THE NETWORK OF CROSS-BORDER MERGERS AND ACQUISITIONS EXECUTED BY THE CENTRAL AND EASTERN EUROPE COUNTRIES IN 2009-2023

dr Dominika Brózda-Wilamek[1]

[1] *Department of International Business and Trade, Institute of International Economics, Faculty of Economics and Sociology, University of Lodz*

dominika.brozda@uni.lodz.pl

Abstract: The article aims to identify the topological properties of the network of CBM&As executed by CEECs in 2009–2023. It uses network analysis tools to measure structural power through degree, betweenness, and eigenvector centrality methods. The results indicate that CEECs have become more interconnected, with CBM&A activities tripling. The financial, high technology, and industrial sectors were major acquirers and targets. Over the past 15 years, the position of the financial sector has increased as the macro-industrie of the acquirer, while the importance of the high technology sector has increased significantly as the macro-industrie of the target. Throughout the period under review, the economies of CZE, LTU, LVA, POL, and SVK occupied the most central place and form the core of this network. Apart from the aforementioned countries, DEU, RUS, ROU, USA, and GBR received a large inflow of foreign capital, while entities from EST and HUN invested heavily abroad through CBM&A.

Keywords: cross-border mergers and acquisitions, Central and Eastern Europe, network analysis

INTRODUCTION

Cross-border mergers and acquisitions (CBM&As)) form complex networks of interactions between entities. Although social network analysis (SNA) is not yet widespread in economics, its use is increasing in studies of business networks (Vitali & Battiston, 2014), international financial crises (Elliott et al., 2014), and trade networks (Dong, 2022). Previous research on CBM&As using SNA includes works by Sánchez Díez et al. (2017), Wassenhoven et al. (2021), Chen et al. (2022), and Brózda-Wilamek (2021). However, there are very few studies that examine the typology of CBM&A networks specifically for emerging markets.

Studies on network-based CBM&A activities have focused mainly on the United States and Western Europe, often neglecting Central and Eastern European Countries (CEECs). In particular, one of the main effects of globalisation is the increased role of emerging markets in the global economy, particularly in the area of FDI (Langenstein et al., 2018). Kazmierska-Jóźwiak (2014) notes that despite the small share of CEECs in the global M&A market, these countries showed increased activity during the sixth wave of M&A. While there is literature on the scale of FDI in CEECs, comprehensive research on the structure of CBM&As transactions carried out by businesses from CEECs is lacking. Recent studies, such as those of Kurtović et al. (2023), have examined the impact of host country location and institutional determinants on CEEC FDI inflows.

The main objective of the study is to identify the topological network characteristics of CBM&A transactions conducted by Central and Eastern European Countries (CEECs) between 2009 and 2023. In particular, the study aims to assess the geographical and sectoral structure of the CBM&A network initiated by the CEECs.

This study is comprehensive in nature. Firstly, 12 countries classified by the OECD as CEECs, that is, Albania, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia, Estonia, Latvia, and Lithuania, were included. Secondly, for each year separately, 15 networks were constructed in which CBM&A transactions were simultaneously collated for all CEECs under analysis.

METHODOLOGY

SNA examines relationships within an economy to understand how interconnections between various entities (i.e. individuals, businesses, sectors, or countries) influence individual behaviour. This article, similar to Guo et al. (2021), analyses directed CBM&A networks using network centrality measures – degree, betweenness and eigenvector centrality – to evaluate the strategic positions of countries (i.e. nodes) within the investment network.

For the CBM&A network, degree centrality allows for the identification of the number of direct connections between acquirer countries (investors) and target countries (recipients of foreign capital). In directed networks, it is also possible to calculate (Yang et al., 2016):

— Out-degree centrality – measures the number of outgoing links that represent CEEC investments through CBM&A operations.
— In-degree centrality - measures the number of incoming links representing the investments made into the country through CBM&A operations executed by CEECs.

In turn, betweenness determines the centrality of a node based on being on the shortest path between other nodes. It assesses the potential of a node to regulate communication within the network. This indicator indicates the frequency with which a given entity is on the shortest path between vertices, highlighting the most crucial nodes for communication between other nodes (Lee & Sohn, 2016). For instance, in CBM&A networks, betweenness centrality reveals how much a country serves as a bridge between two other countries.

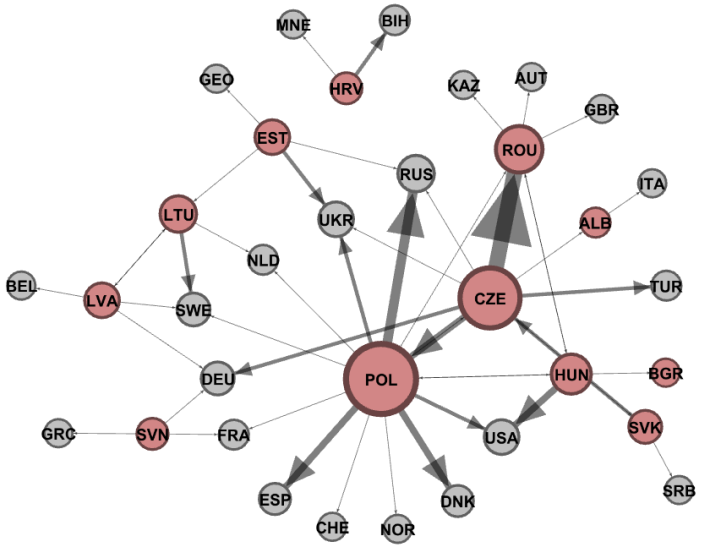
Another centrality measure that can be determined by its neighbors' characteristics is the centrality of the eigenvector. It is used to assess a country's relative importance in CBM&A networks. A high eigenvector centrality value suggests that a node is a leader within the network, as it has numerous relations to other entities that also hold significant positions in the system (Lee & Sohn, 2016). In the case of the CBM&As network, it assesses the connectivity of a country's partners and offers insights into the significance of indirect investment relationships.

Using network analysis to study CBM&As by CEECs, data was sourced from the Refinitiv Eikon. Initially, CBM&A data at company level were aggregated by country and sector, focusing on acquirers headquartered in CEECs. Domestic M&A transactions were then excluded, resulting in a final sample of all completed CBM&A operations from 2009 to 2023.

FINDINGS

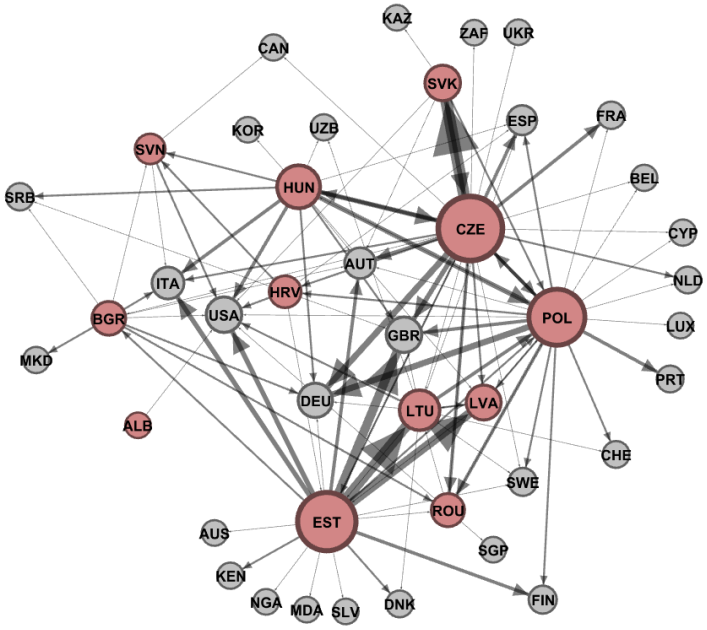
To study CEECs' FDI using SNA, the CBM&A network of nodes (countries) and edges (bilateral M&A transactions) was created and visualised as a directed graph, with edges from the acquirer to the target country. Compared to Figure 1, the network in Figure 2 is extensive and densely connected, reflecting increased interconnections among CEECs in 2023. The number of CBM&As implemented by CEEC companies showed a trend of development, corresponding to trends on the global M&A market (Brózda-Wilamek, 2023). It can be seen that CEEC companies have been continuously expanding their business activities to other countries. While in 2009 CEEC enterprises made investments in only 22 countries, in 2023 they entered the markets of 30 countries.

Figure 1. The network of CBM&As executed by CEECs in 2009



Source: own calculations in Gephi 0.9.2.

Figure 2. The network of CBM&As executed by CEECs in 2023



Source: own calculations in Gephi 0.9.2.

On average, throughout the analysed period, analysing the main nodes in terms of degree centrality values, the following groups of countries can be distinguished (see Table 1):

- Countries for which the normalised degree centrality was the highest: CZE, POL, EST, LTU, HUN and SVK. These economies were the most central actors in the network, having the majority of connections with all other nodes involved in the system.
- Countries for which the normalised in-degree centrality was the highest: DEU, POL, LTU, LVA, SVK, CZE, RUS, ROU, USA and GBR. These countries received a relatively large inflow of foreign capital in the CEECs CBM&A network.
- Countries for which the normalised out-degree centrality was the highest: CZE, POL, EST, HUN, LTU, SVK and LVA. Companies based primarily in these countries have grown activities abroad through CBM&A.

It should be noted that CZE, LTU, LVA, POL and SVK companies were both the main acquirers and targets in the CBM&As carried out by the CEECs. Therefore, it can be assumed that they form the core of the studied network.

On average, between 2009 and 2023, the economies of POL, CZE, LTU, HUN, and EST were leaders in terms of betweenness centrality (see Table 2). Due to the specifics of the studied network, this indicator takes a value greater than zero only for CEECs. Thus, it allows for the identification of the most active entities conducting CBM&A coming from European emerging markets. The nodes mentioned above acted as the main bridges between the countries that form the network of CBM&As initiated by CEEC companies.

Furthermore, the data presented in Table 2 indicate that, on average, throughout the analysed period, the prominent nodes in the CBM&A network were businesses originating from DEU, POL, SVK, CZE and RUS. Companies with headquarters in these countries primarily conducted CBM&A transactions primarily with entities located in other centrally positioned countries within the analysed network. From 2009 to 2023, it is worth noting the improvement in DEU's position and the deterioration in RUS's position in the ranking based on the eigenvector centrality value. In 2018, GBR replaced RUS in this ranking and systematically improved its position from 2018 to 2023, securing the 8th and 4th positions, respectively. Between 2009 and 2023, 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 many connections with other entities holding important positions in this network.

Table 1. The ranking of the top 10 countries for different degree centrality measurements, 2009-2023

position in the ranking	average place					
	2009-2011	2012-2014	2015-2017	2018-2020	2021-2023	2009-2023
	normalised 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
	normalised 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
	normalised 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

Source: own calculations.

Examining the network sectoral structure of the CBM&A carried out by CEECs multinationals leads to the following conclusions. On average, over the past 15 years, companies in the financial sector (36%), high technology (9%), industrials (9%), consumer products and services (7%) and energy sector (7%) have expanded their activities through CBM&A. Based on a detailed analysis of the macro-industrie of the acquirer, it can be stated that the importance of the financial sector has increased significantly, while the role of the other sectors mentioned above remained stable.

In turn, when evaluating the macro-industrie of the target, on average throughout the period, entities from the sectors of high technology (15%), financials (13%), industrials (12%), consumer products and services (10%) and retail (8%) were the main investment targets of CEEC companies within the CBM&A network. It is also noteworthy that between 2009 and 2023, the importance of the high technology sector increased significantly within the target's macro industry.

Table 2. The ranking of the top 10 countries in terms of the betweenness and eigenvector centrality, 2009-2023

position in the ranking	average place					
	2009-2011	2012-2014	2015-2017	2018-2020	2021-2023	2009-2023
	betweenness centrality					
1	POL	POL	POL	POL	CZE	POL
2	LTU	CZE	CZE	CZE	POL	CZE
3	CZE	LTU	HRV	HUN	EST	LTU
4	HUN	EST	ROU	LTU	ROU	HUN
5	ROU	SVK	EST	ROU	LTU	EST
6	EST	LVA	LTU	EST	HUN	ROU
7	HRV	HUN	HUN	BGR	BGR	HRV
8	LVA	HRV	LVA	HRV	HRV	BGR
9	ALB	BGR	BGR	SVK	LVA	LVA
10	SVK	SVN	SVK	SVN	SVK	SVK
	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.

CONCLUSIONS

Since the beginning of the second decade of the 21st century, CEECs have been steadily increasing their share in the CBM&As market. Since 2009, the number of countries in which CBM&As were carried out by CEECs businesses has been steadily increasing. The results show that CEECs have become more intensely interconnected.

Throughout the period under review, the economies of CZE, LTU, LVA, POL, and SVK occupied the most central place and formed the core of the network studied. Apart from the aforementioned countries, DEU, RUS, ROU, USA, and GBR received a large inflow of foreign capital, while entities from EST and HUN invested heavily abroad through CBM&A. Between 2009 and 2023, there has been a significant increase in the importance of DEU and GBR in the CBM&A network of CEECs, with the simultaneous deterioration of the RUS position.

In particular, companies from CEECs have engaged in CBM&As both with entities headquartered in European emerging markets and with foreign companies from developed markets. In particular, Czech and Polish companies have invested in DEU and GBR, Estonian companies in FIN and GBR, and Hungary companies in the US.

In the network of CBM&As undertaken by CEECs, entities operating in the sector of financials, high technology and industrials made CBM&As transactions, and were also the main investment target within this network. During the past 15 years, the position of the financial sector has increased as the macro-industrie of the acquirer, while the importance of the high-tech sector has increased significantly as the macro-industrie of the target.

Finally, it is crucial to acknowledge certain limitations of the study. First, the findings are based on aggregated data at the country and macro-industry levels. Creating comparative ranking tables for individual business sectors and transnational corporations would be too lengthy and thus impractical. Second, the analysis considers only the number of CBM&A transactions, excluding their value due to incomplete data in the Refinitiv Eikon M&A database.

The study reveals which sectors are most active and identifies CEECs that serve as key intermediaries in the CBM&A market. Network analysis highlights the central roles and connections within the CBM&A topology. The application of this research approach ensures that the conclusions drawn from empirical studies bring a certain order to economic reality, making them a valuable source of knowledge for policy makers. In summary, the implementation of this empirical study is significant for enriching the existing knowledge about CBM&As CEECs networks and for business practice.

REFERENCES

Brózda-Wilamek, D. (2021). A Network Analysis of Cross-Border Mergers and Acquisitions in Poland, Czechia And Hungary. *Studia Prawno-Ekonomiczne*, *19*, 163-181. https://doi.org/10.26485/SPE/2021/121/10

Brózda-Wilamek, D. (2023). The global cross-border mergers and acquisitions network between 1990 and 2021. *International Journal of Management and Economics*. https://doi.org/10.2478/ijme-2023-0021

Chen, S. H., Hsu, F. J., & Lai, Y. C. (2022). Do shareholder's independency and board size affect synergies from cross-border bank mergers and acquisitions? International evidence from social network analysis. *Library Hi Tech*, *40*(1), 152-195. https://doi.org/10.1108/lht-02-2019-0032

Dong, H. W. (2022). The Impact of Trade Facilitation on the Networks of Value-Added Trade--Based on Social Network Analysis. *Emerging Markets Finance and Trade*, *58*(8), 2290-2299. https://doi.org/10.1080/1540496x.2021.1974393

Elliott, M., Golub, B., & Jackson, M. O. (2014). Financial Networks and Contagion. *American Economic Review*, *104*(10), 3115-3153. https://doi.org/10.1257/aer.104.10.3115

Guo, Y., Yang, Y., & Wang, C. (2021). Global energy networks: Geographies of mergers and acquisitions of worldwide oil companies. In *Renewable and Sustainable Energy Reviews* (Vol. 139).

Kazmierska-Jozwiak, B. (2014). Activity of Central Eastern Europe Countries on Mergers and Acquisitions Market [Article]. *Social Sciences*, *83*(1), 72-79. https://doi.org/10.5755/j01.ss.83.1.6864

Kurtović, S., Maxhuni, N., Halili, B., & Maxhuni, A. (2023). Effect of Host Country Determinants and Institutional Quality on Outward Foreign Direct Investment from Central, Eastern and South-Eastern Europe [Original Paper]. *Journal of the Knowledge Economy*, 1-37. https://doi.org/10.1007/s13132-023-01622-0

Langenstein, T., Vojtková, A., Uzík, M., & Ruepp, A. (2018). Cross-border acquisitions in Central and Eastern Europe with focus on Russia versus Germany deals: an empirical analysis. *E & M Ekonomie a Management*, *21*(4), 207-225. https://doi.org/10.15240/tul/001/2018-4-014

Lee, H., & Sohn, I. (2016). Fundamentals of Big Data Network Analysis for Research and Industry. *John Wiley & Sons. Ltd., United Kingdom*, 1-196. https://doi.org/10.1002/9781119015451

Sánchez Díez, Á., Galaso Reca, P., & García de la Cruz, J. M. (2017). Mergers and acquisitions carried out by Spanish firms in Latin America: A network analysis study [article in journal/newspaper]. *CEPAL Review ; volume 2016, issue 120, page 51-69 ; ISSN 1684-0348*. https://doi.org/10.18356/9d6a2b0d-en

Vitali, S., & Battiston, S. (2014). The Community Structure of the Global Corporate Network. *Plos One*, *9*(8), Article e104655. https://doi.org/10.1371/journal.pone.0104655

Wassenhoven, A., Block, C., Wustmans, M., & Brring, S. (2021). Analyzing an emerging business ecosystem through M&A activities: The case of the Bioeconomy. *Business Strategy and Development*, *4*(3), 258-278. https://doi.org/10.1002/bsd2.149

Yang, S., Keller, F. B., & Zheng, L. (2016). *Social network analysis: Methods and examples*. Sage Publications.