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Industry and its Surroundings – Multiplier Effects and Embeddedness of Companies

Abstract: Research of industrial enterprises concerning their impact on the surroundings through multiplier effects is becoming more and more important due to changes in the organisation of production processes. They mainly result from the increasing technological advancement of products and the need to achieve the expected financial effect, which is possible only through large-scale production. The result of these components is a continuous increase in the specialisation of both companies and individual industrial plants. These processes are reflected in contemporary models of industrialisation, which show that companies operate on the basis of more and more complex value-added chains. This increases the indirect impact of enterprises on the development of the surroundings. The article aims to present the mechanism of functioning of multiplier effects and indicate factors that affect different sizes, as well as the scale of their range. It also presents the evolution of the idea of multiplier effects on the ground of macroeconomics and shows the contribution of Polish researchers to this trend of knowledge. It should be noted that the research to date in this area is not often undertaken both on scientific grounds and in the field of broadly understood economic consulting for the benefit of local government units, which results mainly from the lack of data. The need to obtain detailed data, particularly financial data, within the company chain is a crucial barrier.

Keywords: embeddedness; industry; multiplier effects

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Introduction

Economic effects that are a derivative of the development of existing industrial plants or the location of new production entities are much more significant than the direct effects of these investments. This results from the indirect impact of enterprises on the socio-economic environment. It is particularly important in the case of industrial activity operating on the basis of the lean manufacturing model, which assumes conducting

industrial production through an extensive network of cooperative relations. In such a business model, a substantial part of the effects of the company's impact on its surroundings is indirect.

Therefore, the most significant effects of the impact of new industrial enterprises on the surroundings are, from the point of view of the development of cities and regions, the creation of local and regional networks of business connections. This process is called the cooperation effect because it usually causes the location of cooperating companies in the vicinity of the recipient's factory. In this way, the production plant, creating networks of connections, causes the so-called multiplier effects on the local economy. They are the result of an increase in income in the economic balance of the place where new economic activity has been developed. It results from the cash flow from the producer both to the network of subcontractors (as a result of the supply of products or services) and to the local market through the remuneration of employees.

An essential element may also be the formation of a positive image of the region, in the case of the location of essential enterprises from the point of view of, for example, the labour market or product brand awareness. The increased recognition of the region resulting from the success of recognised corporations leads to the effect of imitation, causing the emergence of new investors. Subsequent investors together with their co-operators, locating their activities in a given area, may trigger feedback the so-called snowball effect consisting of a rapid increase in the attractiveness of a given location for new investments. In this way, places of particular attractiveness for investments develop. A. Markusen (1999) called them 'sticky places' (Dicken, Malmberg, 2001; Cantwell, 2005), while in Polish terminology the term 'viscosity of places for capital functions' is used (Domański, Gwosdz, Sobala-Gwosdz, 2009). As a result, some places can concentrate significant capital expenditures.

As the indirect impact of enterprises on the surroundings is very wide, the present article focuses on the issue of companies' impact on the surroundings resulting from the increase in capital flow in the economy due to new investments, as well as factors embedding companies in local economic structures that translate into different levels of the spatial closure of finance flows.

Multiplier effects – theoretical approach

Establishment or development of economic activities in a given area results in an increase in income in the economic balance of a given place. Increased revenues, in turn, translate into an increase in the number of jobs in other enterprises and institutions. The effect of this is an increase in the wealth of societies, the economy, as well as – through increasing tax revenues – of territorial units (municipalities, cities, regions or countries). This increase is referred to as multiplier effects, and their size allows to assess the impact of the company's activities on the functioning of companies in its surroundings.

By definition, the multiplier effect is understood as a phenomenon consisting in the development of economic activities resulting from an increase in demand, both from consumers and companies (supply) resulting from the location of a new or extension of an already existing enterprise. These effects may also take the negative form in the opposite case – the reduction or liquidation of the previously existing activity.

The multiplier effect as a concept in the field of macroeconomics appeared already in the 1930s (Keynes, 1936). John M. Keynes (1936) noted that the increase in investments by business entities causes a general increase in the level of global demand. Higher demand, on the other hand, results in increased employment, production and employee incomes. Consistently with this process, consumer spending on produced goods increases, causing an increase in sales of enterprises, which, as a result, will again increase their production, which further affects the growth of the necessary amount of labour force and production factors. The very concept of a multiplier, therefore, results from the mathematical procedure of multiplying the size of an investment by a given multiplier to obtain the value of the total impact of a new investment on the economy. The investment multiplier (mi) is, therefore, a coefficient determining how much income (Y) will increase in a state of equilibrium as a result of a new investment (I).

Keynes (1936) considered the phenomenon of multiplier effects on the national scale. Therefore, the sum of the multiplier effect has been reduced to the increase in national income. When calculating the multiplier itself, the critical factor is the share of consumption in public spending. As there are only two possibilities of disposing of income, consumption or savings, part of the additional income that has not been consumed is a saved part. Part of the incremental income that has been saved is called marginal propensity to save (MPS).

In the presented theory, Keynes argued that the higher marginal propensity to consume (MPC), the higher the multiplier effect. It is because the society spends more money, which stimulates the economy, whereas if the savings increase, they do not participate in circulation, which reduces the multiplier effect. The marginal tendency to save affects the magnitude of the multiplier effects inversely.

We can express the investment multiplier formula according to Keynes' concept (1936) by the following equation (Fig. 1):

Fig. 1. Multiplier formula according to Keynes' concept

$$mi = 1/MPS$$

or

$$mi = 1/1 - MPC$$

where:
MPS – marginal prosperity to save,
MPC – marginal prosperity to consume.

Source: J.M. Keynes (1936).

In contrast, the multiplier effect formula has the form (Fig. 2):

Fig. 2. The multiplier effect formula

$$\Delta Y = \Delta I\ (1/MPS)$$

where:
ΔY – national income growth,
ΔI – investment growth,
MPS – marginal prosperity to save.
Source: Keynes (1936)

It should be borne in mind that the average propensity to save (APS) increases with increasing income. Therefore, the increase in income does not translate linearly into a linear increase in multiplier effects.

Since the first model of Keynes (1936), the conceptualisation of multiplier effects based on econometric models has been widely developed. The most important studies in the methodology and estimation of multiplier effects on examples of various regions include, among others: W. Lee Hansen and Ch.M. Tiebout (1963), K. Sasaki (1963), S.J. Weiss and E. Gooding (1968), P. Bourque (1969), C.S. Yan (1969), D.H. Garnick (1970), N.J. Glickman (1971), E.M. Hoover (1971), P. Lloyd and P. Dicken (1972), J.M. Mattila (1973), O.P. Hall and J.A. Licari (1974) and R.L. Drake (1976). Centres of regional econometric analyses have been established, primarily in the United States, such as the Bureau of Economic Analysis and Economic Modeling Specialists, which deal with the estimation of economic effects resulting from multiplier effects not only due to new industrial investments but also as a result of the development of other economic activities. They are based on input-output models, used for the first time in regional analyses by W. Leontief (1936), providing a framework for the predictive model of the multiplier used in these studies.

In studies of the above literature on the subject, we usually encounter three unique types of multiplier effects, indicating the degree of impact of specific types of enterprises in the surroundings. These are the following effects:

- direct,
- indirect,
- induced.

Direct effects are those changes in the local economy to be investigated which are known or anticipated. Indirect effects, on the other hand, constitute economic operations resulting from satisfying the outcomes of direct effects. Induced effects come from local expenditure on goods and services from people working to satisfy both direct and indirect effects. Therefore, the total impact of a given investment is the sum of all the effects – direct, indirect and induced. The results of calculations of multiplier effects can be presented both in the form of calculations of generated additional incomes – income multipliers, as well as jobs – employment multipliers (Hayter, 1997). In both cases, the value of the multiplier received is multiplied by the generated income or jobs in a given activity, and the product is the value of the total income or jobs obtained in the studied region.

In Polish geographic literature, several studies have been recently produced that are derived from the models by K. Gwosdz and K. Wiedermann (2005) in the development of a study edited by B. Domański and K. Gwosdz (2005) on the impact of the Mielec SEZ on its socio-economic environment. Other studies include works on the automotive industry of Śląskie Voivodeship and its impact on the surroundings (Wiedermann, 2006, 2007, 2008; Rachwał, Wiedermann, 2008), and a publication edited by W. Jarczewski and M. Huculak (2011) on Niepołomice, in which studies of multiplier effects of industrial companies were developed by K. Gwosdz (2011). Other examples include the study edited by T. Stryjakiewicz (2004) on the influence of foreign investors on the surroundings based on the example of GlaxoSmithKline.

In the above-mentioned studies, the model of the most commonly considered type of multiplier effects consists of supply and income effects. The additional demand generated by new companies allows the growth of enterprises that are suppliers of goods

and services. As a result, multiplier supply effects are created. In turn, income effects result from the increase in the purchasing power of the population through the remuneration of employees. Companies that satisfy consumer needs gain from it. Additional demand for products and services caused by the development of some companies means that other enterprises are also developing. Further on, these enterprises are starting to create more demand. It triggers successive cycles of multiplier effects. The model of multiplier effects based on supply and income effects is presented in a study on the impact of the enterprises of the Mielec SEZ on the surrounding (Domański, Gwosdz, Huculak, Wiedermann, 2005). Its more mathematical version referring to the n^{th} order of multiplier effects is presented in K. Wiedermann's monograph (2016).

In the case of comparisons of many studies of multiplier effects, especially from the United States, one can see some similarities between indirect multiplier effects and supply effects. In both cases, the effects resulting from the supply generated by the production plants are most often considered. In turn, income effects are included in the analyses as induced effects. The development of companies also positively affects the income of the budget of the state, gminas and poviats. Taxes paid on the income of natural and legal persons, property tax and the tax on means of transport allow the creation of new investments, which are financed from the central budget and are conducted by various local government units.

The size of individual types of multiplier effects is also strongly diversified in the socio-economic space. It is due to the diversity of business connections with their local and regional surroundings. While the effects of income multiplier are mainly concentrated in the local surroundings, the supply relations in the vast majority go beyond this area. This process is nowadays becoming more and more critical as the level of networking of production processes increases. The strength of the company's connections with the external environment is called its embeddedness.

The range of multiplier effects and the embeddedness of industrial production

From the point of view of the relationship between industry and the local environment, the spatial distribution of multiplier effects, and precisely their size and degree of closure within a given centre, is of highest importance. The combined effects include both the development of local enterprises and suppliers located in other areas. The more materials and services are purchased in a given city or region, the more complete are the local or regional multiplier effects. The size of local multiplier effects also depends on the type of business and the size and characteristics of the company. Individual types of activities and companies also differ in the spatial extent of multiplier effects, including the degree of their local closure. Local supply effects are usually stronger in the case of companies that operate longer in a given place and are based on domestic capital, including, in particular, those that have their head offices in a given location (Wiedermann, 2016). However, for foreign companies, they are usually weaker (Domański, 2001).

The degree of closure of effects in the local space of cities or regions results from the degree of embeddedness of manufacturing companies in the surroundings. Thus, local embeddedness expresses the strength of the company's connections with the immediate surroundings. Common globalisation processes and the development of

transport systems lead to a growing spatial range of links in industry. It often results in limiting the supply possibilities provided by local producers that manufacture semi-finished products destined for further processing in final production plants. At the same time, factories producing parts and components look for suppliers in increasingly distant locations, where production is cheaper, which results from lower production costs, and hence the greater competitiveness of companies operating primarily in the developing countries of Central and East Asia. The effect of this process is the decreasing importance of final producers in creating local and regional production multiplier effects (Dicken, Forsgreen, Malmberg, 1994).

Investigations on the strength of connections of new investors, constituting sizeable foreign manufacturing enterprises with their surroundings in the countries of Central and Eastern Europe, have been undertaken many times. The analyses showed that the embeddedness of such enterprises is usually small. This phenomenon is expressed in the metaphor of the cathedral on the desert (G. Grabher, 1994), which describes a small impact on the broader economic development of poorly embedded new industrial investments in the local and regional environment of Eastern Germany. Also, some investments in Poland take the nature of an isolated enclave, which has no connection to the local or national environment (Hardy, 1998). The complexity of foreign investors' relations with the local surrounding, including service links and impacts through staff and its revenues, has been shown in more extensive studies (Sobala-Gwosdz, 2000; Domański, 2001, 2004; Stryjakiewicz, 2004; Domański, Gwosdz, 2005, 2009; Wiedermann, 2006).

Small and medium-sized enterprises show a much higher degree of embeddedness concerning branches of transnational production corporations through stronger local and regional production and service links, as well as broader use of local human and capital resources, especially in the area of higher value-added work (Gwosdz, 2014). Research carried out by M. Dej (2011) prove that positive social and economic effects resulting from embeddedness of companies are particularly strong in the case of native local enterprises whose owners come from their place of business or live in its vicinity. The size and spatial distribution of multiplier effects are significant. These effects make up the development of local enterprises and suppliers located in other areas. The more significant the number of materials and services purchased by companies in their immediate environment, the higher the local closure of multiplier effects.

The size of the multiplier effects depends on the type of business and the size and attributes of the company. Selected industries and enterprises differ in the spatial extent of multiplier effects, which is, among other things, the degree of their local closure. Regional supply effects are usually stronger at a time when the situation concerns companies that operate longer in a given place, such as enterprises with family capital having their head offices in a given location. For foreign companies, especially in the case of greenfield investments focused on global sales markets, they are usually weaker (Domański, 2001; Domański, Gwosdz, 2008, 2010; Wiedermann, 2006). Multiplier effects in the business environment, created by commissioning service tasks, are usually stronger than the effects resulting from the product supply. Of course, the most local nature refers to the remuneration multiplier effects, which is related to the location of the place of residence of the employees. The size of these effects is influenced primarily by the number of jobs offered and the level of employees' remuneration.

The social and economic characteristics of a given area have a significant impact on the size of local multiplier effects. Capture of multiplier effects by a given city and agglomeration is in no small extent the result of the ability of local enterprises to meet the demand reported by production companies. It depends on the size, development indicator and elements that make up the local economy, as well as the involvement of local business entities and, in some cases, public authorities. According to K. Pawłowski (2007), the role of small and medium-sized enterprises (SME) in the economic development of the region is more important than the investments of large foreign enterprises. However, it should be borne in mind that the investments of international corporations, with sufficiently strong embeddedness and features of the local society, may become locomotives of local economic development, which enable a more extensive growth of SME entities in the surroundings of these plants.

An essential element affecting the higher degree of closure of multiplier effects in a given city or region is the degree of isolation of the studied area from other economic centres, which by definition may be competitive. Referring to microeconomics, we can conclude that this is due to the marginal propensity of companies to import, which is negatively correlated with the distance from the competitive centre (Shanidsaless, Gillis, Shaffer, 1983).

The model approach to the relationship between an industrial enterprise and its surroundings in the context of embeddedness was presented by K. Wiedermann (2016). According to the author, the two most important variables affecting the embeddedness of companies, are the type of products manufactured and the place of origin of investment capital. In the case of production assortment, the degree of firm embeddedness differs primarily between the production of standard (traditional) products and custom-fit products, which usually show greater innovation and design. In the case of the place of origin of capital, the scale of business links is primarily affected by the fact whether the enterprise is the result of investments of endogenous or exogenous origin.

For enterprises producing standardised products in the case of an investment by an external company, it is noted that in the investment region there is often only a production plant and suppliers of essential services (security, cleaning, operating canteens) who are located there primarily due to the short time of their implementation. Higher-order services are subordinated to the company's parent unit. In such cases, practically all decision-making competencies are located in the head office where the given investment is subjected. A separate group are suppliers of parts and subassemblies whose products go directly to the plant. Their location is often found in low-cost countries, which allows low-cost sourcing. Such an organisation model is a typical example of the so-called cathedral in the desert distinguished by G. Grabher (1993) and J. Hardy (1998).

In the case of a local company, the network of cooperative links looks a bit different. a large part of units, including the management, as well as design and implementation centre, is located in the region of the company's investment. Outside, there are suppliers of standard final product components, whose production is most profitable in countries with lower manufacturing costs. This element is similar for both types of investors.

In the activities of enterprises producing customised products, an increase in the importance of local component suppliers is noticeable. It is particularly evident in the case of investment by an external company, which is often based on a local supplier

park. As in the case of standard products, the plant is located outside the central office, where jobs essential from the point of view of building a post-industrial society are located, i.e. those related to product design and research and implementation activities, as well as sales support and contracting departments. The difference is the emergence of direct access to limited higher-order services performed locally, which is the result of obtaining certain decision-making powers, as well as much broader connections with suppliers of components in the region of investment. In the case of a local company investment, there are greater similarities between the production of standard products and the so-called custom-fit products.

Method for calculating multiplier effects

Multiplier effects arising in the local environment of large enterprises and economic zones are not often addressed by researchers. It is due to the need to use an analysis method other than that used for the country or region. Data on inter-branch flows at local and supralocal levels are unavailable. Therefore, attempts are made to use the questionnaire method.

Estimating the size of multiplier effects on a local scale carries a lot of methodological problems, primarily in the spatial dimension. The empirical studies of local and regional multiplier effects conducted so far in the national system were based on the results of research carried out in the Mielec Special Economic Zone (Domański, Gwosdz, Huculak, Wiedermann, 2005), Niepołomice (Jarczewski, Huculak, 2011), business services centres and passenger transport companies in Krakow, as well as in the car industry companies in the Śląskie Voivodeship (Wiedermann, 2006). In the case of multiplier effects expressed in the number of jobs, small differences in their total numbers were observed. It is due to a small variation in income effects depending on the industry. However, in the case of supply effects, this variation is more significant. These differences occur among dominant sectors depending on the business activities studied. The primary spatial difficulties in estimating multiplier effects include the issue of determining the boundary of the local environment, estimating the scale of local leakage of multiplier effects outside the city or region, diversification of the multiplier effects depending on the geographical scale, as well as differences between the place of paying taxes and the actual place of residence.

The scale and size of multiplier effects are always determined for a specific time interval. If the development of individual enterprises occurs between the two-time sections determining a given unit, so that they generate additional consumer or supply-demand, multiplier effects are beneficial for a given economy, as they create new jobs in a given area. However, in the opposite case, when there is a regression of the company's activity or its development, which causes a reduction in additional external demand, which occurs, for example, during the modernisation of production processes resulting in a decrease in labour demand (increase in work automation), the multiplier effects are negative. To calculate the number of jobs created due to the functioning of industrial enterprises through the process of multiplier effects, it is necessary to set a period for which these effects will be calculated. Due to the necessity of including the dynamics of the phenomenon, the analysis of the scale of multiplier effects often assumes a period between the creation of a given investment and the state for which research is conducted. In this case, the current state is referred to as the base level, which equals zero.

In the adopted method, the size of multiplier effects is expressed by the number of persons employed outside newly created investments whose work results from the functioning of these companies. The basis for calculating the multiplier effects is information obtained through surveys and interviews conducted with a representative group of industrial enterprises and in business entities that are their co-operators. Part of the information on operating costs, average wages or the household expenditure basket is available from official statistics (CSO) and financial statements of enterprises (Monitor Polski B). In the case of discrepancies in data from several sources, lower values should be used, which means that the calculated employment may be slightly underestimated rather than overestimated. Thanks to this, it can be determined what the minimum number of jobs has been created thanks to the new investments.

Supply multiplier effects

The supply multiplier effects include the supply of raw materials and production materials (supply production multiplier effects) and the provision of services to the enterprise (supply service multiplier effects). Due to the different relations of industrial enterprises located at various levels of supply chains, the production supply effects are very diverse. In the case of the location of factories producing final products for the consumer market, the level of supply multiplier effects is vast in the network production model. The establishment of such a factory raises the necessity of building a network of numerous cooperating companies, which also show the demand for deliveries for the needs of manufactured parts and subassemblies. Therefore, the higher the level in the production chain (value added), the higher are the indirect effects of the factory's impact on the surroundings. The type of production is also vital for the scale of supply effects. Manufacturing products with a higher degree of complexity results in the creation of a much larger supply network. The level of technological advancement of products plays an essential role in this respect. The higher the specialisation and the technological complexity of production, the faster and on a larger scale a cooperating factory needs to specialise in a given production, which follows the concept of cross-linking.

In the area of supply multiplier effects, a group of services should be distinguished, which can be potentially used by enterprises for outsourcing. In the era of cross-linking economic activity and the concentration of companies' attention on significant production, external services have been subject to sub-contracting processes even earlier and to a much greater extent. In their case, transaction costs determine the formation of separate business entities to an even greater extent. Among the outsourced services, the following types can be distinguished – basic and specialised services. The first of these groups are primarily:

- transport,
- cleaning and maintenance,
- security,
- occasional and permanent catering service;

while the second group includes:

- making tools and servicing devices,
- design and research services,
- legal services,
- financial services,

– IT services,
– employee training services.

The essential differences between these services depend on the degree of their specialisation, which results in a different scale, but also the range of multiplier effects of the services provided. In the first case, these are services with lower added value, which do not require high qualifications of employees, so local companies can provide them. In the case of highly specialised services, the effects are more significant due to the higher unit cost of transactions, but also the network of connections can take on a global character, most often not connected with a local plant, but with the company's head office. Previous studies on the development of multiplier effects were based on surveys and interviews that allowed determining the shape of the network of connections. Next, based on the input-output models and supply value data, the scale of multiplier effects was determined.

To determine the number of people working in the following levels of the supply chain based on the data on the money flow, the following models for calculating the multiplier effects were used (Wiedermann, 2006, 2016), allowing to estimate the number of newly created jobs at suppliers. To calculate them it is necessary to obtain information on the income of enterprises, the share of supply in income and costs related to employment (Fig. 3–6).

In order to determine the size and range of impact of a particular type of investment on the environment during interviews in a representative group of companies, information on the use of the above types of services in the place of origin of contractors and the number of people who are involved in work for individual companies should be obtained. On the basis of interviews conducted in this way, as well as interviews with co-operators operating in particular industries in accordance with the developed algorithm presented on the above diagram (Fig. 3–4), the size of employment generated by suppliers can be estimated. In this case, it is necessary to obtain the data on income of the enterprises, the share of supply in income and costs related to employment.

Fig. 3. The developed algorithm

$$Msup = Rni \times Ssc$$

where:
Msup – amount of money for suppliers
Rni – revenue of the new investment
Ssc – share of supply costs

Source: Wiedermann (2016)

Fig. 4. The developed algorithm

$$Jsup = Msup \times Sec / Sucw$$

where:
Jsup – new jobs at suppliers
Msup – the amount of money for suppliers
Sec – share of employment costs in revenues
Sucw – unit cost of the workplace

Source: Wiedermann (2016)

To calculate the next order of supply multiplier effects, the algorithm presented in Fig. 4 was used. It allows calculating jobs. If the data on the revenues of individual companies or entire groups of enterprises is missing, it is necessary to calculate them. In this case, the calculation can be made from the number of jobs existing in given companies or industries as well as labour cost structures in the income and cost of one job for a given type of activity (Fig. 5).

Fig. 5. The developed algorithm

$$Ient = Jno \times Sucw / Sec$$

where:
Ient – income of the enterprise
Jno – number of new jobs
Sucw – unit cost of the workplace
Sec – share of employment costs

Source: Wiedermann (2016)

After calculating the number of jobs generated in the supply of enterprises in subsequent orders of multiplier effects, the results obtained should be summed up. The resultant value is the total number of jobs created thanks to the supply demand generated by new investments.

INCOME MULTIPLIER EFFECTS

In addition to the delivery of goods and the use of services, the companies influence the surroundings by acquiring employees. Their income increases the purchasing power of the community, which leads to the development of enterprises that meet the consumption needs of employees and their families. Multiplier income effects are the result of the increase in the purchasing power of the population through the remuneration of employees, which leads to the development of companies that meet consumer needs. The more people have a job as a result of the creation of new activities or the development of existing ones, and the more people earn, the higher are the income multiplier effects resulting from consumer demand. For this study, algorithms were constructed (Fig. 6–8) to determine the number of new jobs created as a result of new investments. If, as a result of the new investment, jobs are created, then multiplying them by net wages will give the sum of money allocated by a given group of employees for consumption purposes. The multiplication obtained in this way is multiplied by the share of individual industries in the expenditure basket, which is published by the Central Statistical Office, as a result of which we receive the income of money for individual industries. After multiplying this value by the share of labour costs for a given industry, then after dividing it by the cost of the workplace, we get the number of newly created jobs in a given type of activity. The total number of jobs for all industries gives the total number of jobs created thanks to the consumer demand of employees of the analysed industrial enterprises. Another order of multiplier effects is consumer demand generated by employees of enterprises in particular industries in which new jobs have been created. For these jobs, we calculate the next order of multiplier effects according to the same procedure (Fig. 6).

Fig. 6. The developed algorithm

$$Mecon = Jno \times Mwor$$

where:
Mecon – amount of money flowing into a given economy
Jno – number of new jobs
Mwor – net salary

Source: Wiedermann (2016)

It should be remembered at this point, as already mentioned earlier in this chapter, that the salary level has a positive effect on the amount of money spent on consumption, but this relationship is not linear. The higher the income of employees, the higher the propensity to save, which translates into a decrease in the share of money spent on consumption. Therefore, to account for this differentiation, it is necessary to recalculate the income earned by employees in line with the expenditure basket. In the case of Polish statistics, the CSO publishes reports on the proportions of savings and expenses, as well as diversification in the expenditure basket itself. Therefore, to determine the amounts flowing from the employees of companies to particular sectors of the economy, it should be – as the above equation shows (Fig. 6) – multiplied by the participation of a specific sector in the employees' expenditure basket (Fig. 7).

Fig. 7. The developed algorithm

$$Mind = Mecon \times Seb$$

where:
Mind – amount of money reaching particular industries
Mecon – amount of money flowing into a given economy
Seb – share in the expenditure basket

Source: Wiedermann (2016)

So to calculate the number of jobs created as a result of the development or location of new industrial investment, the previously calculated amount for a specific industry (Fig. 7) should be treated as an additional income and multiplied by the share of labour costs in the industry's revenues. In this way, we will get information about the money allocated to labour costs, which after dividing by the unit labour cost for a given industry will give us the final result in the form of newly created jobs (Fig. 8).

Fig. 8. The developed algorithm

$$Jind = Mind \times Sec / Sucwi$$

where:
Jind – new jobs in the industry
Mind – amount of money reaching particular industries
Msup – amount of money for suppliers
Secb – share of employment costs in industry revenues
Sucwi – a unit cost of the industry's workplace

Source: Wiedermann (2016)

It should also be remembered that due to consumer demand, trade and service companies produce, apart from jobs, the need to supply products and services related to their business. It generates more jobs in wholesale of food and industrial goods, as well as in manufacturing companies due to supply demand.

RESULTS OF RESEARCH ON THE SCALE OF MULTIPLIER EFFECTS IN POLAND IN THE LIGHT OF WORLD RESEARCH

The results of research carried out in Poland on the size and range of multiplier effects indicate the relatively small scale. The highest values of indicators were obtained in the research conducted by K. Gwosdz (2011) and implemented as part of the project of the Institute of Urban Development on Success of pro-investment policy of the town of Niepołomice (Jarczewski, Huculak, 2011). The results in the calculation of multiplier effects indicated that for every 100 employees in companies operating in the Niepołomice Investment Zone (NIZ) there were 68 additional jobs on country scale. In the case of regional closure (Małopolskie Voivodeship), the scale of multiplier effects was calculated at 46 additional jobs for every 100 jobs in the NSI. If we translate this data into multipliers, it would be 1.46 for the regional and 1.68 for the national multiplier, respectively (Gwosdz, 2011). Slightly lower values of indicators were obtained during previous research on the impact of the Special Economic Zone Europark Mielec on its surroundings (Domański, Gwosdz, Huculak, Wiedermann, 2005). In the study prepared for the Agency of Industrial Development (Domański, Gwosdz, 2005), the calculated value of the multiplier was 1.55 in the case of closure of effects on the national scale. On a regional scale, this value was 1.43, while on the local level it was 1.38. An even lower level of indicators was obtained during regional studies on the automotive industry in the Śląskie Voivodeship (Wiedermann, 2006). In this case, the estimated number of jobs generated by the automotive industry in its environment in the Śląskie Voivodeship was at least 13,000. These were mainly jobs resulting from the demand of automotive companies for services and the resulting from the consumer demand of employees of automotive companies. Subsequently, the demand for the supply of products for further processing in automotive companies and workplaces created in successive multiplier order effects was significant.

The results of calculations of multiplier effects obtained in the above research projects deviate significantly from the data obtained during research in the most developed countries (Gwosdz, 2011). A study by G. Weisbrod and B. Weisbrod (1997) conducted in large cities in the United States indicated that the multiplier values for industrial activities were in most cases in the range of 1.5 to 2 depending on the type of production. Even higher values of the multiplier were reported by the studies of D. Mulkey and A. Hodges (2003), who indicated that these values ranged from 1.5 to 2.5. Therefore, lower levels of obtained results testify to a lesser degree of cross-linking of industrial production on a local and regional scale in Poland as compared to the economies of more developed countries (e.g. the United States). That is why, to a greater extent, these effects "leak" beyond the borders of the country.

The low value of the obtained results may also be thought-provoking from the perspective of information provided during the announcements of new industrial investments. In such cases, most often when justifying public aid for new companies, information is given on the size of the multiplier of up to 5 or 7 people working in the

surroundings per each new job created in the factory being opened. These values are therefore fundamentally divergent in comparison to those in the studies carried out.

Especially the case of the low value of the multiplier for the automotive industry is puzzling, because this type of activity shows very high cross-linking indicators, especially on a regional scale. The large size of connections results mainly from the specificity of production, that is, on the one hand, from the complexity of the final product, which is a car, and on the other from the multiplicity of production departments whose products are parts and components of the final product. An essential element is also the scale of the companies' operations and the complicated logistics of production deliveries for specific orders, causing the need to expand the numerous partners near the company. Thus, a dissonance arises between the expected and obtained multiplier value indicating a much lower scale of multiplier effects.

The low value of the indicators results from the failure to take into account the supply multiplier effects among companies in the following levels of the supply chain located in the research area. The multiplier effect calculated for the impact of companies on the surroundings does not take into account the respective multiplier effects between the cooperating entities. The result of such a balance is the lack of jobs created at the supplier as a result of supplying the parent company. We could, therefore, speak of a considerably larger scale of multiplier effects in the case of considering only the plants of the final producers. It would turn out that the majority of these effects on the automotive industry fall on the Fiat and GM Opel factories operating here. Thus, the total balance could be reduced to the fact that 7,000 jobs in car manufacturing plants have created 33,500 jobs at supplier companies and an additional 13,000 jobs through multiplier effects calculated for the entire automotive production system. In this case, the sum of jobs of 7,000 resulting from the operation of Fiat and GM Opel would give 48,500 jobs in the environment, which would apply to the multiplier value at 6.93. Of course, manufacturers of parts and subassemblies do not work exclusively for the needs of factories located in this region, so it is impossible to attribute all supplier jobs to the supply multiplier effects of these two companies producing cars. However, this simulation indicates that much higher multiplier effects relate to the functioning of companies producing ready-made products for the sales market than in the case of industrial co-operators producing factory supply elements.

Conclusions

As shown in the article, the development of the local economy resulting from the initial impulse, which is the location of the production plant, resulting in the emergence of new companies in its environment, both through the effects of cooperation and imitation, helps to improve the situation on the labour market and stimulates the commercial and residential real estate market. All these elements lead to an increase in revenues of both companies and population, translating into an increase in revenues of local governments from taxes, thanks to which territorial units on which production activity develops, become more prosperous.

For urban and regional development, greater attention should be paid to the scale of companies' impact on their surroundings. This aspect should be taken into account when considering supporting measures for enterprises, especially in the case of newly created business entities. Existing regulations place more emphasis on the direct

impact of companies on the labour market, as well as on the scale of investment outlays, where production equipment of enterprises is the highest expenditure.

In the actions taken in the field of pro-investment policy, those investments should be more supported, whose supply chains will be as much as possible demonstrated by the local and regional closure of supplies. From this perspective, the critical factor is the investor's local origin. It is also critical in the case of the development of products based to a greater extent on the production of technologies that have a more significant impact on the creation of post-industrial communities. Therefore, much more significant development effects are possible to obtain as a result of the development of technology parks combined with business incubators allowing for the extraction of companies based on endogenous resources.

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Changing Geographical Patterns of Automotive Industry in Poland

Abstract: The paper aims at identifying the main trends in the spatial patterns of automotive industry in Poland and their underlying changes. The analysis includes the distribution of employment in the sector by regions (voivodeships) in 1998 and 2015 on the basis of the Central Statistical Office data, as well as the location of greenfield plants built in the country since 1991 using the authors' database. It is shown that after the general stability of the spatial pattern of production in the first transformation phase of the 1990s, a major shift towards south-western and western Poland together with the decline of the historically dominant region of Warsaw took place later. This can be explained by the success and/or decline of some leading producers and trends in the location of new plants dependent on the proximity to foreign markets, good road accessibility and industrial traditions (labour skills) in the main. These tendencies are in congruence with the general changes in the spatial pattern of Polish industry as a whole, with the growing role of Wielkopolskie and Dolnośląskie voivodeships and the decreasing share of Mazowieckie in the national industrial employment. The rapid expansion of automotive industry in Upper Silesian Industrial District has contributed to its successful restructuring.

Keywords: automotive industry; geographical pattern; Poland; spatial changes

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Introduction

Post-socialist transformation brought about fundamental changes in Central European manufacturing. State ownership was replaced by private enterprises and Eastern European markets largely by the Western European ones, which was accompanied by the reshaping of organisation, technology, productivity and employment. The dynamics and attributes of these processes differed among various sectors leading to significant changes in the sectoral structure of manufacturing. The interesting question is to what

extent these radical restructuring resulted in a shift in geographical distribution of production and employment.

The issue of the geographical change of industrial activity can be approached in the evolutionary theoretical perspective. On the one hand, the privileged position of the developed regions based on agglomeration economies could be expected. Among other advantages, they might benefit from the established market position and supplier networks of large firms, as well as possible spinoffs. Moreover, foreign investors, which have become important forces of the growth of Central European economies since 1989, often tend to locate in the advanced areas of emerging countries, the capital region in particular, rather than in peripheral regions, due to easier availability of information and lower uncertainty (Dicken, 2015). On the other hand, the development of old industrial districts may be hindered by negative mechanisms of lock-in, as a result of overspecialisation, oligopolistic economic structures and/or institutional sclerosis and rigidification (Hudson, 1989; Grabher, 1993; Hassink, 2010). Their situation may be exacerbated by their negative image of areas of unfavourable environmental and social conditions, including strong unions and high wages. In addition, institutional approach may be useful here to capture the role of public authorities in the processes of regional change.

The authors address the problem of changing spatial patterns of automotive industry in Poland. The aim is to identify the main trends in this respect and the factors underlying the regional and local changes.

The automotive sector seems particularly suitable to address these questions due to its fast expansion in Poland and in Central Europe in general in the last two decades, as well as vast domination of foreign-owned companies (Domański, Guzik, Gwosdz, Dej, 2013). It is a prominent sector of high-volume production including both sophisticated components and relatively simple labour-intensive ones. The share of the automotive industry (NACE 29) in the total sold production of Polish manufacturing and mining has increased from 2.4% in 1991 to 10.7% in 2016 (6.7% in value added and 6.2% in employment of national industry). The broadly defined sector provides about 20 per cent of Poland's exports and contributes to an increasing trade surplus in manufactured goods with core economies of Western Europe.

The development of the automotive sector or passenger car industry in Poland from the spatial perspective has been analysed earlier by K. Gwosdz and G. Micek (2010), P. Lizak (2011) and P. Nowak (2011). There are several studies on the geographical change in other manufacturing sectors in Poland, most of them illustrate moderate changes in spatial structures, e.g. in fish processing industry (Czapliński, 2013), furniture production (Dyba, 2017) and brewing industry (Wojtyra, Grudzień, 2017), but some reveal more radical shift, e.g. in footwear manufacturing (Kocaj, 2016). This can be seen in a broader context of changing patterns of the transition of Polish economy (Stryjakiewicz, 2009), foreign investment in the country (Tobolska, 2014), the impact of changing spatial accessibility (Komornicki, Rosik, Śleszyński, Solon, Wiśniewski, Stępniak, Czapiewski, Goliszek, 2013) and the multiplier effects of the supplier networks of large firms (e.g. Wiedermann, 2006; Stryjakiewicz, 2008).

The paper is divided into four main sections. First, the distribution of employment in automotive industry by regions (voivodeships) in 1998 and 2015 is examined with shift-share analysis on the basis of the Central Statistical Office data on the narrowly defined automotive industry (NACE 29). Then the analysis of the location of greenfield

plants built in the country since 1991 is carried out using the authors' database covering broadly understood automotive sector, including NACE 29 together with the producers of auto components classified in other branches, especially seats, electric, plastic and rubber parts. This is followed by the explanation of the identified trends and conclusions with comparison to trends in other countries and Polish manufacturing in general.

Regional differentiation of the sector 1998–2015

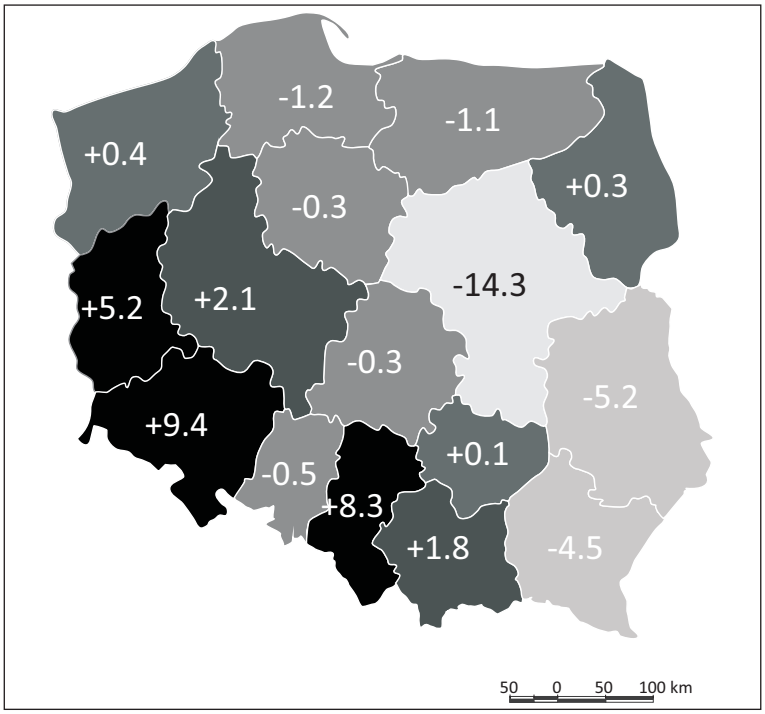
When state socialism ended there were two major concentrations of the automotive industry in the country: in the capital region of Warsaw in central Poland and in the Upper Silesian Industrial District with Bielsko-Biała area in the south. The former represented the historical core of the sector, which began with assembly activities before World War II and grew following the establishment of FSO in 1950 with numerous branch plants and component suppliers in the region. The latter was largely a product of the creation of FSM in 1971 with an engine factory in Bielsko-Biała, the car assembly plant in Tychy and about a dozen branch plants. There were also two truck plants (Starachowice and Lublin) and a bus factory (Sanok) in the south-east of the country, as well as smaller ones in western Poland (Jelcz, Nysa, and Poznań), but they were not accompanied by a large number of suppliers.

Fiat was the first international carmaker that decided to invest in Poland acquiring FSM in 1992. It was followed by Daewoo Motors, which bought the Warsaw-based FSO and Lublin light truck plant in 1996, while VW started to expand a small light vehicle factory in Poznań in 1993. In 1998 a new greenfield car assembly plant was opened by General Motors in Gliwice in Upper Silesia. Truck and bus factories were chiefly privatised by domestic capital, new bus assembly plants were located by Volvo in Wroclaw and MAN near Poznań. Major foreign supplier companies, including Delphi and Valeo, gradually increased their investment in the country taking over state-owned producers and/or building new factories (Domański, 2001).

Despite considerable ownership shift, the geographical picture of the automotive industry in the late 1990s was more or less the same as a decade earlier. More than 40% of employment in the sector in 1998 was concentrated in two regions: Śląskie (22.4%) and Mazowieckie (18.1%), and nearly two-thirds in four voivodeships including Podkarpackie (11.7%) and Wielkopolskie (10.7%). The decline of the Starachowice truck plant resulted in the lower position of Świętokrzyskie.

The rapid growth of production, fuelled primarily by vast foreign investment, led to a systematic increase in the number of people working in the automotive industry in Poland since 1998. By 2015 the employment in the narrowly defined automotive sector (NACE 29) has risen from 100,600 to 177,100 people. In absolute terms, the largest growth in employment took place in Śląskie (+31,800), followed by Dolnośląskie (+22,700), Wielkopolskie (+11,900) and Lubuskie (+9,700). The shift-share analysis confirms the enhanced role of south-western regions of Dolnośląskie (+9.4 percentage points) and Śląskie (+8.3) along with western voivodeships of Lubuskie and Wielkopolskie, and partly Małopolskie. On the other hand, a spectacular decline occurred in the share of the central region of Mazowieckie (-14.3 percentage points), and to somewhat lesser extent in the case of Lubelskie and Podkarpackie in the south-east (Fig. 1).

Fig. 1. Shift-share in the employment in automotive industry (NACE 29) in Poland, 1998–2015 (changes in the share of voivodeships in the national employment in the automotive industry)

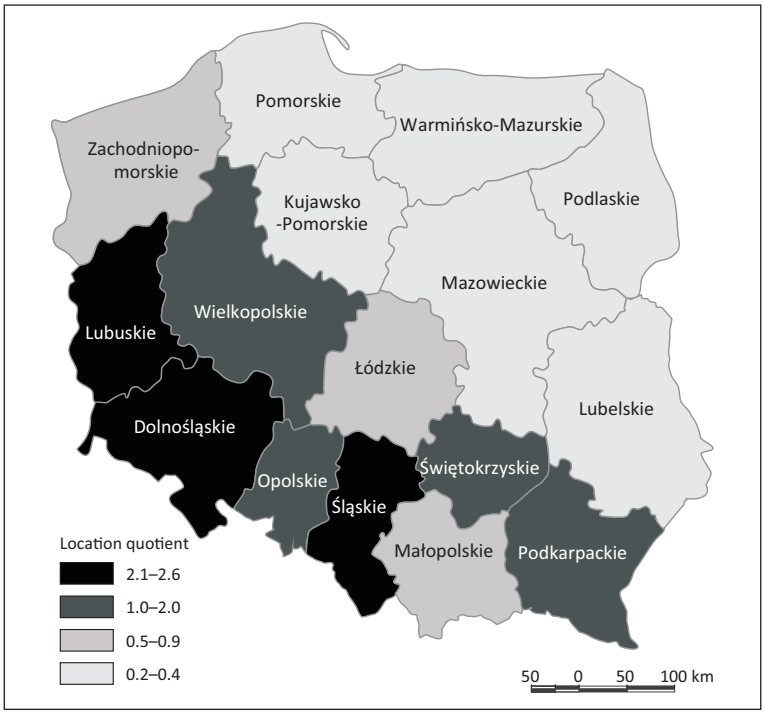


Source: authors' work based on the Central Statistical Office data

Mazowieckie and Lubelskie have experienced an absolute loss of employment, whereas the number of jobs in Podkarpackie has increased, but at a lower rate than nationally.

Thus, the spatial distribution of the automotive industry in 2015 differs significantly from the situation in the first decade of post-socialist transformation. There is a strong agglomeration of the sector in south-western Poland with the new core in Śląskie voivodeship, including Upper Silesian conurbation, Bielsko-Biała subregion and Częstochowa. Its share in the national employment has increased to 30.7%, and the share of Dolnośląskie to 17.3%, hence these two voivodeships concentrate almost half of the workforce of the Polish automotive industry. Wielkopolskie represents 12.8% of the employment in NACE 29. Five voivodeships of south-western and western Poland together with Lubuskie and Opolskie comprise 70% of this employment. The marked specialisation of these regions in the automotive industry is illustrated by the location quotient comparing the share of employment in NACE 29 sector and the share of working age population. Such location quotient is the highest in Śląskie, Dolnośląskie and Lubuskie, and above average in Wielkopolskie, Opolskie and Podkarpackie (Fig. 2). Despite the relatively slower growth since 1998, Podkarpackie shows the fourth largest workforce in the sector (7.2%), and three south-eastern voivodeships including Małopolskie and Świętokrzyskie represent 16% of the national employment. Lubelskie is no longer important here, and the share of Mazowieckie is merely 3.8% now.

Fig. 2. Location quotient of the employment in automotive industry (NACE 29) in relation to the working age population in Poland in 2015



Source: authors' work based on the Central Statistical Office data

Location of greenfield plants since 1991

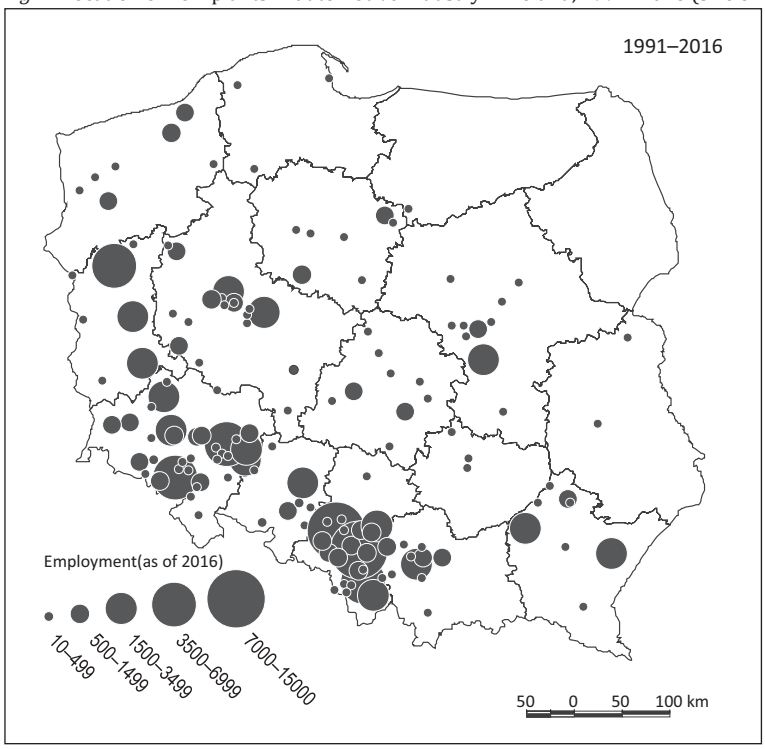
What deserves special attention from the geographical point of view is the location of new plants. There are 325 greenfield factories manufacturing motor vehicles and their components that opened in Poland between 1991 and 2016. Fig. 3 shows that their spatial distribution is extremely uneven (Fig. 3).

By far the largest concentration of new automotive plants is found in Śląskie – in the historical Upper Silesian Industrial District and the Bielsko-Biała area to the south. Substantial greenfield investment in the sector has been attracted by Dolnośląskie, where it is located both in the Wrocław metropolitan area as well as in Legnica-Polkowice subregion to the west and the Sudeten to the south. Large and medium-sized factories have also been built in Wielkopolskie, Lubuskie and Opolskie.

Greenfield investment outside south-western and western regions have been relatively rare. Some of it has taken place in Małopolskie and Podkarpackie in the south-east as well as in Mazowieckie and Łódzkie in central Poland, but very few in other areas of eastern and northern parts of the country.

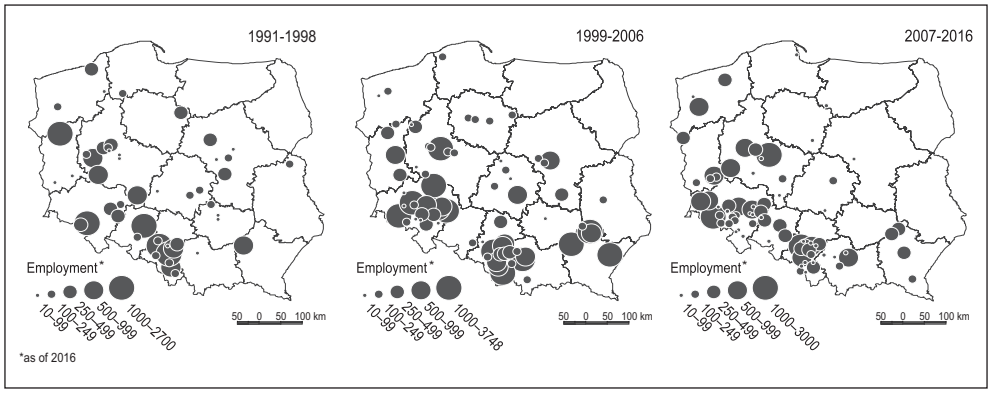
It is interesting to examine the location of greenfield plants opened in three periods: 1991–1998, 1999–2006 and 2007–2016, i.e. after the financial crises (Fig. 4). South-western and western regions have been attractive places for the location of new factories from the early years of the transformation until nowadays. This is also to a lesser extent true about Podkarpackie in the south-east. Greenfield investment in Małopolskie started at

Fig. 3. Location of new plants in automotive industry in Poland, 1991–2016 (size of employment in 2016)



Source: authors' work

Fig. 4. Location of new plants in automotive industry in Poland, 1991–1998, 1999–2006 and 2007–2016 (size of employment in 2016)



Source: authors' work

the end of the 1990s. By contrast, automotive plants were built in the central regions of Mazowieckie and Łódzkie in the 1990s and at the beginning of the 21st century, but this is no longer the case in the recent decade. The trend to locate factories in south-western and western parts of Poland has never been so dominant as since 2007, when almost no companies chose central and eastern Poland, except for Podkarpackie.

Factors affecting the geographical shift in Polish automotive sector

After little change in the spatial pattern of the automotive industry in Poland in the 1990s, a major geographical shift took place in the 21st century. It stems, on the one hand, from the successful development or decline/closure of some large existing producers and, on the other, from the trends in the location of new plants.

The early privatization of FSM and the modernisation and expansion of car and engine production by Fiat together with the advent of its Italian suppliers strengthened the position of the Upper Silesian and Bielsko-Biała region. This increased its attractiveness for the greenfield investment of various component producers[1], which was further boosted by the location of a new General Motors assembly plant, and is discussed in detail later. A similar process to some extent took place in Wielkopolskie with a gradual development of van production by Volkswagen in Poznań.

At the same time, Daewoo Motors, which had become the owner of FSO, ran into financial trouble after the Asian crisis in the late 1990s, went bankrupt and was sold to GM, but its overseas subsidiaries were not part of the deal. FSO became controlled by the Ukrainian carmaker UkrAVTO and finally stopped car assembly in 2011. As a consequence, the manufacturing of automotive components in the Warsaw region has also significantly decreased and some of the suppliers shifted to other production.

In addition, the collapse of Daewoo resulted in the bankruptcy of the van producer in Lublin in 2001. Moreover, Zasada Group was not able to maintain the position of truck and bus manufacturers in south-eastern Poland; hence the role of this region in the sector has been diminished. The Starachowice factory was taken over by MAN in 1999 and specialises in the production of bus frames now[2], the Sanok plant is again state-controlled after its bankruptcy in 2013.

The large number of new factories built in Poland since 1991 had a vital impact on the contemporary geographical picture of the industry. Three fundamental factors seem to have determined their location: the position in relation to the market (customers), geographical road accessibility and the availability of skilled labour.

The automotive industry is characterised by the extensive network of suppliers and deliveries are increasingly made on a just-in-time basis, i.e. they arrive at the assembly plant shortly before they are needed in order to reduce the costs of inventory. To facilitate the reliability of such deliveries the majority of suppliers are located within a one-day driving distance from their customers, which means up to 700–800 km (Klier, Rubenstein, 2010). In the situation when automotive components made in Poland are primarily exported to Western Europe, Germany, Italy and France in the first place, eastern and northern regions of the country are at a disadvantage. Furthermore, the dynamic development of the automotive industry in Poland is part of its growth in the broader Central European agglomeration. Numerous plants located and expanded in south-western Poland are suppliers of factories situated nearby in the Czech Republic, newly-built assembly plants in Slovakia, as well as automotive producers in Hungary.

[1] Determinants and effects of the development of automotive industry in Śląskie voivodeships were examined by Wiedermann (2006)

[2] In 2016 MAN relocated production of city buses from Sady near Poznań and coaches from Salzgitter to Starachowice, increasing employment.

A favourable location in relation to customers as well as various suppliers is connected with good geographical accessibility of a factory. As most transportation goes by road this means a privileged position of areas with modern motorways. There is little doubt that the early construction of the A4 motorway as the first motorway in the country, linking Lower and Upper Silesia with Germany and further with the European road network, was instrumental in attracting numerous new factories in these regions. Its eastern extension made Podkarpackie voivodeship the only region of eastern Poland with significant greenfield investment. The A2 motorway is important for the location of new plants in Wielkopolskie and Lubuskie, while the motorway A1 improved the connections of Śląskie with the Czech Republic, Slovakia and Italy.

Quality requirements in the automotive sector are particularly high. It is evident that most greenfield investment was located in towns and regions with industrial history, where technical culture and skilled manufacturing labour could be found. This is true of south-western and western regions, but also Podkarpackie due to the traditions of the Central Industrial District dating back to the 1930s.

The role of the public sector and policies is interesting in this context. There are two mechanisms how it could affect the location of new factories. First, the establishment of early special economic zones in the 1990s, when only limited areas offered tax exemptions and infrastructural advantages, was important in the case of Upper Silesia, Podkarpackie and partly Lower Silesia. Second, the pro-investment attitude and activity of local authorities mattered. This could have a self-reinforcing effect due to the learning process in the communes which were successful in attracting an investor and developed their competences in meeting the expectations of further firms.

Last but not least, there is clear imitation behaviour in locational choices of foreign investors. This is illustrated by the fact that there are more than ten or even twenty automotive plants of various firms situated in a single town, e.g. Gliwice, Bielsko-Biała, Wałbrzych, most of which are not connected by direct supply linkages. The choice of a place where other manufacturers have invested earlier may depend on serving the same customer, but may also stem from favourable infrastructural conditions created by the local authorities and lower uncertainty related to the presence of other firms. In addition, companies often choose location of a new factory in the same region where they already have production facilities, e.g. Toyota, Faurecia, Tenneco, which is associated with their knowledge about the area and allows better management and possibly workforce transfer.

All things considered, western and especially south-western Polish regions offer the best conditions for the location of new automotive plants: proximity to the major foreign markets, good accessibility and skilled labour. Their attractiveness for the component manufacturers has been enhanced by the location of the GM car assembly plant in Gliwice, new bus factories of Volvo in Wrocław and Solaris and MAN near Poznań, as well as the expansion of existing car plants in Tychy and Poznań. The immense greenfield investment has not been discouraged by the traditions of strong trade unions and environmental problems characteristic of old industrial regions such as Upper Silesia and the Sudeten. Together with the development of existing plants this contributed to their current dominant position in the automotive sector of the country, even though two important final producers from the socialist era lost their significance – the Nysa van plant went bankrupt and the state-owned Jelcz company remains a small-scale manufacturer of military trucks.

The loss of the leading role in the discussed industry by the Warsaw region is an effect of the collapse of the foreign investor which controlled the core company. What is harder to explain is the limited greenfield investment in Mazowieckie, and in central Poland in general. This may be related to a relatively late motorway connection, high costs of land in the fast growing metropolitan area of the capital city (Gwosdz, Micek, 2010), possibly insufficient supply and high costs of industrial labour force and lower maximum regional aid intensity than in other regions. The development of the sector in Łódzkie was similar to the national trend. One of few large domestic-owned automotive manufacturers is situated here – Wielton established in Wieluń in 1996 has become one of the top European producers of semi-trailers and trailers.

Świętokrzyskie has retained its position, despite lower employment in the Starachowice factory and very little greenfield investment. In contrast, several large and medium-sized new plants were located in Podkarpackie due to its industrial labour supply, good connection through the A4 motorway and possibly higher regional aid intensity than in western regions, but the region has suffered from the difficulties of the Sanok bus factory.

It has to be emphasized that if we take into account a broadly defined automotive sector, including components classified outside NACE 29, the picture of the industry in some regions may be different. There are for example a tyre plant in Dębica and a factory of rubber components in Sanok in Podkarpackie, another large tyre producer is situated in Olsztyn in Warmińsko-Mazurskie in the north-east and several manufacturers of plastic parts are located in Kujawsko-Pomorskie and Łódzkie.

There is some evidence of the functional division between metropolitan areas and higher developed regions of Upper and Lower Silesia and Wielkopolskie on the one hand and eastern Poland including Podkarpackie on the other. More sophisticated higher-value added products seem to be manufactured in the former, while the latter tend to specialise in more simple, labour-intensive ones. The issue is worth broader analysis and discussion as the specialisation in various types of products may affect the future prospects of individual industrial towns and regions.

Conclusion

The time of the dynamic growth of Polish automotive industry is a period of a major shift in the spatial distribution of production, which began in the late 1990s. The radical change in the geography of the sector results from both massive foreign greenfield investment in south-western and western regions and the collapse of some companies – foreign investors such as Daewoo and former state-owned monopolistic manufacturers of buses and heavy vehicles. Thus, this geographical change can be seen as a product of globalization and its relations with local conditions and processes including post-socialist transformation.

The Upper Silesian Industrial District together with the neighbouring Bielsko-Biała, and partly Częstochowa and Krakow regions have developed as the core of the sector in the country with two car assembly plants, diversified supplier base and relatively strong non-production functions including R&D. The emergence of this new core area can be seen as a path-dependent process, the seeds of which were sown by locational decisions related to Fiat-licensed car in the 1970s, its early successful privatisation and the location of General Motors, which have triggered large foreign investment in the

area. Dolnośląskie is a major winner of the expansion of automotive component sector in the corridor of the A4 motorway close to German and Czech borders. Proximity to foreign markets, good road accessibility, industrial traditions (skills), infrastructure and special economic zone incentives are important factors behind the location of numerous new plants in south-western and western Poland, as well as to some extent in Podkarpackie. Institutional factors in the form of national policy together with attitudes and activity of local governments proved important to attract foreign corporations to industrial towns and regions and hence trigger the agglomeration processes fuelled later by imitation locational behaviour of further investors.

All this means that the advantages of industrial regions and towns prevailed. Foreign investors have not been discouraged by their structural and social legacy and negative image, and hence contributed to their structural change.

The study confirms the growing spatial concentration of automotive industry in Poland, which leads to the creation of a few strong agglomerations with a large number of producers embedded in extensive supplier networks. K. Gwosdz and G. Micek (2010) identified hub-and-spoke and TNC-led satellite platforms as the most frequent agglomeration types in the sector, but no Porter's clusters nor Marshallian industrial districts. As to the mechanisms of the spatial evolution of the automotive industry, agglomeration economies have been important in the formation of its structure in Poland, while rather limited role has been played by spinoff processes emphasized by Boschma and Wneting (2007) in the case of the Coventry-Birmingham region in the United Kingdom.

The surprising demise of the historically leading role of the Warsaw region, contrasting with the locational preference of foreign investors for the capital regions of many countries, general trends of the inflow of capital to the Warsaw metropolitan area and its fast economic growth since the 1990s, is contingent on individual events.

A significant change in the spatial pattern of Polish automotive industry contrasts with the general continuity in its geographical distribution in many countries. For example, Hardi et al. (2014) point out that foreign export-oriented investment in Romania and Serbia has contributed to the development of the major clusters of the automotive industry formed in the past, outside the capital cities. The motor vehicle industry in the United States remains largely concentrated in the vast region called auto alley extending between the Great Lakes and the Gulf of Mexico. However, auto alley was only formed in the 1980s, whereas earlier most of automotive component production was concentrated in the much narrower area of the Central Manufacturing Belt between Milwaukee and Buffalo with the core in south-eastern Michigan (Klier, Rubenstein, 2010).

Finally, it is worth noting that the identified trends in the geographical distribution of the automotive sector are in congruence with the general changes in the spatial pattern of Polish industry as a whole. Wielkopolskie and Dolnośląskie are two regions which have increased their share in the national industrial employment most of all since 1998, the role of Lubuskie has also risen. All these voivodeships have shown the fastest growth in value added in industry. The enhanced position of the historically industrialised regions of Wielkopolskie and Dolnośląskie has been emphasized earlier by T. Rachwał (2010) and B. Domański (2015). At the same time, the share of Mazowieckie in the industrial employment in Poland has decreased; its dynamic GDP growth by and large rests on the development of the service sector. The main difference concerns Śląskie as its general industrial growth rate was below the national average and its share in the national employment has lowered. This reflects the shrinking of the traditional sectors

such as coal mining and metal industries in the Upper Silesian Industrial District, where the rapid expansion of automotive industry has become an important factor of the successful restructuring.

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