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Winning at Home and Abroad: A Generalized Double Diamond Framework for Selected CEE Countries

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Abstract

In the lens of European integration, national competitiveness no longer depends just on national inheritance, but also on the new member states' capacity of exploiting existing advantages of EU membership. In this paper, we closely follow the effects of European Union (EU) admission on national competitiveness for eleven Central and Eastern European (CEE) countries that joined the EU after 2004. The analysis includes new specific variables that we consider potential boosters of competitiveness in this particular sample of countries, besides the proxies generally used in the literature. The results indicate that, for most of the CEE countries, EU accession bought both domestic and international advantages, with a more visible positive change in the international position. Although we were able to classify the analysed economies into three distinct groups, there are still notable differences across the CEE countries that require differentiated strategies for enhancing competitiveness.

Keywords: Competitive advantage, Porter's diamond, generalized double diamond model, CEE countries

JEL Classification: F10, F23, O52, R58

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1. Introduction

The study of competitiveness is in the spotlight of policymakers. It is well acknowledged that competitive economies are considered more prosperous and capable of offering higher living standards for their citizens. Within the European Union, large discrepancies can be observed among the member countries, with some difficulties in following the long-term common objective of enhancing competitiveness regionally. The existence of country-specific advantages or disadvantages requires country-specific measures, which motivates the study of competitiveness from a national perspective.

We acknowledge that competitiveness nowadays has a large variety of facets and relies on concepts originating mainly from economics and management, without excluding its other valences. While it is true that competitiveness is an extensive concept, for the aim of this analysis, we try to stick to a broadly accepted view regarding its definition and embrace that international competitiveness is "*the extent to which a country fosters an environment where enterprises can achieve sustainable growth, generate jobs and, ultimately, increase welfare for its citizens*" (IMD, 2021, p. 3). In this way, we do not reject the idea that gross domestic product or the level of productivity are reliable proxies for competitiveness but they rather add other relevant aspects to those measures. Therefore, international competitiveness can be viewed as the capacity of a country to attain long-term economic growth while providing the environment and the mechanisms through which the economy can generate a sustainable increase in its citizens' welfare.

Following the state of the art in this branch of study, we aim to assess competitiveness for the largest eleven Central and Eastern European countries that joined the EU after 2004. Through the lens of European integration, these countries have benefited from international financial support in stimulating their competitiveness, support that has been beneficial not only for their domestic development and modernization but also for their ability to enhance international competitiveness. As some authors indicate (Rugman and D'Cruz, 1993; Moon *et al.*, 1998; Rugman *et al.*, 2012), geographical proximity and regional membership may be driving factors for stimulating the increase in national competitiveness, due to the impact of foreign factors. If we take a look at the data provided by the IMD World Competitiveness Yearbook 2021, in our sample Estonia is the highest-ranking economy, occupying the 26th position in the world. Despite the differences among them in terms of competitiveness, these countries occupy close positions in the ranking relative to each other, and only Estonia and Lithuania occupy a place in the first 30 countries in the world.

The purpose of this paper is to identify specific factors that might be useful for public policy to improve competitiveness and lead to a sustainable process. The analysis should indicate the current state of competitiveness, while the comparative approach in the context of Europe-

an integration might bring valuable insights into the factors that should be supported at the national or regional level to improve these countries' results in terms of competitiveness in the future. We use the generalized double diamond (GDD) model proposed by Moon *et al.* (1995) to assess competitiveness from both national and international perspectives. Not only does it remedy deficiencies of Porter's (1990) model by adding the international component to the traditional diamond, but it also offers a relatively simple representation of competitiveness by using an intuitive graphical form.

This study contributes to the national competitiveness literature in several ways. First of all, to the best of our knowledge, no previous studies have attempted to analyse competitiveness for this precise sample of CEE countries from the perspective of European integration. Our study also benefits from a large dataset comprising the European pre-accession and post-accession periods. Data covering the crisis period are included in the analysis, even though, for the sake of space, we focus mainly on the pre-accession and the post-crisis periods. Moreover, we work on average data for sub-sample periods to better identify general trends in data and not only take a single glance over them. Using data averages, we minimize the effects of transitory events that may affect data and distort our results.

From the policy perspective, our paper sets the objective of assessing the configuration of national diamonds relative to the EU and relative to each other and checking whether a causal relationship between the domestic and international dimensions exists. Furthermore, the analysis is expected to offer a comparative view of past data, identify possible strengths for each country, and suggest ways to explore existing advantages of EU membership.

The paper is structured as follows. In the next section, we revise the literature on competitiveness indicators to better understand its current stance and motivate the topic and the approach followed in our analysis. Section 3 describes the data and the methodology used. Section 4 presents the results, while the conclusions are presented in Section 5.

2. Literature Review

2.1 Theoretical aspects

Starting from the trade theories formulated in the eighteenth century by Adam Smith and David Ricardo, the concept of competitiveness has undergone numerous changes over the years. Factor endowment as a source of national competitiveness was at the core of traditional theories about competitiveness. However, the experience of various economies that had poor factor endowment, yet proved to be highly competitive, raised the need for reconsidering the factors that might drive a country's competitiveness. In the 1990s, Porter (1990) studied competitiveness in the national context by emphasizing the role of institutions, policies or the general economic environment in enhancing firms' success in different industries.

Therefore, Porter (1990) introduced a new perspective in the field, utilizing the national diamond. Leaving aside the well-grounded theories on the role of trade, the single diamond model of competitiveness brings together four categories of factors, both endogenous and exogenous. The first category includes variables representing factor conditions (*FC*), demand conditions (*DC*), related and supporting industries (*RSI*), and firm strategy, structure and rivalry (*FSSR*), while government and chance are treated like exogenous factors. According to Smit (2010), countries compete on international markets in similar ways to firms, the prize being quantified in a higher market share, better performance, increased productivity or higher profits. This approach was later extended to comprise the role of the international context in boosting a country's competitiveness and fit the particular characteristics of small open economies.

In terms of national competitiveness, further advances were made by Cho (1994) and Cho and Moon (2005), who additionally exploited the role of human factors. They included four additional human factors (workers, politicians and bureaucrats, entrepreneurs, and professionals) along with an exogenous variable: chance. A few years later, in 1993, Rugman and D'Cruz introduced the *double diamond model*, which added the international context to the existing diamond. Moon *et al.* (1995) extended the topic and introduced the *generalized double diamond model* (GDD), which includes both the domestic and the international diamond of competitiveness. This GDD model uses, in fact, the four categories of factors proposed by Porter, and the analysis is conducted in both a domestic and international context. Cho *et al.* (2008) tried to incorporate all the existing theories into a comprehensive framework and developed the *dual double diamond* (DDD) model that includes: domestic physical factors, international physical factors, domestic human factors and international human factors. The authors used a sample of 66 countries classified according to their international connectivity and human-factor dependency to assess the reliability of this new framework. Their empirical analysis suggests that the DDD model has a better performance in assessing competitiveness among countries with heterogeneous attributes.

In this paper, we stick to the framework proposed by Moon *et al.* (1995) since their model incorporates the elements that we consider, a priori, responsible for changes in competitiveness at the national level. It distinguishes between domestic competitiveness and international competitiveness, and we are interested to see competitiveness from these two perspectives. Our choice is motivated in particular by the sample of countries we analyse, for which not only national variables matter, but also the way in which these countries perform and boost their competitiveness in a regional context. More specifically, we focus our analysis on the CEE countries, which are also EU members. Consequently, we need to incorporate international variables in the analysis to gather a broader perspective on the factors responsible for enhancing competitiveness in the context of European integration.

2.2 Empirical facts

Despite the numerous efforts made in this field over the years, even nowadays, assessing a country's competitiveness is a complex task in terms of selecting factors that might be significant. There is a consensus in the empirical literature (see, *e.g.*, Fang *et al.*, 2018; Żmuda, 2017) for including a large number of factors, to improve the quality of the analysis. Żmuda (2017) made an extensive literature review on the topic of competitiveness and proposed the use of a multi-layered model to describe competitiveness. This model is based on the "metaphor of an onion"; therefore, competitiveness determinants are classified into three layers: micro (firm-level), mezzo (industry/cluster level) and macro (national level).

In an attempt to find a better framework for assessing a country's competitiveness, many economists have recently extended the traditional set of determinants. Liu (2017) drew attention to the role of technology competitiveness and advanced two possible effects. The first possible outcome is positive, and it derives from technological transfer among countries, reducing the gap between them, while the second one is negative, indicating that more technologically developed countries might possess advantages that cannot be reached by emerging economies. In Fainshmidt *et al.* (2016), governance quality is found to be a key element for competitiveness on a sample of 90 developing and developed economies. Moreover, the study undertaken by Fang *et al.* (2018) used the diamond model for the G20 countries and shed light on the concept of renewable energy competitiveness and the frameworks in which it manifests.

The importance of correctly specifying the context in which competitiveness is analysed is supported by the dual double diamond framework proposed by Cho *et al.* (2008). The empirical study they conducted revealed that for multinational companies (MNC), a reliable assessment of a country's comparative advantage is a prerequisite for benefiting from that host country's possible advantages. According to Zhang (2016), a country's specific advantage is mainly influenced by two sets of determinants: resource endowment and institutional factors. Other authors advance the idea that not only the characteristics of the host country must be considered, but also the characteristics of the region where the MNC are going to operate. Rugman and Oh (2008) drew attention to the need to improve regional competitiveness (rather than global competitiveness), as they found supporting evidence, in the case of 127 large Asian firms, that they compete not as much globally but regionally. Accordingly, Belesks-Spasova *et al.* (2016) showed that multinational enterprises in Thailand can boost their competitiveness by benefiting from the advantages offered by the ASEAN region, where they operate. Cooperation among countries was also exploited in relation to national competitiveness by Cho *et al.* (2016) in the case of two geographically distant countries: Dubai and South Korea.

Moving our attention to the narrower field of study of competitiveness indicators, we identified in the literature several papers that have followed, to some extent, the approach used in ours. For example, Castro-Gonzáles *et al.* (2016) and Castro-Gonzáles *et al.* (2017) made a comparative analysis of two different samples of countries from Latin America. The first study (Castro-Gonzáles *et al.*, 2016) used the double diamond model framework and averages of data between 2000 and 2010 for a sample of Latin American economies. They used the partial least squares structural equation modelling (PLS-SEM) methodology to assign weights to different indicators considered determinants. The results indicate that Brazil is the most competitive country in the region, followed by Argentina, Chile, Uruguay and Colombia in both global and local dimensions. In the second paper (Castro-Gonzáles *et al.*, 2017), the same methodology was used to test the significance of 36 competitiveness indices from 2010 to 2013. Out of the three analysed countries, Columbia ranked first, followed by Peru and Ecuador. However, when the international dimension was considered, Ecuador was more distant from the other two countries.

The experience of several countries in South, Central and Eastern Europe has been assessed in the papers of Moledowski and Żmuda (2014), Balcarová (2014) or Savic *et al.* (2014). Significant improvements in terms of competitiveness in Visegrad countries after their EU accession were identified by Moledowski and Żmuda (2014). These improvements are visible only if the international component is considered, especially for the Czech Republic and Slovakia – the latter being (according to the quoted analysis) the country that benefited the most from the accession due to the established international relations. Balcarová (2014) argued in favour of the nine-factor model in less developed economies since she identified smaller differences in competitiveness among the three analysed countries (Hungary, Slovakia and the Czech Republic), in comparison with the diamond model. According to the results provided in Savic *et al.* (2014), obtained from analysing a sample of eight Southeast European countries using 2012 data, these countries' competitive advantage relies on factor conditions and the context for strategy and rivalry. Competitiveness development in the region might be supported by rising R&D expenditures (Kiselakova *et al.*, 2018), investing in innovative infrastructure and building strong and reliable institutions (Savic *et al.*, 2014; Żmuda, 2018) or by increasing human capital endowment and by increasing labour force educational attainment (Mulliqui *et al.*, 2018).

While many of these studies have tried to investigate the factors that drive competitiveness in Central and Southeastern Europe, to the best of our knowledge, competitiveness has not been regarded from the perspective of European integration, using a regional perspective. We aim to fill this gap in the literature, and we use the experience of eleven CEE countries that joined the EU after 2004 to shed light on the impact of the European integration process on national competitiveness. More specifically, we want to determine whether there has been a notable improvement in competitiveness due to EU membership, and which are the factors that improve it mostly from a regional perspective.

3. Data and Methodology

As revealed by the previous section, there is a lack of literature regarding the generalized double diamond model analysis in CEE countries. In order to fill this gap, the present paper sketches the GDD for eleven CEE countries, *i.e.*, Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Slovakia, Slovenia, Romania, together with the Baltic countries: Estonia, Latvia and Lithuania. Because all the selected countries are also EU members for which the "catching-up" process is important, we compare their evolution with the EU average. For this reason, the indicators calculated for the EU average take into account the number of member states at the time that they joined the EU.

It is worth mentioning that the papers on international competitiveness in CEE countries focus only on individual years (Molendowski and Żmuda (2014) analysed GDD for 2004, 2007, 2009 and 2011) or small time spans Liu and Hsu (2009) collected data for 2000–2004; Postelnicu and Ban (2010) and Ban (2017) for 2002–2006; Balcarová (2014) for 2008–2010; Castro-Gonzáles *et al.* (2017) for 2010–2013. Castro-Gonzáles *et al.* (2016) used indicators for a broader period, namely 2000–2010. To have a better overview of the given countries' international competitiveness, our study analyses the entire time span 2000–2019 divided into three periods. Moreover, to avoid the cyclical component of indicators, the periods include at least four years and are constructed based on political and economic events. More precisely, the periods are (1) 2000–2008, (2) 2009–2012 and (3) 2013–2019 underlying the level of competitiveness (1) before[1], (2) during and (3) after the global financial crisis (GFC) to the COVID-19 sanitary crisis.

As seen in the previous paragraphs, the concept of national competitiveness is an extremely controversial one. It has many facets and numerous indicators are used in the economic literature to measure this concept. The most challenging part when assessing the competitiveness of one country is to construct the composite indicators meant to reveal the level of one country's competitiveness. Following OECD (2008) and Terzi *et al.* (2021), the first steps in constructing composite indicators are to specify the theoretical framework and to select a group of representative indicators.

Regarding the theoretical background, our method consists in building a formative model in which particular indicators are causes of an underlying latent variable. Our four latent variables (or pillars), in accordance with Porter (1990), are: factor conditions; demand conditions; related and supporting industries; and firm strategy, structure and rivalry, seen from both a domestic and

1 At the same time, during this period, most of the selected countries (except Croatia) became EU members. Basically, by splitting our sub-periods this way, we are also able to analyse competitiveness before and after the GFC, and to closely follow the effects of EU admission on CEE countries.

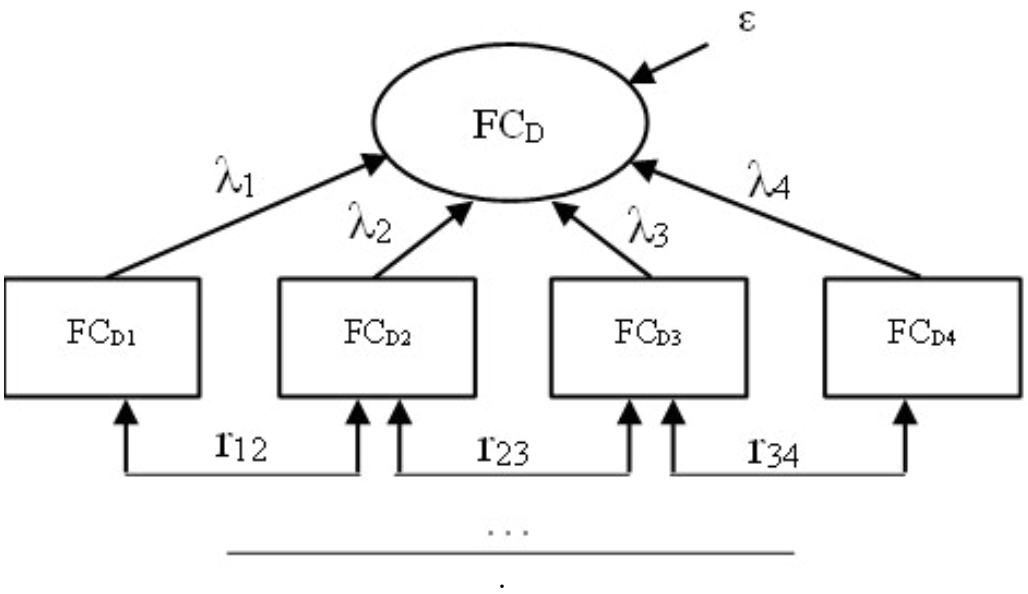
international perspective. To illustrate the model, we exemplify based on the first pillar of domestic competitiveness (*i.e.*, factor conditions). The model can be described as follows (Terzi *et al.*, 2021):

$$FC_D = \sum_{i=1}^{4} \lambda_i \times FC_{Di} + \varepsilon$$

where FC_D is the first pillar of domestic competitiveness, factor conditions or dependent variable; FC_{Di} is the individual indicators or explanatory variables; λ_i is a coefficient measuring the effect of individual indicators on the latent variable; i is the number of individual variables; and ε is the error term.

The graphic representation of the model can be seen in Figure 1. In this type of model, it is not assumed that indicators are correlated and the model does not account for correlations between indicators (r_{ij}, $i \neq j$). It is possible to have high correlations between variables, but they are not necessarily required. Precisely due to the fact that the formative model does not require the correlation of indicators, we cannot use the correlation structure of the data to determine the latent variable. Hence, the latent variable (or the competitiveness pillars in our case) can be calculated employing weighted averages of the indicators. Terzi *et al.* (2021) recommended giving equal weights if there is no theory that suggests otherwise.

Figure 1: Formative model for latent variable "factor conditions"



Source: Adapted from Terzi *et al.* (2021, p. 18)

Based on this theoretical approach, we will move to the next step in our analysis and choose the group of indicators for each pillar of the domestic and international competitiveness diamond. In measuring the determinants of competitiveness, we follow the papers from economic literature and the suggested proxies, but we also add some new variables specific to CEE countries. The statistical data are mainly taken from databases run by Eurostat, UNCTAD and the World Bank.[2] Based on these data, we sketch generalized double diamonds (GDD) for each country including both domestic and international variables (Moon *et al.*, 1998). We are aware that the list of variables included in this paper is not exhaustive (it can never be), and this represents one field of improvement for our study. However, considering data availability, we try to sum up the most important determinants of competitiveness and add new ones, specific for the CEE countries. According to the GDD model, the determinants of competitiveness are grouped into four classes: factor conditions, demand conditions, related and supporting industries, and firm strategy, structure and rivalry.

Factor conditions (FC)

We keep the distinction made by Porter (1990) between basic and advanced factors. At the *national level*, we analyse as *basic factors* the endowment of each country with labour using the evolution of the labour force participation rate (Liu and Hsu, 2009; Castro-Gonzáles *et al*., 2017). At the same time, as underlined by different studies (Liu and Hsu, 2009; Molendowski and Żmuda, 2014; Balcarová, 2014), it is relevant to also measure the labour force productivity and therefore, the GDP/person employed in the industry is also considered. Porter (1990) stressed the importance of advanced factors because they are the real source for the long-run development of a country and they can sustain the competitive advantage. The advanced factors at the national level have been measured using the number of researchers per million of inhabitants and the ratio of civil R&D expenditure to GDP (Moon *et al*., 1998; Liu and Hsu, 2009; Balcarová, 2014; Molendowski and Żmuda, 2014).

With respect to *international factor conditions*, the *basic factors* are quantified using exports of goods and services per capita (Liu and Hsu, 2009; Postelnicu and Ban, 2010) because they show the capacity of companies and products to pass the test of international competition[3]. In addition, as the foreign direct investment made by multinationals spreads the competitive advantage and exploits the specificities of each country, we also analyse the evolution of outbound stock of FDI (Porter, 1990). In the same group, we include net migration because the higher it is, the higher

2 Detailed description of variables and data sources are available upon request.

3 Because the selected CEE countries have a lot of service centres which generate important export revenues, we will also include the exports of services.

the labour supply and the possibilities to create added value in the economy. This variable was used by Castro-Gonzáles *et al.* (2016) to measure local factor conditions explaining that migration increases if the economic situation is not appropriate, indicating a negative correlation between the two. In our opinion, given the GDD framework, migration should be seen as positively causing competitiveness and not vice versa. Moreover, for most CEE countries in our sample, the net migration is negative because the population of these countries has migrated massively to Western countries. In our opinion, this fact weakens their diamonds as well as their competitiveness.[4] Passing to the group of *advanced factors*, we choose as proxies patent applications to the European Patent Office (per million inhabitants), as suggested by Molendowski and Żmuda (2014). We also embrace the point of view of Rugman and D'Cruz (1993) and include inward stock of FDI because they generate positive externalities into the host country and increase the level of competitiveness.

Demand conditions (DC)

The proxies used to capture this dimension of competitiveness are further divided into two groups to indicate the market size and its sophistication. The *domestic market size* is measured by real GDP per capita as suggested by many studies in this respect (see, *e.g.*, Liu and Hsu, 2009; Postelnicu and Ban, 2010; Molendowski and Żmuda, 2014). In addition, we also include the GDP growth rate (Moon *et al.*, 1998) and population growth rate (Castro-Gonzáles *et al.*, 2017) to have a better picture regarding the size of the national demand. *Demand sophistication* also plays an important role because if consumers are more educated, they tend to choose a larger variety of products. Competitiveness might be boosted by means of a more diversified demand (in terms of both goods and services). As an argument, a more educated population tends to be more specific and fastidious in terms of what kind of products it is willing to consume and what types of products satisfy their needs. This puts pressure on the supply side to satisfy all the requirements, and leads to diversification of the range of goods and services offered. Therefore, following most of the studies on this topic (Moon *et al.*, 1998; Liu and Hsu, 2009; Postelnicu and Ban, 2010; Molendowski and Żmuda, 2014; Balcarová, 2014), we use as a proxy the percentage of the population between 15 and 64 included in our research that has at least tertiary education. Moreover, we take into consideration the studies of Balcarová (2014) and Castro-Gonzáles *et al*. (2017) and collect data for government expenditure on education[5] (as a ratio to GDP), too.

4 This pillar might be improved with an indicator assessing the education level of migrants. Unfortunately, we could not find data for our sample.

5 Certainly, higher wages are not the only driver of quality of education and different variables such as the Pisa test could be a better measurement. This was not possible due to data unavailability.

The *international* variables to measure the *market size* are: the ratio of exports to GDP, first used by Liu and Hsu (2009) and taken by Postelnicu and Ban (2010) and Molendowski and Żmuda (2014), and personal remittances received (as % of GDP). At this point, we introduce a new variable into the GDD model, *i.e.*, the received remittances as their level positively influences the market size[6]. The remittances are highly relevant for CEE countries and are correlated with a high emigration rate. Moreover, for many persons in these countries, consumption is mostly financed by remittances (Goschin, 2014) and, in several cases, they are even used to finance small businesses in the home country (León-Ledesma and Piracha, 2001). The inclusion of this variable is one of the paper's original contributions. With respect to market *sophistication* at the international level, the export diffusion index was used, meaning the share of exports without the top three destination markets in total exports (Liu and Hsu, 2009; Postelnicu and Ban, 2010).

Related and supporting industries (RSI)

Following Liu and Hsu (2009) and Postelnicu and Ban (2010), we choose to measure the *local* related and supporting industries using the share of ICT goods in total trade, motorway accessibility, as well as the percentage of the population using the internet. All these factors have an important impact on facilitating commercial communication within a country. The paper also considers electricity consumption because it indicates the level of a country's industrialization (Castro-Gonzáles *et al*., 2017). Given the problematic situation of mankind generated by the worldwide spread of COVID-19 beginning in 2020, we think that the health system also represents a facet of competitiveness. This is another original contribution of this paper. Without a well-established health system, all social and economic activities are blocked and the level of competitiveness is negatively influenced. That is why we also analyse the healthy life expectancy based on self-perceived health.

International related and supporting industries are meant to reveal the development degree of international communication. For this reason, we include in our study the number of passengers transported by air (per 1,000 inhabitants) and the outbound mobility ratio. The latter is measured as the number of students from a given country studying abroad, expressed as a percentage of total tertiary enrolment in that country (Molendowski and Żmuda, 2014). Besides these factors, we also examine the number of published articles (per researcher) to account for the international mobility of the academic sector (Liu and Hsu, 2009).

6 Previous research points towards a positive effect of remittances on consumption or economic growth, on similar samples of developing countries. For example, Goschin (2014) identified that in CEE countries remittances have a positive effect on both GDP and GDP growth rate. A similar positive result on economic growth was found in the recent paper of Bucevska (2022), which conducted a panel data analysis on 6 SEE countries for 2008q1–2020q2. In addition, the positive effect has also been identified in larger samples or time spans (see, *e.g*., Batu, 2017; Simionescu and Dumitrescu, 2017).

Firm strategy, structure and rivalry (FSSR)

According to Sakakibara and Porter (2001), a higher degree of domestic competition is positively correlated with and may boost firms' international competitiveness. To measure the *domestic* determinants of competitiveness and, more precisely, the firm strategy, we choose, first of all, the average full-time adjusted salary per employee (Liu and Hsu, 2009; Postelnicu and Ban, 2010). Proxies to reveal domestic rivalry are the number of days to start a business and the costs of business start-up procedures.

International firm strategy, structure and rivalry are quantified by exports of high technology products (Postelnicu and Ban, 2010) and the export value index (Castro-Gonzáles *et al*., 2016)[7].

The following steps in our analysis (after defining the phenomenon to be measured – in our case competitiveness –, the pillars – *FC*, *DC*, *RSI* and *FSSR* – and the corresponding indicators) are to normalize data, aggregate the normalized values and validate the composite indicators (see OECD, 2008; Terzi *et al.*, 2021).

Before normalizing the values, we verify that there is a positive correlation between each measure and the national or international competitiveness. In our paper, the majority of indicators are positively correlated with competitiveness; but there are two proxies, namely the number of days to start a business and the costs of business start-up procedures, which are negatively correlated. In this case, we do a linear transformation to reverse the polarity. Effective data normalization comes next. There are several normalization methods, but we choose to use the distance from a reference, also called "indicization" technique. Therefore, 100 is attributed to the country with the highest value of the indicator. For the other countries, the competitiveness indices are computed as the ratio between the original value and the reference (maximum) one.

With respect to aggregation of the normalized indicators, we choose to use equal weights as indicated by the majority of studies on this topic. For each of the four pillars (*DC*, *FC*, *RSI*, *FSSR*), the indices' average values are computed for both the domestic and the international diamond. The conclusions drawn in the next section are based on relative, not absolute performance, compared to other countries in the sample. One of the reasons why our results might be different compared to other studies (Balcarová, 2014; Molendowski and Żmuda, 2014) is because the sample of countries is different. Other discrepancies might occur because our data are calculated as multi-year averages and/or refer to different time spans.

7 We could not use other indicators suggested by Castro-Gonzáles *et al.* (2017) because of data unavailability and proxies, such as the average tariff rate because it takes the same values for EU member states.

In order to validate the previously constructed composite indicators and to check their robustness, we decided to use a different aggregation methodology. So, in accordance with OECD (2008) guidelines, we additionally compute the composite indices based on principal component analysis (PCA). Lastly, we compute the correlation coefficients between the composite indicators obtained with the two methods to see the degree of association between them.

4. Results and Discussion

The primary focus of this section is to observe how domestic and international competitiveness has evolved in each country in light of European integration. Therefore, we have computed the area or competitiveness in both domestic and international dimensions and their evolutions. The representations of domestic diamonds (DD) and international diamonds (ID) for each country are presented in Appendix, for the first and the last analysed periods.

It is worth mentioning that, compared to the EU, all the countries in our sample had and still have a smaller competitiveness area. Besides this aspect, for most countries, the international diamond registered a more significant evolution than the domestic one.

Taking into consideration the entire time span 2000–2019, the percentage changes of both domestic and international diamonds are represented in Figure 2. The bubble size is given by the level of domestic competitiveness area in the last period, 2013–2019.

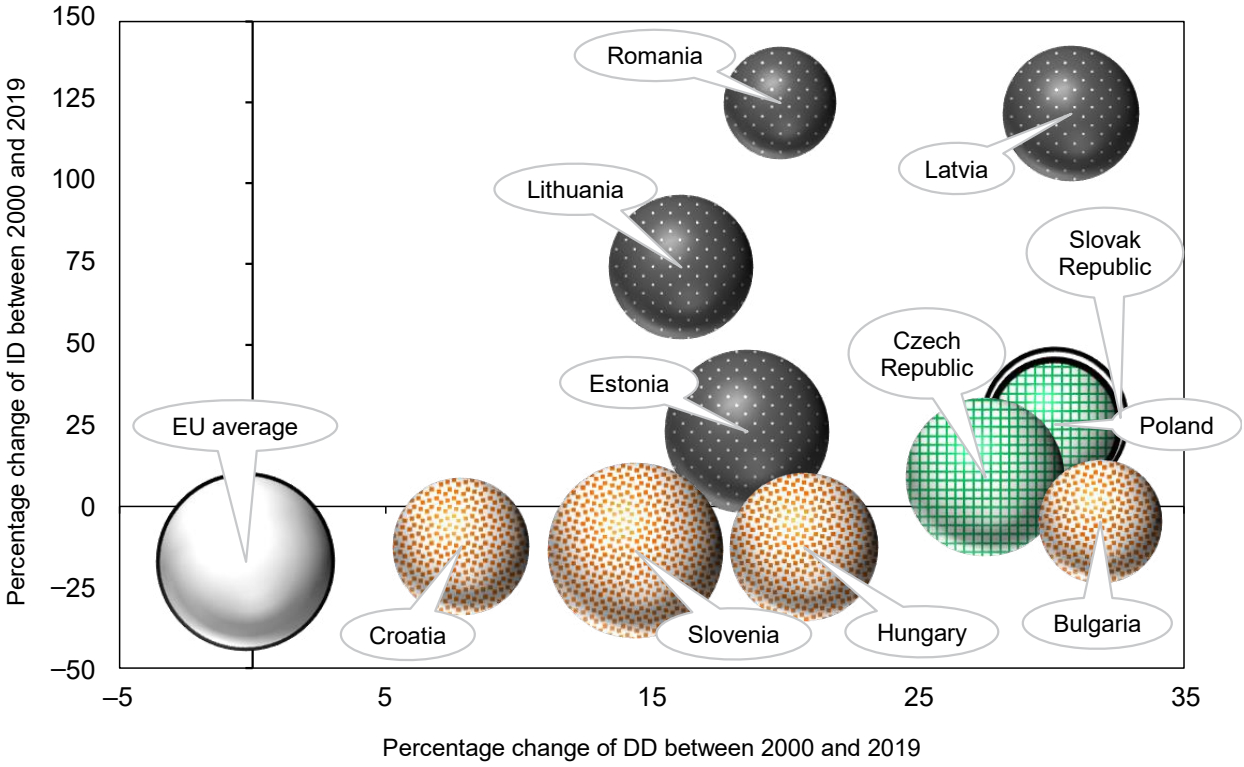
Based on their development in both domestic and international competitiveness areas, the countries can be categorized as follows:

- There is a first group of countries that mainly improved their domestic diamond but experienced a decline in the international one. These countries are Bulgaria, Croatia, Hungary and Slovenia.
- The second group includes countries with comparable increases in both domestic and international competitiveness. Here we include the Czech Republic, Slovakia and Poland[8].
- Estonia, Latvia, Lithuania and Romania belong to the third group, improving their international competitiveness significantly more than their domestic one.

According to our analysis, Slovenia and the EU average had the largest competitiveness areas between 2013 and 2019. Estonia came in second. From our point of view, Latvia is the most dynamic country improving both national and international diamonds, but relatively more the latter.

8 Slovakia's competitiveness bubble lies immediately behind Poland's in Figure 2. Although the dynamics of domestic and international diamonds in these two countries are comparable, Poland's competitiveness area is lower than that of Slovakia.

Figure 2: Evolution of domestic and international diamonds in selected CEE countries between 2000 and 2019



Source: Authors' own representations

Looking in detail at the data, as we already mentioned, we observe that the EU has a negative evolution over the analysed period, both internationally and domestically. In the case of the European Union, the negative evolution can be justified by its expansion process. The accession waves in 2004, 2007 and 2013 enlarged the existing members, adding countries that were less developed than the existing members. This generates the deterioration of its competitiveness position over the entire period. The domestic diamond (DD) representation reveals good performance in factor conditions, demand conditions and firm strategy, structure and rivalry, which are relatively stable over time. From the international point of view, the best values are observed in factor conditions.

Slovenia and Hungary had a negative evolution of international competitiveness over time, their ID decreasing by more than 10%. The shrinking was visible, especially in related and supporting industries and firm strategy, structure and rivalry. Overall, the countries performed well in demand conditions and factor conditions. It is important to mention that for the entire time span 2000–2019, Slovenia had the largest competitiveness area among the 11 CEE countries in our sample. Other countries with a negative evolution in international competitiveness are Bulgaria

and Croatia. Whereas in Bulgaria the negative evolutions are visible in *DC* and *RSS*, Croatia has its weaknesses in three out of the four pillars: *FC*, *RSS* and *FSSR*.

The remaining CEE countries in our sample have benefitted in terms of both domestic and international competitiveness position. For example, the Czech Republic had between 2000 and 2019 a domestic diamond larger than Poland or Slovakia. Molendowski and Żmuda (2014) also included the Czech Republic in their analysis and found that the Czech Republic had the best competitiveness performance among the Visegrad countries at that time. Similar to our results, they identified a positive evolution in domestic competitiveness, with a slight deterioration in 2007. However, their analysis covered only half of our analysed period and used annual data for 2004, 2007, 2009 and 2011 and a different sample, which included only the four Visegrad Group countries (Poland, Hungary, the Czech Republic and Slovakia). Moreover, the range of indicators used as proxies was not identical, which makes the comparison difficult.

Slovakia, the Czech Republic and Poland had similar dynamics in both DD and ID. The first two economies performed better compared to the EU average, especially in terms of the international indicators for *DC* and *FSSR*. Among all the economies in our sample, after Romania and Bulgaria, Poland was the country with the smallest competitiveness area of DD before joining the EU. However, during the analysed period, Poland increased its domestic diamond by 30%. The overall improvement was mainly related to supporting industries and firm strategy, structure and rivalry. Similar to Molendowski and Żmuda (2014), we found that in Poland, the size of the international diamond was surpassed by the size of the domestic diamond for the entire analysed period.

The Baltic countries expanded their domestic diamonds between 2000 and 2019. Comparing the Baltic countries among them, Estonia managed to attain the largest competitiveness area for domestic and international diamonds. This result is in accordance with the IMD World Competitiveness Yearbook 2021, which (as mentioned in the Introduction) places Estonia among the 30 highest ranking economies in the world. Regarding 2013–2019 and the international diamond, the three Baltic countries' performance was almost equal to or above the EU average in demand conditions, related and supporting industries and firm strategy, structure and rivalry. Romania had the most dynamic evolution in terms of international variables, which increased by 125% between 2000 and 2019, surpassing the EU average in demand conditions. However, Romania has the smallest domestic competitiveness area among all the analysed CEE countries.

In the final part of our analysis, we wanted to see how reliable our findings are. For this reason, following OECD (2008), we constructed the composite indicator as the sum of weighted indicators, using unequal weights. To acquire these weights derived from the data, we used principal component analysis. The correlation coefficients between the four pillars of competitiveness (both domestic and foreign) using the two methodologies range from 0.56 to 0.99. They indicate a strong

link between the composite indicators when we apply the two abovementioned approaches.[9] Therefore, despite the fact that we based our conclusions on composite indicators computed with equal weights, our conclusions are still robust.

Summing up, our analysis reveals that in light of EU integration, the CEE countries experienced some similarities in competitiveness evolution and relied on particular factors to boost their competitiveness. Seven out of the eleven have benefitted in terms of domestic as well as international competitiveness position.

5. Conclusions

This paper aimed to shed light on the impact of European integration on national competitiveness in the Central and Eastern European countries that joined the European Union in the last three waves (2004, 2007 and 2013). The starting point in our analysis was that not only national characteristics matter for competitiveness, but also the way in which these countries perform and boost their competitiveness in a regional context. Therefore, we closely followed the effects of EU admission to explore how much individual countries have benefitted from this process. We used the generalised double diamond model (GDD) proposed by Moon *et al.* (1998) since we were interested in exploring competitiveness from both domestic and international perspectives. To assess the level of competitiveness, we selected a total of 30 proxies based on the existing literature and data availability. Additionally, we proposed new specific variables, such as: net migration, received remittances and healthy life expectancy, variables that might have been beneficial for the catching-up process in this particular region of Europe. Overall, the results indicate that the EU accession brought both domestic and international advantages for most of the CEE countries. Compared to the EU average, all the analysed countries still lag behind in terms of their competitiveness areas. Improvements in competitiveness are also visible to different degrees across the countries, since improvements are driven by different pillars of competitiveness, as presented above.

With respect to the *domestic* diamond and relative to each other, in the last period, 2013–2019, the EU had by far the best results in GDP per capita, R&D expenditures, healthy life expectancy and salary per employee. For each of the analysed CEE countries, the domestic competitiveness resides in different pillars. Croatia is the best performer in motorway accessibility, while Estonia has the highest rates for labour force participation, government expenditure on education, individuals using the internet and the smallest number of days to start a business. All these confirm, indeed, that Estonia ranks high in digital competitiveness. Its neighbour country, Lithuania, outperforms

9 The results are available upon request.

the other countries in our sample in the percentage of population with at least tertiary education. Among all the CEE countries, Romania had the highest annual average growth rate. Lastly, if we compare Slovakia and Slovenia, the former had the largest share of ICT goods in total trade, while the latter had the highest values for the number of researchers (per million) and electricity consumption, but the lowest costs of business start-up procedures.

Analysing the *international* diamond in the last period (2013–2019), the EU average has the highest values of competitiveness indicators in the first pillar: factor conditions, more precisely in outbound FDI and patent applications. Bulgaria had the best results in the export diffusion index, indicating that its exports are widely spread among different partner countries. Croatia had by far the highest level of received remittances as a ratio to GDP and published papers per researcher. Estonia had the best results in inbound FDI (as a ratio to GDP) correlated with exports of high-tech products, while Lithuania registered the best values in the export value index. The average export dependency and outbound mobility ratio are the highest in Slovakia. Slovenia had the highest rate of immigration and the highest export value per capita.

Given our interest in studying competitiveness at the national level, but in a regional context, the results provided in this paper are useful for sketching some policy implications. First, our findings are supportive of the idea that enhancing competitiveness in the region would require differentiated strategies depending on national characteristics. This derives from the fact that, in each country, competitiveness resides in different pillars. So, a joint policy in a regional context will not benefit all these CEE countries. Secondly, the use of the GDD model had the advantage that it offered us a clue about the international dimension of competitiveness by including multinational companies' role. From this perspective, in terms of FDI inflows, Estonia was the country with the highest level of inbound FDI as a ratio to GDP. Other countries, such as Slovenia, Romania, Lithuania and Poland, still performed poorly regarding FDI inflows and could benefit more in future if they succeed in attracting more foreign direct investments. If we also consider export diffusion, the best performer in our sample is Bulgaria. In contrast, the Czech Republic is the country that registered the lowest scores. By implementing policies designed to stimulate FDI inflow and improve export structure and diffusion, the CEE countries can increase their international competitiveness and, consequently, benefit domestically.

This study also has some limitations. In our opinion, the difficulty in finding an exhaustive list of competitiveness determinants is the major limitation of our study. As previously stated in the literature review, this limitation applies when assessing competitiveness due to the multitude of factors that might influence it.

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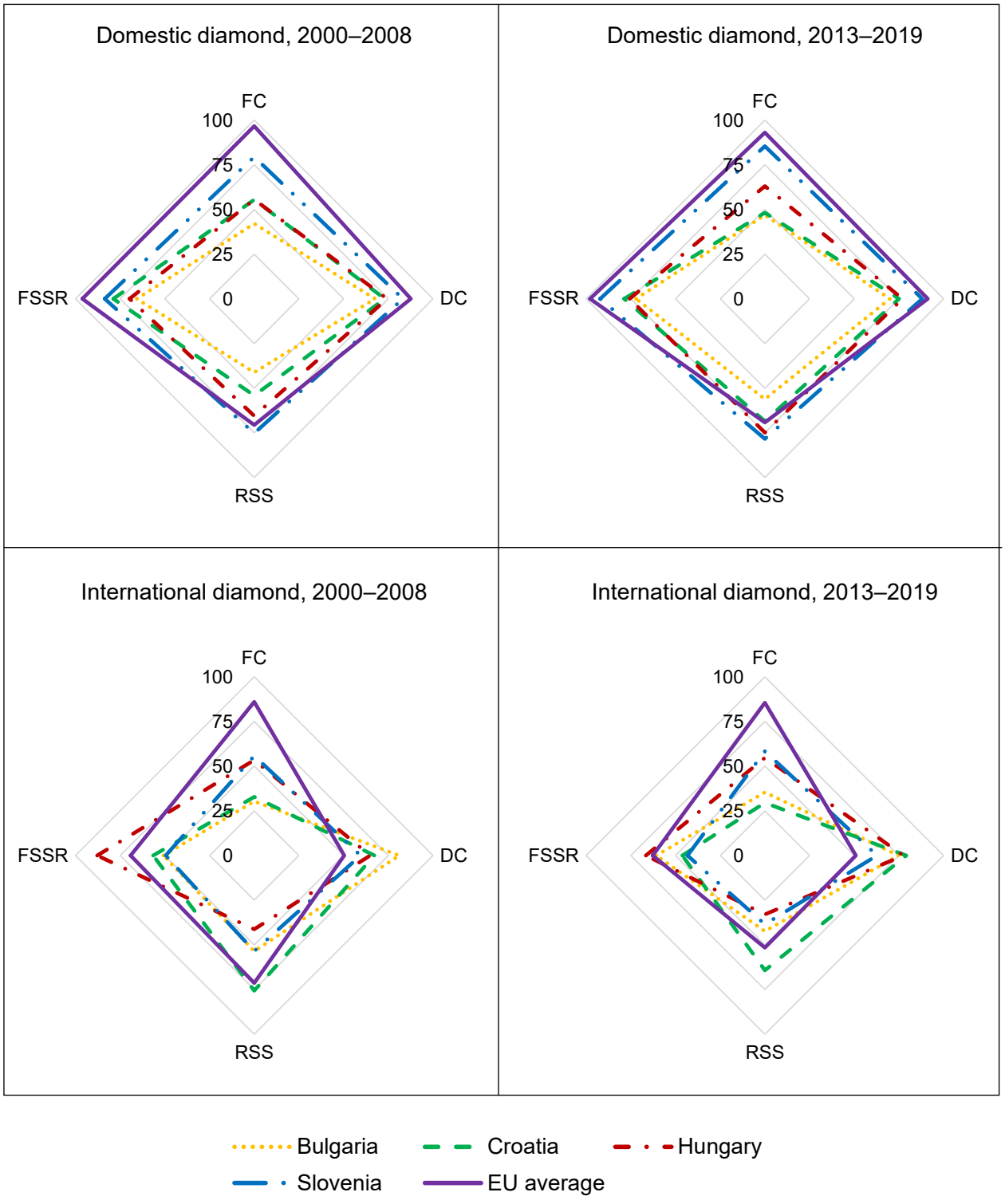
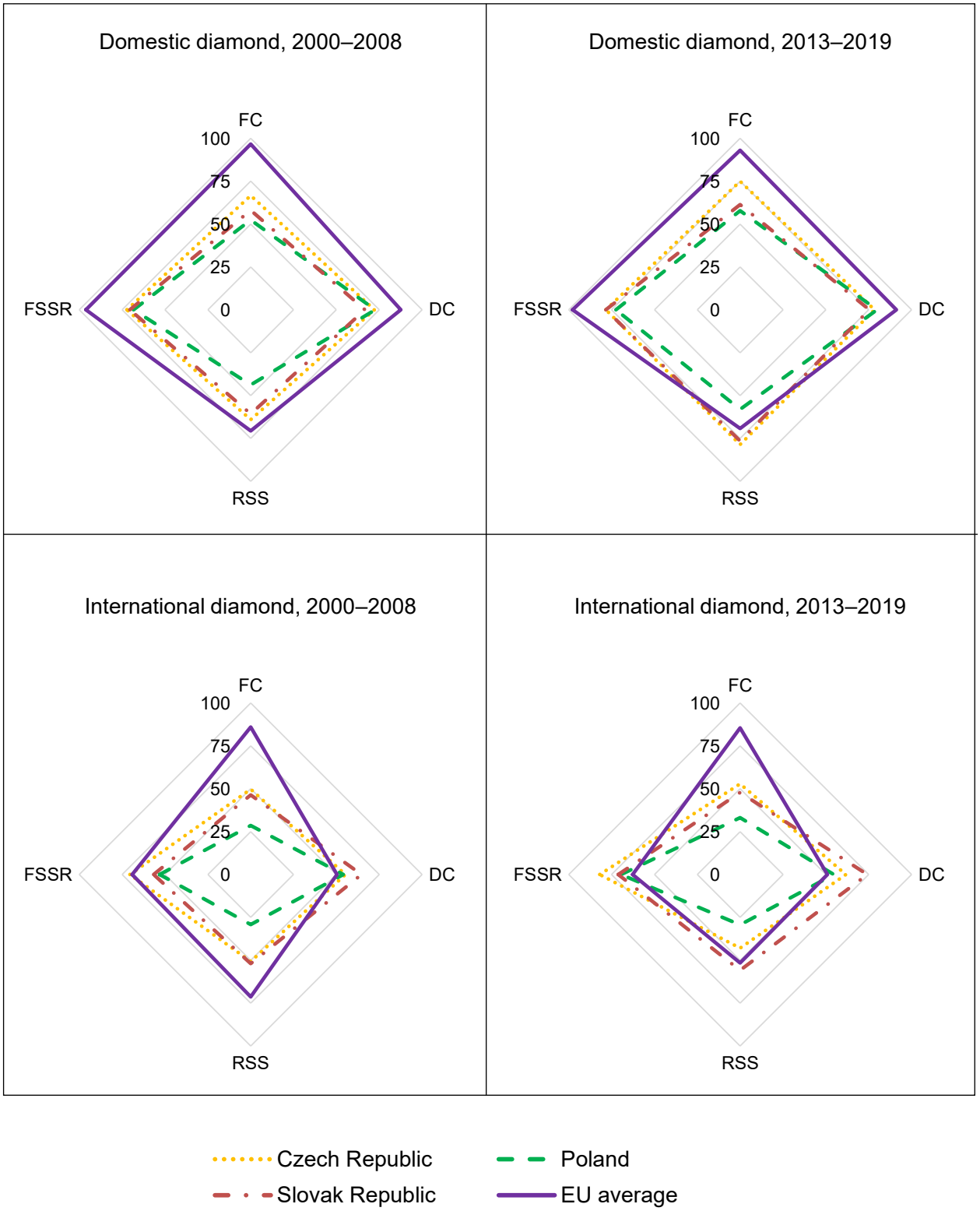
Appendix

Domestic and international diamonds of selected CEE countries for 2000–2008 and 2013–2019

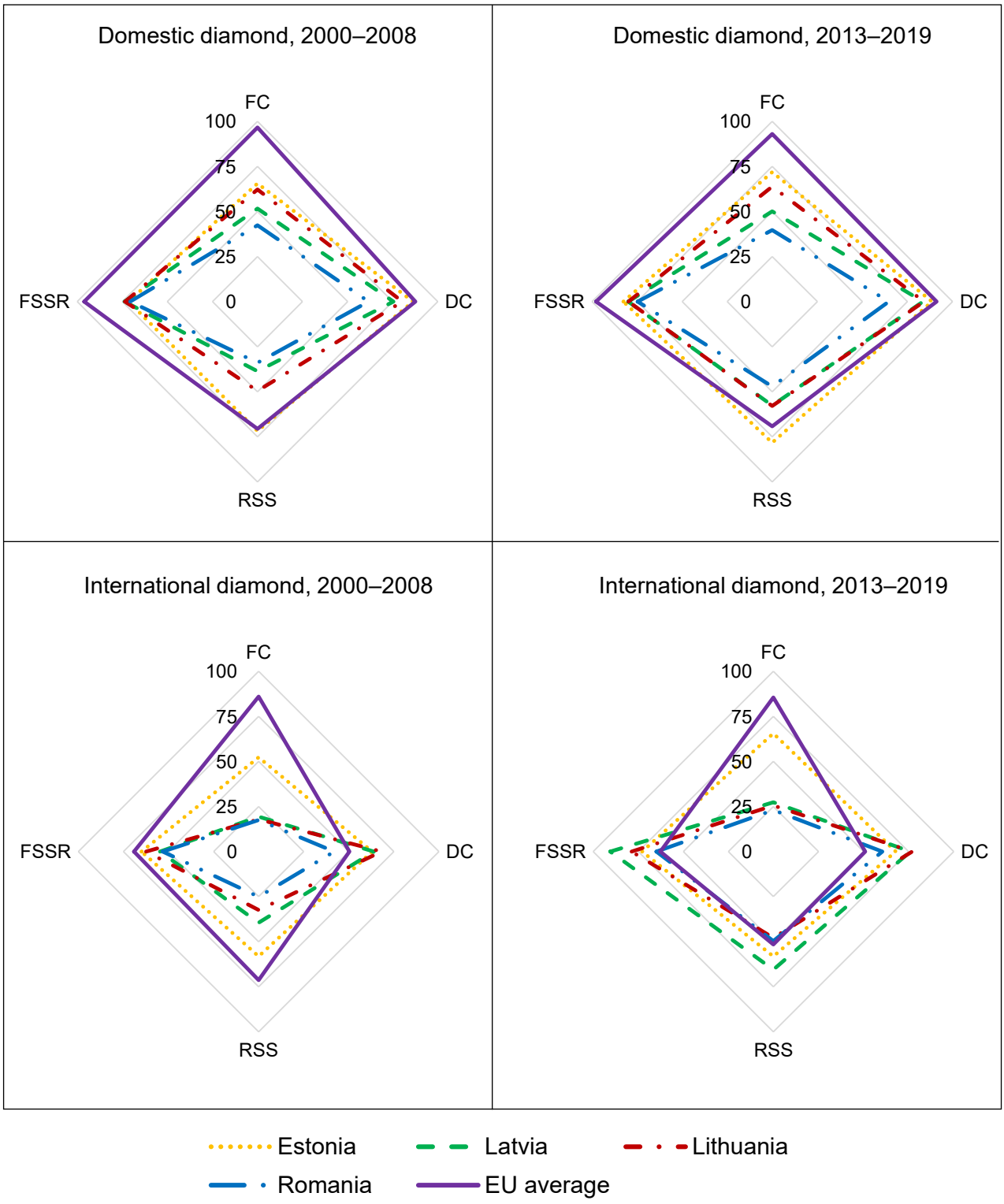
Bulgaria, Croatia, Hungary, Slovenia



Czech Republic, Slovak Republic, Poland



Estonia, Latvia, Lithuania, Romania



Source: Authors' own representations