

ENVIRONMENTAL PERFORMANCE DEVELOPMENT IN THE CONTEXT OF ECONOMY STRUCTURE

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Abstract

The development of the economic structure of individual economies changes over time from the perspective of national economic output. Structural changes in national economies have an impact on the importance of individual sectors but they can have further impacts in other areas. One of these areas may be the environmental performance of a country as measured by environmental indicators. These indicators are a tool for assessing sustainable development based on the three main pillars: economic, social, and environmental. The main objective of the paper is to assess how changes in the performance structure of economies affect the development of the environmental performance of individual countries. The analysis focuses on all countries of the European Union. The study uses change over a 10-year period. The result of the analysis groups countries with the same development in the context of the change in the economic structure of individual countries. This study did not show the effect of changing the sectoral structure of the economy on environmental performance. On the contrary, EU countries with a constant sectoral structure as Italy, Germany or Finland have the highest growth in environmental performance over time.

Key words: structural changes, environmental performance, EU countries

JEL Code: O44, Q57

Introduction

The direction of the economy is to some extent determined to the ability of the economy to reduce negative environmental impacts while maximizing the sustainable use of natural resources. This dimension is tracked by the environmental performance of the economy. Higher environmental performance means that the economy achieves its economic objectives while minimizing its harmful impact on the environment. The structure of the economy can have a significant impact on environmental performance. Economies with a high share of the industrial sector may have higher greenhouse gas emissions and waste production, while economies with a higher share of services may have a lower environmental burden. The transition to a lower environmental impact economy often requires a transformation of the

structure of the economy. The main objective of the paper is to assess how changes in the performance structure of economies affect the development of the environmental performance of individual countries.

The national economy of each country is a very complex entity and in terms of economic performance it can also be divided into four sectors - primary, secondary, tertiary and quaternary sectors. The importance of individual sectors in national economies is not constant, but changes over time. The importance of individual sectors is assessed mainly in terms of value added or employment share. The current understanding of a country's economic growth is largely based on the neoclassical growth model of Robert Solow (1956). In this model, capital accumulation is the main factor contributing to economic growth (Cermakova et al., 2021). In developed countries, it is research and development (R&D) activities that are the basis for both economic growth and the engine of change. Technological change and innovations are essential sources of structural change. Measuring environmental performance is not new and the definition of different types of indicators has been the focus of researchers for the last 20 years. In recent years, this effort to measure environmental performance has increased due to a greater environmental focus.

Measuring environmental performance today does not only look at the national level but also at the level of regions (Dusek, 2019), municipalities (Mauro et al., 2021), companies (Mura & Hajduová, 2021) or organisations. In developing these indicators, they take into account complex aspects such as environmental and ecological measures, where the dimensions included in the analysis can be extremely diverse and belong to very different areas of study (Mauro et al., 2021). For example, indicators that focus on the country level include the Human Development Index or the Environmental Performance Index. The Environmental Performance Index (EPI) provides a summary of quality data on the state of sustainability worldwide. Using 40 performance indicators in 11 issue categories, the EPI ranks 180 countries in terms of performance on climate change, environmental health and ecosystem vitality. EPI's overall ranking shows which countries are best addressing the environmental challenges each nation faces. Going beyond the aggregate scores and drilling down into the data to analyse performance by problem category, policy objective, partner group, and country offers even greater value to policymakers (Wolf et al., 2022).

Although input and process indicators are essential for selecting policy solutions in the context of cost-benefit analysis, the ultimate goal is to achieve the stated objectives for the conditions on the ground. Therefore, EPI indicators are results-oriented to the extent of data availability and understanding of causal relationships (Hsu & Zomer, 2016). The problem with

these indicators may be that often these tools are not useful for specific decision making by design (Pham et al., 2020).

1 Data and methodology

The paper focuses on how changes in the structure of economies affect the evolution of environmental performance of individual countries. The change in the structure of the economy is considered in terms of sectors (primary - sector 1 (agriculture, forestry and fishing), secondary - sector 2 (industry + construction), tertiary - sector 3 (services)).

The environmental performance of EU countries is assessed through the EPI composite indicator, which is a registered trademark of Yale University. The analysis focuses on all EU countries. The study uses changes over a ten-year period.

The structure of the economies and the distribution by sector is assessed through the macro indicator Gross value added (GVA), in 2012 and 2022. The percentages in these years were compared to find the change 10 years. EPI scores for EU countries were extracted from the results database (<https://epi.yale.edu/epi-results/2022/component/epi>). The data source for GVA was Eurostat - constant 2015 prices.

The EU countries were divided according to the change in the 10-year structure of the economies, i.e. according to the percentage point change by sector, into 3 groups, namely:

- negative change in percentage (<1),
- very small change in percentage points (0 - 1),
- positive change in percentage points (>1).

Subsequently, the level and change of the 10-year EPI was assessed for these groups of countries. A correlation matrix (Montgomery & Runger, 2007) was used to test the dependence of each variable.

The two-sample Student's t-test was used to test the similarity or dissimilarity of the mean values. File X1 contains the observations of change 10 years change in the share of sector 2 and sector 3 respectively and file X2 contains the observations of change 10 years EPI. The respective means can be denoted μ_1 and μ_2 . We can formulate the null and alternative hypotheses:

H0: $\mu_1 = \mu_2$ (The mean of both sets is the same).

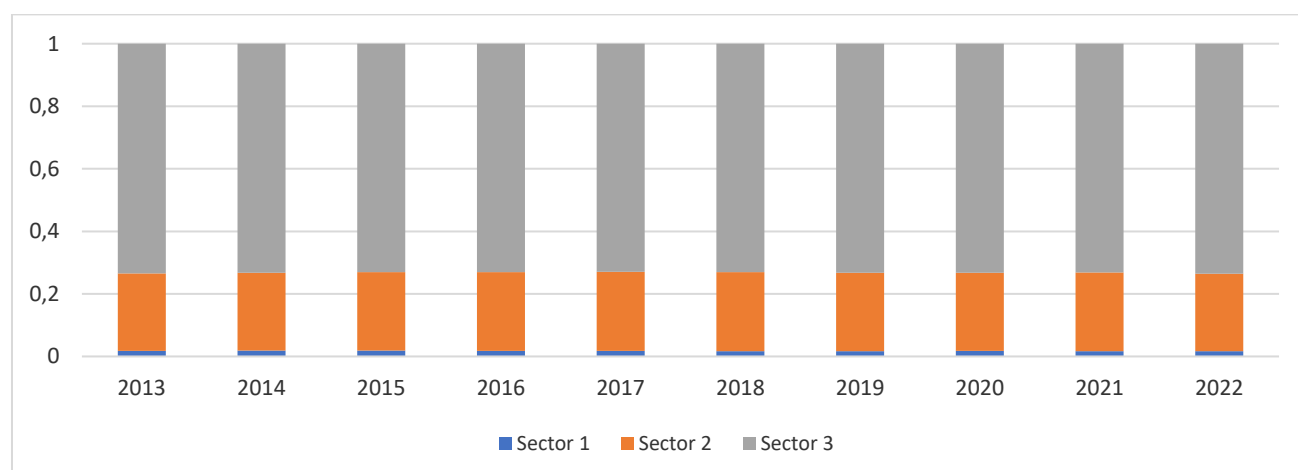
H1: $\mu_1 \neq \mu_2$

The alternative hypothesis says that the average change 10 years of the share of sector 2 and sector 3 is not equal to the average change 10 years of EPI.

2 Results

The importance of individual sectors of the national economy changes over time, but this change is not entirely marked in the short term. First, the analysis focused on the contribution of each sector to GVA in the EU (27 countries). Figure 1 illustrates the contribution of each sector to GVA.

Fig. 1: Structure of GVA in EU (27) countries by sector

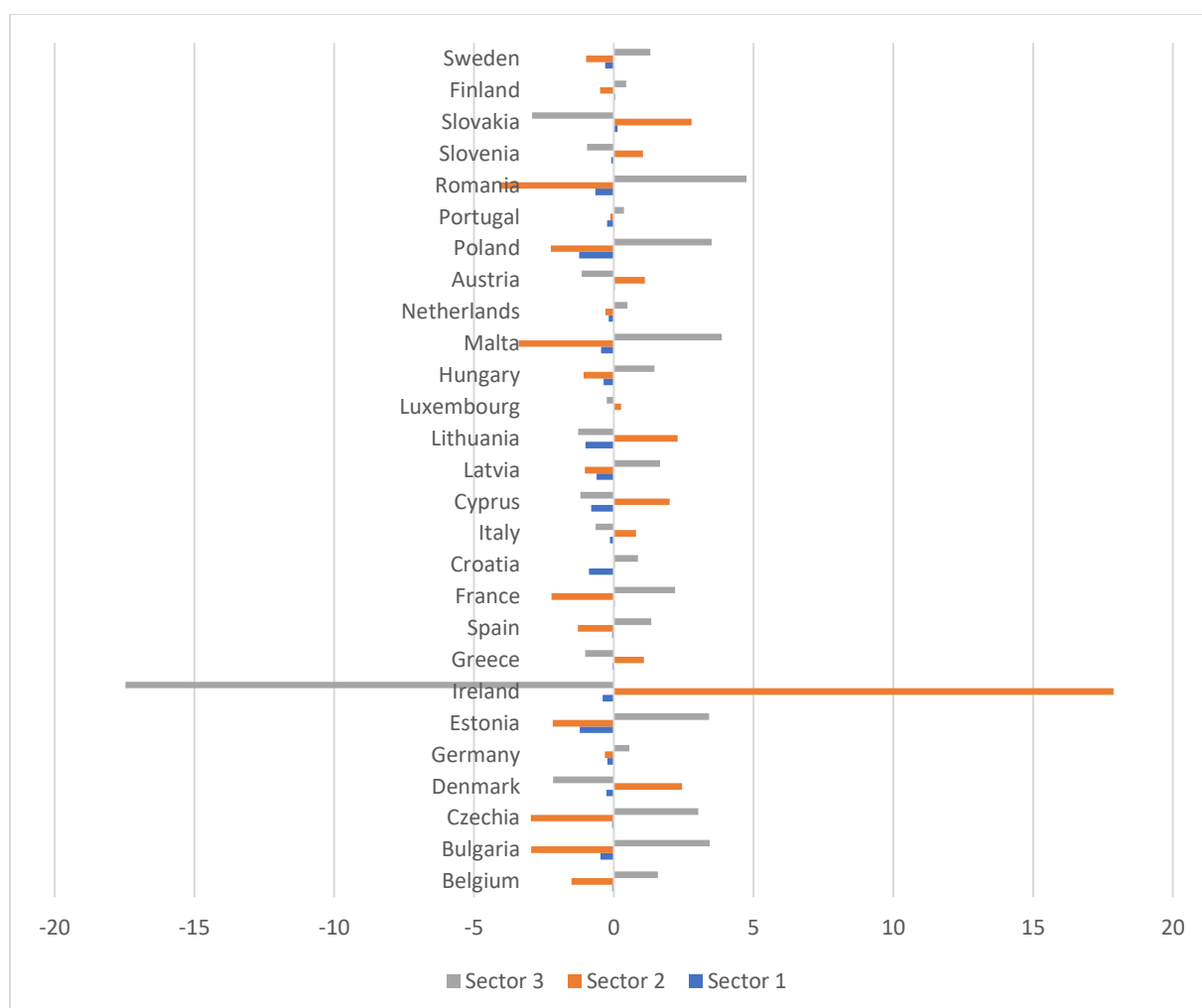


Source: Own calculations based on the data Eurostat

Figure 1 also shows the evolution of the share of each sector in the EU average (27). It is clear that sector 1 accounts for a minimal share (about %) which hardly changes over the 10 years. The secondary sector accounts for a share of about % in the EU and the tertiary sector accounts for the largest part of the GVA of about %, as expected.

A more detailed analysis examined the change in the share of each sector in GVA (Figure 2). Figure 2 shows that the share of the primary sector in GVA is almost unchanged. There are changes in the share of the secondary and tertiary sectors. For some states, the secondary sector is strengthening at the expense of the tertiary sector and vice versa

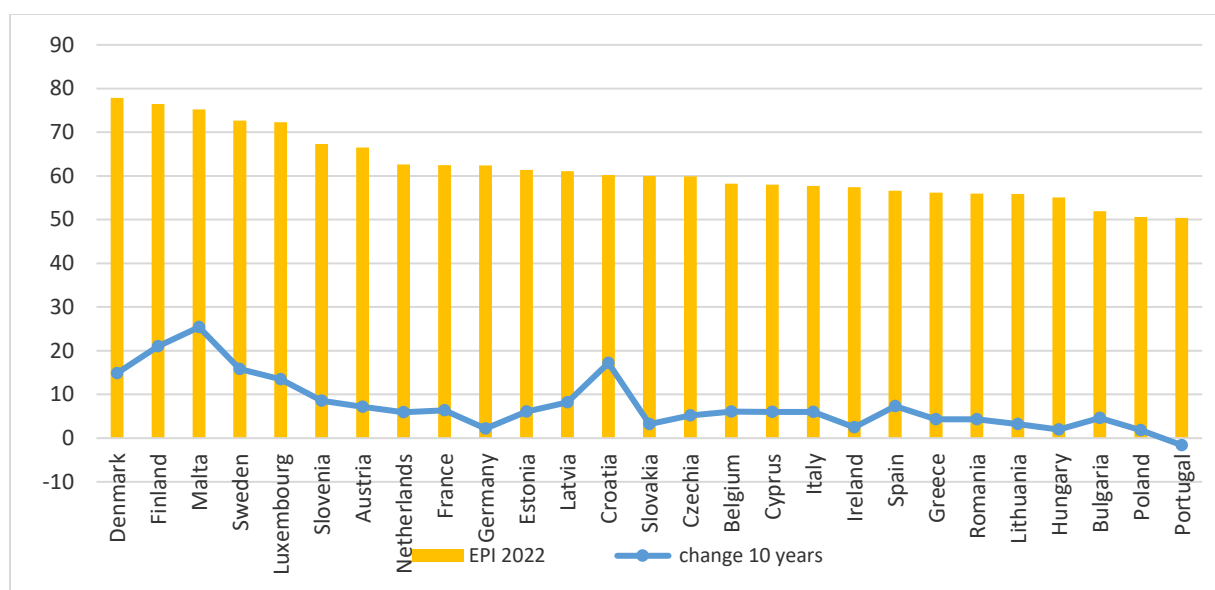
Fig. 2: Ten-year change in GVA structure (in percentage points)



Source: Own calculations based on the data Eurostat

In line with the current trend, it is necessary to monitor not only the performance of national economies, but also the environmental performance of individual economies. It is necessary not only to improve the economic performance, i.e. the competitiveness of individual economies, but also to take sustainability into account. Figure 3 shows the EPI component indicator and its change over 10 years.

Fig. 3: EPI 2022 size by country and its change over 10 years



Source: Own calculations based on the data <https://epi.yale.edu/epi-results/2022/component/epi>

Figure 3 shows the national leaders in environmental performance. The Nordic countries (Denmark, Finland, Sweden) are among the leaders. Of the last 10 years, Malta has improved its EPI score. Of note is Croatia, which is one of the countries that has seen a high increase in EPI scores over the last 10 years. Czechia is in the second half of EU countries. Countries with the lowest EPI scores and the lowest change 10 years EPI scores include Hungary, Bulgaria, Poland, as well as Portugal.

The countries were then divided (grouped) according to the change in the share of GVA in sector 2 and sector 3 (sector 1 accounts for a minimal share of GVA and the changes are not significant, so it was not considered further). For the countries grouped in this way, the average change 10 years EPI was found. The objective was to see whether the change in GVA share also contributed to the change in EPI (Table 1).

Tab. 1: EU country groups by 10-year change in GVA structure (2nd and 3rd sector) and EPI 2022

Sectors	Change 10 years in GVA (in percentage points)	EU countries (27)	Average Change 10 years EPI
Sector 2	negative (<1)	Romania, Malta, Czechia, Bulgaria, Poland, France, Estonia, Belgium, Spain, Hungary, Latvia, Sweden, Finland, Germany, Netherlands, Portugal	7.54
	Low change in GVA (0 -1)	Croatia, Luxembourg, Italy	12.23
	Positive change (>1)	Slovenia, Greece, Austria, Cyprus, Lithuania, Denmark, Slovakia, Ireland	6.24

Sector 3	negative (<1)	Ireland, Slovakia, Denmark, Lithuania, Cyprus, Austria, Greece, Slovenia, Italy, Luxembourg	6.94
	Low change in GVA (0 -1)	Portugal, Finland, Netherlands, Germany, Croatia	8.94
	Positive change (>1)	Sweden, Spain, Hungary, Belgium, Latvia, France, Czechia, Estonia, Bulgaria, Poland, Malta, Romania	7.77

Source: Own calculations based on the data Eurostat

Table 1 shows that states that have experienced only a slight change in GVA structure, both in the share in sector 2 and sector 3, on average have the highest change in 10years EPI. The stable structure of the economies (without significant shifts in the GVA share) gives room for the introduction of innovations towards sustainable development with circularity elements and thus higher environmental performance can be expected. In line with the ESG criteria, which will need to be monitored under the EU EC Regulation to be completed, some countries are better prepared, which may contribute to improving EPI.

Tab. 2: Correlation matrix

	Sector 1	Sector 2	Sector 3	EPI 2022	EPI change 10 years
Sector 1	1,000000	0,068011	-0,164668	0,330742	0,090461
Sector 2	0,068011	1,000000	-0,995264*	-0,024137	-0,177973
Sector 3	-0,164668	-0,995264*	1,000000	-0,008362	0,167138
EPI 2022	0,330742	-0,024137	-0,008362	1,000000	0,825699*
Epi change 10 years	0,090461	-0,177973	0,167138	0,825699*	1,000000

Note: *Signed correlations are significant at the $p < .05000$ level, $N=27$

The above correlation matrix (Table 2) showed a negative relationship between the second and third sectors. In the case of a structural change in favour of the third sector (services), the secondary sector (industry) is reduced. On the other hand, there was no significant association with a change in structure or change in the size of EPI. Subsequently, I would conduct a two-sample t-test, which did not show an association of change 10 years in GVA share by sector with change 10 years EPI.

Conclusion

The area of environmental sustainability is attracting increasing attention in society as the scarcity of non-renewable natural resources hinders sustainable development. The EU 27 are already embarking on a Green Deal policy that will have an economic, social and environmental impact in the coming years (Danila et al., 2022). The paper focuses on an analysis to determine whether changes in the structure of economies affect the evolution of environmental

performance of individual countries. The study does not show that a gradual change in the sectoral structure of national economies has a significant impact on the Environmental Performance Index. The analysis showed that countries with almost constant sectoral share of environmental performance have the highest growth in environmental performance. This effect was displayed in both the secondary and tertiary sectors. A limitation of the research may be the short 10-year time period where changes in structure may be of a longer-term nature. In future research, the authors plan to focus on the area of corporate environmental performance with respect to economic performance.

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