

Contribución de la
industria automotriz a
la economía doméstica
desde el punto de vista
centro-periferia*

/ Contribution of the
Automotive Industry to
the Domestic Economy,
From a Center-Periphery
Point of View

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RESUMEN

Esta investigación estudia la contribución de la industria automotriz a las economías nacionales desde el punto de vista del desarrollo regional. Asimismo, busca proporcionar una visión general de cómo la posición centro-periferia y la ubicación en la cadena global del suministro automotriz afectan el papel económico de la industria, así como las actividades relacionadas con el automóvil. Por lo tanto, este documento examina el centro (Alemania, Francia e Italia) y los países semi-periféricos (España, Portugal, República Checa, Hungría, Polonia, Rumania y Eslovaquia) en Europa comparando los resultados con las conclusiones anteriores. El objetivo de este estudio es comparar el efecto indirecto de la industria automotriz entre los países centrales y periféricos para investigar si los países periféricos también están rezagados en esta área. Por lo tanto, la columna vertebral del estudio es la creación de un marco estadístico que pueda ser utilizado para medir los efectos automotrices colaterales en los países examinados..

PALABRAS CLAVE

Industria automotriz, actividades relacionadas con la automoción, efectos indirectos, Europa meridional, Europa central y oriental

ABSTRACT

The paper investigates the contribution of the automotive industry to the domestic economy from the point of view of regional development. This research seeks to provide an overview of how the center-peripheral location structure and the position of the global automotive supply chain affect the economic role of the industry, as well as automotive-related activities.

Therefore, this paper examines the core (Germany, France and Italy) and the semi-peripheral countries (Spain, Portugal, Czech Republic, Hungary, Poland, Romania and Slovakia) in Europe comparing the results to previous outcomes.

The aim of the study is to compare the automotive industry's spillover effect between core and peripheral countries in order to investigate whether peripheral countries are lagging behind in this area. Therefore, the backbone of the study is the creation of a usable statistical framework to measure automotive spillovers in the countries examined.

KEYWORDS

Automotive industry, automotive related activities, spillovers, Southern Europe, Central and Eastern Europe

**Investigador del Institute of World Economics, Centre for Economic and Regional Studies, Hungarian Academy of Sciences, Budapest, Hungría. (tury.gabor@krtk.mta.hu). <https://orcid.org/0000-0002-9339-1586>

1. Different interpretations of the automotive industry /
2. Contribution of the automotive industry to the economy in the context of the European core-periphery relationship /
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1. DIFFERENT INTERPRETATIONS OF THE AUTOMOTIVE INDUSTRY¹

For measuring the contribution of the automotive industry to the economy, there are generally two kinds of approaches. On the one hand, the activity-based interpretations use economic activity classification. Among others there are the Statistical Classification of Economic Activities in the European Community (NACE), the Standard industrial classification (SIC) introduced for U.S. government agencies and the Harmonized System (HS) developed by the World Customs Organization. On the other hand, for measuring its global embeddedness by analyzing its foreign trade, there are product-based approaches using the Standard International Trade Classification (SITC) or Combined Nomenclature (CN).

To give a holistic picture about the automotive-related activities, the paper first reviews the previous activity-based approaches; then makes an analysis based on its own NACE database. The backbone of the study is the creation of a statistical framework based on these previous researches. Therefore, in the introductory part of the paper, I devote more space to the different interpretations. Based on the literature, there are several approaches regarding automotive-related activities (i.e. production and service activities also belong to the automotive industry). Based on the vertical integration of the production, the supply chain involves many other activities that sell their products to other industries as well. The most commonly used nomenclatures are the NACE Rev 1.1 Division 34 or later the NACE Rev. 2 Division 29², or in the SIC 371 in terms of analyses to U.S. automotive industry³, where

¹ The study was prepared in the research supported by the National Research, Development and Innovation Office, project no. K 115578, title: "Factors influencing export performance – a comparison of three European regions"

² see Heneric, Oliver, Licht, Georg and Sofka, Wolfgang, (eds.), "Europe's Automotive Industry on the Move: Competitiveness in a Changing World", Heidelberg, *Physica-Verlag*, 2005.; Sturgeon, Timothy J. and Memedovic, Olga, "Mapping Global Value Chains: Intermediate Goods Trade and Structural Change in the World Economy", Vienna, *UNIDO, Working Paper* 05/2010, 2011.; Hanzl-Weiss, Doris and Stehrer, Robert, "Cars »Made in Europe«", *Croatian Economic Survey*: volume 16, number 1, 2014, pp. 49-74.

³ Fulton, George A., Grimes, Donald R., Schmidt, Lucie G., McAlinden, Sean P., Richardson and Barbara C., "Contribution of the Automotive Industry to the U.S. Economy in 1998: The Nation and Its Fifty States", Ann Arbor, MI, The University of Michigan Institute for Labor and Industrial Relations, *The*

the activities include manufacturing of passenger and truck bodies as well as parts and accessories related to the vehicle production.

In the case of employment and foreign direct investment, Pavlínek⁴ defined broadly the automotive industry. He added NACE Rev. 2 Division 30 to the common used Division 29. Schulten and Müller⁵ similarly combines the two activities in its analysis. The authors broaden the scope of the investigated activities: namely the manufacture of other transport equipment contains ships and boats, railway locomotives and rolling stocks, air and spacecraft and related machineries and furthermore military fighting vehicles as well. Lengyel⁶ also uses a broader view, he takes into consideration eight NACE Rev. 1.1 divisions.⁷ Eurostat gives a much broader/complex definition (Table 1) of the automotive industry adding some related activities. In addition to the NACE Rev. 2 Division 29, (manufacture of motor vehicles, trailers and semi-trailers) Eurostat⁸ listed 12 other activities (Table 1) connected to the automotive production, enumerating activities from the manufacturing industry to the service sector. The four-digit NACE classes included also other activities not related to automotive production, therefore we found that there are activities with considerable relevance and there are some with hardly any relevance.⁹ Demand for electric lighting for motor vehicles and manufactured goods, for example, represents only a smaller market segment (only about 20 percent).

The technological change in the automotive industry fundamentally transforms the value chain^{10 11}, thus attracting new industries into the pro-

University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation, and the Center for Automotive Research, 2001.

⁴ Pavlínek, Petr, “Dependent Growth: Foreign Investment and the Development of the Automotive Industry in East-Central Europe”, Basel, *Springer International Publishing AG*, 2017.

⁵ Schulten, Thorsten and Müller, Torsten, “Wages and collective bargaining during the European economic crisis - developments in the European manufacturing industry – report for the industriAll”, *European Trade Union collective bargaining and social policy conference*, Vienna, 12-13 June 2014.

⁶ Lengyel, Balázs, “Regional Clustering Tendencies of the Hungarian Automotive and ICT Industries in the First Half of the 2000s” in Welfens, Paul J.J. (ed.), *Clusters in Automotive and Information & Communication Technology*, Berlin, Heidelberg, Springer, 2012. pp 113-134.

⁷ 25.11 (Manufacture of rubber tyres and tubes), 25.12 (Retreading and rebuilding of rubber tyres), 31.61 (Manufacture of electrical equipment for engines and vehicles n.e.c.), 34.10 (Manufacture of motor vehicles), 34.20 (Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers), 34.30 (Manufacture of parts and accessories for motor vehicles and their engines), 35.41 (Manufacture of motorcycles), and the 35.50 (Manufacture of other transport equipment n.e.c.).

⁸ Eurostat, “Statistical classification of economic activities in the European Community”, Luxembourg, *Eurostat Methodologies and Working papers, Office for Official Publications of the European Communities*, 2008, pp. 185-187.

⁹ It shows the problem of statistical counting that for instance NACE 27.40 including residential and non-residential lighting (commercial, industrial and street lighting), represents about 80 percent of all electric lighting product sales (McKinsey & Company 2012).

¹⁰ Klug, Florian, “How electric car manufacturing transforms automotive supply chains.” *In 20th International EurOMA Conference Proceedings*, Dublin, Ireland, 2013.

¹¹ Túry, Gábor, “Consequences of Technological Changes in the Automotive Industry – Perspectives of the Central European Region as part of the Global Value Chains”, *Global Economic Observer*, volume 2, number 6, 2018, pp. 89-94.

duction vertical. For example in the last decade, manufacturing of Li-ion batteries (part of the manufacture of batteries and accumulators: NACE Rev. 2 27.20) has grown more than 10 times¹², giving the 73 percent of the built-in output (MWh) in 2010. The main driver is the growing production of alternative fuel¹³ vehicles.¹⁴ Due to electromobility (replacement of internal combustion engines), rising demand for automotive batteries in OEM (Original Equipment Manufacturer) and aftermarket segments, the role of battery production will increase.

Table 1, A broader interpretation of the automotive-related industries by Eurostat

NACE class	automotive-related activity	strength of relationship/relevance (author's estimations)
22.11	Manufacture of tyres	there are some household consumption products but – considerable relevance: close to 100%
22.19	Manufacture of rubber hoses and belts and other rubber products	most of the products are for household consumption (apparel industry) – weak relevance
27.11	Manufacture of electric motors (except starting motors)	mostly for industrial solutions, there is relevance only in the case of the hybrid and full electric vehicles weak relevance
27.20	Manufacture of batteries for vehicles	lead-acid, advanced lead, NiMH and Li-Ion batteries – partly relevance, 10% of the total sales in 2012
27.40	Manufacture of lighting equipment for motor vehicles	residential and nonresidential lighting represents over 70% of all sales – partly (some 30%) relevance
28.11	Manufacture of pistons, piston rings and carburetors	partly relevance (not quantifiable)
28.13	Manufacture of pumps for motor vehicles and engines	partly relevance (not quantifiable)
28.30	Manufacture of trailers and semitrailers specially designed for use in agriculture	considerable relevance
28.92	Manufacture of off road dumping trucks	considerable relevance

¹² Pillot, Christophe, “The worldwide battery market 2011-2025”. Conference “Batteries 2012” Nice, France. *Avicenne Energy*, October 24-26, 2012.

¹³ hybrid electric vehicles (HEV), plug-in electric vehicles (PHEV) and battery electric vehicles (BEV)

¹⁴ Recharge, „The Batteries Report 2018”, Brussels, *The Advanced Rechargeable & Lithium Batteries Association* 2018, [Query: January 15, 2019]<https://www.rechargebatteries.org/wp-content/uploads/2018/05/RECHARGE-The-Batteries-Report-2018-April-18.pdf>

30.40	Manufacture of tanks and other military fighting vehicles	considerable (100%) relevance
30.99	Manufacture of vehicles drawn by animals: sulkies, donkey-carts, hearses etc.	weak relevance
45.20	Maintenance and repair of motor vehicles	considerable (100%) relevance

Source: author, based on Eurostat 2008

According to other interpretations, these classifications do not cover the whole circle of automotive-related activities. McAlinden and Smith¹⁵ investigated the U.S. automotive parts industry and emphasized that the size and complexity of auto parts manufacturing lead to difficulties in defining the range of the automotive companies (i.e. automotive-related industries). Therefore, their research tried to focus on activities that specialize in the manufacture of products for automotive use as well as other automotive parts and components. Using SIC nomenclature, they specified nine supplier industries related to automotive industry.¹⁶

During the investigation of the U.S. automotive sector, McAlinden and his co-authors¹⁷ and later Chung his co-authors¹⁸ called the attention to some accounting issues. Firstly, among the above mentioned nine supplier industries, there are branches that make nonautomotive products as well. For instance, in the case of the companies producing internal combustion engines (SIC 3519: non-automotive gasoline engines, automotive diesel engines, engine parts), only one third of their output is destined for automotive use. The observation of Chung and his co-authors (2003) also included companies whose primary activity was not the production of vehicle components, but automotive parts or stampings (SIC 3714 or SIC 3465) gave more than 10 percent of their sales. Secondly, in the turnover of the automotive-related companies the aftermarket sales also have an important role. Manufacturers of tires and inner tubes (SIC 3011) sell most of their products “aftermarket”. Therefore, the retail trade sale of the automotive parts comprises a

¹⁵ McAlinden, Sean P. and Smith, Brett C., “The changing structure of the U.S. automotive parts industry”, Ann Arbor, MI, *University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation*, 1993.

¹⁶ SIC 2396 (Automotive and apparel trimmings); SIC 3011 (Tires and inner tubes); SIC 3465 (Automotive stampings); SIC 3519 (Internal combustion engines, nec.); SIC 3592 (Carburetors, pistons, rings and valves); SIC 3691 (Storage batteries); SIC 3694 (Vehicular lighting equipment); SIC 3694 (Engine electrical equipment); SIC 3714 (Motor vehicle parts and accessories)

¹⁷ *ibid*

¹⁸ Chung, Wilbur, Mitchell, Will and Yeung, Bernard, “Foreign direct investment and host country productivity: the American automotive component industry in the 1980s”, *Journal of International Business Studies*, 2003, number 34, pp. 199-218.

significant part of their production. On the other hand, if we take into consideration the SLI¹⁹ battery market, 68 percent of their turnover stemmed from aftermarket sales in 2015.²⁰

In the subsequent analyses of Fulton and his co-authors²¹ a wider interpretation is applied in order to offer a comprehensive picture about the contribution of the automotive industry to the U.S. economy. To estimate the employment and income contributions of the U.S. automotive sector, they consider the spin-off effect of the sector. The spin-off effect includes the expenditure-induced effect in addition to the indirect effect. Therefore, the scope of related activities became quite wide, from the construction, trucking, credit and finance, wholesale trade, retail trade until the other services as well (Table 2). Just to illustrate the difference between SIC 371 – that employed 1.01 million people in 2000 – and the data supplemented by the industry's spin-off effect, 1 direct job in the automotive assembly generates 6.6 additional spin-off jobs i.e. 2.9 further jobs at the supplier industries and further 3.7 expenditure-induced employment²² in general. Hill and her co-authors²³ confirmed this result when they concluded that every direct OEM job adds 6.6 additional jobs (automotive parts sector, selling and servicing new vehicles) therefore close to 7.3 million U.S. jobs were related to the automotive industry in 2015. At the same time, the multiplier effect depends on our definition of automotive industry. For instance, elsewhere in their paper Hill and her co-authors²⁴ refer to a much wider base²⁵ where a 4.7-fold employment multiplier effects was detected. Concerning the Japanese automotive industry, the Japan Automobile Manufacturers Association evinced a 6.5-fold employment effect in 2015.²⁶ The European Automobile Manufacturers' Association (ACEA) measured in Europe a 5.3 difference between direct and total employment.²⁷

¹⁹ SLI means starting, lighting and ignition. These batteries are responsible for powering the starter motor, the lights, and the ignition system of a vehicle's engine. These lead-acid type batteries gives most of sales.

²⁰ Girardi, Filippo, "Market Outlook - Update 2016", *EUROBAT Annual forum Berlin*, 16-17 June 2016, p. 8.

²¹ Fulton, George A., Grimes, Donald R., Schmidt, Lucie G., McAlinden, Sean P. and Richardson, Barbara C., "Contribution of the Automotive Industry to the U.S. Economy in 1998: The Nation and Its Fifty States", Ann Arbor, MI, *The University of Michigan Institute for Labor and Industrial Relations, The University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation, and the Center for Automotive Research*, 2001

²² The expenditure-induced employment or job is those that is a result of direct or indirect employee's spending money in the community.

²³ Hill, Kim, Menk, Debra Maranger and Cregger, Joshua, "Contribution of the Automotive Industry to the Economies of All Fifty States and the United States", Washington, DC, *Center for Automotive Research*, January, 2015, p. 2

²⁴ *Ibid*, p. 29.

²⁵ where 1,553,000 are directly employed from all operations, 2,316,000 intermediates employed and 3,381,000 spin-off employed

²⁶ JAMA, "The motor industry of Japan 2016", Tokyo, *Japan Automobile Manufacturers Association, Inc.*, p. 1.

²⁷ ACEA, "Automobile Industry Pocket Guide 2018-2019", Brussels, *European Automobile Manufacturers' Association*, 2018.

In this context, McAlinden and his co-authors²⁸ applied the holistic approach of the automotive production and handled the *upstream* and *downstream* sides of the industry. They separated the upstream side to commodities (e.g. metal, plastics and rubber) and functions (e.g. heating and cooling, trucking and warehousing).

Therefore, if we want to specify the contribution of the automotive-related industries within the automotive-related activities, first we should take into consideration the structure of the whole automotive supply chain. Their role at the production and after sales period must be distinguished as upstream and downstream activities. Upstream activities of the automotive value system are organized hierarchically where automotive-related companies have linkages with the OEMs. At the downstream level, automotive-related activities are involved in distribution, after sales services and recycling where the linkages are established among the automotive-related industries, traders and consumers (end users).

Table 2, Private nonmanufacturing sectors related to automotive industry

Industry division	SIC Code
Construction	15-17
Trucking	42
Credit and finance	61, 62, 67
Wholesale trade	50-51
Retail trade	52-59
Services	70-89
<i>Business services</i>	73
<i>Professional services</i>	81, 87, 89
<i>Nonprofit services</i>	83, 84, 86

Source: Fulton et al. 2001, p. 38.

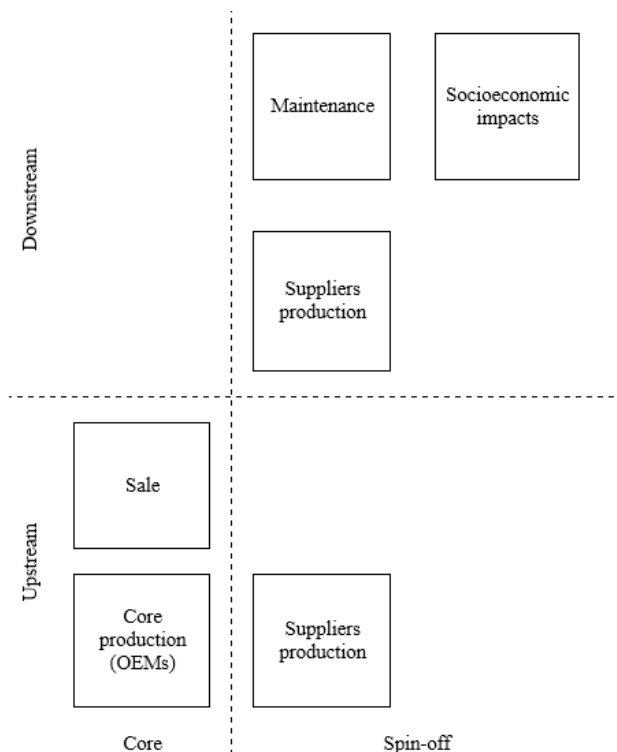
On the other hand, the downstream industries contribute to maintenance and the use of the vehicle. This means that the downstream activities are beyond the commonly used aftermarket approach (Table 2); they are not only related to maintaining, but to using the motor vehicles. Heneric and his co-authors consider the following as downstream activities²⁹: motor vehicle retail enterprises (NACE 50.1); motor vehicle maintenance and repair enterprises (NACE 50.2); the sale of motor vehicle parts and accessories

²⁸ McAlinden, Sean P., Hill, Kim and Swiecki, Bernard, "Economic Contribution of the Automotive Industry to the U.S. Economy – An Update", Ann Arbor, MI, *Center for Automotive Research*, 2003

²⁹ Heneric, Oliver, and Licht, Georg and Sofka, Wolfgang, (eds.), "Europe's Automotive Industry on the Move: Competitiveness in a Changing World", Heidelberg, *Physica-Verlag*, 2005., p. 160.

enterprises (NACE 50.3); the sale of motor bikes, motor bike maintenance and accessories enterprises (NACE 50.4) and the retail sale of automotive fuel (NACE 50.5).

Figure 1, The spin-off contributors of the automotive production



Source: author, based on McAlinden et al. 2003

In order to estimate the total spin-off effects of the industry McAlinden and his co-authors³⁰, expanded the impacts of the industry. They separated downstream economic contributions provided by support activities maintaining the motor vehicles, and the socioeconomic contributions resulting from the employment opportunities that make integral use of a road vehicle. The downstream industries employed 3.2 million people in 2000, among others used vehicle dealers, automotive repairmen, car washers, gasoline traders, oil and gas field manufacturers, highway and street construction workers or automotive recyclers. On the other hand, the so called socioeconomic impact of the downstream industries is related to the public’s sense of personal freedom i.e. the mobility in space. The socioeconomic impacts affected 3.9

³⁰ McAlinden, Sean P., Hill, Kim and Swiecki, Bernard, “Economic Contribution of the Automotive Industry to the U.S. Economy – An Update”, Ann Arbor, MI, *Center for Automotive Research*, 2003.

million employees working as a taxicab- truck- and bus drivers. According to McAlinden and his co-authors³¹ along with the socioeconomic impacts, vehicle related employment represented almost 9.8 percent of U.S. employment in 2001.

Based on the idea of McAlinden and his co-authors³² the automotive industry can be separated as the upstream and downstream side of the following automotive-related activities (Figure 1). Concerning the employment figures, the downstream side exceeds the upstream side. In addition, taking into consideration the value added along the supply chain³³, the “smile curve” both has a high added value on the upstream and downstream site.

2. CONTRIBUTION OF THE AUTOMOTIVE INDUSTRY TO THE ECONOMY IN THE CONTEXT OF THE EUROPEAN CORE-PERIPHERY RELATIONSHIP

The automotive industry is a key branch for Europe’s prosperity. The sector employed 13.3 million people (manufacturing, service and construction) in 2016 and accounted for 6.1 percent of the EU’s total employment.³⁴ Regarding direct automotive manufacturing employment, Czech Republic has the leading position where 3.22 percent of the active population works in the sector. Slovakia ranks the second (2.6 %), Germany the third (2.04 %), Hungary the fourth (2.04 %) and Romania the fifth (2.0 %). Poland (1.10 %) and France (0.75 %) are close to the EU 28 average (1.05 %), while Portugal (0.68 %) and Spain (0.67 %) are not far below the average. The sector has a significant foreign trade surplus of 90.3 billion euros, exports are nearly three times higher than imports.

The importance of the automotive industry is also outstanding in other countries’ economic indicators. According to the data of the Slovak Automotive Industry Association (ZAP), in 2017 the Slovak automotive industry accounted for 12 percent of the country’s GDP, 44 percent in industrial production and 35 percent in the industrial export.³⁵ The contribution of the vehicle industry to the Hungarian economy is outstanding, accounting for nearly ten per cent of GDP, and 25 per cent of the exports came from the

³¹ Ibid, p. 34.

³² Ibid

³³ Mudambi, Ram, “Location, Control and Innovation in Knowledge-Intensive Industries”, *Journal of Economic Geography*, volume 8, number 5, 2008, pp. 699-725., p. 712.

³⁴ ACEA, “Automobile Industry Pocket Guide 2018-2019”, Brussels, *European Automobile Manufacturers’ Association*, 2018., p. 10.

³⁵ The Slovak Spectator, “Suppliers are an integral part of the automotive industry in Slovakia 2019” <https://spectator.smc.sk/c/22026152/suppliers-are-an-integral-part-of-the-automotive-industry-in-slovakia.html>

sector in 2017.³⁶ The Spanish automotive products represent 17.9 percent of total exports, and accounted for 8.6 percent of GDP in 2017.³⁷ The automotive industry has an outstanding role not only in these small export oriented countries, but in the core countries as well. In Germany the industry has the largest export share, accounting for more than 16 percent of all exports in 2017.³⁸ In France the automotive industry is the third largest exporter next to aeronautics and agri-foods, accounting for 10% of total exports in 2017.³⁹

The global pattern of the automotive production as well as the position of the European production in it has been examined by several authors⁴⁰. The analyses highlighted the dependency relationship – so called “supply role” – between advanced and semi-peripheral countries. It draws a center – peripheral pattern within the global automotive industry.

The center-periphery concept was introduced by Wallerstein to model the development of the modern world's economic system. Prior to this, a number of authors examined the issue of development spreading.⁴¹ Paul Krugman interprets territorial concentration as the most important concept of economic geography.⁴² Later he distinguished⁴³ the centripetal factors

³⁶ PricewaterhouseCoopers Magyarország, “Magyarországi Autóipari Beszállítói Felmérés 2018”, Budapest, *PricewaterhouseCoopers Magyarország Kft.*, 2018.

³⁷ Anfac, “Informe Anual 2017”, Madrid, *Asociación Española de Fabricantes de Automóviles y Camiones*, 2018.

³⁸ Germany Trade & Invest, “The Automotive Industry in Germany”, SSUE 2018/2019, Berlin, *Germany Trade & Invest*, 2018.

³⁹ CCFA, “The French Automotive Industry, Analysis and Highlights 2018”, Paris, *Comité des Constructeurs Français d'automobiles*, 2018.

⁴⁰ see among others: Sturgeon, Timothy J. and Florida, Richard, “Globalization and Jobs in the Automotive Industry”, *MIT IPC Working Paper* 00-012, 2000; Pavlínek, Petr, “Transformation of the Central and East European passenger car industry: selective peripheral integration through foreign direct investment”, *Environment and Planning A*, volume 34, number 9, 2002, pp. 1685-1709.; Humphrey, John and Memedovic, Olga “The global automotive industry value chain: What Prospects for Upgrading by Developing Countries”, Vienna, *United Nations Industrial Development Organization* 2003.; Barta, Györgyi, “Central and Eastern European Automotive Industry in European Context”, in Rechnitzer, János and Smahó, Melinda (eds.), *Vehicle Industry and Competitiveness of Regions in Central and Eastern Europe*, Győr, *Universitas-Győr Nonprofit Kft.*, 2012, pp. 33-70.; Aláez-Aller, Ricardo, Gil-Canaleta, Carlos and Ullibarri-Arce, Miren, “Foreign investment in eastern and southern Europe”, in Galgóczi, Béla and Drahoukupil, Jan and Bernaciak, Magdalena (eds.), *Foreign investment in eastern and southern Europe after 2008. Still a lever of growth?* Brussels, *European Trade Union Institute*, 2015, pp. 139-170.

⁴¹ Perroux, François, „L'effet de domination et les relations économiques”, *Économie appliquée*, volume 40, number 2, 1949, pp. 271-290.; Perroux, François, “Note sur la notion de poles croissant”, *Économie appliquée*, 1-2, 1955, pp. 307-320.; Perroux, François, “The Pole of Development's New Place in a General Theory of Economic Activity”, in Higgins, Benjamin, Savoie, Donald J. (eds.), *Regional Economic Development. Essays in Honour of Francois Perroux*, London: Routledge, 1988.; Myrdal, Gunnar, “Economic Theory and Underdeveloped Regions”, London, *Duckworth*, 1957.; Hirschman, Albert, O., “The Strategy of Economic Development”, New Haven. CONN., *Yale University Press*, 1958.; Boudeville, Jacques, “Les espaces économiques”, *Press Universitaire de France*, Paris, 1961.; Friedmann, John, “Economic policy for development areas”, *Papers and Proceedings of the Regional Science Association*, 11, 1963, pp. 41-61.; Hägerstrand, Torsten, “Innovation Diffusion as a Spatial Process”, *University of Chicago Press*, 1st English ed., 1967.

⁴² Krugman, Paul, “Geography and Trade”, Leuven, Belgium, *Leuven University Press and Cambridge, MA, MIT Press*, 1991.

⁴³ Krugman, Paul, “What's new about economic geography?” *Oxford Review of Economic Policy*, volume 14, number 2, 1998, pp. 7-17.

pointing towards concentration and centrifugal factors pointing towards deconcentration.

Based on the different approaches, maps of the center-periphery relations of Europe can be drawn. Including the most famous Roger Brunet's concept of the 'European Backbone' (known as the 'Blue Banana'), which has drawn the development axis of Europe on the basis of population density in Europe.⁴⁴ Or 'Central European Boomerang' drawn by the potential developing centers based on infrastructure density and innovative urban areas.⁴⁵ These interpretations separate the economically developed core areas of Europe from the semi-peripheral and peripheral areas surrounding it.

According to automotive studies that analyzed the position of the Southern, Central and Eastern European countries (see above), the role of the semi-peripheral countries in the European value chain has been limited to the assembly of vehicles with medium- or low added value. If we look at the ownership structure of road vehicle manufacturing, we come to a similar conclusion: Western European producers have a dominant (sometimes exclusive) share in manufacturing capacity⁴⁶. Regarding the global position of the Southern European and the Central and Eastern European economies, according to Lung⁴⁷ and Pavlínek⁴⁸ the European automotive value chain is characterized by two hierarchical structures. On the one hand, the *assembly-based hierarchy* resulted a centrum-periphery geographical pattern where France and Germany are the core area and the rest of the European countries belong to the peripheral states. The high-end models are assembled in the core countries while mainly the smaller vehicles⁴⁹ are assembled in the periphery like Spain and Portugal and the Central and Eastern European countries. On the other hand, the *function-based hierarchy* means that strategic functions like R&D centers are concentrated in the home countries of the automotive companies and the supplier as well⁵⁰. The assembly functions

⁴⁴ Brunet, Roger, "Les villes européennes: Rapport pour la DATAR", Montpellier, *Reclus*, 1989.

⁴⁵ Gorzelak, Grzegorz, "The Regional Dimension of Transformation in Central Europe", London, *Jessica Kingsley*, 1996.

⁴⁶ van Tulder, Rob and Ruigrok, Winfried, "European Cross-National Production Networks in the Auto Industry: Eastern Europe as the Low End of European Car Complex", Berkeley, CA, *Berkeley Roundtable on the International Economy, Working Paper* 121, 1998. [Query: August 15, 2017] <http://brie.berkeley.edu/publications/WP121.pdf> pp. 19-23.

⁴⁷ Lung, Yannick, (ed.), "Coordinating competencies and knowledge in the European automobile system – CoCKEAS", Luxembourg, *Office for Official Publications of the European Communities*, 2007

⁴⁸ Pavlínek, Petr, "The impact of the 2008–2009 crisis on the automotive industry: global trends and firm-level effects in Central Europe", *European Urban and Regional Studies*, volume 22, number 1, 2015, pp. 20-40.

⁴⁹ In some cases not only small or economy vehicles are assembled in the region. Large SUV vehicles, i.e. Volkswagen Tuareg and Audi Q7 went into production in Volkswagen's Bratislava plant in mid of 2000's.

⁵⁰ see detailed: Sturgeon, Timothy, Van Biesebroeck, Johannes, and Gereffi, Gary, "Value chains, networks and clusters: Reframing the global automotive industry", *Journal of Economic Geography*, volume 8, number 3, 2008, pp. 297-321.

were more widely scattered following the above-mentioned assembly-based hierarchy.

As mentioned earlier, there are different interpretations of the contribution of the automotive industry to the economy. There are studies which tried to measure the significance of the industry by quantifying its contribution to economic growth. They tried to measure the GDP contribution of the passenger car industry. During the research Tirpák and Kariozen⁵¹ observed the backward and forward (or upstream and downstream) linkages within the industry. An input-output calculation carried out by the analysis of data between 2001 and 2005, showed a contribution to GDP between 0.19-0.59 percentage points on average. The broader definition of automotive industry – originally focusing on the employment – of this paper is based on the approach of McAlinden and his co-authors⁵². Although the authors provide a rather detailed analysis of the economic role of the sector, they don't give any detailed statistical classification of the activities related to the manufacturing and the use of the motor vehicles. The reason for this is that in some cases – for instance in the case of employment in automotive-related advertising – statistical data collection is not able to separate the aggregate records. On the other hand, the European nomenclature (NACE) doesn't it go into details about recycling; oil and gas field machinery manufacturing; refinery of the oil products⁵³; or urban and suburban passenger land transport⁵⁴. As we can see from Table 3, because of statistical severability problems, some related activities were not taken into account. Therefore, NACE Rev. 2. 19.2 and 49.31 activities were not included in the database.

⁵¹ Tirpák, Marcel and Kariozen, Agata, "The Automobile Industry in Central Europe", Washington, D.C., *International Monetary Fund, IMF Note*, 2006.

⁵² McAlinden, Sean P., Hill, Kim and Swiecki, Bernard, "Economic Contribution of the Automotive Industry to the U.S. Economy – An Update", Ann Arbor, MI, *Center for Automotive Research*, 2003.

⁵³ There are different values based on different sources. According to the U.S. Energy Information Administration, of the approximately 7.19 billion barrels of total U.S. petroleum consumption in 2016, 48% was motor gasoline (includes ethanol), 20% was distillate fuel (heating oil and diesel fuel), and 8% was jet fuel. (<https://www.eia.gov/tools/faqs/faq.php?id=41&t=6>) The consumption of the road transit accounts for 68% of the total. According to the International Energy Agency (<https://www.iea.org/oil-marketreport/omrpublic/charts/>) the demand for motor gasoline accounted for 31.2%, gasoline, diesel accounted for 28.2% of the total consumption of oil products in April 2017. The sum of these demand was 59.4% which included road transport and rail transport as well.

⁵⁴ According to the Eurostat nomenclature and definition (Eurostat NACE Rev:2), urban and suburban passenger land transport includes different modes of land transport not only road transport. Namely next to land transport with motor bus, such as with tramway, streetcar, trolley bus, underground and elevated railways etc.

Table 3, Contribution of the automotive industry to the economy: activities related to the manufacturing and the use of motor vehicles

Motor vehicle related employment (partly based on SIC) ¹	NACE Rev. 2 (definitions and codes)	
Automotive Manufacturing Related Employment	Automotive Manufacturing Related Activities	
Total Direct Employment + Manufacturing Supplier Employment (SIC 371: the motor vehicle and motor vehicle equipment industry)	Manufacture of motor vehicles, trailers and semi-trailers (C)	29
Non-Manufacturing Supplier Employment	<i>Not specified</i>	-
Manufacturing and Extraction Spinoff Employment	<i>Not specified</i>	-
	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres (C)	22.11
Downstream Employment	Downstream Activities	
New light vehicle automotive retail	Wholesale and retail trade; repair of motor vehicles and motorcycles: This class includes wholesale and retail sale of new and used vehicles (G)	45.1; 45.2; 45.3
Advertising	<i>Not specified</i>	-
Rail	<i>Not specified</i>	-
Jobs related to the use of the motor vehicle:	Activities related to the use of the motor vehicle:	
Used Vehicle dealers (cars and trucks)	Wholesale and retail trade; repair of motor vehicles and motorcycles: This class includes wholesale and retail sale of new and used vehicles (G)	45.1; 45.2; 45.3
Used Vehicle Operations and Off-Warranty Service Employees		
Automotive Repair (body, paint, and general repair)	Rebuilding or remanufacturing of machinery (C)	29.10
Carwashes		
Automotive parts and accessories	Wholesale and retail sale of parts and accessories for motor vehicles (G)	45.3
Tire Dealers		

Gasoline Stations with Convenience Store	Retail sale of automotive fuel (G)	47.30
Other Gasoline Stations		
Oil and Gas Field Machinery manufacturing	<i>Not specified</i>	-
Petroleum Refining	Manufacture of refined petroleum products (C)	19.2 (see footnote 38)
Passenger Car Rentals	Renting and leasing of motor vehicles (renting and leasing of cars and light motor vehicles and trucks as well) (N)	77.1
Automobile Parking	Parking facilities for motor vehicles (Service activities incidental to land transportation also included operation of terminal facilities such as railway stations, bus stations, stations for the handling of goods) (H)	52.21
Highway and street construction workers	Construction of roads and motorways (F)	42.11
Automotive Recycling (scrapyards)	Wholesale of waste and scrap (G)	46.77
Socioeconomic Employment		
Taxicab drivers and chauffeurs	Taxi operation (H); Renting of motor vehicles without driver (N)	49.32; 77.1
Truck drivers	Freight transport by road (H)	49.41
Bus drivers	Urban and suburban passenger land transport (H) Other passenger land transport n.e.c. (H)	49.31 (see footnote 39); 49.39

Source: compilation of the author

This study is using four variables: number of enterprises and number of employees; production value; gross value added per employee. Concerning the availability of data, there are detailed figures about the number of enterprises and the number of employees from almost all countries. In the case of the production value and gross value added per employee, more data are missing. Looking at the variables there are significant differences among the data. The figures show a fairly mixed picture: for some indicators the ratios are different from, for other indicators the values are in line with previous

researches⁵⁵ which emphasize the outstanding importance of the downstream activities within automotive-related activities.

In the case of the distribution of enterprises related to automotive industry (Figure 2) wholesale and retail trade, repair of motor vehicles and motorcycles (G) and the transportation and storage (H), as well as administrative and support service activities (N) have a high representation, exceeding the automotive manufacturing activities and the construction sector (F4211) in all examined countries. The latter two activities represent only 1.4-2.8 percent of all automotive-related activities, which shows a strong labor concentration in these activities. Looking at the average number of the employees by large activities (C, F, G, H+N) especially the sum of C2211⁵⁶ and C29⁵⁷ have high figures. These companies employ 10-40 times more people (50-340 employed) than the average. Concerning the companies that are involved in G, H and N activities, there are no significant differences among the countries. Only one characteristic of the Central and Eastern European countries can be mentioned, which may be a *consequence of the center-peripheral location*. The H and N activities have a greater share than wholesale and retail trade (G) compared to the core countries. This can be linked to the size of demand that is much lower in the semi-peripheral EU countries than in the countries that belong to the center.⁵⁸

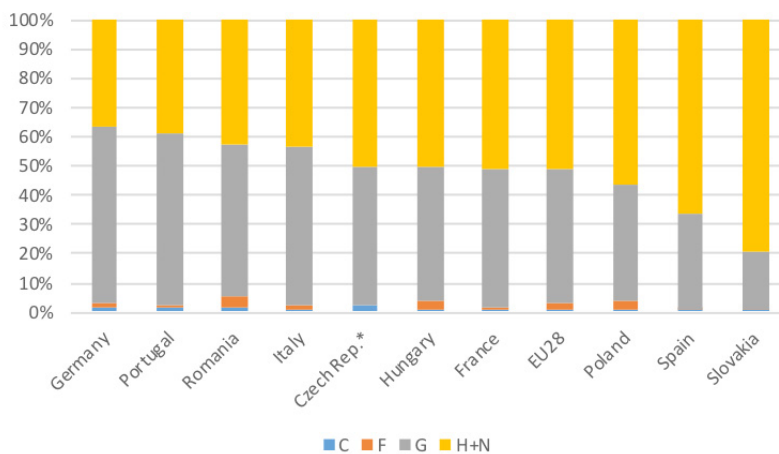
⁵⁵ See: Fulton, George A., Grimes, Donald R., Schmidt, Lucie G., McAlinden, Sean P., Richardson and Barbara C., "Contribution of the Automotive Industry to the U.S. Economy in 1998: The Nation and Its Fifty States", Ann Arbor, MI, *The University of Michigan Institute for Labor and Industrial Relations, The University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation, and the Center for Automotive Research*, 2001.; McAlinden, Sean P., Hill, Kim and Swiecki, Bernard, "Economic Contribution of the Automotive Industry to the U.S. Economy – An Update", Ann Arbor, MI, *Center for Automotive Research*, 2003.

⁵⁶ Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres

⁵⁷ Manufacture of motor vehicles, trailers and semi-trailers

⁵⁸ ACEA, "Automobile Industry Pocket Guide 2018-2019", Brussels, *European Automobile Manufacturers' Association*, 2018., p. 36.

Figure 2, The distribution of the automotive-related enterprises by main sectors as a percent of the total number of activities related to the manufacturing and the use of motor vehicles, 2016



* some data are missing

Note:

C: manufacturing activities related to automotive industry

F: F4211 Construction of roads and motorways

G: wholesale and retail trade, repair of motor vehicles and motorcycles related to automotive industry

H: transportation and storage related to automotive industry

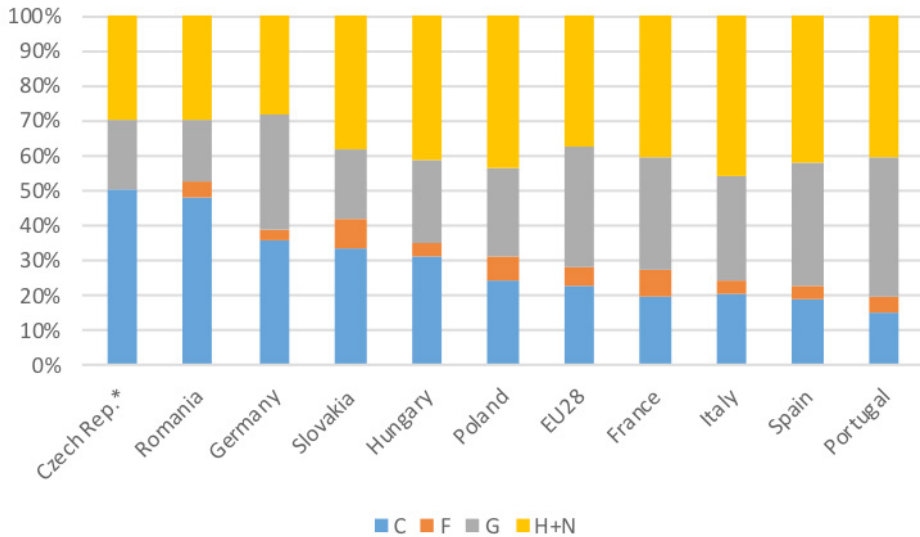
N: administrative and support service activities related to automotive industry

Source: authors' calculations based on Eurostat 2019

In the case of the number of employees, the significance of the aforementioned activities (G, H and N) is no longer so obvious (Figure 3). The employment related to automotive manufacturing (see below table 3) has significant share (between 30 and 50%) in the countries with 'relatively significant' automotive industries. In the Czech Republic, Romania, Slovakia, Germany and Hungary the employment are over 30 percent of the sum of the activities related to manufacturing and use of the motor vehicles.⁵⁹ The EU28 average of the manufacturing activities is 23.1 percent. In Spain and Portugal the wholesale and retail trade, repair of motor vehicles and motorcycles activities show a very high value. Regarding the differences, there are no discrepancies based on regional position, however the importance of the automotive industry and the labor intensive manufacturing operations are reflected in the data.

⁵⁹ For the Czech Republic, due to missing data, the values are unreliable.

Figure 3, The distribution of the automotive-related employees by main sectors as a percent of the total number of activities related to the manufacturing and the use of the motor vehicles, 2016



* some data are missing

Note:

C: manufacturing activities related to automotive industry

F: F4211 Construction of roads and motorways

G: wholesale and retail trade, repair of motor vehicles and motorcycles related to automotive industry

H: transportation and storage related to automotive industry

N: administrative and support service activities related to automotive industry

Source: authors' calculations based on Eurostat 2019

From the point of view of our investigation, the most important factor is the spin-off effect of the automotive manufacturing activities on employment. Firstly, table 4 shows the share of the direct employment (i.e. NACE Rev. 2 C291: Manufacture of motor vehicles and C292: Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers), based on the method of McAlinden and his co-authors⁶⁰, within automotive industry what compare the direct employment and the activities (NACE Rev. 2 C293 Manufacture of parts and accessories for motor vehicles; C2211 Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres) related to automotive manufacturing that include the supplier employment as well. Employment figures show quite large differences among the countries, which can be traced back to the structural differences and

⁶⁰ McAlinden, Sean P., Hill, Kim and Swiecki, Bernard, "Economic Contribution of the Automotive Industry to the U.S. Economy – An Update", Ann Arbor, MI, *Center for Automotive Research*, 2003.

specialties in the industry, as well as in their position within the global value chain.⁶¹ The core countries and Spain have a higher rate in vehicles production while the semi-peripheral countries have a relative higher rate in parts production, despite the intensive assembly growth happening in the last two decades. Secondly, the table also shows the differences regarding the multiplier effect in the last row. With regard to the multiplier effect (last row in the table) on employment, there is no significant difference between the central peripheral countries. A correlation can be found with the proportion of direct employees (correlation value: 0.81), i.e. where the proportion of direct employees is higher, as in Germany, Romania, the Czech Republic and France, the multiplier effect is smaller. If we compare our data to the U.S. or Japanese figures (Table 4), we can see that the direct employment spin-off effect is similar to the countries with relatively low direct employment.

Table 4, Activities related to the manufacturing and the use of motor vehicles in the following sections
Number of employees in 2016

	NACE Rev.2. C				NACE Rev.2. C	NACE Rev.2. F	NACE Rev.2. G	NACE Rev.2. H+N	Total	Direct Employment per (C29+C221) in %	Multiplier effect: Direct Employment vs. Total
	Direct Employment		Manufacturing Supplier Employment								
	NACE Rev.2. C291	NACE Rev.2. C292	NACE Rev.2. C293	NACE Rev.2. C2211							
EU28	1 089 729	157 452	1 228 743	124 539	2 600 463	578 839	3 822 534**	4 244 750	11 246 586	48.0	9.0
Germany	536 468	42 970	273 135	24 774	877 348	85 812	811 553	688 457	2 463 170	66.0	4.3
France	111 268	23 599	78 189	23 840	236 896	91 424	387 204	482 509**	1 198 033	56.9	8.9
Italy	66 590	9 529	83 681	9 903	169 703	33 763	250 414	378 574	832 454	44.9	10.9
Czech Rep.	35 896	3 394	126 875	7 692	173 858	n.a.	68 244*	103 782	345 884	22.6	8.8
Hungary	20 066	3 312	69 412	5 461	98 251	11 242	73 147	128 449**	311 089	23.8	13.3
Poland	31 978	11 506	142 828	11 194	197 506	59 701	208 972	355 141**	821 320	22.0	18.9
Romania	17 153	2 003	154 950	8 708	74 325	7 463	27 253	46 046	155 087	25.8	8.1
Slovakia	18 692	1 592	49 840	4 201	182 814	46 399	111 519	207 562	548 294	11.1	27.0
Portugal	5 329	2 315	25 557	2 420	35 621	12 314	93 690	97 552	239 177	21.5	31.3

⁶¹ see: van Tulder, Rob and Ruijgrok, Winfried, “European Cross-National Production Networks in the Auto Industry: Eastern Europe as the Low End of European Car Complex”, Berkeley, CA, *Berkeley Roundtable on the International Economy, Working Paper* 121, 1998. [Query: August 15, 2017] <http://bric.berkeley.edu/publications/WP121.pdf> pp. 19-23.; Nunnenkamp, Peter, “The German automobile industry and Central Europe’s integration into the international division of labour: Foreign production, intra-industry trade and labour market repercussions”. Madrid, *Universidad Complutense de Madrid, Papeles del Este: Transiciones poscomunistas*, number 9, 2004., p. 6.

Spain	71 544	9 420	72 197	11 228	164 389	35 998	303 236	365 602**	869 225	49.3	10.7
USA***	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	48.0	22.4
Japan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	66.0	25.8

* data on employment are not available for the Czech Republic, therefore no major conclusions can be drawn; ** latest year available; *** in 2001

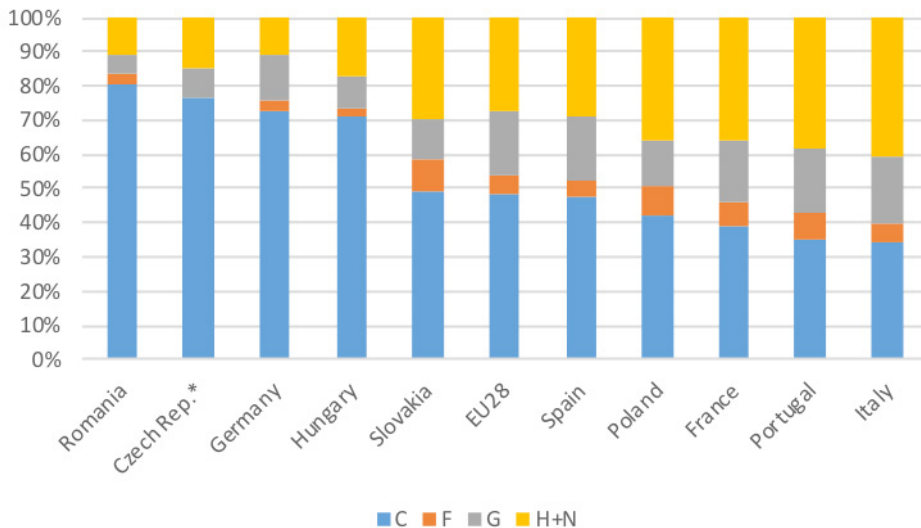
Note: n.a.: not available

NACE Rev. 2 C293 Manufacture of parts and accessories for motor vehicles; C2211 Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres

Source: authors' calculations based on Eurostat 2019; McAlinden et al. 2003; JAMA 2017

Unlike the number of enterprises and employees, in the case of production value (Figure 4) direct automotive manufacturing activities have a high share in almost 50 percent of the countries. Figures of Spain, Poland, France, Portugal and Italy are below the EU28 average. There are three countries: Romania, Hungary and Germany where automotive manufacturing related activities have a very high share because the car industry has a strong position, as we saw, in terms of employment as well. *Similar to the previous figure there are no center-peripheral characteristics.*

Figure 4, Automotive-related activities in the following sections
Production value in 2016, as percent of the
total automotive related activities



* data on production value is not available for the Czech Republic, therefore no major conclusions can be drawn; ** latest year available

Source: authors' calculations based on Eurostat 2019

During the whole analysis, we have not been able to detect the decisive importance of center-peripheral location in any case, except *the value added figures that show the lag of the semi-periphery region, in particular in the new Central and Eastern European EU member states*.⁶² Concerning gross value added per employee (Table 5) almost all core countries' values are above EU28 average figures. For automotive manufacturing activities (i.e. NACE Rev. 2 C activities), the Czech Republic, Hungary and Slovakia have outstanding values just like the Iberian countries, where Spain has above average values. This confirms the previous researches about the role of the semi-peripheral countries in the European value chain, which has been limited to the assembly of vehicles with medium- or low added value. However, a catching-up can be detected in the Southern European countries in other automotive related (spin-off) activities.

Table 5, Automotive-related activities in the following sections
Gross value added per employee (in 2016; ths. euros),
Values in bold letters show figures above the EU average

	Manufacturing (C)	Construction sector (F)	Wholesale and retail trade, repair of motor vehicles and motorcycles (G)	Transportation and storage + Administrative and support service activities (H+N)
European Union 28	85	50	50**	55**
Germany	123	59	57	49
France	85	55	53	73
Italy	77	66	62	72**
Czech Rep.	51	n.a.	30*	26
Hungary	50	18	18	22**
Poland	35	25	24	23
Romania	22	10	17	12
Slovakia	46	26	25	24**
Portugal	44	36	24	38
Spain	72	64	41	64**

* data on gross value added per employee are not available for the Czech Republic, therefore no major conclusions can be drawn; ** latest year available

Source: authors' calculations based on Eurostat 2019

⁶² Barta, Györgyi, "Central and Eastern European Automotive Industry in European Context", in Rechner, János and Smahó, Melinda (eds.), *Vehicle Industry and Competitiveness of Regions in Central and Eastern Europe*, Győr, *Universitas-Győr Nonprofit Kft.*, 2012. pp. 33-70.

3. SUMMARY

The objective of this research was to investigate the contribution of the automotive industry to the domestic economy in a regional development approach. Therefore, the study compiled automotive related activities in order to compare the automotive industry's spillover effect between the core and peripheral countries. Thus, the backbone of the paper is the creation of a usable statistical framework to measure automotive spill-overs. That is the novelty of the research to set up this framework based on the NACE nomenclature which provides an opportunity to examine spin-off effects and compare individual countries all over the world. Based on this statistical framework, we examined the center and the semi-peripheral countries with different indicators and reached the following conclusions.

Firstly, we found that *automotive manufacturing has an outstanding employment multiplier effect* in all countries, which coincides with previous results.

Secondly, there was *no significant difference between the central peripheral countries* with regard to *the number employees, production value and multiplier effect on employment*. As long as there is a high concentration of the direct manufacturers and the construction sector at the distribution of the automotive-related enterprises, the number of the G, H and N automotive related sectors dominated the figures. Employment figures and production value showed quite large differences among the countries, which can be traced back to the structural differences and specialties in the industry, as well as in their position within the global value chain. In the case of the number of employees, activities related to direct automotive manufacturing had significant share in the countries with 'relatively significant' automotive industries (the Czech Republic, Romania, Slovakia, Germany and Hungary). In the case of production value, direct automotive manufacturing activities had a high share in almost half of the countries, but as previous figures showed there are no center-peripheral characteristics.

Thirdly, we could detect the *decisive importance of center-peripheral location* only in the *number of enterprises* and the *value-added figures*. For the former, market demand (economic development), for the latter, the position within the automotive manufacturing. It confirmed the previous researches about the role of the semi-peripheral countries in the European value chain, which has been limited to the assembly of vehicles with medium- or low added value.

As a conclusion, it can be stated that the differences cannot always be explained by the center-peripheral dependency approach, diversion is more dependent on the position of automotive production in the national economy and at the same time within the global automotive value chain.

4. BIBLIOGRAPHY

- ACEA, "Automobile Industry Pocket Guide 2018-2019", Brussels, *European Automobile Manufacturers' Association*, 2018, p. 10.
- Aláez-Aller, Ricardo, Gil-Canaleta, Carlos and Ullibarri-Arce, Miren, "Foreign investment in eastern and southern Europe", in Galgóczi, Béla and Drahokoupil, Jan and Bernaciak, Magdalena (eds.), Foreign investment in eastern and southern Europe after 2008. Still a lever of growth? Brussels, *European Trade Union Institute*, 2015, pp. 139-170.
- Anfac, "Informe Anual 2017", Madrid, *Asociación Española de Fabricantes de Automóviles y Camiones*, 2018.
- Barta, Györgyi, "Central and Eastern European Automotive Industry in European Context", in Rechnitzer, János and Smahó, Melinda (eds.), Vehicle Industry and Competitiveness of Regions in Central and Eastern Europe, Győr, *Universitas-Győr Nonprofit Kft.*, 2012. pp. 33-70.
- Boudeville, Jacques, "Les espaces économiques", *Press Universitaire de France*, Paris, 1961.; Friedmann, John, "Economic policy for development areas", *Papers and Proceedings of the Regional Science Association*, 11, 1963, pp. 41-61.
- Brunet, Roger, "Les villes européennes: Rapport pour la DATAR", Montpellier, *Reclus*, 1989.
- CCFA, "The French Automotive Industry, Analysis and Highlights 2018", Paris, *Comité des Constructeurs Français d'automobiles*, 2018.
- Chung, Wilbur, Mitchell, Will and Yeung, Bernard, "Foreign direct investment and host country productivity: the American automotive component industry in the 1980s", *Journal of International Business Studies*, 2003, number 34, pp. 199-218.
- Eurostat, "Statistical classification of economic activities in the European Community", Luxembourg, *Eurostat Methodologies and Working papers*, Office for Official Publications of the European Communities, 2008, pp. 185-187.
- Fulton, George A., Grimes, Donald R., Schmidt, Lucie G., McAlinden, Sean P. and Richardson, Barbara C., "Contribution of the Automotive Industry to the U.S. Economy in 1998: The Nation and Its Fifty States", Ann Arbor, MI, *The University of Michigan Institute for Labor and Industrial Relations, The University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation, and the Center for Automotive Research*, 2001.
- Germany Trade & Invest, "The Automotive Industry in Germany", SSUE 2018/2019, Berlin, *Germany Trade & Invest*, 2018.
- Girardi, Filippo, "Market Outlook - Update 2016", *EUROBAT Annual forum Berlin*, 16-17 June 2016, p. 8.
- Gorzela, Grzegorz, "The Regional Dimension of Transformation in Central Europe", London, *Jessica Kingsley*, 1996.
- Hägerstrand, Torsten, "Innovation Diffusion as a Spatial Process", *University of Chicago Press*, 1st English ed., 1967.
- Hanzl-Weiss, Doris and Stehrer, Robert, "Cars »Made in Europe«", *Croatian Economic Survey*: volume 16, number 1, 2014, pp. 49-74.
- Heneric, Oliver, Licht, Georg and Sofka, Wolfgang, (eds.), "Europe's Automotive Industry on the Move: Competitiveness in a Changing World", Heidelberg, *Physica-Verlag*, 2005.

- Hill, Kim, Menk, Debra Maranger and Cregger, Joshua, “Contribution of the Automotive Industry to the Economies of All Fifty States and the United States”, Washington, DC, *Center for Automotive Research*, January, 2015, p. 2
- Hirschman, Albert, O., “The Strategy of Economic Development”, New Haven, CONN., *Yale University Press*, 1958.
- Humphrey, John and Memedovic, Olga “The global automotive industry value chain: What Prospects for Upgrading by Developing Countries”, Vienna, *United Nations Industrial Development Organization* 2003.
- International Energy Agency (<https://www.iea.org/oilmarketreport/omrpublic/charts/>)
- JAMA, “The motor industry of Japan 2016”, Tokyo, *Japan Automobile Manufacturers Association, Inc.*, p. 1.
- Klug, Florian, “How electric car manufacturing transforms automotive supply chains.” In *20th International EurOMA Conference Proceedings*, Dublin, Ireland, 2013.
- Krugman, Paul, “Geography and Trade”, Leuven, Belgium, *Leuven University Press and Cambridge, MA, MIT Press*, 1991.
- Krugman, Paul, “What’s new about economic geography?” *Oxford Review of Economic Policy*, volume 14, number 2, 1998, pp. 7-17.
- Lengyel, Balázs, “Regional Clustering Tendencies of the Hungarian Automotive and ICT Industries in the First Half of the 2000s” in Welfens, Paul J.J. (ed.), *Clusters in Automotive and Information & Communication Technology*, Berlin, Heidelberg, Springer, 2012. pp 113-134.
- Lung, Yannick, (ed.), “Coordinating competencies and knowledge in the European automobile system – CoCKEAS”, Luxembourg, *Office for Official Publications of the European Communities*, 2007
- McAlinden, Sean P. and Smith, Brett C., “The changing structure of the U.S. automotive parts industry”, Ann Arbor, MI, *University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation*, 1993.
- McAlinden, Sean P., Hill, Kim and Swiecki, Bernard, “Economic Contribution of the Automotive Industry to the U.S. Economy – An Update”, Ann Arbor, MI, *Center for Automotive Research*, 2003.
- Mudambi, Ram, “Location, Control and Innovation in Knowledge-Intensive Industries”, *Journal of Economic Geography*, volume 8, number 5, 2008, pp. 699-725., p. 712.
- Myrdal, Gunnar, “Economic Theory and Underdeveloped Regions”, London, *Duckworth*, 1957.
- Nunnenkamp, Peter, “The German automobile industry and Central Europe’s integration into the international division of labour: Foreign production, intra-industry trade and labour market repercussions”. Madrid, *Universidad Complutense de Madrid, Papeles del Este: Transiciones poscomunistas*, number 9, 2004, p. 6.
- Pavlínek, Petr, “Dependent Growth: Foreign Investment and the Development of the Automotive Industry in East-Central Europe”, Basel, *Springer International Publishing AG*, 2017.
- Pavlínek, Petr, “The impact of the 2008–2009 crisis on the automotive industry: global trends and firm-level effects in Central Europe”, *European Urban and Regional Studies*, volume 22, number 1, 2015, pp. 20-40.

- Pavlínek, Petr, “Transformation of the Central and East European passenger car industry: selective peripheral integration through foreign direct investment”, *Environment and Planning A*, volume 34, number 9, 2002, pp. 1685-1709.
- Perroux, François, “L’effet de domination et les relations économiques”, *Économie appliquée*, volume 40, number 2, 1949, pp. 271-290.
- Perroux, François, “Note sur la notion de poles croissanc”, *Économie appliquée*, 1-2, 1955, pp. 307-320.;
- Perroux, Francois, “The Pole of Development’s New Place in a General Theory of Economic Activity”, in Higgins, Benjamin, Savoie, Donald J. (eds.), *Regional Economic Development. Essays in Honour of Francois Perroux*, London: *Routledge*, 1988.
- Pillot, Christophe, “The worldwide battery market 2011-2025”. Conference “Batteries 2012” Nice, France. *Avicenne Energy*, October 24-26, 2012.
- PricewaterhouseCoopers Magyarország, “Magyarországi Autóipari Beszállítói Felmérés 2018”, Budapest, *PricewaterhouseCoopers Magyarország Kft*, 2018.
- Recharge, „The Batteries Report 2018”, Brussels, *The Advanced Rechargeable & Lithium Batteries Association* 2018, [Query: January 15, 2019] <https://www.rechargebatteries.org/wp-content/uploads/2018/05/RECHARGE-The-Batteries-Report-2018-April-18.pdf>
- Schulzen, Thorsten and Müller, Torsten, “Wages and collective bargaining during the European economic crisis - developments in the European manufacturing industry – report for the industriAll”, *European Trade Union collective bargaining and social police conference*, Vienna, 12-13 June 2014.
- Sturgeon, Timothy J. and Florida, Richard, “Globalization and Jobs in the Automotive Industry”, *MIT IPC Working Paper* 00-012, 2000.
- Sturgeon, Timothy J. and Memedovic, Olga, “Mapping Global Value Chains: Intermediate Goods Trade and Structural Change in the World Economy”, Vienna, *UNIDO, Working Paper* 05/2010, 2011.
- Sturgeon, Timothy, Van Biesebroeck, Johannes, and Gereffi, Gary, “Value chains, networks and clusters: Reframing the global automotive industry”, *Journal of Economic Geography*, volume 8, number 3, 2008, pp. 297-321.
- The Slovak Spectator, “Suppliers are an integral part of the automotive industry in Slovakia 2019” <https://spectator.sme.sk/c/22026152/suppliers-are-an-integral-part-of-the-automotive-industry-in-slovakia.html>
- Tirpák, Marcel and Kariozen, Agata, “The Automobile Industry in Central Europe”, Washington, D.C., *International Monetary Fund, IMF Note*, 2006.
- van Tulder, Rob and Ruigrok, Winfried, “European Cross-National Production Networks in the Auto Industry: Eastern Europe as the Low End of European Car Complex”, Berkeley, CA, *Berkeley Roundtable on the International Economy, Working Paper* 121, 1998 [Query: August 15, 2017] <http://brie.berkeley.edu/publications/WP121.pdf> pp. 19-23.
- Túry, Gábor, “Consequences of Technological Changes in the Automotive Industry – Perspectives of the Central European Region as part of the Global Value Chains”, *Global Economic Observer*, volume 2, number 6, 2018, pp. 89-94.

