

Changes in automotive value chain participation on the integrated periphery – The case of Czechia and Hungary

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ABSTRACT

Central and Eastern European countries, including Czechia and Hungary, have become parts of the integrated periphery in the automotive industry. Through input-output analysis, company data and interviews, the article reveals the determining role of the industry in both economies and their deep integration in global value chains (GVCs). In addition to these similarities, the analysis reveals that domestic, simple and complex global value chain performances, ownership structures, the scale and types of upgrading tendencies as well as the consequences of the appearance of newcomers in the industry show different patterns of GVC structures over time. Due to these, the development paths of the two countries widely differ.

KEYWORDS

automotive industry, global value chains, Czechia, Hungary, development path

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1. INTRODUCTION

Czechia and Hungary are highly specialized in automotive production and the industry is of determining importance in their economies. The production of cars and car components has steadily increased, owing to lower production costs and geographic proximity to core markets (Humphrey – Memedovic 2003). A large share of the production in the region is export-oriented and is controlled by foreign automotive multinationals. Both countries are highly integrated into global, or rather regional automotive value chains (VC). Their VC-participation and positions are very similar, especially in Central and Eastern European (CEE) comparison, with major changes occurring over recent decades.

The aim of this article is to analyse and compare the various characteristics and dynamics of the Czech and Hungarian development paths in automotive global value chains (GVCs) between 2000 and 2018. We show the similarities and differences in automotive value-chain positions and their evolution. Furthermore, factors enabling these changes, mainly in terms of company strategy and company entry are also highlighted. We rely on a combined methodology: the analysis of input-output data, company-level data and information gained from company interviews.

The article is organised as follows. First, we present a brief review of the relevant literature. Second, our methodology is described. Third, the analysis of statistical data, company-level data and finally information gained from company interviews are presented. The subsequent section discusses the results, while the final section concludes the findings and highlights the limitations of the approach and possible paths of further research.

2. LITERATURE REVIEW

The automotive industry belongs among the most important and most fragmented industries (de Backer – Miroudot 2013). It has been called the “industry of industries” due to its large scale and extensive linkages to other industries. In general, activities at the beginning and the end of the value chain with the highest value added (design, R&D, marketing) remained in the developed “core countries”, whereas assembly and basic production, embodying low-value-added activities have been transferred to lower wage “peripheries”. Thus, over the last decades, there have been geographical shifts in automotive production, with the increasing role of emerging regions including CEE (Sturgeon et al. 2008; Pavlínek 2022). Company strategies towards lower costs and/or access to new markets, changes in global institutional settings, particularly liberalization of trade, the industrialization of many emerging markets and the integration of post-communist countries into the global economy (Humphrey et al. 2000) were important factors. In CEE, the geographic proximity to core markets and integration into the EU lowered economic and political barriers and eased the flow of goods. This led to large FDI inflows, dominated by investments of foreign automakers and component suppliers (Pavlínek 2012).

Automotive industry VCs are organized hierarchically with a high share of vertical disintegration leading to strong backward linkages between lead firms (original equipment manufacturers, OEMs) and a large number of component suppliers (Humphrey – Memedovic 2003).



Lead firms control strategic functions such as design or R&D and select their suppliers, though some of these functions have been recently transferred to module integrators (Pavlínek 2012). These operate globally, because lead firms require their largest suppliers to do so (Sturgeon – Florida 2004). Still, companies can produce a wide variety of products with different degrees of complexity and their position in supply chains can differ by product and change over time.

Since the 1990s, we can observe upgrading in the CEE region with a gradual shift to more complex activities and growing local sourcing (Sass – Szalavetz 2013). Nonetheless, this upgrading is highly selective and uneven, with mainly process and product upgrading and limited functional and social upgrading (Pavlínek – Ženka 2011). No core R&D is located in the CEE countries and the region has rather a technology adopter status (Szalavetz 2020). Most of the foreign subsidiaries in the region limit their activities to manufacturing and domestic automotive suppliers remain locked in subordinate positions at low tier levels (Peter et al., 2012). Centralized sourcing strategies by automotive MNCs combined with the unavailability of particular materials, components, and services in the required amount and/or quality are the major reasons behind this (Pavlínek – Žízalová 2016). Consequently, mainly labour-intensive processes benefitting from low labour costs are located in the CEE region with the most advanced activities remaining in high-wage countries (Grodzicki – Skrzypek 2020), with rare exceptions of innovative local startups (Szalavetz 2020). The position of the CEE region in the automotive industry has been considered to be either semi-peripheral or peripheral, with Czechia oscillating between integrated periphery or semi-periphery, and Hungary rather belonging to the integrated periphery (Pavlínek 2022).

This paper is aimed at analysing the various characteristics and dynamics of these development paths by comparing two economies, which are highly integrated into European automotive VCs, and for whom the automotive industry is of determining importance.

3. THE AUTOMOTIVE INDUSTRY IN CZECHIA AND HUNGARY

In both countries, the automotive industry is a leading manufacturing sector and represents a high share of GDP, foreign trade, employment and value added and thus has outstanding economic importance. Table 1 presents a comparison of basic indicators in the CEE countries in NACE 29 Manufacture of motor vehicles, trailers and semi-trailers, though it does not include suppliers from other sectors. The size and share of the Czech and Hungarian industries is outstanding even in regional comparison – with the exception of Slovakia, the largest per capita manufacturer in the world.

The leading carmakers are subsidiaries of foreign multinationals: in Czechia, the German Volkswagen acquired Skoda already in 1991, the Japanese Toyota with PSA established its subsidiary in 2002 and the Korean Hyundai in 2006. In Hungary, the subsidiary of the Japanese Suzuki has been operating since 1991, that of the German Audi since 1993 and Daimler-Mercedes since 2012. Furthermore, in both countries, numerous subsidiaries of foreign-owned automotive suppliers are present. In Czechia, the largest automotive suppliers include the German Continental, Robert Bosch, and Brose; French SAS and Faurecia; Korean Sungwoo and American Adient. In Hungary, the largest foreign-owned suppliers include the German Robert Bosch, Continental, Schaeffler, and Thyssenkrupp; the Korean Hankook, American Lear and the Japanese Denso (Orbis 2022).

Domestic-owned automotive suppliers are much less important. In Czechia, only about a quarter of companies are domestically-owned and they are in general much smaller in size. In Hungary, the share of domestic companies is even lower. The largest domestic automotive



Table 1. Selected characteristics of the Czech and Hungarian automotive industries in regional comparison (2020)

	Austria	Czechia	Hungary	Poland	Slovakia
Number of enterprises	225	1,106	500	1,700	791
Production value (million EUR)	15009.8	44523.7	26097.2	32104.8	27927.4
Value added at factor cost (million EUR)	3565.4	7348.6	4369.4	7527.6	3095.7
Wages and salaries (million EUR)	1998.4	3190.2	1814.5	3352.0	1462.8
Persons employed	38,405	175,471	99,315	216,880	78,736
Share of production value in manufacturing total (%)	8.2	27.1	25.9	10.3	39.9
Share of VA in manufacturing total (%)	6.1	17.9	17.2	8.8	22.6
Share of employment in manufacturing total (%) (2018)	5.7	13.7	12.8	7.5	15.7
Apparent labour productivity (gross VA per person employed) (thousand EUR)	92.8	41.9	44.0	34.7	39.3
Export/total exports (%)	9.4	29.8	17.0	23.9	18.8

Source: Eurostat Annual detailed enterprise statistics for industry (NACE Rev.2); Trade by NACE Rev. 2 activity; Enterprise size class.

Note: Manufacture of motor vehicles, trailers and semi-trailers (C29) only. No automotive suppliers from other NACE categories added.

suppliers such as Kovelis Hedvikov, Brano, Hauk and Hronovský in Czechia and Csaba Metal Öntöde, Hajdú or Fémalk in Hungary are approximately 10 times smaller in terms of turnover than the largest (foreign-owned) automotive suppliers. Over the past five years, many of the largest foreign-owned suppliers have kept their position relatively stable, though some have increased considerably (e.g. Faurecia and Adient in Czechia, Thyssenkrupp and Valeo in Hungary). Unlike in Hungary, in Czechia, the largest domestic automotive firms have witnessed significant growth over recent years.

4. METHODOLOGY

The research is based on a mixed methods approach of quantitative and qualitative analyses. Qualitative data were collected through questionnaire-based semi-structured interviews. Ten interviews per country were conducted with representatives of automotive firms and industry associations during 2020–2021. The focus and the structure of the company and expert interviews were aimed at revealing the factors which influence the choice of inputs, presence of upgrading and governance modes. Furthermore, the list of the company players was analysed based on ORBIS data. In the analytical part, we also used information from publicly available sources (newspaper articles, websites of the firms, and balance sheets of the companies).

For the quantitative analysis, we used the 2021 edition of the OECD Inter-Country Input-Output Tables (ICIO), for years 2000, 2007, and 2018. The method applied is based on



Wang (2017), which relates the contribution and the use of each country-industry item to the total value added of the industry. The abbreviations denote the following parts of any final product:

ld – locally produced, domestically used

le – locally produced and exported for final use

sd – simple GVC1: one border cross semi-final good, finalised domestically, used domestically

se – simple GVC2: one border cross semi-final good, finalised domestically and exported for final use in another country

cd – complex GVC1: multiple border cross semi-final good, finalised domestically, used domestically

ce – complex GVC2:– multiple border cross semi-final good, finalised domestically and exported for final use in another country

All the measures above are expressed in proportion to the total final product of the country, industry or country-industry under investigation.

The sum of $sd+se+cd+ce$ gives backward participation. Forward participation measures what percentage of GDP produced by the automotive industry of the given country is built into any final product of other countries. Total participation equals backward plus forward participation, which may run from 0 to 2 (100% + 100%). The position is measured as the logarithmic difference between the backward and forward participation, which has the range of -0.69 to $+0.69$. Negative values reflect upstream positions, positive values indicate downstream positions. The analysis highlights the direct and total linkages and discusses them separately both in terms of backward and forward direction.¹

5. ANALYSIS

Indicators based on newly elaborated data can give insights into the development of the automotive industries and their domestic and foreign linkages. While these data reveal important tendencies, they do not indicate the ownership structure of the linkages or industries in question, thus domestic links refer to all players which operate in the given economy, regardless of being domestically or foreign-owned.

5.1. GVC-participation -international comparison and development paths

Both countries are integrated to the highest extent in automotive GVCs (Fig. 1). Only export-processing Chinese capacities (CN2 – owned by foreign-owned multinationals and operating in China²) have a higher involvement than Hungary, while Czechia is ranked sixth among the

¹It is important to note that the direct linkages that we discuss first are related to the gross output and calculated from the primary data of input-output tables as the sum of domestic supply, import intermediaries (which can be called direct GVC linkages) and local value added. The total linkages as discussed above contain the locally finalised and the global value chain components, as percentages of the final product, calculated from inverse input-output tables. Hence the ratios in terms of the two analyses will definitely differ.

²CN2 covers the input, performance and output of the companies that belong to the so-called export processing zones (EPZ). The CN2 industries sell only to countries outside of China; however, they can purchase inputs from the non-EPZ industries (CN1) of China. CN1 contains the economic performance of those companies that sell both to local and export industries in terms of semi-final and final products.



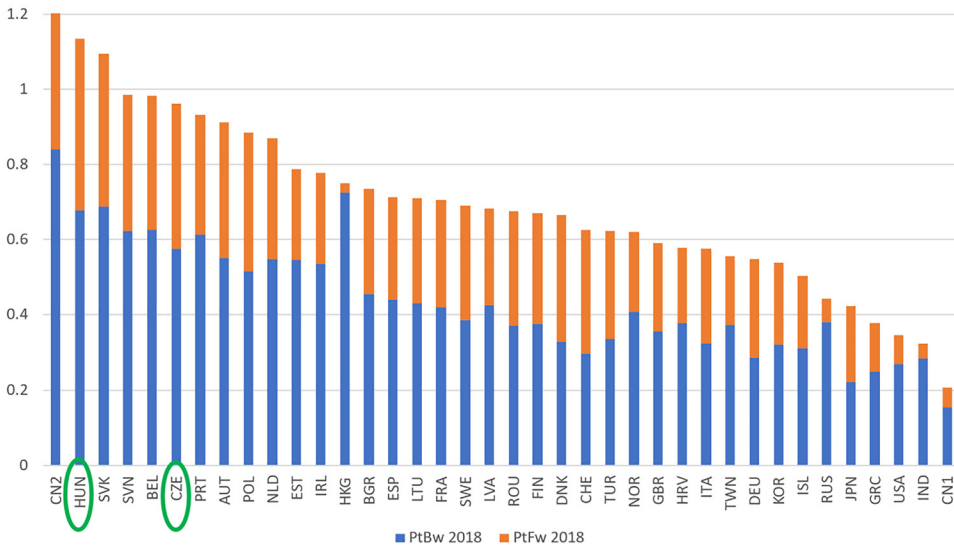


Fig. 1. The backward and forward GVC participation in the motor vehicle industry in international comparison.

Source: authors, based on OECD ICIO.

countries analysed by the OECD. The dominance of backward as opposed to forward participation is apparent in both countries, reflecting the pattern of “factory economies” (Baldwin – Lopez-Gonzalez 2015), i.e. which contribute to GVCs mainly with labour intensive activities.

The changes in participation and position of the two countries over time in GVCs in international comparison are summarized in Fig. 2. By 2018, both Hungary and Czechia had similar high participation and a downstream position in automotive GVCs, with higher indicators for Hungary compared to Czechia. The similarity of their participation and positions (CZE2018, HUN2018) is highlighted by comparison to other CEE countries. However, the two countries followed different development paths: significant changes took place between 2000 and 2018, especially in Hungary. From 2000 on, Hungary went from a lower participation and a less downstream position in 2007 to a very high participation and a medium downstream position in 2018. Czechia’s path was just the opposite and much shorter compared to Hungary: from lower to higher participation between 2000 and 2018, and only slight changes in its downstream position. The downstreamness of an industry in a given country indicates that it uses little value-added in its production process relative to intermediate inputs, especially in cases when it purchases intermediate inputs from industries that themselves use intermediate inputs intensively (Antrás – Chor 2018). Antrás (2019) found that on average downstream industries are more unskilled-labour intensive than upstream industries, furthermore, Bahn et al. (2020) showed in the case of Estonia that downstream industries have a negative correlation with productivity.

In the following parts of this section, we examine how the various elements (direct and indirect backward and forward linkages) contributed to these changes over time.



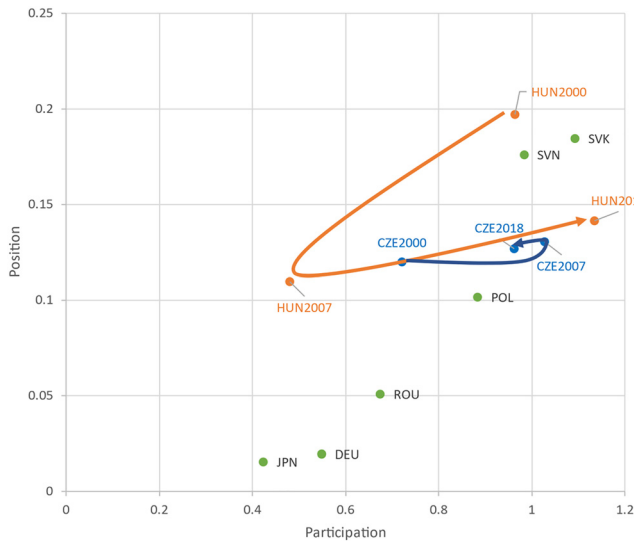


Fig. 2. GVC participation and position paths of automotive industries in selected countries.
 Source: authors, based on OECD ICIO.

5.2. Direct backward linkages

Hungarian automotive production is mainly import-based: almost 60% of the inputs are provided by backward suppliers from other countries (Table 2). This ratio has considerably increased since 2000. In comparison, the Czech automotive industry relies more on domestic suppliers, even if there is an increase in the imported share. In terms of the value added content, Czech production always performed higher value-added activities than that in Hungary.

5.3. Backward GVC linkages

While in both countries backward participation has been dominant and on the increase, the Hungarian automotive industry has always had stronger backward participation than that of

Table 2. Value structure of the direct backward linkages (percentage of total input)

	Czechia			Hungary		
	2000	2007	2018	2000	2007	2018
Int Dom use	47.44	40.83	37.48	32.96	24.00	18.44
Import use	27.48	35.94	41.91	43.37	48.40	58.10
Value added	22.68	21.63	19.43	17.36	21.26	18.54
Total	100	100	100	100	100	100

Source: authors, based on OECD ICIO.
 Note: without taxes (thus parts do not add up to 100%).



Czechia (Table 3). Backward participation characterises usually low-wage countries, where inputs are imported from other countries and are further processed and then exported.

Concerning the structure of the sources of automotive final production (Fig. 3), Czech automotive production was predominantly domestic whilst Hungarian production was mainly domestic in 2000. Since then, participation in GVCs has increased, though the share of export of locally produced/assembled cars has not changed much. Participation in complex GVCs increased due to the increasing fragmentation of world trade, though it is still minor compared to simple GVCs.

5.4. Total backward linkages

Both countries have concentrated backward linkages (Tables 4 and 5). First of all, domestic value added dominates, though its share is higher in Czechia, but has diminished in both countries over time. Second, Germany is by far the most important “source” country, and its share is higher, though slightly decreasing in Hungary. In Czechia, domestic motor vehicles (29), plastic products (22), and fabricated metal industries (25), as well as trade, repair, and other services dominate the supplies (45T47, 69T75). The German motor vehicle industry increased its contribution at the expense of Czech automotive suppliers. In Hungary, similarly, the domestic motor vehicles industry (29) contributes the most, but the contribution of other domestic industries is

Table 3. Backward GVC participation of the Czech and Hungarian automotive industries, 2000, 2007 and 2018

	2000	2007	2018
Czechia	44.24%	52.61%	57.48%
Hungary	62.74%	61.28%	67.79%

Source: authors, based on OECD ICIO.

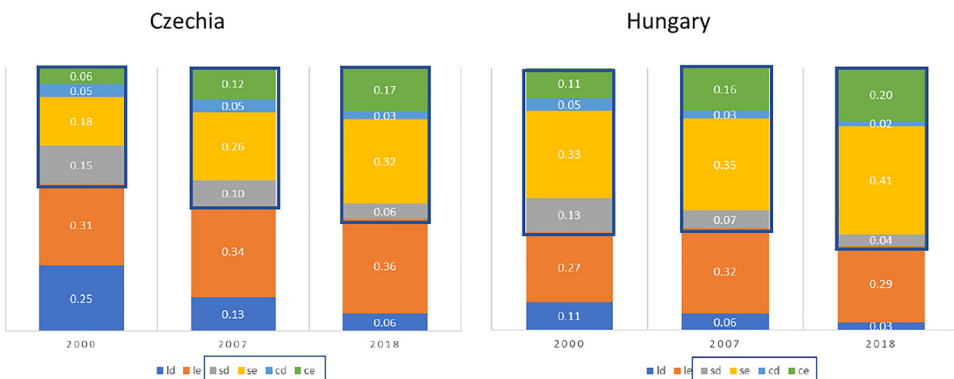


Fig. 3. Sources of the automotive final production, with backward participation highlighted.

Source: authors, based on OECD ICIO.



Table 4. Total direct and indirect backward linkages of the automotive final products from different countries as a percentage of total industry final product

	CZE	DEU	POL	CN1	ITA	FRA	USA	ROW	KOR	SVK	RUS	ESP	AUT	JPN	GBR	NLD	HUN	ROU
2000	56.0	14.6	1.5	0.4	2.5	3.0	2.4	1.5	0.3	1.2	1.6	1.3	2.2	1.5	1.9	1.2	0.4	0.0
2007	47.8	15.0	2.9	1.6	2.9	3.5	1.8	2.0	0.6	1.6	2.1	1.5	1.7	2.1	1.9	1.3	1.3	0.2
2018	43.1	15.9	4.3	3.3	2.8	2.8	2.0	2.0	2.0	1.8	1.8	1.6	1.5	1.5	1.4	1.2	1.1	0.9
	HUN	DEU	ITA	CN1	POL	AUT	FRA	USA	CZE	ROW	NLD	JPN	ESP	GBR	SVK	RUS	ROU	KOR
2000	37.4	21.3	4.4	0.7	1.5	3.2	3.8	3.3	0.9	1.5	1.3	4.6	1.9	2.5	0.5	1.8	0.1	0.7
2007	39.0	19.6	3.3	1.6	2.7	2.6	3.0	2.2	2.2	2.2	1.5	2.9	1.6	1.9	1.0	1.9	0.8	1.0
2018	32.5	19.5	4.0	3.5	3.4	3.0	2.9	2.9	2.7	2.3	2.0	1.9	1.6	1.5	1.5	1.4	1.4	1.3

Source: authors, based on OECD ICIO.



Table 5. Total direct and indirect backward linkages of the automotive final products from different country-industries as a percentage of total industry final product

Czechia					Hungary				
Country	Industry	2000	2007	2018	Country	Industry	2000	2007	2018
CZE	29	29.60%	27.04%	24.38%	HUN	29	24.10%	26.25%	21.18%
CZE	45T47	5.94%	5.26%	5.52%	DEU	29	5.54%	5.06%	4.42%
DEU	29	2.51%	2.76%	4.56%	HUN	45T47	3.40%	3.02%	2.89%
DEU	45T47	1.81%	1.84%	1.90%	DEU	28	1.76%	1.73%	2.83%
CZE	22	2.08%	2.36%	1.59%	DEU	45T47	2.44%	2.15%	2.22%
CZE	25	1.51%	1.14%	1.44%	HUN	69T75	1.02%	1.54%	1.55%
CZE	69T75	1.17%	1.22%	1.42%	DEU	69T75	1.63%	1.33%	1.09%
POL	45T47	0.38%	0.80%	1.08%	DEU	27	0.97%	0.70%	0.99%
DEU	22	1.06%	1.20%	0.96%	DEU	25	1.15%	1.13%	0.98%
DEU	69T75	1.21%	1.05%	0.86%	DEU	77T82	0.86%	0.85%	0.90%

Source: authors, based on OECD ICIO.

minor. This indicates the lower embeddedness of the automotive industry in Hungary compared to Czechia.

In terms of direct backward linkages that contribute both to the semi-final and final production of the motor vehicle industry (Table 6), an important development is the increase in local and German value added and in value added coming from neighbouring countries (Slovakia, Poland, as well as Czechia and Hungary for each other). This may refer to a gradual transfer of productive capacities to the CEE region and the increasing interconnectedness of these economies in regional GVCs. Furthermore, other European countries (Austria, Italy, Spain, and France) are also important, indicating the “Europeanness” of automotive VCs. Additionally, Korea is listed in the case of Czechia, which can be connected to the presence of Hyundai. In Hungary, the Japanese Suzuki is present, but related inputs from Japan have decreased, as many suppliers followed Suzuki to Hungary and established local production capacities (Natsuda et al. 2022). Local electronics industries are important value added contributors in both countries – but these are mainly local subsidiaries of foreign-owned multinationals.

5.5. Direct forward linkages

Motor vehicle production is a highly export-oriented industry in both countries (Table 7). In Hungary, 90% of the industry output is exported, with equal shares of intermediate and final products. The Czech ratio is 73%, with final products dominating and a relatively high share (19%) of intermediate goods used domestically. These patterns indicate a significant change over time. In Czechia, the domestic use of production represented 50% of the total in 2000. Intermediate production processes remained domestic, while final products are now sold mostly



Table 6. Direct backward linkages of the automotive semi-final and final production by country-industry (percentage of industry output)

Czechia			Hungary		
	2000	2018		2000	2018
CZE_29	16.86%	14.11%	DEU_29	11.79%	8.11%
DEU_29	5.44%	7.65%	DEU_28	2.09%	4.71%
CZE_45T47	6.09%	6.57%	HUN_45T47	4.54%	4.12%
CZE_22	4.13%	3.62%	HUN_29	17.69%	2.46%
CZE_25	2.46%	2.34%	CZE_29	0.37%	2.44%
POL_29	0.27%	2.23%	HUN_25	1.84%	1.85%
CZE_27	1.85%	1.94%	POL_29	0.65%	1.69%
SVK_29	0.24%	1.70%	HUN_69T75	0.75%	1.62%
KOR_29	0.13%	1.36%	DEU_45T47	1.22%	1.44%
DEU_22	1.37%	1.35%	DEU_27	0.65%	1.39%
CZE_24	3.54%	1.24%	HUN_22	0.71%	1.30%
CZE_69T75	0.98%	1.18%	ITA_28	0.65%	1.18%
HUN_29	0.36%	1.09%	HUN_49	0.78%	1.11%
FRA_29	1.14%	1.05%	AUT_29	0.83%	0.98%
DEU_45T47	0.91%	0.99%	DEU_26	0.25%	0.87%
DEU_27	0.73%	0.93%	SVK_29	0.33%	0.86%

Source: authors, based on OECD ICIO.

Table 7. Value structure of the direct forward linkages (percentage of total output)

Czechia				Hungary			
	2000	2007	2018		2000	2007	2018
Domestic int	27.57%	20.93%	18.84%	Domestic int	21.24%	11.39%	5.16%
Domestic final	23.09%	14.05%	7.58%	Domestic final	14.81%	8.30%	4.80%
Semi-final export	20.46%	27.73%	31.54%	Semi-final export	26.78%	37.23%	43.68%
Final export	28.88%	37.30%	42.04%	Final export	37.17%	43.07%	46.36%
Total	100.00%	100.00%	100.00%	Total	100.00%	100.00%	100.00%

Note: taxes not included.

Source: authors, based on OECD ICIO.



abroad. In Hungary, the industry has always been predominantly export-oriented; however, domestic forward linkages have been significantly reduced, especially for semi-final production, i.e. capacities produce parts and components for exports. This indicates the increasingly intense integration of the two automotive industries in GVCs.

5.6. Forward GVC participation

Forward GVC participation has increased over time in both countries. It is stronger in the case of Hungary, which specialised slightly more in the production of parts/components (Table 8).

The structure of the forward linkages (Fig. 4) has changed over time in both countries. Domestic use of parts/components and cars has diminished, while exports of these for further processing is now dominant. Similar to the backward structure, simple VCs are dominant (73–75% of the forward participation), though decreasing since 2000, while the share of complex GVCs has increased. This again shows the intensification of automotive GVCs in the region.

5.7. Total forward linkages

For both countries, the dominant foreign partner is Germany, though its share has decreased over time for Hungary (Table 9 and Table 10). In addition, Hungarian forward links are more

Table 8. Forward GVC participation of the Czech and Hungarian automotive industries

	2000	2007	2018
CZE	27.93%	34.81%	38.72%
HUN	33.61%	41.54%	45.66%

Source: authors, based on OECD ICIO.

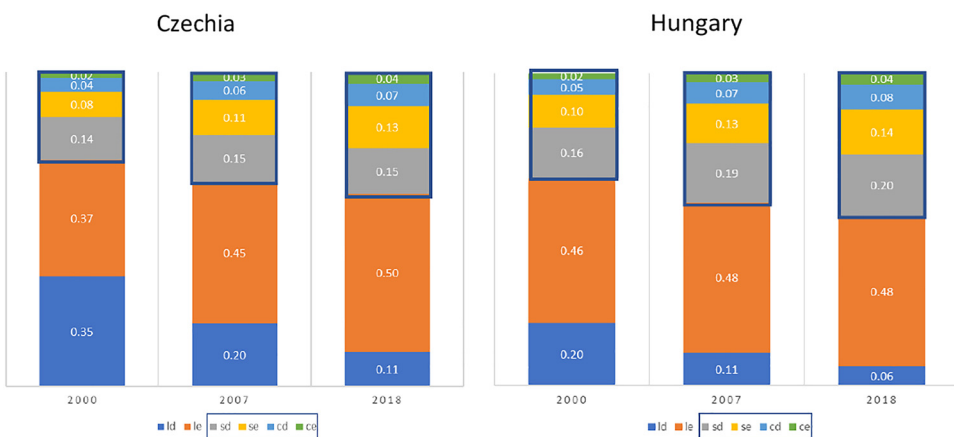


Fig. 4. Structure of the use of automotive value added, with forward participation highlighted.

Source: authors, based on OECD ICIO.



Table 9. Total direct and indirect forward linkages of automotive semi-final products in the final products of different countries (percentage of total industry value added)

CZE to	CZE	DEU	SVK	POL	FRA	ITA	ESP	CN1	GBR	USA	ROW	HUN	RUS	AUT
2000	72.2%	10.8%	1.0%	1.1%	1.3%	1.0%	1.2%	0.2%	1.5%	1.3%	0.7%	0.5%	1.5%	1.1%
2007	65.4%	9.5%	2.9%	1.6%	2.1%	2.4%	1.7%	0.5%	2.4%	1.1%	1.0%	1.3%	0.7%	1.1%
2018	61.7%	11.7%	2.4%	2.0%	1.9%	1.9%	1.8%	1.8%	1.7%	1.5%	1.3%	1.2%	1.0%	0.8%
HUN to	HUN	DEU	CN1	USA	SVK	CZE	FRA	ITA	ESP	GBR	ROW	JPN	POL	ROU
2000	66.5%	17.0%	0.3%	3.0%	0.1%	0.6%	1.0%	1.0%	1.1%	1.3%	0.6%	0.8%	0.4%	0.0%
2007	58.7%	12.4%	2.0%	1.9%	2.5%	2.4%	1.7%	2.4%	2.3%	2.4%	1.0%	0.8%	1.7%	0.5%
2018	54.6%	12.9%	3.7%	3.3%	2.3%	2.1%	1.8%	1.7%	1.6%	1.5%	1.4%	1.4%	1.2%	0.9%

Source: authors, based on OECD ICIO.

Table 10. Total direct and indirect forward linkages of automotive semi-final products in the final products of different country-industries (percentage of total industry value added)

Czechia to	CZE 29	DEU 29	SVK 29	ESP 29	POL 29	HUN 29	DEU 28	CN1 29	CZE 45T47
2000	62.9%	7.4%	0.7%	0.7%	0.4%	0.3%	0.5%	0.1%	1.4%
2007	59.7%	6.9%	2.3%	0.9%	0.7%	0.9%	0.5%	0.1%	1.0%
2018	58.3%	8.9%	2.1%	1.1%	1.0%	0.9%	0.8%	0.7%	0.7%
Hungary to	HUN 29	DEU 29	SVK 29	CZE 29	CN1 29	USA 29	DEU 28	ESP 29	JPN 29
2000	63.3%	13.6%	0.0%	0.4%	0.1%	1.4%	0.5%	0.7%	0.4%
2007	56.2%	9.0%	2.0%	1.5%	0.7%	0.6%	0.7%	1.2%	0.4%
2018	52.6%	8.7%	1.9%	1.5%	1.5%	1.3%	1.2%	0.8%	0.7%

Source: authors, based on OECD ICIO.

concentrated in terms of partners and cover a wider geographic area: China and the US are important partners besides European countries, such as neighbouring Slovakia and Czechia.

The Czech forward links are less concentrated but more regional with Slovakia, Poland and other European countries standing out. China is here a newcomer, with a relatively high share attained by 2018. In terms of industries, both countries directly or indirectly supply motor vehicle (and machinery) final products. While the Hungarian semi-final automotive products contribute significantly to the Chinese and US motor vehicle industries, links to the Slovakian and Czech industries are similarly strong. In the case of Czechia, the dominance of



regional links are reinforced with the Hungarian automotive industry besides Slovakia and Poland.

6. SUPPLEMENTARY ANALYSIS BASED ON COMPANIES IN THE AUTOMOTIVE INDUSTRY AND INTERVIEWS

6.1. Companies

ICIO data do not provide information about the ownership of the companies operating in an industry. That is why we have supplemented our analysis with company level data (Appendix Tables 2 and 3). The findings are the following.

A higher number of domestically-owned firms (and their total turnover) with main specialisation in the automotive industry are located in Czechia compared to Hungary, while in Hungary, proportionately more firms have their secondary specialisation in the production of vehicles, thus they supply automotive companies most probably with “auxiliary” products and services. On the other hand, there are more foreign-owned firms in the automotive industry in Hungary compared to Czechia, denoting the importance of supplier firms in Hungary, who increase the forward links of Hungary through exporting components for further processing – in accordance with the previous section.

A higher share of micro and small firms among the domestically-owned automotive firms and a lower share of medium and large firms are located in Hungary compared to Czechia, denoting a disadvantageous size composition of firms in Hungary, contributing probably to lower embeddedness.

There is a dominant role of German firms according to turnover, reinforcing the findings of the previous section, however, Korea is relatively more important in Czechia (Hyundai) and Japan in Hungary (Suzuki).

In Czechia, automotive firms have five times more patents than in Hungary. Such a difference can be affected by different strategies of MNEs, which apply for patents abroad and not within the subsidiaries (e.g. Škoda). At the same time, even domestic automotive firms have considerably more patents in Czechia. This indirectly indicates the higher level of innovativeness and R&D activities of Czech firms compared to their Hungarian counterparts.

6.2. Interview findings

Through the interviews, a more nuanced picture of automotive GVC developments was attained. In Czechia, six foreign-owned (mainly tier-1) and three domestically-owned (mainly tier-2) companies and one public agency were interviewed. In Hungary, six foreign-owned (two OEMs, two tier-1 and two tier-1-2) and three domestically-owned (one tier-1 and two tier-1-2-3) companies and one representative of an industry association were interviewed. In both countries, we felt a slight bias in our sample as the interviewed domestically-owned companies represented the successful, innovative ones. All companies were selling domestically and exporting. The high level of integration in automotive GVCs was confirmed by our interviews in both countries.

The difference between the two countries in terms of the presence of domestically-owned suppliers has been confirmed by the interviews. In Hungary, both OEMs and the industry expert



emphasized the problems of finding local suppliers and relying more on imports. However, industry averages seem to be shaped by two extremes: with a relatively high reliance of the Suzuki subsidiary and a low reliance of the German subsidiaries on local inputs. Still, the interviews showed that even in the case of Suzuki, traditional Japanese suppliers followed the firm to Hungary and replaced a part of local production and imports, which is a reason for the low share of imports from Japan. Furthermore, German producers rely on inputs from German-owned subsidiaries in Hungary and in the CEE region. In Czechia, the interviews indicated a higher number of domestically-owned suppliers compared to Hungary. Still, for MNE subsidiaries, the majority of supplies is sourced from abroad, mainly from the CEE region.

The composition of backward linkages is influenced by the nationality of the OEMs, especially in the case of non-European countries. This explains the relatively high presence of Korea in Czechia (Hyundai, since 2006) and Japan (Toyota-PSA 2002). Similarly, for Hungary, the Japanese Suzuki (1991) explains a relatively high share of Japan among the supplier countries. However, in both countries, German OEMs are dominant: Volkswagen (1991), Audi (1993) and Daimler-Mercedes (2012). These leading German automotive firms integrate the two economies in European VCs. Among the local suppliers, we also found many German-owned firms. In the case of Czechia, the majority of the foreign sample, while in the case of Hungary, two firms are German-owned. The interviews reinforced the increasing “regionalisation” of the automotive VCs, shown by ICIO numbers: the increase in regional, CEE links.

In terms of forward participation, the interviews confirmed an increase in both countries over time, as all the analysed supplier firms increased their exports – mainly to Germany or to CEE countries. Hungary’s higher forward participation was also reinforced as many large German suppliers, including module integrators, are present in Hungary and supply their OEM partners from Hungary in the region and even in their home country.

Based on the interviews, the different paths of GVC-participation and position of the two countries (Fig. 2) are also confirmed. First, while the Hungarian interviewees still emphasized the cost component of competitive advantages of the country, in Czechia, it was rather the combination of costs and quality, which was highlighted. Second, in Czechia, all firms in the sample have R&D and have increased over time their expenditures in this field while in Hungary, only 4 out of 9 firms had substantial R&D activities. Third, an interesting explanation for the different paths can be found in the appearance or change in major automotive OEMs’ activity in Hungary. Between 2000 and 2007, the increase in Audi’s car and engine production, while between 2007 and 2018, the establishment of the Daimler (assembling) factory in Kecskemét influenced the Hungarian path significantly. In the case of Czechia, a smaller U-turn was caused between 2000 and 2007 by Toyota-PSA (2002) and by Hyundai (2006).

In terms of upgrading, in Czechia all foreign-owned subsidiaries and two domestic companies indicated increased value-added over time. This took the form of process, product and functional upgrading, the latter mainly through R&D and bigger autonomy (e.g. in managing supplies, getting direct access to customers). In Hungary, upgrading also took the form of product, process and functional upgrading for foreign-owned companies, and predominantly process upgrading for domestic companies. Based on the interviews, this can be partly explained by governance modes. In both countries, for foreign-owned subsidiaries, modular and hierarchical governance types were described. However, for Hungarian domestic companies, the governance mode is predominantly market and in the case of the Japanese OEM, relational



and captive, which explains why upgrading is focused almost exclusively on processes. Czech suppliers identified captive and modular governance types, with the captive type of GVC characterising less innovative domestic suppliers (Pavlínek – Žížalová 2016). The presence of modular governance among Czech suppliers explains why product and functional upgrading seems to be more present in Czechia among domestically-owned companies.

7. DISCUSSION AND SYNTHESIS

The motor vehicle industry is of dominant importance in both Czechia and Hungary; and this is the result of their high, dominantly backward integration in automotive GVCs based on the analysis of input-output tables. Their most important partner is Germany. However, the two CEE countries reflect different patterns in GVC position, structure and change over time. This finding is important from the point of view of highlighting the constant changes in the attributes of GVC participation of the analysed countries, which both have similar positions and levels of participation compared to other CEE countries.

These changes in participation and position can have their origins in three sources. First, changes in the operation of already existing capacities result mainly in upgrading, based on our calculations and interview findings, as all players experienced some type of upgrading over time. This is especially true for foreign-owned companies, but even domestically-owned companies indicate this. According to the calculations, this is rather the case for Czechia and less for Hungary. According to our interviews, in Hungary, domestic companies experience mainly process upgrading, while in Czechia, some of them can also move along the VC to higher value-added activities. Company-level data also support that finding, highlighting the limited R&D activities of domestically-owned companies in Hungary compared to Czechia.

Second, changes are initiated by the inclusion of new players in the position and participation in VCs. Based on the statistical analysis and especially on the interview findings, there are few domestically-owned newcomers among the new players. As the calculations show, in the leading industries, overall, there is a decrease in domestic shares and an increase in imported shares in both countries. On the other hand, foreign-owned newcomers are present and they have a major impact on Hungary's position and participation in automotive GVCs. Due to the volume of changes, the start of production of the Daimler-Mercedes subsidiary (2012) is estimated to be responsible for large changes between 2007 and 2018. This is also supported by the interview findings. In the case of Czechia, these changes are smaller compared to Hungary, though the establishment of new capacities in 2005 (Toyota) and 2007 (Hyundai) may have played a role here.

Third, the position and participation of both countries in GVCs can be affected by new players, mainly from the CEE region (especially Poland and Slovakia) as well as from outside Europe (Japan and Korea and more recently China), especially if they replace local (foreign- or domestic-owned) suppliers, as interviews in the case of Hungary indicated. In the calculations, increases in backward linkages over time to Poland, China, Korea and Slovakia in the case of Czechia and to China, Poland, and Czechia in the case of Hungary may also indicate these developments. However, we can assume, based on company level data, that these newcomers are mainly foreign-owned companies, as neither Czechia, nor Hungary, neither Slovakia, nor Poland can be found among the owners of automotive firms.



8. CONCLUSION, LIMITATIONS AND FURTHER RESEARCH

In both the Czech and Hungarian economies, the automotive industry is of determining importance. Both economies are highly integrated into global – or rather regional – automotive VCs. While their GVC-integration and positions had become very similar by 2018 in regional comparison, after significant changes in Hungary and less pronounced ones in Czechia, the attributes of this similar position are different in the two countries. Investigating the ownership composition of value-added through company-level data and company interviews, we showed that domestically-owned companies play a minor and rather subordinate role in the industry in Hungary, experiencing mainly process upgrading, while in Czechia their upgrading is embracing product and functional upgrading besides process upgrading and it is connected to a more active innovation and R&D activity. Furthermore, we showed that large newcomers may change the industry landscape, as happened to some extent in Czechia (Toyota 2005 and Hyundai 2007) and to a large extent in Hungary (Daimler-Mercedes 2012). We also consider it probable that the emergence of regional players (especially in Poland and Slovakia) and their increased role in the two analysed economies are rather connected to capacities established through FDI coming from the core automotive countries. Still, the dominant role of foreign companies confirms the semi-peripheral/peripheral position of both countries in automotive GVCs (Pavlínek 2022).

The limitations of our analysis are connected to the statistical analysis, which could only be executed up till 2018. Furthermore, the interviewed company sample is quite small. In both countries, we assume a slight selection bias, particularly among domestically-owned companies as successful and innovative firms were probably more inclined to take part in the research.

From an economic policy viewpoint, we find the ownership issue very important, since this may determine the development path of the country's industry. For this aim, the increase of the interviewed sample with more domestically-owned companies may be fruitful. Furthermore, extending the analysed countries with Poland and Slovakia would enable us to highlight further attributes of the integrated periphery in the automotive industry. Last but not least, the changes in GVC organisation related to the rise of electric/hybrid vehicles should be covered.

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Appendix

Table A1. Industry codes

22	Rubber and plastic products
24	Basic metals
25	Fabricated metal products
26	Computer, electronic and optical equipment
27	Electrical equipment
28	Machinery and equipment
29	Motor vehicles, trailers and semi-trailers
45T47	Wholesale and retail trade, repair of motor vehicles
49	Land transport and transport via pipelines
69T75	Professional, scientific and technical activities
77T82	Administrative support services

Table A2. List of Czech and Hungarian companies in Amadeus with NACE29 as primary or secondary code – ranking by global ultimate owner (GUO) countries based on total turnover (2020 or latest available)

Czechia						
Ultimate owner country code	Number of companies		Total			
	Primary code 29	Secondary code 29	Total companies	Total turnover (mil. EUR)	Share of total turnover	Number of patents
DE	36	34	70	27,922	56%	574
KR	6	7	13	5,340	11%	0
CZ	258	1,851	2,109	4,841	10%	351
FR	10	3	13	3,255	6%	0
JP	15	1	16	2,322	5%	9
US	8	10	18	1,467	3%	18
AT	7	7	14	652	1%	2
KY	1	4	5	619	1%	2
CA	2		2	544	1%	0
CN	4	7	11	517	1%	2

(continued)



Table A2. Continued

Czechia						
Ultimate owner country code	Number of companies		Total			
	Primary code 29	Secondary code 29	Total companies	Total turnover (mil. EUR)	Share of total turnover	Number of patents
n.a.		427	427	728	1%	24
Other	89	120	209	2,085	4%	29
Total	436	2,471	2,907	50,292	100%	1,011
Hungary						
Ultimate owner country code	Number of companies		Total			
	Primary code 29	Secondary code 29	Total companies	Total turnover (mil. EUR)	Share of total turnover	Number of patents
DE	20	47	67	19,256	37%	11
HU	155	1,785	1,940	6,432	13%	129
JP	14	14	28	3,730	7%	2
US	9	9	18	2,126	4%	0
IN	1	1	2	1,421	3%	0
FR	2	6	8	1,033	2%	10
CN	3	5	8	854	2%	0
GB		1	1	786	2%	0
IE	3	3	6	584	1%	0
KR		3	3	564	1%	0
n.a.	275	3,839	4,114	12,996	25%	68
Other	26	53	209	2,085	4%	29
Total	508	5,766	6,274	51,365	100%	227

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