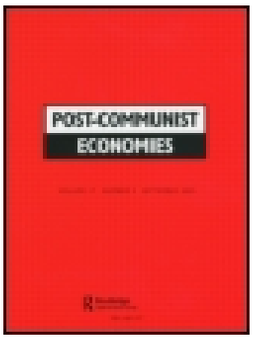

Post-Communist Economies

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/cpce20

Disentangling the semi-periphery: evolutionary trajectories and perspectives of the Austrian and Hungarian automotive industries

Andrea Szalavetz & Magdolna Sass

To cite this article: Andrea Szalavetz & Magdolna Sass (2023): Disentangling the semi-periphery: evolutionary trajectories and perspectives of the Austrian and Hungarian automotive industries, Post-Communist Economies, DOI: 10.1080/14631377.2023.2171179

To link to this article: https://doi.org/10.1080/14631377.2023.2171179

Published online: 26 Feb 2023.

POST-COMMUNIST ECONOMIES
https://doi.org/10.1080/14631377.2023.2171179

Routledge
Taylor & Francis Group

Disentangling the semi-periphery: evolutionary trajectories and perspectives of the Austrian and Hungarian automotive industries

Andrea Szalavetz[a] and Magdolna Sass[a,b]

[a]Centre for Economic and Regional Studies, Institute of World Economics, Budapest, Hungary; [b]Budapest Business School, Budapest, Hungary

ABSTRACT

This article explores the transition of integrated periphery countries to a semi-periphery status. It sets out to refine the broad category of 'semi-periphery', distinguishing between upper and lower-order semi-periphery. It shows that compared to established members of the automotive semi-periphery, newcomers are often poorly equipped to thrive in the new competitive environment. Since it takes decades of organic accumulation to develop competitive assets that provide resilience, newcomers that used to thrive in the competitive environment of the integrated periphery often turn out to be the weakest members in the semi-periphery. Based on expert interviews, the article illustrates the theoretical arguments comparing the evolutionary trajectories of the Austrian and Hungarian automotive industries. We show that Austria, exemplifying the case of within-category upgrading (within the upper semi-periphery), can leverage its strong innovation potential, dense network of capable domestic-owned suppliers, tradition of cluster-based and industry – university collaboration, and developed market for technology. In contrast, the between-category transition of Hungary was propelled by the rising wage-level, while other indicators would not qualify it for the club of semi-periphery countries. Evolutionary trajectories in the lower-order semi-periphery can easily be derailed if industrial policy gets stuck in its – previously highly effective – integrated-periphery role.

ARTICLE HISTORY
Received 9 August 2022
Accepted 11 January 2023

KEYWORDS
Automotive industry; semi-periphery; upgrading; resilience; industrial policy; Hungary versus Austria

Introduction

The spatial concept of integrated peripheries, coined by Pavlínek (2018), has quickly become established in the literature. Apart from economic geography articles, studies discussing diverse subjects, such as industrial path development (Blažek et al., 2020), upgrading and industrialisation through global value chains (GVC) (e.g. Molnár et al., 2020; Szent-Iványi, 2017), and dependent development (Krpec & Hodulák, 2019) equally employ the concept of integrated periphery to refer to countries hosting foreign-owned automotive entities specialised in activities requiring low-cost labour. Examples of integrated periphery include central and eastern Europe, Mexico, Turkey, and Morocco.

CONTACT Magdolna Sass sass.magdolna@krtk.hu Centre for Economic and Regional Studies and Budapest Business School, Budapest, Hungary

The core – periphery categorisation of automotive producing countries (e.g. Lampón et al., 2016, 2022; Sturgeon et al., 2008) was refined not only with Pavlínek's (2018) contribution. With GVC leaders' increasingly complex locational decisions and the technology-push and regulatory-driven transformation of the automotive industry (Ferràs-Hernández et al., 2017; Pardi, 2021), the categories of core, periphery and integrated periphery needed further refinement (Pavlínek, 2020). This was achieved through the inclusion of the semi-periphery concept (Mordue & Sweeney, 2020), referring to intermediate-status automotive producing countries that specialise in high value-added activities, albeit lag behind core automotive regions in various respects (see later).

While the concept of the semi-periphery proved to be influential, adding precision to the analysis of the evolving geography of the automotive industry, it also caused non-negligible confusion regarding the classification of individual countries (Pavlínek, 2022). Some authors (reviewed in Pavlínek, 2022) still used the concept of the periphery to refer to integrated-periphery automotive actors. Others argued that due to their significant upgrading achievements, central European countries are not 'integrated peripheries' anymore: they are already part of the semi-periphery (e.g. Guzik et al., 2020; Markiewicz, 2020; Micek et al., 2021; Molnár et al., 2020). On the other hand, the declining competitiveness of the automotive industry in some European core countries (e.g. Britain, Italy, Sweden) prompted observers to qualify them as semi-peripheries, while others still considered them part of the core (Pavlínek, 2022; Simonazzi et al., 2020).

Obviously, the boundaries of each type of automotive producing countries – core regions, integrated peripheries, peripheries (or unintegrated peripheries as coined by Pavlínek, 2022), and semi-peripheries – are permeable. New members can enter, and existing ones exit any of these groups and transition into another. Nevertheless, the aforementioned confusion is understandable, in particular with respect to the semi-periphery. Transition to the semi-periphery from both the core and the integrated periphery is definitely increasing the – already prevailing – heterogeneity of this category. Consequently, it is necessary to further refine the traditional taxonomy describing the geographic structure of the European (and global) automotive industry. This article responds to this perceived need by distinguishing two groups within the broad category of the semi-periphery: the lower-order and the upper semi-periphery.[1] We define the first research question as follows:

RQ1 *What is the difference between the upper and lower-order semi-periphery?*

To elaborate on similarities and differences between these two sub-categories, we focus on a specific type of between-category transition, when an integrated periphery country quits its prior category to occupy an intermediate competitive position. Some distinctive features of the new position resemble those of semi-periphery countries, while other features are still 'worlds apart' from those of the traditional representatives of the semi-periphery.

The case of between-category transition, from the status of an integrated periphery to that of a lower-order semi-periphery will be illustrated by Hungary, a country where the automotive industry showcases a significant upgrading performance (Sass & Szalavetz, 2013, 2014). For comparison, we chose Austria, a stable and well-established

representative of the automotive semi-periphery (Pavlínek, 2022), where the automotive industry is also a key sector of the economy in terms of manufacturing production, employment, and exports (ABA, 2021; Koza, 2021). While Austria is unanimously classified as a semi-periphery for the lack of domestic-owned global OEMs, scholars also equally subscribe to the view that Austria is effectively pursuing a trajectory of path renewal and within-category upgrading (Baumgartinger-Seiringer et al., 2022; Schneider et al., 2021; Trippl et al., 2021). We will document that Austria showcases the characteristic features of upper semi-periphery countries, and thus its development trajectory serves an excellent comparison with the case of lower-semi-periphery Hungary.

Over and beyond substantiating our arguments for a refined analysis of the semi-periphery, the analysis of the case of Hungary's between-category transition to become wedged in the status of a lower semi-periphery serves to address the following research question:

RQ2: *What does transition to a lower-order semi-periphery mean and imply for integrated periphery countries?*

Our research is informed by Sweeney et al. (2020) who distinguish resilience from resistance. Sweeney et al. (2020) conceptualise resilience as the ability (of firms, regions, or countries) to reinvent themselves in the wake of external disruptions and enter a trajectory of economically sustainable growth. By contrast, countries (firms, regions) are often only partially successful when trying to respond to external shocks. Although they avoid outright collapse such as closures and exit from the market, mass unemployment, and radically declining production capacity, they return to a trajectory marked by slow decline and further diminishing competitive advantages – a development Sweeney et al. (2020) refer to as 'resistance'.

In accordance with these arguments, the changes in and adjustment of the Hungarian automotive industry will illustrate the concept of 'resistance'. Our point of departure is that transition to the status of a lower-order semi-periphery does not necessarily indicate an upward movement in a country's value chain position. Hungary, for example, enters the lower-order semi-periphery as an outcome of its eroding cost competitiveness and only partially successful adjustment to the new business environment. In contrast, developments in the Austrian peer industry indicate true resilience, manifested in within-category upgrading and enabling the country to reinforce its status of and value chain position in the upper semi-periphery.

To answer these research questions, we use an exploratory research design, based on expert interviews. Our article makes two contributions. First, we refine the threefold taxonomy of the European automotive industry and thus add precision to the excessively broad and thus vague intermediate category of the semi-periphery. Comparing Austria and Hungary, we single out the most important factors determining movements within and into this category. Second, we discuss Hungary's between-category transition as a sign of eroding competitiveness coupled with inadequate adjustment to the requirements posed by the ongoing transformation of the automotive industry. This approach is in sharp contrast with most of the studies that examine country and industry-level structural change from an evolutionary perspective. These latter studies tend to focus

on *upward movements* and scrutinise how regions or countries exhibiting strong automotive specialisation upgrade to improve or at least sustain their status and competitive position (Lampón et al., 2016; Micek et al., 2021; Szalavetz, 2012; Trippl et al., 2021).[2] Yet, the case of a between-category transition without a sufficient degree of upgrading is an increasingly common development and offers equally important lessons for policy as success stories showcasing resilience.

The remainder of the article is organised as follows. The next section recapitulates the existing categories of automotive producing countries. This is followed by examples illustrating the permeability of category borders. Next, we elaborate on problems related to this permeability, which leads us to argue that the intermediate category of the semi-periphery exhibits prohibitively large disparities. We develop a refined categorisation of the semi-periphery and narrowing our focus to the two sub-categories of the semi-periphery, we examine how the evolutionary trajectories of automotive producing countries cause changes in their position. Following these conceptual arguments, we outline our research method, present, and discuss our findings. In the concluding section we provide summary and consider the implications for policy.

The three main categories of automotive producing countries

Analysing differences in territorial assets, economic geography scholars classify the countries participating in automotive GVCs as core, semi-periphery, and integrated periphery (Mordue & Sweeney, 2020; Pavlínek, 2018). Core countries are advanced economies that host the headquarters (HQ) of global automotive companies. Local automotive stakeholders specialise in HQ-specific activities such as strategic management, market development, and business model development, as well as in high-value functions such as R&D, development of digital services, and high-value, complex manufacturing activities. The lion's share of innovations in the automotive industry is concentrated in core countries. They host the dominant majority of automotive technology start-ups seeking to disrupt or partner with incumbent OEMs (Kenney & Zysman, 2020).

Integrated peripheries are 'factory economies' (Baldwin, 2013) performing labour-intensive manufacturing activities, mostly in the local subsidiaries of global automotive companies. Automotive production is characterised by the dominance of foreign ownership, dependence on foreign capital and know-how, lack of decision-making power, and weak local embeddedness (Pavlínek, 2017). Automotive exports are oriented towards downstream markets and exhibit a high share of foreign value added (Cieślik et al., 2016). Irrespective of local subsidiaries' upgrading efforts and sometimes non-negligible achievements (Guzik et al., 2020; Sass & Szalavetz, 2014), low-cost labour is and remains the main source of competitive advantage in these countries (Krzywdzinski, 2017; Lampón et al., 2016).

The third group of automotive jurisdictions comprises intermediate-status countries, referred to as semi-peripheries (Lung, 2004; Mordue & Sweeney, 2020; Pavlínek, 2018). Apart from Canada, the main focus of Mordue & Sweeney (2020) investigations, most studies include the following countries in the group of semi-periphery countries: the UK, Belgium, Sweden, Spain, Finland, and Austria. What distinguishes this group from core automotive regions is that although these countries do not possess domestic-owned global OEMs, they still host the HQs of a couple of domestic-owned global automotive

suppliers. In contrast to integrated peripheries, the wage level and thus, production costs are relatively high (Mordue & Sweeney, 2020).

Consequently, the economic history of their automotive industry is characterised by constant struggles to compensate for the competitive disadvantages stemming from the high local wage level. Compared to integrated peripheries, institutions, i.e. factors influencing firms' behaviour and performance (North, 1990) are more developed. The average skill level of the automotive workforce exceeds that of integrated peripheries. Automotive semi-peripheries are characterised by a relatively high innovation potential, and a complex industry structure that comprises not only manufacturing but also related knowledge-intensive business services.

Together, these territorial assets enable the local automotive stakeholders to engage in relatively high-value activities, which may partly and temporarily compensate for the competitive disadvantages stemming from their intermediate status and high wage level. Although the innovation performance and positional power of the automotive industry is below those of core countries, semi-peripheries are better equipped to adapt – among others, to value migration that affects suppliers' value capture (Helper et al., 2019; Simonazzi et al., 2020) and regulation-driven radical technological change (Pardi, 2021).

However, due partly to their intermediate status, semi-periphery countries exhibit large within-group performance disparities. Some of them, e.g. Austria, could leverage existing assets to pursue path renewal and exploit emerging opportunities (Pavlínek, 2022; Trippl et al., 2021). Facing sharply declining production, the prospects of others, e.g. Belgium (Jacobs, 2019) or Italy, a potential newcomer to the semi-periphery group through downgrading from the core (Simonazzi et al., 2020), are less rosy.

Permeable category borders

Economic history provides plenty of examples demonstrating that the boundaries of the afore-described categories are permeable: both entries and exits are conceivable and there is a space for between-category transition. For example, some core countries, e.g. the UK and Sweden, have been relegated to the status of semi-periphery as an outcome of declining local competitiveness and foreign actors' takeover of indigenous OEMs (e.g. of Volvo by Geely from China and Jaguar Land Rover by Tata Motors from India). The flipside of the same coin is that newcomers from emerging markets (e.g. China and India) are about to become core automotive countries (Krzywdzinski et al., 2018; Nyiri et al., 2022; Sebastian, 2021; Zheng et al., 2022).

A number of newcomers are readily observed also in the group of integrated peripheries (e.g. Serbia, Bulgaria, Macedonia, and pre-2022 Ukraine). As a response to exhausted labour surplus and rising wages in existing integrated peripheries, investors from core countries increasingly establish greenfield production facilities in these countries. Pavlínek (2022) refers to this process as integration of new peripheries.

As for between-category transitions, some observers point to the upgrading and internationalisation of indigenous automotive companies in Poland (Markiewicz, 2020; Micek et al., 2021) or more broadly, in central Europe (Guzik et al., 2020) and interpret these developments as a transition from the status of an integrated periphery to that of a semi-periphery.

Economic history also presents examples of efforts to achieve transition from the status of an integrated periphery to the core – at least by one indicator, that of domestic-owned OEMs. One such example is the Polish Izera project, a state-supported effort to cultivate a national champion in a newly opening niche of the automotive industry: battery electric vehicles (Lis & Szymanowski, 2022). Mordue and Sener (2022) discuss a similar industrial policy effort in Turkey, another integrated-periphery country. While the development status and performance of the Turkish OEM is much higher than those of its Polish peer, both cases demonstrate – as the cited authors argue – that the presence of a home-grown OEM is necessary but insufficient for transitioning to the core.

Unresolved questions related to between-category transition

The failure of Poland and Turkey to achieve a core status through cultivating national champion OEMs holds important implications for the analysis of central European countries. These cases raise a general question about how to categorise individual automotive producing countries. To establish which category applies to a given country several indicators need to be combined and multiple attributes of local automotive actors checked. However, it is still unresolved, how indicators should be weighed in cases where countries exhibit certain features of a given category but lack other attributes. In the Turkish case, Mordue and Sener (2022) argue that the presence of an indigenous OEM will not generate the expected spillover effects that characterises the activities of OEMs in core countries: intellectual property and high-value parts will be developed abroad, and a local supplier base will not be created. The home-grown national champion will be unable to wield power in its GVC and achieve a threshold level of international market penetration. In summary, while an important indicator of core countries – the presence of a domestic-owned OEM – indisputably applies, other important qualitative performance indicators refute the claim that Turkey is member of the core.

The presence of selected features and absence of others also hamper the categorisation of central European countries. Due to rising local wages and prior upgrading achievements, Hungary, Czechia and Poland already qualify as 'intermediate-status' countries in the European automotive value chain. Indeed, wages have become far higher than in newly integrated peripheries. Although still far from being high-wage economies, the attractiveness of central Europe for efficiency-seeking foreign direct investment has substantially eroded: these countries are no more characterised by cheap and abundant labour, rather, they struggle with increasingly pressing labour and skill shortages (Brunello & Wruuck, 2021; Guzi & Landesmann, 2022).

The automotive industry in these countries exhibits a strange combination of semi-periphery and integrated periphery features. The above-mentioned attributes of the labour-market are consistent with those of semi-periphery countries. Furthermore, activity specialisation has become more complex for employees in production support functions, shopfloor managers, and to some extent also for frontline workers (Szalavetz, 2022a). The responsibilities of the local technical staff, software developers, and executives grew as a result of functional upgrading and inter-subsidiary consolidation of organisational activities. Digital maturity, at least in global companies' flagship local subsidiaries, has attained a low-intermediate status, characterised by advanced, albeit

isolated solutions and more or less developed cyber-physical production systems (Gwosdz et al., 2020; Szalavetz, 2020a).

Flagship local subsidiaries possess excellent production capabilities and technical capabilities. These subsidiaries showcase impressive achievements in functional upgrading. They have accumulated medium-level technical competences in production optimisation, implementation of digital technologies, and ramping up the production of new products. The highest-flying local automotive subsidiaries have medium-level R&D competences and are engaged in application engineering, advanced engineering, simulations, testing, and software development (Markiewicz, 2020; Szalavetz, 2019b; Winter, 2010). They are among the top R&D spenders in their host countries.

These non-negligible achievements notwithstanding, the automotive industry in these countries is characterised by a number of attributes that are not in accordance with those of the semi-periphery. First of all, a significant share of automotive exports in these countries is low-medium value added. Furthermore, domestic-owned companies are hardly involved in OEMs' value chains to supply production or related activities, not to mention high-value R&D, design or services activities. More importantly, irrespective of *growing anecdotal evidence* of functional upgrading, establishment of local R&D centres, and presence of high-value activities at flagship automotive subsidiaries, the truncated development (Pavlínek, 2016) of central Europe could not be overcome: local innovation potential is tiny at best (Krzywdzinski, 2018; Pavlínek, 2022).

Additionally, the asymmetries in power relations, the high degree of foreign control coupled with low local embeddedness, and the exposure of the local automotive stakeholders to global automotive companies' strategic decisions remained unchanged (Drahokoupil, 2020). Neither the average skill level nor wage-adjusted labour productivity improved in line with investors' expectations. The emergence of local start-ups specialised in automotive technology and automotive industry-related digital technology solutions remained confined to anecdotal cases (Hafner & Modic, 2020; Skala, 2022; Szalavetz, 2019a, 2020b).

In summary, the actual status of central European countries, i.e. whether or not they should be classified as semi-peripheries remains subject to different interpretations. This calls for further research to explore the properties and development level of local automotive actors and critically evaluate the achievements and remaining gaps from the perspective of the semi-periphery.

A related issue is that with the changing status of some integrated-periphery countries, the intermediate category of the automotive semi-periphery has become excessively broad. The semi-periphery exhibits large inter-country disparities in terms of the quality and quantity of core and complementary assets, sophistication of production specialisation, drivers of development, and innovation potential. The heterogeneity of semi-periphery members calls for a more fine-grained understanding of this category.

It is against this background that the twin purposes of this article are defined: (1) to refine the broad category of the automotive semi-periphery by creating two subcategories and answer RQ1 regarding the differences between the upper and lower-order semi-periphery and (2) to explore the specifics of Hungary's transition to the lower-order semi-periphery, comparing the attributes of its current development level with those of upper semi-periphery Austria, and answer RQ2 regarding the meaning and implications of this transition.

Conceptual framework

To refine the broad category of the automotive semi-periphery, we distinguish two sub-categories: the lower-order semi-periphery and the upper semi-periphery. The lower-order semi-periphery comprises countries that previously belonged to the integrated periphery and exhibit the above-described combination of semi-periphery and integrated periphery characteristics. Based on our review of the literature outlined in the previous sections, Table 1 summarises the attributes that determine countries' classification into these sub-categories.

The size of the group of lower-order semi-periphery countries keeps growing through entry by countries that were previously classified as integrated peripheries – a development that has gained momentum at the turn of the second decade of the 21st century.

Another type of dynamics in the semi-periphery concerns within-category upgrading. Even though actors in both the lower-order and upper semi-periphery pursue within-category upgrading, these activities are most pertinent to actors in the upper semi-periphery. Their upgrading is gradual and organic, marked by adoption of digital technologies and accumulation of human capital and infrastructural assets. The innovation-based character of their evolution is most conspicuously manifested in the emergence of new actors through automotive industry-related (digital) entrepreneurship. Although less spectacular, the diversification of automotive exports and the growth of domestic-owned small and medium-sized enterprises is also driven by innovation in products, processes, marketing, business model, and so forth.

Table 1. Comparison of upper and lower-order automotive semi-peripheries.

Features of the automotive industry	Upper SP	Lower-order SP
Wage level and average skill level	High	Intermediate: higher than in new IPs, albeit lower than in USP
Drivers of development	Knowledge accumulation and the resulting upgrading-driven growth of the value added of automotive exports	New FDI inflows and global companies' strategic decisions to expand and upgrade their local subsidiaries
Presence of high-value functions in automotive companies	Medium	Low: confined to anecdotal cases
Local embeddedness, strength of local automotive networks and ecosystems	Medium	Minimal: dominance of hub-and-spoke relations with foreign investors, anecdotal cases of local ecosystem formation
Importance of local knowledge-intensive services providers	Medium	Low
Automotive technology entrepreneurship	Medium	Low: a couple of anecdotal cases
Innovation potential	Medium	Tiny, but an increasing number of R&D centres at subsidiaries and standalone ones
Presence of relatively powerful, domestic-owned automotive actors	Medium	Low (often: outright lack of such actors)

IP = integrated periphery, USP = upper semi-periphery.
Source: Authors' compilation based on their review of the literature.

Although these developments ensure a sustainable evolutionary trajectory for upper semi-periphery actors, their evolution is not necessarily manifested in sustained growth. While this latter concept denotes the absence of declines in production and employment, the former refers rather to the economic sustainability of the automotive industry in the wake of radical changes in its business environment – what Sweeney et al. (2020) conceptualise as 'resilience'.

Figure 1 depicts the refined typology and the possible cases of between-category shifts and within-category upgrading in the semi-periphery.[3] Brown arrows, in Figure 1, represent between-category transition and yellow arrows stand for within-category upgrading. Green arrows represent newcomers entering individual categories. Dashed-line brown arrows stand for the hypothetical possibility of integrated periphery countries leapfrogging to the core or to the upper semi-periphery. The discussion of these latter shifts is, however, beyond the scope of this article. Another hypothetical possibility, for which there is still no evidence in economic history, is transition from the lower-order semi-periphery to the upper semi-periphery.

Data and methods

To empirically substantiate our conceptual framework, we conducted exploratory research involving qualitative data collection from in-depth interviews with 20 experts in Hungary and Austria (Table 2). Exploratory research focuses on identifying and explaining new phenomena and can be used to extend or refine existing theory (Welch et al., 2011). Expert interviews are widely used in social sciences to trace and contrast interpretations of complex processes (Bogner et al., 2009). We applied purposeful sampling (Patton, 2002) and selected experts who were regarded as being able to provide relevant insights in the issues addressed in this article. Our sample includes academic researchers, representatives of industry associations, clusters, consultancy firms, government agencies, trade unions, and corporate stakeholders. These latter represent roughly half of the

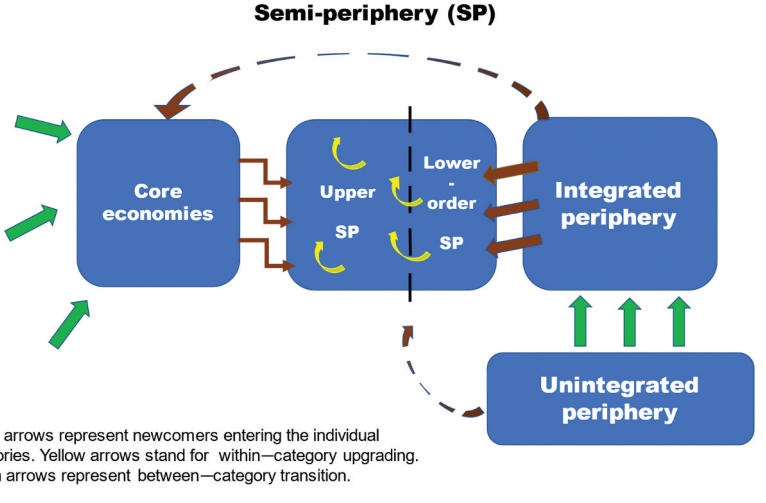

Figure 1. Conceptual framework.

Table 2. Overview of the interviews.

Expert	Country	Professional role and type of organisation	Year of interview
1	H	Managing director of an automotive consultancy firm in Hungary	2021
2	H	CEO of the Association of the Hungarian Automotive Industry	2022
3	H	President of the Hungarian Metalworkers' Federation representing the interests of workers in automotive, electronics, metal, and machinery industries	2021
4	H	Executive director of JAK Hungarian E-mobility Cluster	2021
5	H	Representative of a Hungarian subsidiary of a global Tier 1 supplier that has subsidiaries both in Hungary and Austria	2022
6	H	Managing director of the Hungarian subsidiary of an Austrian international automotive Tier1 supplier	2022
7	H	HRM officer of the Hungarian subsidiary of a large Korean EV battery manufacturing firm	2021
8	H	Representative of the Hungarian subsidiary of an Austrian global automotive R&D services provider	2022
9	H	Representative of a domestic-owned R&D and engineering services provider	2021
10	H	Representative of the Hungarian subsidiary of an Austrian component supplier	2022
11	H	Representative of the Association of the Hungarian Automotive Component Manufacturers	2022
12	H	Representative of one of the Hungarian subsidiaries of a global Tier 1 supplier that has locations both in Hungary and Austria	2022
13	A	Representative of an Austrian international firm that develops and manufactures special-purpose vehicles	2022
14	A	Researcher of automotive industry, representative of the Austrian Chamber of Labour	2022
15	A	Representative of an Austrian global automotive R&D services provider	2022
16	A	Representative of an Austrian company specialised in a niche segment of the vehicle industry	2022
17	A	Researcher of the Austrian automotive industry	2022
18	A	Representative of the Austrian Investment Promotion Agency	2022
19	A	Representative of an Austrian Mobility Cluster	2022
20	A	Representative of an Austrian Automobile Cluster	2022

H = Hungary, A = Austria

sample. The interviews lasted 60 minutes on average and were conducted in two rounds, in 2021 and early 2022.

Three international workshops[4] helped us complement information obtained from the interviews. While the main focus of the workshops was the impact of the transition to electric vehicles, presentations by and conversations with representatives of automotive companies, academic participants, and other stakeholders representing NGOs and trade unions provided valuable information also about the specific issues discussed in this article.

We asked the experts interviewed to evaluate the key features of the Austrian/Hungarian automotive industry and assess the economic sustainability of prior upgrading achievements in the wake of the fundamental transformation of the industry. The time period our interviews focused on is between 2016 and 2022 (present). We selected this period based on the results of our prior investigations (Szalavetz, 2022c) that were based on interviews with some of the companies that are also included in the current sample and with other Hungary-based automotive companies. These prior investigations indicate that the past half a decade of the Hungarian automotive industry is characterised by relatively strong qualitative upgrading, at least if compared to the dominantly quantitative expansion in earlier periods.

The subsequent questions were aimed to validate our prior assumptions concerning the differences between the upper and lower-order automotive semi-periphery. Besides

the above questions that were aimed to set the context, these assumptions, derived from the literature review and summarised in Table 1, guided the themes covered in the interviews. Accordingly, we inquired about issues such as the importance of the wage level, role of clusters, collaborations with external knowledge providers, or more broadly, locational embeddedness of automotive actors, drivers and barriers of future development, and in the case of corporate interviewees, about within-company differences and the division of labour across the different locations of the multinational corporation (MNC).

For data analysis we applied the method of constant comparison, involving not only cross-case comparison (i.e. comparison of the narratives of individual experts) but also a comparison of the data obtained from the interviews with data from secondary sources: business press articles, industry reports (e.g. Koza, 2021; Schneider et al., 2018, 2021), and published interviews involving the same experts or companies. From time to time, we asked the experts interviewed to evaluate specific takeaways derived from other interviews, which added nuance and helped refine our emerging conclusions.

Results

Although the insights of the experts interviewed were derived from different perceptions and filtered through the lenses of their own experiences, their answers exhibited remarkable commonalities. The results presented in this section will highlight the specifics of the differences between the two locations. In the subsequent section, the implications of these differences will be discussed.

At the beginning of the conversations, some interviewees pointed out that the Austrian and Hungarian automotive industries exhibit multiple similarities in terms of the economic weight of the automotive industry, the fact that the automotive industry has long been the most important growth sector in both countries, the export orientation of production, and the outstanding importance of Germany as the home country of foreign investors and the largest export market (cf. Table 3).

While the Hungarian interviewees interpreted the paramount importance of the automotive industry mainly as an 'excessive exposure' and 'one-sided specialisation', Austrian interviewees have rather emphasised the positive connotations of a strong specialisation in terms of the industry's high multiplier effect, its spillover effects stemming from the fact that the industry pioneers adoption of advanced manufacturing technologies, the presence of demanding customers, and the opportunities for learning, innovation, and entrepreneurship through complementary specialisation (e.g. in specific niches of the automotive industry or in automotive industry-specific technology provision).

The listing of similarities proved to be a good departure for interviewees to elaborate on differences. Surprisingly, differences in the wage level were hardly mentioned[5]: this topic came up rather with respect to recently opened subsidiaries in newcomer integrated periphery countries (e.g. Serbia and Turkey). In the context of Hungary, this claim was even explicitly rejected by expert H–1:

> Wage differences used to be important, but their importance has eroded. New investments are driven by more complex motivations such as the availability of labour, public subsidies, and the presence of competitors and battery manufacturers. High-level political stakeholders

Table 3. A snapshot view of basic data of the automotive industry (2020).

	Austria	Hungary
Employment	39,500	172,200
Production (€ billion)	15.6	27.57
Share of exports (%)	87	90.3
Share of Germany in automotive export (%)	31.65*	32.4*
Labour productivity (€ per hours worked)	280.1**	120.1**
Average salary (€)	4,631	1,483.7
R&D expenditures per employee (€)	21,549	5,559***

Source: Koza (2021) for Austrian data and Central Statistical Office for the Hungarian data.

*Source: OECD TiVA Database (Data refer to 2018).

**Gross output per hours worked (of total engaged). Data refer to 2018, current prices, the exchange rate used is 309.28 HUF = 1 EUR. Source OECD STAN Database.

***There is no industry-level data on R&D expenditures in Hungary. Therefore, we hand-collected data on the R&D outlays of the twelve most R&D-intensive automotive firms and calculated the average of R&D expenditures per employee at these twelve companies (€5,559). If we assume that there are no additional automotive firms that conduct R&D in Hungary and take the number of total automotive employees (172,200) as the denominator, the resulting value (R&D expenditures per employee in 2020) is € 1,342.8. There are two caveats to consider. One is that it is unrealistic to assume that there are only twelve automotive companies in Hungary with R&D activities. The other issue is that the denominator contains only 'employees' and does not include the number of temporary agency workers. However, according to the data of the Central Office of Labour, in 2020, the number of temporary agency workers was 13,800 in the Hungarian automotive industry (NFSZ, 2021).

> are often involved in the final locational choice, at least in the case of large-scale investments. As for the existing production facilities, it is rather path dependence and prior upgrading achievements that matter for further investments.

Expert H–12 claimed however, that for skilled, high value-added activities, such as in engineering and R&D, wage differences between the core, upper and lower order semi-peripheries still matter. Furthermore, expert A–17 emphasised, that Austria, overall, is a high wage and high skill location in the automotive industry. Expert H–5 considered the issue of wage differences from a different perspective:

> It took more than a decade till we could claim that the Hungarian production site is fully integrated into the corporate production system. Additionally, we now collaborate with all the relevant Hungarian universities. Therefore, it is out of question to relocate production to a lower-cost location. Building a new factory can be completed quite rapidly. Integrating it into our company's production system, that's what requires time.

When asked about the perceived differences in the sophistication of production technology, interviewees in both countries would mention cases of highly sophisticated, automated and robotised production sites, and advanced cyber-physical systems allowing for digital use cases (real-time control, predictive maintenance, and driverless in-plant transport systems). Although our interviewees were not in the position to provide an overarching and systematic comparison of the average development level of automotive firms' production systems in the two countries and they could not provide a reliable comparison of digital maturity either, analysis of the cases they recounted gave rise to the tentative conclusion as follows. If the best firms in both countries are compared, there is practically no difference in the sophistication of the production technology and in digital maturity. As expert H–5 put it:

> We cannot afford employing less advanced technological solutions in low-cost countries. Since our customers conduct regular audits at each factory, the production system needs to be identical. Maybe the manufacturer of the robots is different in a European and a Far Eastern location, but the technological level is the same. As for the IT system and digital solutions, again, the situation is the same: no difference is allowed.

Relatedly, expert H–12 noted that in automotive electronics, there is no difference in the automation ratio of Hungarian manufacturing sites and their peers in advanced economies. Altogether, instead of within-MNC differences it is rather *the low spread* of advanced manufacturing technology that explains the differences in the performance of the Hungarian and Austrian automotive industries. In Hungary, a substantial proportion of frontier-technology manufacturing is carried out by a relatively small number of subsidiaries of global automotive corporations. The technological level and the digital maturity of these subsidiaries is not inferior to their Austrian counterparts. However, there is a negligible number of Hungarian-owned small- and medium-sized firms deploying the highest technology, as stressed by several Hungarian interviewees (H 1–4). In contrast, in Austria there is a relatively larger population of large and medium-sized automotive companies that exhibits a high level of digital maturity and employs the most advanced manufacturing technologies (A–14, A 17–19).

Notwithstanding, the key differences were identified neither in terms of wages nor in the average sophistication of the production technology, rather in the importance of domestic-owned actors, in terms of the innovation potential, and the approach of public policy to supporting the industry.

Strong/Weak domestic-owned actors

Two Austrian interviewees pointed out that analysts of the automotive industry usually adopt a narrow focus and concentrate only on passenger cars and on the local subsidiaries of global automotive actors. While indeed, these companies account for the lion's share of automotive output and exports, the significance of domestic actors should not be underestimated. There are notable domestic-owned Austrian companies, specialised in certain niches of the vehicle industry, that managed to grow, internationalise, acquire foreign competitors, and carve out significant market share in their niches. Some of the niche companies e.g. the ones that develop and manufacture special-purpose vehicles (e.g. Rosenbauer) or motorcycles (e.g. KTM AG), can be considered OEMs, since they manufacture self-developed end-products and exert strategic control over all business functions. Note that this questions Austria's categorisation as a semi-periphery (that lacks OEMs). Although domestic-owned companies do not necessarily procure parts and components from Austrian suppliers, they do account for the thriving local market for technology (see later). According to our interviewees this is one of the most important differences between Austria and Hungary. Expert H–4 put it bluntly:

> If you take a look at the traditional success indicators such as output, exports, or employment you can rightly claim that we have a thriving automotive industry here in Hungary. However, apart from half a dozen of exceptions, we have no meaningful domestic-owned actors. By contrast, in Austria, there is a multiplicity of well-established, innovative, and internationalised family firms that have been around for half a century or more.

Expert H–11 mentioned a couple of high-flying domestic-owned Hungarian automotive suppliers. However, overall, their number is disturbingly low (Gáspár et al., 2022). To illustrate the order of magnitude differences between the Hungarian and Austrian performance in this respect, we randomly selected two family-owned companies and compared their performance (Table 4).

Obviously the two companies are worlds apart and their comparison yields a distorted picture. Nevertheless, Table 4 illustrates the differences between Austrian and Hungarian family-owned companies in terms of what accounts for success and what their development objectives are. It illustrates the differences in the meaning of terms such as 'market expansion' – participation in international fairs versus growth through acquisition of competitors and greenfield establishment of new facilities –, 'digitalisation' – implementation of specific digital solutions versus an overarching digital transformation –, or 'innovation' – access to a public grant and completion of a collaborative research project with a university versus formal R&D, hundreds of patents and technology leadership. It also illustrates that in the case of the Hungarian company, successful expansion is based

Table 4. Two domestic-owned automotive suppliers.

	Company A (Hungary)	Company B (Austria)
Products and services	tool components, finished tool plates (built into die-casting and sheet metal working tools), contract CNC manufacturing, boring, turning, precision machining – according to customers' models. Provision of design services.	powder metal parts, sintered parts, bearings, friction materials, power electronics components, coatings, special machinery, components for e-mobility applications
Foundation	1992	1927
Number of employees	245	7366 employees worldwide in 30 locations (more than 2000 employees in three locations in Austria)
Technology	CAD/CAM, 3D printing, advanced production machinery	Frontier technology, technological leadership in its fields
Production, (share of exports)	€ 12.5 million (62.7%)	€ 971 million (Global presence: Europe accounts for 63% of sales)
Innovation	Engineers account for 10% of employees. An ongoing R&D project aimed at developing a new type of CVD coating and conducted in collaboration with Pannon University received € 2 million public funding.	300 R&D employees; 400 patents; in 2020, €32 million was invested in R&D focusing on electric motors and battery solutions.
Digital maturity	Medium: digital solutions supporting operations and specific auxiliary functions.	High: has an established digital transformation strategy and dedicated employees to execute this strategy, uses a variety of enterprise software and cloud applications, R&D for digital added value of products, development of data-based services, connection of the whole supply chain, connection of real-time machine data in various production locations (e.g. Slovakia, India); robotic process automation of an increasing number of tasks
Other	Vocational training centre, participation in international fairs e.g. EUROMOLD (Frankfurt), Fakuma (Friedrichshafen)	Initial public offerings: 1986 and 1989; growth through acquisitions and opening new production facilities e.g. in the U.S., China, Slovakia, India; The company employs 300 apprentices and has a corporate 'Academy' for training and lifelong learning provision to employees; A broad product portfolio with an increasing shift to e-mobility

Source: compilation from corporate websites and the business press.

on contract manufacturing services provision. In contrast, at the Austrian company, expansion is based on self-developed products, acquisition of new markets, and new products and services development.

Strong/Weak indigenous innovation potential

Besides differences in the incidence of well-established, powerful, domestic owned companies, another important difference identified by the experts interviewed is the high innovation capacity of the Austrian automotive industry. Compared to Hungary, the R&D-intensity of Austrian automotive firms is far higher (cf. Table 3). As demonstrated in Trippl et al. (2021), many Austrian automotive companies collaborate with universities and other research organisations. The proactive manner by which Austrian (domestic and foreign-owned) automotive companies embrace the ongoing transformation of the automotive industry towards connected autonomous, shared, and electrified mobility is best illustrated by the number of industrial partners in flagship fundamental and applied research projects in Austrian automotive competence centres. For example, there are more than 80 industrial partners participating in various research projects of the Virtual Vehicle Competence Centre in Graz (https://www.v2c2.at/cooperation/partnernetwork). As for output-based R&D indicators, on average, 350 automobile patents are filed in Austria annually (ABA, 2021).[6] By contrast, in Hungary, the number of automotive companies with product R&D is limited, as corroborated by interviewees (H–1, H–3, H–4) representing Hungarian industry associations. The majority of the few automotive companies that have formal R&D activities perform either process R&D (aimed at enhancing the efficiency and reliability of production, e.g. through implementing industry 4.0 solutions and/or introducing new, upgraded process technologies) or technical R&D (such as testing, simulation, tooling, and manufacturing trials to resolve technical challenges).

> Over time we managed to build good relations with the central R&D team of the Austrian HQ. R&D activity is centralised there, since the specific equipment for testing, e.g. high-speed cameras and software for the evaluation of the parameters, are available at the HQ's premises. We try to contribute to overall R&D in the field of design for manufacturing. *(expert H–6)*

Notwithstanding, there are a couple of (10–15) Hungary-based automotive subsidiaries with high R&D inputs. These latter companies conduct formal product R&D – often in local standalone research centres. Accordingly, the R&D-specific differences between the Austrian and Hungarian automotive industries are in a sense similar to what was mentioned in the context of the 'low spread of advanced manufacturing technologies' in Hungary. If we compare only the R&D activities, outlays, and the number of researchers of the highest-flying, R&D-intensive automotive companies (MNCs' local subsidiaries) in Austria and Hungary the differences are not enormous. However, the number of such R&D-intensive companies in Hungary is only a fragment of that in Austria.

Furthermore, there is an important qualitative difference: R&D-intensive local subsidiaries in Hungary conduct *intra-MNC 'contract R&D'*-type activities: these R&D activities are often unrelated to local production. By contrast, the R&D efforts of Austrian domestic-owned companies generate self-developed new products.

> *'We introduced a range of digital functions in our vehicles, and work on launching the electrified versions of every vehicle in our portfolio. We lay much emphasis on digital services and develop*

connected vehicle services, remote monitoring services and other digital systems that are related to our core activities. Besides our core products, the special-purpose vehicles, we develop a range of complementary digitally enhanced tangible and intangible products and solutions. Last year we spent more than €24 million on R&D.' (expert A–13)

In Hungary, the MNC-owned standalone research centres function as 'extended workbenches' that provide high-value R&D services, such as software development, to their owners' global organisation. Note that prior literature limited the notion of 'extended workbench-type R&D' to subsidiaries performing low-value technical tasks or R&D aimed at solving short-term, incremental problems (Zeschky et al., 2014). However, with the digitalisation-driven proliferation of R&D-tasks, the long ongoing decentralisation of R&D activities has further accelerated. Besides opening up innovation (Chesbrough, 2003; West & Bogers, 2014) and managing global innovation ecosystems (e.g. Russell and Smorodinskaya, 2018), the intra-firm division of R&D labour has also become more complex, giving rise to extended workbench-type offshoring of fundamental, albeit partial R&D activities.

> We conduct research among others on sensors, electronic stability control, contribute to the corporate-level development of advanced driver assistance systems, and there is an artificial intelligence development centre in Hungary. The former lines of research are partly related to local production activities, while the latter is part of the corporation's globally distributed research undertakings. *(expert H–12)*

Hungary's significant gap vis-á-vis Austria in terms of the R&D-intensity of automotive production is a serious disadvantage because it reduces the chances of industrial upgrading through local technology providers' entrepreneurial integration in automotive value chains. Szalavetz (2020b) analysed Hungarian digital technology providers' efforts to become integrated in global automotive value chains through knowledge-intensive services provision to or innovation collaboration with global automotive companies' local manufacturing subsidiaries. She pointed out that there are few competent local digital entrepreneurs, and these start-ups find it hard to commercialise their technologies and capabilities. OEMs' local subsidiaries (and their parent companies) consider it risky to contract them, given that they have a relatively short business history. An interview excerpt, quoted in a companion article (Szalavetz, 2022c) is consistent with this claim: *'OEMs are cautious. Although they consider our prototype innovative, they would say, let's come back to this issue if your company can document its viability. If you are still in the market in five years, we can talk about business.'* This is a Catch-22 situation: local technology providers cannot acquire powerful customers because they are not considered sufficiently established. However, if they cannot acquire some flagship customers, they will be unable to grow and become an established company.

A handful of Austrian technology providers could escape this trap because they have a much longer business history than their Hungarian counterparts and have gradually diversified into today's frontier technologies. For example, TTTech Auto – that is not a start-up anymore, but a leading high-tech player specialised in autonomous driving technologies – was originally established in 1998, as a spin-off the Vienna University of Technology. Notwithstanding, there are multiple relatively young automotive start-ups (Kendall, 2021) that managed to gain reputation from collaborating with powerful Austrian and international automotive firms and from participating in R&D projects that

received national and/or European funding. As expert A–17 stated, large local firms continuously and intensively look for technology start-ups and innovative small firms, to benefit from cooperation with them. In summary, the relatively large Austrian market for technology (cf. Arora et al., 2001) is an important factor that reduces the entry barriers faced by the local automotive technology-oriented start-ups and knowledge-intensive services providers.

Austrian experts interviewed (A–13, A–14, A–17, A–18) pointed out that the well-conceived Austrian public policy, in other words, the '*quality of the system*' (political system, institutional system, innovation system) is a key explanatory factor of today's well-functioning market for technology. This remark leads us to the third difference that has crystallised from the expert interviews: in public policy approaches to supporting the transformation and upgrading of the automotive industry.

Differences in public policy

Overall, Austrian interviewees' evaluation of the framework conditions of automotive firms' operations was rather positive. Expert A–18 pointed to the importance of soft factors such as predictability, transparency, and trust that account for a relatively high effectiveness of policy interventions, the prevalence of long-term thinking, and stakeholders' willingness to collaborate. The importance of soft factors is best demonstrated by the conspicuous differences between the two countries in the effectiveness of cluster programmes. Clusters represent a key area of policy interventions targeting innovation-based upgrading and supporting small and medium-sized enterprises, among others in the automotive industry (Szanyi, 2012).

> Cluster programmes in Austria, together with other policy instruments such as the COMET programme (competence centres for excellent technologies) quick-started automotive stakeholders' collaboration. Public funding has been an effective facilitator: after the initial projects collaboration continued, became more diversified, and has significantly expanded due to additional private investment. *(experts A–17, A–18)*

> Clusters used to be very important in Hungary: we could observe a proliferation of clusters throughout the country. However, once the dedicated public funding was over, the parties lost interest. Most of these clusters do not function anymore. *(expert H–2)*

Another important difference between Austria and Hungary, concerns the purpose of automotive-focused industrial policy. In Hungary, the key concern of industrial policy is to improve quantitative indicators such as output, export, and employment. The primary policy objective is to sustain FDI-based growth. For example, the Hungarian government devised generous incentive schemes to attract Asian investors in battery manufacturing. Success in this respect enabled significant growth in automotive output, employment, and exports. The flipside of the coin was however a development that Blažek et al. (2020) refer to as *path downgrading*. Path downgrading occurred as a result of massive inflows of new FDI driven by low-cost motives and a growing share of low-value, standard products within total automotive output.

In contrast, the Austrian industrial policy supports automotive stakeholders' R&D-based upgrading and adjustment to the new patterns of competition within their transforming industry (cf. Pichler et al., 2021). A telling example of this difference in policy

stance is that although Hungary ranks among the top countries in terms of the size of lithium-ion battery production capacity[7] (Placek, 2022), the country does not participate in the European Battery Innovation (EuBatIn) project, a large-scale IPCEI (Important Project of Common European Interest) involving twelve EU member countries (including Austria and some factory economies such as Poland and Slovakia). The purpose of EuBatIn is to establish an *innovative* value chain for lithium-ion battery technology in Europe and enhance the innovation collaboration of innovative actors in this field. In early 2022, there were 42 corporate participants in the EuBatIn project: among them six Austrian companies that conduct battery-related R&D projects. In contrast, apart from the Hungarian subsidiary of AVL, Li-ion battery-specific R&D in Hungary is marginal: confined to a couple of university departments, mainly in chemical engineering (expert H–11). The Asian owners of the large-scale Hungary-based battery production capacities do not engage in local R&D activities (expert H–7). In this vein there is no innovation collaboration between these companies and Hungary-based R&D services providers.

The experts interviewed identified a further important difference in the focus of policy interventions. In Hungary, automotive-focused policy[8] targets the narrowly interpreted automotive sector, i.e. OEMs and parts and components suppliers. In contrast, the Austrian industrial, regional, and innovation policies define the automotive industry in the broadest possible manner. The Austrian dedicated automotive-focused initiatives, e.g. 'Connected Mobility' in Upper Austria or 'AutoContact' in Styria (see the detailed case study by Trippl et al., 2021), try to foster the competitiveness of the '*mobility sector*' that comprises not only the manufacturers of traditional and new energy vehicles, parts, and components, but also includes other transport equipment, digital solutions that enhance the functionality, safety, and security of products, digital solutions related to product development (e.g. digital twins, virtual solutions) and operations, mobility-related sustainability solutions, mobility-related digital services (car sharing, ride hailing, smart city solutions), material research, energy efficiency, and so forth (expert A–19). This broad interpretation of the sector fosters the collaboration of automotive and non-automotive stakeholders and thus promotes complementary specialisation, which is paramount for path diversification, structural upgrading, and a high-road trajectory of the sector's development. Taken together, policy support in Austria fosters both intra-sectoral knowledge flows and the integration of exogeneous knowledge sources. In an era marked by the blurring of industry boundaries (Szalavetz, 2022b), both of these policy objectives are indispensable for within-category upgrading.

Discussion

Although it is tempting to interpret these results in terms of a 'constraining' versus 'enabling' environment for a high-road trajectory of the automotive industry's development and our results firmly support this conclusion, we argue that the introduction of two sub-categories to refine the broad category of the semi-periphery could add a new dimension to this conclusion. By dividing the broad category of the semi-periphery, we can better explain within-category disparities and members' diverging evolutionary trajectories.

Our point of departure is that not all aspects of Hungary's prior upgrading achievements would qualify it for the status of a semi-periphery (Mordue & Sweeney, 2020). The

evolution of the indicators that categorise countries and determine their relative position in the core – periphery structure of the European automotive industry (Pavlínek, 2022) indicate that in Hungary's case, it is the rising wage level that propelled this transition. The quantity and quality of the other indicators, e.g. domestic-owned automotive actors and indigenous innovation potential, would not qualify Hungary for the club of semi-periphery countries.

The flipside of the same coin is that in the current intermediate position of the Hungarian automotive industry, new kinds of competitive assets constitute the criteria for success. In semi-periphery countries, these assets – a strong innovation potential, a dense network of capable domestic-owned suppliers, including automotive technology-oriented knowledge-intensive services providers, a tradition of cluster-based and industry – university collaboration coupled with well-functioning institutions, and a developed market for technology – are accumulated over a couple of decades.

So far, the performance of the Hungarian automotive industry was poor in terms of accumulating these competitive assets and the required capabilities. Industrial policy also failed to adjust to these requirements and got stuck in its – previously highly effective – practice of attracting foreign direct investment in the high-volume, high-multiplier, export-oriented automotive industry, which creates a high number of acceptable jobs. Locked in this *integrated-periphery role*, the Hungarian industrial policy keeps offering extensive fiscal and financial subsidies to new investors.[9] Currently, battery manufacturing is an important target sector of FDI attraction because this labour-intensive activity is deemed to be able to compensate for the eventual job losses the transition to electric vehicles might induce. The spectacular success of the Hungarian industrial policy in this field means that instead of facilitating the adjustment of automotive companies to the requirements of the new context, policy rather furthers *path downgrading* in terms of re-specialisation in low-cost production (Blažek et al., 2020).

In short, the Hungarian industrial policy is fumbling around in the unfamiliar context of a lower-order semi-periphery. The strategic steps (the generous policy support) that were highly successful in the context of an integrated periphery, prove to have adverse consequences in the club of semi-periphery countries. Due to the availability of a relatively skilled workforce and local subsidiaries' effective absorption of the transferred technology – they acted proactively in the context of inter-subsidiary competition and managed to co-evolve with their parent companies (Sass & Szalavetz, 2013; Sass & Szalavetz, 2014; Szalavetz, 2020b)—the Hungarian automotive industry was thriving in the competitive environment of an integrated periphery. Having moved into a new context, marked by a relatively high local wage level, the exhaustion of the labour surplus, and the radical technological transformation in the industry, these assets and capabilities prove to be insufficient: Hungary finds itself as one of the weakest members in the new club.

Meanwhile, the Austrian automotive and automotive-related stakeholders managed to build on, expand, and further upgrade their existing, historically accumulated assets and capabilities. Supported by an industrial policy that has correctly identified the new criteria of competitiveness – the need for technological change, integration of external knowledge sources, diversification, and new (service-oriented) business models (Pichler et al., 2021) – the Austrian automotive industry, a well-established actor in the upper semi-periphery, continued its within-category shift upwards.

Conclusion, implications, limitations, and future research

This article attempted to refine the excessively broad intermediate category of the 'semi-periphery' within the traditional threefold taxonomy that describes the geographic structure of the European automotive industry. We proposed to distinguish between upper and lower-order semi-periphery and showed that the transition of integrated periphery countries, exemplified by Hungary, to the status of a lower-order semi-periphery does not necessarily indicate an upward movement in a country's value chain position. Neither does it suggest a better preparedness for a high-road development. Since this transition was propelled by the rising wage level, while other indicators such as the quantity and quality of domestic-owned automotive actors and indigenous innovation potential, would not qualify Hungary for the club of semi-periphery countries, Hungary now finds itself as one of the weakest members of the new club.

We contrasted the features of the Hungarian automotive industry with those of its Austrian peer, a well-established actor in the upper semi-periphery. We contended that this latter followed a different development trajectory: one that is better aligned with the exigencies of competition (a) in a semi-periphery context and (b) in the context of the ongoing transformation of the automotive industry.

It is specifically this divergence in the evolutionary trajectories of the Hungarian and Austrian automotive industries that justifies the proposed distinction between upper and lower-order semi-peripheries. Most of the lower-order semi-peripheries are characterised by gradually eroding competitiveness, since the prior integrated periphery-type sources of their competitive advantage are wearing away, and the pace of their accumulation of new competitive assets, necessary for resilience in a semi-periphery context (Sweeney et al., 2020), is too slow to compensate for the losses.

Accordingly, besides improving our understanding of the intermediate category of the semi-periphery, the value added of the refined typology is that it highlights the multi-dimensionality of belonging to a certain category. It calls for a fine-grained approach to classifying automotive producing countries, specifically for analysing the context-specific importance of each attribute evaluated, i.e. whether it is a category-defining attribute or just a complementary one of secondary-importance (cf. Mordue & Sener, 2022).

A key policy implication of our findings is that transition to a new competitive context requires the unlearning of traditional policy practices and the reconsideration of policy priorities. In this case, the quest of the Hungarian industrial policy to sustain economic growth through attracting foreign direct investment targeting labour-intensive, export-oriented automotive manufacturing activities needs to be reconsidered.

An important limitation of this research is that it does not discuss the possibility of a continued transition from the status of an integrated periphery to that of a well-established, resilient (upper) semi-periphery. The absence of analysing such a trajectory is not intended to suggest that it is not possible. Further longitudinal research is required to investigate the evolutionary trajectories of countries originating from the integrated periphery. Further possible paths of future research include extending the sample to other Central and Eastern European countries for tracing the similarities and differences with the Hungarian development trajectory. This is all the more important as certain studies (e.g. Cetin & Ackrill, 2018; Gáspár et al., 2022; Micek et al., 2021) highlight differences in various areas among the lower order semi-periphery countries, which

may imply and be the result of diverging developments. Furthermore, the yet unclear consequences of the recent turbulences in the world economy for the evolution of the automotive industry are also to be taken into account.

Notes

1. In this regard, our approach resembles the clustering exercise by Pavlínek (2022), who also set to refine the threefold taxonomy by introducing two subtypes in the categories of core and periphery, respectively. Our approach differs in its focus on the category of semi-periphery.
2. Notable exceptions include Blažek (2016) and Blažek et al. (2020).
3. Obviously within-category upgrading is pertinent not only in the semi-periphery but in each category: both in core economies and in the integrated periphery.
4. 1) 'On the way to net zero mobility', workshop organised by the European Trade Union Institute, in April, 2022, in Brussels; 2) 'Just transition: Where is the European car industry heading?', final conference of the 'Just transition' project supported by the European Climate Initiative, in May, 2022, in Brussels; 3) 'The Need for Transformation: the European Automotive Industry', workshop organised by the Rosa Luxemburg Foundation, in May, 2022, in Milano.
5. Relatedly, the scarcity of adequately qualified frontline workers and engineers was recurrently mentioned both by the Hungarian and the Austrian interviewees. Expert H–12 pointed out that the key problem was the relatively low performance of employees in support functions (technicians, maintenance workers). Quality differences in this specific field can be traced back to the low performance of the Hungarian upper-secondary level vocational education. Around half of the Hungarian interviewees mentioned the prohibitive degree of employee churn, which exacerbates the shortage of frontline workers. Moreover, corporate investment in in-house training is a waste of resources in the wake of a high employee churn.
6. For example, the two Austrian companies in our sample have filed 57 and 220 patent applications respectively.
7. According to the snapshot data published by Visualcapitalist.com, in 2021, Hungary hosted the third and Poland the fourth largest lithium-ion battery manufacturing capacity in the world: 28 GWh and 22 GWh respectively, trailing only China and the U.S. https://www.visualcapitalist.com/mapped-ev-battery-manufacturing-capacity-by-region/.
8. Note that in accordance with the general principles of the EU industrial policy, there are no dedicated automotive policy programmes in Hungary: policy supports digital transformation, sustainability, human resources development, R&D and innovation, and investments in capacity expansion and technological upgrading. Nevertheless, politicians announcing the completion of subsidized automotive investments rarely fail to emphasize the importance of this industry for the Hungarian economy.
9. Obviously, existing automotive investors' investments in capacity expansion and upgrading also receives generous public support.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

Research for this paper was supported by the Hungarian Research Fund NKFIH (project no. 132442).

References

ABA. (2021). *Mobility and automotive: Research and Invest in Austria*. Retrieved July 6, 2022, from www.investinaustria.at

Arora, A., Fosfuri, A., & Gambardella, A. (2001). *Markets for technology: The economics of innovation and corporate strategy*. The MIT Press.

Baldwin, R. (2013). Global supply chains: Why they emerged, why they matter, and where they are going. In D. K. Elms & P. Low (Eds.), *Global value chains in a changing world* (pp. 13–60). Fung Global Institute, Nanyang Technology University and WTO.

Baumgartinger-Seiringer, S., Fuenfschilling, L., Miörner, J., & Trippl, M. (2022). Reconsidering regional structural conditions for industrial renewal. *Regional studies*, *56*(4), 579–591. https://doi.org/10.1080/00343404.2021.1984419

Blažek, J. (2016). Towards a typology of repositioning strategies of GVC/GPN suppliers: The case of functional upgrading and downgrading. *Journal of Economic Geography*, *16*(4), 849–869. https://doi.org/10.1093/jeg/lbv044

Blažek, J., Květoň, V., Baumgartinger-Seiringer, S., & Trippl, M. (2020). The dark side of regional industrial path development: Towards a typology of trajectories of decline. *European Planning Studies*, *28*(8), 1455–1473. https://doi.org/10.1080/09654313.2019.1685466

Bogner, A., Littig, B., & Menz, W. (Eds.). (2009). *Interviewing experts*. Palgrave Macmillan.

Brunello, G., & Wruuck, P. (2021). Skill shortages and skill mismatch: A review of the literature. *Journal of Economic Surveys*, *35*(4), 1145–1167. https://doi.org/10.1111/joes.12424

Cetin, R., & Ackrill, R. (2018). Exports, imports, growth and causality: A study of Slovakia. *Post-Communist Economies*, *30*(3), 395–404. https://doi.org/10.1080/14631377.2018.1442038

Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business Press.

Cieślik, E., Biegańska, J., & Środa-Murawska, S. (2016). The intensification of foreign trade in post-socialist countries and their role in global value chains. *Acta Oeconomica*, *66*(3), 465–487. https://doi.org/10.1556/032.2016.66.3.5

Drahokoupil, J. (2020). Introduction. In J. Drahokoupil (Ed.), *The challenge of digital transformation in the automotive industry: Jobs, upgrading, and the prospects for development* (pp. 7–22). European Trade Union Institute.

Ferràs-Hernández, X., Tarrats-Pons, E., & Arimany-Serrat, N. (2017). Disruption in the automotive industry: A Cambrian moment. *Business Horizons*, *60*(6), 855–863. https://doi.org/10.1016/j.bushor.2017.07.011

Gáspár, T., Sass, M., & Vlčková, J. (2022). Automotive GVCs in Czechia and Hungary – a comparative analysis. In: S. Saroch (Ed.) *ICAI 2022: Proceedings of the 2nd International Conference on Automotive Industry 2022*. Mlada Boleslav, Czechia: Mladá Boleslav, Škoda Auto University. 59–69.

Guzik, R., Domański, B., & Gwosdz, K. (2020). Automotive industry dynamics in Central Europe. In A. V. Covarrubias & S. M. R. Perez (Eds.), *New frontiers of the Automobile Industry* (pp. 377–397). Palgrave Macmillan.

Guzi, M., & Landesmann, M. (2022). Labour market developments before, during and after two crises. In L. Mátyás (Ed.), *Emerging market economies after the pandemic. Stuck in the middle income trap?* (pp. 155–199). Springer.

Gwosdz, K., Micek, G., Kocaj, A., Sobala-Gwosdz, A., & Świgost-Kapocsi, A. (2020). Industry 4.0 and the prospects for domestic automotive suppliers in Poland. In J. Drahokoupil (Ed.), *The challenge of digital transformation in the Automotive Industry: Jobs, Upgrading, and the prospects for development* (pp. 89–105). European Trade Union Institute.

Hafner, A., & Modic, D. (2020). European automotive technological innovation systems in the age of disruption: The suppliers' view. *Research in Social Change*, *12*(3), 53–77. https://doi.org/10.2478/rsc-2020-0014

Helper, S., Martins, R., & Seamans, R. (2019). *Who profits from industry 4.0? Theory and evidence from the automotive industry. NYU stern school of business*. http://faculty.weatherhead.case.edu/susan-helper/papers/helper_martins_seamans.pdf

Jacobs, A. J. (2019). *The automotive industry and European integration: The divergent paths of Belgium and Spain*. Palgrave Macmillan.

Kendall, M. (2021). *78 top automotive start-ups and companies in Austria*. https://beststartup.eu/78-top-automotive-startups-and-companies-in-austria-2021/

Kenney, M., & Zysman, J. (2020). The platform economy: Restructuring the space of capitalist accumulation. *Cambridge Journal of Regions, Economy and Society*, *13*(1), 55–76. https://doi.org/10.1093/cjres/rsaa001

Koza, R. (2021). *Das Autoland Österreich*. Retrived June 13, 2022, from https://www.fahrzeugindustrie.at/zahlen-fakten/wirtschaftsfaktor-automobil/

Krpec, O., & Hodulák, V. (2019). The Czech economy as an integrated periphery: The case of dependency on Germany. *Journal of Post Keynesian Economics*, *42*(1), 59–89. https://doi.org/10.1080/01603477.2018.1431792

Krzywdzinski, M. (2017). Automation, skill requirements and labour-use strategies: High-wage and low-wage approaches to high-tech manufacturing in the automotive industry. *New Technology, Work and Employment*, *32*(3), 247–267. https://doi.org/10.1111/ntwe.12100

Krzywdzinski, M. (2018). Die Rolle von Niedriglohnperipherien in den globalen Wertschöpfungsketten der Automobilindustrie: Der Fall Mittelosteuropas. *PROKLA: Zeitschrift für Kritische Sozialwissenschaft*, *48*(193), 523–544. https://doi.org/10.32387/prokla.v48i193.1144

Krzywdzinski, M., Lechowski, G., & Jürgens, U. (2018). La inevitable evolución de los modelos productivos entre los fabricantes de automóviles de China y de India. *La nouvelle revue du travail*, *12*(12), 1–19. https://doi.org/10.4000/nrt.3653

Lampón, J. F., De la Fuente, M. R., & Fraiz-Brea, J. A. (2022). The dilemma of domestic suppliers on the periphery of the automotive industry global value chain. *Kybernetes*, *51*(12), 3637–3655. https://doi.org/10.1108/K-01-2021-0073

Lampón, J. F., Lago-peñas, S., & Cabanelas, P. (2016). Can the periphery achieve core? The case of the automobile components industry in S pain. *Papers in Regional Science*, *95*(3), 595–612. https://doi.org/10.1111/pirs.12146

Lis, A., & Szymanowski, R. (2022). Greening Polish transportation? Untangling the nexus between electric mobility and a carbon-based regime. *Energy Research & Social Science*, *83*, 102336. https://doi.org/10.1016/j.erss.2021.102336

Lung, Y. (2004). The changing geography of the European automobile system. *International Journal of Automotive Technology and Management*, *4*(2–3), 137–165. https://doi.org/10.1504/IJATM.2004.005324

Markiewicz, O. (2020). Stuck in second gear? EU integration and the evolution of Poland's automotive industry. *Review of International Political Economy*, *27*(5), 1147–1169. https://doi.org/10.1080/09692290.2019.1681019

Micek, G., Guzik, R., Gwosdz, K., & Domański, B. (2021). Newcomers from the periphery: The international expansion of polish automotive companies. *Energies*, *14*(9), 2617. https://doi.org/10.3390/en14092617

Molnár, E., Kozma, G., Mészáros, M., & Kiss, É. (2020). Upgrading and the geography of the Hungarian automotive industry in the context of the fourth industrial revolution. *Hungarian Geographical Bulletin*, *69*(2), 137–155. https://doi.org/10.15201/hungeobull.69.2.4

Mordue, G., & Sener, E. (2022). Upgrading in the automotive periphery: Turkey's battery electric vehicle maker togg. *Development and Change*, *53*(4), 760–795. https://doi.org/10.1111/dech.12713

Mordue, G., & Sweeney, B. (2020). Neither core nor periphery: The search for competitive advantage in the automotive semi-periphery. *Growth and Change*, *51*(1), 34–57. https://doi.org/10.1111/grow.12354

NFSZ. (2021). *Összefoglaló a munkaerő-kölcsönzők 2020 évi. tevékenységéről. Nemzeti Foglalkoztatási Szolgálat, Innovációs és Technológiai Minisztérium*. Retrived July 8, 2022, from https://nfsz.munka.hu/nfsz/document/1/8/6/9/doc_url/Osszefoglalo_kolcsonzok_2020_evrol.pdf

North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.

Nyiri, P., de Graaff, N., McCaleb, A., Szunomár, Á., Verver, M., & Ybema, S. (2022). 'Truly a European company': A Chinese auto maker's strategies of Europeanisation. *Asia Pacific Business Review*, 1–22. https://doi.org/10.1080/13602381.2022.2093535

Pardi, T. (2021). Prospects and contradictions of the electrification of the European automotive industry: The role of European Union policy. *International Journal of Automotive Technology and Management*, *21*(3), 162–179. https://doi.org/10.1504/IJATM.2021.116620

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Sage.

Pavlínek, P. (2016). Whose success? The state–foreign capital nexus and the development of the automotive industry in Slovakia. *European urban and regional studies*, *23*(4), 571–593. https://doi.org/10.1177/0969776414557965

Pavlínek, P. (2017). *Dependent growth: Foreign investment and the development of the automotive industry in East-Central Europe*. Springer.

Pavlínek, P. (2018). Global production networks, foreign direct investment, and supplier linkages in the integrated peripheries of the automotive industry. *Economic Geography*, *94*(2), 141–165. https://doi.org/10.1080/00130095.2017.1393313

Pavlínek, P. (2020). Restructuring and internationalization of the European automotive industry. *Journal of Economic Geography*, *20*(2), 509–541. https://doi.org/10.1093/jeg/lby070

Pavlínek, P. (2022). Relative positions of countries in the core-periphery structure of the European automotive industry. *European urban and regional studies*, *29*(1), 59–84. https://doi.org/10.1177/09697764211021882

Pichler, M., Krenmayr, N., Schneider, E., & Brand, U. (2021). EU industrial policy: Between modernization and transformation of the automotive industry. *Environmental Innovation and Societal Transitions*, *38*, 140–152. https://doi.org/10.1016/j.eist.2020.12.002

Placek, M. (2022). *Share of the global lithium-ion battery manufacturing capacity with a forecast for 2025 by country*. https://www.statista.com/statistics/1249871/share-of-the-global-lithium-ion-battery-manufacturing-capacity-by-country/

Russell, M. G., & Smorodinskaya, N. V. (2018). Leveraging complexity for ecosystemic innovation. *Technological Forecasting and Social Change*, *136*, 114–131. https://doi.org/10.1016/j.techfore.2017.11.024

Sass, M., & Szalavetz, A. (2013). Crisis and upgrading: The case of the Hungarian automotive and electronics sectors. *Europe-Asia studies*, *65*(3), 489–507. https://doi.org/10.1080/09668136.2013.779463

Sass, M., & Szalavetz, A. (2014). R&D-based integration and upgrading in Hungary. *Acta Oeconomica*, *64*(Supplement–1), 153–180. https://doi.org/10.1556/aoecon.64.2014.s1.6

Schneider, H., Demirol, D., Fuchsreiter, K., & Luptáčik, P. (2021). Internationalisierung der Automotiven Zulieferindustrie Österreich. *Eine vielschichtige und global vernetzte Branche zwischen Herausforderungen und Wandel*. Retrived June 30, 2022, from https://www.go-international.at/export-know-how/strategieprojekte-und-studien/internationalisierung-automotive-zulieferindustrie.pdf

Schneider, H., Luptáčik, P., Haas, R., Popko, J., & Demirol, D. (2018). *Die Automotive Zulieferindustrie Österreichs Im Internationalen Wettstreit: Strukturstudie*. Retrived June 30, 2022, from https://www.metalltechnischeindustrie.at/fileadmin/content/Dokumente/Branchenbetreuung/ARGE_Automotive_Zulieferindustrie/Publikationen/Strukturstudie_Automotive_Zulieferindustrie_2018.pdf

Sebastian, G. (2021). In the driver's seat: China's electric vehicle makers target Europe. *MERICS*, Retrived May 31, 2022, from https://merics.org/sites/default/files/2021-08/MericsChinaMonitorAutomotiveindustry%2071_final.pdf

Simonazzi, A., Sanginés, J. C., & Russo, M. (2020). The future of the automotive industry: Dangerous challenges or new life for a saturated market? *Institute for New Economic Thinking Working Papers*, No. 141.

Skala, A. (2022). Sustainable transport and mobility—Oriented innovative startups and business models. *Sustainability*, *14*(9), 5519. https://doi.org/10.3390/su14095519

Sturgeon, T., Van Biesebroeck, J., & Gereffi, G. (2008). Value chains, networks and clusters: Reframing the global automotive industry. *Journal of Economic Geography*, *8*(3), 297–321. https://doi.org/10.1093/jeg/lbn007

Sweeney, B., Mordue, G., & Carey, J. (2020). Resilient or resistant? Critical reflections on resilience in an old industrial region. *Geoforum*, *110*, 125–135. https://doi.org/10.1016/j.geoforum.2020.02.005

Szalavetz, A. (2012). The Hungarian automotive sector: A comparative CEE perspective with special emphasis on structural change. In P. J. Welfens (Ed.), *Clusters in automotive and information & communication technology* (pp. 241–270). Springer.

Szalavetz, A. (2019a). Artificial intelligence-based development strategy in dependent market economies–any room amidst big power rivalry? *Central European Business Review*, *8*(4), 40–54. https://doi.org/10.18267/j.cebr.219

Szalavetz, A. (2019b). Industry 4.0 and capability development in manufacturing subsidiaries. *Technological Forecasting and Social Change*, *145*, 384–395. https://doi.org/10.1016/j.techfore.2018.06.027

Szalavetz, A. (2020a). Digital transformation and local manufacturing subsidiaries in central and eastern Europe: Changing prospects for upgrading? In J. Drahokoupil (Ed.), *The challenge of digital transformation in the automotive industry: Jobs, Upgrading, and the prospects for development* (pp. 47–64). European Trade Union Institute.

Szalavetz, A. (2020b). Digital transformation–enabling factory economy actors' entrepreneurial integration in global value chains? *Post-Communist Economies*, *32*(6), 771–792. https://doi.org/10.1080/14631377.2020.1722588

Szalavetz, A. (2022a). Digital technologies shaping the nature and routine intensity of shopfloor work. *Competition & Change*, *Competition and Change*, 102452942211074. https://doi.org/10.1177/10245294221107489

Szalavetz, A. (2022b). The digitalisation of manufacturing and blurring industry boundaries. *CIRP Journal of Manufacturing Science and Technology*, *37*, 332–343. https://doi.org/10.1016/j.cirpj.2022.02.015

Szalavetz, A. (2022c). Transition to electric vehicles in Hungary: A devastating crisis or business as usual? *Technological Forecasting and Social Change*, *184*, 122029. https://doi.org/10.1016/j.techfore.2022.122029

Szanyi, M. (2012). Industrial clusters: Concepts and empirical evidence from East-Central Europe. In P. J. J. Welfens (Ed.), *Clusters in Automotive and Information & Communication Technology* (pp. 87–112). Springer.

Szent-Iványi, B. (Ed.). (2017). *Foreign direct investment in central and Eastern Europe*. Palgrave Macmillan.

Trippl, M., Baumgartinger-Seiringer, S., Goracinova, E., & Wolfe, D. A. (2021). Automotive regions in transition: Preparing for connected and automated vehicles. *Environment and Planning A: Economy and Space*, *53*(5), 1158–1179. https://doi.org/10.1177/0308518X20987233

Welch, C., Piekkari, R., Plakoyiannaki, E., & Paavilainen-Mäntymäki, E. (2011). Theorising from case studies: Towards a pluralist future for international business research. *Journal of International Business Studies*, *42*(5), 740–762. https://doi.org/10.1057/jibs.2010.55

West, J., & Bogers, M. (2014). Leveraging external sources of innovation: A review of research on open innovation. *Journal of Product Innovation Management*, *31*(4), 814–831. https://doi.org/10.1111/jpim.12125

Winter, J. (2010). Upgrading of TNC subsidiaries: The case of the Polish automotive industry. *International Journal of Automotive Technology and Management*, *10*(2–3), 145–160. https://doi.org/10.1504/IJATM.2010.032621

Zeschky, M., Daiber, M., Widenmayer, B., & Gassmann, O. (2014). Coordination in global R&D organizations: An examination of the role of subsidiary mandate and modular product architectures in dispersed R&D organizations. *Technovation*, *34*(10), 594–604. https://doi.org/10.1016/j.technovation.2014.06.001

Zheng, Q., Noorderhaven, N., & Du, J. (2022). Making the unlikely marriage work: The integration process of Chinese strategic asset-seeking acquisitions. *Journal of World Business*, *57*(3), 101305. https://doi.org/10.1016/j.jwb.2021.101305