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MARCIN MALEC[1], PABLO BENALCAZAR[2]

Assessment of the resource dependence of six central and Eastern European Countries using the Extractives Dependence Index

Introduction

For much of the last two decades, the Central and East European (CEE) economies have experienced a deep structural reform, moving away from a socialist economic system towards a market economy (Roaf et al. 2014). The political situation of the second half of the 20th century had a significant impact on the economic development and competitiveness of these transition countries, when compared with their Western European counterparts (Daian 2012). Some of the key factors for the remarkable progress towards the establishment of a successful market economy in CEE countries have been the introduction of adjustment and stabilization policies and the implementation of policy measures for economic diversification (Cichowicz and Rollnik-Sadowska 2018). Moreover, many of the central and local

✉ Corresponding Author: Pablo Benalcazar ; e-mail: benalcazar@min-pan.krakow.pl
[1] Mineral and Energy Economy Research Institute of the Polish Academy of Sciences, Kraków, Poland; ORCID iD: 0000-0003-4587-9613; e-mail: malec@min-pan.krakow.pl
[2] Mineral and Energy Economy Research Institute of the Polish Academy of Sciences, Kraków, Poland; ORCID iD: 0000-0001-9578-8299; e-mail: benalcazar@min-pan.krakow.pl

governments in CEE countries have invested significant efforts to positively influence the macroeconomic drivers of diversification like net inflows of foreign direct investment (FDI), investment as a share of GDP, and preferential market access.

Over the last few years, the global economic growth and increased demand for commodities such as fuel, mineral, and metals have attracted the attention of researchers to investigate the role that extractive industries play on the inclusive development of low-income and middle-income economies (Gamu et al. 2015). Furthermore, a vast number of studies have been conducted to analyze the structural changes required for resource-dependent economies to achieve long-term development and to understand the synergies between commodities and diversification (Howie 2018; UNFCCC 2016). Yet, the dynamics of resource extraction and resource dependence of regions that have experienced periods of sustained levels of growth have largely been overlooked, especially the Central and Eastern European region –which, just two decades ago, was considered among the poorest in Europe and which currently has a high potential for economic progress.

Poland is one of the CEE countries that is a European Union (EU) member state and that has experienced extraordinary growth for over 20 years. The country is moderately rich in mineral and fossil fuel resources (Nieć et al. 2014; Pietrzyk-Sokulska et al. 2015). According to the Observatory of the Economic Complexity, it is the 24th largest export economy in the world and the 8th largest in the EU (Eurostat 2018; OEC 2019). Historically, Poland has been a notable exporter of nearly 20 mineral commodities including: hard coal and coke, copper, silver, zinc, and sulfur (at least 10% of the national production of these minerals are exported). However, it also imports a significant number of mineral resources including: oil, natural gas, metals and ore concentrates. Incidentally, from a list of over 140 minerals and derivative materials consumed in Poland, nearly 70% are imported from: Russia, Germany, Kazakhstan, Norway, Saudi Arabia and the United States (Smakowski et al. 2015; Szuflicki et al. 2015).

Recently, there has been a growing interest in the development of reliable methods for quantifying the degree of economic dependence of a country (or a region) on revenues from extractive activities (from extractive exports). Two measures have been commonly employed to assess the resource dependence of a country: the ratio of revenues from the export of mineral resources (such as oil, coal, natural gas, sulfur, copper) in GDP (Sachs and Warner 1995), and the share of fiscal contribution of mineral exports in the total export revenue (Baunsgaard et al. 2012). The Extractives Dependence Index (EDI) is a similar measure, but with a higher level of complexity. It consists of three main elements: export revenues (by measuring the export revenue of mineral resources and high-skill and technology-intensive manufactures), fiscal revenues (by measuring the share of fiscal revenues from various extractive activities and non-resource income in the total fiscal revenue), and the value-added contribution of extractives industries as a share of GDP. The EDI measure gives a clear account of a country's dependence on the resource sector; thus, it has been widely used to investigate the resource dependence of countries with high shares of mineral exports and export earnings from extractives (Hailu and Kipgen 2017; Shapiro et al. 2018; Benalcazar et al. 2019).

In this context, this article presents an analysis of the level of resource dependence of Poland and other Central and Eastern European countries which adopted a capitalist market economy and open trade policies after 1989. The analysis shows the dynamic evolution of resource dependence of six countries that joined the European Union in 2004 and 2007. The article is organized as follows. Section 2 briefly presents the structure of Poland's exports along with the statistics of other Central and Eastern European countries, placing a particular emphasis on the export of mineral resources. Section 3 deals with the characteristics of the method employed to monitor the resource dependence of the six countries under study and describes the data sources as well as the information used. Section 4 summarizes the results and conclusions.

2. Export of mineral resources in Poland and other CEE countries

The economic situation of Poland in the second half of the 20th century was undoubtedly influenced and strongly linked to the political and economic circumstances of the Soviet Union (USSR). The centrally planned socialist system imposed limited possibilities of trade with the West and forced Poland, as well as other socialist countries in Eastern Europe, to make economic decisions in line with the directions set out by the Council for Mutual Economic Assistance (COMECON). Consequently, the majority of Polish exports were destined to the Eastern Bloc under the control of the Soviet Union, in particular to the satellite states of East Germany and Czechoslovakia (Newell and Socha 1998; Semple and Demko 1977).

During the 1950s and 1960s, Poland's foreign trade was primarily oriented to the export of: fuels, minerals, and natural resources (accounting for nearly 68% of exports), as well as agricultural products (25%). In the 1970s, the share of fuels and natural resource exports dropped significantly to approximately 10% (Klimiuk 2016), and trade was mainly driven by the export of agricultural and food products, metallurgical products, and electromechanical equipment. In later years, until the 1990s, there was a change in Poland's commercial and industrial activities, which was reflected in its export structure. The export growth was concentrated in a limited number of sectors and dominated by electromechanical, light industry, and metallurgical exports. Chemical, wood-paper, agri-food products, as well as fuel exports, dropped to below 10% of total exports in this period (Yearbook... 2018; Jaszczyński 2016). It is worth pointing out that Poland has a long coal mining history. Throughout most of the 19th and 20th centuries, the coal industry played a major role in its economy (Galos 2010). However, since the 1980s, Polish coal exports have been in decline and have not contributed significantly to the country's economic growth (WISE 2015).

After the collapse of communism and the dissolution of the Soviet Union, the economic and political reforms introduced in the newly democratic states had a tremendous impact on trade flows and in the degree of trade openness among CEE countries. This, in conjunction

with events such as the creation of the Weimar Triangle in 1991 (intended to promote cooperation between France, Germany, and Poland), the establishment of the Visegrád Triangle (in Czechoslovakia, Poland and Hungary), and then the Visegrád Group (V4) in 1993, Poland's accession to NATO (1999) and the European Union (2004) led to a marked increase in trade volume and economic growth. Since 1990, Poland's main trading partners include: Germany, France, Great Britain, Russia and China (Malaga 2016).

The commodity structure of Polish trade has changed considerably since becoming a member state of the EU (Parteka and Tamberi 2013). The total value of resource exports – exports of oil, gas, and minerals – (in billion USD) experienced two periods of expansion (between 2004 to 2008 and 2010 to 2011), and suffered a decline in the crisis of 2008, as is presented in Figure 1. However, the share of Poland's resource exports in total merchandise exports shows a systematically declining trend for the last 6 years. This decrease has been partially attributed to the unfavorable market conditions of the domestic hard coal and copper industry (Lewicka and Burkowicz 2017; Gawlik et al 2016). Furthermore, an analysis of the composition of Poland's exports based on the Standard International Trade Classification (SITC) shows that in 2017 there was a two-fold reduction in the value of Polish coal and copper exports compared to the values of 2011, which constitute the main share of the EIX index value for Poland (UNCSTAD 2019; Eurostat 2018). The figure illustrates the evolution of the total value of resource exports for the years 1995–2017 and the EIX, which is a component of the EDI equation and represents the export revenue from oil, gas, and minerals (as % of total export revenue).

In this context, we perform a comparative analysis of the degree of resource dependence of CEE countries with contiguous histories and similar economic characteristics. These

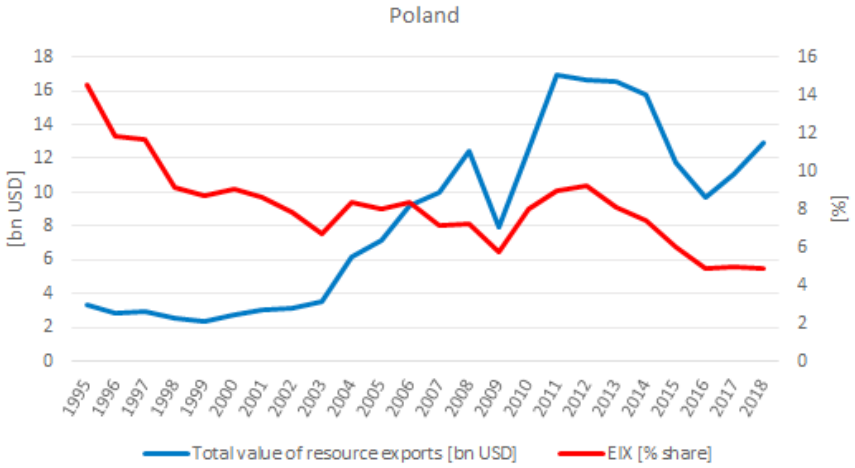

Fig. 1. Poland's total value of resource exports and the value of extractive exports as a share of total exports, 1995–2018
Source: own estimates based on data from: UNCSTAD 2019 and Eurostat 2018

Rys. 1. Wartość eksportu surowców naturalnych (w mld USD) i udział eksportu surowców w całkowitym eksporcie Polski, 1995–2018

countries include: the Visegrád group (the Czech Republic, Slovakia, Hungary, and Poland – EU members since 2004) as well as Bulgaria and Romania (countries of the Eastern Bloc that received accession in 2007). Like Poland, these countries were under the influence of the USSR after World War II (Gilbert and Muchová 2016). The majority of these member states in the CEE region follow similar patterns of trade (expansion and contraction) during that same period, however these economies are based on the export of various natural resources (see Fig. 2). Yet, in recent years, there has been a substantial decrease in the value

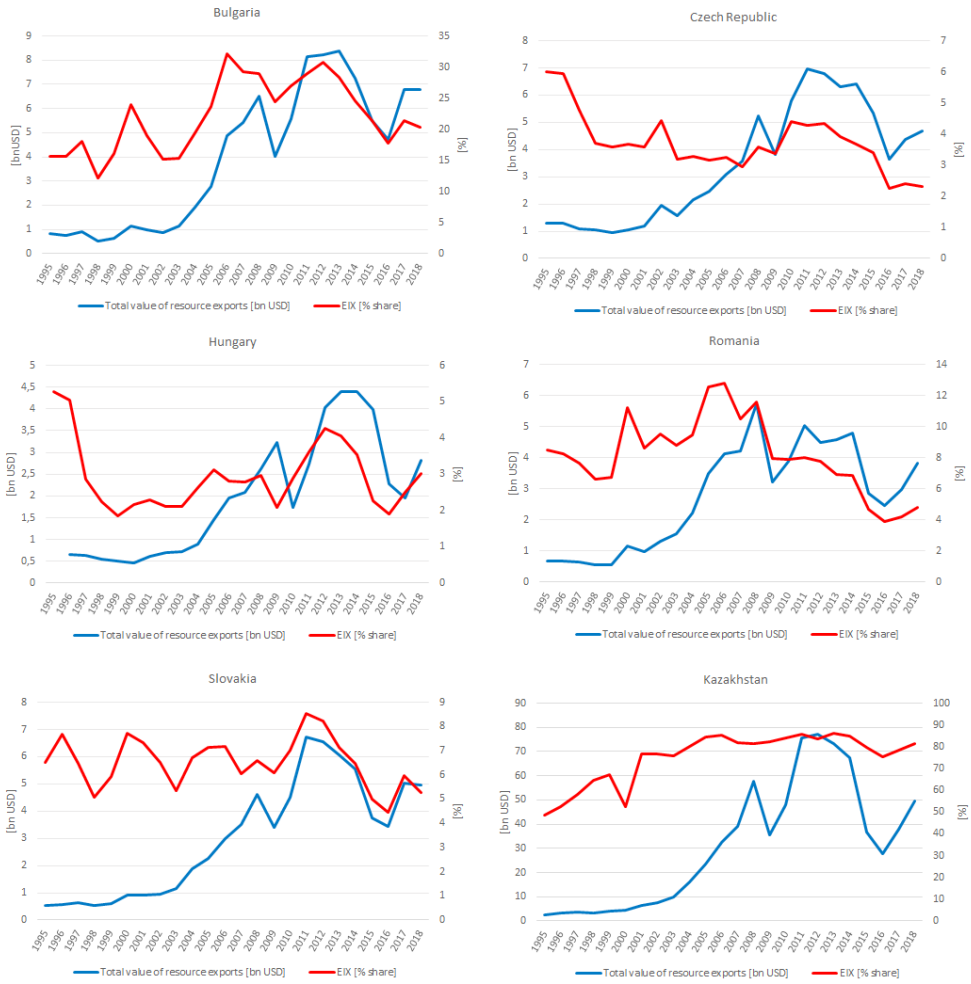

Fig. 2. Total value of resource exports (in billion USD) and the share of exports of mineral resources in CEE countries, 1995–2018
Source: own estimates based on data from: UNCSTAD 2019 and Eurostat 2018

Rys. 2. Wartość eksportu surowców naturalnych (w mld USD) i udział eksportu surowców w całkowitym eksporcie krajów Europy Środkowo-Wschodniej, 1995–2018

of resource exports from CEE EU member states: petroleum oils or bituminous minerals (in Bulgaria, Czech Republic, Hungary, Slovakia), copper (Bulgaria and Czech Republic), coal & coke (Czech Republic), non-ferrous base metal waste (Czech Republic, Romania), petroleum products (Hungary) or gaseous hydrocarbons (Romania) (UNCSTAD 2019; Eurostat 2018). Furthermore, to better illustrate the level of resource dependence of these CEE member states, we include Kazakhstan in our analysis– a country whose economy is strongly dependent on the export of mineral resources (Hailu and Kipgen 2017).

3. Method

We employ the Extractives Dependence Index (EDI) to monitor the level of dependence on oil, gas, and minerals of these CEE transition economies. This index was developed by Hailu and Kipgen (2017) and was originally used to assess long-term aspects of the resource dependence of 81 countries. The index offers the possibility of an in-depth analysis of resource dependence through the evaluation of three key elements: the degree of dependence on the revenues from the extractive exports, the degree of dependence of fiscal revenues from the extractive industry and the degree of dependence on the value added of the extractive sector. The scores of the EDI range from 0 to 100. High EDI scores indicate a high level of dependence on the extractive sector. By using the abovementioned three components, it is possible to rank less-dependent countries with high levels of economic development (e.g., Norway) and developing economies that may be greatly dependent on the revenues of mineral resources (e.g. Angola, Congo, Nigeria, among other countries).

The Extractives Dependence Index (EDI) equation therefore consists of:

- Revenues from the export of mineral resources ($EIX_{m,y} \cdot (1 - HTM_{m,y})$).
- Fiscal revenues ($REV_{m,y} \cdot (1 - NIPC_{m,y})$).
- The share of the mining industry in GDP ($EVA_{m,y} \cdot (1 - MVA_{m,y})$).

The indicator is formulated as follows (Hailu and Kipgen 2017):

$$EDI_{m,y} = \sqrt[3]{\left[\left(EIX_{m,y} \cdot (1 - HTM_{m,y})\right)\right] \cdot \left[\left(REV_{m,y} \cdot (1 - NIPC_{m,y})\right)\right] \cdot \left[\left(EVA_{m,y} \cdot (1 - MVA_{m,y})\right)\right]}$$

- $EIX_{m,y}$ – export revenue from oil, gas and minerals (% of total export revenue) for country m in year y,
- $HTM_{m,y}$ – export revenue from high-tech manufactures (non-resource exports) for country m (as a percentage of global HTM exports) in year y,
- $REV_{m,y}$ – revenue from the extractive sector as a percentage of the total fiscal (total tax and non-tax) revenue for country m in year y,
- $NIPC_{m,y}$ – total non-resource tax revenue as a percentage of GDP for country m in year y,

$EVA_{m,y}$ – value added of extractive sector as a percentage of GDP for country m in year y,

$MVA_{m,y}$ – manufacturing value added per capita for country m in year y.

The data used in this article to estimate the Extractives Dependence Index of six CEE countries was gathered from multiple information sources. The majority of the historical data was acquired from a single information source in order to keep data consistency across all the countries analyzed. Furthermore, the data covers the period of 2000–2017. The estimates of export revenue from fuel and mineral commodities (EIX) were taken from the United Nations Conference of Trade and Development database (UNCSTAD 2019). The UNCSTAD data describing the export revenue of Poland was compared with the values (total export revenue) reported by the Central Statistical Office of Poland (GUS 2019). The export revenues from high-tech manufactures as a share of total HTM exports were obtained from the United Nations Conference of Trade and Development database. Revenue generated by the extractive industry as a percentage of the total fiscal revenue (REV) and the share of non-tax revenue other than resource income (NIPC) was acquired from the Government Revenue Dataset of the United Nations University (ICTD/UNU-WIDER 2019). The value added of the extractive sector as a share of the total value added (EVA) of these CEE countries were collected from the United Nations National Account Database (UN 2019). The data on the manufacturing value added per capita of each country (MVA) was obtained from the World Bank and the United Nations Industrial Development Organization (World Bank 2019).

4. Results

The Extractives Dependence Index values of six CEE countries (2000–2017) were calculated and compared to the EDI score of Kazakhstan. Note that the economic development of these countries was significantly affected by the influence of the USSR and the political transformations in Europe after 1989. Figure 3 shows the results of the estimated scores.

The present results show that the EDI scores of the six CEE member states follow a downward trend. This indicates that from 2000 to 2017, the economies of Poland, Romania, Slovakia, Czech Republic, Hungary, and Bulgaria have slowly reduced their dependence on resource revenues and have improved their level of export diversification. Poland experienced the highest drop in EDI values among all CEE countries, from an initial EDI score of approximately 17 to 10. Despite the reduction of Bulgaria's dependence on the extractive sector, the figure demonstrates that it possesses the highest EDI score of all Central and Eastern European countries analyzed in this article. The Czech Republic has the lowest EDI score among the displayed countries. Furthermore, the average EDI score of the six former Soviet satellite nations that joined the European Union is nearly five times lower than the

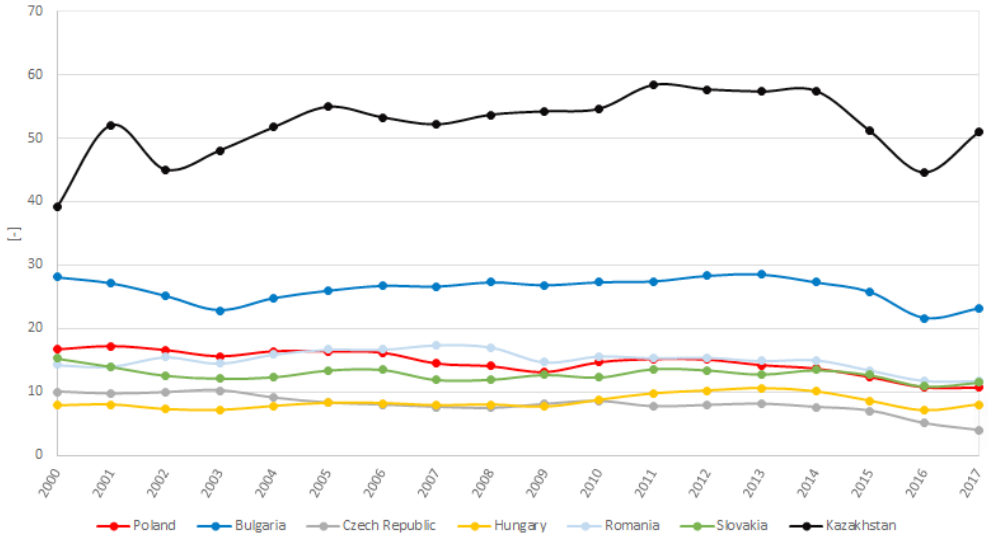

Fig. 3. EDI scores of the analyzed CEE countries and Kazakhstan, 2000–2017

Rys. 3. Wartości wskaźnika EDI dla sześciu krajów Europy Środkowo-Wschodniej oraz Kazachstanu, 2000–2017

value of Kazakhstan, a current member of the Commonwealth of the Independent States (CIS). The considerable difference between the EDI scores of the six CEE economies and Kazakhstan confirm the results of previous studies that have found a deviation in product diversification of exports from Eastern Europe and of the Commonwealth of Independent States (after the collapse of the Soviet Union) (Shepotylo 2013; Astrov et al. 2012). Nonetheless, in recent years, a number of studies have identified Kazakhstan's unexploited potential in specific sectors that can strengthen its economic growth and diversification (Felipe and Hidalgo 2015; ADB 2018).

Figure 4 presents a longitudinal analysis of the EDI components of the six analyzed countries. Each component of the Extractives Dependence Index was standardized to a reference year. The year 2005 was used as the reference year for countries that formally joined the EU in 2004. For countries that joined the EU in the latest round of expansion (Bulgaria and Romania), the year 2008 was used as the reference year. Standardizing the aforementioned components to a base year (the year following the country's EU accession), rather than using their original values, allows us to compare and accurately depict their temporal variation in a single plot.

In the case of Poland, three EDI components have changed considerably since its accession to the EU. Compared to the base year, in 2017 there was a noticeable increase in the domestic industrial capabilities (MVA, manufacturing value added per capita) and productive capabilities (HTM, export revenue from high-tech manufactures). On the other hand,

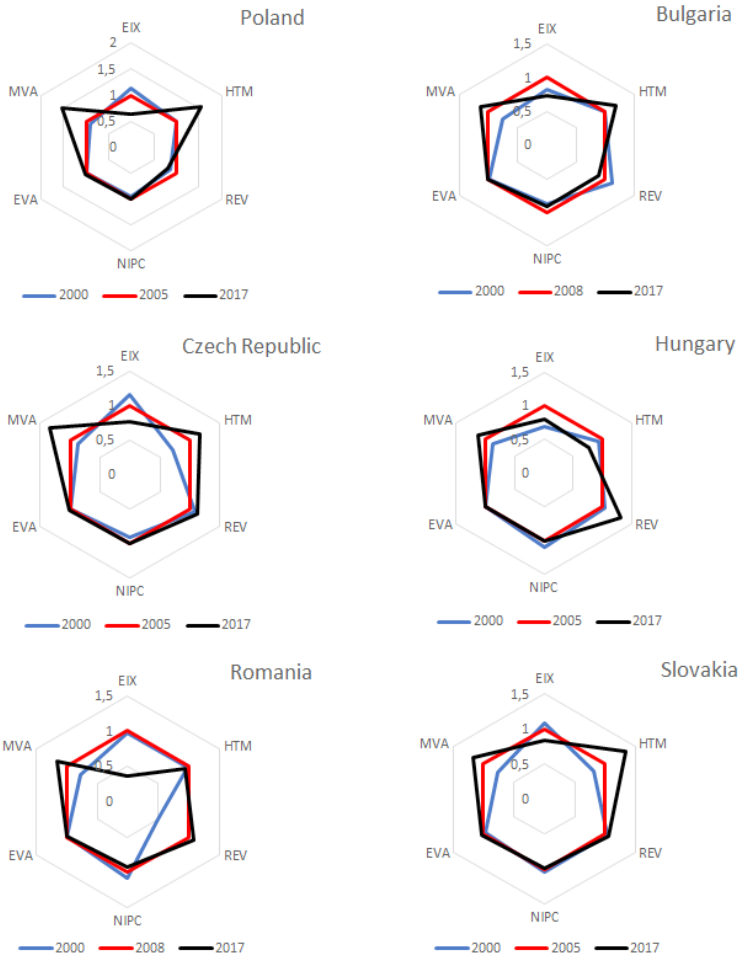

Fig. 4. Longitudinal analysis of EDI components of six CEE Member States, 2000–2017

Rys. 4. Analiza porównawcza wartości składników wskaźnika EDI dla sześciu krajów Europy Środkowo-Wschodniej, 2000–2017

as it can be observed from the figure, in 2017 Poland experienced a drop of nearly 40% in EIX (export revenue from extractives as a share of total revenue), using Poland's EIX of 2005 as a base. The MVA and HTM changes are prevalent in other CEE countries as well (Slovakia, the Czech Republic, and Bulgaria). Furthermore, the value of EIX dropped for all six analyzed countries, reflecting a decline in export revenue from oil, gas, and minerals.

Figure 5 shows Poland's EDI scores and Gross Domestic Product (GDP) for the years 2000–2017. Although there is an observable decrease in Poland's EDI scores, the country has also experienced a continued GDP growth for the last decades. Between 2013 and 2017,

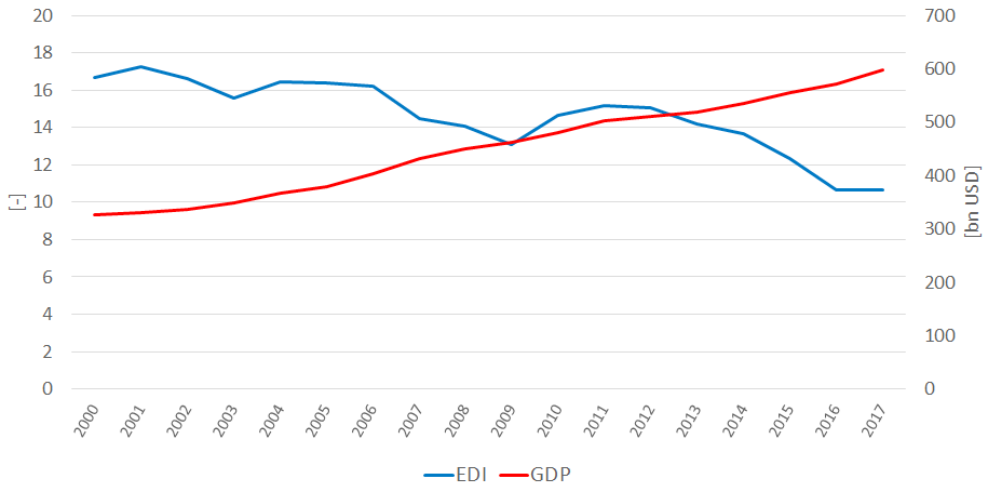

Fig. 5. GDP and EDI values for Poland, 2000–2017

Rys. 5. Porównanie wartości PKB oraz wskaźnika EDI dla Polski, 2000–2017

the GDP increased by more than 15% while in the same period the EDI score dropped by 25%. Furthermore, over a span of seventeen years, Poland's EDI scores nearly halved and the GDP almost doubled. The remarkable period of growth of this CEE member state has been linked to the rapid development of the industry, the strengthening role of the manufacturing sector, foreign direct investment, and an increase in private consumption (Grela et al 2017).

Conclusions

This study analyses the level of resource dependence of Poland and other Central and Eastern European countries which adopted a capitalist market economy and open trade policies after the collapse of the Soviet Union. In order to do this type of analysis effectively, we employ the Extractive Dependence Index, a composite indicator that takes the share of extractive exports in total exports, the extractive revenues as a share of total fiscal revenue, and the level of industrialization of a country through the use of per capita manufacturing value added into account. Using data spanning from the year 2000 to 2017, we calculated the index values for six CEE EU member states and Kazakhstan, a former Soviet state.

Our results indicate that the commodity structure of trade in the six countries that joined the European Union in 2004 and 2007 has changed considerably. Almost all these countries have reduced their economic dependence on extractive resources by developing their high value-added and technology-intensive sectors (HTM and MVA). Additionally, most of the countries analyzed have experienced a significant decline in the value of mineral exports (as a share of the value of total exports, EIX).

Our calculations show that Bulgaria has the highest EDI score of all six CEE countries. Nonetheless, Bulgaria's score is not as high as the EDI score of Kazakhstan or other developing countries. Poland experienced the highest drop in EDI values among all CEE countries, from an initial EDI score of approximately 17 to 10. Furthermore, the results of the EDI analysis show that the economy of the CEE EU member states investigated in the period 2000–2017 exhibit a fairly low dependence on the extractive sector. At the same time, our analysis provides a view on the transformation paths taken by six CEE countries and the structural transformation of their economies, including their economic development based on non-resource exports. Lastly, our analysis offers a comparison of the degree of resource dependence between CEE countries and a historical view of the trends and transformation paths of the six former satellite nations.

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ASSESSMENT OF THE RESOURCE DEPENDENCE OF SIX CENTRAL AND EASTERN EUROPEAN COUNTRIES USING THE EXTRACTIVES DEPENDENCE INDEX

Keywords

resource dependence, Poland, Extractives Dependence Index,
CEE countries, extractive industries

Abstract

For much of the last two decades, the Central and East European (CEE) economies have experienced a deep structural reform, moving away from a socialist economic system towards a market economy. The political situation of the second half of the 20th century had a significant impact on the economic development and competitiveness of these transition countries, when compared with their Western European counterparts. A vast number of studies have been conducted to analyze the structural changes required for resource-dependent economies to achieve long-term development and to understand the synergies between commodities and diversification. Yet, the dynamics of resource extraction and the resource dependence of regions that have experienced periods of sustained levels of growth have largely been overlooked, especially the Central and Eastern European region. In this context, this article presents an analysis of the level of resource dependence of six countries which joined the European Union between 2004 and 2007. Using data spanning from the year 2000 to 2017, we calculate the Extractives Dependence Index (EDI) of six former Soviet satellite nations and one former Soviet state. Our results indicate that the commodity structure of trade in the six countries which joined the European Union has changed considerably. These countries have reduced their economic dependence on extractive resources by developing their high value-added and technology-intensive sectors. Our findings also reveal that Poland experienced the highest decrease in EDI scores among the six CEE countries.

OCENA ZALEŻNOŚCI ZASOBOWEJ SZEŚCIU KRAJÓW EUROPY ŚRODKOWO-WSCHODNIEJ Z WYKORZYSTANIEM WSKAŹNIKA UZALEŻNIENIA OD PRZEMYSŁU WYDOBYWCZEGO

Słowa kluczowe

zależność zasobowa, Polska, wskaźnik uzależnienia od przemysłu wydobywczego, kraje Europy Środkowej i Wschodniej, przemysł wydobywczy

Streszczenie

Przez ostatnie trzydzieści lat gospodarki Europy Środkowo-Wschodniej (CEE) przeżywały głęboką reformę strukturalną, odchodząc od socjalistycznego systemu gospodarczego w kierunku gospodarki rynkowej. Sytuacja polityczna drugiej połowy XX wieku miała znaczący wpływ na rozwój gospodarczy i konkurencyjność tych krajów w okresie transformacji w porównaniu z ich zachodnioeuropejskimi odpowiednikami. W światowej literaturze możemy znaleźć wiele badań analizujących konieczne zmiany strukturalne dla gospodarek zależnych od zasobów. Celem tych zmian jest osiągnięcie długoterminowego rozwoju i zrozumienie roli dywersyfikacji struktury eksportu. Dynamika wydobycia zasobów i zależności od zasobów krajów, które doświadczają okresu utrzymującego się wzrostu gospodarczego, zostały jednak pominięte, szczególnie dla regionu Europy Środkowo-Wschodniej. W tym kontekście w artykule przedstawiono analizę poziomu zależności od zasobów dla sześciu krajów Europy Środkowo-Wschodniej, które przystąpiły do Unii Europejskiej w latach 2004–2007. Korzystając z danych z okresu 2000–2017, obliczony został indeks zależności zasobowej (EDI) dla Polski oraz pięciu innych byłych państw satelickich ZSRR, a także jednej z byłych republik radzieckich. Nasze wyniki wskazują, że struktura handlowa w sześciu krajach, które przystąpiły do Unii Europejskiej po 2004 roku, uległa znacznej zmianie. Kraje te zmniejszyły swoją zależność ekonomiczną od przemysłu wydobywczego, opierając gospodarkę na innych sektorach przemysłu, szczególnie sektorach zapewniających wysoką wartość dodaną i wzroście eksportu towarów zaawansowanych technologicznie.