to Divergence	Expected to Converge
SDG General Index	Sweden, Finland, Denmark, Austria, Norway, Germany, France, United Kingdom, Czechia, Slovenia, Hungary, Poland, Japan, Latvia, Switzerland, Iceland, Spain, Slovak Republic, Canada, Ireland, Belgium, Netherlands	Portugal, Estonia, New Zealand, Italy, Lithuania, Greece, Korea Rep., Chile, Australia, Luxembourg, United States, Israel, Costa Rica, Türkiye, Colombia, Mexico
SDG6	Finland, Sweden, Latvia, Austria, Slovenia, United Kingdom, Denmark, Chile, Australia, Greece, New Zealand, Hungary, Netherlands, France, Estonia, Ireland, Spain, Czechia, Canada, Germany, Switzerland	Slovak Republic, United States, Japan, Norway, Luxembourg, Poland, Lithuania, Italy, Portugal, Colombia, Costa Rica, Iceland, Türkiye, Belgium, Korea Rep., Mexico, Israel
SDG7	Iceland, Norway, Sweden, Finland, Latvia, Costa Rica, Austria, New Zealand, Chile, Switzerland, Portugal, Denmark, Canada, Estonia, Slovenia	France, Spain, Colombia, Lithuania, Germany, Italy, Czechia, Greece, Slovak Republic, Hungary, Israel, United States, Türkiye, Japan, Belgium, United Kingdom, Australia, Ireland, Poland, Korea Rep., Netherlands, Mexico, Luxembourg
SDG12	Colombia, Costa Rica, Mexico, Türkiye, Chile, Hungary, Poland, Korea Rep., Portugal, Israel, Latvia, Slovak Republic, Italy, Spain, Greece, Japan, Lithuania, France, Finland	Sweden, United States, Czechia, Canada, United Kingdom, Slovenia, Australia, Germany, New Zealand, Estonia, Iceland, Austria, Belgium, Norway, Netherlands, Ireland, Denmark, Switzerland, Luxembourg
SDG13	Costa Rica, Colombia, Mexico, Türkiye, Chile, Hungary, Portugal, Latvia, Lithuania, Poland, Spain, France, Slovak Republic, Italy, Greece, Sweden, Slovenia, United Kingdom, Japan, Czechia, Israel, New Zealand	Korea Rep., Germany, Austria, Estonia, Finland, Switzerland, Denmark, Iceland, Belgium, United States, Ireland, Canada, Luxembourg, Netherlands, Norway, Australia
SDG14	Finland, Estonia, Chile, Latvia, Norway, Lithuania, Denmark, United Kingdom, Sweden, Slovenia, Ireland, Poland	Germany, Australia, Iceland, United States, Mexico, Greece, Colombia, Canada, Italy, Türkiye, New Zealand, Costa Rica, France, Netherlands, Japan, Korea Rep., Belgium, Spain, Portugal, Israel
SDG15	Latvia, Czechia, Poland, Lithuania, United Kingdom, Hungary, Slovak Republic, Greece, Germany, Slovenia, Italy, Denmark, Finland, Estonia, Ireland, Austria, Portugal, Belgium, Sweden, France	Netherlands, Spain, Costa Rica, Japan, Australia, Norway, Switzerland, Luxembourg, Colombia, Canada, United States, Mexico, Türkiye, Korea Rep., Chile, New Zealand, Israel, Iceland

The general results of the econometric analysis presented in Table 8 are not politically meaningful on their own. Therefore, combining the expected scenarios presented in Tables 8 and 9 makes it possible to identify country-specific important scenarios and reliable policy recommendations. The policies implemented by countries whose expected convergence/divergence scenarios align with econometric results can be considered successful models and presented as examples worldwide.

However, in countries where econometric results do not match expectations, the relevant policies need to be urgently reviewed and reassessed. These inconsistencies point to significant structural or policy implementation challenges. For example, while the Netherlands was expected to deviate from SDG 13 (Climate Action) due to its initially high performance, econometric results show convergence (Table 8, Table 9). This unexpected convergence suggests that the country's current climate action policies (such as high emission reduction targets or renewable energy investments) have developed more slowly than the OECD mean or have failed to maintain their leading position. This deviation may be linked to dependence on carbon-intensive sectors such as agriculture or difficulties in implementing large-scale transformation infrastructure.

The analysis period of this study, spanning from 2000 to 2023, is characterized by significant global events and structural shifts, thus requiring a non-homogenous approach to time series modeling. Specifically, this period includes major financial crises and the unprecedented shock of the COVID-19 pandemic, which temporarily altered environmental priorities and national policy responses, thereby affecting the observed convergence dynamics of the environmental SDGs. It is important to note that the econometric methodology employed in this study, which incorporates Fourier functions and allows for multiple structural breaks, explicitly addresses this non-homogeneity. The determined break dates in the SDG indices of individual countries often coincide with or closely follow these periods of global turbulence. Therefore, the observed convergence/divergence dynamics and especially the misalignment between expectations and results implicitly reflect the policy resilience (or fragility) of each OECD country against such major, non-homogenous temporal shocks.

These observed deviations and inconsistencies with expectations are based on country-specific structural characteristics and policy preferences. While some countries are more successful in integrating environmental regulations with economic growth and investing in green technologies, others face structural barriers such as dependence on

carbon-intensive sectors, ineffective enforcement of environmental legislation, or failure to prioritize environmental goals. Furthermore, external factors such as global economic shocks and developments in environmental technologies also affect countries' capacities to achieve environmental goals in different ways, shaping these convergence or divergence dynamics. This situation necessitates concrete policy reforms such as strengthening carbon pricing mechanisms, increasing renewable energy incentives, ecological taxation, expanding environmental education programs, and improving the investment environment for sustainable development through public-private partnerships in order to prevent deviations that will continue to negatively affect efforts towards global SDG targets.

6. Conclusion

OECD countries hold a significant position globally in terms of population, geography, and economic size. Therefore, achieving the SDG targets in OECD countries is crucial for global success. While the SDGs are considered an inseparable whole encompassing environmental, social, and economic dimensions, this study focuses on the environmental dimension to ensure methodological depth; The General SDG Index of 38 OECD countries and the environment-related targets SDG 6, 7, 12, 13, 14, and 15 (SDG 14 for 32 countries) were subjected to convergence analysis. This deliberate focus has allowed us to comprehensively and thoroughly examine the convergence dynamics in the environmental performance of high-income countries, rather than superficially addressing all 17 goals.

When we look at the studies in the literature where convergence analysis of OECD countries are conducted, it is seen that convergence is generally analyzed without being determined on the basis of countries and general policy proposals are made. This situation may have shortcomings since each policy is likely to yield different results for each country. In our study, it is determined whether the SDG index values of each OECD country are converging or diverging. It is also determined which OECD country is expected to converge or diverge in terms of economic performance. Thanks to the method, which is one of the current econometric methods, the break dates in the SDG indices of each country were also determined.

The findings of our study reveal the structural differences and policy effectiveness underlying the convergence dynamics of OECD countries toward the environmental dimensions of the SDG. Countries whose expected convergence/divergence scenarios align with the results of econometric analysis offer successful policy models in the field of environmental sustainability. The concrete practices of these countries, particularly in terms of green technology investments, sustainable energy transition strategies, effective waste management, and the integration of circular economy principles, serve as *best practice* examples for other countries and should be disseminated in international platforms. On the other hand, in countries where econometric results differ from expectations, relevant environmental policies need to be urgently reviewed and updated. This situation necessitates concrete policy reforms such as strengthening carbon pricing mechanisms, increasing renewable energy incentives, ecological taxation, expanding environmental education programs, and improving the investment environment for sustainable development through public-private partnerships. Otherwise, the observed deviations will continue to negatively impact efforts to achieve global SDG targets. Based on the findings of this study, future studies can be developed by analyzing other SDG.

The empirical analysis period of our study (2000-2023) is characterized by major global shocks that have altered environmental policy priorities, such as the COVID-19 pandemic. This situation may have disrupted the homogeneity of the data series. Therefore, in future studies, when a sufficient number of data points for the post-pandemic period are published, it is suggested that the structural impact of such macro shocks on SDG convergence dynamics be examined in greater depth using pre- and post-pandemic sub-period comparisons as an important area of research.

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