RESOURCE EFFICIENCY AND ECONOMIC GROWTH IN V4 COUNTRIES

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Abstract

An important aspect of economic growth in V4 countries is to increase the competitiveness of their national economies under the conditions of efficient use of the resources. The economic growth of these states is necessary to assess not only from a production point of view but also with regard to the efficiency of natural resource use. The resource productivity measures how efficiently the states uses material resources to produce products and services. The aim of the paper is to assess if the economic growth is compatible with efficient use of natural resources in V4 countries (Czech Republic, Hungary, Poland and Slovakia). Resource efficiency analysis is focused on indicators used to measure resource productivity. The results of analysis is compared with development other economies in EU. The analysis found that resource productivity growth is linked to economic growth in the Czech Republic, Poland and Slovakia. Negative impact on resource productivity had domestic material consumption.

Key words: economic growth, resource productivity, Visegrad countries

JEL Code: D24, O44

Introduction

The basic precondition for sustainable economic growth is the efficient use of the economy's resources. These resources include natural resources. The efficient use of natural resources for the production of goods and services in the economy will be one of the key determinants of economic success in the coming years and at the same time a condition for ensuring well-being for the population. The paper focus to assess if the economic growth is compatible with efficient use of natural resources in V4 countries (Czech Republic, Hungary, Poland and Slovakia).

The performance and effectiveness of inputs in the economy are measured by productivity. Productivity can be divided into labour productivity, capital productivity, and total factor productivity or multifactor productivity. Productivity can be measured at the level of states, regions or companies (Mura & Hajduová, 2021). In addition to the productivity already mentioned in recent years, with regard to resource scarcity and sustainable growth, resource productivity has become increasingly important in measuring productivity. The efficiency with

which an economy uses materials derived from natural resources to create economic value is described by resource productivity (Pineiro-Villaverde & García-Álvarez, 2020). Resource productivity quantifies the relationship between economic activities and the consumption of natural resources and sheds light on whether they go hand in hand or to what extent they are separate. From a technical point of view, productivity is defined as the ratio of output to input. For indicators of resource efficiency as an output, the country's GDP is defined primarily as the input to the annual consumption of a certain natural resource.

According to the Stundziene study (2016), resource productivity is significantly different not only between regions but also between countries. Resource productivity depends on various factors; the most frequently mentioned being national income and R&D expenditure. Productivity is most often measured by resource productivity according to Tannig et al. (2015) using the GDP indicator divided by domestic consumption of materials (DMC). Domestic material consumption measures the total amount of material directly used in the economy. DMC can therefore be defined as the annual amount of raw materials extracted from the domestic territory of the state, plus the physical import of raw materials minus all physical exports of raw materials. Resource productivity (GDP / DMC) is an indicator of the sustainable development of the European Union (EU) for evaluating the effectiveness of policies. Other indicators are also used to evaluate resource productivity. We have four key categories of resource use: material use, land use, water use, energy use and climate change (Behrens et al., 2015). Each of these resources has its own individual indicators that value the effectiveness of use.

Traditional theories of economic growth have analysed technological progress in relation to labour productivity and human capital. Less attention was paid to natural resources (Šetek, 2015). Resource productivity provides information on whether there is a separation between the use of natural resources and economic growth. The basic concept of economic growth is based on the neoclassical production function. This function includes as inputs capital, labour and technical progress, i.e. the level of knowledge or technology (Barro & Sala-i-Martin, 2004). According to Bleischwitz (2010), a comprehensive view of possible resource constraints in eco-economies provides economies with opportunities to increase economic growth. The way to separate economic growth from the consumption of resources in companies is to use the circular economy (Kjaer et al., 2019). The OECD countries study De La Fuente-Mella et al. (2020) showed that countries with low assessments of resource efficiency and economic growth have great potential for increasing productivity in the future.

1 Data and methodology

The paper is focused on the analysis of economic growth is compatible with efficient use of natural resources in Visegrad countries (Czech Republic, Hungary, Poland, Slovakia – V4). The last part of the paper deal with differences between V4 countries. Economic growth was assessed on the basis of the indicator Gross domestic product at market prices, through Chain linked volumes, percentage change on previous period. Resource productivity is an indicator defined as the ratio of Gross domestic product and Domestic Material Consumption. The observed data were from the period (2010-2020). The data source was Eurostat.

Resource productivity (RP = GDP / DMC) was decomposed using the logarithmic method. A multiplicative deterministic causal model was created:

RP = GDP per capita : DMC per capita

Where:

GDP is Gross domestic product in PPS

DMC is Domestic Material Consumption in Tonnes.

The influence of individual factors (GDP per capita, DMC per capita) on the change in resource productivity was analysed in the form of a relative change and an absolute change in the values of the indicator.

Relative change:

$$I_{RC} = I_{RC}/_{GDP\ per\ capita} * I_{RC}/_{DMC\ per\ capita} \quad (1)$$

Absolute change:

$$\Delta RC = {}^{\Delta RC}/_{GDP\ per\ capita} + {}^{\Delta RC}/_{DMC\ per\ capita} \quad (2)$$

$$\Delta RC/_{GDP\ per\ capita} = \Delta RC * \frac{log\frac{GDP\ per\ capita_{2019}}{GDP\ per\ capita_{2014}}}{log\frac{RC_{2019}}{RC_{2014}}} \quad (3)$$

$$\Delta RC/_{DMC\ per\ capita} = -\Delta RC * \frac{log\frac{DMC\ per\ capita_{2019}}{DMC\ per\ capita_{2014}}}{log\frac{RC_{2019}}{RC_{2014}}} \quad (4)$$

2. Results

The economic development of the monitored V4 countries (Table 1) was assessed first. The development of GDP in purchase prices shows that in the years 2012-2013 there is a slight decrease in GDP or stagnation in all monitored countries. The highest decrease was in Hungary (-1.4%) and the Czech Republic (-0.4%). In the following years, growth was recorded in all V4 countries and on average in the EU, the highest growth rates can be observed in 2018 and subsequently in 2019.

Tab. 1: Chain linked volumes, percentage change on previous period (Gross domestic product at market prices)

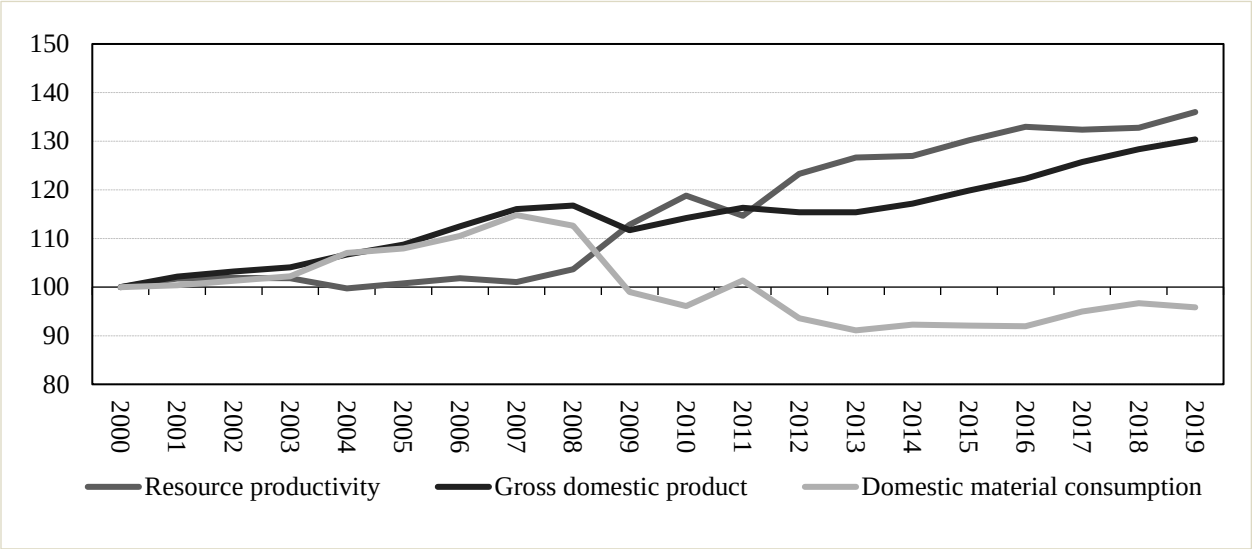
GEO/TIME	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU - 28	2.2	1.8	-0.4	0.3	1.8	2.3	2	2.6	2	1.5	:
Czechia	2.4	1.8	-0.8	0	2.3	5.4	2.5	5.2	3.2	2.3	-5.6
Hungary	1.1	1.9	-1.4	1.9	4.2	3.8	2.1	4.3	5.4	4.6	-5
Poland	3.7	4.8	1.3	1.1	3.4	4.2	3.1	4.8	5.4	4.5	-2.7
Slovakia	5.9	2.8	1.9	0.7	2.6	4.8	2.1	3	3.8	2.3	-5.2

Source: Own calculations based on the data Eurostat

In 2020, there will be a significant decline due to the global crisis due to the Covid pandemic. However, suitable data are not yet available for the evaluation of other monitored indicators in 2020 and the comparison would not be entirely informative. The Resource productivity indicator informs whether economic growth is compatible with more efficient use of natural resources.

Figure 1 shows the development of this indicator and partial indicators for the EU (27 countries), in the years 2000 -2019 in the form of a basic index (year 2000 = 100%). Figure 1 shows that there is a gradual growth of resource productivity in the monitored years, which is accompanied by an increase in gross domestic product, while domestic material consumption, especially since 2012, has been declining compared to 2000.

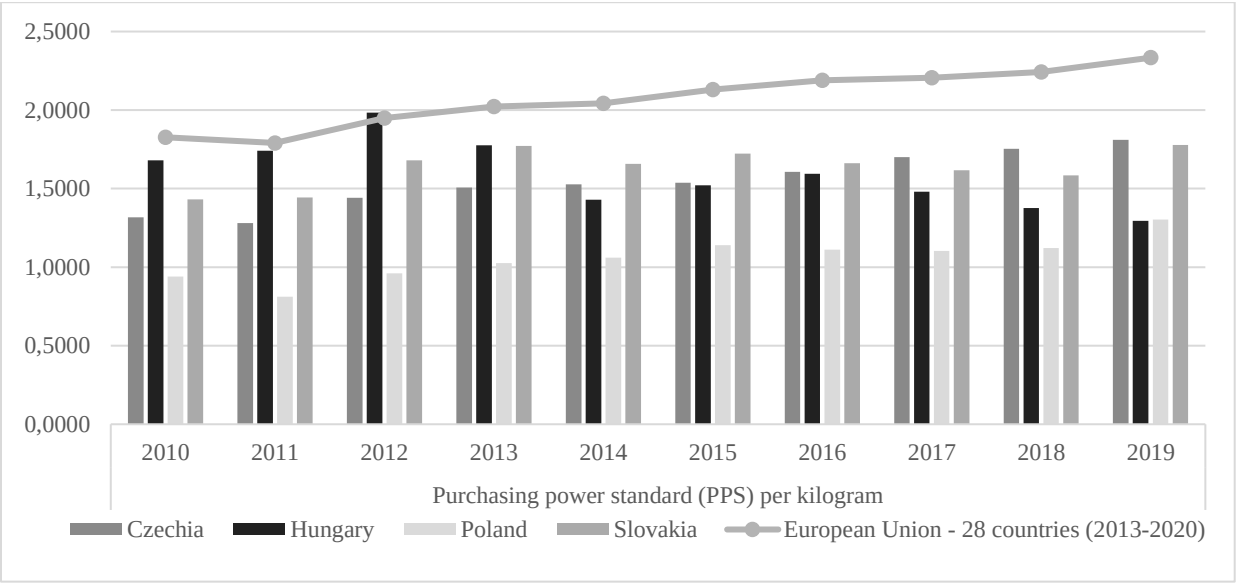
Fig. 1: Development of resource productivity in comparison with GDP and DMC, EU 28, 2000-2019(2000=100%)



Source: Own calculations based on the data Eurostat

The declining value of domestic material consumption, which has been ever lower since 2009 compared to 2000, has also led to a steady increase in resource productivity since that year. In the years of economic decline and stagnation (2009 and 2012 - see Table 1), there are slight fluctuations. Figure 2 shows the development of the value of the resource productivity indicator (in PPS per kilogram) in the monitored V4 countries and on average for the EU.

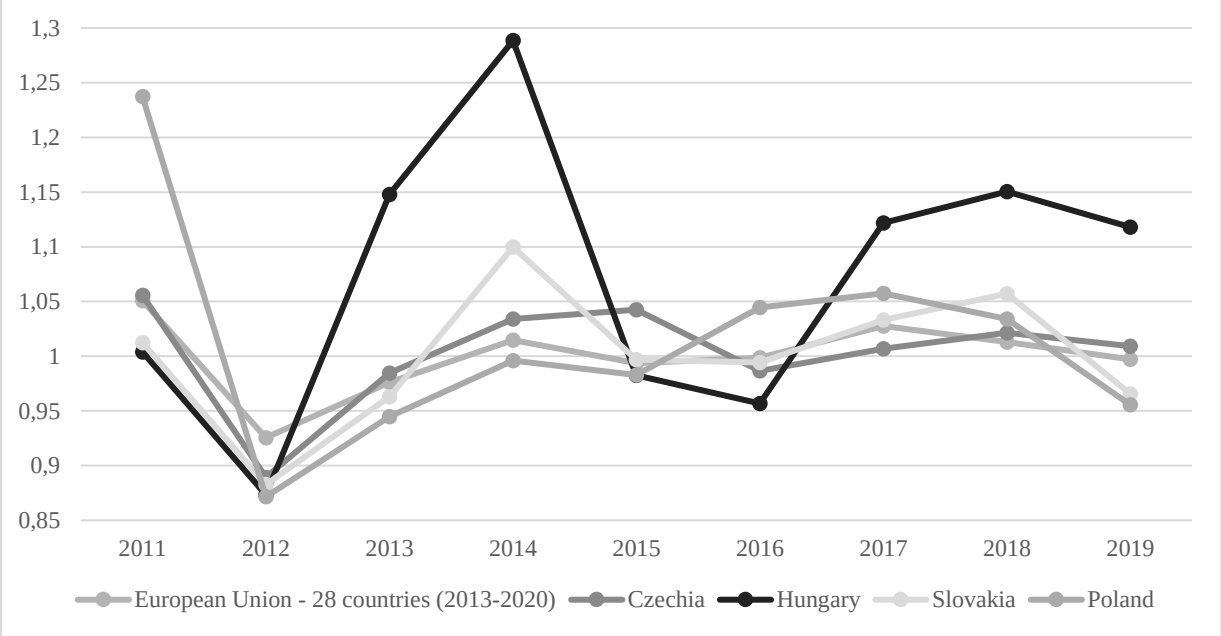
Fig. 2: Development of Resource productivity in countries V4, average EU (28) - years 2010-2019



Source: Own calculations based on the data Eurostat

It is obvious that by 2013, Slovakia and Hungary were closest to the EU average. In the period of growth, the economies of countries according to GDP (table 1), for which we can describe the development since 2014, the monitored countries tend to move away from the EU average and it is clear that Hungary and Poland lag the most behind in recent years. In the Czech Republic, the resource productivity indicator has been growing steadily since 2012 and in 2019 it is at the level of 82.37% of the EU average (Table 2). In Slovakia, the indicator has been stagnant since 2013, but in 2019 it is at 80.95% of the EU average (Table 2). Figure 3 illustrates in more detail the development of DMC in tonnes in the monitored countries and on average in the EU. It is possible to identify countries in which the course of DMC development is not in line with the EU average.

Fig. 3: Index of indicator Domestic Material Consumption



Source: Own calculations based on the data Eurostat

Although the trend of the indicator is the same in all countries (it depends on the growth or decline of the economies), the intensity differs. The largest fluctuations can be recorded in Hungary, where the DMC indicator is still growing year-on-year, especially in the last monitored years.

The change in resource productivity in 2019 compared to 2014 was analysed in more detail in an effort to identify and quantify the factors that influenced this change (Table 2).

Tab. 2: Changes of resource productivity 2019/2014

	Resource productivity		Effect GDP per capita		Effect DMC per capita		Resource productivity (GDP_{PPS}/DMC)	
							(Index EU-27 = 100)	
	Relative change	Absolute change	Relative change	Absolute change	Relative change	Absolute change	2014	2019
EU	1.14	271.5	1.18	333.35	0.97	-61.57	100	100
Czechia	1.18	281.8	1.24	358.59	0.95	-76.78	79.36	82.37
Hungary	0.91	-134.1	1.24	293.96	0.73	-428.00	74.22	58.95
Poland	1.23	241.9	1.26	268.88	0.98	-27.04	55.05	59.26
Slovakia	1.07	121	1.05	87.18	1.02	33.91	86.08	80.95

Source: Own calculations based on the data Eurostat

These results show that in five years, apart from Hungary, there was an increase in the resource productivity indicator in all monitored countries, especially in Poland, which, however, had the lowest value of this indicator in 2014 (an increase of 23%, i.e. 241.9 PPS per 1 ton DMC). GDP per capita had the predominant effect on this growth, which had a positive effect on the resource productivity indicator in all countries. Apart from Slovakia, the effect of DMC per capita on resource productivity was negative. This means that due to the increasing value of DMC per capita, there is a slight decrease in resource productivity due to this factor. The exception is Slovakia, where, on the contrary, decreasing DMC per capita in 2019 in comparison with 2014 increases RC. Although GDP per capita increases in Hungary during the period under review and has a positive effect on DPs, the negative effect of DMC per capita in Hungary prevails and, as a result, resource productivity declines as in a single country.

Conclusion

The efficient use of natural resources is not only an environmental necessity, but also an opportunity for states in terms of their future economic growth. It is necessary to remind here that everything has its limits. The paper focused on assessing how high the economic growth of the V4 countries (Czech Republic, Hungary, Poland and Slovakia) is in line with increasing the efficiency of the use of natural resources. The analysis found that the level of resource productivity in the V4 countries is below the EU 28 average and is between 60 and 80% of the average. The development of economic growth in the V4 countries has very strong similarity tendencies in all V4 countries, which was also confirmed by a study by Pavelka (2016). On the contrary, the development of resource productivity in the V4 countries is not identical.

Stundziene's (2016) study draws attention to different developments in post-communist countries in the area of resource productivity. Resource productivity is growing in the Czech Republic, Poland and Slovakia. This growth is mainly due to the growth rate of GDP and, conversely, there is a slight negative effect of DMC. On the contrary, a significant decline in productivity was found in Hungary, where the DMC indicator deteriorated significantly despite significant GDP growth. Overall, natural resource efficiency is not developing in the same way in the V4 countries. Some influence may be due to a change in the structure of production in the countries concerned. According to Pineiro-Villaverde and García-Álvarez (2020), greater use of the circular economy has a significant positive impact on resource productivity. In 2020 and 2021, due to the epidemic of Covid, a significant short-term deterioration in resource productivity can be expected due to a significant decline in economic performance.

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