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CBM&As from Central and Eastern Europe in 2009–2024: A Network-Based Analysis of Investment Patterns in Emerging Markets

Abstract

Purpose: The primary objective of this study is to examine the topological characteristics and geographical patterns of the cross-border mergers and acquisitions (CBM&As) network initiated by Central and Eastern European Countries (CEECs) from 2009 to 2024, as well as to identify proximity-based determinants of investment linkages within this network. Hypothesis H1 posits that the CBM&As network exhibits a growing number of external linkages between CEECs and non-CEECs, indicating an increasing trend towards internationalisation. Hypothesis H2 asserts that CEECs predominantly engage in the CBM&As within Europe, focusing on neighbouring countries and economically advanced economies with stable institutional frameworks. To verify these assumptions, the study combines social network analysis (SNA) with multiple regression quadratic assignment procedure (MRQAP), providing a comprehensive perspective on both the structural properties and the drivers of CEECs' investment behaviour.

Design/methodology/approach: The study employs social network analysis (SNA) to examine the CBM&As network structure, utilising data from the Refinitiv Eikon database, with a focus on capital flows from CEECs to both CEECs and non-CEECs. Key SNA metrics, such as degree centrality, eigenvector centrality, and the E-I index, are employed to assess the intensity and direction of investment connections. By constructing sixteen annual CBM&A networks, the research explores investment patterns, sectoral preferences, and the structural evolution of these transactions. Additionally, the MRQAP is used to examine the impact of geographical and institutional proximity on shaping the structure of cross-border investment flows.

Findings: The results reveal a significant expansion of CEECs' investment activities, with the number of CBM&A transactions tripling between 2009 and 2024. The network analysis confirms an increasing number of external investment connections initiated by CEECs, particularly with developed European economies such as DEU, GBR, FRA, and EST. POL, CZE, and EST emerge as the most active investors, while DEU, GBR, and USA serve as core external investment destinations within the non-CEECs group. The financial and high-technology sectors dominate CEECs' CBM&As activities, highlighting a shift toward knowledge-intensive industries. The MRQAP regression results further demonstrate that both geographical proximity and institutional similarity significantly influence the intensity of cross-border investment ties, reinforcing the role of spatial and regulatory factors in CEECs' internationalisation strategies.

Originality/value: The CBM&As have taken the form of a network that is poorly described in the literature. Previous research has primarily focused on the United States and Western Europe, neglecting a comprehensive analysis of the CBM&As carried out by CEECs. This study presents a novel perspective on the CBM&As by applying SNA to examine the topological and geographical characteristics of CEECs' investment networks. It extends previous research by incorporating a broader range of CEECs and a longer timeframe. The findings offer valuable insights for policymakers and business leaders, emphasising the strategic role of CEECs in

global investment and laying the groundwork for future research on their economic integration. In addition, the study employs the rarely used MRQAP regression method, which enables the identification of proximity-based determinants of investment linkages within the network structure.

Keywords: cross-border mergers and acquisitions, Central and Eastern European Countries, social network analysis, centrality, Multiple Regression Quadratic Assignment Procedure
Paper type: Research paper

JEL classification: D85, F21, L14

1. Introduction

With the expansion of international trade and investment, the number of cross-border mergers and acquisitions (CBM&As) by multinational enterprises (MNEs) from emerging markets has increased significantly (Wu *et al.*, 2024). This trend, which also applies to MNEs from Central and Eastern European Countries (CEECs), underscores a shift from receiving direct investment (FDI) to active investors seeking strategic assets, competitive advantages, and market expansion opportunities abroad (Gorynia *et al.*, 2015). However, despite the increasing prominence of the CBM&As undertaken by emerging markets, the knowledge of the CBM&As executed by entities from developing countries is limited (Jain *et al.*, 2024).

First, most research focuses on these countries as investment targets (Andries *et al.*, 2021; Bielinski *et al.*, 2019) rather than active investors. This study addresses this gap by examining the outward CBM&A transactions initiated by CEECs.

Second, while some studies (Brózda-Wilamek, 2021) have analysed specific CEECs' markets concerning these transactions, they have often focused on a narrow selection of countries and industries. This research expands the scope by considering twelve CEECs classified by the OECD, namely Albania (ALB), Bulgaria (BGR), Croatia (HRV), Czech Republic (CZE), Estonia (EST), Hungary (HUN), Latvia (LVA), Lithuania (LTU), Poland (POL), Romania (ROU), Slovakia (SVK), and Slovenia (SVN). These nations have undergone similar transitions from centrally planned economies to market-oriented systems, thereby presenting a compelling case for analysing international investment patterns. By incorporating a comprehensive range of CEECs, the research effectively captures the diversity and variance in investment strategies among different economies.

Third, existing research rarely applies network-based approaches to examine the CBM&As executed by CEECs. The CBM&As are the dominant form of FDI and serve as an excellent example of relational data that is increasingly taking the form of networks (Bolívar *et al.*, 2019).

Like other forms of FDI, CBM&As are a key component of the global architecture of FDI, linking firms, sectors, and countries into dynamic capital networks. These processes can be studied from the perspective of a large and dynamic network structure, considering the complex interactions between the entities involved in these transactions (Spelta *et al.*, 2024). This approach offers a new perspective for analysing economic phenomena that can be investigated using network analysis based on social network analysis (SNA).

SNA analyses the connections among actors (nodes), treating the group as a network that allows for the identification of both direct and indirect relationships between them. Unlike most quantitative analyses, which only consider direct connections, SNA reveals structural dependencies between countries, highlighting key actors, central nodes, and patterns of influence that may not be readily discernible through traditional economic metrics (Yang *et al.*, 2016). This research method incorporates algorithms and statistical tools that facilitate the graphical visualisation of connections and in-depth examination of network characteristics. SNA is an interdisciplinary approach widely used in sociology, mathematics, biology, computer science, and physics, although it remains relatively rare in economics (Borgatti *et al.*, 2018).

In the context of CBM&As, network analysis identifies previously unnoticed capital linkages and provides deeper insights into the global dynamics of FDI. The CBM&As can be analysed as a network because they create a system of linkages between countries (Dueñas *et al.*, 2017; Sánchez Díez *et al.*, 2017) - each acquisition or merger represents a relationship that connects economies through capital, technology, and markets. Unlike traditional economic analyses that focus on the volume of capital flows, a network-based approach allows the identification of structural dependencies and patterns in FDI (Bolívar *et al.*, 2019).

To deepen the network analysis, the study is extended by incorporating a Multiple Regression Quadratic Assignment Procedure (MRQAP), which allows for the assessment of how geographical and institutional proximity influence the structure of the CBM&A transaction network. MRQAP enables the evaluation of the statistical significance of relationships between the pattern of investment ties and the relational attributes of the countries involved, while accounting for the inherent interdependencies within the network matrix.

Based on these considerations, this study aims to ascertain the topological characteristics and geographical patterns of the CBM&As network initiated by CEECs from 2009 to 2024 and to identify proximity-based determinants of investment linkages within this network. The main contribution of this research lies in its methodological approach. While previous studies on the CBM&As have focused on financial performance, firm-level strategies, and macroeconomic determinants, this research uses a combination of SNA and MRQAP to examine the structure,

dynamics, and underlying drivers of CEECs' investment networks. This methodology comprehensively assesses direct and indirect capital flows, network centrality, interdependencies among participating countries, and the influence of geographical and institutional proximity on the intensity of investment connections. Moreover, the study extends previous findings by including a broader set of CEECs and covering a more extended period.

The study spans the period from 2009 to 2024, a timeframe selected for several reasons. First, 2009 marks the post-global financial crisis period, during which CEECs began to participate actively in the CBM&As. Second, the selected period encompasses significant European economic and political developments, including the Eurozone crisis, Brexit, and rising geopolitical tensions, which may have influenced CBM&A patterns. Third, the 16-year period enables a long-term analysis of network evolution, providing insights into structural shifts in the investment behaviour of CEECs.

The remainder of this article is organized as follows. The next section reviews the literature, focusing on previous studies that have applied SNA to examine CBM&As. Section 3 outlines the research methodology, with a particular emphasis on the network analysis metrics employed in the study. Section 4 presents the findings from the empirical analysis. Lastly, section 5 offers concluding remarks and addresses the study's limitations.

2. Literature review

Economists have shown significant interest in studying the determinants of M&A (Kurtović *et al.*, 2023). The CBM&As are analysed from various perspectives, including motivation, value creation, payment methods, and behavioural, organizational, legal, and cultural aspects. For example, Yildirim *et al.* (2023) examine the motives and strategies behind the CBM&As undertaken by banks from emerging countries compared to those from advanced countries. Despite the importance attributed to M&A transactions from the point of view of growth and value creation (Tarba *et al.*, 2020), only a few researchers, e.g., Sánchez Díez *et al.* (2017) and Dueñas *et al.* (2017), have addressed the topology and structure of CBM&As as a network of complex interactions between countries or sectors.

The scarcity of research in this area arises from the fact that the statistical data of CBM&As provided by the UNCTAD database lack relational characteristics. These data are aggregated at the country level (for instance, the acquirer's and target's country of origin) and by economic sectors. However, they do not offer insights into specific linkages between entities from both countries or their respective industries. Nevertheless, this information is essential for enhancing understanding of CBM&As.

Moreover, studies examining various facets of M&A have predominantly concentrated on the largest and most developed economies, particularly the United States and Western Europe, due to their significant role in the global CBM&A activity (Brózda-Wilamek, 2023). However, research focusing on emerging markets remains limited, as highlighted by the bibliometric analysis conducted by Jain *et al.* (2024). This study explored the evolving landscape of CBM&A research over the last two decades. It underscored the necessity for additional studies investigating CBM&As within the context of emerging economies.

One of globalization's primary effects is the growing role of emerging markets in the global economy, particularly in the area of FDI. Langenstein *et al.* (2018) highlighted that globalization and European integration have made the CEECs an attractive region for CBM&As due to expected growth rates and favourable framework conditions, especially for Western European investors. Kazmierska-Jóźwiak (2014) emphasized that although the share of CEECs in the global M&A market is negligible, during the sixth wave of M&A, emerging European countries exhibited increased activity in this market. In particular, POL and the CZE attracted investor attention due to dynamic economic growth, deregulation processes, and globalization. POL led the region in terms of the number and value of CBM&A transactions, with CZE securing the second position as the target country.

CBM&A transactions have also emerged as a significant channel for internationalisation and a catalyst for economic growth for companies headquartered in CEECs. Following economic liberalisation and EU integration, firms from these countries have increasingly turned to CBM&A as acquisition targets. These transactions provide access to new markets and strategic assets, playing a pivotal role in driving economic growth and offering a promising future for these firms (Gorynia *et al.*, 2015).

It is essential to highlight that most research on M&A in European emerging markets focuses primarily on CBM&As involving CEECs as target nations – in addition to those previously mentioned; see Bielinski *et al.* (2019) and Andries *et al.* (2021). However, there remains a notable absence of comprehensive studies examining the structure of CBM&A transactions conducted by companies from CEECs.

There is a gap in the literature that allows for a deeper examination of how companies from CEECs manage CBM&As, particularly in terms of their strategic motives and outcomes. For instance, Nowiński (2017) analysed CBM&As made by Polish MNEs from 2002 to 2015, concluding that these transactions generally create shareholder value. The study highlighted that Polish firms tend to perform better in emerging markets as they can adapt effectively to dynamic and underdeveloped institutional environments. Key investment areas included

neighbouring transition economies, such as CZE and UKR, as well as advanced markets like DEU (Nowinski, 2017).

The most recent academic study on CBM&As conducted by CEEC entities (Kurtović *et al.*, 2023) analyses the influence of host country factors, such as GDP, research and development, and institutional quality, on outward FDI from eight Central, Eastern, and South-Eastern Europe (BGR, HRV, CZE, HUN, POL, RUS, SVK, and SVN) during 2001–2021. These entities primarily invested in European nations, especially former socialist bloc states and EU members, targeting economies with stable political systems, low corruption, and robust institutional frameworks. These investments were motivated by the pursuit of efficiency and strategic assets (Kurtović *et al.*, 2023).

The interdisciplinary research method known as SNA is not yet widespread in economics, although the number of scientific studies using network analysis tools to examine business networks (Vitali & Battiston, 2014) and international financial crises (Elliott *et al.*, 2014) economic networks (Chen *et al.*, 2024), and trade networks (Dong, 2022) is gradually increasing. For example, Nacewska-Twardowska and Brózda-Wilamek (2024) analysed the centrality and importance of individual countries in the EU trade network.

In turn, previous research on CBM&As using SNA tools has been conducted by, among others, Sánchez Díez *et al.* (2017), Wassenhoven *et al.* (2021), Chen *et al.* (2022) and Brózda-Wilamek (2023). To the best of the author's knowledge, the literature contains only one article that examines the typology of CBM&A networks for European emerging markets (Brózda-Wilamek, 2021).

Brózda-Wilamek (2021) assessed the geographic and sectoral structure of Polish, Czech, and Hungarian CBM&A networks from 2010 to 2020. However, this study was simplified as it considered only three distinct sectoral CBM&A networks for each analysed country. The results indicated that the financial, industrial, technology and consumer cyclical spending sectors had played important roles in the CBM&As networks across the countries analysed. It also showed that Polish, Czech, and Hungarian MNEs invested mainly in DEU, USA, RUS, and neighbouring countries, highlighting their growing role in global capital flows.

This study builds upon the work conducted by Brózda-Wilamek (2021) and is more comprehensive. First, twelve countries classified by the OECD as CEECs, namely ALB, BGR, HRV, CZE, HUN, POL, ROU, SVK, SVN, EST, LVA, and LTU, are included. Second, fifteen networks are constructed separately each year, and CBM&A transactions were simultaneously collated for all CEECs under analysis. This study extends the geographical and methodological scope of Brózda-Wilamek's earlier work (2021). It provides a comprehensive overview of the

CBM&A transactions conducted by the CEECs within and outside the CEE region. In particular, it encompasses a broader range of countries, a longer time frame, and a more comprehensive analysis of investment relationships.

This study presents a novel approach to evaluating the networks of CBM&A transactions initiated by CEECs, leveraging the relational nature of M&A data. It aims to present a novel methodological approach to studying the typology and structure of the CBM&As market, focusing on the application of several network centrality measures. It seeks to bridge the gap between purely theoretical studies on CBM&As and case studies on individual MNE.

Building on the insights from the literature review and addressing the identified research gaps, the following hypotheses are proposed:

H1: The structure of the CBM&As network initiated by CEECs shows an increasing number of external connections between CEECs and non-CEECs.

H2: CEECs tend to engage in CBM&As within Europe, primarily targeting neighbouring nations and developed economies with stable institutional environments.

3. Research method and data section

The study utilizes data from the Refinitiv Eikon database, which provides detailed information on M&A transactions. Similar to the study conducted by Brózda-Wilamek (2023), the research sample was constructed in two stages. In the first stage, data on CBM&As at the company level was aggregated at the country and economic sector levels. Only transactions involving acquiring companies with their headquarters in CEECs were considered. In the second stage, all domestic M&A transactions were removed. The final sample included only completed CBM&A transactions from 2009 to 2024. Deals were assigned to the year depending on their completion date. Disallowed or withdrawn transactions were ignored. The study focuses solely on the number of CBM&A deals, excluding transaction value due to incomplete data disclosure in the database.

The study employs SNA, which is rooted in graph theory, matrix algebra, and statistics. This research method, which is based on graph theory, matrix algebra, and statistics, provides a robust framework for examining relational properties and dependencies that are undetectable when viewed in isolation (Borgatti *et al.*, 2018). In M&A analysis, SNA facilitates the visualization of business networks as comprehensive structures, revealing previously unnoticed indirect capital connections (Yang *et al.*, 2016). Networks in SNA function as systems, with entities acting as nodes and their relationships as edges, providing deep insights into their

structure and dynamics. Empirical research typically represents these networks as graphs, with nodes represented as circles and edges as straight lines connecting them (Nerurkar *et al.*, 2022).

In this paper, similar to the study conducted by Guo *et al.* (2021) and Brózda-Wilamek (2023), the directed CBM&A networks are examined, designating home and host countries as nodes. The edges represent the number of investment transactions, with CEECs acting as the source (investors) and their partners, including CEECs and non-CEECs, as the target entities (acquired). Links between non-CEECs are excluded. This structure defines a unidirectional flow of capital from CEECs to other countries (both CEECs and non-CEECs). In the analysed network dataset, attributes of individual nodes reflecting the economic sector for both the investor and the acquired entity were also included.

According to Borgatti's (2005) classification, the type of flow process in this studied network can be divided into walks and transfers. The capital flow in CBM&A transactions is transfer-based. Investments are transferred from one country (the acquirer) to another (the acquired entity), and capital is neither copied nor duplicated. The trajectory of the capital flow is similar to walking, as investments can move freely through different countries, with the same entities potentially involved in multiple transactions. This type of flow process determines centrality measures that accurately capture network structure and investment dynamics (Borgatti, 2005), such as degree centrality and eigenvector centrality.

It should be noted that a wide range of indicators different from traditional statistical methods is used in the network analysis. The SNA metrics can be analysed at both the whole network and individual node (country) levels. In this study, the former category of indicators that reveals the general characteristics of the network encompasses:

- density – evaluates the completeness of the network, where a fully connected network contains all possible edges and has a density of 100% (Lee & Sohn, 2016),
- average degree – represents the mean number of direct connections per node within the network,
- E-I Index – measures the degree of externalization and internalization of ties within a network (Krackhardt & Stern, 1988),
- sum of tie strengths within and between groups – represents the total number of connections within and between groups, enabling the analysis of network structure and cohesion.

The second category of SNA metrics comprises indicators essential for assessing a node's position within the network. In this study, the following indicators have been identified within this group:

- degree centrality – the number of all direct connections of a given node,
- eigenvector centrality (prestige centrality) – evaluates a node's connections to well-connected nodes, indicating its influence within the network,
- individual E-I Index level – measures the extent to which a node's connections are external (between groups) versus internal (within its group), providing insight into its integrative or insular position within the network (Krackhardt & Stern, 1988).

The selected network indicators serve as essential tools in assessing the evolution of the CBM&As network initiated by CEECs, directly contributing to the verification of hypotheses H1 and H2.

In particular, density provides insight into the overall connectivity of the CBM&As network, enabling an evaluation of whether the increase in the number of transactions aligns with a broader integration of CEECs into the global investment landscape. In turn, a rise in the average degree would suggest a growing number of direct investment ties per country, supporting the premise that CEECs have expanded their outreach beyond intra-regional transactions.

For calculating the E-I Index and the sum of tie strengths within and between groups, the CBM&As network is divided into two distinct groups. The first group consists of CEECs. In contrast, the second group comprises non-CEE countries. The E-I Index helps determine whether investment ties are predominantly internal (within CEECs) or external (between CEECs and non-CEECs), providing an empirical assessment of the network's shift toward increased external connections. A positive E-I Index indicates the dominance of external connections, meaning that CBM&A transactions initiated by CEECs are more frequently directed toward non-CEECs rather than within the CEE region, which supports H1 and suggests an increasing trend of international investment. Conversely, a negative E-I Index reflects a more substantial internal focus, where CEECs predominantly engage in CBM&As within their region, implying greater economic integration among CEECs rather than outward expansion (Bolívar *et al.*, 2019). The sum of tie strengths within and between groups further clarifies the intensity of intra- and extra-regional capital flows, offering a nuanced perspective on whether external transactions are becoming more prominent. These indicators collectively facilitate a comprehensive analysis of the CBM&As network's structural transformation and contribute to the verification of hypothesis H1.

In turn, the selected centrality measures (within the aforementioned second group of indicators) are crucial for evaluating the structural positioning of countries within the CBM&As network of CEECs, thereby contributing to the verification of hypothesis H2. In the context of

CBM&As, these measures can help identify which countries hold strategic positions in investment networks (Sánchez Díez *et al.,* 2017).

Degree centrality quantifies the number of direct investment connections between acquirer countries (investors) and target countries (recipients of foreign capital), identifying the most active participants in CBM&A transactions. A high degree of centrality value indicates that a country serves as a crucial hub in the network. Guo *et al.* (2019) highlight that in directed networks, it is also possible to calculate the following for a given node:

- Out-degree centrality – measures the number of outgoing links representing the CEECs' investments through CBM&As operations.
- In-degree centrality – measures the number of incoming links representing the investments made into the country through CBM&As operations executed by CEECs.

In the context of CBM&As, out-degree indicates a country's significance as an acquirer, while in-degree reflects its importance as a target. In particular, if European economies display high in-degree centrality in this studied network, it would indicate a strong regional investment focus, supporting H2.

Degree centrality considers the immediate ties that a node has. Therefore, the degree is distinct from other centrality measures because it provides information about the local power of a node. Other dimensions of centrality, such as eigenvector centrality, reflect the node's position regarding the entire network (Barros *et al.*, 2021). By using eigenvector centrality, it is possible to capture the dynamics and structure of the CBM&As network more effectively than just its superficial characteristics derived from the number of transactions.

Eigenvector centrality assesses a country's relative importance in CBM&A networks. This indicator identifies the nodes that are most closely connected to the most influential nodes within the network. It evaluates the relative prominence of entities by considering not only their direct connections but also the connections of their direct and indirect neighbours (Borgatti, 2005). It helps to identify the most prestigious nodes and assess the quality of their connections. A high eigenvector centrality value suggests that a node is a leader within the network, as it has numerous relations to other entities that also hold significant positions in the system (Lee & Sohn, 2016).

In the case of the CBM&As network, eigenvector centrality evaluates the connectivity of a country's partners, providing insights into the significance of indirect investment relationships. A country with high eigenvector centrality maintains relationships with other highly connected and influential nodes, signifying its embeddedness in a structurally significant segment of the network. This can mean that a country plays a key role in CEEC investment flows, for example,

as a dominant investor or a preferred target for acquisition. If countries representing the leading European financial and industrial centres have a high value of eigenvector centrality, this would further support H2, which states that CEECs prefer to invest in European established and stable economies.

Finally, the individual E-I Index level for a particular node provides a crucial differentiation between internal and external connectivity (Bolívar *et al.*, 2019). This metric determines whether a country's investment ties are predominantly intra-regional (within CEECs) or extend beyond the region. If the E-I Index values for CEECs remain relatively high and positive, this would indicate a preference for transactions beyond the CEE region, directly confirming the assumptions of H1. Taken together, these measures allow for a nuanced evaluation of investment behaviours, capturing both direct linkages and broader structural integration within the CBM&As network.

To deepen the analysis and examine the underlying determinants of cross-border investment behaviour within the CBM&As network initiated by CEECs, a Multiple Regression Quadratic Assignment Procedure (MRQAP) was employed. MRQAP is a permutation-based regression technique designed to test hypotheses in the context of relational data, where traditional regression assumptions may be violated due to the inherent interdependencies between observations (Dekker et al., 2007). In this study, the MRQAP regression was applied separately for each year from 2009 to 2024, using the number of CBM&A transactions between country pairs as the dependent variable. The independent variables incorporated into the models capture both spatial and institutional proximity, thus enabling an assessment of whether geographic and institutional similarity between countries affects the volume of cross-border M&A activity.

Specifically, two explanatory variables were included in the MRQAP analysis. The first variable, Geographical Distance Similarity, measures spatial proximity based on the inverse standardised distances between capital cities, derived from the CEPII GeoDist dataset. Higher similarity values indicate closer geographic distance. The second variable, Regulatory Quality Similarity (RQ), captures institutional proximity by transforming the absolute differences in World Bank WGI scores between acquirer and target countries into a similarity index ranging from 0 (maximum institutional dissimilarity) to 1 (perfect similarity). The results of the MRQAP regression will contribute to the verification of hypothesis H2 by assessing whether geographical and institutional proximity between CEECs and target countries influences the direction and intensity of CBM&A flows.

4. Discussion and results

To utilise social network analysis indicators in studying the FDI of CEECs, fifteen networks are constructed separately for aggregated country-level CBM&A transactions each year. The visualisation of these networks is presented in the form of a directed graph, where the edges represent the flow of resources from the acquirer country to the target country. Figures 1 and 2 depict the CBM&As networks of CEECs in 2009 and 2024, respectively. Node size represents degree centrality, and edge thickness indicates the cumulative number of transactions between country pairs. CEECs are highlighted in burgundy.

The visualisation confirms the intensification of economic globalisation, as evidenced by the growing number of countries involved in the CBM&As networks of CEECs. Compared to Figure 1, Figure 2 presents a more expansive and densely connected network, illustrating that CEECs have become more intensely interconnected. The increased outflows from CEECs reflect broader patterns identified by Wu *et al.* (2024), in which emerging markets are transitioning from mere recipients of investment to active investors globally. This shift highlights the growing role of CEECs in the global economic landscape, corroborating previous studies that emphasise their increasing integration into international capital flows (Gorynia *et al.*, 2015).

Table I summarises the CBM&As networks analysis results for CEECs from 2009 to 2024. The network density fluctuates between 6% and 14%, suggesting a relatively sparse but increasingly cohesive structure. The examined network is characterised by relatively low-density indicators (averaging 11%) compared to other macroeconomic networks, such as trade networks, observed by Nacewska-Twardowska & Brózda-Wilamek (2024). However, Dueñas *et al.* (2017) emphasise that despite this modest density, the directional nature and specific characteristics of these transactions render this value adequate for conducting a more detailed analysis of individual nodes.

As illustrated in Table I, the number of CBM&As implemented by enterprises from CEECs showed a development trend corresponding to the trends in the global M&A market (Brózda-Wilamek, 2023). Between 2009 and 2023, the number of CBM&A transactions initiated by CEECs tripled, from approximately 70 in 2009 to over 220 in 2023. Moreover, throughout the analysed period, CBM&A transactions, on average, accounted for approximately 20% of all M&A operations carried out by CEECs. Additionally, this share has increased significantly from approximately 17% in 2009 to around 30% in 2023.

The average degree, which represents the average number of investment links per country, shows an upward trend, from 2.12 in 2009 to 5.41 in 2023, suggesting a systematic

intensification of CEECs involvement in CBM&As. The vast scale of overseas expansion by enterprises from the CEECs in the global market is also confirmed by the significant increase in the number of nodes in the CBM&As network, from 34 to 42, with the most important growth occurring in non-CEECs, which increased from 22 in 2009 to 30 in 2023. This trend underscores the broadening investment reach of CEE firms beyond their immediate region.

Furthermore, based on the data in Table I, it can be seen that investment structure analysis further reinforces the dominance of transactions with non-CEE partners. The E-I Index, which measures the proportion of external investments relative to intra-CEE transactions, remains positive in most analysed years, except for 2014, 2019, and 2021, indicating a prevailing inclination of CEECs toward capital allocation beyond the CEE region. The aggregate strength of ties between CEECs and external entities consistently exceeds intra-CEE transactions, highlighting the region's growing economic integration into the global market. These empirical findings support H1, which is confirmed by the increasing number of external investment connections, a persistently positive E-I Index, and the expanding group of non-CEE target countries.

Table II presents four basic centrality measures related to the ranking positions of the countries comprising the CBM&As networks of CEECs for 2009-2024. The change in the ranking position of individual nodes depends not only on the change in the indicator for a specific country but also on the changes in the values of the indicator for the nodes neighbouring it in the ranking.

On average, throughout the analysed period, overviewing the significant nodes in terms of degree centrality values, the following groups of countries can be distinguished (see Table II):

- The countries with the highest normalised degree of centrality are CZE, POL, EST, LTU, and HUN. These economies were the most central actors in the network, holding the majority of connections with all other nodes involved in the system. The CBM&As network visualisation for 2023 (see Figure 2) confirms their dominance.
- The countries with the highest normalised in-degree centrality are DEU and POL. These countries experienced a relatively large inflow of foreign capital from other CEECs through the CBM&As network. The ranking also shows the increasing presence of Western European countries (GBR and FRA) and the USA as primary targets. RUS, which initially held a strong position in the CBM&A network between 2009 and 2011, gradually lost prominence, particularly after 2011, likely due to geopolitical instability and shifting economic alliances. This trend aligns with studies highlighting the impact of geopolitical tensions on investment flows (Kurtović *et al.*, 2023). Moreover, within the CEECs group, it could also be identified

that LTU, LVA, SVK, CZE, and ROU are the core target countries for FDI locations using CBM&As.

- The countries with the highest normalised out-degree centrality are CZE, POL, EST, HUN, LTU, and SVK. Companies primarily based in these countries have expanded their activities abroad through CBM&As.

It is worth noting that companies from CZE and POL were the leading acquirers and targets in the CBM&A transactions carried out by the CEECs. Therefore, it can be assumed that they form the core of the network being studied. These findings expand on previous research by (Kazmierska-Jozwiak, 2014), who highlighted the attractiveness of POL and CZE for M&A activity.

Additionally, the data presented in Table IV indicate that, on average, throughout the analysed period, the prominent nodes (flagship entities) in the CBM&As network were businesses originating from DEU, POL, SVK, CZE, and RUS. These countries have been highly active in CBM&As, and their companies have often engaged in M&A with companies from other centrally positioned countries within the analysed network. From 2009 to 2024, it is noteworthy to observe the improvement in DEU's position and the deterioration in RUS's ranking based on the eigenvector centrality value, which can be linked to the sanctions imposed and the decline in international confidence in Russian companies. In 2018, GBR replaced RUS in this ranking and systematically improved its position from 2018 to 2023, securing the eighth and fourth positions. Between 2009 and 2024, the USA also recorded a high eigenvector centrality value. Therefore, it can be concluded that in addition to CEECs, the German, British, and American economies have numerous connections with other entities holding key positions in this network. The rise of the GBR and the USA in this network suggests a growing integration of these economies with CEEC markets, which may have further implications for future M&A transactions. Additionally, the substantial investment links with the USA indicate that CEECs are expanding their investment reach beyond Europe, a trend previously noted by Nowinski (2017). The presence of non-CEECs (USA, GBR, FRA, ESP) in recent years partly supports the H2 that CEEC investments are expanding into highly developed European economies with stable institutional frameworks.

The rankings in Table II support the research hypotheses. CEECs are increasingly connected to non-CEECs, as indicated by the rising influence of DEU, GBR, and USA. The preference for European destinations, particularly neighbouring developed economies (except for the USA), aligns with the notion that CEECs' investors prioritize stable institutional environments.

Based on a detailed analysis of the out-degree centrality (see Table III), it can be concluded that MNEs from CEECs also engaged in CBM&As with foreign enterprises headquartered outside the CEEC. In particular, increased investment activity was observed in the case of:

- Czech and Polish corporations – in DEU and GBR,
- Estonian companies – in FIN and GBR,
- Hungarian companies – in the USA.

The observed investment directions of MNEs from CEEC align with the trends noted by Brózda-Wilamek (2021) and expand on the geographic investment patterns previously recorded by Nowiński (2017).

The results presented in Table IV highlight the pronounced heterogeneity in the degree of international capital involvement across CEECs. Positive E-I index values indicate a higher number of external connections between CEECs and non-CEECs. Countries such as POL, EST, and CZE consistently show positive values, suggesting a trend towards external CBM&As activities, which supports H1. In contrast, countries such as SVK and ROU maintain negative E-I index values, underscoring a sustained preference for internal links (within CEECs) that represent regional transactions. This aligns with the assumption (H2) that CEECs countries prioritise engagement within Europe, particularly in geographically proximate and economically stable markets. The fluctuating E-I index values for BRG and LTU indicate periodic shifts in internationalisation strategies, whereas SVN and LVA exhibit a declining outward orientation over time. Collectively, these findings suggest a continuous restructuring of the CBM&As network among CEECs, characterised by a dual trajectory: certain countries are progressively integrating into global markets, while others remain anchored in regional economic structures.

Examining the network sectoral structure of the CBM&As carried out by MNEs from CEECs lead to the following conclusions. On average, over the past 15 years, companies from financials (36%), high technology (9%), industrials (9%), consumer products and services (7%), and energy (7%) sectors have expanded their activities through CBM&As (see Figure 3). Based on a detailed analysis of the acquirer's macro industry, it can be stated that the importance of the financial sector has increased significantly. In contrast, the role of the other sectors mentioned above remained stable. The prominence of the financial sector as a key acquirer is confirmed by Brózda-Wilamek (2021). This suggests that the financial sector, primarily represented by private equity and hedge funds, plays a crucial role in CEEC's investment flow.

In turn, when assessing the target's macro industry, on average across the entire period, entities from high technology (15%), financials (13%), industrials (12%), consumer products

and services (10%), and retail (8%) sectors were the primary investment targets of MNEs from CEECs within the CBM&As network (see Figure 4). It is also noteworthy that between 2009 and 2024, the importance of the high technology sector significantly increased within the target's macro industry.

In addition to the social network analysis, this study incorporates MRQAP to investigate whether spatial and institutional proximity influence the intensity of CBM&A activity among CEECs. The regression model was applied to the same network dataset and included two explanatory variables: geographical proximity and similarity in regulatory quality, both expressed as standardised similarity matrices.

The results of the MRQAP regression, presented in Table V, confirm the relevance of proximity-based mechanisms in shaping the structure of the CBM&As network initiated by CEECs. Geographical proximity yielded statistically significant and positive coefficients for every year from 2009 to 2024 ($p < 0.01$), suggesting that CEEC investors systematically prefer geographically closer targets. Institutional similarity, measured by the similarity in regulatory quality, also showed positive and statistically significant coefficients for most years, though with some fluctuations. This suggests that CEEC investors tend to allocate capital to destinations with regulatory frameworks that are similar to their own.

The adjusted R^2 values for the regression models ranged from 0.51 to 0.80, with the highest explanatory power observed in 2010 and 2013. The robustness of these results across time provides empirical evidence that spatial and institutional proximities consistently influence the formation of investment ties in the region. These findings are particularly aligned with Hypothesis H2, which posits that CEECs favour geographically proximate and institutionally stable European economies. As such, MRQAP regression serves as a complementary tool to SNA, enriching the analysis by offering quantitative support for the relational mechanisms underlying investment behaviour in the CBM&As network.

5. Conclusions

This study offers a comprehensive analysis of the evolving topological structure and geographical distribution of the CBM&As network initiated by CEECs between 2009 and 2024. By employing social network analysis and examining key investment patterns, the findings provide empirical support for the proposed research hypotheses. These findings collectively suggest that while CEEC's CBM&As activity remains predominantly intra-European, strategic linkages with non-CEE markets are becoming more pronounced, indicating a gradual evolution toward broader international integration.

Firstly, the results confirm an increasing number of external connections between CEEC and non-CEECs, substantiating H1. Over the study period, the number of CBM&A transactions initiated by CEECs tripled, with a notable rise in investments directed toward non-CEEC entities. This trend is reflected in the persistent growth of the E-I index, which has remained predominantly positive except for a few select years. The expansion of CEECs' investments beyond their regional confines signifies a broader shift in their role from passive recipients of investment to active investors engaging in international capital flows.

Secondly, the study corroborates H2 by demonstrating that CEEC MNEs predominantly target European countries (the exception is the USA), particularly those with stable institutional and economic environments. The prominence of DEU, GBR, and USA in CEEC investment networks underscores the strategic preference for developed economies. Furthermore, key CEEC investors such as POL, CZE, and EST exhibit consistently high out-degree centrality, highlighting their role as primary drivers of regional and international CBM&As expansion.

The sectoral analysis further underscores the evolving composition of CEEC investment patterns. The financial sector emerged as the dominant acquirer, indicating the increasing influence of private equity and hedge funds in cross-border investment flows. Meanwhile, the high technology sector has gained prominence as a primary target industry, reflecting the growing integration of CEEC enterprises into knowledge-intensive and innovation-driven markets.

Overall, this study demonstrates that the CBM&As network of CEECs has undergone profound structural transformations over the past 15 years. While certain CEEC economies have adopted globalisation through extensive external investment linkages (such as POL, EST, and CZE), others (such as SVK, ROU, SVN, and LVA) remain primarily anchored in intra-regional transactions. This dual trajectory highlights the heterogeneous nature of CEECs' internationalisation strategies and their ongoing adaptation to shifting economic landscapes.

In addition to the network-based findings, the results of the MRQAP regression provide robust statistical evidence in support of Hypothesis H2. The analysis demonstrates that CEEC investors exhibit a strong preference for acquiring targets located in geographically proximate and institutionally similar environments. Both independent variables—geographical proximity and similarity in regulatory quality—yielded statistically significant and predominantly positive coefficients across most years between 2009 and 2024.

Geographical proximity proved to be the most consistent and influential determinant, showing high standardised coefficients (ranging from 0.29 to 0.80) and highly significant p-values in all examined years. This suggests that spatial proximity remains a key driver in the

formation of CBM&A ties between CEECs and their target countries. Furthermore, the results highlight the importance of institutional similarity, particularly in terms of regulatory quality, as a key determinant of cross-border investment flows. Although the significance of regulatory proximity varied over time, in several years (e.g., 2013, 2015, and 2020–2023) its coefficients were both substantial and statistically significant, suggesting that CEEC firms tend to favour destinations with regulatory environments similar to their own.

These regression-based findings complement the network centrality measures and the E-I index trends, reinforcing the argument that CEECs prioritise stability and proximity—both geographical and institutional—when selecting CBM&A targets. The empirical robustness of the MRQAP model confirms that proximity-based mechanisms play a pivotal role in shaping the structure of CEEC investment networks and in driving the spatial dynamics of regional economic integration.

Finally, it is crucial to acknowledge certain limitations of the study. Firstly, the findings are based on aggregated country and macro industry data. Creating comparative ranking tables for individual business sectors and transnational corporations would be too lengthy and thus impractical. Secondly, the analysis considers only the number of CBM&A transactions, excluding their value due to incomplete data in the Refinitiv Eikon M&A database. Another limitation lies in the statistical nature of the MRQAP regression applied in this study. As a non-parametric method based on permutation tests, MRQAP does not rely on traditional assumptions of independence and normality, making it suitable for relational data. However, its exploratory character and reliance on randomised resampling limit the generalizability of findings compared to conventional parametric regression models.

Despite its limitations, the study provides valuable insights into the most active sectors and identifies CEECs as key intermediaries in CBM&As. The network analysis highlights the central roles and connections within the CBM&As topology, making the findings a valuable source of knowledge for policymakers. By using multiple centrality metrics, researchers and policymakers can gain a deeper understanding of how CEECs are integrating into the global investment landscape and how their roles within the CBM&As network are evolving, thereby informing future strategies and policies.

The observed investment patterns and network structures identified in this study may offer useful insights for businesses from CEECs when formulating their internationalisation strategies. In particular, the prominence of destinations such as Germany (DEU), the United Kingdom (GBR), and the United States (USA) suggests potential pathways for further expansion. Although this research does not assess firm-level strategies, the identified sectoral

trends—especially in finance, high technology, and industry—may serve as a reference point for companies operating in these areas.

Policymakers may also benefit from the findings presented in this study. The increasing participation of CEEC firms in CBM&A transactions highlights the importance of fostering a supportive regulatory and institutional environment for cross-border expansion. While the study does not evaluate national policy frameworks, the results suggest that targeted measures—such as facilitating access to foreign markets, supporting the high-tech sector, or monitoring investments in strategic industries—could be considered in response to the growing role of CEECs in international capital flows.

Although this study does not examine socio-economic impacts directly, the growing engagement of CEEC firms in global M&A activity raises questions for future research. Possible areas of exploration include the role of CBM&As in job creation, skills development, and long-term economic resilience. A more granular, firm-level or sector-specific approach could help clarify the broader consequences of international expansion for CEEC economies and societies.

This publication offers a novel approach to evaluating the CBM&As network by leveraging the relational characteristics of M&A data. The topics covered here warrant further study, particularly regarding the ownership structures of the merging entities. Additionally, it would be valuable to identify the structure of the CBM&As network carried out by CEECs from a sectoral perspective. The assessment of the CBM&As network typology could also be supplemented by conducting a study using the core-periphery model and the HITS (hubs and authorities) algorithm.

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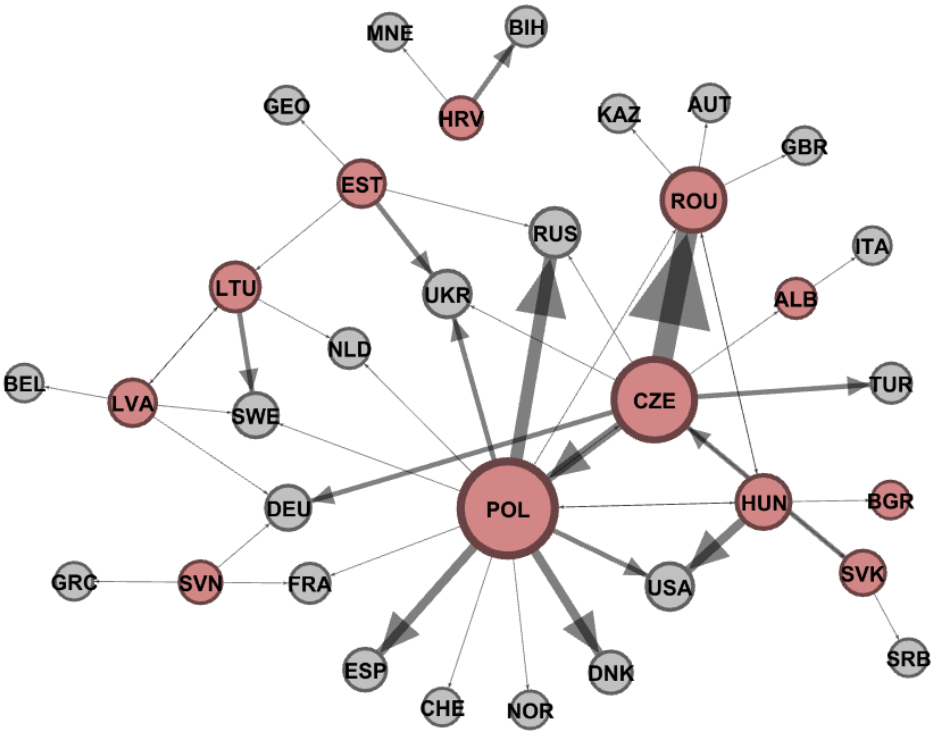
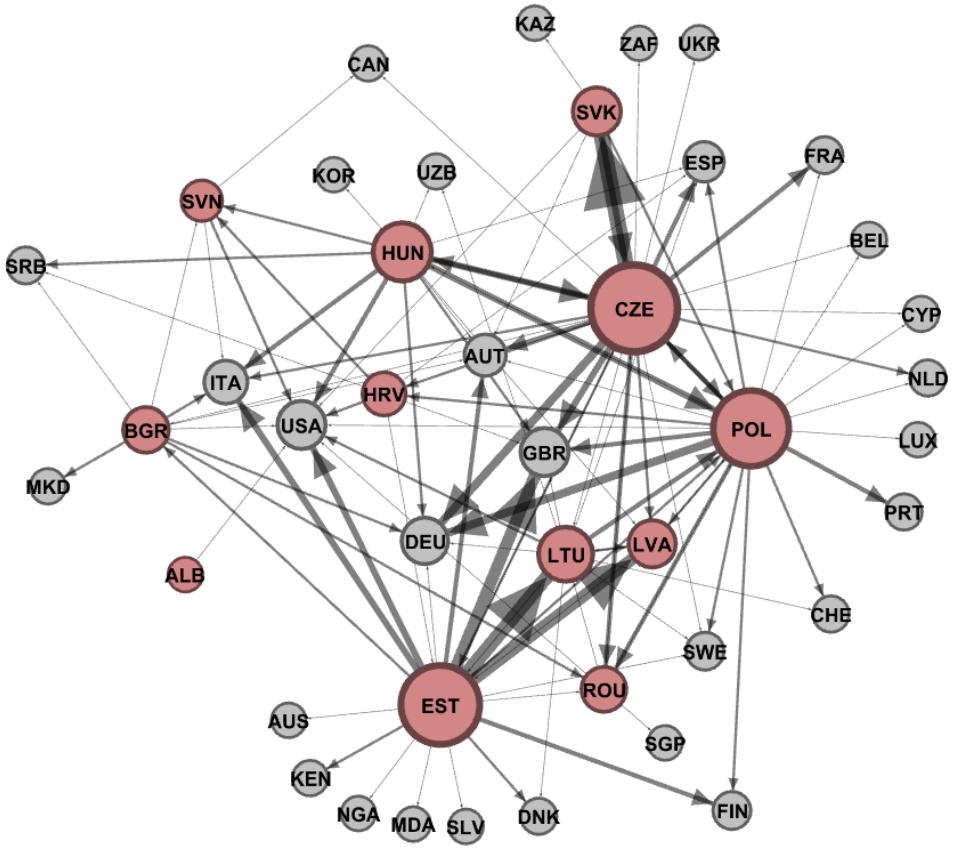
Figure 1. The CBM&A CEEC network in 2009



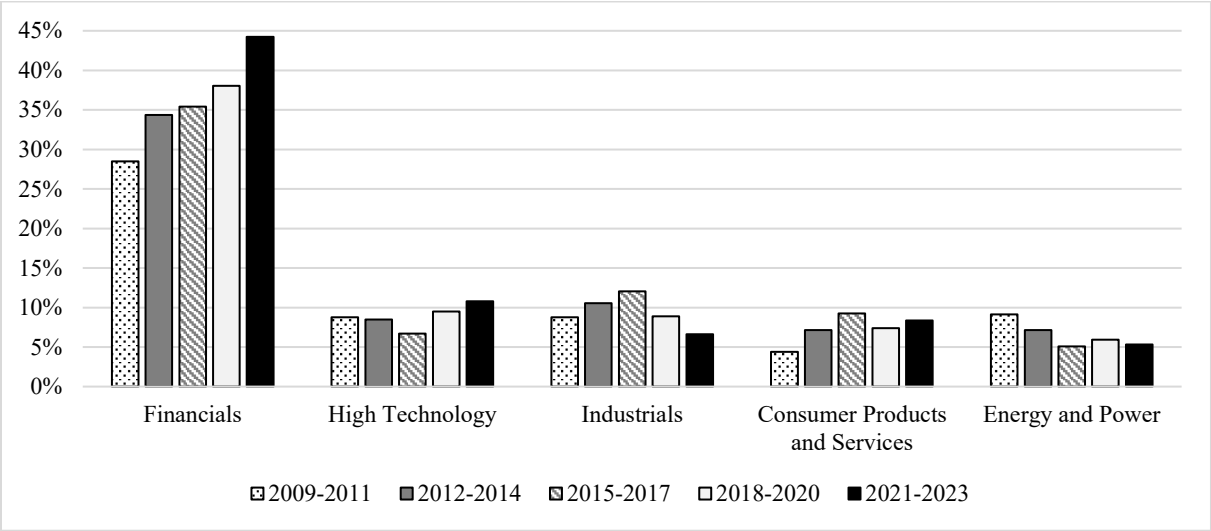
Source: own calculations in Gephi 0.9.2.

Figure 2. The CBM&A CEEC network in 2024



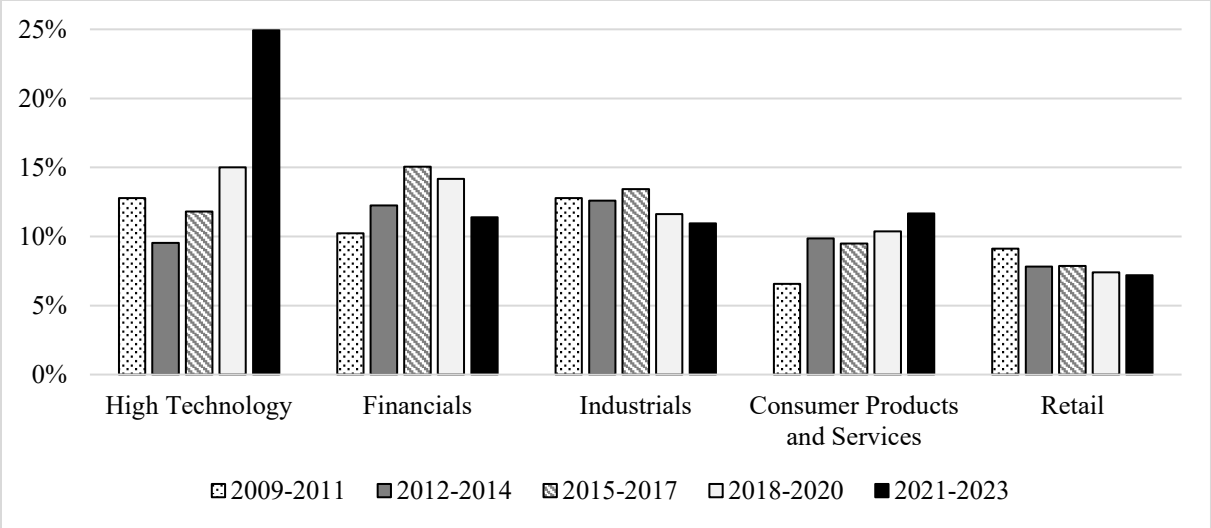
Source: own calculations.

Figure 3. Average percentage shares of the acquirers' macro industries in the CBM&A network, 2009-2024



Source: own calculations.

Figure 4. Average percentage shares of the targets' macro industries in the CBM&A network, 2009-2024



Source: own calculations.

Table I. The values of basic statistics for CEEC CBM&A networks in 2009–2023

	network density	average degree	share of edges in all M&A CEEC	E-I Index	sum of tie strengths within and between groups			node partition		
					within the CEECs group	between groups	total number of edges	CEECs group	noCEECs group	total number of nodes
2009	6%	2.12	17%	0,361	23	49	72	12	22	34
2010	12%	3.52	18%	0,028	53	56	109	11	20	31
2011	12%	3.21	18%	0,140	40	53	93	11	18	29
2012	7%	2.58	20%	0,204	37	56	93	11	25	36
2013	7%	3.39	17%	0,209	34	52	86	12	24	36
2014	12%	3.59	18%	-0,044	60	55	115	11	21	32
2015	11%	4.00	16%	0,028	70	74	144	11	25	36
2016	11%	3.97	16%	0,119	63	80	143	11	25	36
2017	11%	3.92	19%	0,145	62	83	145	11	26	37
2018	10%	3.92	19%	0,190	62	91	153	11	27	38
2019	14%	4.74	18%	-0,044	84	77	161	12	22	34
2020	10%	3.88	18%	0,145	68	91	159	11	30	41
2021	14%	5.67	26%	-0,025	122	116	238	11	31	42
2022	10%	4.67	29%	0,048	109	120	229	12	37	49
2023	13%	5.41	29%	0,181	93	134	227	12	30	42
average	11%	3.91	20%	0,112	65	79	144	11	26	37

Source: own calculations in Gephi 0.9.2

Table II. The ranking of the top 10 countries for degree and eigenvector centrality, 2009-2024

place in the ranking	average place					
	2009-2011	2012-2014	2015-2017	2018-2020	2021-2024	2009-2024
	the normalized degree centrality					
1	POL	CZE	POL	CZE	CZE	CZE
2	CZE	POL	CZE	POL	POL	POL
3	LTU	EST	EST	LTU	EST	EST
4	EST	SVK	LTU	EST	HUN	LTU
5	HUN	LTU	LVA	HUN	LTU	HUN
6	ROU	LVA	HRV	SVK	LVA	SVK
7	LVA	DEU	SVK	LVA	SVK	LVA
8	RUS	HRV	HUN	SVN	HRV	ROU
9	SVK	BGR	SVN	BGR	DEU	DEU
10	DEU	RUS	ROU	DEU	ROU	HRV
	the normalized in-degree centrality					
1	RUS	LVA	DEU	POL	POL	DEU
2	DEU	DEU	POL	DEU	DEU	POL
3	CZE	SVK	ROU	SVK	GBR	LTU
4	ROU	RUS	LTU	LTU	LTU	LVA
5	POL	CZE	SVN	CZE	LVA	SVK
6	LTU	POL	USA	ROU	CZE	CZE
7	HUN	LTU	LVA	FRA	USA	RUS
8	UKR	ROU	SVK	LVA	SVK	ROU
9	LVA	SVN	RUS	USA	ITA	USA
10	FIN	SRB	HRV	GBR	ROU	GBR
	the normalized out-degree centrality					
1	POL	CZE	CZE	CZE	CZE	CZE
2	CZE	POL	POL	POL	EST	POL
3	EST	EST	EST	EST	POL	EST
4	LTU	LTU	LTU	HUN	HUN	HUN
5	HUN	SVK	LVA	LTU	LTU	LTU
6	SVK	HRV	HRV	BGR	HRV	SVK
7	LVA	LVA	HUN	SVK	BGR	LVA
8	SVN	BGR	SVK	SVN	ROU	BGR
9	ROU	HUN	BGR	LVA	SVK	HRV
10	HRV	ROU	SVN	HRV	SVN	SVN
	the eigenvector centrality					
1	RUS	DEU	POL	DEU	DEU	DEU
2	ROU	SVK	DEU	POL	POL	POL
3	HUN	CZE	USA	SVK	SVK	SVK
4	POL	RUS	SVN	ROU	GBR	CZE
5	CZE	LVA	HRV	CZE	LVA	RUS
6	DEU	AUT	ROU	LVA	CZE	ROU
7	DNK	POL	LTU	LTU	LTU	LVA
8	UKR	LUX	SVK	GBR	USA	LTU
9	USA	ROU	RUS	FRA	ESP	USA
10	SVK	LTU	LVA	USA	ROU	GBR

Source: own calculations.

Table III. The primary investment destinations of the top 4 CEECs with the highest average out-degree value, 2009-2024

source country	target country	number of CBM&A transactions				
		2009-2011	2012-2014	2015-2017	2018-2020	2021-2024
CZE	SVK	7	16	13	20	29
	POL	7	6	14	14	28
	DEU	5	8	13	9	15
	ROU	7	1	9	5	4
	GBR	1	1	3	8	11
POL	DEU	9	11	9	14	15
	ROU	6	6	8	8	8
	CZE	8	2	6	7	7
	HUN	5	2	3	1	8
	GBR	2	2	6	3	5
EST	LTU	8	9	15	16	20
	LVA	6	11	11	8	19
	FIN	3	6	5	5	7
	GBR	0	0	3	0	14
	POL	0	1	2	5	5
HUN	POL	2	0	3	10	16
	CZE	0	3	3	4	11
	USA	4	1	3	4	6
	ROU	4	2	1	1	4
	SVN	0	0	1	5	5

Source: own calculations.

Table IV. The values of individual E-I Index for CEEC CBM&A networks in 2009–2024

	2009-2011	2012-2014	2015-2017	2018-2020	2021-2024	2009-2024
POL	0,371	0,324	0,320	0,073	0,224	0,262
EST	0,167	0,317	0,310	0,178	0,315	0,257
CZE	0,178	0,237	0,327	0,259	0,265	0,253
BGR	-0,667	0,276	0,694	0,273	0,067	0,129
LTU	-0,019	0,036	-0,044	0,160	0,051	0,037
SVN	0,867	-0,433	-0,190	-0,124	-0,233	-0,023
HUN	-0,278	-0,111	0,115	-0,223	0,146	-0,070
HRV	-0,067	-0,256	-0,175	-0,095	0,008	-0,117
LVA	0,344	-0,333	0,111	-0,214	-0,500	-0,118
ALB	0,000	-1,000	-	-0,333	0,334	-0,133
ROU	-0,476	-0,400	-0,357	-0,119	-0,210	-0,312
SVK	-0,500	-0,254	-0,511	-0,048	-0,300	-0,323

Source: own calculations.

Table V. The results of MRQAP regression for the CBM&A network initiated by CEEC in 2009–2024

Year	Adj. R-Square	Observations	Independent variables			
			Distance Similarity		Regulatory Quality Similarity (RQ)	
			Standardized Coefficient	P-value	Standardized Coefficient	P-value
2009	0,62	1122	0,631	0,001	0,182	0,002
2010	0,80	930	0,710	0,001	0,202	0,001
2011	0,67	812	0,729	0,001	0,102	0,045
2012	0,71	1260	0,700	0,001	0,153	0,017
2013	0,74	1260	0,466	0,001	0,414	0,001
2014	0,60	992	0,799	0,001	-0,027	0,451
2015	0,63	1260	0,293	0,001	0,519	0,001
2016	0,64	1260	0,618	0,001	0,194	0,003
2017	0,64	1332	0,595	0,001	0,220	0,002
2018	0,59	1406	0,615	0,001	0,164	0,010
2019	0,60	1122	0,583	0,001	0,203	0,005
2020	0,70	1640	0,622	0,001	0,229	0,001
2021	0,54	1722	0,391	0,001	0,357	0,001
2022	0,51	2352	0,373	0,001	0,351	0,001
2023	0,65	1722	0,503	0,001	0,312	0,002
2024	0,57	1406	0,758	0,001	-	-

Source: own calculations.